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What drives the double burden of malnutrition and how do we overcome it?

New analyses from the Global Burden of Disease group have combined the three categories of diet risk factors – Maternal and childhood undernutrition, High body mass index, and Dietary risks for non-communicable diseases (NCDs) – into a single risk of ‘Malnutrition in all its forms’. In 1990, this single risk contributed to 24% of the total global burden of disease. By 2017, it had fallen to 19% but it was still the top risk for all countries, usually more than twice the burden of the next biggest risk factor. In some regions (eg Western Sub-Saharan Africa), malnutrition in all its forms fell by up to 10 %-points due to substantial reductions in undernutrition, and only one region (Pacific island countries) increased in burden.

The food systems within all countries are creating the food environments that sustain these high levels of malnutrition. In middle-income countries, undernutrition has declined markedly in recent decades and has long been eclipsed by diet-related NCDs. In low-income countries, this pattern is also rapidly emerging. What determines the dynamics of the food systems and why are they so difficult to change? Three sets of feedback systems help to answer this question. First, the governance systems set the rules and economic incentives and disincentives for food businesses and people to operate within. Changing those operating conditions, such as though taxes on unhealthy foods or regulations to restrict marketing to children, to improve the health or environmental outcomes of the food systems often creates substantial (and often successful) push-back from the affected food industries. Second, the business system involves the food and food services being exchanged for money, but the health and environmental costs (externalities) are rarely factored into the transaction. Internalising those externalities raises fears of politically unpalatable loss of profits for business and higher food bills for consumers. The third set of feedback systems is the supply/demand nexus. Consumer expectations and brand marketing creates dietary habits which are slow to change, even in the face of mounting evidence of health and environmental harms.

Double- and triple-duty actions are actions that address these feedback systems, thereby reducing two or more of the negative consequences of food systems. Examples for strengthening governance include reducing the power of commercial vested interests and strengthening the power of civil society in policy-making. Examples for changing business models include pigouvian taxes and transparent triple bottom line reporting. Examples for changing supply/demand dynamics include health and environmental labelling of food and tighter marketing constraints. Such actions are, simultaneously, extremely difficult politically, uncertain in their outcomes, yet essential for achieving healthy, sustainable, equitable, and profitable food systems.

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Iron metabolism defined using stable isotopes in obesity

Introduction
Iron deficiency is common in overweight (OW) and obese (OB) individuals and was shown to be at least partially mediated by adiposity-related inflammation. The proinflammatory cytokine interleukin 6 (IL6) induces hepcidin expression which may lead to decreased intestinal iron absorption. On the other hand, greater blood volume in OW/OB individuals may increase hemoglobin mass and iron requirements and confound iron biomarkers by hemodilution. Using stable iron isotopes, we have systematically studied iron metabolism in obesity. We have answered the following questions: 1) to what extent is hemodilution responsible for low iron status in OW/OB individuals; 2) what is the difference in iron absorption in OW/OB compared to normal weight (NW) participants and to what extent can ascorbic acid enhance iron absorption; 3) is the effect of obesity on iron absorption reversible by weight/fat loss.

Methods
In studies 1 and 2 we studied 62 healthy, non-anemic women in Switzerland. We determined blood volume using the carbon monoxide (CO) rebreathing method, body composition by dual energy X-ray absorptiometry (DXA), iron and inflammatory status. Furthermore, we determined iron absorption from two test meals in each person using stable iron isotopes. The test meals consisted of bread with butter and honey, with or without ascorbic acid (+AA/-AA). In study 3 we studied a group of 38 obese participants during weight loss induced by sleeve gastrectomy in Mexico. Iron absorption using stable isotopes was determined 2 and 8 months after sleeve gastrectomy to investigate the effect of weight/fat loss. We further measured iron status, hepcidin, inflammatory markers and anthropometrics including body fat by DXA at both time points.

Results
In study 1, OW/OB participants had significantly higher blood and plasma volume compared to NW. Furthermore, circulating masses of hepcidin, IL6, Hb and soluble transferrin receptor (sTfR) were higher while total mass of serum iron was lower (all p<0.05). In study 2, we showed that in OW/OB participants iron absorption was only two-thirds that in NW participants (p=0.049) and the increase in absorption with ascorbic acid was 56% in NW and only 28% in OW/OB (p<0.05 compared to –AA). In study 3, total body fat, IL6 and hepcidin were significantly reduced 8 months after surgery compared to 2 months. In subjects who were iron deficient at 2 months post surgery (n=17), iron absorption increased by 28% (from 9.7% to 12.4%) while there was no change in iron replete subjects (5.9% and 5.6%).

Conclusion
Taken together, the increased Hb mass which increases iron requirements for erythropoiesis and circulating sTfR mass, the reduced iron absorption and blunted effect of ascorbic acid and the obese body’s failure to fully downregulate hepcidin secretion even if iron stores are low indicate that OW/OB individuals may have higher dietary iron requirements. Moreover, increased blood and plasma volume diluted serum iron affecting interpretation of iron biomarkers. Especially in developing and transition countries the current surge in OW/OB may significantly impair efforts to control iron deficiency in vulnerable population groups and new strategies are urgently needed.

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Session Classification : SESSION 2 - PARALLEL SESSIONS
The double burden of malnutrition among adolescents in 57 low- and middle-income countries

Introduction
Adults and young children in countries experiencing the nutrition transition are known to be affected simultaneously by undernutrition and overnutrition. Adolescence is a critical period for growth and development. Yet, it is unknown to what extent this double burden of malnutrition affects adolescents in low- and middle-income countries (LMICs) and the macrolevel contextual factors associated with the double burden of malnutrition. The aim was to quantify the magnitude of the double burden of malnutrition among adolescents and to examine the potential sources of heterogeneity in prevalence estimates across LMICs.

Methods
We used individual-participant data from the Global School-Based Student Health and Health Behavior in School-Aged Children surveys conducted in 57 LMICs between 2003 and 2013, comprising 129,276 adolescents aged 12–15 y. Pooled estimates of stunting, thinness, or both; overweight or obesity; and concurrent stunting and overweight or obesity were calculated overall, by regions, and stratified by sex, with random-effects meta-analysis. Guided by UNICEF’s conceptual framework for child malnutrition, we used ecological linear regression models to examine the association between macrolevel contextual factors (internal conflict, lack of democracy, gross domestic product, food insecurity, urbanization, and survey year) and stunting, thinness, and overweight and obesity prevalence, respectively.

Results
The prevalence of stunting was 10.2% (95% CI: 8.3%, 12.2%) and of thinness was 5.5% (95% CI: 4.3%, 6.9%). The prevalence of overweight or obesity was 21.4% (95% CI: 18.6%, 24.2%). Between 38.4% and 58.7% of the variance in adolescent malnutrition was explained by macrolevel contextual factors. The prevalence of concurrent stunting and overweight or obesity was 2.0% (95% CI: 1.7%, 2.5%).

Conclusions
The double burden of malnutrition among adolescents in LMICs is common. Context-sensitive implementation and scale-up of interventions and policies for the double burden of malnutrition are needed to achieve the Sustainable Development Goal to end malnutrition in all of its forms by 2030.

This study was registered at clinicaltrials.gov as NCT03346473.

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Session Classification : Oral Abstract Presentations - Regional Differences
Double burden of malnutrition among preschool children in 24 population-based surveys: BRINDA project

Introduction: Overweight and obesity (OW/OB) are increasing globally among young children, while undernutrition, in the form of micronutrient deficiencies, anemia, and stunting, persists. Exposure to this double burden of malnutrition (DBM) may compound the health consequences experienced by children throughout their lives and further strain health care systems. Our objectives were to 1) describe the prevalence and distribution of intra-individual DBM, defined using either micronutrient deficiencies or anemia and OW/OB, among preschool children in diverse settings, 2) assess whether OW/OB and micronutrient deficiencies or anemia are independent, and 3) identify household and individual correlates of the DBM.

Methods: We analyzed data from 24 population-based surveys of children 6-59 months of age compiled for the BRINDA project. Eligible observations had valid data for anthropometric measures, hemoglobin, inflammation (used to adjust iron and vitamin A indicators), and at least one indicator of micronutrient status (iron, zinc, folate, or vitamins A, D, or B12) (n=34,654 children). We defined OW/OB as BMI-for-age Z-score > 2 SD (de Onis and Lobstein, Int J Pediatr Obes, 2010). Intra-individual DBM was defined as OW/OB and either 1) at least one micronutrient deficiency, or 2) anemia (hemoglobin < 110 g/L). All analyses accounted for survey design. We calculated prevalence of DBM by survey and assessed independence of OW/OB and micronutrient deficiencies or anemia using chi-square tests. Finally, we computed adjusted and unadjusted prevalence ratios to examine the association between characteristics of individuals (child age and sex) and households (socio-economic status, urban vs rural location, caregiver education) and DBM among preschool children.

Results: The prevalence of OW/OB ranged from 0% in Cambodia to 19.5% in Georgia and exceeded 5% in 10 of 24 surveys. Micronutrient deficiencies (range: 0.2% to 92.9%) and anemia (range: 1.9% to 83.4%) were generally more common than OW/OB. The prevalence of DBM ranged from 0% (Cambodia) to 9.7% (Mongolia) and from 0% (Cambodia) to 5.0% (Georgia), using micronutrient deficiencies and anemia, respectively, as the measure of undernutrition. In the majority of surveys, there was no association between OW/OB and micronutrient deficiencies (18 of 22 surveys for which a P value could be calculated) or anemia (18 of 21). The most common significant predictor of DBM was child age (in 4 of 9 surveys, DBM was less prevalent among children ≥ 24.0 mo compared to < 24.0 mo), but none of the factors examined consistently predicted DBM across surveys.

Conclusion: The prevalence of DBM varies by definition but appears to be constrained by the low prevalence of OW/OB among children in these surveys. OW/OB was largely independent of both micronutrient deficiencies and anemia, suggesting that targeting of specific interventions for individuals afflicted by DBM may not be necessary. Instead, programs to address both OW/OB and multiple forms of undernutrition among children could mitigate the associated short- and long-term health consequences of these multiple forms of malnutrition.

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Session Classification : Oral Abstract Presentations - Regional Differences
The double burden of malnutrition in East Asia and the Pacific: An emerging public health concern for children

The East Asia and the Pacific region is undergoing a nutrition transition with children increasingly exposed to high-fat, high-sugar, high-salt, energy dense and micronutrient poor foods that are often low in cost and convenient but also low in nutrient quality. These shifts in dietary patterns, along with low levels of physical activity, have resulted in sharp increases in childhood overweight while stunting levels remain a public health concern. Between the periods of 2000 and 2016, there was some progress on stunting reduction in Southeast Asia with a 32% decrease in children under 5 years but no change in the Pacific with a 4% increase. However, during this same time, prevalence of overweight in children under 5 years increased 125% in Southeast Asia and an 88% increase in the Pacific. This paper presents the landscape of the double burden of malnutrition at the community, household and individual level in the East Asia and the Pacific region and actions to address the double burden in the region.

Anthropometric data for children 0-59 months of age was obtained from DHS/MICS/NNS in 8 countries in East Asia and the Pacific Region. Children (0-59 months) were identified as stunted based on a height for age <-2 below the WHO reference median and overweight based on a weight for height >+2 above the WHO reference median. Concurrent stunting and overweight was defined as a child who was both stunted and overweight using the WHO reference mean definitions. Maternal overweight/obesity was defined as a BMI ≥ 25. Maternal-child double burden of malnutrition dyad was defined as a stunted child with an overweight/obese mother.

An overview of the prevalence of both overweight and stunting in children under 5 years, concurrent overweight and stunting in children, and in mother/child double burden dyads will be presented using recent national survey data from Mongolia, Marshall Islands, Timor Leste, Cambodia, Laos, Myanmar, Thailand, and Solomon Islands. Sub-analysis by socio-economic status, urban location, child gender and maternal education will be reviewed. A review of the current landscape of programmes and actions to address the double burden in these countries and in the region, will be provided.

The double burden of malnutrition, either at the community, household or individual level, is a public health concern for young children in South East Asia and the Pacific. The nutrition transition is set to progress in the region with a corresponding increase in consumption of high energy, low-nutrient foods in children across all economic groups. Children, especially those from poorer socio-economic quintiles, are at risk of becoming concurrently stunted and overweight with potential life-long implications on their health. Clear guidance is available to address the double burden in young children with recommendations that serve dual purpose in addressing the obesogenic environment leading to overweight and obesity while also supporting actions to prevent and reduce child stunting. Preventing the double burden of malnutrition in children requires multi-sectoral actions to operationalize these recommendations.

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Session Classification: Oral Abstract Presentations - Regional Differences

Track Classification: Epidemiology

Introduction:
The double burden of malnutrition (over- and undernutrition) with a unique and unusual (non-classical) pattern of epidemiological transition [persistent high burden of maternal, childhood and infectious diseases despite the emerging burden of non-communicable diseases (NCDs)] is the growing and unprecedented challenge for sub-Saharan African (SSA) countries. However, the impact of this phenomenon on the burden of disease in SSA has not been investigated. This study assessed trends of mortality attributable to child and maternal undernutrition (CMU), overweight/obesity and dietary risks NCDs in SSA using data from the Global Burden of Disease (GBD) study 2015.

Methods:
The GBD uses a comparative risk assessment (CRA) approach which is a causal web and hierarchy of risk factors that enables the quantification of risk factors and their impact on health at different levels. For each risk factor, a systematic review of data was used to compute the exposure level and the effect size. A Bayesian hierarchical meta-regression analysis was used to estimate the exposure level of the risk factors by age, sex, geography and year. The burden of all-cause mortality attributable to CMU, 14 dietary risk factors (eight diets, five nutrients, and fibre intake) and overweight/obesity was estimated.

Results:
In 2015, CMU, overweight/obesity, and dietary risks of NCDs accounted for 826,204 (95% uncertainty interval (UI) 737,346-923,789), 266,768 (95% UI 189,051-353,096) and 558,578 (95% UI 453,433-680,197) deaths, respectively, representing 10.3% (95% UI 9.1-11.6), 3.3% (95% UI 2.4-4.4) and 7.0% (95% UI 5.8-8.3) of all-cause mortality (crude proportion). The crude proportion of NCD mortality attributable to overweight/obesity and dietary risk factors was 9.8% (95% UI 7.0-12.8) and 20.5% (95% UI 17.3-24.3), respectively. In 2015, the age-standardized proportion of all-cause mortality was significantly higher for dietary risks of NCDs compared to overweight/obesity and CMU. Overall, the age-standardized proportion of deaths attributable to CMU, overweight/obesity and dietary risks was 12.2% (95% UI 10.2-14.7), 3.8% (95% UI 3.4-4.3) and 5.3% (95% UI 3.8-7.0), respectively. The age-standardized proportion of all-cause mortality attributable to CMU was higher in western SSA compared to other subregions.

While the age-standardized proportion of all-cause mortality accounted for by CMU decreased by 55.2% between 1990 and 2015 in SSA, it increased by 63.3% and 17.2% for overweight/obesity and dietary risks of NCDs, respectively (Fig 1). The age-standardized proportion of deaths attributable to CMU fell by more than half in most of the countries while it rose for overweight/obesity in all countries. The highest increase (140.7%) was recorded in the Western SSA, rising from 2.1% (95% UI 1.1-3.3) in 1990 to 5.0% (95% UI 3.5-6.7) in 2015.

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Session Classification : Oral Abstract Presentations - Regional Differences
Under and over-nutrition in school-aged children and adolescents Ho Chi Minh City, Vietnam: a double burden rapidly shifting over a decade

Introduction
Survey data have indicated that Vietnam is experiencing rapid increases in childhood overweight and obesity, while under-nutrition co-exists. [1] Vietnamese adults and children have undergone a rapid change in diet and physical activity, particularly in large cities such as Ho Chi Minh City (HCMC). [2] Nutritional surveys conducted in HCMC indicated that the prevalence of overweight and obesity in children and adolescents increased from 2002 to 2009, while the prevalence of stunting and thinness appeared to decrease, although it remained a significant issue.[3] More recent evidence has been lacking.

Methods
We estimated prevalence of under and over-nutrition in a cross-sectional survey of 10,949 school-aged children and adolescents (6 – 18 years old) in HCMC, Vietnam and compared with the previous surveys in 2002/2004 and 2009. A representative sample of children was selected from 30 schools (primary, secondary and high schools) in the school year 2014-2015. Summary prevalence estimates of nutritional status indicators were weighted based on the population of students in each stratum (urban or rural) at each school level, and the proportion of surveyed students in each school.

Results
The prevalence of over-nutrition in school year 2014-2015 was very high, with 50 – 60% of primary school children overweight or obese. Compared with previous surveys, the prevalence of overweight and obesity was two to four times higher, whereas the prevalence estimates for stunting and thinness were two to three times lower compared to the 2002/04 estimates. Thus the prevalence of overweight and obesity has been doubled every 5 year, while undernutrition among school-aged children and adolescents still coexists with the prevalence varying from 2% to approximately 20%.

Over-nutrition was particularly common among primary school children (20-30% were overweight; a further 20-30% were obese). Abdominal obesity was also prevalent, with 30-50% of school children affected. There was also substantial coexistence of under-nutrition, particularly in high school students. Across all age groups, boys were significantly more likely to be obese than girls. Over-nutrition was more prevalent in urban areas; under-nutrition was more common in rural areas. The double burden of malnutrition also existed within individuals. There was a high prevalence of overweight/obesity in stunted adolescents, with around one in four being overweight or obese, reflecting the double burden of malnutrition at the individual level. Full details of prevalence estimates and changes over time will be presented.

Conclusion
Overall, this study demonstrates a very high prevalence of over-nutrition, particularly in primary school children, and the coexistence of under-nutrition in high school children in HCMC, Vietnam. While our findings suggest that stunting prevalence is decreasing, these data also indicate that it remains necessary to consider under-nutrition among those in high school to mitigate the risk of chronic disease development among children of the next generation. The substantial increase in overweight and obesity over the examined 12 year period suggests that HCMC children are moving quickly through the nutrition transition. Urgent comprehensive efforts are required from multiple sectors including governments, industry, and community-level organizations to address...
the double burden of malnutrition in Vietnam.

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**Session Classification :** Oral Abstract Presentations - Regional Differences
Understanding body perceptions of adolescents in rural and urban Malawi using pictorial images of various body sizes; A cross-sectional study.

Introduction: The prevalence of overweight and obese children continues to rise in developed and developing countries. This poses an increasing threat worldwide as the standards of living rise. Body perceptions is linked to weight management and Sub-Saharan Africans tend to prefer a larger “overweight” body size which is perceived as being wealthy and healthy. Inaccurate perception of the adolescents’ body weight could lead to lack of physical activity, long-term consequences such as obesity related diseases and unhealthy practices to maintain what they wrongly perceive as healthy.

This study compared rural and urban body perceptions of Malawian adolescents, and the overall ideal body size amongst males and females. Actual body weight was compared to the adolescents’ perceived own body size.

Methods: This was a cross-sectional observational study which took place in rural and urban Malawi. Weights and heights of the adolescents were measured in order to determine their Body Mass Index for age (BMI-for-age). A survey questionnaire which explored various body perceptions was filled out electronically. Seven images of various body sizes from “severely thin” to “extremely obese” were used. Own perceived body size was compared to actual weight to investigate adolescents who over-perceived, under perceived and those who correctly perceived their own body size.

Results: Adolescents aged 10-18 years took part in the study (152 rural, 176 urban). The adolescents were categorized using the BMI for age criteria as per World Health Organisation (WHO) growth standards for children between 5 and 19 years, 1.8% of the subjects were found to be severely thin, 4.2% thin, 80.2% normal, 10.1% overweight and 3.7% obese.

Actual Body Mass Index (BMI) was significantly different in rural and urban adolescents ($\chi^2 = 13.65$, $P=0.01$). More adolescents were overweight in the urban area (13.6%) than in the rural area (5.9%).

There was no significant difference between rural and urban own perceived body sizes ($\chi^2=0.52$, $P = 0.77$) and ideal body size ($\chi^2=0.59$, $P= 0.90$). In comparison to the actual body weight, 34.8% of adolescents over-perceived their body size, 32% under-perceived and 33.2% had accurate own body perceptions.

The "overweight" body image was selected by 48.5% of the adolescents as their ideal body size.

There was a significant relationship between sex and perceived body size ($\chi^2=128.89$, $P<0.001$). More males over-perceived their body size than females.

Conclusion: The findings of this study demonstrate that a larger ‘overweight’ body size is preferred amongst Malawian adolescents. The potential implications include increased risk of non-communicable diseases and the double burden of malnutrition. Adolescence is an important growth period for the development of body image and various psychological, social and cultural changes.

Understanding the complex relationship between actual weight and body perceptions requires internalization of factors such as social influences, body ideals and other weight related concerns. These findings could inform future interventions on body perceptions of adolescents in Malawi.

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Session Classification : Oral Abstract Presentations - Underlying Factors
Bridging the Gap: Engaging Adolescents for nutrition, health and sustainable development

Introduction: Adolescence is a crucial period in the development of adult NCDs. Trend analyses suggests that unhealthy eating behaviors are rising among young people, particularly in urban areas. These established patterns of behavior persist throughout life and are often hard to change.

Methods: Research on adolescent nutrition, food security, health and livelihoods was conducted in rural and urban areas in Kenya, Uganda, Cambodia and Guatemala in 2017. The mixed methods collaborative study included a landscape analysis of adolescent programming and qualitative research using participatory and creative methodologies. A total of 1,303 participants were included in the research and 576 data collection activities were undertaken including focus group discussions, key informant interviews, technology surveys and participatory workshops to document their voices.

Results: While food insecurity and undernutrition were widely prevalent, obesity and NCDs were also already significant problems or an emerging issue. Adolescents described their diets in different ways but the majority were focused on satisfying hunger and immediate energy needs. Many adolescents mentioned the limited variety of foods in their diets. The long term consequences of the diet were rarely a factor in choosing foods.

While over consumption of food was not a major issue, poor food choice and consumption was very common. Because of a limited financial resources, the cheapest foods were most commonly bought and consumed. These tended to be foods that were energy dense, high in refined grains, added sugar and fats but poor in protein and essential micronutrients.

When adolescents had more decision-making in their food selection, their behaviors did not reflect better understanding of the immediate or long term nutritional implications. When asked to document their food aspirations, adolescents from Guatemala took pictures of a local vendor of fried chicken. In Kenya, adolescents who sourced foods in dumpsites of hotels and restaurants reported desires for cakes, pizza and other items perceived as 'rich people food', even if they could only acquire them from the dumpster.

Implications: The research demonstrates potential entry points for slowing or preventing the onset of obesity and NCDs. Adolescents were interested in improving their household’s food security and had valuable suggestions for how to be reached, including "use our groups, don’t group us" and "come to us, fit around our lifestyles" and "ask us, include us".

Adolescents were influenced by food advertising and the social status linked to food choices. Snack vendors outside school, fast food chains in the towns and food stalls along the road side all position their products in ways that influence food choices. A good collaboration between private and public actors to ensure food availability, purchasing power, healthy advertising and good nutrition behaviors will be essential to slow the obesity and NCD endemic.

Adolescents in this study often played a significant role in acquiring and preparing food for the household. As potential change agents in the household, adolescents with increased knowledge about good nutrition, along with improved household financial resources, could influence family and even community behaviors that lead to obesity and NCDs.

Institution
World Food Programme and Anthrologica
Country

Italy, England, Cambodia, Guatemala, Kenya, Uganda

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Session Classification : Oral Abstract Presentations - Underlying Factors
Urban disparities and double burden of malnutrition in Bobo-Dioulasso? A study in the secondary city of Burkina Faso, West Africa

Introduction: To document the existence of health disparities even in secondary cities and to understand to what extent historic, social, economic processes can help to explain these disparities, a population based cross-sectional survey was carried out in 2013 in Bobo-Dioulasso.

Method: Based on map observation, aerial photos and satellite-based remote sensing, coupled with effective field survey on infrastructure, five criterions; position (central or peripheral), duration of urbanisation (old or recent), health care infrastructure (good or bad), potable water availability (good or bad), and risk of flood (high or weak), four neighbourhoods was selected for the study. In each of these four neighbourhoods 250 eligible households were randomly selected and in each household an adult (35 to 60 years) coupled with a child of (6 months to 59 months) were randomly selected. Each adult and child went through an interview for socio-demographic, anthropometric, clinical and parasitological data collection.

Results: Among the adults the overall prevalence of overweight/obesity was 43.2% significantly higher in women than men (52.3% vs. 31.7%, p=0.001). Hypertension, and diabetes prevalence were respectively 40.5% and 5.3% with no gender difference. From the low, middle to high-income people, both obesity (20.3%, 30.4%, 49.3%) and hypertension (29.0%, 32.5%, 37.9%) were significantly higher. At the same time 13.1% and 28.6% of the children were respectively wasted and stunted.

Conclusion: The double burden of malnutrition is a reality even in secondary city like Bobo-Dioulasso. Rather than urbanization disparities, socioeconomic status explained the nutrition status of the study population both for children and adults.

Key words: Health disparities, Secondary cities, Nutritional deficiencies, non-communicable disease, double burden of malnutrition, adults, Burkina Faso

Institution
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Session Classification : Oral Abstract Presentations - Underlying Factors
‘Shortness is not a disease’: Conceptualization of and meanings attached to childhood height and short stature in rural Tanzania

Introduction: Malnutrition is one of the most serious health problems affecting under-fives in Tanzania. Despite Tanzania’s steady trends in the reduction of the rates of undernutrition over the last two decades, the prevalence of childhood stunting remains high (i.e. 35%). The situation is worse in some parts of the country where the prevalence exceeds 40%. Overall, more than 2.7 million under-fives in the country are stunted, which impairs their future learning, productivity, and opportunities to escape poverty. Additionally, Tanzania experiences a double burden of malnutrition where undernutrition exists together with emerging problem of diet-related non-communicable diseases. Given that stunting in Tanzania manifests among under-fives, timely management of the condition at an early age is crucial. We believe that the first step in preventing stunting is to identify it as a problem. Yet, the extent to which caregivers conceptualize linear growth and are able to identify stunting remains unclear.

Methodology: An ethnographic study using cultural schema theory was conducted in Southeastern Tanzania to investigate caregivers’ conceptualizations of child height in relation to growth and the meanings attached to short stature. A total of 19 focus group discussions, 30 in-depth interviews, and five key informant interviews were conducted with caregivers of under-fives, including mothers, fathers, elderly women, and community health workers. Principles of grounded theory guided the data management and analysis. This research was funded by The Netherlands Organization for Scientific Research.

Results: The study revealed the conceptual differences between the biomedical model and the participants’ perceptions of child’s height. Although caregivers could recognize height increments in children and were pleased to see improvements, many held that height is not related to nutrition, health, or overall growth. They referred to short stature as a normal condition that caregivers cannot influence; i.e., as a function of God’s will and/or heredity. A number of cultural signs were considered important in identifying stunting in a child, including ‘face and skin comparable to that of a mature person’, ‘wrinkled and elastic skin like that of an elderly person’, ‘stunted hair (i.e. weak or copper-colored hair), ‘abnormal shortness and thinness’, ‘delayed ability to crawl/stand/walk’, ‘stunted IQ’, and ‘frequent illness’. Since culturally the stunting is broadly conceptualized beyond height, a short child could be considered healthy if s/he portrays cultural markers of healthy growth including chubbiness and heavy weight.

Conclusion: These findings have implications for programs directed at reducing both the levels of stunting and double burden malnutrition, as defined by WHO. Given the rising burden of double malnutrition in Tanzania, the schema that a short child with a fat / heavy body has “normal shortness” is of great concern, and calls for an urgent response. In order to be effective, programs targeting childhood stunting need to be aligned with the local knowledge of the condition, and to explore ways to integrate the concept of height deficits as a sign of stunting into the awareness messages communicated to caregivers.

Institution
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Country
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**Session Classification**: Oral Abstract Presentations - Underlying Factors

**Track Classification**: Policy implications
The first 1000 days: a unique opportunity to influence lifelong health

Understanding the biology of the “first 1,000 days” is especially important in countries that are economically challenged. In particular, low and middle income countries (LMICs) tend to face a complicated array of factors that influence healthy growth, ranging from high food insecurity, poor sanitation, limited prenatal or neonatal care, and high levels of poverty that exacerbate the “vicious cycle” associated with inter-generational promotion of growth retardation. Recently it has been reported that the period prior to conception plays an important role in fetal development and later health, giving rise to the concept of “the first 1,000+”. Thus, improving the overall understanding of how “the first 1,000 days +” influences the health of children, especially those born in LMICs, is critical to reducing the global prevalence of the double burden of disease. This seminar will discuss how paternal and maternal health prior to conception influence offspring health with a focus on specific pre- and post-natal factors that contribute to lifelong health.

Beginning with the pre- and periconceptual period, studies of parental diet and metabolism will be discussed to highlight the transient and permanent impact of this period on growth and health. For example, a number of recent studies have reported that paternal and maternal body composition and diet influence not only the first generation of offspring, but some have shown an influence on the second generation as well. Moreover, a number of studies are now reporting not only phenotypic differences in children exposed to poor maternal or early childhood diet, but also epigenetic differences that provide mechanistic hypotheses. Thus, nutrition and health prior to conception has profound influence not only on fetal health, but health in childhood and later in life.

As well, the intrauterine period of growth is extremely important for lifelong health as growth and development of fetal tissues and organ systems occur at a very rapid pace. Any perturbation to this process, either through nutritional insufficiency or exposure to endocrine disruptors or toxins, not only interrupts or delays the growth process, but in some cases results in metabolic abnormalities that challenge adult health. In terms of early childhood nutrition and growth, a number of studies have reported that stunting is a risk factor for obesity and central adiposity. However, other studies have reported divergent findings. Regardless, it is well accepted that nutrition during early childhood through adolescence has a profound effect on healthy growth and deficits in energy or specific micronutrients have a negative impact of adult height and growth. More important, the growth pattern, such as slow or rapid growth, is now considered to be a primary factor in terms of body composition and health.

Institution
Rutgers University

Country
United States

Presenter(s) : Mr. HOFFMAN, Daniel (Rutgers University)
**Session Classification**: Session 3 - Preconception (1000+ days)

**Track Classification**: 1000 days - Preconception
Nutrition and health of adolescent girls

The major focus of public health and nutrition over the past 40 years since the Alma Ata Conference has been on the survival of young children. This investment has brought excellent results, including dramatic reductions in infant and young child mortality, greatly strengthened maternal and child health programmes and the widespread delivery of evidence-based interventions, such as infant immunizations, diarrhoea and pneumonia treatment and promotion of breastfeeding.

However, the dramatic improvements in the survival of young children have not been mirrored in adolescents, and the reality is that many children are surviving to adolescence only to live impoverished lives with poor mental, physical and social wellbeing. In adolescents, the prevalences of both macronutrient undernutrition (eg. stunting and underweight) and micronutrient deficiency (eg. nutritional anaemia) remain disgracefully high, and the health burden from poor nutrition is compounded by the epidemic of adolescent obesity and overweight. Since dietary and physical activity habits developed during adolescence are often lifelong, interventions to improve the nutritional status of adolescent girls and boys will provide a triple return on investment though improving the nutrition and wellbeing of the adolescent in the short-term, when they become adults and into the next generation. Improving the health and nutrition of older children and adolescents (5-19y) is one of the next great challenges for public health.

Reversing the epidemic of adolescent obesity will require a coordinated, multisectoral approach, since many of the most important interventions, such as health education and the enactment and enforcement of laws and taxation, will require action outside the health sector.

Design of interventions should make full use of our increasing understanding of the neurological and social development of adolescents, which has shown that the adolescent brain, far from being a deficient version of the fully mature adult brain, is excellently adapted to the tasks and challenges that this age group faces. For example, adolescents tend to experience fearful situations as a thrill, are exquisitely sensitive to social and emotional learning and extremely well adapted to innovation. Gaining the respect of both peers and adults is key. The speaker will argue that interventions to improve the nutrition of adolescent girls (and boys) must make much better use of this knowledge.

Institution
Department of Maternal, Newborn, Child & Adolescent Health, World Health Organization

Country
Switzerland

Presenter(s) :  Mr. ROSS, David (Department of Maternal, Newborn, Child & Adolescent Health, World Health Organization)

Session Classification : Session 3 - Preconception (1000+ days)
Dietary diversity in women of reproductive age

Micronutrient malnutrition is a challenge faced by women of reproductive age (WRA), who are particularly vulnerable due to greater micronutrient needs. One of the factors responsible for this type of malnutrition is the lack of diversity of women’s diets. In resource-poor environments, low-quality monotonous diets are the norm. When grain or tuber-based staple foods dominate and diets lack vegetables, fruits and animal-source foods, the risk for a range of micronutrient deficiencies is high. The “gold standard” methods to assess diet entail resource intensive data collection, processing and analysis. Dietary diversity indicators are the result of a strong demand on simple and feasible indicators to measure at least one dimension of dietary adequacy. They are simple counts of foods or food groups consumed. Some of them, like the minimum dietary diversity for women (MDD-W) have defined thresholds, and thus their results can be expressed as prevalence.

The MDD-W is defined as the proportion of women 15-49 years of age who consumed food items from at least five out of ten defined food groups the previous day or night. It was validated as a proxy of women’s micronutrient adequacy as a result of two research projects: the Women’s Dietary Diversity Project (WDD-P)-I and the WDPP-II. The MDD-W is collected at the individual level but interpreted within the population. Groups of WRA where a higher proportion of women consume five or more of the ten food groups are likely to have higher micronutrient adequacy.

The challenges of MDD-W data collection are related to the need of exhaustive information of the foods consumed in the studied population, including knowledge of local recipes in order to properly allocate to food groups the ingredients of mixed dishes.

Among the opportunities which the MDD-W can offer is the fact that it can be used for assessments of diet quality at national and subnational levels in resource poor settings, and it is suitable for integration into large-scale surveys. It is also a good candidate to evaluate nutrition sensitive interventions, as it can be compared with previous assessments, so long as survey timing accounts for seasonality and same baseline and end line surveys are used. It thus contributes to filling the gap of food-based indicators for use in target setting, advocacy and impact evaluation, as well as to inform effective policy on improving diets and nutrition of women of reproductive age.

The MDD-W was internationally endorsed in 2014, and since then it has been used in varied contexts by different stakeholders, as it is: key indicator of the monitoring and evaluation framework of EU-funded projects and programmes in more than 20 countries, a standard World Food Programme corporate indicator for nutrition-sensitive interventions globally and a key indicator for the global programme on Food & Nutrition Security of the German cooperation agency. Furthermore it has been integrated in national surveys of countries like Rwanda, Zimbabwe, Tajikistan, South Africa and Nepal, among others, and it is promoted by international NGOs like Hellen Keller International, Action Against Hunger and Concern Worldwide.

Institution
JRC European Commission

Country
Spain
**Presenter(s)**: Ms. CUSTODIO, Estefania (JRC European Commission, Seville, Spain)

**Session Classification**: Session 3 - Preconception (1000+ days)
Intervention strategies to improve nutrition and health behaviour before conception

The first 1000 days of pregnancy and infancy arguably is a window of opportunity, but more and more evidence suggests that at the time of conception both male and female parents already exhibit patterns of risk – micronutrient deficiencies (anaemia), obesity, substance use, stress, endocrine disruptors and sedentary behaviour to name a few. These parental risk factors may influence the growth and development of the fetus during pregnancy and postnatal with lifelong consequences. Evidence of behaviour interventions during pregnancy to counter these risks and optimise maternal and neonatal outcomes has had marginal effect given the short duration of pregnancy. It is suggested that preconception health provides a formidable public health prevention period that has benefit both to young men and women but also to the next generation.

Patton and colleagues argue that "adolescent growth and development shape the early development of offspring" in this preconception period, and that investing in adolescents’ physical and mental health as the world has the largest cohort of boys and girls in human history, will “yield great dividends for future generations”. There are several strategies that can be implemented to achieve such a return on investment and during the presentation we will review suggested interventions.

Furthermore, we will review the Healthy Life Trajectories Initiative (HeLTI) a partnership with funders from Canada, China, India and South Africa and in collaboration with the World Health Organization to address the increasing burden of non-communicable diseases (NCDs) – including obesity, diabetes, cardiovascular disease and poor mental health – around the world through optimising preconception health. There are four separate but harmonised RCTs implemented in three provinces in Canada, Shanghai (China), Mysore (India), and Soweto (South Africa). All projects are focused on developing evidence-based interventions that span preconception across pregnancy and into the postnatal period with the goal of improving maternal, infant and child health. The review will examine some of the principles guiding the design of the double duty preconception interventions and its delivery to address the double burden of malnutrition.

Institution
University of the Witwatersrand, Johannesburg

Country
South Africa

Presenter(s) : Mr. NORRIS, Shane (MRC Developmental Pathways for Health Research Unit, University of the Witwatersrand, Johannesburg)

Session Classification : Session 3 - Preconception (1000+ days)
Businesses: How to make them a smaller part of the nutrition problem and a bigger part of the solution

Businesses are an important part of the problem in promoting good nutrition outcomes but because they are so enmeshed in the food system they must form a big part of the solution to improved nutrition. They must be engaged to do so, with carrots and sticks. This talk outlines this argument and describes some of the incentives that are available to governments who have a duty to be proactive in helping businesses do more good things and fewer bad things.

Institution
Global Alliance for Improved Nutrition (GAIN)

Country
Switzerland

Presenter(s) : Mr. HADDAD, Lawrence (Global Alliance for Improved Nutrition (GAIN))
Long term consequences of maternal malnutrition for offspring health

The prevalence of obesity in urban pregnant women is alarming at 11%, 21% and 33% in China, UK and South Africa respectively. Data suggests that with every pre-pregnancy BMI unit (kg/m²) increase there is an average 9% increased risk for GDM. The International Diabetes Federation predicts that sub-Saharan Africa and East Asia (China) may see some of the highest ascents in the prevalence of type-2 diabetes (T2D) globally. Similarly, a parallel upsurge in gestational diabetes mellitus (GDM) cases is expected. The prevalence of GDM is 19.6% and 10% in Beijing (China) and Soweto (South Africa) respectively. The GDM prevalence in a high-income country, like the UK, is between 8-24%. Furthermore, many countries do not afford universal screening for GDM.

The consequences of maternal malnutrition (obesity) that result in GDM are:

- Excessive fetal growth, particularly in abdominal circumference, occurs prior to the conventional diagnostic test for GDM in obese women (oral glucose tolerance test, OGTT, 24–28 weeks gestation).
- More prevalent macrosomic-related delivery complications and higher rates of caesarean sections
- Investigators of The Hyperglycaemia and Adverse Pregnancy Outcome Study (HAPO) Follow-up reported that women with GDM had a ~9-fold greater risk of T2D compared to normoglycaemic pregnancies. Furthermore, 19.1% of children born to GDM mothers were obese compared to 9.9% of children born to non-GDM mothers.
- Infants exposed to GDM may also have greater risk for T2D.

We will review the latest longitudinal evidence around the consequences of maternal malnutrition from an obesity and GDM point of view with the aim to understand the need to prioritise and optimise maternal nutrition before and during pregnancy.

Institution

University of the Witwatersrand, Johannesburg

Country

South Africa

Presenter(s): Mr. NORRIS, Shane (MRC Developmental Pathways for Health Research Unit, University of the Witwatersrand, Johannesburg)

Session Classification: Session 4 - Maternal nutrition
Assessing maternal body composition during pregnancy

Body compositional changes in the mother during pregnancy are associated with maternal and infant health outcomes and the assessment of body composition during pregnancy helps in studying the changes in fat mass (FM) and fat free mass (FFM). The ability to accurately determine body composition in pregnant women could help identify women at high risk of adverse pregnancy outcomes, including low birth weight. The techniques commonly used to measure maternal body composition are based on either two compartment (2C) or three compartment model (3C) and include simple methods such as anthropometry, skinfold technique, bioelectrical impedance and more advanced methods based on densitometry and hydrometry. Measuring body composition in pregnancy has some challenges as the commonly used methods cannot partition the total FM and FFM mass into the maternal and fetal components. Magnetic resonance imaging (MRI) which can determine individual organ volumes could provide separate measures of maternal and fetal tissues, but are limited due to potential safety issues, cost and expertise needed. Additionally during pregnancy, there is about 67-80% of water accumulation in the FFM, increasing the hydration of FFM and thus the assumptions of some of the methods may not be valid, creating the need for appropriate corrections for pregnancy.

The deuterium dilution technique using stable isotope of deuterium or 18Oxygen, can provide an estimate of total body water (TBW) in the combined maternal and fetal components. Estimates of body composition can be determined from TBW along with measurements of body weight and density. However since the hydration of FFM changes during pregnancy, the week of gestation must be considered in the conversion from TBW to FFM.

The cellular four compartment (4C) model divides the body into Fat, Body Cell Mass (BCM), Extra Cellular Fluid (ECF) and Extra Cellular Solids (ECS). A whole body potassium counter (WBKC) which measures naturally occurring radio-active potassium (40K), gives an accurate measure of the total body potassium, and from this, body cell mass (BCM) or the metabolically active tissues of the body is estimated. These measurements count the background (or naturally occurring) radioactivity within the body. The measurement of TBK by measuring the natural radioactivity of 40K within the body, can be done safely and non-invasively using the WBKC, which has an array of sodium-iodide (NaI) detectors positioned above or around the body, housed inside a room or shadow shield. This is an accurate direct measurement, which does not get affected by changes in hydration that occur during pregnancy and thus is an important body compositional method. Further research is needed which focuses on improved body composition methods in pregnancy to promote optimal maternal and infant health.

Institution
St. John’s Research Institute

Country
India
**Presenter(s)**: Ms. KURIYAN-RAJ, Rebecca (St. John’s Research Institute)

**Session Classification**: Session 4 - Maternal nutrition
Intervention strategies to improve nutrition and health behaviour during pregnancy

Adverse pregnancy and birth outcomes such as low birthweight, preterm birth, and IUGR, fetal macrosomia, that are influenced by maternal malnutrition have lifelong consequences through affecting future health, quality of life and health care costs. Due to the rising double burden of malnutrition being reported across countries, the focus of intervention strategies to improve nutrition and health behaviors in pregnancy need to be expanded to cover maternal overweight and obesity.

While interventions to improve maternal nutrition are best initiated prior to conception, a package of evidence-based interventions for the antenatal period that can positively influence pregnancy outcomes do exist. The recent WHO recommendations on a positive pregnancy experience highlights the importance of antenatal nutrition support with 19 of the 49 recommendations being related to nutrition. The recommendations include dietary counseling and physical activity, nutrition education on increasing daily energy and protein intake, and protein and energy supplementation in undernourished populations, and iron folic acid supplementation.

Maternal nutrition interventions are usually delivered through maternal care intervention packages via the health sector. Thus, a key strategy in improving nutrition and health behaviors in pregnancy is the strengthening of health systems across countries. Currently, coverage and delivery of quality maternal nutrition interventions are suboptimal. For example, data from the recent Global Nutrition Policy Review 2016/17 (GNPR) indicate that though 90% of countries reviewed report implementing nutrition interventions for pregnant and lactating women, only 56% of countries cover counselling on healthy diet and nutrition during pregnancy; other reports indicate that the quality of counseling is often poor. Aspects such as health service delivery, adequate numbers of trained health workers, sustainable resources, strengthening supplies of nutrition commodities, proper referral systems and comprehensive monitoring of service delivery and outcomes should be improved to ensure universal coverage, accessibility and a high uptake of pregnancy related services.

Empowerment of women themselves, families and communities for optimum nutrition and care during pregnancy are vital and best addressed through a strategy of developing and strengthening supportive community structures. Mother support groups are a popular means of community support and has shown success through improving nutrition knowledge and practices including compliance with supplementation, practicing birth spacing, and seeking of timely health services. Other aspects include safeguarding and increasing women’s access to, and control over, incomes, other resources and decision making.

The success of both strategies stated above depend on increasing synergies and partnerships with other sectors. Actions including social protection through cash transfers; incentives to address food insecurities; improving clean water and sanitation; education of girls; transport and access to health services can only be addressed through cooperation of other sectors. Multi sector coordination is also important in successfully implementing food based dietary guidelines, regulatory and legislative population based strategies such as food labelling and fiscal policies that would increase healthy food consumption and also impact maternal nutrition. As the GNPR review reports, involvement of other sectors in nutrition programmes is low and needs to be scaled up to reduce maternal malnutrition.
**Institution**

WHO Regional Office for South East Asia

**Country**

India

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**Session Classification**: Session 4 - Maternal nutrition
Breastfeeding: new knowledge and old failures

The 2016 Lancet Breastfeeding series summarized epidemiological and clinical evidence for how breastfeeding has major long-term effects on the health, nutrition, and development of children and also on women’s health. The series referenced findings from immunological, epigenetic, microbiome, and stem-cell studies done over the past two decades that elucidated potential mechanisms by which breastfeeding improves health. The rapid pace of new discoveries on components and properties of human milk, with important implication for the health of children and adults was noted. It concluded that “even more exciting discoveries are likely to follow on the exquisite personalized medicine provided by human milk”. And the field is prone to many more discoveries; these are just the tip of the iceberg!

Over the past 3-5 years, there have been major scientific advancements in the exploration and understanding of the composition of breastmilk, the important differentiations in human evolution and how these affect human health. This includes how breast milk interacts with and influences immune modulation and imprinting; gut colonization and the maternal and infant microbiome and regulation of host responses; the unusual abundance of human milk oligosaccharides yet personalized nature of their production; the maternal enteromammary axis and infant health; associated metabolic responses including adipogenesis; the presence and role of multipotent stem cells; the relation with brain development, structure and function.

Yet, despite this evidence for “the value of breastfeeding as a powerful intervention for health and development that benefits children and women alike”, exclusive breastfeeding rates have remained static over the past 20 years; and sales of breastmilk substitutes have increased. We have failed to establish environments that support women who want to breastfeed whether they return to school, to work or stay at home. We do not assume a collective responsibility for low rates of breastfeeding but allow the onus to fall on individual women or to the pressures of work.

We have neglected to invest in research to more fully understand the mechanisms by which breastfeeding mediates its physiological effects. We have allowed substandard science underpinning the development and claims for breastmilk substitutes to go unchallenged. As a result, mothers and families are disadvantaged from making true informed choices on infant feeding practices. We do not hold our own institutions and governments to account for their failure to protect breastfeeding; the rights of children to interventions that contribute to the highest quality of health are thereby undermined. We do not adequately monitor rates of exclusive breastfeeding, especially in high income countries, and so static or negative trends are a blind spot in our public consciousness.

In considering the double burden of malnutrition and the underlying complex interactions between the environment, nutrition, commercial interests, economic and social development we cannot afford to undervalue or be complacent about the contribution of breastfeeding to the health trajectories of future generations.

Disclaimer: The author alone is responsible for the views expressed in this abstract and do not necessarily represent the decisions, policy or views of the World Health Organization.

Institution
WHO

Country
Switzerland

**Presenter(s):** Mr. ROLLINS, Nigel (Department of Maternal, Newborn, Child and Adolescent Health, WHO)

**Session Classification:** Session 5 - Infant and young child feeding I - Breastfeeding
How to use stable isotope techniques for assessment of breastfeeding patterns

Human milk intake and the exclusivity of breastfeeding practices can be assessed quantitatively using the deuterium oxide dose to mother (DTM) technique. The method was introduced by Andrew Coward in 1982, and uses well-established tracer methods for determining input and output rates in body pools using compartmental modelling techniques. It was subsequently refined during an IAEA Coordinated Research Project and an Excel spreadsheet was produced to standardise the calculations. This spreadsheet uses the Solver function of Excel to fit the model to the data using the method of least squares. The cut-off for exclusive breastfeeding was determined empirically as 25 g water per day from sources other than human milk. If the amount of human milk consumed by an infant is measured using the DTM technique and the concentration of nutritional components or potentially toxic contaminants is measured, then the infant’s intake of, for example, vitamin A, zinc, arsenic or other contaminants can be determined.

Over the past 10-15 years, through its technical cooperation and coordinated research programmes, the IAEA has worked with its Member States in Africa, Asia and Latin America to establish capacity for using stable isotope techniques to assess breastfeeding practices. An IAEA database has been established containing data on infant feeding and growth (and maternal body composition) from 691 mother/baby pairs from Africa (represented by Benin, Central African Republic, Ghana, Kenya, Morocco, South Africa, Tanzania), 258 pairs from Asia and the Pacific (represented by India, Sri Lanka and Thailand), and 301 pairs from Latin America and the Caribbean (represented by Argentina, Brazil, Chile, Cuba, Dominican Republic, Ecuador, Guatemala and Uruguay). Preliminary analysis shows that there is no difference in the volume of human milk consumed by exclusively breastfed infants in different regions of the world, when this is expressed in g/day/kg body weight. There is, however, a difference between regions in the accuracy of mother’s self-reported exclusive breastfeeding practices, with the smallest deviations in Asia, and the biggest in Africa.

Recently, a new validation study has been conducted in Indonesia, where mother’s infant feeding practices were determined using the DTM technique and by direct observation. A total of 121 mother-infant pairs were recruited. The mothers feeding practices were observed by trained field assistants recruited from the local community, from 6 am to 6 pm each day on 6 non-consecutive days over the two week protocol. A pharmokinetic modelling approach was used to determine the non-milk water cut-off using a Bayesian framework. The new cut-off is 86.6 g/day. It is hoped to develop an application for analysis of the deuterium data using the same approach, since the IAEA spreadsheet will no longer be applicable. A reduced protocol, involving 3 sampling times (1 pre-dose and 2 post-dose) is also being investigated, which will enable the DTM method to be used to validate information on breastfeeding practices collected during national nutrition surveys.

Institution
Retired IAEA Nutrition Specialist

Country
United Kingdom
Presenter(s) : Ms. SLATER, Christine (Retired IAEA Nutrition Specialist)

Session Classification : Session 5 - Infant and young child feeding I - Breastfeeding
Breastfeeding patterns and infant body composition

Introduction:
Exclusive Breastfeeding (EBF) for the first 6 months of an infant’s life is recommended by WHO for optimal health and growth of infants. Body composition, and in particular higher muscle/fat-free mass is associated with better health outcomes. This study set out to investigate whether the recommended 6 months of EBF is associated with a higher fat-free mass at 12 months of age.

Methods:
The study participants included 100 mother-infant pairs recruited from a low-resource; high HIV prevalence setting in Durban, South Africa. Gold standard measurement of exclusivity of breastfeeding was determined using the deuterium-dose-to-mother method. This methodology also allowed determination of body composition of mothers. The measurements for EBF were taken at 6 weeks, 3 months and 6 months. Infant body composition was determined at 12 months of age by the gold standard, dose-to-infant deuterium dilution method.

Results:
HIV infected and uninfected mothers had similar breastmilk output and similarly there was no negative impact on the mother’s body composition in both groups. The study showed that maternal recall of EBF was not a good measure for this type of study since it correlated poorly with the gold standard measure. Only 50 infants had sufficient information to be able to have a classification of breastfeeding pattern at 6 months of age as well as a body composition measure at 12 months of age. Infants who received EBF for 6 months had higher % fat-free mass (mean of 83.3%) vs those not EBF (mean of 77.3%) – this difference was significant (p <0.025).

Conclusion:
The results provide objective evidence that 6 months of exclusive breastfeeding is associated with optimum body composition at 12 months of life and therefore provides further support for the WHO recommendations of 6 months exclusive breastfeeding. Furthermore the study provides evidence, confirming data that HIV status does not compromise a breastfeeding mother’s breastmilk production nor her fat-free mass.

Institution
University of Kwazulu-Natal

Country
South Africa

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Session Classification:  Session 5 - Infant and young child feeding I - Breastfeeding
Enabling factors to promote and support breastfeeding

Breastfeeding requires support from families, communities, the health system and the work place. A systematic review of 195 articles showed that the highest impact on improving breastfeeding rates is obtained with a combination of interventions from different delivery platforms, for example counselling in the home and in the community, or health systems and the home. This review found that implementing the Ten Steps of the Baby-friendly Hospital Initiative (BFHI) in maternity facilities has a high effectiveness in improving breastfeeding outcomes. Unfortunately, the global coverage of this support package is low, and many countries have not been able to sustain implementation over time. WHO and UNICEF updated the implementation guidance for the BFHI in 2018, moving away from the vertical approach and with emphasis on approaches to achieve universal coverage and sustainability.

In addition to specific breastfeeding promotion and support programmes, the enabling environment in which these programmes are implemented also needs to improve. UNICEF and WHO lead the Global Breastfeeding Collective, a partnership of more than 20 prominent international agencies which calls on donors, policymakers, philanthropists and civil society to increase investment in breastfeeding worldwide. The Collective has formulated seven policy asks, related to increasing funding for breastfeeding interventions, implementing the International Code of Marketing of Breastmilk Substitutes, enacting paid family leave and workplace breastfeeding policies, implementing the BFHI, improving access to skilled breastfeeding counselling, strengthening links between health facilities and communities and strengthening monitoring systems.

The Collective is carrying out advocacy actions at the global level, and engaging with an increasing number of countries. Several advocacy materials, including country specific score cards to assess progress against the policy asks, are accessible on-line. The Collective will also launch a toolkit for breastfeeding advocacy in early 2019.

Institution
UNICEF

Country
United States

Presenter(s)
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Session Classification
Session 5 - Infant and young child feeding I - Breastfeeding
Complementary feeding practices and growth

Complementary feeding is essential for promoting healthy growth and sustaining development of a growing child to ensure he or she has lifelong health. The physiological need for complementary feeding, defined as the introduction of nutrient dense foods to complement breast or formula feeding, is derived from the dynamic changes in body composition that occur during normal growth. This seminar will focus on key elements of complementary feeding programs that promote health and challenges that may exist limit success of such programs.

An infant quite rapidly for the first year, depositing more lean, metabolically active tissue, until the first year of life. After 1 year, changes in body composition are more subtle as the child grows and develops in size and accumulates a greater mass of lean tissue. These changes in body composition dictate changes in energy requirements to support healthy growth and development. For example, from birth to 1 year, energy needs are relatively constant at about 100 kcal/kg/day, yet energy supplied from breast milk or infant formula is generally able to support only 400-500 kcal/day. Thus, once a child has great energy needs, generally at 6-8 months, other calories need to be supplied from complementary foods.

The importance of complementary feeding is most evident when we consider the outcomes of children who are provided such foods later in childhood or in insufficient quantities. When complementary foods are introduced late in childhood, energy and nutrient requirements are not met and growth either slows or ceases depending on the length and timing. In fact, while lean tissue mass nearly triples from birth to 1 year of age, the energy requirements only double, indicating that the balance of energy is required to support growth. A number of studies have shown that poor complementary feeding is associated with growth retardation and developmental delays. Therefore, to prevent the double burden of malnutrition, it is necessary that parents fully understand the importance of properly introducing appropriate foods at the right time that complement other feedings.

Programs to promote complementary foods have been analyzed in several meta-analyses and have been found to be effective to a degree, but challenges remain to make them fully effective. Cultural differences and the choice of appropriate foods limit the effectiveness of many programs. As well, empowering women to decide on the timing and foods to introduce remains a challenge in some cultures. Also, many programs focus on stunting, the most severe form of growth retardation, as the primary outcome studied. Yet, a number of successes can be claimed for programs that do not necessarily influence stunting, such as improved iron status, increased maternal empowerment or education, and so on. Thus, it is important for evaluations to focus on changes in growth and other areas of interest rather than a single programmatic cut-off that may be influenced by a number of competing factors.

Institution
Rutgers University

Country
United States
Presenter(s) : Mr. HOFFMAN, Daniel (Rutgers University )

Session Classification : Session 6 - Infant and young child feeding II - Complementary feeding
Essentials of complementary feeding and national bottleneck analysis

From the age of 6 months, infants need to start complementary feeding. The quality of complementary feeding is crucial to ensure optimal growth between the ages of 6 and 24 months, which is the timeframe during which growth faltering most often occurs. The essentials of complementary feeding are: 1) the quality of the foods provided (diversity, micronutrient and energy content, anti-nutrient content), 2) the timing (age) of introduction, 3) the age-appropriate amounts of foods and 4) frequency of feeding, 5) safety of food preparation and storage, 6) responsiveness of feeding practices, 7) feeding during and after illness and 7) continued breastfeeding.

Understanding factors that influence complementary feeding practices, often referred to as bottleneck analysis, is an important step to improve complementary feeding programs. Factors that can act as bottlenecks on the determinants of complementary feeding can be grouped into enabling environment (policies, social and cultural practices and beliefs), supply (availability of adequate supplies like nutritious foods, information materials, micronutrient supplements), availability of adequately staffed services and information) and demand (financial access, caregivers’ practices and beliefs).

Conducting a national level bottleneck analysis for complementary feeding will require a combination of secondary review and qualitative methods. When information is insufficient or missing, proxy indicators need to be used. Information about the amount of foods provided and responsiveness of feeding practices is often the most difficult to obtain. The status of the determinants can vary between geographic regions in a country and between socio-economic and livelihood groups.

In Ethiopia, a national bottleneck analysis found that for dietary diversity, social and cultural practices and specifically fasting are a constraining factor for the enabling environment in all livelihood zones (Agrarian (food secure and food insecure), pastoralist and agro-pastoralist). Seasonal (in)availability of nutrient rich foods is a supply side bottleneck and so is the availability of knowledgeable health extension workers. On the demand side, mothers’ time for infant food preparation was found as a bottleneck, as well as the cultural practice of providing food for the father first. The constraining factor differed across livelihood zones. This analysis shows that corrective interventions need to be comprehensive and address the bottlenecks at all levels (policy, supply and demand) and for each livelihood zone.

Institution
UNICEF

Country
United States

Presenter(s) : Ms. BÉGIN, France (Senior Nutrition Adviser, UNICEF)

Session Classification : Session 6 - Infant and young child feeding II - Complementary feeding
Responsive feeding: Evidence on association with child nutrition status

Child nutrition programmes are confronted with the challenges of addressing both under nutrition and over nutrition. Establishing healthy eating behaviours begins in childhood and is dependent on healthy foods and responsive care. Responsive care is the capacity of the caregiver to recognise the child’s signals and respond promptly, contingent on the signals in a developmentally appropriate manner. This caregiving skill promotes quality interactions between the caregiver and child thereby supporting healthy development. When applied to a feeding context, responsive care can positively influence early feeding experiences that shape dietary behaviours as well as an individual’s recognition of their internal signals of hunger and satiety. Infant and young child feeding programmes increasingly recognize that addressing feeding behaviours, specifically responsive feeding, may support young children’s acceptance of food and their dietary intake. Studies show promising evidence that responsive feeding is significantly associated with improved dietary intake, fostering healthy eating choices, increased child acceptance of food and increased mouthfuls eaten. There are fewer studies that have shown a beneficial association between responsive feeding and child growth status. However, the field faces several challenges. Firstly, there is a wide range of definitions and operationalization of the term responsive feeding. Secondly, few intervention studies have been designed to isolate the effect of responsive feeding on child nutritional outcomes. Thirdly, there is no agreed standard measure of responsive feeding behaviours. In summary, while the integration of responsive feeding in infant and young child feeding programmes is a promising approach to promote healthy eating behaviours and supporting nutritional adequacy, further research is necessary to provide guidance on effective strategies to implement responsive feeding in different cultural contexts and to prioritize the development of standardized tools to assess responsive feeding behaviours.

Institution
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Country
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Session Classification: Session 6 - Infant and young child feeding II - Complementary feeding
How to do no harm with existing interventions? Examples of unintended effects

Introduction - Food-assisted maternal and child health and nutrition (FA-MCHN) programs are widely used development strategy to address household food insecurity and maternal and child undernutrition in low- and middle-income countries. They typically include food transfers with a package of maternal and child health and nutrition (MCHN) interventions. Evidence shows that these programs can effectively improve child and maternal nutrition outcomes. Transfer programs intended to improve nutrition in poor households, however, may simultaneously lead to excessive energy intake and contribute to unhealthy weight gain among some household members, especially in food secure populations. The study presented here capitalizes on the recently conducted evaluation of PROCOMIDA, a food-assisted MCHN program in Guatemala, a country with one of the highest global rates of under-five stunting, while overweight and obesity increase at an alarming rate. The main objective of PROCOMIDA was to prevent undernutrition in women during pregnancy and postpartum, and in children aged 0–23.9 mo. The program had three core components: the distribution of food rations, a BCC strategy focused on improving health and nutrition practices, and improved provision and use of health services. The program was shown to have a significant positive effect on child linear growth.

Methods - We used a longitudinal cluster-randomized controlled design to assess the program’s impact on postpartum weight retention. A total of 120 study clusters were randomized into one of five treatment arms and one control arm. Treatment arms varied in the amount and types of food transfers they received. Weight was measured during pregnancy and at 1, 4, 6, 9, 12, 18 and 24 months postpartum. We used linear mixed models with random effects (i.e. random intercepts) for the cluster and the mother, fitting the model with restricted maximum likelihood. Sequential multiple imputation by means of chained equations was used to fill in missing values. Data on 3,535 women were analyzed.

Results - PROCOMIDA had a significant impact on women’s body weight. A significant (P<0.05) overall program effect (model 1) of 0.5 to 1.0 kg was found in the arm receiving the largest food ration at all time points after birth. The effects were smaller in the study arms receiving smaller rations. The largest weight effect happened early on: significant effects were evident at 1 months postpartum and grew by no more than an additional 30% by the time women were 12 months postpartum.

Conclusions - Our study is the first to demonstrate, using a rigorous cluster randomized controlled trial, that a food-assisted MCHN program led to significant increase in postpartum weight retention. This increase in weight is of concern because of the problem of overweight and obesity in this population.

Discussion – Our previous work in Mexico found that cash and in-kind transfers increased women’s weight (results will be presented). More work is needed to better understand the effect of food transfers on diet in low and middle-income countries and more importantly on how these programs can be designed to improve dietary adequacy without leading to excess energy intake. Where relevant, programs and policies should simultaneously reduce the burden of both undernutrition and overweight and non-communicable diseases (NCDs). At the most basic level, these double duty actions require current nutrition programs and policies to not inadvertently contribute to overweight and NCDs.

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Session Classification : Session 6 - Infant and young child feeding II - Complementary feeding
Epigenetics within the double burden of malnutrition

An early definition for epigenetics stated that this term involves “the study of the mechanisms of temporal and spatial control of gene activity describing pathways different from those directly attributable to the underlying DNA sequence and with an influence on the adaptive response of an organism”. Epigenetics is contributing to explain undisclosed phenotypical interactions between genes and nutrition. Actually, epigenetics can provide insights to understand genetic foetal programming, monozygotic twin differences and chronic disease onset in the adult. Interindividual differences concerning malnutrition and nutritionally-related chronic diseases depend not only on the dietary intake and the subject’s DNA sequence, but also on the inherited epigenome and the impact of different nutritional influences that modify the epigenetic marks, Epigenetic mechanisms are dynamic, whose outcomes might be transferred from one generation to the next, being able to modulate gene expression, as mediated by DNA methylation changes, covalent histone modifications, chromatin folding and the regulatory actions of miRNA.

Nutritional imbalances in the perinatal period can cause epigenetic alterations, which in the long-term are responsible for metabolic syndrome features. Relationships between adult diseases and perinatal nutritional status founded the theory of fetal origin or programmed development of diseases, which may partially be explained by epigenetic mechanisms. Maternal nutrition can epigenetically modify the newborn expression patterns of genes that persist over time and may contribute to chronic disease in the adulthood. Some genes with plausible epigenetic regulation are related to adipogenesis, inflammation, appetite, energy expenditure, lipid metabolism, etc., whose expression depends on factors related to diet (folic acid, antioxidants, flavonoids, etc.) that influence relevant epigenetic mechanisms involving nutrition. In this context, different examples of dynamical changes in DNA methylation patterns due to the restriction or supplementation with different nutrients have been reported concerning energy, vitamin B6, vitamin A and some minerals intakes.

Undernutrition is caused by an inadequate intake of dietary energy or some specific nutrients, which accompany starvation, famine or voluntary food intake reduction. Cumulative evidence has demonstrated that undernutrition, can modify epigenetic marks throughout life, affecting gene expression and cell function, affecting health in adulthood. The impact of undernutrition on epigenetic mechanisms is driven by the deficiency of dietary methyl-donors (choline, betaine, folate and vitamins B2, B6, and B12) and other micronutrients, low-protein diets, calorie restriction and famine exposure, which is leading to design novel dietary interventions targeting the epigenome. High fat/sugar intake and excessive body weight or obesity are also associated with changes in DNA methylation profiles on different genes involved in energy homeostasis such as LEP, POMC, FASN, CLOCK, and NDUFB6. Epigenetic biomarkers are being identified in order to predict body weight maintenance after weight loss in humans, including methylation changes in CpGs on specific genes such as TNF-alpha, AQP9, ATP10A and CD44 as well as some concrete miRNAs modulation. As a corollary, understanding epigenetic process related to nutritional status will contribute to precision individualized nutrition as well as for the prevention and management of malnutrition, where epigenetic signatures are potential biomarkers as well as targets for intervention in undernutrition and obesity.

Institution

University of Pamplona
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Session Classification : Session 7 - Parallel Sessions
Child’s microbiome and malnutrition

In the gut, the initial microbial population is quite heterogeneous. Regulatory mechanisms generated within habitats (such as immunity and physicochemical environments conditions) and external forces (types of nutrients, environmental contamination and use of antimicrobials) allow the continued presence of some types of microorganisms and the elimination of others. Subsequently, the composition of the microbiota becomes more stable, and the normal adult bacterial community is reached. The children will reach a microbiota with characteristics of adult or community climax around the 2 years of age. From this period, although the intestinal microbiota remains in permanent interaction with microorganisms of the environment, its composition remains stable. The maintenance of eubiosis in the gut depends on diet, providing substrate to microbiota members, as well on the integrity of the epithelial cells and immune tissues. These structures together form the intestinal barrier. Damage in one of the structures of the barrier will lead to a dysbiosis status. Situations of undernutrition and overweight have a direct impact and relation with dysbiosis. In undernutrition situations there is a permanent immaturity of the microbiome together with a disruption of the barrier. Therefore, there is a delay in nutrient absorption as well an impaired immune system. In an overweight situation, there is also a disruption of intestinal barrier, relating to diet and a detriment microbial composition. There is an increase of energy intake and systemic effects on the host such as increased adiposity and inflammation. The breast milk can configure gut microbiome, facilitating optimal microbial colonization. Human milk oligosaccharides stimulate some bacterial genera, such Bifidobacterium longum subsp infantis, which will provide a stable and eubiotic status in infant gut microbiome. Breast milk also improves immune condition and nutritional source. Understanding how the microbial-host interactions occurs, and the effects of diet and breast milk on eubiotic status, we can propose some possibilities to deal with double burden of malnutrition.

Institution
Universidade de São Paulo

Country
Brazil

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Session Classification : Session 7 - Parallel Sessions
Metabolic profiles of adult survivors of severe acute malnutrition

Introduction
The increasing burden of heart disease and type 2 diabetes in lower middle income countries is likely related to exposure to western style diets; however, in many of these countries severe acute malnutrition (SAM) is also prevalent, resulting in a double burden of nutritional insults. While prenatal undernutrition has been associated with increased risk of later cardiovascular disease (1) the consequences of post-natal undernutrition are unknown. SAM can present as severe wasting or oedematous malnutrition; these phenotypes have distinct metabolic signatures. Children with oedematous malnutrition have lower rates of lipolysis (2) and protein turnover (3) than those with severe wasting. Studies using metabolomic analyses report that children with SAM had metabolic profiles that were different from controls even after recovery from SAM (4). Also, 31 metabolites had lower concentrations in children with oedematous malnutrition on admission (4). This study will investigate the long term risks of SAM by evaluating the cardio-metabolic profiles of adult SAM survivors.

Methods
Subjects: This retrospective analysis utilized a cohort of 1,336 Jamaican adults who were hospitalized as children with a diagnosis of SAM between 1963 and 1993 and age, sex and BMI-matched community controls.

Measurements: Birth weight and height and weight measurements were abstracted from hospital records. Anthropometry, blood pressure, glucose tolerance, insulin sensitivity, arterial stiffness, pulse wave velocity, indirect calorimetry and liver fat were measured in adult SAM survivors and controls. Muscle tissue was collected for epigenetic studies and fasting serum was collected for metabolomic analyses. A targeted metabolomics approach (direct injection flow-mass spectrometry) will be used to quantify acylcarnitines, amino acids, biogenic amines, phospholipids and sphingolipids. Fibroblast growth factors, TNF-α, vitamin D and IGF-I will be measured using ELISA.

Data Analysis: Skewed metabolic data were transformed towards a normal distribution and multiple linear regression analyses were used to assess differences between SAM survivors and controls, and between survivors of non-oedematous and oedematous malnutrition. Regression models were adjusted for age and sex and variably adjusted for height, BMI and birth weight. Metabolomic data will be analyzed using R Statistical Software using principal component analysis, partial least square discriminant analysis and lasso regression analyses.

Results
Children with severe wasting weighed 333g less at birth, and as adults, they had lower BMI and fat mass, greater glucose intolerance and differential gene methylation in metabolic, body composition and cardiovascular pathways compared to survivors of oedematous malnutrition. Survivors of severe wasting had more liver fat than oedematous malnutrition survivors after adjusting for age, sex and BW (β = -2.62, SE = 1.23; P = 0.03). In survivors of severe wasting, liver fat was associated with faster rates of catch-up growth during nutrition rehabilitation (r = 0.449, P = 0.004). Whole body fat oxidation was not associated with liver fat in this population. Metabolomic analyses are pending.

Conclusion
Our data indicate that survivors of severe wasting have higher cardio-metabolic risk than survivors of oedematous malnutrition as adults. Detailed metabolic profiling could provide mechanistic insight into the pathways involved.
Institution

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Canada

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Presenter(s) : Dr. THOMPSON, Debbie (Hospital for Sick Children)

Session Classification : Oral Abstract Presentations - Undernutrition
Short children with a low MUAC do not gain excessive fat with food supplementation: an observational study from Burkina Faso

**Introduction:** Children with moderate acute malnutrition (MAM) in many settings receive food supplementation through outpatient programs. It is common practice to avoid measurement of mid-upper arm circumference (MUAC) of children, whose length is below a certain threshold (67 or 65 cm). Thus, even if short children have low MUAC they are excluded from malnutrition programs. This seems based on expert opinion that supplementation of shorter children with weight-for-height z-score (WHZ) ≥ -2 may increase risk of excessive fat accumulation during treatment and later risk of non-communicable diseases. We have previously shown that ponderal growth rates are similar in short and longer children with low MUAC. To what extent there is difference in fat accumulation has not been assessed.

**Objective:** To assess if short children gain more fat than longer children when treated for MAM diagnosed by low MUAC.

**Method:** This was an observational study nested in a randomized nutrition trial. Children aged 6-23 months were included in this sub-study if their MUAC was between 115-125 mm, but WHZ ≥ -2. Based on length at admission the children were categorized as SHORT if < 67 cm and LONG if ≥ 67 cm. Linear mixed-effects models with site-specific random effects were used to compare changes in body composition, based on deuterium dilution, and skinfold thickness while adjusting for month of admission, baseline measure, intervention, sex and age.

**Results:** Following 12 weeks of supplementation, there was no difference in change in fat mass index (-0.038 kg/m², 95%CI -0.257; 0.181, p=0.74) or fat-free mass index (0.061 kg/m², 95%CI -0.150; 0.271; p=0.57) in SHORT vs LONG. In absolute terms, the SHORT children gained both less fat-free mass (-230 g, 95%CI: -355, -106, P<0.001) and less fat mass (-97 g, 95%CI -205, 10, p=0.076). There were no difference in changes in absolute subscapular and triceps skinfold thickness and z-scores (all p>0.5).

**Conclusions:** SHORT children with low MUAC do not gain excessive fat during supplementation. These data support a recommendation for policy change to include all children ≥ 6 months with low MUAC in supplementary feeding programs, regardless of length. The use of length as a criterion for measuring MUAC to determine treatment eligibility should be discontinued in policy and practice wherever such restrictions exist.

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Session Classification : Oral Abstract Presentations - Undernutrition
Long-term metabolic effects of malnutrition: Liver steatosis and insulin resistance following early-life protein restriction.

Introduction
Malnutrition remains prevalent worldwide, and about 45% of all child deaths are linked to malnutrition. It is unclear whether survivors of childhood malnutrition suffer from long-term metabolic effects, especially when exposed later in life to an obesogenic diet. The lack of understanding around this dietary “double burden” warrants studies to understand the long-term consequences postnatal malnutrition. We hypothesized that an early-life nutritional insult of low protein consumption in mice would lead to long-term metabolic disturbances that would exacerbate the development of obesogenic diet-induced fatty liver disease and insulin resistance.

Methods
We investigated the effects of feeding a low protein diet (4% wt/wt) immediately after weaning for four weeks and subsequent feeding of a high carbohydrate high fat feeding for 16 weeks on metabolic function and development of non-alcoholic fatty liver disease (NAFLD).

Results
Mice exposed to early-life protein restriction as a model for malnutrition demonstrated a transient glucose intolerance upon recovery by regular chow diet feeding. However, protein restriction after weaning in mice did not exacerbate obesogenic diet-induced insulin resistance. In additional NAFLD scores were similar in low protein diet fed animals compared to regular protein fed animals after high carbohydrate high fat feeding.

Conclusions
These data suggest that transient protein restriction in early-life does not exacerbate high carbohydrate high fat diet-induced NAFLD and insulin resistance in mice.

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Session Classification : Oral Abstract Presentations - Undernutrition
The companionship of lean mass and fat mass revisited: towards novel concepts in human body composition autoregulation

Current explanations about how body weight is regulated generally center on control systems operating via energy intake and energy expenditure. The role played by control system(s) operating through energy partitioning between lean mass and fat mass is, however, rarely invoked. Yet, in the late 1970’s and 1980’s, the control of the body’s lean-fat partitioning was embodied in the classic work of Gilbert Forbes on human body composition during weight loss and weight gain - leading to his famous quote that ‘lean body mass and body fat mass are in a sense companions’. A control of lean-fat partitioning also constitutes a cardinal feature of the Payne-Dugdale ‘dynamic equilibrium’ model of weight regulation in which an intrinsic partitioning characteristic between lean and fat tissue - which they referred to as the P-ratio. This presentation will first revisit the concepts and hypotheses about an intrinsic (or endogenous) control of lean-fat partitioning, its sensitivity to initial adiposity during weight loss and weight gain, and its role in the dynamics of lean mass and fat mass recoveries during weight regain. It will then focus upon the outcome of interactions between this intrinsic control of lean-fat partitioning with other intrinsic control systems or extrinsic factors, and which have led to more recent concepts of the ‘thrifty catch-up fat phenotype’ and ‘collateral fattening’ – with implications for research directed at understanding the mechanisms by which developmental programming, dieting and sedentariness predispose to obesity and cardiometabolic diseases.

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Session Classification : Oral Abstract Presentations - Undernutrition

Track Classification : Biology
Post-discharge body composition outcomes for children treated for severe and moderate acute malnutrition using ready-to-use therapeutic food

Introduction: Moderate acute malnutrition (MAM) affects 36 million children worldwide and results in increased risk of illness, reduced physical and mental development, and death. International guidelines for managing MAM are currently limited. Understanding the effects of MAM and MAM treatment on body composition is essential for informing the creation of guidelines which are sensitive to the growing "double burden" of malnutrition in low-income countries.

Methods: Nested within a non-inferiority cluster-randomised trial, this study aimed to quantify differences in body composition, 4-months post-treatment, between those treated with a novel, simplified "combined protocol" and those treated with the standard protocol. The combined protocol provides ready-to-use therapeutic food (RUTF) for both severe acute malnutrition (SAM) and MAM. The standard protocol comprises RUTF for SAM cases and ready-to-use supplementary food (RUSF) for MAM cases. Body composition was assessed through bioelectrical impedance analysis (BIA) and skinfold thicknesses. Data was analysed using simple linear regression.

Results: These are preliminary results at the recruitment half-way point. Full results will be available by December 2018. So far 291 children have been recruited (66% female; median age 18 months; age range 11 - 52 months), 171 in control clinics and 120 in intervention clinics. Valid, repeatable BIA readings are available for 275 children. No significant unadjusted differences in BIA outcomes (raw impedance values and phase angles) nor skinfold thickness outcomes (tricep, subscapular and skinfold thickness ratio (tricep:subscap)) were found between acutely malnourished children treated with the combined protocol vs the standard protocol (Table 1). Nor were any significant differences seen between children admitted with SAM and those admitted with MAM by 4-months post-discharge. When comparing MAM cases only (n=187), there was no unadjusted significant differences in raw BIA outcomes nor subscapular skinfold thickness, however MAM cases treated with RUTF had significantly larger tricep skinfold thickness than those treated with RUSF (mean difference: 0.80cm, 95%CI 0.27 to 1.33, p=0.003). Subcutaneous fat levels remained low in all groups (tricep skinfold thickness z-scores -0.6 and -0.9 for MAM treated with RUTF and MAM treated with RUSF respectively).

Conclusion: Based on preliminary, unadjusted analyses, the simplified combined protocol for acute malnutrition was non-inferior to the standard protocol with regard to body composition outcomes at 4-months post-discharge. MAM children treated with the RUTF-only combined protocol appear to have similar lean mass levels as indicated by BIA and similar core body fat levels indicated by subscapular skinfold thickness. However, MAM children treated with RUTF may have more peripheral subcutaneous fat indicated by tricep skinfold thickness. All children remained with subcutaneous fat levels below the WHO global norm (z-score 0), hence there is no evidence of excessive fat gain by 4-months post malnutrition treatment. Future follow-up is needed to explore longer term outcomes.

Institution

No Wasted Lives, Action Against Hunger

Country

UK
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**Presenter(s):**  Dr. LELIJVELD, Natasha (No Wasted Lives, Action Against Hunger UK)

**Session Classification:**  Oral Abstract Presentations - Undernutrition

**Track Classification:**  Interventions
Optimising the balance between metabolic capacity and metabolic load for lifelong health

The double burden of malnutrition represents a new conceptual framework for understanding the life-course aetiology of variability in human health outcomes and disease risk. There is now compelling evidence that under-nutrition in early life is most strongly associated with adult disease when overweight subsequently emerges. However, this association is also complex, as both the manifestation of early-life under-nutrition, and the components of adult phenotype that predict ill-health, vary within and between populations, in association with factors such as age, sex, geography, ethnicity and socio-economic status. The ‘capacity–load’ model represents a conceptual approach developed to improve understanding of the aetiology of adult disease, and its association with ecological and societal risk factors. The model addresses continuous associations of both (a) nutrition and growth patterns in early life and (b) a variety of lifestyle factors at older ages with disease risk. Metabolic capacity refers to physiological traits strongly contingent on early nutrition and growth during the first 1000 days, which promote the long-term capacity for homeostasis in the context of fuel metabolism and cardiovascular health. Metabolic load refers to components of nutritional status and lifestyle that challenge homeostasis. The higher the load, and the lower the capacity, the greater the risk. While most attention to date has been directed to non-communicable diseases (NCDs), the same approach can be used to examine other health outcomes, such as the risk of obstructed labour.

Infancy represents a critical developmental period, during which under-nutrition and slow growth can constrain metabolic capacity, whereas rapid weight gain may elevate metabolic load. Severe acute malnutrition in early childhood (stunting, wasting) may continue to deplete metabolic capacity, and confer elevated susceptibility to NCDs in the long term. Macrosomic infants may already have demonstrated ‘catch-up’ growth in late fetal life, and have accumulated both low metabolic capacity and high metabolic load before birth. The model can be applied to explore associations of NCD risk with socio-economic position (SEP): lower SEP is generally associated with lower capacity but often also with elevated load. In each case, low SEP increases susceptibility to malnutrition through reductions in agency over diet and lifestyle. The model can also help explain ethnic differences in NCD risk, as both early growth patterns and later body composition differ systematically between ethnic groups. For example, populations such as South Asians tend to have low average birth weights, but also a high ratio of fat to lean mass in adult life. Recent work has begun to clarify the role of organ development in metabolic capacity, which may further contribute to ethnic differences in NCD risk.

Institution
UCL Institute of Child Health

Country
United Kingdom

Presenter(s): Mr. WELLS, Jonathan (UCL Institute of Child Health)
Trans-generational impact of the double burden of malnutrition: A case study from India

Maternal nutrition and metabolism can permanently alter the structure and function in a developing embryo which persists for the rest of life, this is called programming. Both undernutrition (of macro- and micro-nutrients) and overnutrition (maternal obesity and diabetes) increase the risk of future adiposity and diabetes. This reflects in the U shaped association between birth weight and subsequent diabetes. In a rapidly transiting country like India, there is a coexistence of persistent nutrient deficiencies and gestational diabetes which together could contribute to the rapidly rising epidemic of diabetes and other cardio-metabolic disorders. Indeed, India has rapidly become one of the world’s capitals of diabetes and cardiovascular disease.

Research in India (Pune Children Study and Pune Maternal Nutrition Study) have shown that the short and undernourished mothers (F0) gave birth to small and thin babies (F1). Despite being underweight they are more adipose than the English babies (thin-fat Indian baby). These babies are at high risk of diabetes and cardiovascular disease, especially if they growth larger during childhood and adolescence. Maternal micronutrient nutrition, metabolic characteristics and physical activity contribute to the body composition and future risk of diabetes these babies. Based on our findings we initiated a pre-conceptional intervention with vit B12 and other micronutrients to influence future risk of diabesity in their offspring (F2). Serial prospective data collection in 3 generations provides a unique opportunity to study trans-generational impact of the double burden of malnutrition.

The F1 children have grown on average 5 cm taller and 1kg/m2 heavier than their parents. Despite their relative thinness (BMI 19 kg/m2) at 18 years of age 18% of women and 35% men have pre-diabetes. Prediabetes is predicted by lower birth weight but higher BMI at 18 years, and lower pancreatic β-cell function in relation to their insulin resistance. F1 pregnant mothers reflect the effects of rapid socioeconomic transition. They have considerably higher glucose concentrations compared to their mothers and their babies (F2) are 200 grams heavier compared to their own birth-weight (F1). Interestingly, F2 babies do not have larger skinfolds. The effect of our micronutrient intervention will be known only after enough number of babies are born.

In summary, we have very interesting data to trace transgenerational programming effects of rapid socio-economic and nutritional transition within two generations over last 3 decades in India. We are also investigating the effects of a ‘primordial’ intervention to reduce the risk of ‘diabesity’ in future generations.

Institution

King Edward Memorial Hospital and Research Centre, Pune

Country

India

Presenter(s): Mr. YAJNIK, Chittaranjan (King Edward Memorial Hospital and Research Centre, Pune, India)

Session Classification: Session 8 - Undernutrition
Understanding children who are both wasted and stunted: What we know from exploring existing data

Introduction
Wasting and stunting are common. They are implicated in the deaths of almost two million children each year but tend to be addressed as separate issues in research, policy and practice despite evidence of common causality and the fact that children may suffer simultaneously from both conditions. The Wasting and Stunting Technical Interest Group (WaSt TIG) coordinated by the Emergency Nutrition Network (ENN) has been exploring the relationship between wasting and stunting in children since 2014 to understand whether this separation is justified. Among various gaps in knowledge and understanding identified after literature review and a research prioritization exercise include outstanding questions regarding the magnitude of concurrent wasting and stunting, which children are most affected by this condition, and how best to identify and support them.

Method
The WaSt TIG has been exploring existing datasets firstly to answer questions related to the prevalence, characteristics and risks for children concurrently wasted and stunted. The group sourced and used readily available cross-sectional datasets such as national level demographic and health surveys (DHS) and Multi-Indicator Cluster Surveys (MICs) data, a compiled database of SMART survey data, and longitudinal data on nutritional status and mortality from Niakhar Senegal to answer these questions.

Results
The literature review found evidence that the risk of death associated with multiple nutritional deficits (wasting, stunting and underweight) is 12.3 (95% CI: 7.7, 19.6) similar to the risk of death reported for severe wasting. However, the analysis of SMART survey data revealed that all children with WaSt are also underweight suggesting that this high mortality risk is applicable to children with concurrent wasting and stunting. Analysis of 84 country DHS/MICs survey data revealed that the prevalence of concurrent wasting and stunting ranges from 0% to 8% with 9 countries recording prevalence of above 5%. Pooled prevalence was at 3.0% (95% CI 2.97 to 3.06). Analysis of 51 country SMART surveys indicated that the prevalence of concurrent wasting and stunting is higher in children aged less than 30 months and nearly 50% more prevalent in boys than girls. The finding that all children with WaSt are also underweight also suggested that measures used in identification of underweight children may be applicable to identify WaSt. Analysis of longitudinal data from >5000 children from Niakhar, Senegal showed that weight-for-age Z score <-2.8 identifies all deaths associated with WaSt. The analysis also reveals that when MUAC <115 is applied, it identifies deaths missed by WAZ<-2.8 which is not the case when WHZ is used.

Conclusion
Concurrent wasting and stunting is strongly associated with mortality. Concurrent wasting and stunting should be routinely reported in surveys and national and global level reports concerned with undernutrition. Given its association with mortality the extent to which children with concurrent wasting and stunting are being identified and supported through nutrition programmes needs further investigation. A combination of MUAC and WAZ may best identify all near-term deaths associated with anthropometric deficits including concurrent wasting and stunting and should be considered as admission criteria into programmes.

Institution
KEMRI Wellcome Trust Research Programme
Country
Kenya

Presenter(s) : MWANGOME, Martha (Kenya Medical Research Institute (KEMRI))

Session Classification : Session 8 - Undernutrition
Linear growth and relapse from acute malnutrition; an example from Malawi

Background:
Since the advent of home-based therapy for acute malnutrition using ready to use therapeutic foods, there has been great improvements in treatment outcomes. However, although children treated for acute malnutrition recover anthropometrically, they remain at risk and exhibit higher mortality and relapse of their malnutrition. Amongst other factors, children suffering from acute malnutrition (wasting) may have co-existing subclinical morbidity and anthropometric deficits including stunting. Wasting and stunting in children under 5 years of age are frequently considered as 2 separate conditions with distinct causes, effects, and treatment outcomes. However, the two conditions may co-exist and predict each other’s occurrence. Paucity of longitudinal data has retarded the understanding and quantification of the risk of acute malnutrition as an immediate outcome of linear growth retardation.

In this example we explore associations between linear growth and relapse to acute malnutrition in high-risk children during the year after recovery from moderate acute malnutrition (MAM). The analysis is based on a secondary data analysis from a cluster randomized trial that assessed the effectiveness of a package of health and nutrition services on post-recovery outcomes after treatment for MAM at a supplementary feeding program (SFP) in Malawi. 1487 Malawian children aged 6–62-month-old were involved in the main trial and were treated for MAM and enrolled into this sub-study upon recovery. In the subsequent one-year post anthropometric recovery, we collected data on anthropometric progress, symptoms of illness, and household food security. Multivariate fixed-effects logistic regression was used to identify associations between linear growth and relapse to acute malnutrition.

Children who recovered from MAM proved to be a high-risk population, with nearly half experiencing a decrease in height-for-age z score (HAZ) for 12 months. Children whose HAZ was declining were more likely to relapse to MAM or SAM than were those who maintained or increased their HAZ.

These results suggest that acute wasting may predict subsequent stunting and that children who experience poor linear growth after MAM are more likely to experience relapse. The directionality of this association cannot however be conclusively demonstrated in this study and further studies are required to better understand this relationship and inform intervention programs design.

Institution
University of Malawi

Country
Malawi

Primary author(s) : Mr. MALETA, Kenneth (University of Malawi)
Presenter(s) : Mr. MALETA, Kenneth (University of Malawi)
Considerations for the Health System for addressing the Double Burden of Malnutrition

The potential costs to individuals and society at large of managing and treating the consequences of the double burden of malnutrition appear prohibitive. Public health has been defined as "the art and science of preventing disease, prolonging life and promoting health through the organized efforts of society" (Acheson, 1988). The evidence indicates that a fully engaged public health scenario is the most cost effective way to achieve greater health for the population. Where this has been adopted in practice substantial health gains have been achieved at relatively modest cost. The challenge is the necessary initial investment of resource and effort; the ongoing monitoring and evaluation to identify and address problems or issues at an early stage; and the assurance of appropriate health literacy to enable each person to accept appropriate responsibility for their health within a health system that assures appropriate support and care within a tiered system of delivery.

All opportunities for health/ill-health devolve around appropriate nutrition at every age. Poor nutrition can be considered to be a failure of the social system, expressed as ill-health and medical problems in the most vulnerable. Appropriate nutrition embraces physical activity, potable water and clean air as well as an adequate and balanced intake of food. Poor nutrition is most often a consequence of stresses imposed by the environment either directly or indirectly, be they associated with infection or social structure. A clear understanding of the mechanistic basis of any disorder directly informs individual and population approaches to ameliorating the challenge at every level of biological and social organization. The opportunity to use big data to establish the underlying principles that determine these relationships and how their application might vary from one context to another is fundamental to enabling the organization of the health system to securely address the double burden of malnutrition at manageable cost.

Institution
Southampton General Hospital

Country
United Kingdom

Primary author(s): Mr. JACKSON, Alan (Southampton General Hospital)
Presenter(s): Mr. JACKSON, Alan (Southampton General Hospital)
Session Classification: Session 8 - Undernutrition
Short-term effects of treatment of acute malnutrition; examples from Uganda and Burkina Faso

Despite progress in the management of severe (SAM) and moderate (MAM) acute malnutrition current foods may be further improved to ensure that children survive and thrive.

Example from Uganda: FeedSAM was an observational study among 122 children treated for complicated SAM with F75/F100. The aim was to assess predictors of refeeding hypophosphataemia. At the time, if a child had diarrhea and milk intolerance was suspected then F75/F100 was replaced by rice porridge for some days. Serum phosphate was low at admission, but increased rapidly, except among those given rice porridge (Namusoke, 2016). Replacement of F75 with rice porridge was a strong predictor of mortality. While rice porridge may be beneficial among children with diarrhea, lack of fortification may result in refeeding hypophosphataemia (Rytter, 2016).

Example from Burkina Faso: The Treatfood trial was based on concern that inadequate quality of foods for MAM treatment may cause impaired bioavailability of iron and growth nutrients, and inadequate repletion of iron stores and impaired linear growth, and gain of fat at the expense of fat-free tissue. Thus, nutritional recovery may not be accompanied by functional benefits, such as improved immunity, survival, physical activity and child development, but rather increase the risk of later chronic diseases. We conducted a 2x2x3 factorial trial among 1609 children aged 6-24 months with MAM, to assess the effects of three key factors in current food aid products, ie the matrix (LNS vs CSB), soy quality (isolate vs dehulled), and milk content (50 and 20 vs 0% of protein). The supplements were provided to give 500 kcal/d for three months, and the primary outcome was fat-free mass (FFM) indexed for height (FFMI), assessed by deuterium dilution. Surprisingly, 93.5% (95%CI 89.5, 97.3) of the overall 0.90 (95%CI 0.88, 0.93) kg weight gain was FFM, but height-for-age declined by 0.17 Z. Despite the lower protein content in LNS (vs CSB), it increased the FFMI accretion by 0.083 kg/m2 (95%CI 0.003, 0.163). There was a marginally significant effect on FFMI of 20% (0.097 kg/m2, 95%CI −0.002, 0.196), but not 50% milk protein (0.049 kg/m2, 95%CI −0.047, 0.146), and no effect of soy quality (Fabiansen, 2017). Despite lower amount of iron in LNS (vs CSB) it increased haemoglobin and iron stores (Cichon, 2018). There were no effects on any of the factors on physical activity (Yameogo, unpublished) and child development (Olsen, unpublished).

For children with complicated SAM, immediate access to treatment is important to ensure survival. The current foods seem to be adequate with respect to bioavailable phosphorus. However, unfortified rice porridge is given if F75/F100 is unavailable or based on belief that it mitigates diarrhea. Such deviations from guidelines are likely to considerably increase case fatality. For children with MAM, treatment with LNS is better than CSB in terms of FFM accretion and repletion of iron stores and gain in Hb.

Institution
University of Copenhagen

Country
Denmark
Presenter(s): Mr. FRIIS, Henrik (Department of Nutrition, Exercise and Sports, University of Copenhagen, Denmark)

Session Classification: Session 8 - Undernutrition
Doing double duty for prevention and treatment of acute malnutrition

Institution
World Food Programme

Country
Italy

Presenter(s) : Ms. ABURTO, Nancy J (World Food Programme)

Session Classification : Session 8 - Undernutrition
Designing double duty actions in the context of acute malnutrition

The UN Decade of Action on Nutrition and the SDG goals aim to end hunger and eradicate all forms of malnutrition worldwide. The co-existence of various forms of malnutrition – contrasting forms such as over-and undernutrition – is a global challenge. Integrated nutrition actions are needed not to address one at the cost of the other.

Double duty actions in the context of acute malnutrition need to include interventions, programmes and policies that reduce the risk of burden of undernutrition (acute and chronic malnutrition) and overweight, obesity and diet-related non-communicable diseases (NCDs). There are biological, environmental and socioeconomic factors that contribute to the risk or prevalence of both.

Optimizing in-utero and early-life nutrition, such as antenatal care, and the protection and promotion of exclusive breastfeeding up to 6 months, and continued breastfeeding up to 2 years and beyond, are examples of such double duty actions in the context of acute malnutrition. Another example are national dietary guidelines that need to provide a framework to reduce undernutrition but also overweight and obesity through a healthy balanced diet.

Analysis by WHO shows that polices that address undernutrition often do not include overweight and obesity considerations. Clear policy guidance is needed to ensure that efforts and initiatives to feed young children affected by acute malnutrition also address their long-term potential risks of overweight and NCDs.

Institution
World Health Organization

Country
Switzerland

Presenter(s) : Ms. WEISE-PRINZO, Zita (World Health Organization)

Session Classification : Session 8 - Undernutrition
Assessing metabolic health through the life-course in the context of the double burden of malnutrition

There is a need for simple proxies of health status, in order to improve monitoring of chronic non-communicable disease (NCD) risk within and between populations, and to assess the efficacy of public health interventions as well as clinical management. This presentation discusses how, building on recent research findings, body composition outcomes may contribute to this effort. Combining information on two generic traits, indexing both the ‘metabolic load’ that increases chronic non-communicable disease risk, and the homeostatic ‘metabolic capacity’ that protects against these diseases, may offer a new opportunity to improve assessment of disease risk. For physiological studies, it is now possible to obtain detailed markers of both metabolic capacity and metabolic load. For example, metabolic load can be assessed in terms of central abdominal adiposity, dietary glycemic index, sedentary behavior and smoking status, while metabolic capacity may be indexed by traits such as birth weight, lean body mass, leg length and markers of organ size, structure and function. Bio-electrical impedance analysis can potentially contribute to both asides of the model, as it can provide information on both lean mass and fat mass, and there are ways to analyse data that avoid the need for equations. This approach can be adapted for larger scale epidemiological studies or clinical trials, where the opportunities to collect data are more limited, and data on early life phenotype is not always available. Readily obtainable markers of metabolic load include BMI, waist girth, skinfolds and physical inactivity, while dietary intake may be assessed using food frequency questionnaires. Depending on the age of the individual, appropriate markers of metabolic capacity may include birth weight, leg length or relative leg length, lean mass from bio-electrical impedance analysis and grip strength. For both capacity and load, a clustered z-score approach could help combine data on these individual traits into composite scores, and could help apply the method at any age through the life-course. Published data suggest that this overall approach can explain a large proportion of inter-individual variability in NCD risk, further work is needed to explore its utility in explaining inter-population and ethnic variability. Recent studies suggest that this approach might be extended to outcomes beyond NCD risk, such as the risk of maternal mortality and morbidity. As such simple measurements can be readily carried out in the home or community, this approach may also prove helpful for M-health and E-health monitoring strategies.
Assessing the role of diet for metabolic health

Although opinions about the optimal diet for successful weight management and good health remain divided, some dietary patterns like the Mediterranean diet have repeatedly been associated with improved metabolic health. Most of the research investigating dietary factors related to metabolic health has been conducted in the westernized world while recent research suggests that diet may be differentially associated with human health in low income settings.

One of the most important challenges for investigating associations between diet and metabolic health is to accurately assess usual dietary intake in free-living individuals. Several dietary intake methods have been developed and validated, though leading to the conclusion that no single method might be ideal for assessing usual dietary intakes in epidemiological studies where accurate estimates of long-term individual exposures are crucial. Indeed, each method is characterized by its specific strengths and limitations, leading to the recommendation of using complementary methods for assessing usual dietary intakes in epidemiological settings. Organizations like FAO and WHO, as well as initiatives like INDDEX and INTAKE are investing in the development and validation of dietary intake assessment tools adapted to low-income settings, where extra barriers such as illiteracy and lack of standard household measures further challenge dietary intake assessments.

Innovative technologies are paving the way for more accurate dietary intake assessments in both, low and high income settings. However, new challenges need to be considered (e.g. analyzing images of portion sizes derived from wearable cameras; or annotating metabolomics data for identifying dietary fingerprints). Further research is needed to establish and validate an integrated dietary intake assessment approach, applicable on a global scale for cutting-edge research investigating relationships between diet and metabolic health.

Institution
International Agency for Research on Cancer

Country
France

Presenter(s) : Ms. HUYBRECHTS, Inge (International Agency for Research on Cancer)

Session Classification : Session 9 - Obesity
Tools for population level assessment of physical activity

With promotion of physical activity becoming a public health priority, it is critically important that researchers and practitioners have access to precise and yet practical instruments to measure physical activity behaviour. Valid and reliable measures of physical activity are a necessity in studies designed to: 1) document the frequency and distribution of physical activity in defined population groups, 2) determine the amount or dose of physical activity required to influence specific health parameters, 3) identify the psychosocial and environmental factors that influence physical activity behaviour in youth, and 4) evaluate the efficacy or effectiveness of programs to increase habitual physical activity. This presentation will provide an overview of the measurement tools available for assessing physical activity behaviour in young people. A conceptual framework for assessing physical activity and sedentary behaviour will first be presented. Relevant self-report and objective methods used to measure physical activity will then be described, along with the advantages and disadvantages of each method. The presentation will conclude by outlining global efforts to collect physical activity data in young people and identifying priorities for future research.

Institution
Queensland University of Technology

Country
Australia

Presenter(s) : Mr. TROST, Steward (Queensland University of Technology)

Session Classification : Session 9 - Obesity
Assessing the role of physical activity and sedentary behaviour for metabolic health

Physical activity is a complex behavioural phenotype that varies in duration, intensity and complexity. Measuring physical activity is difficult because of its complex nature. The advent of accelerometry devices that measure the acceleration of the body simultaneously in multiple dimensions has enabled a rigorous objective comparison of activity patterns. These devices generally render activity into ‘counts’. Such counts are then classified according to the number per unit time. Behaviour may then be classed into different types – sedentary, light, moderate, vigorous and very vigorous. Historically, interest has focussed primarily on engagement in moderate to vigorous activity and the links to health outcomes. Many governments have adopted targets for citizens to engage in certain levels of such activity averaging around engagement of about 30 minutes per day or 150 minutes per week. These targets emerge from correlational epidemiological studies indicating such levels of activity may provide benefits in terms of reduced all cause mortality. More recently there has been a focus on sedentary behaviour as an independent risk factor for non-communicable disease. It is important to note that since total activity time also involves engagement in light physical activity, that sedentary behaviour is not simply the inverse of moderate to vigorous activity. It is possible to meet the recommendations for moderate to vigorous activity, but still be extremely sedentary. Although it has been widely suggested that engagement in physical activity is a modifiable behaviour there is increasing evidence that engagement in physical activity has a large genetic component. This is indicated by studies of heritability that suggest the heritability of physical activity levels is around 50-55%. There are even suggestions that the links to health may be a result of a genetic pleitropy. That is the genes that make us more active are also genes that make us more healthy. These findings undermine the notions that physical activity is a modifiable behaviour and that encouraging greater physical activity is a useful health target. In other words it may not be possible to outrun your genes. However a recent study of identical twins discordant for activity levels has clearly indicated that the twin with greater activity had much improved health markers. Thus the 50-55% heritability of physical activity leaves considerable scope to modulate ones activity levels and the consequences of doing this appear to be beneficial for key health markers. It seems that indeed you can outrun your genes.

Institution

University of Aberdeen

Country

United Kingdom

Presenter(s) :  Mr. SPEAKMAN, John (Institute of Biological and Environmental Sciences, University of Aberdeen, Aberdeen, UK; Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, Beijing, PRChina)

Session Classification :  Session 9 - Obesity
Improving the Quality of Nutrition Counselling in Primary Health Care Settings

Counselling is generally defined as an interactive, collaborative process between a client and a trained counselor which aims to offer assistance in changing attitudes and behaviors, through which the client is supported to make a plan and take appropriate actions. As such, the act of counselling represents a critical behavior change intervention for which most health professionals and community health volunteers alike are woefully ill prepared. In reviewing over 100 recent articles on counselling related to nutrition, including the prevention or control of non-communicable diseases and support for improved infant and young child feeding, the evidence suggests that the quality of counselling greatly affects a client’s adoption of recommended behaviors or therapies, as well as their adherence over time to these recommendations. Given this role, counselling can be viewed as the heart of health care services, but study after study suggests that counselling is truly the Achilles’ heel of our health care system – a critical weakness which often leads to disappointing nutrition and health outcomes, and downfall of nutrition and health programming in both primary health care settings and community outreach services.

A significant investment in effective training in counselling techniques, the development of more effective state-of-the-art tools, and a commitment to coaching and supportive supervision of health care providers who counsel is required in order to address current weaknesses in counselling practices. Widely recognized core competencies for counselling reflect a long list of critical skills that need to be learned and reinforced through practice, coaching, and supportive supervision. Included are the ability to demonstrate respect and empathy to a client; follow ethical standards; ask open-ended questions about client’s situation and practices; practice active listening; encourage the adoption and maintenance of positive practices or behaviors; address client’s concerns; communicate correct information; check that the client understands what’s being recommended; use communication materials or job aids effectively; discuss and agree on an action with the client or caregiver; make appropriate referrals when needed; schedule the next appointment; and end each counselling session on a positive note. Such skills may sound simple or basic, but despite language in training curricula on counselling calling for these interactive techniques, observations and findings from studies across multiple countries reveal a tendency for one-way communication, with a focus on delivering “messages”, rather than on probing to understand clients’ situations, and subsequently tailoring counselling to their needs.

A review of current literature also highlights some emerging opportunities, however, including commitments to improving existing models, adapting successful models from other health fields to nutrition, and developing better tools for training and supervision in both developed and developing world contexts. There are many repeating or common themes and significant (immediately applicable) lessons found in several examples, but first, we must recognize counsellors as critical players in the system and be more aggressive in prioritizing funding to support their behavior change role. A select number of counselling models and tools will be shared, along with recommendations.

Institution
JSI

Country
United States
**Presenter(s)**: Ms. KONIZ-BOOHER, Peggy (Senior Advisor Nutrition SBCC, JSI Research and Training Institute)

**Session Classification**: Session 9 - Obesity
Social network interventions to increase physical activity

Network interventions can help to achieve behavioural change by inducing peer-pressure in the network. However, inducing peer-pressure without considering the structure of the existing social network may render the intervention ineffective or weaker. We present the results from two interventions. 1) The Peer Active study is a seven-week school-based field experiment using preadolescents’ physical activity as a proxy for estimating behavioural change. We test the hypothesis that boys’ and girls’ distinct networks are susceptible to different social incentives. We run three different social-rewards schemes, in which classmates’ rewards depend on the physical activity of two friends either reciprocally (directly or indirectly) or collectively. Compared with a random-rewards control, social-rewards schemes have an overall significantly positive effect on physical activity, with females being more receptive to the direct reciprocity scheme and males to team (collective) rewards. Differences in the sex-specific sub-networks can explain these findings. 2) Social Biking is an internet-based project based on a tracking app for bikers, the BikePrints app, which is developed to collect primary data on cycling and social networks and tests different social-based incentives for increasing cycling. It allows users to form interactive groups and track their rides to collectively earn points which are eventually exchanged with prizes. These prizes do not only incentivize participants to use their bikes more but also to socialize more. S-b mainly targets to grow social capital among users and make cycling a social habit which will remain even after withdrawing the prizes. Preliminary results of this study are presented.

Institution
European Commission

Country
Italy

Presenter(s) :  Mr. PROESTAKIS, Antonios (European Commission)

Session Classification :  Session 9 - Obesity
School and community based interventions for the prevention of obesity and NCDs in Europe: ToyBox-Study and feel4diabetes-study

The increasing prevalence of obesity and obesity related Non Communicable Diseases (NCD) underlines the need for community based, potentially cost effective and scalable preventive initiatives. ToyBox- study aiming to fulfil this goal developed a multi-component, kindergarten-based, family-involved intervention, to prevent obesity among pre-schoolers and their families by promoting behavioural changes and creating more supportive social and physical environments within kindergartens and homes. This evidenced based intervention was developed by a multidisciplinary team from 15 entities throughout Europe using participatory procedures and quantitative data obtained by teachers and parents in six EU countries.

Kindergarten teachers were trained to deliver the intervention which was aiming to promote four key behaviours (water consumption, healthy snacking, physical activity and the reduction/ breaking up of sedentary time) in preschool children and their families. The intervention was implemented during the academic year 2012–2013 in Belgium, Bulgaria, Germany, Greece, Poland and Spain via 309 kindergartens, and reached more than 17,000 preschool children and their families while for evaluation purposes, data was obtained both at baseline and follow-up from more than 5,500 children and their parents. The data obtained indicated significant improvements on the targeted obesogenic behaviours among children and parents, as well as relevant parental practices.

Regarding obesity indices, the linear mixed model conducted revealed that the most significant variables determining an increase of pre-schoolers’ BMI from baseline to one year follow up were: parental misperception of their children’s body weight status, i.e. a large proportion of parents with overweight/obese children were considering them as normal weight (B = 0.39, 95% C.I. = 0.173 - 0.607), maternal pre-pregnancy overweight/obesity (B = 0.181 95%, C.I. 0.123 - 0.238), paternal overweight/obesity (B = 0.082, 95% C.I. = 0.038 - 0.127) and region of residence (i.e. those living in South Europe were at higher risk compared to Central/North Europe and Eastern Europe (B = - 0.320 95%, C.I. -0.227 - -0.023 and B = - 0.125 95%, C.I. -0.423, - -0.217, respectively).

The favorable behavioral changes observed at the end of the intervention as well as the low-cost implementation of the programme has been acknowledged by the international scientific community and the public health sector with the programme is currently expanding in more than 20 countries globally. However, the observed changes on the obesity indices indicated the need to identify and prioritize the most vulnerable population segments as well as certain countries/ regions in Europe. This has been depicted and addressed by the ongoing HORIZON 2020 programme “feel4diabetes” and the first favorable findings of this programme’s implementation indicate a potential new way forward for the prevention of obesity and NCDs.

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Session Classification : Session 9 - Obesity
Impact of environmental toxins on child malnutrition

The first 1000 days of life from conception to two years old is a critical period in child development, during which child growth and development can be adversely affected by many factors including socioeconomic status, nutrition deficiency, infection and exposure to environmental pollutants. Whilst insufficient intake of energy and nutrients due to social economic status and food insecurity are critical determinants of the increasing risk of malnutrition, food contamination by chemical toxins may also be playing a role in causing and/or exacerbating the effects. Mycotoxin exposure in the diet has been associated with child stunting in Africa. Other environmental contaminants that are potent endocrine disrupting agents have also been found to be obesogens contributing to the double burden of malnutrition. Dietary exposure to aflatoxin is common in many countries in sub-Saharan Africa, especially in rural subsistence farming communities. Aflatoxin exposure has been associated with child growth impairment in a number of studies. In Benin and Togo, an inverse dose response was observed between aflatoxin albumin adducts in blood and height for age and weight for age Z-scores. In a follow-up study rate of growth over eight months was inversely associated with aflatoxin albumin biomarker levels. The negative impact of aflatoxin on early child growth was further confirmed in a prospective cohort study in The Gambia. Several mechanisms have been proposed including the possible interaction with insulin growth factor pathway of aflatoxin exposure. We reported maternal aflatoxin exposure associated changes in DNA methylation in white blood cells of six month old children in The Gambia. Exposure levels and environment may be critical factors to the reported association. In two recent studies in Tanzania, aflatoxin exposure was not significantly associated with impaired growth, whilst exposure to fumonisin, another mycotoxin that predominantly contaminates maize in the area, was. A study in infants of Mexico, where exposure to aflatoxin is at moderate level, reported that aflatoxin exposure levels was positively associated with linear growth over four months observation.

Other environmental exposures have been associated with promoting obesity. Among these the widely used plasticiser bisphenol A (BPA) has been shown to be obesogenic in animal studies, with evidence of endocrine disruption and alteration of lipid metabolism pathways as mechanisms. There is an increasing body of evidence that BPA exposure in humans is common, with excretion of BPA in urine providing evidence in a range of studies. Exposure during pregnancy was reported to be associated with increased waist circumference and body fat in the children. Urinary BPA levels have been associated with obesity in children and adults. In a recent prospective cohort study in adults in Shanghai, urinary BPA at baseline was associated with obesity in both men and women four years later.

Dietary exposure to environmental agents at different stages of life can therefore be seen to be associated with the double burden of malnutrition.

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Session Classification : Session 10 - Parallel Sessions
Introduction: Stunting develops in the first 1000 days of life, affects 161 million children<5 years and becomes irreversible without appropriate interventions. Many interventions have been tried and none seems to work alone. Environmental enteric dysfunction (EED) is the presence of diffuse, upper small bowel villous atrophy plus the presence of morphologic evidence of barrier disruption and inflammation affecting nearly all children < 5 years in poor settings linked to compromised sanitation, retarded growth, altered gut microbiota and decreased vaccine responsiveness. In Kenya, 50% of households in rural areas have improved drinking water sources, 64% unimproved facility,16% of households in rural areas having no toilet at all and 26% of underfives are stunted. Justification, a clear link between EED and how it affects linear growth remains unclear despite the significance of EED child health. This study aims to investigate this linkage among rural Kenyan children with poor access to sanitation facilities using a novel, non-invasive stable isotope technique to better understand pathways underpinning EED and child growth for treatment and management to ensure good health.

Specific objectives
• To establish the occurrence of EED using 13C SBT in children from 12 months among rural Kenyan children
• To assess the level of stunting in EED versus none EED children from 12 months among rural Kenyan children
• To assess the relationship between EED and body composition among children from 12 months from rural Kenya
• To establish the correlation between EED and the surrounding water sanitation and hygiene situation among children from 12 months in rural Kenya

Design: prospective cohort study in which the primary question will be how EED affects linear growth trajectory in infants from 12 months

Location: MCH clinics in western Kenya Kakamega County; East Africa.

Sample size: a convenient sample of 100 infants. Due the absence of data on EED and stunting, a difference of at least +0.2 in LAZ between EED+ve and EED-ve groups to be considered biologically relevant.

Study outcomes: stunting, EED positive, lean mass

Inclusion and exclusion criteria: Infants (12 months) who are non-stunted (HAZ ≥ -1 to +2 SD) or at risk of stunting (HAZ < -1 to ≥ -2 SD) will be included in the cohort and screened for several indicators of socioeconomic status and EED. Only infants who are EED+ve or EED-ve by both L:R and K:T ratio criteria will be followed up. Infants with intermediate results (those who meet the criteria for only one or the other ration will be excluded).

Data management and analysis plan: The data entry format will allow for immediate data checks for compliance. Appropriate quantitative univariate & multivariate statistics will be to describe the results and identify independent predictors of the different outcomes and all the statistics will be provided for the entire cohort as defined by EED status. There will be two primary analyses which will compare stunting in individuals previously identified as EED+ or EED- and investigate predictors of change in stunting since baseline in children previously initially EED+ or EED-
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Session Classification : Oral Abstract Presentations - Environmental Hazards

Track Classification : Biology
Human exposure to food and environmental contaminants as potential drivers of the double burden of malnutrition

Background
Epidemiological studies show a global increase in the double burden of malnutrition (DBM) characterised by the co-occurrence of chronic malnutrition and micronutrient deficiencies, and overweight and obesity at both extreme ends of the spectrum. It is estimated that about 40% of countries worldwide, especially low and middle income countries (LMICs) are affected by DBM.(1) This has been majorly attributed to urbanisation, advances in food processing and rising socioeconomic status on the one hand and food insecurity and lack of adequate infrastructure and healthcare on the other. However, the nutrition community has given little attention to the exposure to endocrine disrupting chemicals (EDCs), such as mycotoxins and persistent organochloride pollutants (POPs) in the mitigation of DBM.(2) Exposure to EDCs can occur in utero through placental transfer resulting in the disturbance of placental function, hormonal homeostasis and foetal development. Consequently, this causes intrauterine growth restriction, low birthweight and postnatal growth retardation or rapid ‘catch up’ growth in infancy which may lead to overweight and obesity in later childhood, adolescence or adulthood. The placental perturbation in pregnancy is also associated with long term pathological effects in adulthood, including cardiovascular diseases, obesity, osteoporosis and type 2 diabetes.(3)

Method: In this study, we explored the role of zearalenone (ZEN) and dichlorodiphenyltrichloroethane (p,p’-DDT) in endocrine disruption and unbalanced placental expression of imprinted genes using BeWo placental cell line as an in vitro model.

Results
It was observed that ZEN significantly stimulated oestradiol secretion in dose dependent manner with the highest oestradiol production occurring at 16 μM (76 pg/mL), but had no effect on progesterone production. However, p,p’-DDT significantly reduced both oestradiol and progesterone when the placental cell line was exposed at 16 μM. Most importantly, all the tested compounds reduced beta-human chorionic gonadotrophin (β-hCG) levels in cell media supernatant compared to DMSO control. In addition, co-exposure of ZEN with p,p’-DDT significantly reduced both oestradiol and progesterone levels, but induced β-hCG production in the placental cell line. We also examined the effects of exposure to ZEN and p,p’-DDT in single or mixtures on the mRNA expression of placental imprinted genes and genes involved in one carbon metabolism using quantitative real-time polymerase chain reaction (RT-qPCR). It was demonstrated that ZEN, p,p’-DDT and their combination significantly increased the expression of genes in the insulin-like growth factor (IGF) axis (IGF2BP and IGF2BP2), imprinted genes (PHLDA2 and MEG3), and one-carbon metabolism (DNMT3B, MTHFR and MDB2).

Conclusion: An elevated placental expression of the imprinted gene PHLDA2 has been implicated in low birthweight and intrauterine growth restriction in humans.(4, 5) In addition, the disruption of the placental hormonal homeostasis as observed in vitro could affect embryogenesis and foetal development. Therefore, more research is required to investigate possible molecular pathways through which mycotoxins and POPs contribute to DBM.

Key words: Double burden of malnutrition, endocrine disrupting chemicals, mycotoxins, persistent organochloride pollutants, child growth and development

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**Session Classification**: Oral Abstract Presentations - Environmental Hazards
Multidimensional child growth in India: Exploring the potential of using the Capabilities Approach for empirical analysis focusing on very young children

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Introduction
In the past few decades, scholars of child nutrition and healthy growth have become increasingly interested in studying the social determinants of growth faltering. Both academics and practitioners have attempted to develop conceptual frameworks of child growth that go beyond the immediate factors that lead to malnutrition (i.e. nutritional input) to capture the root causes of growth faltering. These new frameworks suggest that child growth is influenced not only by nutritional inputs, but by economic arrangements, resource allocation patterns, and societal settings. Yet despite these theoretical innovations, anthropometric outcomes remain the sole focus of child growth monitoring and measurement. In this paper, we aim to explore how the Capabilities Approach could be operationalized to conduct empirical analysis on child growth. Our study is the first to define child growth as a multi-dimensional concept with a set of outcome indicators, and is also the first to apply the CA to evaluate child growth empirically.

Data & Methodology
We use the latest available DHS data (2005-2006) and perform fuzzy analysis in evaluating children’s healthy growth in India. Applying fuzzy analysis enables us to measure the plural space of outcomes. Operationalizing the capability approach for child growth using DHS data proved challenging, primarily because data on several dimensions that are defined by the Capability Framework to Child Growth are lacking in the dataset.

Results
The results of our analysis of the available data suggest that in children with low height for age, several other capabilities in addition to the capability to be nourished are not fully achieved in either children or their caregivers. However, richer data would be required to further optimize the potential of the Capability Framework to Child Growth.
Assessment of body composition in young Caucasian adults: Validation of a single- and a multi-frequency BIA against isotope dilution technique

Background and Aims: As a simple field approach to measure body composition, the skinfold technique has increasingly been replaced by Bioelectrical Impedance Analysis (BIA), which is rapid and easy-to-use, non-invasive, portable and highly reproducible in providing estimates of total body water (TBW), and hence suitable for both clinical and field assessment of fat-free mass (FFM) and fat mass (FM). However, the accuracy of BIA – which measures TBW through the electrical impedance or resistance to the flow of a small alternative electric current as it travels through the body’s water pool - is uncertain and requires validation in the population under study. We investigated here, in young Caucasian adults, the accuracy of two 8-contact electrode BIA systems, namely a single frequency BIA (SF-BIA, Tanita-BC418, Japan) and a multiple-frequency BIA (MF-BIA, InBody 720, Biospace, S. Korea) against the reference isotope dilution technique for body composition.

Methods and Design: We compared the estimates of body composition by SF-BIA and MF-BIA vs D2O isotopic dilution technique in 50 healthy adult Caucasians (29 men and 21 women) with a large range in BMI (17–33 kg/m2). Mean age and BMI in men were 23.3 (sd 3.4) years and 24.0 (sd 3.5) kg/m2, respectively, and in women were 23.5 (sd 2.4) years and 21.9 (sd 2.7) kg/m2, respectively. Isotopic enrichment was assessed from saliva samples by FTIR spectroscopy. The degree and limits of agreement between the estimates of body composition (TBW, FFM, FM) and bias determined by either of the two BIA techniques against D2O technique were assessed by the Bland-Altman method.

Results: Relative to the isotope dilution technique, SF-BIA and MF-BIA overestimated TBW (and FFM) by ~2% (CI: 0.3; 3.3) and 0.6% only (CI: -0.4; 1.6), respectively, and underestimated FM by 6.7% (CI: -14; 0.6) and -0.45% (CI: -5.7; 4.8), respectively. Bland-Altman analysis indicates a mean bias of about 1 kg for TBW (and FFM) and -1 kg for FM by SF-BIA, compared to a mean bias of 0.3 kg for TBW (and FFM) and -0.3 kg for FM by MF-BIA. For each body composition parameter assessed by SF-BIA or MF-BIA, the bias was independent of the degree of fatness, and did not differ according to gender, but the limits of agreement were larger with the SF-BIA than with the MF-BIA.

Conclusion: In this healthy young adult Caucasian population sample, only the multi-frequency BIA equipment was shown to have a high degree of agreement and to be accurate for body composition estimates when compared with the isotope dilution technique.

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Session Classification : Oral Abstract Presentations - Assessment
Exclusive breastfeeding rate by maternal recall is overestimated compared with the dose-to-mother isotope dilution method: Evidence from Asian countries

Introduction: Exclusive breastfeeding (EBF) is the recommended infant feeding mode for the first six months of life and has been promoted worldwide. WHO/UNICEF use maternal recall of whether only breast milk is given during the past 24 hr as the indication of EBF. Small scale studies consistently show that the recall method is likely to overestimate the actual practice. The objective of this study was to investigate the agreement between the maternal reported EBF and EBF defined by the deuterium oxide dose-to-mother (DTM) method in Asia.

Methods: Lactating women who reported that they were EBF at 3 months were recruited in 8 participating countries. 217 mother-infant pairs from 6 countries were included in the present analysis. Breast milk intakes and non-milk water (NMW) were calculated using the Bayesian approach. The cutoffs for NMW used to define EBF were <25 g according to IAEA recommendation, and the newly proposed (Houghton, et al, unpublished data) of 82.6 g using DTM and home observation.

Results: At 3 month of age, EBF by maternal recall was 73%, compared to only 22 and 63% (cutoffs <25 and <82.6 g/d of NMW, respectively) generated by the DTM method. Similarly, at 6 mo, EBF by maternal recall was 45% versus 3 and 18% EBF by DTM method using respective cutoffs for NMW.

Conclusion: Data from Asian countries showed that maternal recall of EBF commonly used in large scale surveys overestimated the EBF rates both at 3 and 6 months. The evidence from these Asian countries call for a need to revisit the maternal recall of EBF currently used in surveys and in monitoring progress in EBF promotion.

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Session Classification: Oral Abstract Presentations - Assessment
Increases in body mass and body water in pregnancy and relationship to weight of the child and placenta at birth.

Maternal size, weight gain in pregnancy, fetal gender and gestational age are well known determinants of birth weight. It is not clear which component of maternal weight or gained weight during pregnancy influences fetal size and/or placental size at birth. We aimed to answer the question "Are changes in impedance, water and vascular expansion related to birth weight/placenta weight?"

At both 17 and 34 weeks of pregnancy 99 women stayed overnight at the Diabetes Research Centre, Pune, India. Five hours after dinner subjects emptied their bladder completely, provided a baseline urine sample, then drank 75mg per kg body weight of deuterated water. After 5 and 6 h equilibration urine samples were collected, deuterium enrichment was determined by dual-inlet mass spectroscopy and total body water calculated. Hand to foot bioimpedance at 50 kHz was measured at 17 and 34 weeks.

At 17 weeks maternal weight was 48.1±6.9 kg and body water 25.5±2.9 kg. At 34 weeks maternal weight was 54.6±7.6 kg and body water 29.8±3.5 kg. Mean birth weight was 2783±344g and maternal weight post-delivery 51.9 ±8.2 kg. Birth weight was not correlated with maternal weight or total body water at 17 or 34 weeks but was positively related to dry maternal weight at 34 weeks as well as parity, placental weight and maternal weight at post-delivery. Placental weight (n=83) was positively related to total body water at 34 weeks, maternal dry weight at 17 and 34 weeks and maternal body weight post-delivery. Systolic blood pressure increase was positively related to the increase in body water. At both 17 and 34 weeks total body water could be predicted with 60% of the variation explained from the impedance index (height squared/resistance) and maternal weight.

The use of bioimpedance in pregnancy to measure changes in total body water needs to be explored further as do the relationships of changes in dry maternal mass and birth outcomes.

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**Session Classification:** Oral Abstract Presentations - Assessment

**Track Classification:** Assessment
Methods for measurement of body composition in rural Zimbabwe using Bio-impedance and other techniques transported by motorbike

Introduction
Early life growth patterns predict disease risk, particularly the ratio of fat to lean mass. The optimal allocation of energy to either fat or lean tissue in early life may therefore vary across different environments and populations. There is increasing interest in appropriate techniques for measurement of body composition within marginalized populations with poor nutrition and high prevalence of stunting.

The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) trial (NCT01824940) was designed to test the independent and combined effects of infant and young child feeding (IYCF) and water, sanitation and hygiene (WASH) on stunting and anaemia in rural Zimbabwe. The SHINE trial provided a unique opportunity to measure the body composition response to these public health interventions in the first 24 months of life. Techniques were adapted for rural conditions for 3 methods: Bio-impedance, skinfold thicknesses and knee-heel length.

Methods
An initial pilot study was performed to check the acceptability of the methods and build experience amongst the research nurses. Two standardisation exercises, each involving 10 children, were undertaken. Research nurses travelled by motorbike using a custom-built equipment case and all collection occurred at the child’s homestead. Bio-impedance analysis (BIA) was performed using the Bodystat 1500MDD machine to pass an imperceptible alternating current (200µA RMS at 50kHz) after placing electrodes on the left hand and foot of the child. Every child was carefully positioned with arms by the sides and legs together. The child was laid on an adapted yoga mat if no cloth was available from the family. Distraction techniques included toys, puppets and local snacks or waiting for the child to sleep. Subscapular, triceps and maximal calf skinfold thicknesses were also measured. Good positional control was achieved when mother held the child facing her on her lap in a ‘bear-hug’ position with legs either side. For knee-heel length, the child moved across to sit on one of mother’s legs. A custom-built knemometer was compared to an adapted commercial abdominal caliper (Holtain) for knee-heel measurements (Figure 1).

Results
The standardisation exercises between research nurses using a 2 way mixed model showed good inter-observer correlation coefficients (ICC) of >0.9 except for triceps skinfolds (0.74). Of the 230 children, 67 had knee-heel measurements from both the adapted commercial abdominal caliper and custom-built digital knemometer. A Bland-Altman plot showed a mean difference of only 0.013mm, with a Pitman’s test of variance r= 0.016, p=0.895. Hence the adapted manual abdominal caliper was suitable for measurement of knee-heel length to the nearest millimetre. 230 children had their body composition measured by BIA and this is presented in a separate abstract.

Conclusion
Body composition measurement techniques including bio-impedance and knee-heel length can be successfully adapted for use in rural areas only accessible by motorbike. Such investigations should involve community sensitisation, pilot studies, fieldworker training and standardisation exercises.

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Session Classification : Oral Abstract Presentations - Assessment

Track Classification : Assessment
Addressing the Double Burden of Malnutrition in West-Africa: A Twelve-Year Experience with Institutional Partners in Benin, Burkina Faso and Mali

Introduction: While the prevalence of child undernutrition remains high in low- and middle-income countries, the rapid nutrition transition entails an escalation of chronic diseases such as obesity, diabetes and cardiovascular diseases. Even low-income countries of sub-Saharan Africa are affected by this double burden, particularly in urban areas. Addressing the double burden of malnutrition is compelling and should translate into vigorous measures to halt chronic disease progression. As part of its mandate as a WHO Collaborating Centre on Nutrition Changes and Development, TRANSNUT of University of Montreal has addressed the double burden of under- and overnutrition with partners from three West African countries for more than a decade. The purpose of this presentation is to discuss the activities that were carried out in the framework of projects funded by Canada in order to better equip the partners to tackle this double nutritional burden.

Methods: Project components included new university training programs and training of Ph.D. students in nutrition, a primary school intervention, applied research, and advocacy and communication. In 12 urban primary schools of Benin and Burkina Faso, the “Nutrition-Friendly School Initiative” of WHO, which is intended to prevent the double burden of malnutrition, was implemented on a pilot basis, reaching more than 7000 pupils. New university training programs in nutrition were initiated, with the development of a professional bachelor program in dietetics and nutrition and a Master program in public health nutrition at the Abomey-Calavi University of Benin. On-line courses on the management of severe malnutrition, and on the nutrition transition and chronic diseases, were used in degree-granting and continuous education programs. Research on eating practices and lifestyles in connection with obesity and other cardiometabolic risk factors was a major contributor to the development of a Food Guide in Benin. As regards advocacy, the focus was on the control of type 2 diabetes and for this purpose, the diet-related challenges of patients were investigated in Mali and advocacy tools were developed including a standardized costing tool to estimate the out-of-pocket expenditures of patients for appropriate management of diabetes without or with complications.

Results: Every year, there are around 20 graduates of the undergraduate nutrition program and 10 of the Master’s program. Ph.D. graduates participate in the training and pursue their research. The school intervention resulted in improved nutritional quality of the food served to pupils and better sanitation in school precincts. Underweight, which was more prevalent than overweight, declined in intervention schools compared to control schools. It is expected that better school eating practices will contribute to prevent overweight. The Food Guide was adopted by the government of Benin and is used by health and nutrition professionals.

Conclusion: The community, university and school activities described above are on-going for the most part but their sustainability is a challenge. Although their impact on the double burden cannot be assessed directly, we strongly believe that they contribute in the long run to better policy, programs and practices.
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Session Classification: Oral Abstract Presentations - Double-duty actions
Making every move count: double duty innovations for nutrition and health

Introduction
The world is becoming increasingly connected. Agenda 2030 and the SDGs reflect this connectivity, with action plans citing co-benefits for several goals in a way that did not happen with their predecessors, the MDGs.

There are connections between problems too. In terms of nutrition and health, we increasingly need to think in terms of “one world, one nutrition” as overweight/obesity is rising dramatically against a backdrop of slow progress in reducing undernutrition. Poor diets and physical inactivity are both major drivers of obesity and non-communicable diseases, with huge long-term consequences.

In terms of our ability to respond to these challenges, and meet global nutrition targets, we need to think and act differently and we need innovative approaches to fund these actions. A recent study suggests that one third of the estimated requirement of 11 billion per year for nutrition will need to be generated from innovative financing and household contributions. And yet, despite recent calls, there are few innovations which seek to do “double duty” in simultaneously addressing both aspects of the “double burden of malnutrition”. And we have few examples of innovative financing for nutrition that work at scale. Pivotal is an “idea in motion” – an exploratory new initiative that aims to address these intersecting challenges. It does this by incentivizing and tracking increased physical activity of individuals, and using the aggregated calorie burn to leverage funding for nutrition and health projects. Pivotal revolves around the strength and links between three communities: a) calorie burners who walk, run, cycle and upload their calorie burn using fitness tech to an online platform, b) investors who “match-fund” this pooled calorie burn according to pre-agreed ratios (e.g. every 100,000 calories burnt generates 100) and c) implementing organizations who put these new funds to use in nutrition and health projects (locally or globally).

Methods
We will undertake formative research to scope the three core communities – to understand who they are, where they are, and their incentives and disincentives for engaging with Pivotal. Second, we will develop the online platform that visualizes and aggregates calorie-burn and connects these communities. Using the formative research, we will create a detailed communications and marketing plan to attract, engage, connect and grow our three key communities. Three key indicators will be used to monitor Pivotal’s progress: a) uptake, measured by user numbers and disaggregated by age, gender and location; b) user activity levels – which will combine metrics of activity levels of users on sign up with any subsequent increases over baseline; and c) leveraging power, measured as funds raised. In addition to this dashboard, we will undertake market research with user communities to respond to demand, including in new geographies.

Conclusion
Pivotal is a new approach to addressing the double burden of malnutrition while simultaneously generating financing to support future action. Formative research linked to a feasibility study is being undertaken to further test and develop this concept, prior to implementation and scale up.
UK

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**Session Classification**: Oral Abstract Presentations - Double-duty actions
Formative Research to Identify Actions to Address the Double Burden of Malnutrition in Young Children in Rwanda

Introduction: Historically, low- and middle-income countries (LMICs) have focused on addressing undernutrition, but they are increasingly experiencing the double burden of malnutrition (DBM). Despite this shift, few studies have investigated behaviors that could address both under- and over-nutrition among young children in LMICs. We sought to identify relevant and acceptable behaviors or actions that could be incorporated into interventions addressing both ends of the malnutrition spectrum in children aged 6 months to 5 years in Rwanda.

Methods: Using the Trials of Improved Practices (TIPs) method, we conducted a series of three visits in households of 136 under- and overweight Rwandan children. The purpose of the visits was to (a) conduct assessments of nutrition and physical activity practices through caregiver interviews and unstructured observations; (b) counsel and negotiate with caregivers about behavior changes to try for one week based on assessment results; and (c) conduct interviews with caregivers to gauge the relevance and acceptability of the behavior changes they tried. Behavior change recommendations were based on international recommendations for complementary feeding and young children’s physical activity; Rwanda’s National Community Maternal, Infant and Young Child Nutrition Counselling Package; and recent guidelines for responsive feeding. Behaviors fell into the following categories: breastfeeding, appropriate quantity of food, appropriate consistency of food, appropriate feeding frequency, dietary diversity, responsive feeding, hygiene and food handling, feeding during and after illness, and physical activity. We tabulated responses regarding behavior changes and identified themes from interview transcripts and observational data.

Results: Caregivers agreed to try nearly all the recommended behaviors and, for the most part, reported that they planned to continue them. Of the behavior changes that were relevant to both under- and overnutrition, our study tested 25 specific behavior that caregivers agreed to try. The behaviors most frequently related to dietary diversity, food quantity, hygiene and food handling, and breastfeeding (see Table 1). The most common facilitator to trying a behavior was its perceived and/or anticipated impact on child health, growth, appetite, and/or activity level. Barriers included financial constraints, limited food availability, competing interests for caregivers’ time, inconvenient food preparation and/or storage, and perceived negative behavioral response from the child. Some caregivers reported modifying the recommended behaviors, such as by implementing the behavior less often than intended or implementing only certain aspects.

Conclusion: We identified acceptable behaviors for Rwandan households with potential as “double-duty” actions that could be incorporated into a broader intervention addressing the DBM. Some of the behaviors that are typically promoted for underweight young children are also relevant for the health of overweight children. These behavior-change actions may be relevant for incorporation into a DBM intervention tailored to young children in the Rwandan context. Caregivers’ insights regarding facilitators, barriers, and modifications to behaviors could be incorporated into the design of a DBM intervention and accompanying behavior change communication messages to strengthen its potential for impact.

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Session Classification : Oral Abstract Presentations - Double-duty actions
Impact of breastfeeding promotion on breastfeeding rates in a hospital cohort

Introduction:
The first two years of life are critical for a child’s growth and development. Breastfeeding is the natural way of providing young infants with the nutrients they need for healthy growth and development. WHO recommends exclusive breastfeeding (EBF) in infants for the first six months to achieve optimal growth and development. Thereafter, nutritious complementary foods should be given and continue breastfeeding up to the age of two years or beyond. Breastfeeding support and education offered by health professionals can enable mothers and families to overcome breastfeeding obstacles. The goal of the study was to evaluate the impact of education and counseling on breastfeeding practices during the first 6 months of life.

Methods:
A case control study was conducted in the postnatal wards of the Aga Khan University hospital. The study population comprised of 500 mother infant dyad with 250 in the control and 250 in the intervention group. The babies and mother dyads in the intervention group were part of Multicenter Body Composition Reference Study and included full term healthy infants while the control group comprised of similar pairs. The pair was followed up to 6 months for breast feeding practices. A comprehensive package was developed for the intervention group that ensured provision of adequate information on breastfeeding practices through the use of IEC material which comprised of educational leaflets; breastfeeding sessions with the use of Flip charts. In addition the package consisted of monthly telephonic follow ups. Free post natal clinics were also provided by neonatologist at 3 and 6 months where reinforcement on breast feeding practices was done. The aim of these interventions was to address the barriers to exclusive breastfeeding and reinforce exclusive breast feeding practices. Mother’s assigned to control group received standard breastfeeding education and support as per hospital guidelines.

Results:
More women exclusively breast fed across the intervention group, as compared to the control. In the intervention group, 30% exclusively breastfed their infants till 6 months vs. 12.3% in control group. According to National Nutrition Survey Pakistan the reported frequency of EBF was 12.9% at 6 months of age. Mothers whose age was >30 years were more likely to exclusively breast fed infants compared to <30 years old (OR 1.037; 0.57 – 1.88). EBF for 6 months significantly reduced the risk of respiratory infection (4.2% vs. 7.1%) and diarrhea (2.8% vs. 8.6%) compared to non-exclusive breastfeeding. The gender, occupation of mother and education had no significant association with breast feeding practices. However multiparous mothers were more likely to exclusively breast feed compare to primiparous mothers (OR 0.238; 0.10-0.54; p= 0.001)

Conclusion:
Our intervention improved breast feeding rates to 30% which was higher than the national rates 12.9%. These findings demonstrate an early and repeated contact with mother by trained health care providers can improve breast feeding rates. The introduction of health education and assisting mothers to overcome barriers by sessions can significantly improve EBF.

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Session Classification : Oral Abstract Presentations - Double-duty actions

Track Classification : Interventions
Food insecurity and the double burden of malnutrition

Recent evidence indicates that household food insecurity (HFI), measured with experienced based scales such as ELCSA, FIES and the US Household Food Security Survey Module; is associated with infectious diseases (malaria, diarrhea), micronutrient deficiencies (iron deficiency anemia), stunting, obesity, and/or non-communicable diseases (NCDs) in low-, middle- and/or high-income countries. Furthermore these findings remain even after adjusting the statistical models for traditional socio-economic, demographic, and nutritional status covariates. Therefore, HFI is a strong risk factor for the Double Burden of Malnutrition (DBM) and is central for preventing it globally. HFI has been consistently associated with suboptimal dietary quality and immune function, hence it is not surprising that it is related to micronutrient deficiencies and stunting. It has been hypothesized that HFI leads to obesity through three pathways. First, global food systems provide easy access to cheap ultraprocessed foods and beverages that are rich in calories, saturated fat, trans fatty acids, sugars, and/or salt. Second, HFI is a major psycho-emotional stressor that triggers the consumption of excessive amounts of ultraprocessed or comfort foods and beverages to attenuate the sadness, anxiety, or emotional “pain” caused by HFI, via the release of opioid-like substances in the pleasure centers of the brain. Third, HFI has been associated with suboptimal sleep duration and poor sleep quality which in turn have been associated with increased risk of obesity and NCDs. Preventing HFI during the first 1000 days is crucial for addressing the DBM as it is during this period of time that stunting risk as well as the metabolic dysregulation in glucose and lipids metabolism that leads to NCDs later on in life gets set. Hence, breastfeeding protection, promotion, and support as well as access to healthy, nutritious and safe maternal diets before and during pregnancy, and among infants (starting at 6 months) and toddlers should be highly prioritized. At a family level, conditional cash transfer programs such as Mexico’s PROSPERA have been found to reduce HFI and prevent stunting among vulnerable children but at the same time have been associated with increased risk of obesity among adults living in the same households. This illustrates the need to improve the design of multisectorial policies and programs to prevent malnutrition in all its forms and to not improve one aspect of the DBM by making another one worst. The successful implementation of these policies and programs requires major changes in the governance and quality of the global food supply as well as price policies that make healthy dietary choices the default, especially for socio-economically vulnerable populations. Additionally it requires developing legislation in support of taxation and consumer protection against unethical marketing of ultraprocessed foods and beverages, and transparent consumer friendly front of package food labels.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5998358/

Institution
Yale School of Public Health

Country
United States
Presenter(s) : Mr. PEREZ-ESCAMILLA, Rafael (Department of Social and Behavioral Sciences, Yale School of Public Health, New Haven CT USA)

Session Classification : Session 11 - Food Systems
Food systems: Their role in improving diets sustainably and addressing the double burden of malnutrition

We are at a crossroads in which many people do not have access to optimal diets – and this lack of access is having ramifications on nutrition, health and the environment. What we are left with is a massive, complex burden of multiple malnutrition outcomes, as a result of multiple drivers and causes. The consequences are staggering not only for the health and wellbeing of individuals, but economically, socially and environmentally costly for society.

Food systems allow many points for intervention to improve diets – across the supply chain, within food environments and related to consumer behavior. However, food systems are not static. They are rapidly transforming due to multiple drivers, including global dietary pattern shifts. With globalization, urbanization and income growth, people are experiencing new food environments, expanding their food choices and diversifying their dietary patterns in both positive and negative directions.

Current food systems have dramatic effects on human and planetary health. They shape producers’ decisions and consumers’ food choices. Nevertheless, human decisions and choices (whether individual or collective) regarding production and consumption can also influence food systems and improve their ability to deliver healthy and sustainable diets. The Sustainable Development Goals serve as a global platform that if implemented and invested in, can address simultaneously all forms of malnutrition through sustainable food system approaches. To achieve the SDGs, address the malnutrition burden and ensure food systems move towards those that are more sustainable and resilient, action is required by everyone.

The presentation will summarize with:
• There are many policy actions that can be taken: global goals to national food policies that span value chains, food environment and consumer demand.
• Composite approaches are needed: No one approach will do everything. A mix of regulatory, fiscal, voluntary and other approaches is required.
• Consumption matters: Sustainable healthy eating patterns must be taken seriously.
• Lack of evidence is no excuse for inaction: action generates evidence.
• Monitoring and evaluation are essential: more focus is needed on mechanisms to track the impact of interventions and inform refinements.
• A whole food system approach is needed: While there are health and environmental win-wins there can be trade-offs too as seen with the different health and environmental impacts of sugars and meats. There will also be food system trade-offs, and the different interests of different stakeholders need to be recognized.

Institution

Johns Hopkins University, FAO

Country

United States
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Session Classification: Session 11 - Food Systems
Shaping food systems for children

In many parts of the world, most children are not fed the minimum they need - in quantity, frequency and/or quality - to survive, grow and develop to their full potential. In parallel, an increasing number of families and individuals are exposed to processed, less nutritious, less healthy foods that are skillfully marketed and widely attainable and affordable while nutritious, fresher foods are often more expensive and unaffordable to many. The consequences of caregivers’ and children’s interactions with the food system include not only undernutrition and overweight, but also greater susceptibility to diet-related non-communicable diseases which are largely preventable with better diets.

The systems that grow, produce, distribute, regulate, market and sell food have the potential to deliver healthier diets to children and adolescents. Governments can make it easier for caregivers, children and adolescents to procure healthier food, and businesses can help to produce, market and distribute it. Effective behavior change programs can influence what caregivers feed their children and the foods and diets children and adolescents demand and consume.

Last November, a global consultation was organized by UNICEF and GAIN at the Innocenti Center aiming to align food systems and nutrition priorities for children and adolescents by developing a new, common narrative in which a main goal of global and national food systems is to produce and supply nutritious, safe, affordable and sustainable diets for all children, everywhere. The presentation will focus on key highlights of the consultation including:

- Why we need to initiate a global discussion on food systems for children and adolescents.
- How many children are not receiving the diets they need for optimal growth and development;
- How children and food systems interact with caregivers’ and children’s access to and consumption of nutritious, safe, affordable and sustainable diets;
- A conceptual framework on Food Systems for Children: How food supply chains, external and personal food environments and consumer and caregivers’ behaviors are interconnected and need to be part of the solutions to provide nutritious, safe and affordable diets for children;
- Implications of the Global Consultation of Food Systems for Children on UNICEF’s work in shaping food systems so that they be responsive to children’s dietary and nutrition needs.

Institution
UNICEF

Country
United States

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Session Classification: Session 11 - Food Systems
The Philippines’ ”Unang Yakap” (First embrace): Implementing an integrated quality improvement practice for newborn health and the Baby-Friendly Hospital Initiative

Health facilities catering to births and those providing maternity and newborn services are one of the first environments where human beings access their food, that is, through breastfeeding. The environment where births and initiation of early and exclusive breastfeeding take place are influenced by policies, the physical infrastructure, health workers, financial resources, and families’ engagement in taking care of the mother and newborn dyad. Both the newborn infant’s survival, and the success of breastfeeding coexist in a delicate balance interacting together.

The Philippines was one of the first countries to adapt the Baby-Friendly Hospital Initiative (BFHI) in 1991. Its country adaption was institutionalized by a law, Republic Act No. 7600, known as The Rooming-In and Breastfeeding Act of 1992. The 1993 National Demographic and Health Survey (NDHS) showed that only 28.2% of babies born in health facilities have been initiated to breastfeeding in the first hour. This increased to 40.7% in the 1998 NDHS. However, linking breastfeeding initiation to newborn health outcomes didn’t show a direct interaction to reduce newborn mortality rates (NMR) of the country.

Comparing the same NDHS breastfeeding statistics to the NMR, the latter showed 17.7 newborn deaths per 1000 live births in 1993 and with no change in 1998 (17.8 newborn deaths per 1000 live births). The Philippines’ NMR showed a sluggish decline from 1993 up to 2008.

Even though the BFHI was widely implemented across the Philippines, newborn care practices have not caught up with global recommendations. A government hospital outbreak in 2008 became the turning point for the Philippines’ approach to newborn care and the BFHI. Findings of the 51-hospital study, commissioned by DOH and WHO, on newborn care practices were used in the development of the national essential newborn care protocol, the “Unang Yakap” (First Embrace) social marketing campaign, with an accompanying clinical practice pocket guide and institutionalized by a national health policy, DOH Administrative Order 2009-0025 in 2009. Supported by a joint project undertaking between the DOH and WHO in the Philippines, 11 government hospitals with large number of births have been selected to scale-up the implementation of the newly-adopted essential newborn care (ENC) protocol from 2010-2011.

Weekly meetings by the convened by project staff with the hospital management team and maternity and newborn service providers have been instrumental in addressing necessary practice reforms. Service providers applied knowledge on how the four time-bound steps in initiating early and exclusive breastfeeding, most especially the non-separation of the newborn from her mother. As a result, early and exclusive breastfeeding initiation, and rooming-in practices of the 11 hospital project sites have shown increases initiation rates and improvements in newborn outcomes.

Since then, the DOH has integrated the ENC protocol in the BFHI assessment and accreditation. From policy to practice, both newborn care practices and the BFHI ensured both mothers and their newborns stay together to successfully breastfeed in the first hours of life. Not just these practices have improved on breastfeeding initiation rates; it also helped in the reduction of the NMR of the country.

Institution
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**Country**
Philippines

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**Session Classification:** Session 11 - Food Systems
Chilean Healthy Eating Law

Obesity and related non-communicable chronic diseases (NCDs) represent the main causes of death and disability in Chile. These causes account for a major proportion of health-care costs and loss of productivity, burdening the country’s economy. Based on the 2013 Global Burden of Disease estimates, high body mass index (BMI) is the second most important risk factor in Chile with consistent evidence indicating increasing overweight and obesity rates in the population and a socioeconomic gradient. These increasing rates were fueled by massive increases in the consumption of sugar-sweetened beverages (SSBs). For example, in 2014, Chileans had the highest per-person daily calories from sugary beverages in the world. As of 2014, the Chilean government undertook some policy steps1 to combat these trends considering the influence of the food system on the diet of the Chilean population. More specifically, in October 2014, the government implemented tax modification on nonalcoholic beverages, or soft drinks i.e. 8% tax on SSBs relative to other beverages. As of 2016, further implemented changes on foods and beverages with added sugars, sodium, saturated fats or calories that exceed set thresholds were mandated in the form of ‘front-of-package warning labels’ (on packaged products). Additionally, several marketing restrictions applied i.e. cannot advertise on TV programs or websites targeting children (<14y) and in 2017, the advertising ban expanded to all TV programming and cinema from 6am–10pm. A number of studies are looking into the before and after effect of the policy on the food environment and on children’s health including their dietary behavior. During the talk, some of these preliminary results will be presented and discuss implications of this policy in other countries facing similar challenges.


Institution

University of Chile and London School of Hygiene & Tropical Medicine

Country

Chile, United Kingdom

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Session Classification : Session 11 - Food Systems
Regulatory efforts in Mexico: impact of taxation

In the past decades, Mexico has become one of the most obese countries in the world. Over 72% of its adult population is overweight or obese and there are over 100,000 diabetes-related deaths per year. At the same time, stunting in children <5y has decreased (from 26.9% in 1999 to 10% in 2016). However, there are various less developed areas in the country where stunting rates are above the national average (for example the southern region 13.4% and rural areas 12.6%, ENSANUT, 2016). These areas used to have lower Non-Communicable Disease prevalences and now they are increasing at a higher rate than the rest of the country.

However, Mexican society has failed to take serious actions to control this epidemic, considering the budget cuts to health of $5.1 billion USD over the past 5 years and less than 1% of the health budget allocated to the prevention and control of obesity and diabetes. The most successful approach thus far has been the tax to sugar sweetened beverages (SSBs) and junk food implemented in 2014. Studies have shown promising results with a 7.6% reduction in SSB purchases and a 7.4% reduction in junk food purchases. Nonetheless, enduring challenges such as lack of funding, poor monitoring mechanisms, low accountability, conflict of interest, and industry interference in public health nutrition policies have stymied progress. Mexico must find ways to push back on these challenges so that cost-effective, population-level prevention policies can be implemented immediately. These strategies include raising the soda tax to 20%, adopting front-of-pack warning labels for industrialized products, regulating marketing to children and in schools, and promoting exclusive breastfeeding. In addition, there must be substantial improvements in the quality of primary care to improve the control and prevention of obesity comorbidities. The rural south, a region with the highest prevalence of stunting in children under five years of age, is also the region with the highest obesity and overweight prevalence in children under five.

Clearly the data shows a reduction of undernutrition and therefore, a decreasing the risk of experiencing the double-burden of malnutrition at the national level. However, at the subnational level, in areas with high marginalization and poverty where indicators of undernutrition are higher, overweight and obesity is rising as well, placing these populations at risk of experiencing both undernutrition and NCDs (for example the southern region of Mexico has an overweight and obesity prevalence higher than the national average 7.2%, ENSANUT 2016).

There are many priority efforts that need to take place to reduce both undernutrition and NCDs in Mexico. An important window of opportunity has opened with the recent change in the federal government (as well as in many states). During the following two years, priority should be given to strategies that could prevent the double-burden. Among them are: Access to potable water, breast-feeding promotion and regulation of infant formula marketing, refined SSBs and junk food taxation strategies, regulation for advertising directed to children, implementation of an easy to understand front-of-pack warning label for unhealthy foods, and strategies to improve accessibility and price of healthy foods. An additional challenge that should be considered in policy design is attempting to develop healthier food systems in a sustainable manner. Finally, primary health care should standardize and develop preventive services and health education to reinforce healthy behaviors among the population.
Institution

Mexican National Institute of Public Health (INSP)

Country

Mexico

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Session Classification : Session 11 - Food Systems
Assessing food environment to monitor policy implementation

Measuring the implementation of food policies by governments, the nutrition commitments and performance of food companies, and changes in the food environments are critical 'upstream' components of monitoring for accountability for improved nutrition. The International Network for Food and Obesity/NCD Research, Monitoring and Action Support (INFORMAS) has developed the monitoring protocols that are being implemented in over 30 countries. It is essential for civil society and academia to place themselves within the accountability systems for action on nutrition as one way of overcoming the policy inertia that is stalling better progress on nutrition. In several countries, academic and civil society groups are being supported by philanthropies to increase the demand for food policy action and the INFORMAS tools are a vital component of the evidence base policy justification and evaluation. Upstream indicators of policy action need to be incorporated into the UN/WHO monitoring systems for improved nutrition.

Institution

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Session Classification :  Session 11 - Food Systems
The opportunity for urban planning to encourage healthier living

Cities must reconsider the food systems and fight against this double burden of malnutrition and obesity. It is important not to forget that it is in the urban environments, and in particular in neighbourhoods which have lower purchasing power, where a higher percentage of the population, and especially children, are exposed to this epidemic.

For that matter, city networks have been coordinating their agendas in order to establish their priorities, policies and actions for the provision of healthy and sustainable food.

Following the Rome, Valencia and Tel Aviv summits, amongst many others, it has been encouraging to see the way in which the world’s cities have been exchanging information, experiences and even mistakes within a collaborative context. The efficient nature of the cities has allowed for these policies and campaigns to be spread, meaning, therefore, that if these are acted upon properly, it will be possible to reach every last street in every last neighbourhood.

Several of the proposals that have already been set in motion in the city of Valencia and which are being shared with other cities are outlined below:

1/ The local administrative bodies must ASSUME OWNERSHIP for the agri-food policies. It is clear that action must be taken and there is plenty of scope for mayors to do so for the good of their citizens, however, it is fundamental that this is ACTIVE and EFFECTIVE legislative action.


3/ The city councils must boost and promote the creation of common spaces in which ALL OF THE STAKEHOLDERS are able to interact. In Valencia these include the Consell Agrari Municipal, Consell Alimentari, Municipal. Likewise, markets such as “La tira de comptar” must be promoted.

4/ PERMANENT CAMPAIGNS to raise awareness amongst citizens about nutrition. Seasonal and local food products. Very important: This constant discourse must reach the very last corner of the very last neighbourhood, targeting in particular neighbourhoods with a lower purchasing power. Healthy and Sustainable Food should be linked to the CITY’S IDENTITY.

5/ Big changes come from the bottom up. The city councils must INVOLVE the provincial, regional, national and supranational administrative bodies in large-scale strategies for Healthy and Sustainable Food, under the understanding that affordable access to healthy and sustainable food is a UNIVERSAL RIGHT, just like access to health care and education.

The World Sustainable Health Centre, an initiative by the Valencia City Council and the FAO, will be inaugurated in Valencia next March, and its main goal is to coordinate and disseminate the considerable amount of knowledge and content which is being produced with regards to these matters. This initiative has the full backing of a considerable number of public administrative bodies as well as other United Nations agencies and it is highly represented by research centres and the private sector.

Institution

Comisionado Especial Centro Mundial para la Alimentacion Sostenible (CEMAS)

Country

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**Session Classification:** Session 11 - Food Systems
Evidence base on the region-specific context, causes, and health and economic consequences of the double burden of malnutrition

Africa is complex and rapidly transitioning with economic development and urbanisation. A positive trend is that the communicable disease burden across the African continent is decreasing. However, Africa has persistently high rates of intrauterine growth restriction, pre-term birth, low birthweight, underweight and child stunting, but also rapidly increasing rates of overweight and obesity early in childhood and adolescence. Further, communities across Africa now exhibit a ‘double burden’ of malnutrition, where under-nutrition in infancy is followed by over-nutrition in terms of macronutrients, but with enduring deficiencies in micronutrients (iron, folic acid and other vitamins). Of particular concern is that from Developmental Origins of Health and Disease (DOHaD) research, early life under-nutrition coupled with excessive weight gain in later life significantly increases risk for adult obesity, diabetes and hypertension. Given that non-communicable diseases (NCD) are major causes of death and disability globally and are now increasing most rapidly in low- and middle-income countries (LMICs), understanding the nutritional status of future parents, and thus tackling the double burden of malnutrition of mothers may in the short-term improve growth and neurodevelopment of their offspring, and in the longer-term could set up healthier trajectories that reduces the risk for NCDs in later life.

We will review key health trends across Africa, and in particular, examine the consequences of maternal malnutrition on the next generation both in the shorter-term and longer-term. This complex health transition underway in African if not tackled will severely impact on human capital and economic development through escalating health costs and decreasing productivity.

Institution

University of Witwatersrand

Country

South Africa

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Session Classification : Session 12 - Regional Parallel Sessions - Africa
Policies and measures to address the double burden of malnutrition and diet-related NCDs in the African Region

The Double Burden of Malnutrition (DBM) is the coexistence of both under nutrition and over nutrition in the same population across the life course. Malnutrition refers to nutritional excesses of macronutrients and micronutrients as well as deficiencies (WHO 1995). Double burden of malnutrition has been observed at country, household, and even individual levels. All countries, rich and poor, are affected by the DBM but it is a particular concern in countries with high stunting rates. For people who become stunted during the first two years of life, the capacity to resist disease, to carry out physical work, to study and progress in school is impaired across the life course. Later in the life course, unhealthy diet (generally energy dense but poor in micronutrients, characteristically high in sugars, salt and fat) and obesity are important underlying causes of many non-communicable diseases (NCDs), including hypertension, diabetes, cancer, stroke, and ischemic heart disease.

In order to tackle all forms of malnutrition remedial actions from multiple sectors are necessary. These actions, include policies and community action to control the marketing and consumption of unhealthy foods and beverages (including breast milk substitutes); setting and enforcing nutrition standards and dietary goals; nutrition labelling of processed foods; policies to promote consumption of healthy foods through taxation and subsidies; initiatives to promote consumption of fresh fruits and vegetables and increased physical activity; social marketing campaigns and multi-component community-based interventions, among others.

The Second Global Nutrition Policy Review (GNPR2) (1) reported that in the WHO African Region existing policies and measures to promote healthy diets mostly consist in nutrition and diet counselling (26 of 47 countries) and media campaigns (24 countries), or nutrition labelling (22 countries) and dietary guidelines (19 countries). The public health impact (2) of such measures depends on the number of individuals reached by counselling interventions or the media campaigns who change their consumption patterns to systematically opt for healthy food choices. By contrast, policies that change the context to make individuals’ default decisions healthy can have a higher health impact as they rely less on individual choices. For example, a ban on industrial trans-fats would be more effective in cutting down their consumption than an education campaign in a context of liberal marketing and poor labelling practices. According to the GNPR2, no country had a ban on industrial trans-fats and only three countries reported having fiscal policies such as taxation on unhealthy foods.

The Region needs to step up efforts to improve the food environment through designing and implementing policies and measures that have greater public health impact.


Institution
Ministry of Health, Republic of Seychelles; Ministry of Health, Kenya

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Session Classification : Session 12 - Regional Parallel Sessions - Africa
Breastfeeding is unparalleled as the ideal food for the infant and the best start in life. The importance of breastfeeding for child survival cannot be overemphasized. The Constitution of Kenya (2010) guarantees every person the right to be free from hunger and every child the right to basic nutrition (article 53). The global recommendation is that infants should be exclusively breastfed for the first 6 months of life and continue breastfeeding up to 2 years or beyond, alongside appropriate, adequate and safe complementary foods. Aggressive and unethical marketing of breast-milk substitutes undermines women’s understanding of value of breastfeeding and the confidence to sustain breastfeeding. Global sales of breastmilk substitutes accounted for US$44.8 billion in 2014 with an expected increase to US$70.6 billion by 2019.

Kenya adopted and ratified the International Code of Marketing of Breast-milk Substitutes through an Act of Parliament in 2012. The Breast-Milk Substitutes (Regulation and Control) Act 2012 (BMS Act, 2012) helps to establish breastfeeding as the foundation of healthy diet right from birth. It also helps to achieve food and nutrition security in the first 1000 days. The BMS Act 2012 binds the government making its compliance mandatory. To operationalize the BMS Act 2012 implementation framework 2018-2022 together with monitoring and enforcement guidelines have been developed. The Act has given impetus to complementary initiatives seeking to promote, protect and support breastfeeding. For example, the Kenyan Health Act 2017 (article 71 and 72) makes it mandatory to establish lactation rooms at the workplace. The Baby friendly community initiative has been rolled out in 25 of Kenya’s 47 counties, and in 2018 a human milk bank has been established at Pumwani Maternity and nursing home in Nairobi.

It can be argued that these initiatives contributed to observed improvements in nutrition indicators between 2008 and 2014, namely, increased rates of exclusive breastfeeding (32% to 61%), reduction in the prevalence of stunting (35% to 26%), reduction in wasting (7% to 4%) and underweight 16% to 11%) in 2014. In fact, in the Global Nutrition Report of 2015, Kenya was reportedly the only country on course to meet the World Health Assembly targets for 2025.

The main challenges to the effective implementation of the BMS Act include the long delay in passing the Regulations because of staff turnover linked with the political process. A plan to establish a monitoring system for the Code implementation (NetCode) were similarly impacted. The Kenya experience shows that necessity of strong government leadership and partnership with UN agencies, NGOs and other players with a genuine interest to promote breastfeeding. There is also a critical need for technical and legal expertise to support the drafting of the Code and Regulations, particularly to counter opposition to the legislative process and to manage conflicts of interest.

Institution
Ministry of Health, Kenya

Country
Kenya
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**Session Classification**: Session 12 - Regional Parallel Sessions - Africa
Understanding the double burden of malnutrition and approaches to tackle it: Lessons from South Africa

INTRODUCTION
South Africa is in a nutrition transition in which under-nutrition, notably stunting and micronutrient deficiencies, co-exist with a rising incidence of overweight and obesity and the associated consequences such as hypertension, cardiovascular disease and diabetes.
South Africa acknowledges that drivers of malnutrition in all its forms are multifaceted, requiring an all of Government and a multi-sectoral approach. Addressing food security, food processing, distribution and marketing; feeding practices, women empowerment and poverty would have an impact on all forms of malnutrition. The presentation was based on available information in South Africa and sources used are therefore acknowledged.

DISCUSSION
A multi-sectoral and all of Government approach in addressing malnutrition has yielded positive results in Kwa-Zulu Natal a Province in South Africa. Due political support a program called Operation Sukuma Sakhe (Stand up, let’s build together) was introduced. Sukuma Sakhe is guided by 5 Principles namely: community partnerships (strengthening integration at ward and municipality levels), integrating Government services, promoting economic activities, environmental care and behavior change campaigns. The Provinces also invested resources (human, finance and research) in nutrition, focusing on breastfeeding promotion.

Obesity has become a global health problem; South Africa is no exception. South Africa has seen a rapid increase in the prevalence of overweight and obesity especially among women and children. Multiple factors were identified as the drivers of obesity including but not limited to; lifestyle, increase in fast foods outlets and portion sizes, overreliance on processed foods, marketing of energy-dense foods and sugar-sweetened beverages, poor feeding practices and a decrease in physical activity.

To address these challenges, a consultation with various stakeholders was held, inclusive of researchers in the area, NGOs, media and development partners. An outcome of the consultation was the development of a Strategy for the Prevention and Control of Obesity in South Africa. The process was inspired by available evidence on the obesity situation and its drivers, the rising health cost due to NCDs and the effect on the economy, and the fact that South Africa has the highest prevalence of obesity in sub-Saharan Africa.

Cost effective interventions appropriate for South Africa were outlined. The strategy has six goals, two of which relate to the creation of an enabling environment to promote healthy food choices and physical activity. Population level interventions identified included; regulating marketing of unhealthy foods; fiscal measures; easy to understand food labels (Currently SA is in the process of testing FOP labels that will be understood by South African consumers, and public awareness and social mobilization). Stakeholder consultation, evidence and NGO support are critical in the success of adopting population based policies.

Conclusion
Addressing malnutrition requires a strong political and the involvement of multiple stakeholders. A whole of government approach would look economic, agricultural and trade issues and the impact on health, education and overall developmental outcomes. Additionally, funding’s and researchers for intervention research studies in the areas of malnutrition, obesity and physical inactivity are urgently needed.
Institution
North Western University

Country
United States

Presenter(s): Ms. MOENG MAHLANGU, Tshimi Lynn (North-Western University, Faculty of Health Sciences)

Session Classification: Session 12 - Regional Parallel Sessions - Africa
Addressing the double burden of malnutrition: Double duty actions in the health systems response to reduce maternal malnutrition

When women or adolescent girls enter pregnancy in a malnourished state, the cycle of maternal malnutrition, fetal growth restriction, stunting and a lifetime of reduced productivity is perpetuated. Undernutrition (thinness) affects 20-25% of women of reproductive age in South-East Asia and 6% of women in Western Pacific countries. An estimated 36% pregnant women in South-East Asia and 33% in Western Pacific regions are anaemic. Concurrently, many countries face an increasing prevalence of overweight and obesity in women of reproductive age and in adolescence. Nine Pacific countries are among the top 10 most obese countries globally. Thinness and anaemia are associated with poor maternal and child outcomes such as hemorrhage, low birth weight and small-for-gestational age infants. Obesity is associated with increased rates of miscarriage, diabetes, caesarean section due to obstructed labor, antenatal and postnatal depression and adverse newborn outcomes. The risk of metabolic syndrome is increased after exposure to suboptimum nutrition during crucial periods of fetal development and recent evidence also points to intergenerational effects of overweight and obesity.

Interventions that improve maternal nutritional status are among the most effective and sustainable means of achieving positive impacts and reducing inequalities in health across generations. The recent WHO recommendations on antenatal care for a positive pregnancy experience has increased the attention on programmatic delivery of maternal and pre pregnancy nutrition interventions, and provides a benchmark for countries to measure their policies, programmes and practices in maternal nutrition, while considering the double burden of malnutrition. Though some progress has occurred, data indicate that coverage and quality of maternal nutrition interventions is far from satisfactory across health sector settings in many countries. Further, the majority of maternal nutrition policies in South-East Asia and Western Pacific Regions are geared towards undernutrition and micronutrient deficiency reduction. While the need for implementing interventions for overweight and obese women is increasing, such actions are yet few. The implication of expanding the interventions has to be considered in the context of the governance issues, resource constraints, health sector capacity and monitoring gaps.

Strong policy advocacy and technical support are needed by most countries to scale up maternal nutrition interventions as part of an integrated health service delivery system to address all forms of malnutrition. Double-duty actions such as integration of counselling on maternal diet and weight gain during pregnancy as well as monitoring of progress in maternal nutrition, into the existing health system service delivery should be strengthened. A national surveillance system should facilitate monitoring of maternal, nutritional status and other variables, and provide regular information to programme staff. A collective effort is needed to identify evidence gaps and needs, carry out implementation research and develop capacity for comprehensive implementation, improved coverage and quality of evidence based interventions to reduce maternal malnutrition.

Institution

WHO Regional Office for South East Asia, WHO Regional Office for Western Pacific

Country
India, Philippines

**Presenter(s) :** Ms. DE SILVA, Angela (Regional Adviser Nutrition and Health for Development, WHO Regional Office for South-East Asia); Ms. UNTORO, Juliawati (WHO Regional Office for Western Pacific)

**Session Classification :** Session 12 - Regional Parallel Sessions - Asia / Pacific
Strengthening Maternal Nutrition Data for Policy and Program in Selected ASEAN Countries

Global interest on early life nutrition (i.e., 1000 d) is gaining traction as a long term measure to reduce the risk of malnutrition in all its forms. This calls for improving diets and nutritional status of women prior to or upon conception throughout pregnancy, as well as those of infants and young children through the first 2 y of life. Only a few nutrition indicators on maternal nutrition status and dietary intakes are available in large scale surveys. A few indicators, e.g., maternal anemia and birthweight data may also be available through the routine health information system in some countries, but bias and errors associated with low coverage is the major concern. Moreover, data on maternal dietary intakes are scarce, or if exist, tends to be based on a single day 24-h recall only. Data are not collected/compiled, analyzed and interpreted in line with the specific purposes of use (policy decision, program planning, monitoring or evaluation). Existing national data in selected countries in the ASEAN region: Indonesia, Philippines and Thailand can serve as case studies to construct the evidence-based data system to inform policy and program implementation.

Institution

Mahidol University

Country

Thailand

Presenter(s) : Ms. UDOMKESMALEE, Emorn (Mahidol University)

Session Classification : Session 12 - Regional Parallel Sessions - Asia / Pacific
Overview of efforts to address unhealthy diets, prevent obesity and eradicate pockets of undernutrition in the WHO European Region: surveillance, policy development and evaluation

The prevalence of overweight and obesity is either rapidly increasing or stabilizing at very high levels in almost all European countries, and dietary intake remains far from optimal. Excess intake of saturated fats, trans fats, salt and sugar contribute to diet-related noncommunicable diseases (NCDs), while inadequate intake of fruit, vegetables and whole grains undermines their potential benefits. Groups with low socioeconomic status are the most severely affected in the majority of countries, with significant economic and welfare costs for individuals and society as a whole.

The WHO Regional Office for Europe has advocated for implementation of comprehensive policies to promote healthy diets and prevent obesity in the European Region since at least 2000. Since then, almost all Member States have adopted some form of government-approved policy on nutrition or obesity. The current and ongoing WHO European Action Plan 2015-20, builds on lessons learnt, challenges that countries experienced, and incorporated the latest evidence on what works. In particular, it focused on the factors that influence nutrition and dietary behaviour throughout the life-course, the importance of food environments, and the need to ensure access to healthy food in specific priority settings and domains. In addition it identified a role for the health system in promoting healthy diets and weight management, as well as encouraging Member States to establish systems for routine surveillance, monitoring and evaluation.

This presentation will provides a snapshot of progress in implementation of these policies and actions in the European Region at the mid-point of implementation of the action plan. It is based on the most up-to-date data on epidemiology and policy reported by Member States as part of the WHO global nutrition policy review questionnaire. Implementation of key policies has improved significantly in recent years. Substantial progress has been made in areas such as school food, food product reformulation, fiscal measures and surveillance of childhood obesity. Areas in which implementation is lagging and which therefore require more attention include front-of-package labelling and comprehensive marketing restrictions. Other areas in which work might be reinvigorated or extended include protection, promotions and support for breastfeeding as well as appropriate complementary feeding practices. The presentation will identify some differences among countries in terms of context and the breadth and depth of their policy implementation.

Institution
WHO Regional Office for Europe

Country
Denmark

Primary author(s) : Mr. JEWELL, Jo Martin (WHO Regional Office for Europe)
Presenter(s) : Mr. JEWELL, Jo Martin (WHO Regional Office for Europe)
Development of a Regional Framework on Obesity Prevention in the Eastern Mediterranean Region

Background:
With an increasingly complex global nutrition landscape and an overwhelming increase in overweight and obesity in all ages, using cost-effective public health interventions to optimize nutrition at regional and population level is essential. Nutrition is an important contributor to the 17 SDGs, contributing directly to achieving SDG2 (end hunger, achieve food security and improved nutrition, and promote sustainable agriculture) and a decisive enabler of SDG3 (ensure healthy lives and promote well-being for all at all ages). In October 2018, the 68 WHO Regional Committee endorsed the Framework of Action on Obesity prevention.

Overweight and Obesity among adults in the Eastern Mediterranean Region (EMR) has become a public health problem. With regional obesity and overweight prevalence rates well above the global average, half the Region’s adult women (50.1%) and more than two in five men (43.8%) were overweight or obese in 2014. In several countries two-thirds or more of adults (especially women) are overweight or obese. High rates of childhood overweight in the Region are particularly concerning. On average, 8.4% of children under five years are already overweight or obese and in some countries more than 15% of children are affected. In many countries of the Region more than half of adolescents are overweight or obese.

The increasing prevalence of overweight, obesity is closely linked to a dramatic reduction in physical activity accompanied by marked changes in dietary patterns in the Region. Dietary factors causing unhealthy body weight gain include high intakes of total fat and free sugars, excessive saturated fatty acid consumption and an inadequate intake of fibre-rich foods. The average intakes of energy and fat are above WHO recommended levels, and more than three-quarters of the Region’s countries consume substantially higher levels of sugars than WHO recommends.

The Regional Framework on Obesity Prevention in the EMR has been developed to provide member states with technical guidance. This regional framework of action on obesity contains evidence based, cost-effective strategies to help prevent overweight and obesity in the Eastern Mediterranean Region (EMR). By following the interventions suggested in this framework, member states can give their populations the opportunity to enjoy a healthy lifestyle and a healthy body weight (Figure 1). The framework vision, mission, target and objectives are illustrated in the following diagram.

The policy proposals presented here are therefore consistent with those best buys, which includes the following strategic interventions: unhealthy diet than the previous version here, particularly in terms of restricting marketing of unhealthy foods to children, reformulating processed foods, taxing sugary drinks and subsidizing fruit and vegetables, legislating to ban the use of industrial trans fats, improving food in public institutions, implementing front-of-pack labelling, promoting breastfeeding, providing nutrition education and counselling and implementing mass media campaigns.

The way forward: The proposed policy priorities have been translated into a Regional Framework on Obesity Prevention and will be disseminated to Member States to ease the implementation and monitoring of evidence-based, cost-effective, population-level interventions.

Institution
WHO Regional Office for the Eastern Mediterranean
Country
Egypt

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Session Classification : Session 12 - Regional Parallel Sessions - Asia / Pacific

Track Classification : Interventions
Using market regulations to tackle overweight and obesity: An example from Norway

Food continue to be one of the most advertised products geared toward children, and food advertising makes up a greater proportion of promotions aimed at children than at adults. Energy-dense, highly processed foods and beverages that are high in saturated fats, trans fats, free sugars and/or salt (HFSS) dominate advertised foods, while healthier food items such as fruit and vegetables continue to be significantly underrepresented. Available research demonstrates that children recall, enjoy and engage with these promotional efforts. Furthermore, research examining the associations between food promotion and food behaviors, determinants of behavior and diet-related health outcomes, finds modest but consistent evidence that the link is causal.

In 2010, the World Health Assembly endorsed a set of recommendations on marketing of foods and non-alcoholic beverages to children, and this has since then been followed by a framework for how to implement these recommendations. Within Europe, a WHO network of member states has, since 2008, been working in order to share experiences and best practices to help identify and implement specific actions that could reduce the extent and impact of such marketing to children. A recent report from WHO Europe evaluating the implementation of the WHO set of recommendations conclude, however, that there is slow progress so far with respect to effective implementation. The report clearly states “There is a growing body of knowledge concerning both the impact of HFSS food marketing on children and the limited effectiveness of the measures some States have taken”.

This presentation will provide a brief overview of various policy initiatives across the European region in order to ensure compliance with the endorsed WHO recommendations. In particular, recent experiences from Norway will be presented. In Norway, all television advertising of any product before, during and after children’s programmes is prohibited. Furthermore, in 2014, a self-regulatory scheme was introduced, aiming to expand the range of marketing techniques covered through voluntary restrictions on marketing aimed at under 13. This followed a draft regulation proposed by the Norwegian government that originally proposed comprehensive restrictions on marketing aimed at children under 18.

In this presentation, the specific content of the self-regulatory scheme will be presented along with results from evaluation studies conducted in Norway since its introduction.

Institution
University of Oslo

Country
Norway

Presenter(s): Mr. KNUT-INGE, Klepp (The Norwegian Institute of Public Health/University of Oslo)
Necessity of establishing Regional Nutrition Partnership and Capacity Building Network in Central Asia and Caucasus

Children’s Nutrition security is still an unfinished agenda in Central Asia region. Still between 10 to 30% of the children in Central are stunted. The number of overweight under-5 year old children have increased from 2.1 to 4.5 million from 2000 to 2016 (over 100% increase) which is the greatest increase compared to other regions. The regional average for use of iodized salt is at 61 per cent (of which 51 per cent adequately iodized). Infant and young child feeding practices are poor across the Region, with a 26% rate of Exclusive Breast which is the poorest in the world. In such demanding region with a transiting nutrition agenda, it was necessary to look into the regional capacities of building blocks of the nutrition sector through a systematic desk review.

Based on the findings, in Central Asia and Caucasus the public health nutrition is not a recognized discipline and hence no single university is offering such educational programs. Although almost all countries in this region have a national nutrition plan, only less than 50% of these plans are costed. In only 12% of the countries dedicated national managers are in charge of the national nutrition programs and majority are not nutritionist by background, and widely the nutrition workforce is not equipped with expertise and competencies to tackle the nutrition from a community or public health point of view.

The building blocks of an influential, strong and functional nutrition sector includes but not limited to: Functional and trained workforce, leadership and governance, financing, evidence generation, information systems and knowledge exchange and integrated programs. Ultimately to raise the profile of nutrition as a corner stone to development, the capacity of the building blocks of the nutrition sector in Central Asia needs to be empowered in a coordinated manner. To achieve this UNICEF proposed an initiative to establish a functional Regional Nutrition Capacity Development and Partnership Platform, In December 2017, the Regional Sustainable Food Systems symposium, for Europe and Central Asia was held in Budapest and as a concluding remark, formation of a functional Nutrition Capacity Development and Partnership Platform for Central Asia and the Caucasus was welcomed and recommended.

Institution
UNICEF Regional Office for Europe and Central Asia

Country
Kazakhstan

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**Session Classification**: Session 12 - Regional Parallel Session - Europe / Eastern Mediterranean

**Track Classification**: Policy implications
Nutritional situation and policies to address the double burden of malnutrition in the Americas Region

The number of hungry people has increased from 38.5 to 39.3 million (2017). In contrast, food availability is more than 3,000 kcal a day per person. Among children under five years old, 9.6% are stunted, 1.3% are wasted, and 7.3% are overweight. While, 22% of women in reproductive age are anemic, 57.5% adults over 18 years old are overweight, and 23% are obese. This is the current nutrition situation in Latin America and Caribbean (LAC) countries. Evidence shows that hunger, food insecurity, stunting, anemia, and overweight could coexist in the same person, household and community. High consumption of ultra-processed foods that are high in sugar, salt or fat are the common denominator of this epidemic. It is urgent to transform the food system to increase access of healthy foods and consequently end all forms of malnutrition. PAHO Plan of Action for the Prevention of Obesity in Children and Adolescents is an example of comprehensive policies to address the double burden of malnutrition; Its lines of action, encourage Member States to: 1) put in place clinical guidelines to manage overweight and obesity and promote healthy eating in primary health care; 2) adopt and monitor the implementation of the International Code of Marketing of Breastmilk Substitutes and certify at least 50% of maternity health facilities as Baby Friendly Health Hospital; 3) create an enabling school environment to improve nutrition and increase physical activity; 4) regulate marketing to children, implement a front-of-package food label system and tax food and beverages high in sugar, salt or fat; 5) promote family farming and adopt measures to reduce relative price of healthy foods; 6) create an enabling environment to increase physical activity; and 7) monitor food and nutrition status for decision making.

After three years: nine countries have guidelines in place to prevent obesity and promote physical initiatives in primary care. Recently, Chile, Dominican Republic, Ecuador and Mexico monitored the International Code of Marketing of breast-milk substitutes. Barbados, Colombia, Nicaragua, and Uruguay have at least 50% of their maternity health services certified or recertified as Baby Friendly. Eighteen countries have national school feeding programs that satisfy nutritional needs. Twenty-five countries report that at least 70% of their schools have access to clean drinking water. Barbados, Chile, Dominica, Mexico, Ecuador have taxed sugar sweetened beverages. Chile, Ecuador, and Mexico have passed regulation on marketing of food and beverage to children. Chile and Ecuador in place front-of package labeling regulations. Nine countries have “open streets” programs in at least 5 cities or municipalities. Nineteen countries have created incentives to support family farming programs. Eighteen countries have introduced measures to improve relative prices and/or accessibility to healthy foods. Finally, Canada, Colombia, Mexico and the United States of America have comprehensive nutrition monitoring systems in place. Latin America and Caribbean countries have made important progress but there is still space for scaling up.

Institution
WHO Regional Office for Latin America and the Caribbean

Country
Presenter(s) : Mr. GRAJEDA, Ruben (Advisor, Nutrition and Social Determinants, Pan American Health Organization)

Session Classification : Session 12 - Regional Parallel Session - Latin America and the Caribbean
School-based interventions to tackle the double burden of malnutrition in the Caribbean

The Caribbean Public Health Agency is the Caribbean Region’s collective response to strengthening and reorienting our health system approach so that we are equipped to address the changing nature of public health challenges. The work done by the Agency is people-centred and evidence-based. This presentation highlights the technical cooperation activities being conducted as it relates to addressing the double burden of malnutrition in the Caribbean. While there are still pockets of stunting and wasting existing in the region, overweight and obesity are the main problems among school-aged children.

Support for and assistance with the development of policy is one the Agency’s areas of focus. Firstly, the 6-point Policy Package developed in collaboration with CARICOM and PAHO outlines the rationale, evidence base and consideration for sectors for the development and implementation of various policy options, including: 1) Food labelling; 2) Nutrition standards/guidelines for schools and other institutions; 3) Food marketing; 4) Nutrition quality of food supply; 5) Trade and fiscal policies; and 6) Food chain incentives. Policy areas 2 and 3 directly impact the school environment. Policy area 2 examines standards and guidelines for the schools to have healthier diets while policy area 3 addresses the unethical bombardment of marketing to children.

Secondly, the Agency is actively involved in providing technical assistance for the development of school nutrition policies. At present, most islands have either developed school nutrition policies or are in the process of finalising. These policies restrict/ban the use of sugar sweetened beverages, unhealthy snacks and examine key strategies and activities for creating health-promoting environments at school and in the surrounding community.

Finally, CARPHA has collaborated with Ministries of Health, Education and Sport for the development and implementation of two World Diabetes Foundation funded projects targeting students (11-14 years old) in 7 secondary schools in Grenada, St Kitts and Nevis, St Vincent and the Grenadines (2008-2011) and students (5-11 years old) in Grenada and St Lucia. Both projects adopt an intervention-control design and have 4 components: Behaviour Curricula on Nutrition/Diet and Physical Activity, School-wide Promotional Activities, Building Supportive Environments at school, at Home and in the community. These projects also target key behaviours: Eating a Variety of Foods Daily, Eating Breakfast Daily, Eating Fruits and Vegetables Daily, Reducing Daily Intake of Fats and Salts, Reducing Daily Intake of Sugary Snacks and Drinks, Engaging in at least Moderate Physical Activity (PA) for a Minimum of 60 minutes at least 5 days Weekly and Engaging in a Variety of Physical Activity Daily. The Agency continues to advocate for this behavioural intervention to be adapted/adopted in schools across the Region given that the materials have already been developed and support for teachers to deliver healthy lifestyle messages can be provided during regular in-training sessions.

The combined effect of these policies and interventions in collaboration with government and civil society support will ensure that the environments in which Caribbean children live and learn are more supportive of physical activity and healthy eating and that communities are empowered to embrace healthy living.

Institution
Caribbean Public Health Agency (CARPHA)

Country
Trinidad and Tobago

**Presenter(s)**: Ms. ASHBY-MITCHELL, Kimberly (Caribbean Public Health Agency (CARPHA))

**Session Classification**: Session 12 - Regional Parallel Session - Latin America and the Caribbean
Crece Contigo policy programme in Chile

In Chile, maternal and infant health and nutrition programs have been recognized as key to enhance human capital formation. Most of the Chilean population (70%) benefits from access to public health care and social welfare programs; these have the greatest impact in the less privileged population groups. As such, the comprehensive child protection system “Chile Crece Contigo1” (Chile grows with you) integrates health, social development, and educational activities, from early pregnancy to 4-5 yrs of age, it aims at optimizing growth, and childhood cognitive-motor development. It is implemented in Chile since 2007 and was institutionalized under the framework of the Intersectoral Social Protection System. During the presentation, lessons learned and implementation challenges will be presented in addition to results from the Chilean Maternal & Infant Nutrition Cohort Study (CHiMINCs).

1. http://www.crececontigo.gob.cl/acerca-de-chcc/que-es/

Institution

University of Chile and London School of Hygiene & Tropical Medicine

Country

Chile, United Kingdom

Presenter(s) : Mr. UAUY, Ricardo (University of Chile and London School of Hygiene & Tropical Medicine)

Session Classification : Session 12 - Regional Parallel Session - Latin America and the Caribbean
Brazilian commitments to the UN Decade of Action on Nutrition

Brazil has significantly reduced wasting and stunting over the last decades, as a result of intersectoral policies such as increasing formal employment, expanding conditional cash transfer programs and expanding the access to public education, health and sanitation, although higher rates may still exist among vulnerable populations. Meanwhile, obesity and overweight have rapidly increased in all age groups, regardless of socioeconomic status of communities, as a result of changes in diet and physical activity. Staple foods have been continuously replaced by ultraprocessed foods and the intake of sugar, salt and sugar are far above WHO recommendations. Consequently, Non-Communicable Diseases have been responsible for over 70% of deaths in Brazil and tackling this situation has become a public health priority in the country and Brazil has built a comprehensive NCD prevention and Control Plan and committed to several international targets regarding NCDs and its risk factors.

The II International Conference on Nutrition, the Sustainable Development Goals and, following, the UN Decade of Action and Nutrition have set tackling the double burden of nutrition an international priority, stressing the importance of healthy food systems and the role of multiple sectors in achieving all goals. So, in 2017, Brazil became the first country to officialize three major commitments to the Decade of Action: stop the growth in the adult obesity rate (which currently stands at 20.8%); reduce by at least 30% consumption of sugar-sweetened beverages among adults; and increase by at least 17.8% the proportion of adults who regularly eat fruit and vegetables. Brazil outlined specific policy measures it will take to achieve these goals. Afterwards, Brazil has also included other commitments regarding intersectoral policies related to food and nutrition security, as fiscal and regulatory measures, food reformulation for reducing sodium, sugars and fats, microcredit loans to family farmers, and cash transfers to poor families so that they can buy fresh produce. The government also committed to providing healthier meals and nutrition education to children in public schools and increasing public procurement of foods from family farmers. In order to strengthen the regional efforts for the Decade of Nutrition, the Ministry of Health of Brazil is coordinating two Networks of Action (Food-Based Dietary Guidelines and Sodium Reduction for Cardiovascular Disease Prevention) and the Ministry of Social Development has proposed other two Networks, regarding Governance on Food and Nutrition Security and Food Procurement Policies. Brazil believes that tackling the double burden of malnutrition requires multistakeholder and intersectoral approaches and country and inter-agency cooperation and the Decade of Action on Nutrition provides an important setting for commitments and policy action.

Institution
Ministry of Health

Country
Brazil

Presenter(s): Mr. NILSON, Eduardo (Vice Coordinator of Food and Nutrition, Ministry of Health)
Overweight and micronutrient malnutrition among children under five years of age in Mongolia: a dual burden of epidemic proportions

Introduction: The Mongolian diet is associated with a high intake of proteins, but little dietary diversity, leaving much of the population at risk for micronutrient deficiencies. Further, greater consumption of Western-influenced high-energy, nutrient-poor foods has contributed to a growing burden of overweight and obesity. We examined the occurrence of overweight and micronutrient malnutrition among Mongolian children under 5 years of age.

Methods: We utilized data from the 2015 National Nutrition Survey conducted in Mongolia’s 21 provinces and capital city of Ulaanbaatar. Weight (kg), height/length (cm), and micronutrient status were assessed for children 0-59 months using haemoglobin (Hb) concentration (g/l), serum ferritin (μg/l), serum retinol (μmol/l), and serum 25(OH)D (ng/ml), adjusted for elevated C-reactive protein (> 5 mg/l) or α1-acid-glycoprotein (> 1 g/l) inflammation/infection biomarkers.

Results: Almost one-quarter (23.8%, n=413) of children < 5 were anaemic (Hb < 110 g/l), 21.6% (n=374) were iron-deficient (serum ferritin < 12 μg/l), 69.9% (n=1210) had insufficient vitamin A (serum retinol < 1.05 μmol/l) levels and 90.9% (n=1556) had inadequate vitamin D [serum 25(OH)D < 30 ng/ml] status, with the largest proportion of micronutrient deficiency in the 0-23 month age group. The prevalence of child overweight (WHZ Z-score > 2 SD above median) was 10.3% (n=176), with 49.4% (n=87) of overweight children living in households with some level of food insecurity. Among overweight children, 31.3% (n=55) were anaemic, 27.3% (n=48) were iron-deficient, and 87.5% (n=154) and 70.5% (n=124) had insufficient vitamin D and vitamin A status, respectively. Among overweight children 6-23 months, though 90.8% (n=99) received minimum meal frequency, 53.2% (n=58) consumed vitamin A-rich foods the previous day, 45.0% (n=49) had minimum dietary diversity (items from ≥ 4 food groups), and 42.2% (n=46) had an overall minimum acceptable diet. For anaemic children, 64.2% (n=265) lived in households experiencing some level of food insecurity, while 66.5% (n=1035) of children with inadequate vitamin D status were from food insecure households.

Conclusion: Mongolia is facing a double burden of malnutrition, evident by a concurrently high prevalence of overweight and micronutrient deficiency among young children across all regions and socioeconomic groups. The fact that overweight is being established at an early age poses serious public health concerns for the country. Tackling Mongolia’s nutrition challenges requires a lifecycle approach focusing on good prenatal, infant, child, adolescent, and adult nutrition to address factors contributing to micronutrient deficiencies and excess weight gain in the population. Intersectoral policies aimed at increasing the availability, affordability, and access to nutritious foods while restricting exposure to unhealthy foods, strengthening infant and young child feeding practices, and greater family-focused promotion of healthy eating and physical activity behaviours are necessary to reduce the double burden of malnutrition in Mongolia.

Institution
UNICEF Regional Office for East Asia and the Pacific

Country
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Presenter(s) : Dr. BLANKENSHIP, Jessica (UNICEF EAPRO)

Session Classification : Oral Abstract Presentations - Micronutrients
Iron Deficiency is Associated with Higher Fat Mass in Cambodian Infants: The Winfood Project

Introduction.
Nutritional status in early childhood might predispose to a higher risk for non-communicable diseases through metabolic alterations which are not fully understood. Rapid growth during the first years of life and fat mass at 2 yrs of age are strong predictors for later obesity. High quality fortified complementary foods (FCF) play an important role in preventing childhood malnutrition, but may have long-term health benefits also. The WinFood project investigated the role of FCF and iron status on body composition in Cambodian infants.

Methods.
In a double-blinded intervention trial, Cambodian infants (n=419) were randomized to one of four FCF products. Infants received FCF daily from 6 months of age onwards for 9 months. Body composition (deuterium dilution), anthropometry and iron status (total body iron, TBI, calculated from ferritin and sTfR concentrations) were measured at 6 and 15 months of age. Zinc and vitamin A status was determined too at both time-points.

Results.
Overall there was no significant difference in body composition among the FCF groups. Body fat decreased from 21.7% to 14.9% over the study period (P<0.001). Iron status at 6 and 15 months of age was significantly associated with body composition, with infants with negative values for TBI at endpoint having higher fat mass (14.0% vs 15.5%, P=0.02). Infants who had sufficient iron stores throughout the study had on average 286 g less fat than infants which insufficient TBI at baseline and endpoint (P=0.015). Neither zinc nor vitamin A status was related to body composition.

Conclusion.
Iron status in early childhood is a significant determinant of body composition. FCF aimed at improving iron status may have long term health benefits by reducing the risk for obesity in later life.

Institution
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Country
France

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**Presenter(s):** Dr. WIERINGA, Frank (UMR-204 Prevention of Malnutrition, Institut de Recherche pour le Développement)

**Session Classification:** Oral Abstract Presentations - Micronutrients
Tipping the Balance of Vitamin A Status: The Double Burden of Vitamin A Deficiency and Excess in African Children

Introduction: The long-term benefits or consequences of implementing multiple vitamin A (VA) interventions in the same countries on VA status is currently unknown. Many countries are fortifying multiple foods with preformed VA during processing, including cooking oil, sugar, flour, and snacks.

Methods and Results: African countries now have stable retinol isotope dilution (RID) methods available to assist in monitoring total body stores of VA. In Zambia, in addition to having diets high in provitamin A carotenoids in some areas, multiple VA interventions have been successfully implemented. These include administration of high-dose supplements to children <5 years, mandating sugar fortification, and promoting biofortified orange maize enhanced with β-carotene. In one district in Zambia, children (5-7 years) had an alarming prevalence of 59% hypervitaminosis A (>1.0 μmol VA/g liver) with high serum provitamin A carotenoid concentrations, and during mango season many children experienced hypercarotenodermia. At baseline, 16% of these children had >5% serum retinol as retinyl esters, a measure of intoxication. Figure 1 shows projections that were made with sugar fortification on total liver reserves in children in Nicaragua. The Zambian children actually show a parallel increase in total liver VA reserves over time. In South Africa, some areas have adequate intake of VA through the consumption of sheep liver. In addition, wheat and maize flours are fortified, and high-dose VA supplements are still mandated to be given to children under the age of 5 years. In one area of South Africa, elevated serum retinyl esters were discovered. In a follow-up study in the same area, 63.6% of children were diagnosed with hypervitaminosis A by RID and it was directly related to the number of VA supplements that they had received during their lifetime. On the other hand, young children in Tanzania would likely benefit from more intensive efforts to improve VA status. However, they need to know which interventions will work best and how to continue to monitor status if they choose to adopt fortified foods. In Burkina Faso, by the time the children had reached school they had an adequate VA status. This was determined by RID before the launch of widespread oil fortification. In the United States, a high prevalence of VA deficiency and hypervitaminosis was discovered in a small group of adults using autopsy samples. Serum retinyl esters were not elevated in those with hypervitaminosis (>1.0 μmol/g liver) before toxicity occurred (>3 μmol/g liver).

Conclusions: VA deficiency and excess are occurring in the same population groups and causing a double burden with unknown ramifications. RID methods need to be more widely available to be able to diagnose hypervitaminosis A before toxicity occurs. Rising evidence suggests that bone health is affected with excessive VA intakes. This may occur in cases of hypervitaminosis A before toxicity manifests. Population monitoring of VA status is important so that programs can be appropriately targeted or scaled back when adequate status has occurred.

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Session Classification : Oral Abstract Presentations - Micronutrients
Understanding the co-occurrence of overweight and inadequate iodine intake: national cross-sectional study among Tunisian school-age children in 2012.

Introduction. Obesity is considered as a public health problem throughout the world. However, this is not exclusive of micro-nutrient deficiencies, including ID (Iodine deficiency), so that a number of countries have adopted universal salt iodization (USI) programs. Although these programs achieved some success in reducing ID, defaults in the process of salt iodization, were shown to increase the risk of iodine excess (IE). Also the nutrition transition which underlies the obesity epidemic is characterized by salt-rich diet, so that there could be a cumulative effect with respect to iodine status. In this work, we assess the co-existence of overweight and inadequate iodine intake.

Methods. A national cross-sectional study in 2012 used a stratified, clustered random sample of 6-12 y. children (the recommended target age class for the assessment of iodine status in populations) in Tunisia (n=1560). Overweight (Ow) was defined as body mass index (BMI)-for-age ≥+1z according to the World Health Organization (2007). Urinary iodine concentration (UIC) was measured in casual urine samples using Sandell-Kolthoff method. At the individual level, we used international cut-offs: ID<100µg/L and excess of iodine (IE)≥200µg/L. Prevalence of double burden (DB) was expressed as weighted percentage (95% Confidence Interval). Chi-square tests and logistic regression models were used to examine the association of socioeconomic and demographic factors with the DB (Ow–ID or Ow–IE).

Results. The prevalence of overweight, ID and IE were 18.4% (95% CI:[15.5-21.7]), 11.4% (95% CI:[8.6–14.9]), 52.2% (95% CI:[50.1–62.2]), respectively. The overall prevalence of Ow–ID was 2.7% (95% CI:[1.4-5.3]) while Ow–IE was found among 9.8% (95% CI:[7.7–12.3]). Few associations were found between the co-occurrence of Ow–ID after adjustment to the socio-demographic characteristics of children. Adjusted regression analysis revealed that this Ow–IE was not associated to the gender, living area, father’s instruction level and parent’s occupational status. In contrast to the age increasing (OR=1.7; 95% CI:[1.1-2.7]), low mother instruction level was found as a protector factor from Ow–IE (OR=0.6; 95% CI:[0.4-0.9]).

Conclusion. The coexistence of overweight and inadequate iodine status seems to not heavily impact Tunisian children at the time of the study. Nonetheless, salt will be the catalyst in the occurrence of the Ow–IE DB: i) salt is proved to be an obesogene molecule; ii) higher salt consumption is a driver for IE intake. Inadequacy of iodine intake may promote to overt hypothyroidism which is associated to the weight gain. In fine, cumulative effects of high salt intake, excess of iodine and unhealthy life style will probably have a prominent role in the genesis of Ow–IE DB. Anti-obesity and salt reduction policy should be closely monitored with the USI program to ensure the expected effects among population.

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Session Classification: Oral Abstract Presentations - Micronutrients
**Possible Mechanism of Double Burden of Malnutrition: Effect of Nutrient Deficiency on Resting Metabolic Rate Status**

Background: Obesity and overweight along with the under-nutrition consider as main problem in low-income countries. Whereas deficiency in food intake has contributed to the under-nutrition problem, a lack of dietary diversity also has a demonstrated major role in increasing over-nutrition. Previous study demonstrated that deficiency in several nutrients may contribute to metabolic status and decrease the resting metabolic rate (RMR) and thus increased in overweight/obesity (OW/OB) risk. So, we design current study to determine the correlation between nutritional status and resting metabolic rate in OW/OB Iranian women.

Methods: This cross-sectional study was conducted on 304 overweight and obese women 18–50 years (BMI≥25). Anthropometric measurements were assessed for all cases. The MH phenotype was defined according to the Karelis criteria. Dietary intake were determined using a valid and reliable Food Frequency questioner with 147 items. Resting metabolic rate was measured by indirect calorimetry (METALYZERR 3B-R3) according to the manufacturer’s instructions.

Result: Our results demonstrated the participant with decreased of normal status of resting metabolic rate (Dec. RMR) had inadequate intake of vitamin A and riboflavin. Results of multivariate regression analysis showed that, participant with inadequate intake of vitamin A had greater odds of Dec. RMR (OR=2.45, 95%CI=1.11-2.88, P=0.02) after control confounder factors, also women with inadequate intake of riboflavin had high odds of Dec. RMR (OR=1.63, 95%CI=0.97-2.20, P=0.04) after adjusted for BMI, age, total EI, compared to those in the adequate intake.

Conclusion: It seems that the nutritional deficiency through several mechanism in cellular energy and body metabolism increased the risk of metabolic disorder and consequently obesity progression.

Keywords: Double Burden of Malnutrition, Nutrient Deficiency, Resting Metabolic Rate Status

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**Session Classification**: Oral Abstract Presentations - Micronutrients
**Sub-clinic inflammation a factor associated with both cardio-metabolic risk factors and micronutrient deficiencies in adults of Ouagadougou; Burkina Faso**

**Introduction:** Increasing evidence suggests that high sensitivity C-reactive protein (hsCRP) is associated with cardio-metabolic risk factors (CMRF) while being related to micronutrient deficiencies.

**Method:** As part of a project on the double burden of under and over-nutrition in sub-Saharan Africa, we assessed the relationship between hsCRP with both cardio-metabolic risk factors and micronutrient deficiencies in a population-based cross-sectional study carried out in the Northern district of Ouagadougou, the capital city of Burkina Faso. We randomly selected 330 households stratified by income tertile. In each income stratum, 110 individuals aged 25-60y and having lived in Ouagadougou for at least six months were randomly selected, and underwent anthropometric measurements and blood sample collection.

**Results:** The prevalence of high hsCRP was 39.4% without sex difference. Vitamin A deficient subjects (12.7%) exhibited significant odds of elevated hsCRP (2.5; \( p = 0.015 \)). Serum ferritin was positively correlated with log hsCRP (0.194; \( p = 0.002 \)). The odds of elevated hsCRP was significant in subjects with BMI \( \geq 25 \) (6.9; 95% CI, 3.6, 13.3), abdominal obesity (4.6; 95% CI, 2.2, 7.3), and high body fat (10.2; 95% CI, 5.1, 20.3), \( (p<0.001 \) respectively). Independent predictors of hsCRP in linear regression models were WC (\( \beta = 0.306; \ p = 0.018 \)) and serum triglycerides (\( \beta = 0.158; \ p =0.027 \)). In this sub-Saharan population, hsCRP was consistently associated with adiposity.

**Conclusion:** Assuming that plasma hsCRP reflects future risk of cardiovascular events, intervention, which reduces CRP, or chronic and acute nutrition conditions associated with it, could be effective in preventing their occurrence particularly in sub-Saharan Africa.

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**Session Classification :** Oral Abstract Presentations - Micronutrients

**Track Classification :** Biology
How Much Breast Milk Do Young Filipino Kids Consume? Data from Vitamin A Safety Assessment Study

INTRODUCTION

Vitamin A deficiency (VAD) increases the risk of morbidity and mortality among young children. As VAD-endemic countries implement large-scale intervention programs to reduce VAD, the risk of excessive vitamin A intake due to overlapping coverage has in turn become a growing concern. The Philippines has many VA programs in place, including high-dose supplementation, micronutrient powder, large-scale fortification of staple foods, and market-driven fortification through the Sangkap Pinoy Program. Children who are breastfeeding are likely to receive adequate VA from breast milk if their mothers have adequate VA status; thus, any excessive VA intake caused by exposure to multiple vitamin A programs may be most likely among breastfeeding children.

The study aimed to determine the breast milk intake among children 12 to 18 months of age who are exposed to multiple VA intervention programs using the dose-to-mother deuterium dilution technique. The information on breast milk intake will be combined with information on VA concentration of breast milk and VA intake from complementary foods to calculate total VA intake of the children.

METHODS

Patterned after the “Super Kid” design, there were three study groups consisting of breastfeeding children who were: 1) exposed to multiple VA programs and have received a high-dose VA supplement (VAS) in the past month, 2) exposed to multiple VA programs and have received a high-dose VAS in the past 3-6 months, and 3) not exposed to multiple VA programs but have received a high-dose VAS in the past 3-6 months. Out of 481 mother-child pairs screened in Mandaluyong City, 56 breastfeeding pairs were recruited for the study. In 52 pairs who completed the protocol, average daily breast milk intake of the child over a 14-day period was estimated by modelling the data from mothers and children at each time point. The study has been approved by the FNRI Ethics Review Committee.

RESULTS

Mean (± SD) breast milk intake among 12- to 18-month-old urban Filipino children was 531 ± 208 g, which is close to the usual milk intake for this age group from pooled studies in developing countries, i.e., 526 ± 214 g. Breast milk intake in Group 3 (637 ± 205 g) was significantly higher (p < 0.05) than 451 ± 173 g and 413 ± 151 g reported in Groups 1 and 2, respectively, because the children in Group 3 were generally younger (13.7 months vs. 15.2 and 15.8 months).

CONCLUSION

The dose-to-mother deuterium dilution technique was applied to estimate the breast milk intake of children exposed to multiple VA programs. The study findings will provide guidance to program managers and public health nutrition policymakers to optimize the evaluation of their vitamin A programs, especially in the Philippines where multiple VA interventions are in place, and to enable them to improve national nutrition plans and strategies.

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Session Classification : Oral Abstract Presentations - Micronutrients

Track Classification : Assessment
Food insecurity, nutritional anthropometry markers and risk of micronutrients deficiency in households of preschool children and women in rural communities of Osun, Nigeria

Introduction
Hidden hunger, stunting, wasting, and underweight among preschool children as well as low body mass index (BMI) among women of reproductive age (WRA) are still common forms of undernutrition in developing countries, especially in rural communities where household food insecurity is a burden. The co-existence of undernutrition and overnutrition is a recent twist of the problem in rural communities, resulting in a double burden of malnutrition. However, there is paucity of data on the magnitude of the double burden of malnutrition at the household and community level. This study investigated the overlap and discrepancy between anthropometric marker classification of preschool children and their mothers in rural communities of Osun State, Nigeria.

Methodology
A cross sectional survey of households involving preschool children age 36-59 months (n = 128) and their mothers (n = 90) was conducted in selected rural communities of the Ola-Oluwa Local Government Area of Osun state, Nigeria. Household food insecurity was assessed by household hunger scale. Body height and weight of preschool children and WRA (n=65) were measured, and for children expressed as height-for-age, weight-for-height and weight-for-age z-scores using WHO anthro software. Children with z-scores < -2 were classified as being stunted, wasted or underweight, respectively. BMI (kg/m2) values were calculated for WRA and categorized as underweight (BMI <18.5), normal weight (BMI 18.5-25), overweight (BMI 25-30) or obese (BMI >30). Venous blood samples of all children were taken to assess haemoglobin (Hb) concentrations, with anemia defined as Hb <110g/L. Risk for VAD among preschool children (n=97) was assessed by the frequency of consumption of vitamin A-rich foods, i.e. animal and plant sources or fortified food products, with a consumption frequency of ≤4-6 times/week indicating to be at risk (adapted HKI-FFQ). Statistical software was used for data analysis and level of significance was set at p<0.05.

Result
Average age of preschool children and WRA were 43 months and 33 years respectively. Moderate and little/no hunger households were 13.5% and 86.5% respectively. Among preschool children, 20.5% were stunted, 2.4% were wasted and 16.4% were underweight. Among WRA, 26.2% were underweight, 10.8% were overweight and 1.5% were obese. Mean Hb of preschool children was 98.96 g/L with 73.9% having anemia. Approximately 75% of the children were at risk for VAD. Though, 63% consumed vegetables (tomatoes, red sweet, chili, cherry peppers) and palm oil as a single dish > 6 times per week, less than one-fifth consumed green leafy vegetables > 6 times per week. Households with anemic children and overweight and/or obese mothers were 6.4% and 1.6% respectively. The relationship between household hunger and anthropometry markers of preschool children (height-for-age = -0.034, weight-for-height = -0.078 and weight-for-age = -0.089) and WRA (BMI = -0.177) were not significant.

Conclusion
Undernutrition in the form of stunting, wasting and underweight as well as risk for micronutrient deficiencies are still the primary nutritional problems among preschool children and their mothers in the studied communities. Although the double burden of malnutrition existed at the community level, it did not occur within the studied households.

Word count: 494

Keywords: Anthropometry markers, food insecurity, women of reproductive age, preschool children
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Session Classification : Oral Abstract Presentations - Micronutrients

Track Classification : Epidemiology

INTRODUCTION: A growing number of countries are facing a dual burden of malnutrition, across nearly every region of the world. The food insecurity is often one of the causes of many forms of malnutrition. Malnutrition and food insecurity are also directly related to several non-communicable diseases (NCDs), like diabetes and cardiovascular disease. Coordinated policy action to effectively address malnutrition, NCDs, and food security is critically needed, but policies are usually crafted separately by separate sectors. As a result, contradictions can arise and synergies can be missed.

METHODS: Double-duty actions, defined by the World Health Organization as actions that address multiple forms of malnutrition, can provide the biggest impact on reducing the dual burden. To examine whether existing nutrition, NCDs, and food security policies have harmonized guidance and include double-duty actions, we undertook a qualitative policy review. We selected all 29 maternal and child health (MCH) and nutrition priority countries named by the U.S. Agency for International Development (USAID) in 2017. Using a systematic Internet search and email requests to each country, we sought all prevailing policy documents for topic areas of nutrition, NCD prevention, and food security (if available). The searches were cross-checked with the several global policy databases, and conducted in English, Spanish and French. Documents reviewed included plans, policies, and strategies that outlined a strategic direction for the country. We did not review operational guidelines or protocols. The countries with all three policies were selected for a more in-depth review and the results compiled in Microsoft Excel.

RESULTS: The review provided several new insights. First, national policies related to nutrition, NCDs, and food security are often not up-to-date or available in the public space. Among policies we found, only eight of 29 countries had up-to-date policies for all three topic areas. Second, the deeper dive into those eight countries revealed that none included all six double-duty actions in all three policies. Finally, the review revealed that, in several cases, contradictions in guidance for these actions could negatively impact implementation.

CONCLUSION: We conclude with recommendations that, if followed, will improve the harmonization of policies and increase the prioritization of double-duty actions. Findings from this review can be used spur greater discussion among government stakeholders in the areas of nutrition, NCDs, and food security on how to maximize investments across the malnutrition spectrum using greater policy alignment and enhanced accountability. As countries review and renew the various national policies, focusing on double-duty actions to address the dual burden of malnutrition is an opportunity to stretch scarce resources to meet multiple goals.
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Session Classification: Oral Abstract Presentations - Policy actions
Track Classification: Policy implications
Agriculture to Nutrition (ATONU) - Making agriculture work for nutrition: from research evidence to policy

Malnutrition is one of the greatest contemporary challenges affecting health, productivity and economic growth of many developing countries. Africa is most at risk of many types of malnutrition because a large proportion of its population relies on agricultural production for food and nutrition. In addition, agricultural policies and programming in Sub-Saharan Africa has tended to focus on increased production and productivity of staple foods such as cereals and tubers. Agriculture programming and activities that do not consider nutrition outcomes contribute to the prevalence of micronutrient deficiency and obesity among rural African communities that rely on agricultural production for nutrition. It is against this backdrop that the Food, Agriculture and Natural Resources Policy Analysis Network and partners implemented the Agriculture to Nutrition (ATONU): Improving Nutrition Outcomes through Optimized Agricultural Investments Project, to answer the question of what agriculture projects and programs can do to deliver positive nutrition outcomes. ATONU tested three pathways to deliver improved nutrition to smallholder farming households in Tanzania and Ethiopia: (i) agricultural production for own consumption, (ii) use of agriculture income to purchase other nutritious foods, and (iii) women empowerment to improve agency and nutrition. The aim was to use the results from the household level studies to feed into engagements with decision-makers. Following ATONU interventions, vegetable production and dietary diversity improved among farmers; farmers who received nutrition education demonstrated better understanding of what and how to consume foods for better nutrition; farmers demonstrated a keener consideration of messages coming from government workers such as hospitals and extension workers. The success of ATONU was partly due to the fact that the project worked with government structures in implementation. According to the results of the project’s formative research, men had the final say on household decisions. Therefore, in order to empower women to make nutrition-sensitive decisions, ATONU engaged men to sensitize them on the importance of maternal and child nutrition and the need for women to participate in household decision-making. This created an enabling environment for the women to participate in household decision-making, especially in matters concerning nutrition. Some of the men that were actively involved in ATONU social behavior change sessions have become champions for good nutrition within their communities. While research brings out the existing gaps and what works in addressing nutrition, it takes an enabling policy environment to facilitate both agriculture programming that is nutrition-sensitive and the uptake of nutrition-sensitive actions by the target group. Five policy and programming recommendations are made in order to improve the nutrition of smallholder farm families in Tanzania: (i) increasing support for diverse agricultural production; (ii) formulation of agricultural policies that ensure that nutrition education reaches smallholder farming families from multiple channels to enable them make informed food choices; (iii) capacitating agricultural extension officers in nutrition-sensitive agriculture; (iv) engaging men in women empowerment programmes that aim to improve the nutrition of women and children; and (v) building local level communities of practice for sustainability of nutrition-sensitive initiatives.

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Session Classification : Oral Abstract Presentations - Policy actions
The Zambia Good Food Certification mark - Fighting the Double Burden through certification marks for nutritious foods

THE GOOD FOOD SEAL/LOGO

What is it?
A mark or seal that will go on eligible products that meet predefined criteria across the various food groups to help consumers identify nutritious foods in store. The Logo is being developed by the Scaling Up Nutrition (SUN) Business Network (housed within World Food Programme Zambia), together with the Zambia National Food & Nutrition Commission and Zambia Bureau of Standards.

It fits within the goal of improving nutrition awareness and demand as described in the SUN Business Network Zambia strategy, as well as the Zambia National Food & Nutrition Strategic Plan 2017-2021. The project aims to develop a front-of-pack Nutrition mark or seal to help consumers identify nutritious foods in-store. During roll-out, the logo will be accompanied by a nationwide marketing campaign aimed to create awareness surrounding good nutrition and buzz around the logo, especially in urban and peri-urban areas.

The nutrition brand logo aims to:

1. Introduce a simple, positive mark to “Help Zambian people make better food choices” in store with the objective of increasing intake of micronutrients and reducing consumption of ingredients that lead to overweight and obesity and resulting non-communicable diseases (NCDs)
2. Reduce overweight & obesity, NCDs, and micronutrient deficiencies
3. Encourage food companies to reformulate existing products and develop new ones with a healthier product composition

Project Objective: Develop and roll out a Good Nutrition Logo on foods that meet established nutrition-related standards to increase ease of identifying nutritious products for consumers.

Project rationale
The project is based on initial research and data which indicates that:

- Nutrition knowledge and awareness is limited
- Consumer demand for nutritious foods is low
- Availability of nutritious products is inadequate
- Junk food is cheap, fast, and everywhere

Current Progress
The Good Nutrition project has made significant progress so far including:

- Completed development of criteria for the logo in the first quarter of 2017
- Finalized the graphic design for the logo including testing of consumer interpretation of the symbol through Focus Group Discussions (FGD)
- Completed a food consumption patterns survey which will inform the communications campaign strategy
• Mobilized resources to implement the Good Food Logo commencing mid-2018
• Negotiation and agreement with a government agency through which the certification mark will be implemented ensuring sustainability

Next Steps

1. Formalising ownership, and trademark of the certification mark and for the implementation agency to implement
2. Identify Compliant Products
3. Recruit new companies to apply for the logo
4. Initiate learning exchanges with front-of-pack seals from other countries

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Session Classification : Oral Abstract Presentations - Policy actions
The Child Support Grant in Thailand: a solution for addressing the double burden of malnutrition?

Despite Thailand’s remarkable progress in overall development, the double burden of malnutrition remains a challenge for the nation’s children. An analysis of the Multiple Indicator Cluster Survey (MICS) 5 shows the coexistence in children under 5 of overweight (8.2%) and wasting (5.4%), with many still experiencing stunting (10.5%).(1) The double burden is also found in the same child with 11.8% of stunted children in the MICS also overweight.

In 2015 the Government of Thailand (RTG) adopted the Child Support Grant for young children from poor and near-poor families to strengthen child nutrition outcomes, improve access to social services and empower women. In 2017, an estimated 23% of all children under the age of 36 months received the CSG in Thailand. To evaluate the impact of the grant, the RTG launched a national impact evaluation study that adopted a mixed-method quasi-experimental design, following principles of the rights-based approach that precludes randomization. The evaluation included infants who received the CSG and matched comparison infants who did not receive the CSG.

The initial analysis of the end-line data found evidence that both new-born infants and younger children in households receiving the Child Support Grant (CSG) achieved better nutritional outcomes than children in matched comparison households. Of those extremely poor children in the households receiving the CSG, 8% were wasted, significantly lower than the 17% in the matched comparison group.(2) For all stunted children receiving CSG, 18% were overweight compared to 34% in the matched comparison group. This result, directly supporting the impact of the CSG in specifically reducing the double burden, is also statistically significant.

The results also demonstrate, in the entire sample, significant impacts in terms of improving access to post-natal care and increasing the proportion of mothers who exclusively breastfeed their infants for the first six months—behaviors that lead to improved nutritional outcomes. For very poor children in the sample, the rate of exclusive breast-feeding increased from 78% to 85% with receipt of the CSG, and nearly doubled the rate of access to recommended post-natal care. For non-poor children, the rate of exclusive breast-feeding increased from 64% to 73%.

The powerful evidence of developmental impact demonstrates the potential role of the Child Support Grant in achieving core nutrition impacts, as well as strengthening access to vital health services and empowering women. A transition to a universal grant, starting from pregnancy, may provide a valuable initiative further strengthening inclusive social development and equitable economic growth.

1. MICS 5
2. The sample is into three groups: (1) "extreme poor": households with reported per capita income less than Thb 1500 p/m (30.0% of the sample); (1) "less poor": with income between Thb 1500 and Thb 3000 (35.4% of the sample); (3) "non-poor": with reported p/c income greater than Thb 3000 (34.6% of the sample, of which 74.0% reported per capita income less than Thb 6000.)

Institution
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Session Classification : Oral Abstract Presentations - Policy actions
Double burden of malnutrition: The role of framing in development of political priority and policy agendas for the rise in nutrition-related non-communicable diseases in Tamil Nadu, India

Introduction: In many low- and middle-income countries, non-communicable disease (NCD) prevalence is increasing rapidly while undernutrition persists. How policy actors frame malnutrition, particularly the rise in nutrition-related NCDs, may shape development of nutrition and health policies that direct programming and investments in countries. In India, much food and health policy is decentralized, which means that state-based nutrition policy is critical for addressing the emerging double burden of malnutrition. There is little evidence, however, about how these issues are understood at the state level in India and elsewhere. In Tamil Nadu, used as a case study, undernutrition persists and nutrition-related NCDs are more prevalent than in the rest of the country. We aimed to identify frames used by policy actors who influence the nutrition agenda-setting process regarding the double burden of malnutrition, priorities reflected by those frames, and potential implications for nutrition policy development.

Methods: We conducted 29 in-depth, semi-structured interviews with actors in the nutrition policy and program space in Tamil Nadu and at the national level. We identified initial key informants from a desk review of policy documents and used purposive and snowball sampling of international policy advocates, government officials, and state-level implementers of policies and programs to include perspectives from the health, nutrition, and agriculture sectors. All interviews were audio-recorded, transcribed and coded using Nvivo 11. Major themes were identified from the frames using the policy analysis strategy developed by Bacchi (2009), to include these elements: main issues represented, priorities emphasized, recurrent or key themes or subjects, underlying assumptions, potential effects of the frame (or likely policy result), and omissions that logically could have been included in the frame.

Results: NCDs were mostly either not mentioned without interviewer prompting or were seen as non-urgent, in contrast to the almost universal concern about persistent stunting and anemia in women of reproductive age in Tamil Nadu. With respect to addressing malnutrition, respondents perceived Tamil Nadu to be relatively successful compared to other states but were concerned about lack of convergence of efforts. They saw sanitation as a particular failure impacting persistent undernutrition. Respondents from agriculture and medicine perceived NCDs as more important than respondents from health and nutrition. Suggested policy solutions ranged from highly-specific interventions for undernutrition to addressing nutrition-related NCDs through promotion of millet-based products to systems-based multidisciplinary schemes addressing both undernutrition and NCDs.

Conclusion: The frames used by policy actors suggested different priorities, only some of which explicitly address NCDs. The different priorities and suggested policy solutions emanating from actors working in the same policy space has troubling implications for development of policy convergence and resources. Convergence can be enhanced through gaining in-depth understanding of the populations affected by undernutrition, nutrition-related NCDs, or both. This work extends previous work on the impact of framing of nutrition framing on policy to the double burden, and on frames evident among policy actors across multiple sectors with influence on the nutrition agenda-setting process.

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Session Classification : Oral Abstract Presentations - Policy actions

Track Classification : Policy implications
How to strengthen the link between biology and implementation for sustainable action

The knowledge in human biology over the past century was linked to the treatment and prevention of single nutrient deficiency diseases and provided the basis to address undernutrition in low and middle income countries (LMICs). Such programmatic experiences led to the recommendation for scaling up nutrition-specific interventions, primarily through the health sector on micronutrient fortification/supplementation, infant and young child feeding, and treatment of acute malnutrition (2008 /2013 Lancet Series on maternal and child undernutrition). While these interventions contribute to improving nutrition, the emerging multiple burden of malnutrition (undernutrition, overweight/obesity, micronutrient deficiencies) requires in-depth understanding of complex biological processes leading to comprehensive strategies that incorporates nutrition across sectors (health, agriculture, education, social protection etc).

Examples of current policies and implementation in LMICs are related to the first 1,000 days of life and healthy diet. Linking biology to implementation requires evidence on diet-related biological system; development of multi-sectoral metrics for targeting, monitoring and evaluation; and assessing biological impact that complements implementation process. To ensure the quality and strength of such evidence, technical guidelines or systematic reviews should be issued by relevant international organizations and/or renowned expert groups who could also act as facilitator or catalyst of the evidence uptake by policy/program level. Existing international events or global gatherings could serve as dialogue platform for knowledge sharing and interactive discussion between scientific community and the country policy makers and implementers. Further steps to support the linkage of biology to program sectors should involve strategic communication, taking into consideration the insights on national policy/program decision and prioritization; translation of advanced biological evidence for effective interventions; identification of ‘entry point’ for dialogue and building trust; proposing model of collaboration (science-implementation) to demonstrate program progress and speed up achievement of committed goals.

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Session Classification : Session 14 - Bridging the evidence
Nutritional status and caloric consumption of children from communities in urban division of Jaffna divisional secretariat area: A post war context of Sri Lanka

Introduction: Coexistence of undernutrition along with increasing diet-related non-communicable diseases of a developing country is more crucial and it affects on health and economic status of the country. In urban sector, nutritional intervention of economically more vulnerable children from colonies as communities is imperative to improve the nutritional status while monitoring obese children are crucial. High prevalence of childhood undernutrition was prevailed in Jaffna during three decades of war which ended in 2009.

Objective: The aim was to determine the nutritional status of children from Poor Urban Communities (PUC) and Urban Communities (UC) in Jaffna Divisional Secretariat Area.

Methods: A descriptive cross sectional study was used to identify the children in 2017. Twenty two GramaNiladhari divisions (8 PUC and 14 UC) were selected based on stratified sampling technique. Socio-demographic and economic factors, dietary pattern and illness were obtained. Anthropometric data (weight, height and skin fold thickness) were measured.

Results: A total of 953 children (461 males and 492 females) were selected from PUC (n=341) and UC (n=612). The mean(±SD) age of the children was 33.4(±15.6) months with ranged from 01 to 59 months. Mean(±SD) weight and height of the children from UC [13.4 (±2.5)kg and 94.2 (±10.3)cm] was significantly higher than from PUC [10.9(±2.7)kg and 85.2(±11.4)cm]. Mean(±SD) fat percentage of children from PUC and UC was 15.8(±8.7) and 27.4(±12.2) (p<0.001) respectively.

The prevalence of wasting, underweight, stunting, overweight and obesity were 16.1, 28.4, 32.2, 12.1 and 4.2% respectively while only 1.2% of the children from PUC was affected with overweight. Prevalence of LBW children (<2500g) was 17.6 and 14.2% from PUC and UC respectively. Highest percentage of the households (36.7%) received the income between LKR5,000-10,000 while 12% of the families from PUC had the monthly income less than LKR5000. Mean energy from carbohydrate, fat and protein were 786.8(±492.7), 215.7(±124.3) and 178.8(±106.1)kcal/day respectively.

Only 22% of the children from PUC had adequate consumption of calories while 23% of the children from UC consumed calories more than the recommended daily allowance. Family income (x²=11.503;df=4;p=0.021), educational level of parents (x²=16.443;df=3;p=0.001), dietary pattern, sanitary condition, frequently affected with diseases and low birth weight (x²=10.76;df=2;p=0.005) were significantly associated with malnutrition.

Conclusion: The undernutrition is still remained high level while overweight and obesity are gradually increasing in Jaffna district in post war scenario. This study confirms that, even though several factors have been influencing malnutrition, birth weight, family income, parental education and quality and quantity of food consumption are the causes for double burden of malnutrition among the children in Jaffna.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Co-existence of maternal overweight and obesity with childhood stunting in rural and urban communities of Lagos State, Nigeria

Introduction: Childhood under-nutrition remains a major public health problem in sub-Saharan Africa. The emergence of overweight and obesity at the household level has been linked with the rising prevalence of childhood under-nutrition. The aim of this study was to determine the prevalence of maternal overweight and obesity, childhood stunting, coexisting maternal overweight and obesity with childhood stunting (MOCS) and the associated socio-demographic factors in rural and urban communities of Lagos State, Nigeria.

Methods: This was a cross sectional survey conducted using the multistage random sampling technique. A total of 300 mother-child pairs were studied, consisting of 150 each from rural and urban communities. Data collected include demographics, socio-economic characteristics and anthropometric measurements of the subjects. Maternal overweight and obesity was determined using body mass index (BMI) classified according to World Health Organization recommended cutoff points and stunting in children was defined as height-for-age z-scores < -2.0. Bivariate and multivariate analyses were used to determine risk factors for coexisting maternal overweight and obesity with childhood stunting.

Results: The mean ages of mothers in urban and rural communities were 30.4 years and 29.6 years respectively with no statistically significant difference (t=1.33, p=0.186). The prevalence of overweight and obesity among mothers was significantly higher in urban than rural areas (50.7% vs. 41.3%; p = 0.022) while the prevalence of childhood stunting was significantly higher in rural than urban areas (43.3% vs. 12.6%; p < 0.001). Coexisting maternal overweight and obesity with childhood stunting was observed in 31 (10.3%) mother-child pair with a significantly higher prevalence in rural than urban areas (14.7% vs. 6.0%, p = 0.014). In multivariate logistic regression (Table 1), maternal short stature (OR 3.3, 95% CI = 1.2-9.0, p = 0.02) and living in rural area (OR 0.2, 95% CI = 0.1-0.5, p = 0.001) were the identified risk factors for coexisting maternal overweight and obesity with childhood stunting.

Conclusion: The prevalence of coexisting MOCS is high especially in rural areas. There may be intergenerational effect perpetuating malnutrition. Effort at reducing the vicious cycle of childhood and maternal malnutrition should focus on appropriate interventional measures aimed at improving infant and child nutritional status especially in the rural area.
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**Session Classification**: Poster session 1

**Track Classification**: Epidemiology
The Nutritional Double Burden in Benin

Introduction
Developing countries are faced not only the problem of malnutrition caused by micronutrients deficiencies but also the emergency and the increasing of overweight and obesity. Benin is a West African country with 11 million inhabitants facing also such situation. The objective of this paper is to describe the situation of nutritional double burden in Benin and to reveal associated factors.

Method
In order to characterize the global situation, we based our study essentially on literature review. However, graphs and tables presented had been produced by ourselves.

Results
Chronic malnutrition is highly prevalent in Benin; one third of 6 to 59 months children (34%) were affected. Underweight and wasting affect respectively 18% and 4.5% of children. People suffering from Anaemia are decreasing in the population but the percentage is still high notably 58% of children and 41% of women in 2011/2012. In the same time, overweight and obesity become an issue with 1.7% of children affected. Nutritional status of women aged 15-49 years assessed by the Body Mass Index revealed that obesity followed an increasing trend from 2001 to 2011/2012 (6% to 7.2%) while chronic energy deficiency was decreasing (11% to 6.2%) but relatively still worrying. In some districts, percentage of mothers overweighted or obese with stunted children is important (graph). These show the coexistence of over and undernutrition in the same Benin population (double burden).

Life conditions such as high socioeconomic situation, living in urban area are positively associated with overweight and obesity. Household poverty, food insecurity, parents’ illiteracy and inadequate feeding practices lead mostly to stunting.

Conclusion
The nutritional double burden is a tangible reality nowadays in Benin. In order to overcome the problem, we suggest firstly to develop nutritional education programmes which promote adequate feeding practices and care for children and women in general and physical activities for households with high socioeconomic status; secondly, to promote women empowerment and education initiatives in order to improve their life conditions and impact children feeding and care. Finally, to struggle rural exodus by promoting local inclusive development and small income generating activities which could enhance agricultural production and allow fathers to support financially their family.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Assessment of Nutritional Status and Growth in School Children of Oran City (Western Algeria)

Introduction and objective. The nutrition transition results in malnutrition that exists in two aspects; undernutrition and overnutrition; facing both the health and development, and define today as the double burden. The objective of this study was to evaluate the nutritional status and growth in schoolchildren of Oran city.

Population and methods. Children (n = 835) (sex ratio G/B = 430/405, 6 to 9 years) were recruited from seven public primary schools in Oran city. Schools were selected by epidemiological method of stratification. Weight and height were measured. The Body Mass Index (BMI) was calculated and classified according to the International Obesity Taskforce (IOTF): Underweight (UW), Normal Weight (NW), Overweight (OW) and Obesity (O). The anthropometric index Weight-for-Age (W/A), Height-for-Age (H/A) and Weight-for-Height (W/H) were calculated by z-score and % of median. Children growth was detected and classified according to WHO (2006, 2007). The nutritional status of mothers and their education level were evaluated.

Results. According to IOTF, 5.5%, 79.2%, 8.6% and 6.7% of children were UW, NW, OW and O, respectively. According to WHO (2006), 0.1%, 1.0%, 2.3% and 8.3% of the population presented significant growth retardation, stunting, very large and large size, respectively. According to WHO (2007), 1.3%, 27.1% and 71.6% were underweight, growth problem risk, and normal weight, respectively. Significant differences were noted between W/H, H/A, W/A when compared to gender (p<0.05). A significant difference of mother nutritional status (18% NW, 78.2% OW, 3.8 O), when compared to WHO classifications (2007) (p<0.05). Moreover, significant difference was observed between children moderate malnutrition (2nd degree), and maternal education level (α = 0.05).

Conclusion. The double burden exists within the same family (mother, child). Stunting promotes obesity (abdominal) development, later in life, thus presenting a risk factor for cardiovascular diseases. Nutritional management is necessary early in childhood.

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**Session Classification:** Poster session 1

**Track Classification:** Epidemiology
Evolution of the double burden of malnutrition during 15 years in the Cuban adult population

Background. Globally, the trend of overweight and obesity continues to rise, which causes significant consequences for the health and the economy of the countries, because this increases the risk of other non-communicable diseases in the adult population, also coexisting with a weight deficit, which is representative in the poorest countries. This problem is promoter of a double burden of malnutrition in low and middle income countries, its reduction depends on different factors including the elimination of poverty, improvement of the quality of food, increasing the physical activity and sustainable food systems, among others. In Cuba, the deficit of weight does not constitute a public health problem, while the excess of weight is in ascending progression.

The purpose was to analyze in Cuba the changes in the prevalence of overweight, obesity and chronic energy deficiency (CED) in a period of 15 years, between 1995 and 2010, defined by the three national surveys of risk factors, carried out as independent epidemiological studies.

Methods. The sample in each study was obtained from a complex, stratified, multi-stage cluster sampling design, based on the households survey system in the Cuban population over 15 years of age. Measurements of weight, height, waist and hip circumferences were made. CED, overweight and obesity were defined and evaluated using Body Mass Index (BMI) and WHO cutoff points (CED < 18.4 kg/m²; overweight 25–29.9 kg/m²; obesity ≥ 30 kg/m²). Regional distribution of adipose tissue was determined by waist-to-hip ratio and risk levels for chronic disease (men: ≥ 1.00; women: ≥ 0.85). For the present analysis, individuals ≥ 20 years were taken who were part of the self-weighted samples obtained in each of the studies, as follows: for the I and II surveys performed in urban areas in the years 1995 and 2001, with national representation, the sample sizes were N=14203 and N=228514, respectively. For the III survey of 2010 with national and urban/rural residence area representation, the number of subjects was N=7928 individuals. Pregnant women were excluded of analyses. Prevalence was estimated, with confidence intervals at 95% of CED, overweight, obesity and central adiposity by sex and age intervals for comparative purposes.

Results. The results point towards an evolutionary increase of overweight and obesity in the Cuban population, in 6% and 5.9% percentage points respectively in 15 years. The obesity was more marked between the years 2001-2010 (Figure 1), with predominance in females and in ages up to 59 years; although the increase in overweight was slight in the last decade, the prevalence of obesity was higher, with a central predisposition, which is an important independent factor that increases comorbidity due to chronic non-communicable diseases. The CED has been reduced in the country, in men the prevalence has dropped to 4.9% and in women it is 6.7%.

Conclusion. The trend in Cuba between 1995 and 2010 has shown a reduction in weight deficiency and a significant increase in excess weight and abdominal adiposity.
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**Session Classification**: Poster session 1

**Track Classification**: Epidemiology
Metabolically unhealthy obesity phenotypes and the Risk of Double Burden of Malnutrition

Background: Whereas deficiency in food intake has contributed to the under-nutrition problem, a lack of dietary diversity also has a demonstrated main role in increasing over-nutrition. Previous study demonstrated that obese people with metabolically unhealthy phenotype are more likely to get chronic disease and nutrient deficiency. So, we design current study to determine the nutritional status in the Healthy/Unhealthy phenotypes of overweight/obese Iranian women.

Methods: This cross-sectional study was conducted on 374 overweight and obese women 18–50 years (BMI≥25). Anthropometric measurements were assessed for all cases. The MH phenotype was defined according to the Karelis criteria. Dietary intake were assess using a valid and reliable, FFQ with 147 items. The body composition was assessed for all cases by BIA. Serum HDL –C, LDL –C, total Chol, TG, FBS, insulin, hs-CRP levels were quantified by ELISA method.

Result: A total subjects including 102 MH (27.27 %) and 272 MUH individuals (72.72%) were included in this study. Percentage of participant MH in categorical of BMI: 25-30 (kg/m²), 30-35 (kg/m²) and >35 (kg/m²) was 77.2%, 20.3% and 2.5%, respiratory. Considering nutritional status and body composition, our result demonstrated that there was statistically significant difference even after control confounder factors, regarding BMI (P <0.0001), WC (P<0.0001), WHR (P<0.0001) and NC (P<0.0001), BF % (P =0.004), body fat mass (BFM) (P <0.0001), FFM (P=0.005), between two groups. In particular, MUH subjects had respectively 1.04, 1.14 and 1.05 fold higher BF % and BFM and FFM in comparison with MH participant. Our results also demonstrated that decrease of FFM are more prevalence in participant with inadequate intake of vitamin B12 and lutein.

Conclusion: Overall, these findings underscore the importance of nutritional status in the alarming prevalence of MUH phenotype in developing countries. Identifying the association between nutritional status and MUH phenotype may open new insight considering double burden of malnutrition mechanism.

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Session Classification : Poster session 1
The Double Burden of Malnutrition in Asia: Prevalences and Body Composition of Children from POCAsia Countries

Introduction: The double burden of malnutrition has been reported in many Asian countries, where prevalence of overweight and obesity is rising rapidly while stunting and underweight remains a significant problem. However, data on body composition of children, especially that measured with stable isotope techniques, is scarce. Hence, this study aimed to report the prevalence of malnutrition and to compare D2O-determined body composition of Asian children from five countries that participated in the Preventing Obesity among Children in Asia (POCAsia) study.

Methods: A total of 828 children aged 7-12 years from China, Indonesia, Malaysia, Thailand, and the Philippines are included in this analysis. Anthropometric measures of body weight, height and waist circumference (WC) were taken and body mass index (BMI) was calculated. Weight-for-age (WAZ), height-for-age (HAZ) and BMI-for-age (BAZ) were determined based on WHO 2007 growth reference for 5-19 years. Total body water (TBW), fat-free-mass (FFM) and body fat (BF) were assessed using stable isotope by applying the deuterium dilution technique.

Results: Mean age, weight, height, WC and BMI of children were 9.18 ± 1.16 years, 29.5 ± 9.3 kg, 131.1 ± 9.5 cm, 58.4 ± 9.7 cm, 16.9 ± 3.6 kg/m², respectively. Mean of body composition measures were 15.8 ± 3.7 kg (TBW), 20.6 ± 4.9 kg (FFM) and 27.2 ± 6.1 % (BF%). Results from this sample indicate that Malaysian children had lower %TBW and %FFM, and higher BF and %BF, compared all other countries (p<0.05). The overall prevalence of underweight, stunting and thinness were 9.1%, 9.7% and 6.5%, respectively. In this sample of children, prevalence of underweight based on WAZ was highest in Filipino (17.5%) and Indonesian (12.7%) children, and lowest among Chinese (2.5%) children; prevalence of stunting based on HAZ was highest among Filipino (20.2%) and Indonesian (19.8%), and lowest among Thai (1.9%) children; while prevalence of overweight and obesity based on BAZ was highest in Thai (29.2%) and Malaysian (27.8%), and lowest in Indonesian (12.4%) children.

Conclusion: The double burden of malnutrition varies across countries. Half of the participating countries (China, Indonesia and Malaysia) are experiencing higher prevalence of overweight and obesity than underweight and stunting. These findings suggest that Asian countries may be experiencing diverse issues related to the double burden of malnutrition and interventions to tackle this problem may differ among countries.

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**Session Classification**: Poster session 1

**Track Classification**: Epidemiology
**Trends and Inequity in the Double Burden of Malnutrition in India between 2006-2016: Insights from Nationally Representative Surveys**

**Introduction:** India is experiencing an emerging burden of overweight/obesity and other diet-related non-communicable diseases (NCD) alongside high burden of undernutrition in the context of multiple forms of inequities within the country. This paper aims to: 1) examine trends in underweight and overweight/obesity between 2006 and 2016; 2) assess the changes in socioeconomic (SES) inequalities in these outcomes by gender and urban/rural residence; 3) identify factors associated with overweight/obesity, hypertension and high blood sugar in 2016; and 4) examine drivers of changes in overweight/obesity over time.

**Methods:** Data were from the 2005-06 National Family Health Survey (NFHS-3) and the 2015-16 NFHS-4 (n~ 767,000 women and 177,000 men). The main outcome measures were 1) underweight (body mass index [BMI in kg/m2] <18.5), 2) overweight/obesity (BMI ≥23 – cut-off based on the high risk for NCDs among Asian population), 3) hypertension (≥140 [systolic] or ≥90 [diastolic] or taking medication or prior diagnosis by physicians), and 4) high blood glucose (fasting plasma glucose ≥ 100 mg/dL or taking medication). Data for hypertension and high blood glucose were available only in 2016. We used t-test to examine changes in underweight, overweight/obesity over time. We constructed SES quintiles (Q) and assessed inequalities in these outcomes using concentration and slope indices. We used logistic regression to examine factors associated with all outcomes, and regression-based decomposition to estimate predicted changes in overweight/obesity over time.

**Results:** Between 2006 and 2016, the prevalence of underweight reduced significantly for women (36 to 23%) and men (34 to 20%), but overweight/obesity increased in both groups (21 to 33% and 20 to 35%, respectively). Hypertension and high blood glucose were slightly higher among men than women in 2016 (17 vs.12% and 15 vs.12%, respectively. On average, 45% women and 49% men had 1 or more of these conditions. Overweight/obesity increased rapidly with SES quintile at almost the same pace in both men and women and in rural and urban areas. Equity gaps between highest and lowest SES quintiles (Q5-Q1) for underweight (19-26%) and overweight (28-32%) were large in both rural and urban areas in 2006; these gaps became narrower for underweight, but were unchanged for overweight in 2016. The equity gap (Q5-Q1) was small for hypertension (2-3% in women and 5-9% in men), and almost unobservable for high blood glucose. Compared to adults in Q1, those in Q5 were 2.6 times more likely to be overweight/obese and 1.2 times higher hypertension. Being overweight/obese was associated with higher odds of hypertension (OR:2.16; 95% CI: 2.03-2.30) and high blood glucose (OR:1.43; 95% CI: 1.36-1.51). Improvement in SES explained 30% of the changes in overweight/obesity in the last decade.

**Conclusions:** The growing double burden of malnutrition across the SES strata and in both rural and urban areas in India is alarming. Due to its high population, the country will soon have staggering numbers of people and households experiencing the dual burden. It is therefore imperative for India to develop a strong nutrition strategy that simultaneously addresses multiple forms of malnutrition and socioeconomic inequalities.

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**Session Classification:** Poster session 1

**Track Classification:** Epidemiology
Dual Burden of Malnutrition Among Adolescents of Smallholder Coffee Farming Households of Jimma Zone, Southwest Ethiopia

Background: Substantial evidence is emerging on the coexistence of double burden of malnutrition on adolescents of low-income countries, shaping the health challenges of the upcoming adult generation for the worst. Whether nutritional status markers of adolescents in the cash crop setting are on par with economic gains remains uncertain. Thus, we investigated the nutritional outcomes of adolescents and their determinants in coffee farming households.

Methods: The survey was carried out in 3 top coffee-producing districts of Jimma Zone, Ethiopia. Five hundred fifty mothers/caregivers and their respective adolescents were selected using multistage random sampling. Anthropometric data were converted into height-for-age and body-mass-index-for-age Z scores using WHO Anthroplus software and analyzed by SPSS for windows.

Results: Prevalence of thinness, stunting, and overweight/obesity were 11.6%, 15.6%, and 7.1%, respectively. The odds of stunting among adolescents in households in the lowest wealth tertile was nearly 6-fold higher compared to the highest tertile (adjusted odds ratio [AOR] = 5.6 [2.6-12]). Conversely, the odds of overweight/obesity was higher among adolescents in the households in the middle wealth tertile (AOR = 2.72 [1.08-6.86]) compared to the highest tertile. Adolescents living in households with low-dependent age-groups were more than twice likely to be overweight/obese (AOR = 2.58 [1.06-6.24]).

Conclusion: The current study revealed the presence of substantial dual burden of malnutrition. In such a setting, it is critical to draw a fine line and trade-off for eliminating morbidity and mortality of undernutrition, without triggering the risk of overweight/obesity.

Keywords adolescents, cash cropping, nutritional status, dual burden

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Session Classification : Poster session 1
Double burden of malnutrition in Cuban preschool children. Obesity, anemia and iron deficiency

Introduction: Obesity is a cause invoked in iron deficiency and anemia in population; inflammation is one of the aspects related with both malnutrition forms. Non study were carried-out in Cuba exploring that aspects and preschool children is a mean risk groups of iron deficiency and anemia.

Objective: To assess nutritional status, iron deficiency, anemia and inflammation in Cuban preschool children

Materials and Methods: 1226 children of 3 Cuban Regions (Western, Central and Easter) 2015-2017. Weight, Height and Skinfolds were measure to calculate Weight/Height and adiposity and were evaluated by WHO standard. Anemia prevalence was evaluated by Hemoglobin quantification (ABX Micros 60), iron store depletion by ferritin, inflammation by C-reactive protein (CRP) and alfa-1 acid glycoprotein (AGP) by Immunoturbidimetric method. Soluble transferrin receptor (sTfR as iron tissue depletion) by ELISA.

Results:
Undernutrition was 1,1%, overweight 5,8% and obesity 2,2% (global overweight 8%). Adiposity by Tricipital skinfold +2DS was 5,5% and +3DS 1,4%; by Subscapular skinfold was slightly higher (+2DS was 7,3% and +3DS 1,6%). Anemia was 22,3% (17,6-27,1), no several cases were found. Iron store depletion adjusted by Thurnham factor was 34,4% (25,1-41,7), iron tissue depletion was 13,2% (5,0-21,5). Inflammation evaluated was high by CRP (>5mg/L) 12,3% (9,8-14,8) and by AGP (>1g/L) 34,3% (27,9-40,6). Overweight plus obesity was not a significative protector factor for anemia (OR=0,442 CI95%=0,173-1,128) and iron store depletion (OR=0,514 CI95%=0,229-1,154). No association was found between inflammation and overweight and obesity. Anemia was associated with iron store depletion (stratified by group of up to 2 year and 2-4 years old) ORMH=2,09 CI95%=1,49-2,93, iron tissue depletion ORMH=2,78 CI95%=1,81-4,28 and inflammation ORMH=1,61 CI95%=1,16-2,24.

Conclusions:
Undernutrition is not a public health problem. Overweight and obesity are not associated with anemia. Anemia was associated with iron deficiency and inflammation.

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**Session Classification:** Poster session 1

**Track Classification:** Epidemiology
Burden of Malnutrition in Clients Enrolled in ART and TB Services in Swaziland

INTRODUCTION:
Swaziland has the world’s highest estimated HIV prevalence (26%) and TB incidence rate of 1,287 per 100,000 population with an 79% TB/HIV co-infection rate. Malnutrition in its different forms currently coexist in Swaziland as in many countries. However, literature on the burden of malnutrition among people living with HIV/AIDS (PLHIV) and on TB treatment in Swaziland is limited and not well documented. An assessment was conducted to determine the levels of malnutrition among adult (≥15 years) PLHIV enrolled for ART and TB treatment.

METHODS:
A cross-sectional, retrospective assessment was carried out. Data was randomly extracted from 3,521 PLHIV and 1,046 TB client records in 33 health facilities’ using a standardized data collection tools. Analysis was done using SPSS version 19. The confidentiality of collected data was assured at all times. The main limitation was incomplete data from clients’ health facility record. Malnutrition was determined using body mass index (BMI) calculations and classified as underweight (< 18.5 kg/m²) and overweight or obese (> 25 kg/m²).

RESULT:
The results, upon eliminating missing data and co-infected patients, represent 397 PLHIV and 267 TB clients’ records. Median age for PLHIV was 33 years (min;max 15;79) comparable to 34 years (min;max 15;90) for TB patients. Mean BMI for both PLHIV (25.3±5.2 kg/m²) and TB patients (22.3±4.5 kg/m²) compared to (24.4 kg/m²) as established by the 2007 Swaziland demographic and health survey (DHS). In both PLHIV and TB patients, females had significantly higher mean BMI than males (P <0.005).

PLHIV: Overweight/obesity (46.4%) was 10 times higher than underweight (4.6%). More females were overweight/obese than males with the inverse observed in underweight. Underweight was slightly lower than DHS while overweight/obesity was higher.

TB patients: Overweight/obesity (23%) was slightly higher than underweight (18%). More females were overweight/obesity than males, but the inverse applied in underweight. Underweight was 3 times higher than DHS while underweight was lower.

CONCLUSION:
There is a growing presence of a double burden of malnutrition in PLHIV and TB patients. Underweight has been in existence since the discovery of HIV previously referred to as "slim disease". However, the emerging overweight and obesity, and associated non-communicable diseases further complicates the management of PLHIV and TB patients hence an important target for intervention. An integrated approach for tackling malnutrition in all its forms is necessary.

KEY WORD: BMI, underweight overweight and obesity

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Session Classification : Poster session 1

Track Classification : Epidemiology
Double burden of malnutrition among female adolescents in Greater Tunis area and its associated factors

Background:
As with many countries undergoing rapid economic growth, Tunisia is facing the “double burden of malnutrition”, defined as the coexistence of both under-nutrition and over-nutrition within individuals, households and populations, and across the life-course. Most studies focus on high prevalence of underweight or stunting and overweight in the same population, or on households with both obese and stunted or underweight individuals. Individuals may experience a dual burden of malnutrition, with overweight and obesity coupled with micronutrient deficiencies. Although initially documented in adults, this emerging disaster has been also observed in children and adolescents.

Objective:
The objective of this study is to assess the prevalence of double burden of malnutrition (overweight and anaemia) among Tunisian female adolescents and to understand the role of sociodemographic factor, dietary intake and physical activity in this regard.

Methods:
In cross-sectional surveys representative of the region of Greater Tunis area, we randomly selected 1258 adolescents aged 10-19 years including 585 male and 673 female participants. We assessed the magnitude of the double burden of malnutrition among Tunisian female adolescents, as defined by the coexistence of overweight and anaemia. The BMI status was determined in accordance with the sex- and age-specific percentiles of the national reference standards. BMI status was defined as follows: underweight (BMI<5th percentile), normal (BMI≥5th percentile, and <85th percentile), overweight (BMI≥85th percentile and <95th percentile), and obese (BMI≥95th percentile). Female adolescents younger than 12 years who had an Hb concentration <11.5 g/dL and those older than 12 years who had an Hb concentration <12 g/dL were considered as anaemic. The association between anaemia and overweight, and socio-demographic and lifestyle factors were estimated by multinomial regression.

Results:
The prevalence of overweight and anaemia was 23.3% and 17.7 % respectively, illustrating the double burden of malnutrition among female adolescents. The coexistence of overweight and anaemia was found in 3.7% of female adolescents. Generally, associated sociodemographic factor, dietary intake and physical activity differed from those usually associated with overweight or anaemia. The double burden of malnutrition “anaemia and overweight” was associated with energy intake and sedentary lifestyle.

Conclusion:
The significant prevalence of the double burden “anaemia and overweight” among Tunisian female adolescents requires special attention, e.g. through interventions, which simultaneously target both types of malnutrition within the same subject.

Keywords:
Overweight, Anaemia, Double burden of malnutrition, female adolescents, Greater Tunis Area

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Session Classification : Poster session 1

Track Classification : Epidemiology
The dietary patterns and double burden of malnutrition in Mexican adolescents: Results from the National Survey of Health and Nutrition (ENSANUT-2006).

Introduction: Mexico faces the double burden of malnutrition, characterized by the coexistence of micronutrient deficiencies and non-communicable diseases, and adolescents are not an exception. Adolescents’ eating behaviour may be influenced by sociodemographic characteristics such as socioeconomic level, education level, ethnicity and gender. The dietary habits established during adolescence tend to persist during adulthood. Furthermore, dietary patterns adopted during this stage may contribute to health outcomes later in life. Therefore, the primary aim of this study was to describe dietary patterns of Mexican adolescents in 2006 using Principal Component Analysis (PCA), and to examine the association between the identified dietary patterns and adolescents’ nutritional status.

Methods: A sample of 7,670 Mexican adolescents aged 12-19 years old from the National Survey of Health and Nutrition (ENSANUT-2006) was analysed. The data comprises dietary, anthropometric, and hemoglobin information. Dietary intake was assessed by a 7-day Food Frequency Questionnaire (7d-FFQ), and the dietary patterns were derived by PCA. The association between dietary patterns and overweight-obesity and anemia was determined by Prevalence Ratio (PR). All the associations were adjusted for sociodemographic characteristics and for energy.

Results: We identified six dietary patterns which explained 36.6% of the total variance: 1) processed food; 2) fruit and vegetables; 3) milk and breakfast cereals; 4) soup, meat and cereals; 5) snacks; and 6) legumes and eggs. High consumption of the "processed food" pattern was positively associated to overweight-obesity (PR 1.09, 95%IC 1.06, 1.13) and to anemia (RP 1.16, 95%IC 1.06, 1.27). Adolescents who scored high for the patterns "milk and breakfast cereals" (RP 0.88, 95% IC 0.81, 0.96), and "fruit and vegetables" (RP 0.88, 95% IC 0.81, 0.96) were at lower risk of anemia compared to those who scored low for these patterns. Overweight-obesity was inversely associated with the high consumption of the pattern "snacks" (RP 0.95, 95%IC 0.92-0.98). This association was diluted after conducting a sensitivity analysis for underreporting.

Conclusion: Our results infer that the consumption of processed food pattern, which is characterized by high content of fat and low content of fiber and micronutrients, seems to be positively associated to the two faces of the double burden of malnutrition. In addition, the consumption of dietary patterns that contain food rich in micronutrients (fruit and vegetables), and micronutrient-fortified food (breakfast cereals) may reduce the risk of anemia. The sensitivity analysis suggested that underreporting may explain the inverse association between the pattern snacks and the prevalence of overweight-obesity. Further longitudinal research are needed to understand the influence of diet on nutritional status.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Double Burden of Malnutrition among Mother-Child Pairs of Bangladesh: Prevalence and Socio-demographic Determinants

Introduction: In Bangladesh, the persistence of childhood undernutrition is accompanied by an increasing prevalence of overweight and obesity among reproductive age women. But to our knowledge, no analysis was done to explore its coexistence at household level. Considering the context, we measured the nationwide prevalence and identified socio-demographic determinants of household level mother-child double burden (MCDB) of malnutrition in Bangladesh.

Methods: The analysis was done using Bangladesh Demographic and Health Survey (BDHS) 2014 data and a total of 5951 households where a mother had at least one under five children were included. Multivariable logistic regression was performed to identify the socio-demographic determinants of MCDB of malnutrition. We reported odds ratio (OR) with 95% confidence interval (CI) and considered p-value <0.05 as significant.

Results: Overall 6.4% households demonstrated a coexistence of overweight or obese mother and underweight or stunted or wasted child (OWOBM/USWC). The prevalence of overweight or obese mother and underweight child (OWOBM/UWC) was 3.8%, overweight or obese mother and stunted child (OWOBM/STC) was 4.7% and overweight or obese mother and wasted (OWOBM/WSC) child was 1.7%. For OWOBM/USWC pairs, households with mother’s age 21-25 years at first birth [OR: 1.8 (95% CI: 1.1-3.2), p<0.05], the middle wealth index group [OR: 1.7 (95% CI: 1.0-2.8), p<0.05], no exposure to information media [OR: 1.5 (95% CI: 1.1-2.2), p<0.05], having two to three children [OR: 2.04 (95% CI: 1.34-2.9), p<0.05] and four or more children [OR: 3.3 (95% CI: 2.1-5.20), p<0.05] were associated with higher odds of MCBD of malnutrition. The presence of OWOBM/UWC showed statistically significant positive association with mother’s age 21-25 at first birth [OR: 1.9, 95% CI: 1.01-3.5], middle wealth index group [OR: 2.2, 95% CI: 1.2-4.2], having two to three children [OR: 2.18, 95% CI: 1.1-3.2] and four or more children [OR: 2.9, 95% CI: 1.7-5.0]. The statistically significant determinants of OWOBM/STC also include mother’s age being 21-25 years at first birth [OR: 1.9 (95% CI: 1.02-3.5), p<0.05], middle wealth index group [OR: 2.3 (95% CI: 1.2-4.2), p<0.05], no exposure to information media [OR: 1.8 (95% CI: 1.1-2.9), p<0.05], having two to three children [OR: 1.8 (95% CI: 1.1-3.2), p<0.05] and four or more children [OR: 2.9 (95% CI: 1.7-5.0), p<0.05].

Conclusion: Malnutrition prevention programs must not ignore the nutrition concerns of the whole household. Such programs need to be tagged with family planning and increasing awareness through social and behavior change counseling and exposure to information media.
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Session Classification: Poster session 1

Track Classification: Epidemiology
Double burden of malnutrition among child-mother pairs: magnitude, and associated factors of co-occurrence of child anemia and mother abdominal adiposity in an urban area in North Africa

Introduction. In the Middle East and North Africa (MENA) region, the nutrition transition has resulted in drastic increases in excess adiposity, particularly among women. Most of the studies are based on overall adiposity only, even though abdominal adiposity may be specifically predictive of adverse health outcomes. At the same time, malnutritions, partly linked to micronutrient deficiencies like anemia remains a public health problem especially among pre-school children. In this study, we assessed the magnitude of double burden of malnutrition among child-mothers pairs, as defined by the co-existence of anemic child with abdominal obesity in mother, and explored the associated lifestyle and sociodemographic factors.

Methods. A cross-sectional survey was carried out in the Greater Tunis (Tunisia) in 2009/2010 using a stratified two stage random cluster sampling of households with 20-49 y. women. Our analyses used the subsample of 437 child-mother pairs (children 6-59 months, living with their mothers). For children, anemia was defined by Hb < 110 g/l. For mothers, abdominal adiposity was assessed by waist circumference (WC), with WC ≥ 88 cm defining high risk abdominal obesity according to World Health Organization. Relative prevalence ratios (RPR) were used to assess associations between the double burden of malnutrition in 4 categories, and lifestyle and sociodemographic factors, using multinomial logistic regression models. Also, this modeling framework enabled to assess if the coexistence of these two types of malnutrition among child-mother pairs is synergetic, antagonistic or independent by deriving estimates of the ratios of the probability of the double burden over the product of the probabilities of each type of malnutrition (either overall or by categories of lifestyle or sociodemographic factors). All analyses (first type error rate=0.05) took into account sampling design.

Results. More than half of the mothers suffered from abdominal obesity (51.3% [45.4-57.2]) and third of the children were anemic (32.8% [28.3-37.7]). The coexistence of anemic child and central obesity in mother affected 16.8% [12.7, 21.8]. The co-occurrence of these two types of malnutrition among child-mother pairs was independent without specific synergetic or antagonistic association (P=0.80). Adjusted associations with sociodemographic factors showed that this double burden of anemic child-abdominal obesity mother was more frequent among pairs with younger children, and showed a strong decreasing gradient with child age (P=0.0001). Also, mother’s energy intake was associated to the double burden (P=0.0092).

Conclusion. Our finding highlighted a significant prevalence of the paradoxical co-occurrence of two different types of malnutrition among child-mother pairs. Our data did not demonstrate a higher risk of child anemia when the mother suffered from abdominal adiposity, nor vice versa. But prevention programs should nevertheless simultaneously address anemia in children together with abdominal adiposity among mothers.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Gender inequalities in coexistence of excess adiposity and iron deficiency at individual level and their socioeconomic patterning in a nutrition transition context in North Africa

Introduction: In the context of nutrition transition, the Middle East and North Africa region has experienced a dramatic rise in overweight and obesity, especially among women. At the same time, micronutrient deficiencies, like iron deficiency which women are also especially prone, persist. Thus, gender is considered as a major determinant of health inequalities. The aim of this study was then to assess gender inequality vis-à-vis this double burden of excess adiposity and iron deficiency. Sociodemographic patterning of these gender inequalities were also explored.

Methods: A cross-sectional study was carried out in the Greater Tunis region including the Tunisian capital city in 2009-2010. We analysed the sub-sample of 20-49 years old adults of both genders (women n=1689, men n=930) from a stratified, two-stage cluster sample of households. Overweight was defined by body mass index ≥ 25 kg/m² and obesity ≥ 30 kg/m² as recommended by World Health Organisation. Iron status was assessed using serum ferritin concentrations. Iron deficiency (ID) in adults was defined by C-reactive protein and orosomucoid corrected serum ferritin <15 µg/L. The gender inequalities measures were women vs. men Relative Prevalence Ratios (RPR), assessed by multinomial logistic models, using the double burden of malnutrition in four categories as response variable. Their variation with sociodemographic characteristics were estimated by models featuring gender x covariate interactions. The type I error risk was set at 0.05 and 0.20 for interactions.

Results: Gender inequality in excess adiposity was high (e.g. overweight: women 64.9% v. men 48.4%; RPR=2.0; 95% CI 1.5, 2.5) and even much higher for ID (women 27.4% v. men 10.1%; RPR=3.3; 95% CI 2.2, 5.1). The double burden of overweight and iron deficiency affected 17.2% of women v. 3.7% of men (RPR=8.6; 95% CI 5.3, 14.0). Gender inequalities in overweight adjusted for covariates, increased with age (p=0.0007) e.g. RPR=1.2 (95% CI 0.7, 2.0) for 20-29 years v. 2.7 (95% CI 1.7, 4.0) for 30-39 years v. 4.2 (95% CI 2.8, 6.5) for 40-49 years old but decreased with professional activity (p=0.0061). Adjusted women v. men inequality for ID were higher in rural area v. urban area (p=0.0102). We found that double burden of overweight and iron deficiency adjusted of all socioeconomic covariates was uniformly distributed.

Conclusion:
In this context of nutrition transition, we found a large gender gap, detrimental to women, for this double burden of overweight and ID. This situation poses a new and serious public health challenge. In this respect, interventions should aim at, on the one hand, prevention of individual double burden with the difficulty of simultaneously addressing excess adiposity and iron deficiency. On the other hand women should be positively discriminated in terms of their specific needs.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Epidemiology of the double burden of malnutrition in Niger: longitudinal analysis of mother and child nutritional status from 1992-2012

Introduction
Global reviews conducted on double burden of malnutrition (DBM) showed increasing prevalence of overweight and obesity among adolescents and adults in Asia and northern Africa. Niger is often spotlighted for its higher prevalence of acute and chronic malnutrition of children under 5 but less is known on pattern of DBM.

Main objective of this study is to determine current status and evolution of DBM in Niger at mother–child dyad level within the context of multisector nutrition programming targeting mainly reduction of chronic malnutrition.

Materials and Methods
Anthropometric data of 21900 mother and children under 5 from 4 DHS rounds (1992, 1998, 2006 and 2012) were analysed.

DBM is defined at the mother and child pair as the concurrence of child stunting (height for age z score < -2 SD) and mother overweight/obesity (BMI > 25 kg/m²) and stunting/overweight as combination of child of HAZ < -2 SD (stunting) and WHZ > 2 SD (overweight/obesity).

Results
In children under 5, the prevalence of chronic malnutrition was stable over the 20 year period, half of them, 44.6% (43.8-45.3) are stunted while 3% (2.6-3.1) of them were overweight/obese. No sex difference found between boys 3.11 (2.7-3.4) and girls 2.6 (2.2-2.9). Prevalence doubled over the twenty year; 1.91% (1.6-2.2) in 1992-1998 compared to 3.8% (3.4-4.2) in 2006-2012. Stunting/overweight mean prevalence was 0.7% (0.6-0.8) in under 5 children.

DBM increased with mother education 5.7% (4.7-6.6) with primary school level compared to 3.4% (3.2-3.7) without schooling.

DBM was higher significantly in urban setting 7.0 (6.3-7.6) vs 2.6 (2.3-2.8) in rural areas, higher in the 3 main cities; Niamey 9.3% (9.1-9.4); Zinder 4.7 (3.8-5.7) and Maradi 4.0% (3.2-4.7). DBM higher with wealth quintile; 7.7% (7-8.5) in the richest, 3.5% (2.7-4.4) in the medium and 3.1% (2.5-3.7) in the lowest wealth quintile. The prevalence increased in household with accessed to clean water, prevalence of DBM were 3 times higher in HH with access to potable water 7% (6.4-7.7) than HH without access 2.5% (2.3-2.8) and within HH with toilet facility 6.9% (6.2-7.3) than HH without 2.7% (2.5-3).

Conclusion
From 1992 to 2012, the double burden of Malnutrition doubled owing mostly to increase in mother overweight/obesity despite stagnation of child stunting at HH level, DBM increased despite relative decrease of child stunting in well living families. Current Multisector Nutrition policy prioritizing more on reduction of child stunting need to be revised to account new pattern of mother and child malnutrition.

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**Session Classification**: Poster session 1

**Track Classification**: Epidemiology
Double burden of obesity and malnutrition in Montenegro – current status and challenges

Childhood obesity is an emerging public health problem that requires effective prevention and treatment programs. The national prevalence of child overweight/obesity in Montenegro has increased by one third in the last decade. Several studies including anthropometric measurements has been performed during the last decade.

Montenegro joined COSI (Childhood Obesity Surveillance Initiative) program in 2016. In this research 3443 children were measured. The obtained results on obesity prevalence show that every fifth boy and every tenth girl are obese, while the prevalence rate of overweight was almost the same in boys and girls. Comparing with WHO charts for boys and girls, 14 children (9 boys, 5 girls) had body weight lower than 3rd percentile which suggests that they were malnourished.

Last round of Multiple Indicator Cluster Survey (MICS) in Montenegro was conducted in 2013. Percentage of children under age 5 who are above two standard deviations of the median weight for height of the WHO standard was 22.3%. Underweight prevalence - moderate and severe included 1%, while severe underweight prevalence included 0.1% of children. Stunting prevalence moderate and severe together included 9.4%, while severe stunting prevalence alone included 5.6% of children. Wasting prevalence moderate and severe included 2.8%, while severe wasting prevalence alone included 1.2% of children.

Living Standards Measurement Survey, LSMS, type - National Health Survey of the population of Montenegro was conducted in 2008. This research include anthropometric measurements of weight and height of respondents, and the results were compared with respect to the CDC (Centers for Disease Control and Prevention in the United States) standards. Results of this study showed that 3.8% of children and adolescents aged 7-19 years in Montenegro were underweight, while a total of 21.2% were overweight and obese. The same survey showed that according to the body mass index (BMI) more than half of respondents older than 20 years, was overweight 40% and obese 15.1%, while 2.1% were underweight in relation to the WHO standards.

Nowadays, using stable isotope labeled water it is possible to accurately determine the amount of fat/fat free mass in the total body mass and thereby reliably determine the total energy consumption of the organism which is valuable research method to increase knowledge of metabolic disturbances in malnutrition and to evaluate the effects of interventions. Despite the many advantages, methods using stable isotopes were not represented so far in Montenegro, even though they have been in use for more than thirty years in different parts of the world. Institute of Public Health with support of IAEA and partner institutions in coming period is planning to use advantages of stable isotope techniques in population research in order to obtain necessary data to improve public health interventions and consequently reduce morbidity and mortality from the double burden of obesity and malnutrition in the population.

Key words: childhood obesity, COSI, LSMS, MICS, stable isotopes

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Session Classification: Poster session 1

Track Classification: Epidemiology
Poverty and female gender the common traits of the double burden of undernutrition and cardio-metabolic risk factors among adults of Ouagadougou, Burkina Faso (West Africa).

Introduction: Low-income countries, particularly urban areas, are experiencing the double burden of malnutrition and cardio-metabolic risk factors (CMRF). This study was carried out in order to document it among the adults and according sociodemographic parameters.

Method: A population-based cross-sectional observational study was carried out. We first randomly selected 330 households stratified by tertile of the income levels proxy in low, middle and high group at the northern district of Ouagadougou, the capital city of Burkina Faso. In each income stratum, 110 individuals aged 25-60y and who had lived permanently in Ouagadougou for at least six months were randomly selected, followed with collection of anthropometric, socioeconomic and clinical data, and blood samples.

Results: The overall obesity/overweight prevalence was 24.2% and it was twice as high in women as in men (34.1% vs. 15.5% p<0.001). Hypertension, hyperglycaemia and low HDL prevalence were 21.9%, 22.3% and 30.0%, respectively, without gender difference. The prevalence of the metabolic syndrome (MetS) was 10.3%. Iron depletion and vitamin A deficiency affected 15.7% and 25.7%, of subjects respectively with higher rates in women. Coexistence of at least one nutritional deficiency and one CMRF was observed in 23.5% of subjects, and "this double burden" was significantly higher in women than in men (30.4% vs. 16.1%; p=0.008), and in the lower income group.

Conclusion: CMRF are becoming a leading nutritional problem in adults of Ouagadougou, while nutritional deficiencies persist. The double nutritional burden exacerbates health inequities and calls for action addressing both malnutrition and nutrition-related chronic diseases.

Keywords: Nutritional deficiencies, non-communicable disease, double burden of malnutrition, adults, Burkina Faso

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Session Classification: Poster session 1
Dietary patterns and physical inactivity, two contributing factors to the double burden of malnutrition among adults in Burkina Faso (West Africa)

Introduction: A population-based cross-sectional study was carried out in the northern neighbourhoods of Ouagadougou (Burkina Faso), to examine the relationship of nutritional deficiencies and cardio-metabolic risk factors (CMRF) with lifestyle in adults. Method: We randomly selected 330 households stratified by income tertile. In each income stratum, 110 individuals aged 25-60 years and having lived in Ouagadougou for at least 6 months were randomly selected. We performed anthropometric, dietary intake and physical activity measurements, and blood sample collection. Results: Cluster analysis of dietary intake identified two dietary patterns, ‘urban’ (29% of subjects) and ‘traditional’ (71%). The ‘urban’ cluster exhibited a higher intake of fat and sugar, whereas a higher intake of plant protein, complex carbohydrate and fibre was observed in the ‘traditional’ pattern. Female gender, low income and lack of education were associated with the ‘traditional’ cluster, as well as iron and vitamin A deficiency. CMRF prevalence (abdominal obesity, hypertension, hyper-glycaemia, dyslipidaemia) was similar in both clusters. Subjects in the ‘traditional’ cluster spent more time in physical activity and had less sedentary time than those in the ‘urban’ cluster. ‘Traditional’ dietary pattern, low income, female gender and sedentary time were significant contributing factors to the double burden of malnutrition. Conclusion: The rapid nutrition transition is reflected in this co-occurrence of CMRF and nutritional deficiencies. This stresses the need for prevention strategies addressing both ends of the nutrition spectrum.

Keywords: Dietary patterns, physical activity, micronutrient deficiencies, cardio-metabolic risk factors, double burden of malnutrition, adults, Burkina Faso, West Africa

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Session Classification: Poster session 1

Track Classification: Epidemiology
A secondary data analysis of food security indicators in households affected by a double burden of malnutrition in Saharawi refugee camps in southwest Algeria

Introduction

Stunting and obesity are known to coexist within the household in a variety of contexts. Stunting in childhood is associated with overweight and nutrition-related non-communicable diseases in adulthood. Furthermore, the simultaneous presence of seemingly opposite malnutrition types makes it difficult to programme comprehensive nutrition interventions in resource poor settings. This difficulty is often greater in humanitarian contexts. The study aimed to assess whether household food security indicators are different in households affected by this double burden of malnutrition compared to unaffected households among Saharawi people living in refugee camps in the southwest of Algeria.

Methods

We performed a secondary data analysis of a cross-sectional stratified cluster nutrition survey, implemented in four Saharawi refugee camps in 2010. The survey collected data from 2,040 households that included 1,759 children and 2,734 women. Of these, 651 households that had data on at least one child and one woman were included in this analysis. Households were classified as Double burden, Stunted only, Overweight only, and Normal, according to the presence of stunted children and women with abdominal obesity.

We estimated an age-specific Infant and Child Feeding Index (ICFI) to assess dietary adequacy in children aged 6-59 months. Household food security and diversity was defined by the Food Consumption Score (FCS) and the average number of food groups consumed in a week, respectively. Age, women’s height and number of children per household were also analysed.

Results

We observed that 48.9%, 25.6%, 9.8%, and 15.7% of households were classified as overweight only, double burden, stunted only and normal, respectively. Table 1 summarises the differences found in FCS and ICFI categories across households. We did not find differences in FCS nor in the average number of food groups consumed among the different types of households. A higher proportion of households whose children presented a poor ICFI was found in households defined as stunted. In double burden households, women’s age, children’s age and the number of children were greater than in other categories.

Conclusions

Indicators of food security and dietary diversity are not different between households affected by different types of malnutrition. Our findings suggest there is limited value in using food security indicators alone to guide nutritional interventions in humanitarian contexts where the double
burden of malnutrition is highly prevalent. A more comprehensive approach to understand the dynamics of food security and dietary adequacy need to be explored to develop nutritional strategies in humanitarian contexts where different types of malnutrition coexist.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Tale of two extreme worlds – the big and the small

Pacific Island and Indian peoples represent extremes of obesity prevalence but both ethnic groups have a high prevalence of type 2 diabetes mellitus (T2DM) and related traits. For the same BMI they have substantially different fat and fat free masses. We compared the body size, biochemistry and blood pressure variables of Pacific and Indian adolescent boys and girls.

Despite their younger age, Pacific boys and girls were considerably heavier, taller and adipose, and had higher blood pressure and lipid levels. Forty percent of Pacific Island children were obese while more than 40% of Indians were underweight. Measured with whole body dual X-ray absorptiometry Pacific Island adolescents had a substantially higher proportion of body fat and higher bone mineral density than Indian. Despite these differences, Indians had higher glycaemia. Comparison of birth weights suggests that foetal nutrition and growth patterns could have programmed these populations differently for later cardio-metabolic risk. Lifecourse comparisons of populations with extreme ecological and ethnic characteristics is likely to improve our understanding of factors affecting cardiometabolic risk at either end of nutritional exposures.

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Session Classification : Poster session 1

Track Classification : Epidemiology
The rapid change in the double burden of malnutrition in a protracted refugee context: Comparison of two cross-sectional nutrition surveys of Saharawi refugees living in camps in Algeria

Introduction

Vulnerable households experiencing epidemiological transitions are often concomitantly affected by under-nutrition and overweight. This double burden was shown to affect refugee populations. Yet, it is unknown how rapidly this double burden can change in a humanitarian context. This study aimed to assess the change in the double burden of malnutrition among Saharawi refugees living in a protracted emergency.

Methods

Two stratified, cluster nutrition surveys were implemented between Oct-Nov in 2010 and 2016 in the Saharawi refugee camps, located near Tindouf, southwest Algeria. The 2010 survey had four strata, but given population growth and movement, the 2016 survey had five strata. We surveyed 2,041 households in 2010 and 2,100 in 2016.

For children aged 6-59 months we obtained weight, length/height, and oedema data. Anthropometric data were transformed to anthropometric indicators weight-for-length/height (WHZ), weight-for-age (WAZ) and height-for-age (HAZ) z-scores using the 2006 WHO growth standards. We defined acute malnutrition as WHZ<-2 and/or oedema, stunting as HAZ<-2, underweight as WAZ<-2, and overweight as WHZ>2.

For women of childbearing age (15-49 years), who reported not been pregnant or lactating children aged <6 months, we obtained weight and height data. We calculated body mass index (BMI). We estimated HAZ using the 2007 WHO growth references assuming a maximum age of 19 years. We defined stunting as HAZ<-2, underweight as BMI<18.5, and overweight as BMI≥25.

To quantify the proportion of households with a double burden of malnutrition, we selected households that have at least two members surveyed. Households were classified as (1) undernourished if they contained under-nutrition cases in women (stunting or underweight) or children (acute malnutrition, stunting, underweight); (2) overweight if they contained overweight cases in women or children; and (3) double burden if they contained both cases.

Results

The table shows the individual and household prevalences of different nutrition indicators. The main change observed between 2010 and 2016 was that in children all under-nutrition indicators decreased significantly except overweight; in women, under-nutrition indicators decreased significantly, whilst overweight increased significantly.

For households, the prevalence of households with members suffering under-nutrition decreased significantly whilst households with overweight members increased significantly. Overall, the proportion of households suffering the double burden of malnutrition increased significantly. In 2010, 49.4% of households with an undernourished member had also an overweight member. In 2016, this proportion has increased to 78.5%. Conversely, in 2010 and 2016, 45.0% and 42.5% of households with an overweight member had also an undernourished member.
Conclusions

The Saharawi refugee camps have experienced a significant change in their nutrition profile in six years, and now most households are affected by overweight, almost half are still affected by under-nutrition and one third experience a double burden. Our results highlight how rapidly an overweight prevalence can increase in a protracted refugee context. Research is needed to understand the drivers behind these changes to enact adequate interventions.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Associated factors to the double burden of malnutrition in mother-child dyads in the Republic of the Marshall Islands

A double burden of malnutrition is evident in Pacific Islands nations, where the prevalence of child stunting remains a serious public health concern and the regional prevalence of overweight adults is among the highest in the world. A recent national Integrated Child Health and Nutrition Survey (ICHNS 2017) conducted in the Republic of the Marshall Islands (RMI) confirmed that the double burden of malnutrition was common with one in four households with a child under 5 years having both a stunted child and an overweight or obese mother. In our analysis, we examined key influencing factors of the double burden of malnutrition through the mother-child dyad in households.

Anthropometric measures were collected in 634 mother-child dyads in a nationally representative sample. Children (0-59 months) were identified as stunted based on a height for age <-2 below the WHO reference median and maternal overweight/obesity was defined as a BMI ≥ 25. Relative Risk Ratios (RRR) from mother-child pairs with a stunted child and an overweight mother, or households with a maternal-child double burden (MCDB), were compared to both non-stunted child-overweight mother pairs and non-stunted child-healthy mother pairs.

The national prevalence of mother-child double burden dyad was 25% with 36.5% of children stunted and 70.9% of mothers either overweight or obese. The results of multinomial logistic regression analysis are presented in Table 1. Compared to households with a healthy child and an overweight mother, MCDB households were poorer and had more household members with highest risk associated in the poorest (RRR 3.96, 95% CI 1.51-10.43) and second poorest households (RRR 3.52, 95% CI 1.64-7.55). The maternal characteristics of being never being married (RRR 2.02; 95% CI 1.33-3.06) and short stature less than 150cm (RRR 5.82; 95% CI 2.14-15.83) and 150-159cm (RRR 3.28; 95% CI 1.24-8.64) were associated with increased risk of MCDB. Age of the child and gender were both associated with high risk of MCDB with children older than 12 months and boys at highest risk. In comparison to non-stunted child-healthy mother pairs, increased risk of MCDB was associated with the poorest households (6.29; 95% CI 1.61-24.57), older mothers (1.18; 95% CI 1.13-1.24), mothers with short stature (3.45; 95% CI 1.01-11.74), and children older than 12 months.

Our findings indicate that the double burden of malnutrition is a national public health concern in RMI with poorer and vulnerable households at highest risk. In RMI, both stunting and overweight may be rooted in the early undernutrition of children with early disadvantage impacting health and well-being throughout the life course. To address the conditions leading to the double burden of malnutrition, categorical unconditional cash transfers to pregnant women and young children during the first 1,000 days will be implemented in RMI.

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Session Classification : Poster session 1

Track Classification : Epidemiology
Multiple malnutrition burdens in children under five in West Africa

Introduction
Although progress has been made in the past decade, the burden of child malnutrition remains high in many low- and middle-income countries. They continue to be affected by a high burden of undernutrition, whilst the rate of childhood overweight/obesity is increasing substantially. This study aimed to critically assess the multiple malnutrition burden in children under five (U5) in West Africa (WA).

Methods
We applied a mixed-method approach including a secondary data analysis and a systematic mapping review. The secondary data analysis used the Demographic Health Surveys and Multiple Indicator Cluster Surveys data for all WA countries. We report on prevalence levels of U5 stunting (height-for-age Z-score < -2), U5 anaemia (hemoglobin < 110 g/l), low birth weight (LBW: birth weight < 2,500 g), U5 overweight/obesity (weight-for-height Z-score > 2), and U5 wasting (weight-for-height Z-score < -2). We applied standard prevalence cut-offs to identify severe country-level burdens: U5 stunting ≥ 30%, U5 anaemia ≥ 40%, LBW ≥ 10%, U5 overweight ≥ 3%, and U5 wasting ≥ 10%. The systematic mapping review identified and catalogued all peer-reviewed literature (in MEDLINE) since January 1, 2010 that reported on any of these forms of U5 malnutrition, except for U5 anaemia.

Results
The secondary analysis showed that across the 16 WA countries, LBW is ranked as the most prevalent form of malnutrition in children (15 out of 16 countries), followed by anaemia (14 out of 16 countries), stunting (8 out of 16 countries), overweight (7 out of 16 countries) and wasting (5 out of 16 countries). Ten countries face multiple types of malnutrition simultaneously. Guinea, Mali, Niger, and Sierra Leone experience a quadruple burden of child malnutrition.

Of the 230 studies identified in the systematic search, seven only reported on overweight/obesity, 22 only on stunting, 30 only on wasting, and 109 only on LBW, whereas 62 reported on more than one type of malnutrition. Only seven studies reported on overweight/obesity in conjunction with at least one form of undernutrition (stunting, wasting and/or LBW); the remaining reported on several forms of undernutrition. Nigeria is the country with the most research reporting on U5 overweight/obesity (n=6).

Conclusions
West African countries experience multiple types of undernutrition in U5, whilst the burden of U5 overweight/obesity is increasingly prevalent alongside. Research reporting on multiple malnutrition burdens is lacking, and there is an urgent need for more studies focusing on both over and undernutrition simultaneously. These multiple burdens conceal many complexities both in causation and necessary interventions, and countries will need to better understand what drives these and how they coexist to address them simultaneously through adapted programs and policies.

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**Session Classification:** Poster session 1

**Track Classification:** Epidemiology

Background: Formula-fed infants experience metabolic stress that could put them at a greater risk than breast-fed babies to a wide range of health issues. Objective: To, roll out the burden of formula milk on the kidney by comparison between measured plasma renin (PRA) and aldosterone (PAldo) in breast- fed and formula fed & serum sodium (Na) and potassium (K) with urinary sodium (Na) excretion /24 h. Methodology: The study included 40 infants, classified into 2 groups, exclusively breast or formula feed estimation of plasma rennin, aldosterone, serum sodium and potassium, urinary sodium excretion /24 h was estimated. Results: the mean values of PRA & PAldo were higher in breast- fed than formula- fed infants, serum Na & K were nearly equal in both type of feeding. The excretion of Na in urine was higher in formula-fed than breast –fed infants. Conclusion: Bottle- fed infant are more liable to so many co- morbidity in their life later on. Formula - milk have high potential renal solute load places infants at an increased risk of serious dehydration beside their financial burden.

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Session Classification : Poster Session 2

Track Classification : Biology
Determination of Babies’ Intake of Trace Elements Through Breastmilk and Mothers’ Nutritional Status in Ile-Ife, Nigeria

This work assessed the amount of some trace elements ingested by babies through mother’s milk by determining elemental concentrations in milk and volume of milk consumed by babies. It also simultaneously assessed the nutritional status (fat free mass and body mass index) of the mothers.

Methods: Forty-eight volunteer Mother-Baby pairs were recruited from Ile-Ife, Osun State, Nigeria. Levels of lead and selenium were determined in milk samples from the mothers using ICP-MS while mercury levels in the same samples were determined using a Direct Mercury Analyser. Next, milk intakes in babies were determined using the deuterium dose-to-mother stable isotope technique. Thirty milligram of sterile deuterium oxide was orally administered to each mother irrespective of body mass; and saliva samples were obtained from both mother and baby over a two-week period on days 0, 1, 2, 3, 4, 13, and 14 following the dose. Deuterium enrichment in saliva was determined using Fourier-Transform Infra Red (FTIR) spectrometry at the Centre for Energy Research and Development of the Obafemi Awolowo University, Ile-Ife. The transfer of deuterium from mother to baby through milk intake was modelled by a multi-exponential function, and the simultaneous solution of this function with the mono-exponential decay of deuterium from mother body pool was achieved using the SOLVER function in Microsoft Excel environment through a customized Spreadsheet supplied by the IAEA. The Mid-Upper Arm Circumference of each baby was determined using a flexible tape.

Average milk intake over two weeks in the babies ranged from 387 to 1045 g/day. Water intake from other sources apart from human milk (reflecting exclusiveness of breastfeeding in these babies) ranged from nil to 420g/day in the same period. Fifty percent of subjects for which we obtained good results practiced exclusive breastfeeding during the period of study. Average Maternal lean body mass (Fat-Free Mass) was 37.9±7.01 kg, and the mean maternal body fat was 18.03 ±9.87 kg. Baby’s Mid-Upper Arm Circumference significantly (p < 0.01) correlated with Mother’s Body Mass Index while the Milk intake in babies had a significant (p<0.02) inverse correlation with the %Body fat of their mothers. This could imply that babies from women with low body fat needed to consume larger quantities of milk to be satiated. When intakes data were combined with the trace elements measurements in the milk samples, the amount of lead, mercury, and selenium ingested by babies through mothers’ milk were evaluated as ranging from 0.11 – 0.65 μg/kg b.w., 0.03 – 0.48 μg/kg b.w., and 1.37 – 9.20 μg/kg b.w. respectively.

Conclusion: Results from Ile-Ife demonstrate the applicability of stable isotope technique to simultaneously determine important nutritional parameters in mothers and breastfed babies, which could be combined with other data to permit evidence-based assessment of the double burden of malnutrition and formulation of effective interventions as may be necessary.

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Track Classification :  Epidemiology
Nutritional Status and Feeding Practices among 0-2 Year-Old Children in Lebanon

Introduction
Little is known on early life nutrition in Lebanon and the region of the Eastern Mediterranean basin, a region that harbors one of the highest burdens of NCDs worldwide. This study aims at assessing the nutritional status and feeding/dietary practices among 0-2 year-old Lebanese children, investigating the association of early life feeding practices with overweight and obesity in this age group and identifying factors associated with exclusive breastfeeding.

Methods
A nationally representative survey was conducted, in 2012/2013, in the six Lebanese governorates of Lebanon, based on stratified-cluster sampling. A random sample of 478 child/mother pairs were recruited. Data on socio-demographic, lifestyle, dietary, and anthropometric characteristics were collected and breastfeeding practices were assessed based on the WHO indicators.

Results
The prevalence of stunting, wasting, overweight and obesity were estimated at 5.8%, 2.3%, 10.8%, and 3.6% of children, respectively, based on the WHO standards. Prevalence rates of ever-breastfeeding and exclusive breastfeeding (EB) for 6 months were estimated at 88.49% and 20.4% respectively. The odds of EB increased significantly with early initiation of breastfeeding within one hour (OR=2.199; 95% CI: 1.914-4.900) and with the child not being the first child in the family (OR=2.361; 95% CI: 1.195-4.665). In contrast, the odds of EB were significantly lower among babies born small for gestational age (OR=0.268; 95% CI: 0.087-0.830) and among mothers who reported not being breastfed as a child (OR=0.287; 95% CI: 0.086-0.954). Similarly, using the breastfeeding knowledge questionnaire, mothers with overall knowledge scores below the median were less likely to exclusively breastfeed their children (OR=0.274; 95% CI: 0.127-0.591). The mean age of introduction of formula milk and solid food was estimated at 1.00±1.62 and 5.00±1.65 months, respectively. EB for 4 months (OR=2.17; 95% CI: 0.27-17.8), or 6 months (OR=2.11; 95% CI: 0.55-8.04) was not significantly associated with overweight or obesity among children. Early introduction of solid food was also not found to be associated with overweight and obesity in this age group (OR=1.35; 95% CI: 0.37-4.86). In contrast, the high prevalence of obesity (24.7%) in Lebanese mothers was significantly associated with higher odds of overweight and obesity in the studied child population (OR=3.272).

Conclusion
Findings reveal suboptimal feeding practices and a relatively high prevalence of overweight amongst 0-2 year old children in Lebanon. Effective evidence-based interventions, consisting of promotion of EB and timely and adequate introduction of complementary foods, can enhance the nutritional status of this age group. In particular, the identified barriers against EB may be used for the development of culture-specific interventions that aim at improving breastfeeding practices and possibly contribute towards curbing the NCD epidemic in the country.

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Track Classification : Epidemiology
Breastfeeding and reasons for weaning among mothers and infants from the Southern Brazil belonged to a multi-centre study

The objective of the study was to evaluate the maternal intention to breastfeed, duration of breastfeeding and reasons for weaning among mothers and babies from southern Brazil participating in a multicenter study. This is a cohort study conducted in Pelotas, RS, with participants from the Multi-Centre Body Composition Study. Mothers and babies were followed at 3, 6, 9, 12, 18 and 24 months of age. The reasons for weaning were investigated before 12 months. Median and interquartile intervals of breastfeeding duration were presented according to sociodemographic and nutritional characteristics. Of the 1377 mothers screened, 74% had intention to exclusive breastfeeding until 6 months and 91% to prolong breastfeeding until at least 12 months. Only 168 pairs of mothers and babies met all eligibility criteria and agreed to participate in the follow-up. The median breastfeeding was 11 months (IQR: 5.8-23.0 months), and 52% of the children were weaned before 12 months. The main reasons for weaning were insufficient milk (57%), return to work / school (45%) and unexplained refusal of the baby (40%). The results showed that despite the intention to breastfeed, there is a need to clarify the mothers and families about issues related to breastfeeding.

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Session Classification :  Poster Session 2

Track Classification :  Epidemiology
Exclusive breastfeeding in Rabat and outskirts, Morocco: Risk factors for non-compliance

BACKGROUND AND AIMS
Exclusive breastfeeding (EB) till six months of age is a simple and worldwide-accepted WHO recommendation that reduces morbidity and mortality in infants. The Aim of study is to explore factors leading to non-compliance of EB in Morocco.

METHODS
During October 2014, mothers attending an urban paediatric hospital in Rabat or a rural clinic in Benslimane with children older than 6 months were approached.
Oral informed consent was provided and an interview on mother and child nutrition done. Logistic regression was used to determine independent risk factors for non-compliance of EB.

RESULTS
A total of 235 women were recruited, 183 (78%) from the urban hospital. 163 (69%) referred having exclusively breastfed their children. Among those who did not, 67% referred lack of breast milk, 18% referred hospital admission during neonatal period as the reason for non-compliance, and 15% incompatibilities with their economic activity. Household monthly revenue was higher in the group of non-compliant (470 euros vs. 380 euros, p = 0.067). In the multivariate analysis, having delivered in a public hospital was independently associated with EB (OR 2.5, 95%CI 1.2-5.0). Counselling to encourage EB was not associated with EB compliance.

CONCLUSIONS
Efforts should be done to design more appropriate strategies to encourage EB among mothers in Rabat and outskirts, especially in the private sector, and to avoid interfering with EB in case of admission during neonatal period.

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Presenter(s) : Dr. RADOUANI, Mohammed Amine (MD,PhD in neonatology and nutrition, research team of mother and children’s health, Faculty of medicine and pharmacy, University Med V, Rabat,
The associations between maternal body composition and breast milk output: An explorative causal inference approach

Introduction: Several scholars have found an association between maternal body composition and breast milk output. Heavier mothers tend to have lower breast milk output. Other maternal and child factors might affect breast milk output and/or body composition as well. Examples are parity, weight of the child, and even non-biological factors like socioeconomic status or smoking. In order to obtain the desired unconfounded effect estimates for the association between body composition and breast milk intake by the child, knowledge of the underlying causal mechanisms is necessary, taking into account all possible confounding background variables. The aim of this study was to explore these causal mechanisms.

Methods: Causal inference search algorithms were used to explore the underlying mechanisms, by determining which causal graphs were compatible with the given data. With this technique, not only the causal effects between exposure and outcome variables can be determined, but also the effect of background variables on both exposure and outcome variables can be explored. Structural equation modelling was then applied to the models to find the values for the regression coefficients. Data for this study was obtained from a database in which milk intake data from 16 studies was pooled together (n=188). All studies used the dose-to-the-mother deuterium-oxide turnover method for measuring breast milk transfer from mother to child.

Results: For each of the three measures of maternal body composition (BMI, FMI, FFMI), and height the model best fitting the data was selected. Preliminary findings of the model for BMI showed a direct negative effect of BMI on milk output, i.e. a higher BMI results in lower breast milk output. This direct negative effect was also found in the FMI model, but not in the FFMI model. Education was found to have a confounding effect in the association between body composition and milk output through parity and smoking. Firstly, higher maternal education was associated with lower parity, and subsequently lower fat mass, and higher milk output. Secondly, higher maternal education was associated with lower smoking prevalence, which in turn resulted in higher milk output.

Conclusion: Even though results are still preliminary, this exploratory study identified several confounders in the association between body composition and breast milk output, like parity, smoking, and education. When decomposing BMI into FMI and FFMI, we found that the effect of body composition on milk output is caused by maternal fat mass and not by her lean mass.

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Session Classification: Poster Session 2

Track Classification: Epidemiology
Antenatal care in Rabat and outskirts, Morocco: Risk factors for non-attendance

Background and aims
Antenatal care (ANC) is a preventative measure that improves both mother and newborn health outcomes. The objective is to describe the compliance and determining factors for non-attendance are scarce and urgently needed to improve ANC in Morocco, if necessary.

Methods
During October 2014, mothers attending an urban paediatric hospital in Rabat or a rural clinic in Benslimane with children older than 6 months were approached. Oral informed consent was provided and a questionnaire on ANC filled. ANC was defined as done if the mother attended at least once the antenatal clinic. Logistic regression was used to determine independent risk factors for non-attendance to antenatal visits.

Results
A total of 235 women were recruited, 183 (78%) from the urban hospital. 51 (22%) women referred not to have done any antenatal visit, 53% of whom pointed distance as the reason for non-attendance. Among those who did at least one visit, 98% had at least one echography done, 78% had their blood group typed, and 73% had the haemoglobin assessed. On the other hand, 32% did not have the glycaemia checked, and no serology was tested in 58% of the women who attend an antenatal clinic. Household monthly revenue was higher among women who did at least one antenatal visit (median revenue 333 euros vs. 185 euros, Wilcoxon rank-sum test p < 0.001). In the multivariate analysis, being uneducated was strongly associated with not attending any antenatal visit (OR 37, 95%CI 13-107). Living in a rural area was also an independent risk factor for non-attendance (OR 4.3, 95%CI 1.5-12.5), as was the parity (OR 1.5, 95%CI 1.1-2.1 per unity increase of parity).

Conclusions
Adverse socio-economic factors are an important barrier to antenatal care in women from Rabat and outskirts, leaving mothers and children from poorer families in higher risk of perinatal morbidity. Programmes should be implemented to detect households in risk of exclusion and to promote and facilitate their access to medical care. The effect of high parity should be further explored to determine whether it might contribute to household poverty, or whether previous contact with the health system discourages mothers from attending antenatal clinics.

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Session Classification: Poster Session 2

Track Classification: Epidemiology
Predictors of maternal breastmilk output as possible determinants of infant growth variations in a high HIV prevalent area in Kenya

Irrespective of maternal and infant HIV status, breastfeeding is recommended as the sole source of nourishment up to 6 months of age and is to be continued up to 2 years and beyond. Breast milk does not only provide the much needed nutrients but also has bio-actives – all needed for the growth of a breastfeeding infant. It is therefore imperative that all infants are breastfed on demands and consume as much breastmilk as possible. Despite the similar breastfeeding messages that are given to all mothers, mothers breastmilk output vary, and this may subsequently elicit growth variations among their infants. Understanding the predictors of breastmilk out particularly in a community which of HIV prevalent (a condition that has been found to affect growth of infants) is critical in foretelling infant growth faltering. Using data from a breastmilk study, the potential predictors of breast milk output have been analyzed for and discussed. The objective was to identify specific group on infants below 6 months of age born in a high HIV prevalent areas that could be more vulnerable to growth faltering due to lower breastmilk intake. One hundred and forty mother-infant pairs were recruited into the study at 6 weeks post-partum and followed up to when the infants were 6 months old. Breastmilk output was measured using Dose-to-mother Deuterium Oxide technique at both 6 weeks and 6 months postpartum. At both points in time, socio-economic data and child feeding practices were also collected by maternal recall method. This data may be critical programmatically in providing a basis for identifying and providing specialized counselling for mothers who are most likely to produce lower breastmilk, therefore putting their infants at risk of growth faltering.

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Session Classification : Poster Session 2

Track Classification : Assessment
Breastfeeding and Body Composition in Latin American Infants

Background: Breastfeeding (BF) seems to be important in obesity prevention. One of the difficulties is measuring breast milk intake and body composition in infants. Stable isotope methods provide objective measurements of both factors.

Objective: To evaluate the association between breastfeeding and body composition of infants at 3 and 4 months of age in Latin America.

Methods: A multicenter, transversal and non-random sampling study was performed in mother-infant pairs. Healthy, term, non-twin infants who were partially or totally breastfed at 4 months and nonsmoking mothers without chronic diseases were included. Body weight and length were determined and z scores for height/age (zH/A) and BMI (zBMI)(WHO, 2006) were calculated. The intake of breast milk and non-milk water intake were measured by the dose to the mother deuterium oxide turnover method (DMDOT) and expressed in g/day. The body composition, evaluated by the deuterium dilution method, was expressed as the fat mass index (FMI; kg/m2) and the fat-free mass index (FFMI, kg/m2). Breastfeeding was classified as exclusive (EBF) and non-exclusive (NEBF) according to the maternal report or considering as EBF when the intakes of other liquids <52 g/day. Descriptive statistics were performed and body composition was evaluated between the two groups by T test. The study was approved by an ethics committee in each country and mothers signed an informed consent.

Results: 235 mother-infant pairs (48% girls) from Argentina (n = 17), Brazil (n = 32), Chile (n = 52), Cuba (n = 21), Dominican Republic (n = 38), Ecuador (n = 14), Guatemala (n = 35) and Uruguay (n = 21) entered the study. The average age of the infants was 3.7±0.6 months. zH/A was -0.5 (CI: 1.1 to -0.8) and zBMI 0.11 (CI -0.03 to 0.2). The Intake of breast milk was 882 g/day (CI 752 to 985) and 553 g/day (CI: 287 to 685) in EBF and NEBF infants, respectively (p<0.001); meanwhile, the intake of other liquids was 32.5g/day and 278g/day, respectively. EBF reported by the mothers was different to that estimated by DMDOT (60% vs 34%, respectively; p< 0.01). No significant differences were found in FMI and FFMI of EBF and NEBF infants according to the report of the mothers (FMI 9.2 vs 8.3 and FFMI 16.0 vs 16.4; p <0.001, respectively).

Conclusions: In Latin American infants, there was no difference in body composition at 3 and 4 months between infants exclusively and not exclusively breastfed.

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Session Classification : Poster Session 2

Track Classification : Epidemiology
Level of cadmium, lead in maternal blood, placenta, umbilical cord blood and fetal death in the Metallurgical City of La Oroya Peru

Introduction: Environmental contamination by lead, cadmium and its effect on the health and nutrition of the fetus mother binomial is currently a social problem in metallurgical areas.

Objective: To determine the relationship of levels of cadmium, lead in maternal blood, placenta, umbilical cord blood and fetal death in the city of Oroya Peru.

Methods: Cross-sectional, descriptive, observational study. A sample of 40 pregnant women residing in the city of Oroya for at least 2 years was sampled in the Pb, copper and zinc smelters. Blood samples were collected from the pregnant woman before delivery and postpartum samples were taken from placenta and blood from the umbilical cord and collection of fetal fetal data. The level of Cd and Pb of these samples was evaluated by atomic absorption spectrometry with graphite furnace. The analysis was performed with the statistical package SPSS version 22.

Results: The geometric means of cadmium levels in maternal blood 3.3291, Cd in umbilical cord 3.8364, Cd in placenta 31.8591 are above the level of 0.412 which is the geometric mean of the population in the United States. The percentages of cases with hematological levels of Lead in blood from 0 to 60.20 \( \mu g / dL \) divided into four degrees of elevation: less than 10 \( \mu g / dL \) 17.5%; 10 to 19 \( \mu g / dL \) 20%; From 20 to 44 \( \mu g / dL \) 47.5%; And from 45 to 60.20, \( \mu g / dL \) 15%. In the case of Pb umbilical cord blood from 0.80 to 40 \( \mu g / dL \) and in bp in the placenta from 20 to 1,542 \( \mu g / dL \) can be seen. Significant relationships were found between cadmium umbilical cord blood and fetal death \( r = -0.459 \) pvalue 0.003, lead in placenta and fetal death \( r = -0.341 \) pvalue = 0.031.

Conclusions: Since the statistic \( r = -0.459 \) is less than the critical value \( r = -0.304 \) it is located in the critical region, which indicates that we must reject the null hypothesis and consequently accept the alternative hypothesis. Therefore, we conclude that for a level of confidence at 95%, there is a significant negative relationship between cadmium in umbilical cord blood and fetal death. Since the statistic \( r = -0.341 \) is less than the critical value \( r = -0.304 \) it is located in the critical region, which indicates that we must reject the null hypothesis and consequently accept the alternative hypothesis. Therefore, we conclude that for a 95% confidence level, there is a significant negative relationship between lead in placenta and fetal death.

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Session Classification : Poster Session 2

Track Classification : Biology
Breast milk fatty acid composition in Egyptian women delivered at term and prematurely and the omega-6 to omega-3 ratios

Exclusive breastfeeding is the optimal food for the first six months of post natal life and according to WHO (2011), no other liquids or solids are given – not even water to protect against diarrhoea and common childhood illnesses and to achieve optimal growth, development and health. Thereafter, to meet their evolving nutritional requirements, infants should receive nutritionally adequate and safe complementary foods, while continuing to breastfeed for up to two years or beyond. Over 200 fatty acids (FA) of different chain length and unsaturation have been identified in human milk; only linoleic acid (LAɷ-6), arachidonic acid (AAɷ-6), alpha linolenic acid (ALAɷ-3) and docosahexanoic acid (DHA ω-3) are essential because they cannot be synthesized by the human body and deficiency symptoms will develop when they are not supplied in the diet.

Premature infants, born before the full gestational period (<37 weeks gestation) comprises nearly 11% of all Egyptian births and have an increased risk of disabilities, such as respiratory illnesses, retinopathy, sensory deficits, motor impairment, learning disabilities, speech and language delay due to various nutrient deficiencies. The third trimester of gestation (> 6 months) is a vulnerable period, because maternal long chain polyunsaturated fatty acids (LCPUFA) are delivered to the fetus during this trimester and their supplies are essential prenatally for proper brain maturation, development, and visual acuity of premature infants.

Objective: The present study presents the results of breast milk fatty acid composition in Egyptian women delivered at term and prematurely and the omega-6 to omega-3 ratios. Materials and Methods: Lactating mothers belonged to two ethnic groups and were attending public hospitals in Giza and Sohag. The collection of mature milk samples and the gas chromatographic analysis of the fatty acids were completed under standard conditions.

Results: The GC separated 21 fatty acids under the experimental conditions. (Table 1). The ratios of linoleic (ɷ-6) to α- linolenic acid (ɷ-3) averaged 30.4:1 and 34.6:1 in the milks of mothers with term and preterm babies, respective, which is quite disproportionate compared to the respective optimum ratio of 4:1. The results were interpreted on the basis of variation in biological, social and eating habits. Conclusion: Preterm infants are high at risk group resulting from unique biological suboptimal early exposures and they are in urgent need to suitable intervention strategies in the immediate post-natal period. The need to develop novel sustainable technologies to use deodorized and stabilized oils derived from inedible (ɷ-3) PUFA-rich marine organisms to produce a wide variety of fortified foods.

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Session Classification: Poster Session 2

Track Classification: Biology
Consumption of sugary drinks and addition of honey or sugars to the liquids in infants up to two years-of-age belonging to a longitudinal multicenter study

Introduction: Proper nutrition during childhood is essential to ensure the child’s growth and development. The World Health Organization recommends that the child be exclusively breastfed, up to six months of age and continued up to two years, including the complementary feeding. In this scenario, high-fat and high-sugar foods should not be offered to infants. Improving the quality of complementary foods is one of the most cost-effective strategies for improving health, reducing morbidity and mortality in children. The aim of this work was to describe the prevalence and monitoring in the consumption of sugary drinks and addition of honey or sugars to the liquids in infants up to two years-of-age and their associated factors.

Methods: Observational longitudinal study with infants from Pelotas, Brazil, enrolled in a multicenter study performed in five medium- or low-income countries, which included only newborns who met specific criteria related to their capacity in reach their maximum growth potential. Consumption of sugary drinks was evaluated at 3, 6, 9, 12, 18 and 24 months-of-age by 24-hour food recall and food frequency questionnaire (FFQ). Addition of honey or sugar to liquids was evaluated at the same ages using FFQ. Independent variables were mothers’ schooling, work, age and parity and infants’ sex and nutritional status at 24 months. Bivariate analyses were performed using the Fisher’s exact test.

Results: One hundred and sixty-eight newborns were included in the study. Around 70% of the infants consumed sugary drinks in the 24 hours prior to interview in at least one follow-up from three to 24 months-of-age. About a third of the infants had daily addition of honey or sugar to the liquids in at least one follow-up. Infants from less schooled mothers showed higher consumption of sugary drinks up to 24 months-of-age (90%) in relation to infants from more schooled mothers (55.9%).

Conclusions: Consumption of sugary drinks and addition of honey or sugar to the liquids was high in this sample. Around seven in every ten infants consumed sugary drinks in the 24 hours prior to the interview in at least one follow-up. Results were worrying since the current guidelines do not recommend the use of these foods in the complementary feeding of infants. It is important the implementation of policies and nutrition education programs about food habits in the first years of life, focusing in lower schooling families.

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Session Classification: Poster Session 2

Track Classification: Epidemiology
Exploring Fat Oxidation as the Link Between Early Life Factors and Body Composition in Peripubertal Jamaican Children

Introduction: Jamaica is a middle income country in which overweight and obesity in children are increasing at an alarming rate. The mechanism of obesity remains unclear. Adverse in utero conditions resulting from maternal over- or undernutrition may lead to programming of fat oxidation of the developing fetus. Limited studies in children have examined the association of birth size on fat oxidation. Studies showing an association between fat oxidation and adiposity in children are contradicting. Based on the assumption that lower fat oxidation is related to higher fat deposition, we hypothesized that an inadequate maternal nutritional state (as evidenced by maternal anthropometry) and lower birth size are related to high body fat in peripubertal children and this relationship is mediated by low fat oxidation. This study therefore aims to explore (1) the relationships among early life factors (i.e. maternal weight, body mass index (BMI) and height, birth weight, birth length and ponderal index) and body composition and (2) fat oxidation as the link between early life factors and body composition in peripubertal Jamaican children.

Methods: 176 healthy Jamaican children, 9-12 years of age were recruited from a longitudinal cohort. Their birth anthropometric and maternal anthropometric data during pregnancy were available for analysis. After an overnight fast (10 hours), measurements of anthropometry, body composition using bioelectrical impedance analysis and fat oxidation using indirect calorimetry, were made. Pubertal stages were recorded according to the method of Marshall and Tanner. Multiple linear regression analyses were performed.

Results: Adjusting for age and sex of the children, maternal weight and birth weight were positively associated with child’s weight, height, BMI and lean body mass (LBM); maternal height was positively associated with child’s height and LBM; and maternal BMI was positively associated with child’s BMI and LBM. Also, birth length was positively related to child’s height. When child’s current height was further added to the models, child’s LBM was no longer associated with weight and height of mothers and birthweight but was related to child’s current height (p = 0.00). Adjusting for age and sex, child’s fat oxidation was positively associated with either their current weight or height or BMI or LBM or fat mass in separate models. When LBM was included in the models, fat oxidation was no longer associated with child’s weight, height, BMI and fat mass but remained positively associated to LBM in the models with child’s height (both sexes), weight, BMI and fat mass in males only.

Fat oxidation was not associated with early life factors controlling for age and sex. When LBM was added to the models, fat oxidation was positively related to LBM in each of the models and was inversely related to birthlength (p=0.04) but not related to the other early life factors.

Conclusion: The results suggest an independent influence of early life, mainly through birth-length in male babies, and of current LBM on fat oxidation, but with a pattern different from our hypothesis.

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Session Classification : Poster Session 2

Track Classification : Biology
Risk factors and epidemiology of neural tube defects in Morocco

Introduction - Neural tube defects has a considerable importance because they can be prevented by supplementing Folic acid & Vitamin B12 during periconceptional period and fortification of staple foods. In Morocco, the Ministry of Health launched a national program for fortification of flour with folic acid.
Purpose: to evaluate the prevalence of neural tube defects after fortification.
Material and Methods - This is a retrospective descriptive study at the National Reference Centre for Nutrition and Neonatology of the Children’s Hospital of Rabat over 4 years. Data were identified from the registry of congenital malformations held at the perinatology unit.
Results - During the 4 years, 674 congenital malformations were identified. The neural tube defects account for 11.9%. Their annual prevalence decreased significantly from 21.78 in 2008 to 12.1 per 10,000 total births in 2011. The most common form was anencephaly (60%). Neural tube defects were isolated in 85% of cases and associated with other malformations in 15% of cases. 49.4% of infants with neural tube defects were female and 50.6% were male. Perinatal mortality in newborns with neural tube defects was 63.8% versus 25.2% in malformed newborns without neural tube defects.
Conclusions - The neural tube defects seem to be common after supplementing Folic acid & Vitamin B12 during periconceptional period in Morocco. Permanent epidemiological surveillance is needed to determine the true prevalence and risk factors in our context.

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Session Classification : Poster Session 2
Track Classification: Epidemiology
Infant growth trajectories and childhood growth status in India

Introduction: Early growth and nutrition can influence later risk of overweight and chronic diseases; however, whether different infant growth trajectories have different later effects is unclear.

Methods: We used data from 904 children in the Delhi Infant Vitamin D Supplementation (DIVDS) study of low birth weight term infants, measured monthly from birth to 6 months and again at age 4-6 years. We investigated how growth in the first 6 months of life was related to later height, weight, mid-upper arm circumference (MUAC), all expressed as WHO growth standard Z scores, and tibia and radius bone density, measured by quantitative ultrasound. The SuperImposition by Translation and Rotation (SITAR) growth curve model was used to analyse infant weight and length growth patterns, summarising each in terms of a population mean curve and child-specific growth parameters (random effects) entitled size, tempo and velocity. Size, tempo and velocity represent simple adjustments to the mean growth curve to match it to individual growth curves. Size adjusts the level of the curve, analogous to the mean Z score; tempo adjusts the age when growth is fastest; and velocity adjusts the mean growth rate. Linear regression models for childhood height, weight, MUAC, tibia and radius bone density were then fitted with these SITAR parameters as independent variables.

Results: The cohort were light and short at age 4-6 years: mean weight Z -1.93 (SD 0.95), height Z -1.82 (SD 0.99), and MUAC Z -0.71 (SD 0.85). Mean tibia and radius Z scores were, respectively, -0.53 (SD 1.01) and -0.64 (SD 1.04). The length size and length velocity SITAR parameters were strongly positively associated with both childhood height and weight. Length tempo was positively associated with childhood weight and MUAC. SITAR weight size and weight velocity were strongly associated with childhood height, weight and MUAC with no significant effects of weight tempo. None of the SITAR parameters were significantly associated with radius bone density, and the only significant associations with tibia density were negative for weight velocity and positive for weight tempo. Vitamin D supplementation in infancy did not modify the results.

Conclusion: Using growth models for 0-6 months, both length and weight size and velocity were—perhaps unsurprisingly—associated with greater anthropometry at 4-6 years. However, greater weight velocity was also associated with less dense tibia; a possible explanation is that a longer period of less rapid growth permitted greater deposition of bone mineral. Length tempo was positively associated with weight and MUAC, and weight tempo with tibia density; positive associations with tempo indicate that delayed growth resulted in higher values of the outcomes. Since these children at 4-6 years were still growth retarded compared to international standards, higher anthropometric Z scores and tibia density could be considered beneficial. Whether the tempo can be modified by dietary or other intervention cannot be determined from this study, especially since there was little dietary variety with virtually all the children exclusively or predominantly breastfed during the first half of infancy.

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Session Classification : Poster Session 2

Track Classification : Biology
Knowledge of breastfeeding among mothers in Vietnam in 2017

Introduction: Breastfeeding rates in Vietnam have made very slow improvement in recent years. Whilst breastfeeding itself is a very popular practice in Vietnam, exclusive breastfeeding for 6 months remains challenging. Data from MICS 2014/2 show that 96.9% of children under 2 received breastmilk at some point in their life, but only 49% were predominantly breastfed for 6 months and even fewer (24.3%) were exclusively breastfed for 6 months. Early initiation of breastfeeding (within the first hour of birth), has surprisingly been decreasing over recent years, from 40% in 2011 to 26.5% in 2014. A previous review of US pointed out that educating on breastfeeding is proved to be the most effective single intervention in increasing breastfeeding initiation and short-term duration. Therefore, understanding about the breastfeeding knowledge among Vietnamese mothers is critical for appropriate interventions in educating mothers in breastfeeding.

Methods: This descriptive cross sectional study was conducted in 2016 in 8 hospitals in Ho Chi Minh and Danang city. Ho Chi Minh and Danang cities were selected based on their geographical distribution around the country (central and south), and as being large cities with many hospitals, both general hospitals and those specialising in obstetrics or paediatric care. The data was collected by interviewing mothers with new born babies with pre-test, structured interview based questionnaire. The data then were entered and analysed using STATA 12.

Results: A total of 419 mothers were included in this study with a 100% response rate. The majority of the participants (69.3) knew that they should give their baby the breastfeeding initiation in one hour of delivery. In terms of benefits of breastfeeding within an hour of delivery for infants, only 13.9% knew that initiation breastfeeding lower the risks of mortality and 23.2% understood that initiation breastfeeding helps the metabolism system of infants. With regards to benefits of breastfeeding in one hour after delivery for mothers, only 14.1 and 15.8 of participants knew that initiation breastfeeding is good at prevention of postpartum haemorrhage and reducing fat accumulation, respectively. Most of the survey participants had right knowledge about understanding about exclusive breastfeeding which means the infant receives only breast milk - no other liquids or solids, even water are given (87.9) and time for exclusive breastfeeding is recommended at least first 6 months (82.2). The percentage of surveyed mothers with good knowledge about benefits of breastfeeding is all less than 50%, especially only 15.1% knew that breastfeeding is good for mothers’ health and 26% knew that it is cost-effective compared to feed with formula milk.

Conclusion: In this study, the participants had good knowledge about exclusive breastfeeding; however, the percentage of mothers having good knowledge regarding the benefits of breast feeding and initiation breastfeeding for mothers and infants is still low. Therefore, appropriate breastfeeding education and promotion should be well planned and provided to raise mothers’ knowledge about breastfeeding.

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Session Classification: Poster Session 2

Track Classification: Epidemiology
Adolescent Health: Long term health effects of pubertal timing in Mexican women

Introduction: Adolescence is an important period of time in which children develop into adults and is of high importance for the development of adequate long term health. Most obvious sign of reaching puberty in girls is the first menstruation (menarche). Timing of it is dependent on numerous internal (metabolic) and external factors. Several countries have reported a decline in age at menarche (AAM), which is thought to be associated with the occurrence of several non-communicable diseases. Mexico, as an emerging country, is facing several changes towards being a developed country. These changes might have an effect on AAM and thus on health status. The objective of this study was to examine the impact of a young AAM on several health outcomes and on the nutritional status as adults. Further, the presence of a nation-wide secular trend in AAM among Mexican women was investigated.

Methods: Data was obtained during the Mexican National Health Survey of 2000. Participants were randomly selected from all states and both, urban and rural settings. In total, 30,628 women aged > 20 y were included of which data on weight, height, BMI, diabetes, hypertension, hypercholesterolemia, breast cancer and arthritis was collected. The association between AAM and nutritional status was assessed using simple linear regression. Health outcomes were analysed by logistic regression and log binomial regression with complementary log log link. The secular trend of AAM was studied by Welch-ANOVA and Games-Howell post-Hoc test.

Results: A total of 4,073 women (14 %) were classified as having an early AAM (< 12 y), 70 % had a normal AAM (12-14 y) and 16 % were considered late (> 14 y). AAM was significantly negatively associated with weight (β = -1.01) and BMI (β = -1.01). Height was found to increase with increasing AAM (β = 0.18). All health outcomes showed the hypothesized inverse association with AAM, however only diabetes and hypercholesterolemia were found to be significantly associated with RRs of 0.95 and 0.93, respectively. Welch-ANOVA showed a significant difference of AAM between decades of birth (Welch F = 99.42, p < 0.001). Largest significant difference was found between the decades of the 1920s and 1980s, where mean AAM decreased by almost 1 year.

Discussion and Conclusion: Our findings are at large in line with previous studies in several countries. Younger AAM can be linked to increased body weight in adulthood and a decreased final height. Further, there is an association between AAM and several non-communicable diseases. However, the association was only significant for diabetes and hypercholesterolemia. This could partly be explained by the lack of social demographic and lifestyle data. It should further be noted, that group sizes among the different decades of birth differ largely, even though standard deviations were comparable. Yet, there is a clear overall trend towards a younger AAM, which should be monitored continuously in more recent years. Future studies should also make an attempt to find reasons behind the decreasing AAM in order to prevent the further decline.

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**Session Classification**: Poster Session 2

**Track Classification**: Biology
The burden of obesity: Alteration of Oral Fatty Acids Detection System Contributes to the Development of Obesity among Adults-Morocco

Introduction:
For many years the world suffers from under-nutrition as a result of insufficient food intake, but in the last decades the focus is also on overweight and obesity as other forms of malnutrition that generally refers to excess body fat. The epidemic of obesity is become an alarming threat for all human health in all ages, viewed as a major risk factor for many non-communicable diseases (cardiovascular disorders, type 2 diabetes...) which in turn are considered as the leading causes of death in the world. By 2014, more than half a billion people are obese (WHO). Under the results of the national survey (Stepwise 2017-2018): More than 50% Moroccan adults are overweight and obese (20% obese, 33% overweight). Emerging evidences now suggest that the rise of obesity is not only associated to the lack of physical activity, environmental and genetic factors, but also to the altered of oro-sensory detection mechanism, which probably leads to extra fat intake in our diet. The aim of our work is to examine the role of oral gustatory detection of oleic acid (OA), a long-chain fatty acid in the fat consumption and then in the development of obesity in Moroccan adults.

Methods:
Adults (male and female) with eligible criteria were recruited in a nutrition unit; their written consents have been obtained. All anthropometric measures were calculated in order to classify the participants into obese (case) and non-obese (control) subjects. Also they were exposed to an oral fat test using emulsions containing OA at different concentrations according to the three-alternative forced choice (3-AFC) method to evaluate their OA detection thresholds.

Results:
Up to now a total of 120 (60 obese and 60 non-obese) adult was recruited. The average BMI (Body Mass Index) and fat content for obese were respectively 37.84kg/m2 and 40.94% and those of non-obese were 22.26kg/m2 and 25.00%. Obese participants exhibit fourfold higher OA detection thresholds than the other group (p<0.0001). The subjects were classified into hyposensitive (higher detection threshold) and hypersensitive (lower detection threshold) to fatty acids.

Conclusion:
The alteration of oral fat detection system may be a crucial cause in increasing fat intake and possibly in promoting obesity.


Session Classification: Poster Session 2

Track Classification: Biology
Malnutrition and inadequate breastfeeding practice among mother-baby pairs during the first six month.

Introduction
Understanding infant feeding practice and mother nutrition is essential for better intervention during the 1000 days’ window of opportunity. Stable isotope technique has found as a promise tool for exclusive breastfeeding (EBF) evaluation and nutritional status determination by measuring the breastmilk consumed by the baby and the body composition of the mother. In this work we described the nutritional status of mother-baby pair during lactation up to six month using deuterium dilution technique.

Methods
Forty-six mothers who willing to exclusive breastfeed up to 6 mo were followed from baby birth up to six months with cross-sectional measurement at 1-2 week and after 2, 4 and 6 mo. At each visit, anthropometry measurement was done, hemoglobin level was assessed in mother and the deuterium oxide dose to mother was applied. After weighing the mother and her baby saliva sample were collected from the mother and her baby. Then an accurate dose of 30g of deuterium oxide (D2O) was given to the mother and post dose saliva sample were collected at 1, 2, 3, 4, 13 and 14 days after the dose. Deuterium enrichment in saliva was analyzed by Fourier Transformed Infrared spectrometer (FTIR). The quantity of human milk intake (HM) as well as the water from source other than milk (non-HM) was determined using the two compartment model and the maternal body composition was assessed in term of fat free mass (FFM) and fat mass.

Results
We found that malnutrition was present among the mothers as well as their babies. Among the mothers, anemia was coupled with overweight up to 6 mo. The proportion of anemia was very high even if it decreased significantly from 76% at 1-2 w, to 47 % at 4 mo. The FMI indicated that overfat was 14% at birth and 18.3% at 4 mo. The anthropometry showed that wasting was present among babies during all the follow up (WHZ<-2 was 16.3% at 1-2 w, 6.6 % at 4 mo and increased to 22.7 % at 6 mo. At 1-2 week EBF was 54.5% at the first mo; 60.9% at 2 mo; 84.6% at 4 mo and the cumulated data showed that the rate of EBF up to 4 mo was 33.3%. So, not only the mothers introduced early other food in the baby diet but the EBF practice was also discontinuous in the group up to 6 mo. And that could explain why baby are malnourished.

Conclusion
This work revealed that there was a double burden of malnutrition among mother-baby pairs in the Kou Valley. It also described that EBF is not practiced as recommended by the national program that followed the WHO recommendation. The stable isotope technique helps to monitor infant feeding practice and to well document women and their babies’ nutritional status during lactation. And the efficiency of the breastfeeding evaluation will be in longitudinal follow up.

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Session Classification : Poster Session 2

Track Classification : Epidemiology
Assessment of resting, activity and total energy expenditure in free-living Thai elderly: A pilot study

Introduction: Obesity and non-communicable diseases (NCDs) are increasingly prevalent among Thai older adults. Establishing guidelines for healthy diet and lifestyle to address this problem, require a basis on dietary energy recommendation that suits body conditions and local context. To derive the dietary reference values for energy, the data gap on energy expenditure in relation to various physical activity levels must be filled. Therefore, this study aims to measure resting/activity and total energy expenditure through the use of stable isotope technique and to determine associations between these values and body composition indices among free-living Thai older adults.

Methods: The study was an observational, cross-sectional design, enrolling 35 free-living and relatively healthy elderly who are able to perform their daily activities (aged 62 to 83 years, 16 men and 19 women). The total energy expenditure (TEE) was measured using doubly labeled water technique. The Resting energy expenditure (REE) was measured by respiratory gas analysis, and the activity energy expenditure (AEE) was derived from the difference between TEE and REE, assuming the thermic response to feeding contributes 10% of TEE. Physical activity level (PAL) is the ratio of TEE to REE. Body composition estimates were determined using dual energy x-ray absorptiometry (DEXA).

Results: Measured TEE and REE were significantly higher in males comparing to females (Figure 1A). REE accounted for the largest component of TEE (57.6 % for men and 53.8 % for women, followed with AEE (36.2 % for men and 33.6 % for women). Multiple regression analysis showed that FFM could explain 70.5 % and 30.9 % of the individual variation in REE and TEE, respectively. TEE varies greatly within volunteers due to variation in physical activities, in which PAL ranged from 1.2 to 2.6 in men and 1.1-2.3 in women (Figure 1B). A trend decrease in PAL with age was observed only in females, this finding needs to be confirmed with larger sample size. There was no correlation of AEE with FFM or % body fat.

Conclusion: In this group of free-living older adults, total energy expenditure is majorly influenced by different levels of physical activity. Therefore, emphasis should be placed on determination of activity energy expenditure as part of the basis to derive dietary energy recommendation.

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Underestimation of the prevalence of excessive body fatness in primary school children in Mauritius: assessment of body composition by isotope dilution technique

Background & Aims: Global estimates of overweight and obesity prevalence in children are based upon the World Health Organization (WHO) body mass index (BMI)-for-age. As part of the ROUND-IT Africa project (a cross-sectional multi-center study conducted in 11 countries) our aim was to validate the accuracy of WHO BMI-for-age as a means of assessing excessive body fatness in primary school children in Mauritius.

Methods: We studied 377 children (200 boys and 177 girls) aged 8-13 years and belonging to the two main ethnic groups ~ Indians (South Asian descent) and Creoles (African/Malagasy descent). Body weight was measured to the nearest 0.1 kg (using an electronic portable scale with the participant barefoot and wearing light clothes), height was measured to the nearest 0.1 cm using a stadiometer, and the BMI calculated. Z scores were calculated using WHO Child Growth Charts and WHO Reference 2007 Charts, and the cut-off value of BMI-for-age > +1SD (overweight) used to estimate excess fatness. Actual body fat was assessed from total body water measured by the isotope dilution technique using Deuterium oxide (D2O), and excess fatness was determined using the criterion-referenced thresholds of >25% for boys and >30% for girls.

Results: The percentage of children with excess fat was found to be greater using reference (isotope dilution) method than using WHO BMI-for-age, namely 43% vs 34%. Overall, about 6% of boys and 12% of girls were misclassified (as normal fatness rather than excess fatness), and the proportion of misclassification being greater among Indians (9% boys and 13% girls) than among Creoles (2% boys and 8% girls). Furthermore, linear regression analysis of body fat% versus BMI-for-age reveals a significantly higher body fat% (by ~ 4 units, p< 0.001) in Indians than in Creoles among boys, though not among girls.

Conclusions: The use of BMI-for-age cut-off points for classifying excess fatness needs to take into account both ethnicity and gender in order to avoid gross adiposity status misclassification in this population known to be at high risk for later development of type 2 diabetes and cardiovascular diseases.

This study was supported in part by the IAEA (Projects RAF 6042/MAR6010) and in part by the Mauritian Ministry of Health & Quality of life.

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Session Classification : Poster Session 3

Track Classification : Assessment
Body fat assessment using Bioelectrical Impedance Analysis and Deuterium Dilution among South African children: BC-IT study

Introduction: Percentage body fat is strongly correlated with several non-communicable disease (NCDs) of life style, but its accurate measurement is difficult. The purpose of this study was to compare percentage body assessed by bioelectrical impedance analysis (BIA) against deuterium dilution (D2O) techniques among South African children.

Methods: A preliminary data on a total of 90 (38 boys and 52 girls; mean age 8.1±0.88) school-going South African children aged 6 to 8 years are participants in the Body Composition by Isotope Technique study (BC-IT Study). Total body water (TBW) and fat free mass (FFM) using D2O technique. Bodystat at 50 Khz was used to calculate TBW and FFM. Descriptive statistics, t-test for differences and correlation coefficients were employed to analyse the data.

Results: The mean total body hydration for total group was 76.92±0.24, with no significant (p=0.50) gender differences (76.90±0.26 for boys and 76.94±0.23 for girls). Mean values were 125.41±6.26cm height, weight 26.32±6.32kg; TBW 14.44±2.56kg; 18.79±3.38kg FFM and 7.52±3.75kg FM using D2O. With the use of BIA the mean values were 26.55±8.81kg FFM and 7.43±3.81 FM. No significant gender differences in age, body mass, height, TBW, FFM and FM. Significant positive relationship was found between body fat components determined by D2O and BIA with high significant positive correlations observed in girls.

Conclusion: It can be concluded that Bodystat underestimate fat mass and overestimate FFM and TBW compared to the deuterium dilution D2O technique in this sample of South African children.

Keywords: Body composition, bioelectrical impedance analysis

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Session Classification : Poster Session 3

Track Classification : Assessment
Problem of Obesity in Bosnia and Herzegovina and Use of Nuclear Techniques in Efforts to Counteract It

Undernutrition mainly occurs in vulnerable groups but poor dietary habits, lifestyle and food environment led to obesity among young children and adolescents that is recognised as one of the major public health challenges in both entities of Bosnia and Herzegovina. In Federation of Bosnia and Herzegovina entity 2% of children under five are underweight 2.6% wasted and 9.9% of children stunted but 17.7% are overweight. In Republik of Srpska only 0.5% of children under five are underweight while 20% are overweight.

In Federation of Bosnia and Herzegovina rates of overweight among adolescents are even higher with 22.3% being overweight and 3.9% obese. In Republic of Srpska 21.4% of adolescents are overweight and 8.3% are obese.

Having in mind noncommunicable diseases that present major disease burden with cardiovascular diseases being the major cause of mortality both in Federation of Bosnia and Herzegovina and Republic of Srpska entity, actions have been taken to counteract obesity and related health risks. In order to acquire accurate information on adiposity that would help shape strategies and responses to prevent and control it, at international level ten countries of South-Eastern Europe joined a regional project supported by IAEA on application of nuclear techniques for assessment of body composition using the deuterium dilution technique.

Portable Fourier Transform Infrared (FTIR) Spectrometer for deuterium analysis has been provided to Bosnia and Herzegovina and three more participating countries by IAEA. A joint framework protocol of pilot studies to establish reference and field methods to assess body composition and physical activity has been agreed and acquisition of ethical approvals in each country was the first step. Data collection of the pilot study is planned for September 2018 and in Bosnia and Herzegovina two pediatric nutrition counseling centers one in Mostar and one in Bjeljina have been selected for conduction of pilot study. The study will include 30-60 children aged 8 -10 years. Deuterium dilution technique will be conducted and saliva samples analysed in the Entity Institutes of Public Health. Bioelectrical impedance and anthropometric measurements will be performed. Optionally assessment of physical activity and food consumption and dietary habits will be made as well. Preliminary results are expected at the end of 2018.

Possibilities to include assessment of body composition using deuterium dilution technique within the WHO supported Childhood Obesity Surveillance Initiative (COSI) on a subsample of children has been discussed.

Assessment of body composition using nuclear techniques is a useful tool for generating accurate information on adiposity and thus can contribute to better understanding and shaping strategies to counteract obesity as well as to evaluation of existing and new interventions.

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Session Classification : Poster Session 3

Track Classification : Assessment
Contribution of isotopic techniques in the diagnosis of chronic non-communicable diseases: a community experience

Objective: In Argentina, chronic non-communicable diseases (NCDs) represent a relevant public health problem. Due to the importance to approach isotopic techniques at the service of the community, the aim was to conduct an evaluation of NCDs risk factors that included assessment of fat mass in adult population of Basavilbaso, located in Province of Entre Ríos, in support of the Project for the Protection of the Vulnerable Population against Chronic Non-communicable Diseases (PROTEGER) of the National Ministry of Health.

Methodology: Invitation to participate in the evaluation of risk factors was made in March 2018 at the Primary Health Care Center (PHCC) Pueblo Nuevo, which is located 325 km from country’s capital. Part of the work team, which belongs to Department of Nutrition, Faculty of Pharmacy and Biochemistry, University of Buenos Aires (UBA), moved to PHCC to perform the assessment. Inclusion criteria were: ≥18y, healthy or in treatment by NCDs. On study day, 19 women (W) and 9 men (M) (n=28) attended voluntarily. Data on pre-existing treatments and received medication were collected in a personal interview. Blood pressure (BP, mmHg), weight (kg), height (m) were measured and BMI (kg/m²) was calculated. Total body water was assessed by isotopic dilution technique and fat mass (FM%) was estimated. Measurement of deuterium enrichment was performed in a Shimadzu FTIR co-funded by IAEA and UBA. Blood sample was collected to determine glycemia (Gly, mg/dL), cholesterol (Chol, mg/dL) and triglycerides (Tg, mg/dL). 24-hour urine sample was collected to determine sodium (Na) and potassium (K) by atomic absorption spectrometry and estimate salt intake (SI, g/day). Previously, participants were trained to collect 24-hour urine sample and collaborators to help in the administration of deuterated water. After 15 days, participants received their individual report and it was organized a meeting at Hospital of Basavilbaso to show the results to the authorities of the Coordination Office of NCDs Prevention of Entre Ríos.

Results: 95% W and 66% M were overweight or obese. FM% was elevated in 100% W (41.7±5.4) and 78% M (28.3±7.5). Although 90% of the participants received antihypertensive, lipid-lowering and hypoglycemic medication, mean values of Gly, Chol and Tg were 117.5±64.4; 205.6±38.7 and 182.8±115.6; being elevated in 29%, 54% and 43%, respectively. BP was increased in 32% of participants. In addition, 72.5% presented SI higher than WHO recommendation of 5 grams/day (9.1±4.4) with a decreased K/Na ratio (0.4±0.2). Taking into account the sum of risk factors (FM%, Gly, Chol, Tg, BP, SI), 64.5% of participants presented three or more, being FM% elevated in 86%.

Conclusion: Community participation and application of isotopic techniques were successful. The study of risk factors in the population demonstrates the double burden of obesity and associated factors to the excessive consumption of sodium. Isotopic techniques contributed as a tool for better diagnosis of NCDs.

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Session Classification : Poster Session 3

Track Classification : Assessment
Contribution of body fat mass measurements in the
global assessment of nutritional status in
Argentinean children

Background: Excess weight is a public health problem in Argentina. BMI is used to evaluate overweight and obesity in national surveys. Taking into account that WHO defines obesity as an excessive fat accumulation that may impair health, its evaluation gained special significance as an associated risk factor. Previously, we observed high variability of fat mass in children when using different prediction equations obtained elsewhere. After receiving technical capacity during IAEA regional projects, we had the opportunity to assess fat mass in the community by isotopic dilution reference method. Objective: To evaluate fat mass in Argentinean children. Methods: 243 subjects, both sexes, 6-12 y, from Province of Buenos Aires, were evaluated. The work team moved to schools, health units and recreation centers to conduct the assessment. Children were weighed and measured and BMI (kg/m2) was calculated. Nutritional status was categorized into normal weight (N), overweight (O), obesity I (OI) and II (OII), according to BMI Z-score. Waist circumference (WC, cm) and skinfolds (SKF, mm) were measured. After a basal saliva sample was collected, children received an oral dose of 0.5g D2O/kg and a second sample was collected after 3 hours post-dose. Deuterium was determined by FTIR to obtain total body water, fat-free mass and fat mass (FM%). Discordance between BMI and FM% was analyzed, considering a suggested value of FM% ≤30% in girls and ≤25% in boys. Serum cholesterol and triglycerides (mg/dl) were determined in a subsample (n=97). Results: Overweight and obesity were 28% and 16%, respectively. FM% was 29.5±7.1 (Girls:32.7±6.2 vs Boys: 26.1±6.4,p<0.01). Gradual increase of FM% was observed either in girls (N=29.2±4.4 vs O=35.6±4.8 vs OI=39.3±4.5 vs OII=44.9±3.7; p<0.01) or in boys (N=22.9±4.4 vs O=27.9±4.7 vs OI=32.7±6.1 vs OII=40.4±4.6; p<0.01). It was found that 18% girls and 16% boys presented higher FM% than the suggested value, even with normal BMI. FM% was positively associated with WC (r=0.57,p<0.01), SKF (r=0.80,p<0.01), cholesterol (r=0.22,p<0.01) and triglycerides (r=0.45,p<0.01). Conclusions: This is the first approach in the knowledge of children’s fat mass in community based studies by isotope dilution technique in Argentina. An increase in adiposity associated with childhood obesity was observed; moreover, it should be noted that increased body fat was also found in normal-weight children. Considering that adiposity increases the risk of insulin resistance and dyslipidemia, the evaluation of fat mass is useful to identify children at risk who are not detected by BMI. Moreover, the positive association between fat mass and anthropometric variables allows them to be considered in the generation of validated prediction equations, not yet available, to contribute to monitoring programs.

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Session Classification : Poster Session 3

Track Classification : Assessment
Validation of impedance-based equations for the prediction of body composition as measured by deuterium dilution in North African Arabic children

Background/Objectives: Equations for predicting body composition are population-specific. The aim of this study is to cross-validate prediction equations previously published for the prediction of body composition using the deuterium oxide dilution (D2O) technique.

Subjects/Methods: Body composition was estimated by the Tanita impedance analyzer in 134 school children aged between 8 and 11 years. We tested the validity of prediction equations previously published and mainly those made on children aged between 8 and 10 years. Total body water (TBW) and Fat Free Mass (FFM) were determined using the D2O technique.

Results and discussion: The cross-validation of equations from the literature in our sample population showed significant correlations in boys and in girls. TBW predicted by Wells et al. and Leman et al. equations was significantly overestimated in girls. However, in boys, Wells equation gave an acceptable absolute bias of 0.36±1.18, (p=0.075). The bias was negative and significant in boys for Leman et al. Liu et al. equations significantly underestimated TBW and FFM in males and females. Rush et al. equation showed the higher absolute value for the bias (-5.54 Kg for boys and -5.58 Kg for girls), significant differences displayed by the paired-sample t test (<0.001), highest pure error and widest limits of agreement. Previous reports suggested that population-specific prediction equations might be developed for body composition assessment.

Conclusions: The assessment of body composition in children is essential to monitor nutritional status. Since body composition prediction equations are population specific, there is a need for a valid equation in Tunisian children.

Keywords: Deuterium dilution, body composition, total body water, fat free mass, impedance analysis, prediction equation.

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**Session Classification**: Poster Session 3

**Track Classification**: Assessment
The energy needs of adults aged 65 years and over using doubly labelled water: current evidence and opportunities for international data sharing.

Introduction: The World Health Organisation predicts that by 2050, the world’s population over 60 years will almost double to 2 billion and those over 80 years will almost triple from 125 million to 434 million. The challenges of the globally ageing population include impacts on the health, social, and economic systems. This shift in demographics has implications for nutrition science and practice. Assessment of energy and nutrient requirements are fundamental concepts however a synthesis of the evidence for total energy expenditure (TEE) has not been undertaken. For effective strategies to help manage nutrition-related chronic diseases and conditions, an accurate assessment of energy requirements is critical. The nuclear stable isotope technique of doubly labelled water (DLW) is the gold standard method for measuring TEE in free-living individuals. This study aimed to determine the extent of the international evidence for TEE measured using DLW in older adults (aged ≥ 65 years).

Methods: Participant level TEE data measured by DLW were identified using systematic review principles; the protocol was registered (PROSPERO registration CRD42016047549). Records of studies were included where all participants were aged ≥65 years, or where participant-level data could be obtained for those ≥65 years. There were no search restrictions on date, language or study designs of original research; reviews and conference abstracts were ineligible. Four databases (EMBASE, CINAHL Plus, MEDLINE complete and Cochrane Central) were searched up to July 2016. Title and abstract screening, then full text assessment of the identified records were undertaken by two independent evaluators. Where data at the participant level were not publicly accessible, attempts to contact the corresponding author by email to request access were made.

Results: The database search identified 1419 records, with another five identified via other sources. Full text of 317 records were reviewed, of which 170 were excluded mainly as a result of not meeting criteria for population (e.g. aged less than 65 years) and study design (e.g. energy expenditure not measured by DLW). Authors of the remaining 147 records were contacted to obtain participant level data not publically available. In total, data was obtained for 890 participants aged ≥ 65 years, and for only 248 participants aged ≥ 80 years. Data was unobtainable from approximately 67% of records for reasons including authors being unable to be contacted and or declining to participate and data no longer being retrievable.

Discussion: We have systematically reviewed the peer-reviewed literature to identify records reporting TEE measured in individuals aged 65 years and over. The majority of original data were irretrievable. The development of an international data repository is necessary to support future international research efforts, data sharing and reduce data loss over time.

A marked deficit of TEE measured by DLW in the older elderly (80 + years) was also evident. Use of stable isotopes are crucial in the development of contemporary energy expenditure data to inform policies and guidelines aimed to optimise the health and wellbeing of this rapidly growing age group.

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**Session Classification**: Poster Session 3

**Track Classification**: Assessment
Use of deuterium dilution technique in the assessment of sarcopenic obesity in urban Jamaican elderly

Introduction: Diagnosis of sarcopenia in the elderly, which is a reduction of muscle mass and muscle function and a major cause of frailty and disability, is not universally defined. Age-related increase in adiposity can also potentiate risk of cardiometabolic disease. Different techniques have been used to estimate muscle mass depending on cost, availability and portability. Lean body mass (LBM), measured using deuterium dilution technique (D2O), a relatively cheap and portable method, may be a surrogate for muscle mass. We aim to use this method with measurements of muscle function to assess sarcopenic adiposity.

Method: The study was non-randomized with non-probabilistic sampling of free living participants. LBM and fat mass (FM) were measured using DXA and D2O with saliva collection. These variables and DXA appendicular lean mass (ALM) were adjusted for height (kg/ht2) to give ALMI, LBM and FMI. Functional measurements were: 6-metre walk speed, 6-minute walk distance (6MIN-WALK), and handgrip force using a dynamometer. Two frequently used algorithms were used for sarcopenia diagnosis: the European consensus (EC) by Cruz-Jentoft et al (2010) and an International consensus (IC) by Morley et al (2011). Unpaired t-test, ranksum test and regression models were used to explore sex difference and association of body composition indices with measures of function controlling for age and sex.

Results: Participants were 56 females and 54 males, aged 60 to 80 years. LBMI and ALMI were significantly correlated (r-squared = 0.84, p = 0.000). Both were positively related to handgrip (p =0.000) but not related to the walk tests. FMI and BMI were negatively associated with the walk tests. The 6MIN-WALK was low in 35% of the participants compared to less than 10 % for the other functions. Using ALMI, 7 and 6 participants were classified as sarcopenic according to both IC and IS respectively, with 5 overlapping. D2O-LBMI was normal in all participants assuming similar cut points based on reported BIA-LBMI. Using the lowest quintile from the present data as a cut point for low D2O-LBMI (<15.25), 7 participants were sarcopenic by EC and 11 by IC: 50% of both were sarcopenic using ALMI.

In all participants, 51% were preobese and obese and 5% underweight. Among those estimated as sarcopenic: BMI was normal except one underweight; none above FMI 75th percentile; 45% had waist circumference > 83 cm and 63% were hypertensive.

Conclusion: Low sarcopenic cases (5% –10%) did not allow for analysis by sex (eg ROC analysis) to conclude if D2O-LBMI is a good surrogate for muscle mass. However, the results indicating that both D2O-LBMI and D2O-FMI have significant effects on overall muscle function suggest their potential use in diagnosis, but a larger study and diagnostic criteria cut points based on younger healthy Jamaicans are needed to improve this investigation. Fat infiltration of muscle may explain low 6MIN_WALK in ~30% of the participants. Abdominal obesity and not obesity according to BMI and FMI could have additive negative health effects with sarcopenia.

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**Session Classification**: Poster Session 3

**Track Classification**: Assessment
The effect of ambient evaporative loss on the reproducibility of deuterium oxide dilution measurements assessed by FTIR spectroscopy

IAEA endorses the use of stable isotope techniques to assess body composition in an effort to address public health nutrition impediments around the globe. In particular, the deuterium dilution technique has proven its superiority to anthropometric and bioelectrical impedance analysis by providing high-quality data under diverse experimental settings [1-2]. Total body water (TBW) is often used to assess human body composition in a two compartment approximation model (fat mass, FM, and fat free mass, FFM) under the assumption that the water to lean body mass ratio is constant. Fourier-transform infrared spectroscopy (FTIR) has been successfully used for measuring saliva and plasma with the deuterium dilution technique [1-2] providing high measurement precision and accuracy at low cost. However, for the successful application of FTIR in deuterium oxide dilution measurements, a rigid experimental protocol must be followed. A critical point to consider is whether changes in isotope concentration by evaporative loss or condensation can be eliminated. The aim of this study was to quantify the errors introduced by evaporative loss in diluted deuterium oxide samples of different concentrations, in ambient conditions, using FTIR spectroscopy. A wide O-D absorbance band appear in the mid-infrared region (2650–2350 cm\(^{-1}\)) as an unresolved multiple band, centered at approximately 2500 cm\(^{-1}\), involving combinations of symmetric (\(\delta\)) and asymmetric stretching (\(\gamma\)) modes. An Agilent 4500 Series FTIR spectrometer was used to measure the absorbance at the peak position (\(<2500\) cm\(^{-1}\)) of aqueous samples of deuterium, in different concentrations, with or without evaporative loss. Our results provide an estimate of the bias due to evaporation and subsequent isotope fractionation under normal and elevated ambient temperatures. Extrapolation of results to wider temperatures range, could suggest correction factors for the assessment of body composition using stable isotope techniques in varied lab and field settings.

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Session Classification: Poster Session 3

Track Classification: Assessment
The Use of Anthropometrics, BMI and Isotope Dilution Techniques in assessing Double Burden Malnutrition in Children (3-5 years) in the Northern and Southern part of Botswana

INTRODUCTION: Under-nutrition and over-nutrition have adverse effects of health and are both associated with negative human developments. In Botswana data is limited on the prevalence of these conditions; moreover the existing data is at best equivocal. There is also evidence of high stunting rates in children under five years of age. Therefore, there is a critical need to explore assessment tools and techniques that are reliable. The aim of this study was to assess the prevalence of under and over-nutrition using three different assessment techniques.

METHODS: This was a descriptive cross sectional survey conducted on 197 children under five years of age who were attending growth monitoring as a standard component of paediatric services. Convenience sampling was used to enrol children who met the inclusion criteria of the study. Weight and height were measured using calibrated instruments and data was entered into the World Health Organization Anthro software to calculate z scores. Stunting was defined as <-2SD for height for age and overweight as >+2SD for weight for height. BMI was also calculated and the CDC gender and age specific growth charts were used to classify the children. Below 5th percentile was considered as underweight and greater than 85th percentile as overweight. Finally, for the deuterium (D2O) dilution technique which is used to assess body fat mass percentage, DBM was defined as fat mass percentage < 13% for boys and < 23% for girls (low fat mass) and > 20% for boys and >30% for girls (high body fat) as under- and overnutrition respectively. Results are presented as means: standard deviations (SD), ranges for continuous data and percentages for categorical data. ANOVA was run to compare group means of particular methods. Results were significant at p<0.05.

RESULTS: The prevalence of undernourished and over-nourished were 12.2% and 2.5% respectively using z scores classification whilst using the BMI method, 11.2% were undernourished whereas 53.8% were over-nourished. When using Deuterium(D2O) dilution technique, 46.7% were found to be undernourished and 14.7% were over-nourished. Further analysis showed a statistical difference in the methods of assessment towards under-nutrition as shown by one-way ANOVA (F (2, 134) = 367.1, (p <0.00001)). Similarly, with over-nutrition there was a statistical significance in the measurement of over-nutrition using the three methods as shown by one-way ANOVA (F (2,136) = 299.7, (p <0.00001).

CONCLUSION: Despite the differences in the prevalence rates by the three methods all revealed the co-existence of under and over nutrition. It is evident that the burden of underweight and overweight are a problem in children in Botswana, hence government should intensify efforts in putting in place effective strategic programmes and address the gaps in the current programmes with a view of promoting the health of children in Botswana. More extensive research with a representative sample is required to further validate these findings.

Keywords: Double burden malnutrition, Under-fives, Isotope dilution technique, Anthropometrics, BMI

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**Session Classification**: Poster Session 3

**Track Classification**: Assessment
INTRODUCTION
Namibia is faced with the “double burden of malnutrition” with undernutrition coexisting with over nutrition in the population. Children are exposed to ultra-processed, energy-dense, nutrient-poor foods, which are cheap and readily available. Opportunities for physical activity have been reduced and more time is spent on screen based and sedentary leisure activities. The findings of the Namibia Demographic and Health Survey (NDHS 2013) among children under 5 years showed that 24 percent were stunted, 6 percent were wasted, 13 percent were underweight and 3 percent of children were overweight. However nutritional status data on older children aged 5-14 years was not included in NDHS 2013 necessitating for a study to be conducted among school children aged 8-11 years old from public urban schools in Windhoek to assess the magnitude of obesity and determine body composition using stable isotopes and BMI for age. Overweight and obese children are likely to stay obese into adulthood and develop non-communicable diseases at a younger age (World Health Organization, 2016).

METHODS
A cross-sectional study was conducted among randomly chosen school children aged 8-11 years. Permission to conduct the study was granted by Ministry of Health and Social Services Ethical Committee. A total of 155 school children including boys and girls were assessed for anthropometry and body composition. WHO reference tables (2006) were used to categorize obesity (BMI-for-age >+2SD), overweight (BMI-for-age >+1SD) and wasting (BMI-for-age <-2SD). The percentage of body fat was estimated by deuterium dilution technique and saliva samples were analysed using the Fourier Transform Infrared Spectrometry (FTIR) machine. Using body fat percentage, boys with percentage >25% and girls with percentage >30%, were considered to be overfat and at risk of cardiovascular metabolic disease (CMD) (Pablo et al, 2015). Data was analysed using the Statistical Package for the Social Science (SPSS) version 19.

RESULTS
The findings of the study revealed that the prevalence of overweight and obesity using BMI-for-age in girls was the same 18.4% while in boys it was 10.3% and 16.2% respectively. Seven percent of boys were wasted compared to almost 5% of the girls. Determining body fat percentage by deuterium dilution showed that girls had a significantly higher mean percentage fat mass 25.4 ± 9.2 than boys 3.3 ± 8.5 (p<0.005). Additionally, 50% of the children had high body fat using deuterium dilution method compared to the prevalence of overweight and obesity of 32% by BMI-for-age z-score. These results showed that BMI-for-age under estimates obesity.

CONCLUSION
Underweight and overweight among children needs to be tackled. An integrated approach to tackle all forms of malnutrition is of importance. The study was conducted with support from the Ministry of Health and Social Services and the IAEA, through the TC project NAM6042 "Applying nuclear techniques to design and evaluate interventions to reduce obesity and related health risks in children."
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Session Classification : Poster Session 3

Track Classification : Assessment
Body composition using the deuterium oxide technique in older people from Uruguay

Introduction: In the last few decades, Latin American and Caribbean region has been experiencing a series of demographic, epidemiological and nutritional transformations, which in the nutritional field have led to the double burden of malnutrition (DBM). This phenomenon is characterized by the coexistence of overweight, obesity and malnutrition. This problem is more serious in vulnerable groups, such as older adults. Uruguay has the oldest population in Latin America (14%) and no previous body composition studies have been done.

Objective: determine the nutritional status and body composition using the deuterium oxide method in older adults.

Methods: A cross-sectional study was done in 81 community-dwelling, non-disabled older subjects (63 women, 18 men), aged 65-89 years from the Departamento de Geriatría y Gerontología, after signing an informed consent approved by the Ethics Committee. Weight and height were measured and body mass index (BMI=kg/m²) was calculated to assess their nutritional status. Obesity (O) was defined as BMI≥32, overweight (OW) BMI=28-31.9, normal (NW) BMI=23.1-27.9 and underweight (UW) BMI≤23. Total body water (TBW) was assessed using the deuterium (²H) dilution technique. Before consumption of a dose of the isotope, a sample of saliva was collected to determine the basal ²H concentration in the body. A second saliva sample was collected 3 hours later. The enrichment of deuterium in saliva samples was measured in the Laboratorio Tecnológico de Pando. Fat-free mass (FFM) was calculated by dividing the TBW (kg) by the hydration coefficient (73.2%).

Results: With reference to age, 58% were 65-74 years and 42% 75-89 years. 45.7% of the older adults were NW, while 38.3% were OW/O and 16.1% UW. There are differences between sexes in anthropometric and body composition parameters. Women had lower values of height, weight, TBW (kg), FFM (kg), Fat-free mass index (FFMI) and higher Fat-mass (FM (kg)), FM% and Fat-mass index (FMI) than men (p<0.05).

Older men and women (75-89 years) had lower mean values of BMI, weight, TBW (kg), FFM (kg) and FM (kg) than younger men and women (65-74 years) (p<0.05).

However, in both sexes older people had higher average %FFM than younger elderly people (men 75.29±3.6SD vs. 69.65±5.6SD p = 0.02; and women 62.97±6.5SD vs. 59.35±4.4SD p = 0.01). The average %FM decreases at greater age in men and women (men 30.45±5.6SD vs. 24.70±3.6SD p = 0.02 and women 40.66±4.4SD vs. 37.02±6.5SD p = 0.01). In both sexes, as the BMI increases, the average values of the body composition variables also increases. Only the %FFM decreases.

Conclusions: Obesity and malnutrition were found in this study. There were statistically significant differences in body composition according to sex. With increasing age, %FFM increases in men and women and %FM decreases.

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Track Classification : Assessment
Lactating mother’s high body fat measured by stable isotope technique coexisting with high risk of 4 to 5.5 months stunted children in rural Southern Benin

Introduction: The burden of malnutrition is well known in Benin under all its phenotypes. In 2005, Ntandou et al, found that the undernutrition child coexisted with maternal overweight or obesity in 16.2% of the households. Ten years after, Sossa et al, showed that the prevalence of children’s undernutrition and mother’s overweight/obese in the same household was 21.68% and was associated to food insecurity. Those studies used body mass index (BMI) to determine overweight/Obesity. According to De Lorenzo (2013), BMI does not measured percentage of body fat (PBF) directly and poorly distinguishes total body fat from total body lean or bone mass.

Objective: The study aims to determine the prevalence of the double burden of malnutrition as phenotype overweight of lactating mothers and the risk of 4 to 5.5 months stunted child.

Methods: A hundred and tree (103) lactating mothers at 4-5.5 months post-partum were recruited to assess their effective practice of exclusive breastfeeding using the deuterium oxide dose-to-mother technique. The weight and height/length of mother and child were measured first day of the study and have been used to calculate anthropometrics index (BMI and Length-for-Age Z-score). The back-extrapolation method as part of the dose-to-the mother turner technique of estimated human milk intake in breast-fed infants, following AIEA standards procedures, was used to find the percentage of maternal body fat (PBF). Length-for-age Z-score <-1 SD was considered to be the cut-off point of Risk of Stunted Child (RSC). BMI ≥ 25Kg/m2 or PBF ≥ 29 % was classified maternal overweight. In each household, prevalences of maternal overweight’s BMI/Risk of Stunted Child (MOB/RSC) and maternal overweight’s PBF/Risk of Stunted Child (MOP/RSC) were calculated.

Results: About 36% of children were at risk of stunting while 21% of mothers were overweight’s PBF in the same community. Prevalence of maternal overweight’s BMI was 13.6% which is low than maternal overweight’s PBF (21%). Also, in the same household, the Double burden of malnutrition as MOB/SRC and MOP/SRC had equal value to 7.8% (figure 1).

Conclusion: The coexistence of maternal overweight and child at risk of stunting was observed in the households. That shows one more, the double burden occurrence in Benin. The prevalence of obesity by PBF using stable isotope technique was greater than that of obesity measured by BMI. Early nutrition specific interventions for mothers and their children are needed.

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**Session Classification:** Poster Session 3

**Track Classification:** Assessment
Body composition assessment of young adults in Mauritius: comparison between dual-energy X-ray absorptiometry and isotope dilution technique

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Background & Aims: Both dual-energy X-ray absorptiometry (DXA) and isotope dilution technique with deuterium oxide (D2O) are widely used as reference methods for body composition assessments. There are, however, very few studies that have compared these two reference methods, let alone in non-Caucasian ethnic groups. We compared here the estimates of body composition by DXA and isotope dilution D2O technique in healthy adult Mauritians belonging to the two main ethnic groups on the island, namely Indians (South Asian descent) and Creoles (African/Malagasy descent).

Methods: We studied 90 healthy adult Mauritians (54 women and 36 men, aged 20-43 years) of Indian and Creole descent and with a wide range of BMI (15 – 44 kg/m2). Whole body scan was performed by DXA Hologic Horizon® Wi (software version: APEX™ 5.6.0.5) and isotopic enrichment was assessed in saliva by FTIR spectroscopy. The degree and limits of agreement between the estimates of body composition (fat mass and fat-free mass) determined by the two techniques were assessed by the Bland-Altman method.

Results: The mean age and BMI were (27.5 ± 5.3) years and (25.7 ± 5.3) kg/m2, respectively for men, and were (27.4 ± 5.6) years and (23.9 ± 4.9) kg/m2, respectively, for women. Relative to the isotope dilution technique, DXA showed lower values for fat-free mass by about 6% (95% CI: -7.3, -4.7) and higher values for fat mass by about 19% (95% CI: 13.8, 23.9), with the Bland-Altman analysis showing wide limits of agreement. The mean bias, however, was independent of the degree of fatness, and did not differ according to gender or ethnicity.

Conclusions: Our study revealed substantial differences and poor agreement in the estimations of fat-free mass and fat mass by these two widely utilized reference methods. Consequently, these two methods - DXA and isotope dilution technique - cannot be used interchangeably for the estimation of body composition in Mauritian adults.

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Session Classification : Poster Session 3

Track Classification : Assessment
Evaluating an Intervention Programme on Obesity and Obesity Related Risk Factors in Children

The current prevalence of overweight and obesity among school-aged children (5-16 years) was 27.5% in 2017. Between 1998 and 2017, the prevalence of combined overweight and obesity has doubled in children (from 11% to 27.5%) in Seychelles and is high or higher than many western countries.

Although childhood obesity is a concern in Seychelles there is little information about growth quality. The primary aim of this study was to assess body composition using the criterion stable isotope technique (deuterium oxide dilution [2H2O]), and anthropometry (weight, height, waist circumference) in 8 to 10 year-old children in primary four level. The study had two phases. Phase 1, was a capacity building of personnel involved in the study on the use of the stable isotope technique, administration of questionnaires, anthropometric measurements and use of accelerometers. Phase 2 was a cross-sectional study which involved the assessment of body composition through the administration of deuterium oxide dilution to eligible children, completion of questionnaires and measurement of physical activity.

The main outcome from this study was that under-malnutrition is not a public health problem among the studied children but malnutrition by excess is an important health problem among schoolchildren. Indeed, the assessment of the obesity by using isotope techniques and William’s recommendation (%FM >25% for boys and >30% for girls) show a very higher prevalence of obesity among those children (54%). However, the assessment by using anthropometry (BAZ) seems to underestimate the prevalence of fat excess. By using anthropometric technique 15% of children who are supposed to be normal had actually a higher percentage of fat mass. In comparison with other African countries, the prevalence of the obesity among schoolchildren using similar assessment technique and using similar cut-off point for obesity shows that Seychelles has the highest obesity prevalence followed by Mauritius 41%, Ghana being the lowest with only 3%. The food habit shows that more children consume daily sugar sweetened beverages, energy dense snacks, milk and milk product and refined grains. However, the fruits, vegetables and whole grains were consumed daily by fewer children. Otherwise, a higher percentage of children are exhibiting sedentary behaviour; 57% watched TV and 28% played electronic device on school days at least for 2 hours per day. By using accelerometry, it seems that most children were engaged in sedentary or light physical activity. Only the quarter of children meet the recommendation for physical activity (MVPA ≥ 60 min/day). The only activity which seems to impact the fat mass compartment in our study is the vigorous physical activity. Indeed and according to fat mass excess, children who had a normal rate of fat mass spend more time (15 min/d) in vigorous activity than those who had an excess of fat mass or obese (11.2 min/d).

Obesity in school-aged children is a serious public health problem in Seychelles, one out of two children aged between 8-10 years old is obese. Integrated and complementary actions must be maintained to reduce and control this malnutrition recognized not only as risk factor for non-communicable diseases but as a disease of its own by WHO since 1997 (WHO, 2003).

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**Session Classification**: Poster Session 3

**Track Classification**: Interventions
Measuring body composition with bio-electrical impedance analysis in acutely malnourished children: lessons from operational research

**Background:** Bio-electrical Impedance Analysis (BIA) is a noninvasive and relatively simple assessment of body composition via a harmless electric current using portable equipment. Height-adjusted resistance and reactance values obtained hence can be plotted on a graph and the vector displacement analyzed relative to a reference population. This bio-electrical impedance vector analysis (BIVA) is proposed to visualize changes in the magnitude of fat-free tissue and hydration status, and may provide useful information on the evolution of a disease or the success of a therapy.

Severe acute malnutrition (SAM) in children 6 to 59 months is a condition currently diagnosed based on weight-for-height and/or mid-upper-arm circumference cut-offs or presence of bi-pedal edema. These simple body measures do not distinguish between the type of tissue lost or regained, or health status. BIA could potentially fill this gap, establishing the severity of the condition and informing on the success of the therapeutic approach. Body composition following treatment should reflect that of normal children to avoid relapse and long-term risk of chronic disease. More data is needed from representative samples of SAM children to understand their body composition upon admission and at discharge from therapeutic treatment. This information is crucial in understanding the potential need to revise the treatment and its targeting, in order to optimize health outcomes of SAM children treated and to ensure those most in need receive adequate attention and care.

**Methods:** The challenge in measuring BIA among SAM children is obtaining good quality raw data. We sought to capitalize in a Technical Briefing report the lessons learned upon implementing BIA measurements on SAM children without edema participating in clinical trials in Burkina Faso, Liberia and Bangladesh.

**Results:** First, the BIA analyzer should measure resistance between 0-1700 Ohms and preferably operate on battery. Secondly, test the measurement and the quality scale on the target population and train the teams. Seek to identify tricks to relax and keep children calm and immobile during the measurement. Thirdly, prepare the material, calibrate the device and identify a calm and comfortable place to perform the measurement. Fourth, place the child on their back on a thin mattress, arms towards the lower body not touching the torso, lower limbs separated. Attach the electrodes making sure to leave a minimum of 3 cm distance from each other moving the receptive electrode up the arm or calf if necessary. Fifth, start the device, wait (maximum 2 minutes), note down the results and evaluate the quality of the measurement.

**Conclusions:** BIA is an easy body composition measurement suitable for operational research settings and relatively simple to adapt to different contexts and target populations. Five steps guide the user to obtain quality measurements. Research on appropriate SAM diagnosis, treatment effectiveness and its long-term consequences should systematically evaluate body composition as a necessary way to move beyond anthropometry and get to physiological information. This more detailed information could lead to the optimization of current treatment protocols.

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**Session Classification**: Poster Session 3

**Track Classification**: Assessment
The relationship of breast milk intake as assessed with deuterium dilution on haemoglobin levels of infants in urban Jamaica

Introduction
The WHO recommended exclusive breastfeeding for the first six months of life and continued breastfeeding with complementary foods for up to 2 years, to achieve optimal growth, and development. Despite this recommendation however, the prevalence of exclusive breast feeding for the first 6 months in Jamaica remains low. The concentration of iron in breast milk is low (0.2–0.4 mg/L); but it is highly bioavailable, compensating for its low concentrations. Iron is required for the synthesis of tissues and growth. Notwithstanding, in Jamaica, the prevalence of iron deficiency anaemia, IDA, in children <5 years is estimated at ~ 30 %. It is unclear how this relative low proportion of exclusive breast feeding in Jamaica will impact on nutrient (particularly iron) intake of infants, in the first year of life. This study aims to relate breast milk consumption on haemoglobin levels in Jamaican infants during the first year of life.

Method
A longitudinal and observational study was designed using 29 child-mother pairs recruited from the postnatal ward of the University Hospital of the West Indies. Breast milk intake was measured at 6 weeks using dose to mother deuterium dilution technique. Haemoglobin levels were measured (using the Cell-Dyn Ruby System Abbott core Diagnostics) at 6 weeks, 6 months and 12 months postnatal age. Summary statistics was used to summarise the data and repeated measures anova and pairwise comparison were conducted to determine the variation of haemoglobin concentrations at all time points.

Results
Ten or 30% of the infants were found to be exclusively breastfed with mean intake of breast milk to be 1001.6 ± 278.5 g/ day contrasting with 19 infants who were not exclusively breastfed consuming 697.9 ± 374.2 g/day of breastmilk. Haemoglobin levels in the exclusively breastfed group were 10.1 ± 0.9 g/dL, 10.8± 0.9g/dL and 11.1± 1.2g/dL while the mixed fed group values were 9.8± 1g/dL, 10.6± 0.8g/dL and 11.5±0.8 g/dL at 6 weeks, 6 months and 12 months respectively. The mean haemoglobin level in the breastfed group was not different to that of the mixed fed group at all time points (see Figure 1).

Conclusion
We were able to demonstrate quantitative measurement; the most reliable assessment of breast milk intake, for the first time in Jamaica. The data suggest that there is no difference in haemoglobin levels between the feeding groups. Infants are born with ample stores of iron that is sufficient to sustain metabolic activities for up to 6 months of age. Therefore, the type of feed may not have an effect on the existing levels at 6 weeks of age. At 6 and 12 months; the period beyond exclusivity, the lack of significant difference in the haemoglobin levels, could be related to a similar feeding pattern between the feeding groups. Furthermore, the sample size may not be sufficient to produce a statistical significant difference between the groups.

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Session Classification : Poster Session 3

Track Classification : Assessment
Relationship of body mass index to percent body fat determined by deuterium isotopic dilution and impedancemetry among schoolchildren in Tunisia

Background/Objectives: The study of body composition is an important step in the evaluation and assessment of nutritional status. This study aims to evaluate the body composition of children by two techniques impedancemetry and deuterium oxide dilution (D2O) and to determine the correlation between nutritional status, socio-economic level and dietary habits.

Subjects/Methods: This study was carried out in 156 schoolchildren aged between 8 and 11 years. The children received interrogation specifying lifestyle and food habits. We conducted the study of body composition using two techniques: the technique of impedance and D2O technique.

Results: The results showed a difference between the percentage of obese and overweight children according to the BMIZ classification (30.1%), the impedance technique (14.7%) and the D2O technique (42.9%). Despite the difference between the last two classifications, we found a significant correlation between body fat percentages determined by impedancemetry and D2O technique ($r = 0.695$). There was no observed association of obesity with socio-economic level since the majority of overweight/obese children (73.1%) were of middle socio-economic class. The study of eating behavior has shown frequent consumption of sugary foods and fast foods. However, no significant correlation was found between the overweight/obesity status and eating habits.

Conclusion: This study has demonstrated that the prevalence of overweight and obesity varied according the methods used. Thus, it would be interesting to use the technique of isotopic dilution as a reference technique for the real determination of the obesity prevalence and therefore a better monitoring of this public health problem.

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Session Classification : Poster Session 3

Track Classification : Assessment
Use of different international criteria to quantify under and over nutrition in children and adolescents in Ho Chi Minh City, Vietnam—the need for consensus on optimal definitions

Introduction
Consensus on the criteria by which to define and estimate the double burden of malnutrition is required, but this is lacking for Asian children for whom different criteria are being used. There is general agreement that Asian populations require lower cut-points to identify overweight and obesity than Western populations, [1-3] but these cut-points have not been well-established for children and adolescents. We therefore used data from a large nutrition survey of school-aged children in Ho Chi Minh City (HCMC) to quantify the prevalence of under-nutrition (thinness) and over-nutrition (overweight, obesity, abdominal obesity), Vietnam, comparing the different international criteria.

Methods
We estimated prevalence of under and over-nutrition in a cross-sectional survey of 10,949 school-aged children and adolescents (6 – 18 years old) in HCMC, Vietnam. A representative sample of children was selected from 30 schools (primary, secondary and high schools) in the school year 2014-2015. The following criteria were used:

**Definition WHO [4]**
BMI-for-age Z-score < -2 SD Age and sex –specific cut-points of BMI < 18.5 (kg/m²) Age and sex –specific cut-points of BMI < 18.5 (kg/m²)

**Overweight**
BMI-for-age Z-score > + 1 SD and ≤ 2 SD Age and sex –specific cut-points of BMI ≥ 25.0 (kg/m²) and < 30.0 (kg/m²) Age and sex –specific cut-points of BMI ≥ 23.0 (kg/m²) and < 27.0 (kg/m²)

**Obesity**
BMI-for-age Z-score > + 2 SD Age and sex –specific cut-points of BMI ≥ 30.0 (kg/m²) Age and sex –specific cut-points of BMI ≥ 27.0 (kg/m²)

**Abdominal obesity**

Summary prevalence estimates of all nutritional status indicators were weighted based on the population of students in each stratum (urban or rural) at each school level, and the proportion of surveyed students in each school, using the “svyset” command in STATA version 12 (College Station, Texas 77845 USA).

Results
Regardless of definitions used, the prevalence of over-nutrition was high, particularly in primary school-aged children (20-30% were overweight, 20-30% were obese, and about 50% had abdominal obesity). Undernutrition among school-aged children and adolescents still coexists, with the prevalence varying from 2% to approximately 20%.

The prevalence of over-nutrition, using general international criteria (WHO and IOTF) was substantially lower than those using Asia-specific criteria (IOTF-Asia), particularly in high school children (Figure). The prevalence of abdominal obesity using a Chinese reference population was considerably higher than those using a United States reference population (45.7% vs 22.7% for primary school), and the difference was larger in secondary (42.3% vs 11.9%) and high school-aged children (33.7% vs 8.9%, respectively).
Conclusion
General international criteria may underestimate the prevalence of overweight and obesity in children and adolescents in HCMC, Vietnam. These findings highlight the need to achieve a consensus for definition of childhood obesity in Asian populations. They also highlight the urgent need for greater efforts to address the double burden of malnutrition in children and adolescents in HCMC, Vietnam.

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Session Classification : Poster Session 3

Track Classification : Assessment
Using accelerometry devices to capture intra-household seasonal patterns of energy expenditure, time-use, and food intake in agricultural and rural livelihoods: Findings from Ghana

In this study we integrate energy expenditure data from wearable accelerometry devices with data on time-use and food intake to capture seasonal intra-household differences in agricultural and rural livelihoods in developing country contexts. We report the preliminary findings from a study in Northern Ghana respondents wearing accelerometry devices for four non-consecutive weeks (7 days) matching key phases of the agricultural season, i.e. land preparation, sowing and seeding, land maintenance, and harvest. The accelerometer data triangulated with individual daily survey on time-use and food intakes provide a robust and precise delineation of seasonal gender-differentiated intra-household allocation of food and labour in rural households. Results will provide a seasonal dimension to agriculture-nutrition linkages in developing countries. We conclude discussing the potential applications of using accelerometry devices for a better understanding of agriculture-nutrition linkages in developing countries.

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Session Classification : Poster Session 3
Track Classification : Assessment
Body composition during first year of life in a cohort of healthy Pakistani children

Introduction: Human growth during the first 2 years of life includes not only quantitative changes in body size, but also qualitative changes in composition. Body composition assessment provides an accurate measurement of growth and nutritional status of babies as compared to anthropometric measurements. In this longitudinal study we aimed to estimate body composition of babies studied during the first 2 years of life. This reference data will improve the understanding of the association between physical growth, body composition, health, and risk of non-communicable disease in later life.

Methods: A Multicenter body composition reference study was carried out at the Aga Khan University hospital Karachi, in collaboration with IAEA using stable isotope technique. The aim of this study was to produce normative body composition reference data in healthy term infants from age 3 to 24 months. Repeated anthropometric and body composition measurements were performed on 170 healthy term infants at 3, 6, 9, 12, 18, and 24 months of age. Body composition assessment was performed by deuterium dilution method. Total body water (TBW) was calculated, to estimate the amount of fat free mass FFM. Fat mass (FM) was then calculated as the difference between body mass and FFM.

Results: The mean ± SD birth weight and length of the infants were 3.10 ± 0.37 kg and 49.04 ± 1.65 cm, respectively. Mean gestational age was 38.50 ± 2.32 wk. We know FM and FFM is age dependent and gradually increase with age; in our study we found a similar trend. FM%, increased in girls and boys up to 6 months (girls 20.92 ± 4.63 to 24.31 ± 5.63; boys 18.9±4.52 to 20.99 ± 4.65) and thereafter it reduced in both gender but more in boys than girls (Figure). However FM% was significantly higher in girls across all time points (p=0.037).

Conclusion: This is the first longitudinal study evaluating the body composition of healthy Pakistani children in the first 2 years of life. Our study shows that the fat mass is comparable in both genders till 6 months of age. This may be due to similar feeding practices i.e. milk being the predominant nutrition offered to this age group. However females tend to loose less fat compared to the males. This aspect needs to be further explored.

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**Session Classification:** Poster Session 3

**Track Classification:** Epidemiology
The association between stunting, wasting and breastfeeding, and fat-free mass and fat mass in Kenyan children aged 6 and 15 months

Introduction: It is important to understand the linkage between nutritional status, growth, breastfeeding and body composition in order to design interventions to prevent growth faltering, but few data from low- and middle-income countries are available. The objective was to assess the role of nutritional status and other correlates of body composition in Kenyan children aged 6 and 15 months.

Methods: Four hundred and forty nine infants were enrolled in an observational study embedded in a nutrition intervention trial conducted in rural Kenya. Infants were enrolled at 6 months of age. Anthropometric measurements were conducted, and fat-free mass (FFM) and fat mass (FM) were measured with the deuterium dilution technique when the children were 6 and 15 months of age, respectively. Linear regression was used to assess the association of sex, breastfeeding, stunting and wasting as correlates of fat-free mass index (FFMI), fat mass index (FMI) and body mass index (BMI).

Results: At the age of 6 months, boys had a 0.45 (95% CI 0.10-0.80) kg/m² higher FFMI compared to girls. There was no difference in FMI. A similar pattern was seen when the children reached the age of 15 months. Those who stopped breastfeeding before the age of 15 months (11%) had a 0.10 (95% CI -0.60; 0.40) kg/m² lower FMI when they reached 15 months. At 6 months, stunted infants had a 0.28 (95% CI -0.85; 0.29) kg/m² lower BMI than infants with LAZ above 0, due to 0.66 (95% CI -1.08; -0.23) kg/m² lower FMI, but not FFMI. Stunting was not associated with body composition at 15 months of age. Wasted children had both lower FMI and FMI at 6 and 15 months of age.

Conclusion: Further research is needed to establish the relation between these early changes in body composition and later body functions and the risk of infectious and chronic diseases.

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Session Classification: Poster Session 4

Track Classification: Epidemiology
Food Security and Prevalence of Anemia Chronic Nutrition in Children (AS) Under Five Years of the Indigenous Communities Ashaninkas Puerto Ocopa, Puerto Prado, Peru

Introduction: Food security is a complex phenomenon that explains the biopsychosocial, nutritional and economic relationship especially in vulnerable indigenous populations.

Objectives: Determine the relationship between food security and prevalence of anemia, chronic malnutrition in children under the age of five in the native communities of Puerto Ocopa, Puerto Prado.

Materials and methods: Analytical cross-sectional study the population was selected families that had at least one child under 5 years of age, in the Asháninka native communities of Puerto Ocopa, Puerto Prado Perú, with a sample of 34 children under 5 years of age, the statistical program SPSS v.22.

Results: 8.8% of families have moderate food insecurity, 91.2% severe food insecurity; 14.7% have severe anemia, 29.4% moderate anemia, 50% mild anemia and only 5.9% have no anemia, 29% have chronic malnutrition and 29.8%. Severe chronic malnutrition, 41.2% does not have anemia. Significant feeding relationships were nutrition during pregnancy and prevalence anemia p valué = 0.005, destination of the agricultural production that has and prevalence of anemia p valué = 0.023, Predominant material of the ground floors and prevalence of anemia p valué = 0.001, the frequency of consumption of corn and prevalence of anemia p valué = 0.015, consumption of beef, sheep and pork and prevalence of anemia p valué = 0.050, frequency of tomato consumption and prevalence of anemia p valué = 0.047, frequency of consumption of celery and prevalence of anemia p valué = 0.040, frequency of cassava consumption and prevalence of anemia p valué = 0.014 consumption of water destined for drinking and prevalence of anemia p valué = 0.049, consumption of boiled water and prevalence of chronic malnutrition p valué = 0.012, lactation maternal and chronic malnutrition p valué = 0.019, frequency of rice consumption and prevalence of chronic malnutrition p valué = 0.008, frequency of consumption of palm oil and chronic malnutrition p valué = 0.024, frequency of consumption of sugarcane and chronic malnutrition p valué = 0.018, frequency of consumption of yellow vegetables and chronic malnutrition p valué = 0.004 Food security is significantly associated with chronic malnutrition ( p valué = 0.019). Food safety is significantly related to the prevalence of anemia p valué = 0.04. Conclusions: Chronically malnourished children mostly live in households affected by severe food insecurity. Children with mild, moderate, severe anemia live mostly in homes affected by severe food insecurity.

Keywords: Security food; Chronic malnutrition; anemia Hand washing; Breastfeeding; (source: DeCS BIREME).

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Session Classification : Poster Session 4

Track Classification : Epidemiology
The potential contribution of small fish to dietary nutrient adequacy and nutritional status of women of reproductive age and under-five children in Zambia

This study examined the determinants of food consumption patterns amongst women of child-bearing age and children aged 6-59 months from urban poor settlements of Lusaka, with particular emphasis on the role of fish on dietary micronutrient contribution and nutritional status of women and children. A cross-sectional survey design was applied, in which 714 mother-child dyads were enrolled. A three-stage randomized cluster sampling approach was applied. A 24 hour recall and food frequency questionnaires were used to collect dietary data. The Calculator of Inadequate Micronutrient Intake (CIMI) programme, adapted for Zambia was used to calculate the nutrient intake and establish potential micronutrient gaps in women and children. The mean dietary diversity scores among children aged 6-23 and 24-59 months were 2.98 (±1.27) and 3.478 (±1.07), respectively. In children aged 6-23 months, there was a significant difference in their nutritional status, based on fish consumption ($\chi^2=10.979$, df = 2, p=0.004). Women and children from poorer households consumed mostly small fish (Kapenta). The quantity of fish consumed by children was significantly associated with stunting in both age groups, odds ratio=0.947 (95% CI: 0.896, 1.000) for children aged 6-23 months and odds ratio=1.038 (95% CI: 1.006, 1.072) for children aged 24-59 months old. Other significant risk factors for stunting in children aged 6-23 months were: child’s age, mother’s body mass index, access to treated water and child morbidity. Child’s age, mother’s educational level and wealth status were determinants of dietary diversity in children aged 6-59 months as shown by the Poisson regression. The mean nutrient intake of the study population for most micronutrients was below the recommended daily allowance (RDA). Children aged 6-12 months and 12-36 months had much lower micronutrient intakes, based on the RDA. Micronutrient gaps in children were observed in the following micronutrients: vitamin B2, vitamin B12, folic acid, potassium and magnesium. T-test indicated significant differences in the mean intakes of vitamin B2, vitamin B12, potassium, and magnesium amongst women and children who consumed fish and those who did not consume fish.

Conclusion:
Nutritional status of children aged 6-23 months is associated with fish consumption, with children consuming fish less likely to be stunted. Small fish (Kapenta) is an animal-source food that is particularly important in the diet of children in Zambia, contributing to better nutritional outcomes, and having the potential to increase the intake of several micronutrients, for example, niacin, vitamin B12, calcium, iron and zinc, and to a lesser extent, vitamin B2. Therefore, an increased consumption, both in frequency and in portion size of fish, especially small fish should be promoted to improve the micronutrient status of women and young children in Zambia.

Key words: Food and nutrition security; nutritional status, fish; dietary diversity, undernutrition, children, women, micronutrients, Zambia

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Track Classification : Epidemiology
Content of iron and vitamin A in participatory improved complementary dishes for children in Central Uganda

Background: In many Ugandan households’ complementary foods are starchy staple-based meals that often lack micronutrient such as vitamin A and iron needed for adequate growth and development. Participatory improvement of complementary foods using locally accessible ingredients is an effective intervention to improve child growth. An earlier cross-sectional study, followed by in-depth interviews and observations with selected households and laboratory analysis established that the common complementary foods for children 6-24months in Uganda are either based on maize or cooking banana. The common maize-based porridges had no trace of either vitamin A or iron while the banana-based dishes indicated no negligible levels of iron and very low levels of vitamin A (23-43 RAE ug/100gep). Considering the estimated average requirements of iron and vitamin A for children 1-3yrs being 5mg/day and 275 RAE ug/day respectively, these foods are poor sources of these nutrients in their current form.

Methods: Based on vitamin A and iron gaps in the common dishes, a recipe modification model for five dishes was developed using community participatory methods. This involved interactive community meetings with farmer-households in Kiboga district, Uganda. The participants identified local ingredients such as Orange Flesheed Sweet Potatoes (OFSF), vitamin A-rich banana (‘Biira variety’) and green leafy amaranth for possible inclusion in the recipes. Through several recipe trials, tasting using mother-child pairs and expert consultations, 5 recipes were arrived at for further testing. Raw ingredients of the respective recipes were obtained from local markets and farms and transported as hand luggage to Universität für Bodenkultur (BOKU), Austria within 48hrs. At the laboratory, the meals were prepared using community validated procedures within 24hrs of ingredients arrival. A portion of each sample (20-40 g) was frozen at -24℃ for 6 hours and then freeze-dried for 24 hours. Dry matter was determined, and the samples homogenized using the Osterizer, and stored at -24℃ until analysis (not more than 14days). The standard method microwave digestion and the Flame Atomic Absorption Spectroscopy (FAAS) method were performed for determining the content of iron. Since the diets were mostly plant-based, vitamin A was measured in form of provitamin A carotenoids (pVACs) using HPLC analysis. Each analysis was carried out in triplicate.

Findings: In banana-based dishes where ingredients such as groundnut paste, soy flour and silver fish were present, iron content increased 10-fold. There was no significant improvement in vitamin A level in the improved banana-based dishes. The Vitamin A content in the improved porridge recipes was significant, from no trace to between 20 and 40 RAE/100gep while the iron also improved significantly to levels of between 4-5.8g/100gep.

Conclusion: Using local available foods, has been emphasized in the WHO/UNICEF global strategy for infant and young child feeding as one of the important strategy for addressing poor nutrient intake. CONTINUES in DOC!

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Session Classification : Poster Session 4

Track Classification : Epidemiology
Frequency of Malnutrition (Undernutrition, Overweight/Obesity) and Prevalence of Iron Deficiency in Western Algeria Infants

Introduction and objective. Stunting in childhood is a risk factor that may result in overweight and obesity later in adolescence and adulthood, indicating the need to screen children below 1 year of age to identify stunting early in life. Iron deficiency (ID) is one of the most widespread nutritional disorders in both developing and industrialized countries, making it a global public health concern. The aim of the study was to evaluate the frequency of malnutrition (undernutrition, overweight and obesity) and the prevalence of iron deficiency among a population of infants from western Algeria.

Population and methods. From January to June 2016, 130 healthy children (72 males), mean age 21.2 ±3.9 mo, were prospectively enrolled during their visit to three immunization centers in Oran. After written consent, anthropometric measurements (weight/age, height/age, weight/height, BMI, expressed in Z-scores according to WHO standards) were taken, dietary intakes were assessed by 24H recall followed by three days records. Hemoglobin, serum ferritin and soluble transferrin receptor (sTfR) were determined to assess iron status. Continuous values were expressed as mean ± standard deviation, and discrete values as percentages.

Results. Weight and height were assessed in 112 children. Mean weight was 0.482±1.07 z-scores, mean height 0.09±1.39 z-scores, mean weight/height 0.72±1.55 z-scores, mean BMI 0.79±1.69 z-scores. Wasting (weight/height <-2 z-scores) was found in 6 (5.5%), stunting (height/age <-2 z-scores) in 7 subjects (6.2%), overweight was present in 16 (14.3%), and obesity in 7 (6.3%). Anemia was present in 61/130 infants (46.9%), and iron deficiency (ferritin<11mg/dl and/or positive sTfR) was found in 71/119 (59.6%). Dietary assessment showed micronutrients consumption deficiencies of iron (84%), zinc (65%), iodine (48%), and Vitamin D (95%).

Conclusion. Our study shows that 10% of infants present undernutrition (wasting and stunting), and 18.7% overnutrition. Moreover, anemia and iron deficiency are particularly prevalent. This is a clear example of the burden of malnutrition and the “hidden hunger” in our context.

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Session Classification: Poster Session 4

Track Classification: Epidemiology
Introduction and purpose of the study: Iodine deficiency has several adverse effects on growth and human development, causing organic disorders commonly known as iodine deficiency disorders (IDDs). Among school-age children, an estimated 29.8% worldwide suffer from iodine deficiency. As a way of fighting IDD, salt iodization remains the best way to increase iodine consumption in a community, this is how it is adopted by several countries in the world, including Morocco; whose IDD is considered moderate.

The Aim: The purpose of this study is to determine the level of salt and iodine intake by children in the Rabat capital of the country, and to assess the percentage of iodine deficiency in these children, this pilot study will be used in the preparation of the future National IDD Survey in Morocco.

MATERIAL AND METHODS: This is a cross-sectional study of 280 children and adolescents aged 6 to 18 years. Data anthropometric data and a questionnaire on food frequency were collected. Urinary excretion of sodium and iodine has been measured in the urine collected over 24 hours, and evaluated respectively, by plasma mass spectrometry by coupling inductive and by spectrophotometry following the Sandell-Kolthoff reaction, creatinine excretion was used to validate the completeness of urine collection.

Results and Statistical Analysis: The mean values observed for the salt were 5.7 ± 0.2g / day, and 96 μg / l for excretion of iodine. 70% of children have iodine deficiency, 50% of whom consume more than 5g / day recommended by WHO.

Conclusion: the majority of children who consume more than the recommended intake of salt, which is supposed to be fortified with iodine, suffer from iodine deficiency, so the Ministry of Health should consider new alternatives for iodization, and take into consideration these shortcomings during the implementation of its new strategy on reducing salt consumption.

Conflicts of interest: No conflicts to declare

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**Session Classification**: Poster Session 4

**Track Classification**: Epidemiology
Effects of HIV and ART on diabetes in Tanzanian adults

Introduction:
The phenotype and risk factors for diabetes appear different among Africans from among people in high-income countries. The increased burden of infection and the higher prevalence of malnutrition may contribute to these differences.

Methods:
We measured diabetes by three methods – haemoglobin A1c (HbA1c), fasting plasma glucose (FPG), and oral glucose tolerance test (OGTT) – among the Chronic Infections, Co-morbidities, And Diabetes in Africa (CICADA) cohort. The cohort comprised 1942 Tanzanian adults belonging to one of three groups: 652 HIV-uninfected (HIV-), 954 HIV-infected, antiretroviral therapy (ART)-naïve (HIV+ART-), and 336 HIV-infected and on ART for a median of 5.4 (SD 2.8) years (HIV+ART+). The last group were undernourished (body mass index (BMI) <18.5 kg/m2) when starting ART, as they participated in a previous trial for which low BMI was an inclusion criterion. WHO cut-offs were used to define diabetes (HbA1c ≥6.5%, FPG ≥7 mmol/L, OGTT ≥11.1 mmol/L) and dysglycemia (HbA1c 5.7-6.5%, FPG 6.1-7 mmol/L, OGTT 7.8-11.1 mmol/L). Risks of these outcomes by HIV categories were analysed by multinomial logistic regression, controlling for classic risk factors: age, sex, BMI, current or previous smoking, intake of fruits and vegetables, and achievement or not of recommended levels (75 minutes/week) of vigorous physical activity.

Results:
Mean participant age was 41 (SD 12) years and 59% were women. BMI >25 kg/m2 was found in 55% of HIV-, 35% of HIV+ART-, and 9% of HIV+ART+. 13.2% of participants had diabetes indicated by HbA1c, 25.7% by FPG and 6.4% by OGTT; of these, 1.9% had diabetes by all three measures. Percentages with diabetes and dysglycemia in each HIV status group and for each test are shown in the table.

In univariable analysis the HIV+ART- group had increased risk of diabetes by all measures and the HIV+ART+ group by FPG and borderline by OGTT. In the adjusted multinomial logistic regression, the HIV+ART- group still had increased risk by all three measures but the HIV+ART+ group only by FPG. Of the standard risk factors for diabetes, age tended to increase risk and having adequate vigorous physical activity was associated with lower risk of dysglycemia and diabetes by HbA1c and OGTT.

Conclusion:
Untreated HIV infection increased the risk of dysglycemia and diabetes by HbA1c, FPG and OGTT. The lesser risk of diabetes in the ART-treated group could have resulted from less active infection and inflammation than in untreated patients, with therefore less inflammation-induced raised glucose. It could also have resulted from the lower BMI in that group, although high BMI itself did not significantly increase diabetes risk in the cohort. Vigorous activity was associated with better glucose control, so improving the health of HIV-infected people so that they are able to be active is an important goal.

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Session Classification : Poster Session 4

Track Classification : Epidemiology
Birth weight and weight gain during early life in relation to body composition and cardiovascular disease risk of rural Thai adolescents

Introduction: Under- and overnutrition during early childhood may lead to alterations in metabolic programming, thereby predisposing individuals to early obesity and increase risks of chronic non-communicable diseases (NCD). This study aimed to determine the influence of birth weight and weight gain during early childhood on body mass index-for-age Z-scores (BAZ), waist circumference (WC), body fat, and cardiovascular disease (CVD) risk at 14 years old.

Methods: A longitudinal study was conducted in Khon Kaen province in the northeast of Thailand. Weight, height, and WC of 461 adolescents (Male 247 vs. Female 214) were measured at 14.1 ± 0.3 years of age and BAZ was calculated using WHO AnthroPlus. Blood lipids and blood glucose were assessed using standard techniques. Body composition was assessed using deuterium dilution technique (D2O). A composite CVD risk score was created using the 4 selected CVD risk factors, including triglyceride, HDL-cholesterol, LDL-cholesterol, and blood glucose. Standardized residuals of the selected factors were created by regressing them on age, sex, and sexual maturation. The standardized HDL-cholesterol residuals were multiplied by -1 and then all standardized residuals of the 4 factors were summed to create the CVD risk score. The higher CVD risk score represented the less favorable CVD profile. Exposures were birth weight and weight gain during each of the following periods: birth-4 months, 4 months-1 year, 1-9 years, and 9-14 years. Multiple-stage least square analyses were used to generate uncorrelated residuals of weight gain and tested the independent relationships of birth weight and weight gain with BAZ, WC, body fat, and CVD risk score at adolescents.

Results: Birth weight and weight gain at all periods were positively related with BAZ and WC; the strongest being the weight gain between ages 1-9 and 9-14 years with higher BAZ and WC at 14 years old in both male and female adolescents. Birth weight and weight gain of all periods were positively related with body fat in males. On the other hand, only weight gain between birth-4 months, 1-9 years, and 9-14 years were related with body fat in females. Only a weak, but significant relationship between weight gain during 9-14 years and CVD risk score was found among females.

Conclusion: In this study setting, higher birth weight and weight gain during early childhood were consistently related with higher BAZ, WC, and body fat, but not the CVD risk at adolescence, which may need a longer follow-up. Promotion of appropriate weight gain during early childhood till preadolescent years are important and possibly reducing the risk of NCD in later adulthood.

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Session Classification : Poster Session 4

Track Classification : Biology
Urinary calcium in Moroccan schoolchildren and adolescents

Background: Depending on the World health organization reports, calcium deficiency is one of the most important deficiencies of all micronutrients that present a major health problem, which is responsible of many functional diseases especially osteoporosis and fracture risk at the later life. In the Moroccan population, studies about calcium are limited. Urinary calcium dosage is one of the most used methods for studying calcium deficiency and determining the body balance of this mineral. Thus, our aim’s of study is study the urinary calcium in a sample of Moroccan children and adolescents.

Methods: A total of 131 children and adolescents aged between 6 and 18 years were involved in this descriptive cross-sectional study and were required from public schools at Rabat and its regions. Socio-economic and morbidity status were assessed for each participant and anthropometric parameters were measured. Urinary calcium was assessed through 24 hour urine by ICP-mass spectrometry.

Results: The total mean of urinary calcium was 72.48 mg/day. About 73% of children and adolescents present a urinary calcium deficiency confirmed by the Ca/Cr ratio which provides a good indicator of urinary calcium deficiency and that the reference value for urine Ca/Cr is 0.2. There were no significant differences related to sex towards calcium excretion and its correlation with nutritional status was shown negative.

Conclusion: Our findings show the existence of a several risk of calcium complications because due to the very less value of calcium excretion in comparison with recommendations. To deal with this situation, it is necessary to carry out an adequate strategy to prevent any calcium deficiency.

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Session Classification : Poster Session 4

Track Classification : Epidemiology
Assessing of Sodium and potassium intake in sample of school aged children from Morocco.

Introduction: The World Health Organization (WHO) 2013 recommendations outline the importance of prioritizing sodium intake reduction as a means to reduce blood pressure and decrease the risk of cardiovascular diseases, and strokes in adults. The WHO strongly recommends the consumption of less than 2g of sodium/day in adults and children. Moreover, 33% of Moroccans suffer from hypertension, 29% have high cholesterol levels and 13% are obese. However, there is little existing data on salt intake of the Moroccan population and available measurement indicators remain limited. The present study was planned to assess the status of sodium and potassium in a sample of school-children aged 6 and 18 years. Methods: The sample for this transversal study includes 131 children recruited from the region of Rabat-Kénitra. There are two main components to the study: a questionnaire concerning anthropometric measures, morbidity, socioeconomic factors, and evaluation of sodium and potassium intake through analysis of 24 hour urinary excretion, using ICP-mass spectrometry. Creatinine was measured to validate urinary completeness. Results: The mean of sodium and potassium were respectively 2235.3±823.2mg/day (equivalent 5667.9±2077.7mg/day of salt) and 1431±636.5mg/day. 46.7% of children consume over the UL of salt (5g/day) and 75% consume under recommended level for potassium. Conclusion: The sodium excretion show higher consumption of sodium than recommended intake. And consumption of potassium is very low. Thus, there’s need to set up a national strategy to reduce salt intake and therefore limit associated NCDs, and set nutritional strategy to encourage potassium intake.

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**Session Classification:** Poster Session 4

**Track Classification:** Epidemiology
Assessment of Micronutrient Status in Children Under Five in Java Indonesia

Malnutrition and poor diets are the main causes of the global burden of disease. This could lead to reduce immunity and productivity. It is known that micronutrient deficiency is a major cause of growth faltering. In Indonesia, double burden has received major concern. More than one out of every three children (37%) are stunted (the fifth-highest number in the world). West Java and Banten Provinces reach more than 30%. Therefore, the assessment of micronutrient status of children under five is needed to carry out to assess their daily intake. Food samples were taken by duplicate diet method of 70 children in Bandung West Java and Lebak Banten district. The samples were analyzed using nuclear techniques neutron activation analysis of Se, Fe and Zn. Quality control of data analysis was assessed using SRM NIST 1548a Typical Diet. It is generally concluded that these children are still lack of micronutrient intake, and many of them are under the recommended dietary allowance. The results are expected to be used as reference to encourage governments and relevant agencies to make policies for improving public health and malnutrition solutions as well.

Keywords: micronutrient, neutron activation analysis, daily intake, recommended dietary allowance

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Session Classification : Poster Session 4

Track Classification : Epidemiology
Dietary Calcium Intake in Sample of Moroccan schoolchildren and adolescents

Background: The adequate development of children and adolescents is conditioned by an adequate calcium intake which plays an essential role in maintaining bone health. Indeed, inadequate calcium intake presents a several health problem that may cause many disorders especially in adulthood. As other countries, the calcium status must be studied to meet the objectives set by the Minister of Health in the fight against micronutrient deficiencies. Thus, our aim’s study consists in the estimation of calcium intake in a sample of children and adolescent aged from 6 to 18 years.

Methods: This is a descriptive cross-sectional study including 131 children and adolescents. For each participating children and adolescent, anthropometric measurements were taken and calcium intake was assessed based on 24 h dietary recall. Children’s nutritional habits was also evaluated, by a food frequency questionnaire, to assess the consumption of calcium-rich food.

Results: The total mean of calcium intake was 522.0 ± 297.0mg/day with 85.5% of subjects highlighted an inadequate calcium intake. No significant deference between boys and girls. According to age groups, calcium intake was significantly different with high consumption in subjects aged from 14 to 18 years (776.86 ± 290.07mg/day) showing insufficient calcium intake of the studied population. Analysis of daily food intake and food frequency showed that bread, vegetables, and fruits are the most consumed food and the main source of daily calcium intake, while consumption of dairy products, presented the best source of calcium, is limited (14% of total calcium intake).

Conclusion: Findings from this study showed that a large proportion of Moroccan children and adolescents have inadequate calcium intake. Hence, the urgent need to put in place strategies and action plans in order to improve the calcium status and to reduce different inadequate calcium disorders that threaten the Moroccan population health, both in childhood and adulthood.

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Session Classification: Poster Session 4

Track Classification: Epidemiology
Anemia Screening and Micronutrient Status of Pregnant Women in Rural and Semi-urban Primary Healthcare Centers in Ikwuano Umuahia of Abia State in Nigeria

Anemia is a widespread public health problem associated with numerous factors, both nutritional (such as vitamin and mineral deficiencies) and non-nutritional (such as infection and hemoglobinopathies), contributing to the onset effect, which iron deficiency and malaria play an important role. This randomized study was designed to evaluate anemia prevalence at primary healthcare centers among volunteered semi-urban (Ahiaeke) and rural (Amawom) pregnant population attending Antenatal Clinic (ANC) in Ikwuano Local Government Area in Abia State, Nigeria. The socioeconomics and demographic peculiarities of these volunteers were captured using structured questionnaires and standard biochemical methods were adopted in evaluation of hemoglobin (Hb), Packed Cell Volume (PCV), malaria status (positive or negative), vitamin A and B12, folate, selenium, and serum iron. A total of 36 pregnant women (mean age=26.5±5.21) agreed to take part in the study; 16 and 20 of the pregnant women were from rural (mean age=26.43±5.91) and semi-urban (26.65±4.57) primary health care centers respectively. The prevalence (overall 53%) of anemia was categorized as follows: 30-31%; mildly; 20-25%, moderate; 0 %, severe; predominantly in second and third trimester of their pregnancy based on world health index. Malarial parasite was presence in 56% of the blood analyzed, though common with rural dwellers. Evaluated relationship between serum iron and vitamin B12 among other (PCV, Hb vitamin A, folate, and selenium) were significant (p<0.05) at various stages of their pregnancy with age, despite respondents increased awareness in drug supplementation (folic acid and iron), use of antimalarial during pregnancy, food needs and personal hygiene. The respondents showed varied levels of awareness with strategic and policies programs (water, sanitation and hygiene, disease control, reproductive health, counseling management) indices in anemia intervention evaluated in the questionnaire. However, further screening of Iron content of some market vegetables (fluted pumpkin and garden egg), snack and cereals (roasted corn and pap) and sweet potatoes in these localities considered as common sources of iron indicated significant (p<0.05) differences in content. Besides malaria which leads to losses of blood or impairment of the production of Hb, nutrition plays one of the most important roles. Some vitamins like vitamin B12, and folic acid, influence the formation of Hb but the most important nutritional factor is iron deficiency and the most frequently occurring micronutrient deficiency (Selenium and vitamin A) in developing economy. Thus, iron’s vital roles in oxygen transport, storage, oxidative metabolism and cellular proliferation; with roles of micronutrient under-provision and malaria impact on hemoglobin impairment or loss in pregnancy are critically implied interacting variables in anemia management.

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Session Classification : Poster Session 4

Track Classification : Epidemiology
Burden of obesity on Vitamin D status and bone health in obese Egyptian children.

Introduction: Children with malnutrition will have deleterious effects on their health and life either malnutrition is due decreased or increased nutrition. Liability of bone health deterioration may be imminent. Aim of the study: In this study, we visualized the relation between overweight and levels of bone deterioration markers, minerals and vitamin D status in Egyptian children. Methods: 40 children aged 8-13 years old were enrolled, 30 obese with body mass index (BMI) 32±2.8 and 10 with BMI 24±3.1 as control group. Parathyroid hormone (PTH), Osteocalcin (OS), bone alkaline phosphatase (APH), 1,25 (OH) vitamin D3 (vitD3), 25(OH) vitamin D3 were analyzed by immunoradiosay kits. Serum and urinary calcium, phosphorus, hydroxy proline in urine all done by quantitative calorimetric method. Statistical analysis: Data were expressed as mean ± standard deviation, T Student test and Pearson correlation were used for differences of variance. Analysis with excel for windows 10 Microsoft was used. Results: showed high BMI group have elevation of PTH with disruption of levels of OS, APH, bone minerals, urinary hydroxyproline and vitD3 status versus control group (P ≤ 0.05). Significant Positive correlation between BMI and PTH level was detected. Conclusion: Obesity positively correlated with hyperparathyroidism which can cause imminent bone mineral deterioration with liability for week bone hazards. Wide scale studies are needed, meticulous investigation of bone health in obese children as well as calcium and vitamin D supplementation are recommended.

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Session Classification: Poster Session 4

Track Classification: Biology
Independent and combined effects of IYCF and WASH on body composition: analysis within the SHINE trial

Introduction
Body composition has important implications both for early child growth and later measures of cardiovascular risk. The Sanitation Hygiene Infant Nutrition Efficacy (SHINE) trial (NCT01824940) was designed to test the independent and combined effects of infant and young child feeding (IYCF) and water, sanitation and hygiene (WASH) on stunting and anaemia in rural Zimbabwe; a substudy evaluated body composition at 24 months of age.

Methods
The SHINE trial was a 2x2 factorial, cluster-randomised, community-based trial across two contiguous districts in rural Zimbabwe. The standard of care arm promoted breastfeeding, family planning and prevention of mother to child transmission of HIV (PMTCT). The WASH intervention arm additionally provided interactive behaviour change, a ventilated improved pit latrine, handwashing stations, liquid soap, water chlorination and a play space to separate infants from animal faeces. The IYCF intervention arm provided a lipid-based nutrient supplement (Nutributter) between 6-18 months of age plus education on optimal complementary feeding. The combined WASH+IYCF arm received all interventions.

Among the body composition substudy children, bio-impedance measurements were undertaken using the Bodystat 1500MDD machine to pass an imperceptible alternating current (200µA at 50kHz) after placing electrodes on the hand and foot. Skinfold calipers (Holtain) were used to measure subscapular, triceps and maximal calf skinfold thicknesses using a standardised approach. Knee-heel length was measured using an adapted commercial abdominal caliper (Holtain). All measurements were performed in the family homestead. All analyses will be intention-to-treat at the child level. Primary analyses will use generalized estimating equations (GEE) that account for within-cluster correlation and contain two dummy variables representing the two interventions, unadjusted for other covariates, with an exchangeable working correlation structure. We will test for an interaction between the two interventions.

Results
230 children were enrolled in the substudy (112 male, 118 female), of whom 69 (30%) were stunted. 38 were HIV exposed but uninfected, whilst 1 was HIV positive. 69 were in the standard of care arm, 41 in the WASH arm, 49 in the nutrition arm and 71 in the combined nutrition and WASH arm. The overall body composition characteristics of the cohort are shown in table 1.

Detailed body composition outcomes will be presented by randomized intervention trial arm:
- Fat mass index
- Fat-free mass index
- Phase angle
- Central fat (subscapular skinfolds)
- Peripheral fat (sum of triceps and calf skinfolds)
- Central to peripheral fat ratio
- Z-score residuals from regression analysis of central versus peripheral fat.
- Leg length
- Leg length / total length ratio
- Calf circumference

Conclusion
This substudy will report the independent and combined effects of IYCF and WASH on body composition among children aged 24 months. It will test the hypothesis that the additional nutrition in the IYCF group may provide the energy and protein required for growth, hence accumulating
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fat and lean mass, subcutaneous fat and expanding knee-heel length. Similarly the WASH intervention may decrease the chronic inflammation that underlies stunting, hence increasing fat and lean mass, central fat accumulation and knee-heel length.

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Session Classification : Poster Session 5
Track Classification : Epidemiology
Serum metabolomics analysis shows no longer-term metabolic consequences in children that survived severe acute malnutrition 7 years post-discharge: ChroSAM study

Introduction:
Global childhood mortality is decreasing, but the prevalence of severe acute malnutrition (SAM) is increasing in certain regions, especially in Africa and South East Asia. Thus, the total number of SAM survivors is increasing, and, once adults, SAM survivors are at subsequent risk for non-communicable diseases. We aimed to better understand the long-term metabolic impact of SAM.

Methods:
We studied the metabolite profiles of children who had been hospitalized for SAM at the Queen Elizabeth Central Hospital, in Malawi, 7 years prior (i.e., between July 12, 2006 and March 7, 2007). Of the children successfully followed up (n=352), we obtained blood samples from SAM survivors, sibling controls and aged matched community controls after overnight fasting. 185 endogenous metabolites were measured using both nuclear magnetic resonance spectroscopy and a targeted quantitative metabolomics approach using the AbsoluteIDQ™ p180 Kit (Biocrates) via both direct injection and reversed phase LC-MS/MS strategies in an API 4000 Q-Trap mass spectrometer (AB Sciex). The classes of metabolites measured were: amino acids, acylcarnitines (fatty acid oxidation), biogenic amines, glycerophospholipids, sphingolipids, sugars, alcohols, organic acids, amines, TCA cycle intermediates and short chain fatty acids.

Results:
We profiled the circulating metabolites of SAM survivors (n=69, 9.6±1.6 years), sibling controls (SC, n=44, 10.5±2.7 years), and aged matched community controls (CC, n=37, 9.4±1.8 years). 31% of SAM survivors were positive for HIV while only 8% of SC and CC were reactive. No metabolite was found to be associated with early childhood SAM after false discovery rate correction. Next, the high dimensional data was adjusted for age, sex, and HIV and analyzed using Partial Least Square to explore metabolite correlations and group differences. Least Absolute Shrinkage and Selection Operator (LASSO) regression with feature selection and regularization was also conducted with 10-fold cross validation as implemented in the Glmnet R package. Based on these analyses, no significant differences were found between the metabolic profiles of SAM survivors, and their sibling or community controls. With LASSO, no metabolites significantly differentiated the groups and the area under the Receiving Operating Curve indicated poor predictive value (68% in training set, and 46% in holdout test set). Metabolites were also not predictive of the type of SAM experience by the child (i.e., severe wasting vs. edematous SAM) or associated with the severity of the episode as evaluated by anthropometry at the time of hospitalization for SAM.

Conclusion:
We did not detect longer term metabolic consequences in children that survived SAM until 7 years post-discharge. However, we cannot rule out that metabolic dysregulations initiated by early childhood malnutrition could exacerbate metabolic conditions that typically develop in later adulthood.

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Session Classification : Poster Session 5

Track Classification : Biology
Wasting, but not stunting, is associated with reduced fat-free mass index in Cambodian children aged 6 and 15 months

Introduction
Few data are available from low-income countries regarding the association between nutritional status and body composition in early life. This period is particularly critical for long-term outcomes. The main objective was to assess the association of stunting and wasting with body composition in young rural Cambodian children.

Methods
A cross-sectional study with two time points of analysis was nested in a nutrition intervention trial (WinFood, ISRCTN19918531). FFM and FM were measured with the deuterium dilution technique when children were 6 and 15 months of age. Linear regression was used to assess the association of stunting, wasting, sex and breastfeeding with FFM, FM and height-adjusted indexes, FFMI and FMI.

Results
The study enrolled 419 children. At 6 months of age, 98% were breastfed, 15% were stunted and 4% were wasted. At 15 months (n=358), 78% were breastfed, 24% were stunted and 11% were wasted. Boys had higher FFMI compared to girls at 6 and 15 months of age. At 15 months, non-breastfed children had 0.26 (95% CI 0.02; 0.51) kg/m2 lower FMI compared to children still being breastfed. At 6 months, stunted infants with a length-for-age z-score (LAZ) <-2 had lower FMI (0.54, 0.12; 0.96) kg/m2 but not FFMI, compared to children with LAZ ≥0. There was no association between stunting and FFMI or FMI at 15 months. At 6 and 15 months, wasted children with a weight-for-length z-score (WLZ) <-2 had both lower FFMI and FMI compared to children with WLZ ≥0. The FFMI and FMI deficits were -1.93 (-2.35; -1.51) kg/m2 and -2.16 (-2.63; -1.70) kg/m2 at 6 months of age and -2.13 (-2.55; -1.72) kg/m2 and -1.28 (-1.66; -0.89) kg/m2 at 15 months, respectively.

Conclusions
At 6 months, stunting was associated with lower FMI, but not FFMI. In contrast, wasting was associated with both reduced FMI and FFMI at 6 as well as 15 months of age. The reduction in FFMI in wasted children seemed to worsen with age while the FMI deficit seemed to decrease. This indicates that wasted children may preserve body fat at the cost of FFM accretion. The possible long-term consequences of early stunting and wasting in relation to double burden will be discussed.

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Session Classification : Poster Session 5

Track Classification : Biology
National Income and Malnutrition in Africa: a Rapid Analysis

This paper aims to determine the relationship between national income and income distribution indicators and malnutrition statistics in selected African countries. It follows a simple analysis of a static relationship between national income and income distribution and obesity/overweight and undernutrition. The relation between national income and malnutrition statistics is as expected. Countries that have higher income tend to have higher prevalence of obesity/overweight. The opposite relationship holds for undernutrition. Countries with higher income tend to have lower levels of undernutrition. However, this relationship is not very strong, with a correlation coefficient of less than 50% in both cases. This is because higher income does not guarantee good nutrition and that there is friction in the response of undernutrition to growth in GDP. As such, it is important to lobby governments to mainstream food and nutrition security in other initiatives that increase national income, especially as part of meeting the Sustainable Development Goals (SDGs) of the UN. This will ensure that high national income translates to reduction in malnutrition prevalence.

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Session Classification : Poster Session 5

Track Classification : Policy implications
Undernutrition and associated factors among school age children in Southern Ethiopia

Background:
Undernutrition among school age children is becoming a major public health concern as they are at the active growing phase of childhood. Children at this stage in life need more emphasis and care for proper physical and psychosocial development. Moreover, school feeding programs are poorly practiced in many developing countries worsening the situation. The present study examined the nutritional status of school age children in Southern Ethiopia to assess the extent of the problem and to suggest appropriate intervention strategies to mitigate undernutrition.

Methods:
A community based cross sectional study was conducted among school age children (7-14 years old) at Kindo Didaye Woreda, Southern Ethiopia from January to Feb., 2017. Multi stage sampling technique was used to select 644 school age children. Information on different variables was collected using pre-tested questionnaire. Measurements on weight and height were made using standardized weighing scales and measuring boards, respectively. Then data was entered using EpiData software version 3.1 and analyzed using SPSS version 20. Descriptive statistics, bivariate and multivariate logistic regression analysis were done and the statistical significance was declared at p-value <0.05.

Result:
Among the school age children the prevalence of stunting was 29.7% [95% CI; 26.3%, 33.5%], and thinness was 16.3% [95% CI; 14.5%, 20.3%]. Secondary and above education status of mother [AOR=0.18; 95%CI (0.07, 0.44)], child age greater than ten (AOR = 2.52, 95% CI = 1.64, 3.70), meal frequency less than three per day (AOR=6.22, 95% CI= 3.80,9.50) were associated with stunting whereas family size greater than six (AOR=1.99; 95%CI, 1.241, 3.432) and latrine availability (AOR=2.85; 95% CI, 1.311, 4.92) were significantly associated with thinness of school age children.

Conclusion and recommendation:
The current study showed that undernutrition was a public health problem among school age children in the study area and the prevalence is comparable with national survey conducted in Ethiopia among school children. Therefore, improving women’s literacy rate, implementing family planning strategies, increasing the number of meals per day when child age increases and improving access to latrine are suggested for better nutrition of children.
Sodo University)

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**Session Classification**: Poster Session 5

**Track Classification**: Epidemiology
Prevalence of malnutrition among older peri-urban farmers with modifiable risk factors: A food and nutrition insecurity study, South Africa

Introduction
Malnutrition in a form of obesity and micronutrient deficiency can affect productivity levels in older farmers who are also facing chronic non-communicable diseases. Lack of customary and pathway interventions for farmers contributes to increasing malnutrition levels and as well increased complications of lifestyle diseases. These take priority within farming communities which can often compromise full engagement and commitment.

Objective
The objective of study was to determine nutritional status and micronutrient intake among vegetable producing farmers. The objective was pivotal in linking the reported health challenges affecting agricultural production.

Methodology
The study was a cross sectional design aimed at observing and examining variable relationships for developing an intervention programme. Measurements included anthropometrics to determine (BMI, WC, WHR). Dietary assessments included Dietary Intake Nutrients Analysis, Nutrient Adequacy Ratio (NARs) with Dietary Reference Intakes (DRIs) according to 24 hour recalls. The total population comprised of 112 farmers living in a peri-urban area.

Results
Women were in the majority (79.5%, n=89 women and men 20.5%; n=23). The mean age was 63.3 (± 8.2) for both women and men. The majority (88.7%; n=79) of women as well men (56.2%; n= 13) were over-nourished (>24-99->40). Women had exceeded (84.3%; n=75; >88cm) the cut off points for waist circumference whilst only 39.1% (n=9) men exceeded (>102cm). Women had exceeded (88.8%; n=79) as well as the men (65.2%; n=15) for WHtR recommended scores (>05). Energy intake exceeded EER-estimate energy requirements (5514.63kJ vs 12881kJ) and women (4857.02kJ vs 10093 kJ). Men and women were significantly below the recommendations of the WHO of at least ≥400g daily consumption. The mean per capita per day was higher for men frequency and portion size intake was the lower in men (104.3g) than for women (99.1g). The total fruit and vegetable intake was <20% for both women and men. Vitamin A vegetables A and fruit FVS was lower 4.9 (±1.52). Micronutrients intake was low for calcium for men and women with (100.0%; n=112) below Estimated Adequacy Ratios-EARs (1200mg). Women had a lower (98.8%; n=88) iron intake (5.0mg). Magnesium was below- EARs (100.0% n=112) for men (320mg) and women (320mg). Vitamin A intake was below (73.9%; n=17) for men (625μg) whilst only (70.7%; n=63) women (525μg) were also below. Vitamin C was below EARs (95.6%; n= 22) in men (75mg) and (91.0%; n=81) for women (60mg). Vitamin D was below EARs for both men (15μg) and women (10μg) respectively (100.0%; n=112). Vitamin E was below (73.9%; n=17) for both men (12mg) and women (93.2%; n= 83) EARs (12mg) respectively.

Conclusions
Interventional programmes addressing the double burden of malnutrition including promotion of WHO goals should develop tailor fitting strategies for farmers as they are key players in food and nutrition insecurity redress.

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Session Classification : Poster Session 5

Track Classification : Epidemiology
Body Composition (Unhealthy Fat Mass %) Was Associated With Stunting In Supposedly Healthy Children Aged 3-5 Years Old In Ndola, Zambia

Introduction: The prevalence of stunting in children under five years in the world stands at 33% and in Zambia is at 40%. Prolonged undernutrition during gestation and extending into early childhood is common in developing countries and causes stunting. Consequences of impaired growth, cognitive delays, greater susceptibility to infections and high risk of mortality. Stunted children have different Body composition structure compared to normal children particularly lean mass. In Zambia there is scanty information on body composition and therefore this study was designed to assess body composition in stunted children compared to normal children without malaria and other infections in the preceding one week.

Methods: This was a cross-sectional study in which children aged 3-5 years were recruited at Nkwazi clinic in Ndola. Children’s weight, height, Haemoglobin and Malaria were measured. Saliva collected was analysed for body composition to determine fat mass (FM) and fat-free mass (FFM) using deuterium dilution technique by Fourier transformed infrared (FTIR).

Results: A total of 116 children were recruited and 104 had analysable data. About 54.2% were males and the average age was 48 months. Stunting, underweight and wasting levels were found to be 36.6%, 23.8% and 4.9% respectively. Overall 40.4% of the children had healthy body fat (36.2% of girls and 43.8% of boys). Of the children with unhealthy body fat, 14.4% had lower than healthy and 45.2% had higher unhealthy body fat. Logistic regression was done with FM% as the dependent variable against Gender, Stunting and Underweight. Stunting was found to be statistically significant against FM% (P=0.011) and not others.

Discussion/Conclusion: Stunted children with unhealthy Fat Mass percentage were found to be significantly higher compared to the children who were not stunted (P=0.011). This should trigger further investigations in these children to counter future complications that can arise as a result of this amount of fat. The other variables such as malaria illness in the previous 1 month, age and gender were not statistically significant (P>0.05). The study was successfully implemented with use of deuterium water to assess body composition of children under the age of five years and that this can serve as baseline data for subsequent studies in this and other age groups.

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**Session Classification**: Poster Session 5

**Track Classification**: Biology
Factors associated with malnutrition of children under-five-years in an informal area in Egypt

Introduction
The prevalent child malnutrition in low and middle income countries results in increased mortality and disease burden. Although stunting in children under the age of 5 years is decreasing worldwide, it is estimated that 171 million children are stunted globally of which more than 97% live in developing countries. Children under 5 constitute around 11.7% of the population in Egypt and 21% of them are stunted. Additionally 15% of them are obese.

What factors contribute to stunting and obesity in children under the age of five years?

Aim
To explore factors contributing to stunting and obesity in children under the age of five years

Methods
Around 200 mothers with children under the age of five years were interviewed in a non-governmental organization in an informal area of Cairo. The questionnaire included beside characteristics of the mothers, weekly nutrition of children, breastfeeding, junk food consumption, carbonated drinks, food sanitation, hand washing, vaccination of children and infections. In addition, 10 women were interviewed in-depth.

The weight and height of 10% of the children were measured, and anemia and stool were investigated. The Body Mass Index of children was calculated using the Center for Disease Control and Prevention online calculator. The data was analyzed using the Statistical Package for the Social Sciences (SPSS) version 17.

Results
The mean number of months for breastfeeding among Egyptians is 15-17. Weaning started after the third month. Children aged 1-5 years eat whatever is available at home or from street food vendors. Mothers in general cannot afford to provide their children with special food required for their age. On average children get 4 glasses of milk a week. The children consume junk food on a daily basis and drink 3 carbonated soft drinks per week on average. Mothers perceive junk food as nutritious food.

Over 80% of the children had vaccination coverage. 21% had diarrhea and 35% had a respiratory infection within fortnight preceding the study.

From the subsample with laboratory investigations, most of the children were overweight or obese (71.4%), 43% had anemia and 58.8% had parasites.

Conclusion
The food consumption of children under the age of five years is not appropriate. This can be attributed to poverty and / or a lack of mother’s awareness. The perception of mothers regarding junk food and carbonated drinks needs to be changed. 43% of children in the subsample were obese and anemic.

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Session Classification: Poster Session 5

Track Classification: Epidemiology
"We even struggle with the earth": Parents’ Perspectives on the Capabilities for Healthy Child Growth in Haor Region of Bangladesh

Introduction: The prevalence of childhood stunting is over 45% in the haor region of Bangladesh (HKI and JPGSPH, 2016). Hoar areas are located in the north-eastern part of the country. People endure four seasonal phases: 6 months’ wet season and 6 months’ dry season along with two transition phases. Having a good understanding of child growth in the first thousand days of life is important in relation to later health outcomes, and developing relevant and effective interventions.

Objective: To identify the capabilities of the parents and their children that shape multidimensional child growth outcomes in haor in the first thousand days of life.

Methodology: A qualitative study was conducted in two sub-districts of haor region including Derai and Baniachang from Sunamganj and Habiganj districts respectively. We facilitated eight focus group discussions with the parents of children less than 2 years of age, four with mothers and four with fathers separately. In-depth interviews were conducted with four fathers and four mothers to explore their individual narratives. A capability approach framework to child growth was used in shaping the interview guides and analysing the data (Yousefzadeh et al., 2018). The Capability Framework for Child Growth conceptualises child growth as a plural space, including indicators from multiple dimensions. The capability approach describes the capabilities that represent the various sets of options or opportunities from which an individual chooses to do or be something. Children’s capabilities are partly depending on their parents’ capabilities through an intergenerational transfer. In this paper, we describe child and parental capabilities that shape child growth outcomes in haor areas.

Findings: The stories of the participants indicated a range of capabilities at the child, parental and household levels. At the child’s level, they talked about the capabilities “to stay away from disease and eat well”, “to be borne with God blessings” and “hereditary traits of the parents to grow in size”, and the capability “to stay happy and be playful”. They emphasised the importance of several maternal capabilities such as the capability “to seek health care for having safe delivery”, “to stay healthy and eat well”, “to stay away from violence”. They highlighted that having a safe delivery is a major challenge in haor areas because of infrastructure and delays. They stressed that most of the fathers lack the capability to earn to get food, clothes, oil and other basic things for the children and mother because of long-term flood and agricultural loss. At the household level, the participants stressed the importance of the capability “to live in a shelter that is safe during wet season”, “overcome the struggles with earth to stay neat and clean”, “be mobile” and the capability “to source safe drinking water”.

Conclusion: The findings suggest that improving child growth in haor requires a multidimensional approach for its assessment that goes beyond the health and nutrition dimensions and adds other dimensions such as safe shelter, earning opportunities, mobility.

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Session Classification : Poster Session 5

Track Classification : Epidemiology
Malnutrition in childhood and chronic diseases in adulthood in the context of Eastern DR Congo: a longitudinal study protocol

INTRODUCTION
Malnutrition is a public health problem in low- and middle-income countries. In Eastern DR Congo where up to 8% of children younger than 5 years are acutely malnourished and over 1 in every 2 children are stunted. The overall prevalence of diabetes is 3.5%, a combination of hypertension and diabetes is found in 59.6% of patients and the prevalence of obesity is estimated at 7.7%. Despite the increasing awareness of the lifelong deleterious effects of early life deprivations, there is scant information on link between undernutrition in infancy and the risk of non-communicable diseases (NCD) in adulthood in DR Congo. Our study aims to estimate the association between both acute and chronic malnutrition during childhood and different NCD-related characteristics including high blood pressure, diabetes, obesity, dyslipidemia and body composition in later life in South-Kivu.

METHODS
We are conducting a cohort study on adults who were previously treated for severe acute malnutrition at age of 6-59 months between 1988-2003 at Lwiro pediatric hospital, South kivu province. The exposed group consists of people aged 18 years and above, living in Miti-Murhesa and Katana health zones, with history of severe acute or chronic malnutrition before the age of 5 years. A control group will be recruited and consists of adults with no history of early childhood undernutrition, living in the same area as the participants in the exposed participants to whom they will be sex- and age-matched.

Up to 2011 medical files have been obtained and will constitute the baseline sample size for this study. Trained community health workers are working toward tracing the participants who are still living in Miti-Murhesa and Katana health zones. Structured and pre-tested questionnaires will then be administered to the participants by trained data collectors. The main study outcomes will include body composition parameters and cardiovascular risk factors like high blood pressure, obesity, diabetes and dyslipidemia. Data will be analyzed as cohort study.

PRELIMINARY RESULTS
Of the 2011 subjects recorded today, 708 are alive, 192 dead, 463 displaced and 648 lost to follow-up.

DISCUSSION/ CONCLUSION
A follow-up study of this length in a setting where malnutrition is prevalent is rare. Our results will estimate the link between undernutrition in infancy and the risk NCD in adulthood. Our findings could inform future programs to minimize long-term adverse outcomes of malnutrition.

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Session Classification: Poster Session 5

Track Classification: Epidemiology
The Association of the Dietary Approaches to Stop Hypertension (DASH Diet) With Overweight/Obesity in Chinese Schoolchildren

Background
The effect of the Dietary Approaches to Stop Hypertension (DASH diet) in child overweight/obesity control is unknown.

Objective
To study the association between the DASH diet and the risk of overweight/obesity, and to explore the potential correlates of DASH Diet pattern in Chinese schoolchildren.

Methods
A cross-sectional study was carried out in 6-18-year schoolchildren (n=3868, 51.5% was boys, average age: 13.0±2.4 years old) recruited by the convenient clustered sampling in 21 suburb or urban schools in three areas of China (the eastern, central, and western China) in 2012. A self-filling structured Food Frequency Questionnaire (FFQ) was used to collect the frequencies and portion size of DASH Diet components (fruits, vegetables, meat, high fiber grains, milk, nuts, and desserts), physical activity, and leisure time screen use. The DASH Scores was revised according to literatures, with the higher DASH Score represented a healthier dietary pattern (ranged 0-7). Overweight and obesity were determined according to the Cutoff Values of Body Mass Index (BMI) for Chinese Children.

Results
36.5% of the participants were overweight or obese. The average BMI (kg/m2) was 21.0±4.3(kg/m2, and the BMI-Z score was 0.54±1.38. There was no difference in the DASH Scores between the obese and non-obese children (obese: 3.5±1.0 vs non-obese: 3.6±1.1, P=0.342). After excluding dessert’s score, non-obese group had a higher DASH Score than overweight/obese group (2.6±0.9 vs 2.4±0.9, P<0.001). Children in the highest quartile of DASH Score has the lowest BMI-Z score (BMI-Z value in q4: 0.49±1.33 vs q1: 0.67±1.4, P<0.001). The overweight/obesity risk in the highest score group q4 was 32.9% lower than in the lowest DASH Score group q1 (OR=0.671, 95%CI: 0.533-0.846, P=0.001), and the group q3 was 20.5% lower than q1 (OR=0.795, 95%CI:0.634, 0.997, P=0.047) (model 1). After adjusted for physical activity and sedentary behaviors on the basis of Model 1, The risk for overweight/obesity in q4 was 25.7% lower than that in q1 (OR=0.743, 95%CI: 0.583-0.947, P=0.016).

Conclusions
The DASH diet pattern is negatively correlated with overweight/obesity risks in Chinese schoolchildren.

KEYWORDS
Dietary Approaches to Stop Hypertension (DASH Diet), China, Schoolchildren, Obesity

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Session Classification : Poster Session 6

Track Classification : Assessment
Dietary pattern association with overweight and obesity in urban Ukrainian population

Background. Because of economic and social crisis in Ukraine nutrition of many people is unbalanced and deficient for some nutrients, especially for protein. The diet studies in different age groups with or without metabolic risk factors is of interest due to possible nutritional risks.

Aim. To study the nutrition in urban Ukrainian population and its relationship to anthropometric indicators of obesity.

Methods. 60 middle aged people (35-59 years) were examined. Body weight, body mass index (BMI) and waist circumference (WC) were measured. The food intake was evaluated by the method of the 24 hour food diary for three days augmented by weighing method. For statistical analysis non-parametric methods were used. The Spearman correlation coefficients were considered significant at p level < 0.05.

Results. In middle age people positive correlations of meat products consumption with body weight (r = 0.43), BMI (r = 0.35) and WC (r = 0.47) were found; and, correspondingly, higher consumption of animal protein was associated with higher body weight (r = 0.48), BMI (r = 0.35) and WC (r = 0.50). In addition, fat and energy consumption were associated with body weight (r = 0.38 and r = 0.31) and WC (r = 0.40 and r = 0.35). The important is an association of processed meat intake with some anthropometric indicators. In men the relationship between anthropometric indicators of obesity and animal protein intake became stronger but it was not revealed in women.

A very low (2016 -1.34%), but growing (2003 - 0.83%) level of childhood obesity in Ukrainian population and the high level (2016 - 22%) of adulthood obesity are existing simultaneously. Traditionally children, especially of early age, have more balanced diet and have more physical activity than adults do, which determine such a large gap. Nevertheless, the question about validity of childhood obesity data is raised due to used methods for obesity assessment. In addition, analysis of young people diet showed nutritional risks such as low level of protein and fiber, high level of mono- and disaccharides, which indicates an increased risk of metabolic disorders in later life and we suggest the same situation with children and adolescents nutrition. Therefore, the RER/6/034 project could help to clarify situation about childhood obesity in Ukraine and help to fight against the growing obesity in adolescence and adulthood.

Conclusion. Thus, sex differences between dietary pattern and anthropometric indicators of obesity were revealed for middle age people. The nutritional risk for middle age obese persons is higher meat products consumption associated with higher fat and energy intake. It raises a question to quality of animal protein source consumed and to overall energy intake that should be considered while composing diet recommendations. Metabolic and nutritional risks studying in childhood and adolescence is important for preventing the growing obesity prevalence in adulthood.

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Session Classification : Poster Session 6

Track Classification : Epidemiology
Burden and Trends of Obesity Related Selected Cancers in Sri Lanka: Review of National Cancer Registry Data

Introduction
Globally, cancer is a leading cause of morbidity and mortality. There are consistent evidences that higher amount of body fat are associated with increased risk of cancers including Breast (post-menopausal), Colon and Endometrial. With increasing average life expectancy, urbanization and the accompanying lifestyle changes, Sri Lankans are increasingly exposed to risk factors of Non communicable diseases such as sedentary lifestyle and unhealthy dietary habits. According to the STEP survey 2015 nearly 29% of Sri Lankan adults were estimated to be overweight or obese (95% CI 27.5 – 31.1) with 24.6% of men and 34.3% of women.

Objective: To describe the Burden and trends of Breast, Colon and Endometrial cancers in Sri Lanka utilizing the cancer registry data of the National Cancer Control Programme.

Methodology: Incidence data of Breast, Colon and Endometrial cancers were extracted from the database of the National Cancer Registry from 2000 to 2010 to assess the burden and trends of above mentioned cancers. National cancer registry collects data from 39 centers including 13 pathology laboratories island wide. The review was confined to the period of 2000 to 2010 since use of ICD-O classification was commenced in 2000 and last published data available only up to 2010.

Results
Female Breast cancer
The Age standardized Rate (ASR) of female breast cancer was 19.9 per 100,000 in 2000 which was increased by 1.15 fold in 2010 to 23 per 100,000. Further analysis of data shows there is a greater increase of post-menopausal (> 50 years) breast cancer from 58.1 to 75.9 per 100,000 compared to pre-menopausal (from 20 - 50 years) breast cancers which shows slight decline during the period from 20.8 to 19.4 per 100,000.

Colon cancer
There were 217 colon cancers in year 2000 with the ASR of 1.5 almost equally distributed among males and females (109 and 108 respectively). The incidence rate of Colon cancer is gradually increased over the years and in 2010 there were 443 incident cases with ASR 2.3 per 100,000 population. (1.5 fold increase over the period).

Endometrial cancers
Age specific rate of endometrial cancer in year 2000 was 2.27 per 100,000 and was not among the 10 leading cancers among females. However endometrial cancer incidence increased gradually and in 2010, the age standardized rate was 3.9 per 100,000 with 1.7 fold rise. Endometrial cancer was the 8th leading cancer among females in year 2010.

Conclusion:
There is a notable increase in incidences of post-menopausal breast cancers, Colon cancers and endometrial cancers over the period of 11 years in Sri Lanka. Improved reporting may partly contributed to this increase. However, as obesity shows an increasing trend among Sri Lankans, it is timely to conduct further research to determine the exact contribution of obesity and overweight for certain cancers among Sri Lankan adult population.

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**Session Classification:** Poster Session 6

**Track Classification:** Epidemiology
Body fatness and its relationships with lipid profile in Senegalese school-aged children

Introduction: Childhood obesity is a serious public health challenge with an increased risk of dyslipidemia and related health issues including coronary artery disease, hypertension, and stroke. This study aimed to investigate the association between body fatness and fasting plasma lipid concentrations among Senegalese school-aged children.

Methods: The study was conducted under the ROUND-IT (Reducing Obesity Using Nuclear Techniques To Design Interventions) study and involved 147 pupils, 8-11 years old (73 boys, 74 girls) randomly selected from elementary public schools in urban area of Dakar. Weight and height was measured and BMI-for-age z-score calculated. Body fatness (%BF) was determined using the criterion deuterium dilution technique. Fasting plasma lipid concentrations including total cholesterol (TCH), high-density lipoprotein (HDL-c), triglycerides (TG) were measured by Immunoturbidimetry and low-density lipoprotein (LDL-c) calculated according to Friedman’s formula. Linear regressions were performed to investigate the associations between %BF and plasma lipid concentrations.

Results: The prevalence of excess fatness was 11.3% (%BF ≥25% in boys, and ≥30% in girls), while that of overweight/obesity using BMI z-score was 4.6%. %BF was 16.8 [CI 95%: 15.4-18.9] and was significantly lower (P<0.01) in boys (13.5) than in girls (19.4). Gender and age differences were not found in lipids profile, but mean TCH and LDL-c differ significantly across level of body fatness (P<0.001). Children with excess body fat presented higher mean TCH and LDL-c than their normal peers (TCH: 217±44 mg/L vs. 186±40 mg/L, P=0.003 and LDL-c: 189±47 vs. 153±45 mg/L, P=0.0025). A significant correlation was observed between %BF and TG (r= 0.206; P=0.012), TCH (r=0.179; P=0.030) and LDL-C (r=0.184; P=0.025).

Conclusion: Excess body fatness is significantly associated with abnormal lipid concentrations among Senegalese school children in urban setting.

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Session Classification: Poster Session 6
Investigating the risk factors for low physical activity levels in preschool-aged children in a densely populated urban community in Bangladesh

**Background:** As the double burden of malnutrition emerges in low- and middle-income countries (LMICs), it is important to understand the risk factors associated in order to develop effective intervention strategies. This is especially important in young children, as intervention strategies in the early years can promote the development of healthy habits and routines that can continue throughout life. Physical activity (PA) is a known determinant of health; however, in particular densely populated LMICs, such as urban Bangladesh, there may not be adequate space to facilitate PA. In addition, evidence supports that low iron status and iron-deficiency anemia is a risk factor for low PA.

**Objectives:** Our primary aim was to describe the PA levels of 65 preschoolers (34-38 months of age) in Dhaka, Bangladesh. We also aimed to estimate the associations between preschooler PA levels and (1) the characteristics of the physical environment of the home and (2) their hemoglobin concentration (hb).

**Methods:** We conducted a cross-sectional, observational study. We collected socioeconomic data, anthropometric measures, hemoglobin concentration, and measures of the home built environment and surrounding play spaces. The preschoolers wore an accelerometer on their right hip for 7 days to objectively measure PA levels. We used linear mixed models with child-specific intercepts to assess the associations between physical activity and the exposures of interest.

**Results:** We found that the sample of 65 preschoolers (37 boys, 28 girls), had a mean height-for-age z-score of -1.48 ± 1.0 and three participants (5%) were classified as overweight (according to International Obesity Task Force cut-offs). Of the 64 preschoolers who provided a blood sample, 23 (36%) were identified as anemic (hb<110 g/L), one of which was also classified as overweight. We found that on average, the preschoolers spent 421±48 min/day (52% of daily wear time) sedentary, 301±37 min/day (37%) lightly active and 82±23 min/day (10%) moderate-to-vigorously active. There were no associations between PA and characteristics of the home built environment or hemoglobin concentration; however, there was significantly higher PA in boys (girls had 18.5 min/d of MVPA less; 95% CI= -29.2, -7.78). Additionally, children from higher asset indices (4 min/d increase in MVPA; 95% CI=1.0, 7.6), as well as children of mothers with at least secondary school completion had 24 min/d of MVPA more than children whose mothers did not complete primary school (95% CI=6.88, 40.7).

**Conclusions:** Risk factors in the home built environment and hemoglobin concentration are not associated with preschooler PA level; however, child sex, socioeconomic status, and maternal education were found to be significant predictors of child PA. Large variation within children’s daily observations indicate that all children can improve their daily physical activity, to increase consistency across all days. High compliance rates of wearing the accelerometers implies that there are opportunities for future PA intervention trials or sleep hygiene research within this population.

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**Session Classification**: Poster Session 6

**Track Classification**: Epidemiology
Factors Associated with Overnutrition Among Adults, 20 Years and Over: Results from the 2013 National Nutrition Survey, Philippines

Obesity has reached epidemic proportions globally and is a major contributor to the global burden of chronic disease and disability. In the Philippines, the prevalence of overweight/obesity shows a gradually increasing trend from 1993 to 2013. There is a dearth of local studies using national-scale data on the determinants of overnutrition (overweight/obesity) among adults in the Philippines. The identification of factors of overnutrition is warranted in order to formulate policies and interventions for this emerging public health problem. This study aimed to determine the factors associated with overnutrition among Filipino adults 20 years and over using data from the 2013 National Nutrition Survey (NNS), to address the research gap and provide an evidence-based approach for setting targets for halting the increase in the prevalence of overweight/obesity in the country. Analysis of secondary data was done using data from the 2013 NNS conducted in the Philippines. Data on the sociodemographic and socioeconomic profile of the respondents and selected behavioral and lifestyle factors such as smoking, consumption of alcoholic and sugar-sweetened beverages, physical inactivity and dietary consumption were collected through face-to-face interview. The weight and height of respondents were measured using standard anthropometric techniques. Body Mass Index (BMI) was computed and categorized according to the WHO cut-off standards of 25.0-29.9 kg/m² to define overweight and > 30.0 kg/m² to define obesity. Multiple logistic regression analysis was employed to determine the factors associated with overweight/obesity among Filipino adults 20 years and over. Findings showed that three (3) in ten (31.1%) adults were overweight (24.3%) and obese (6.8%). This condition was more common among females (34.4%), among urban dwellers (36.1%) and among residents of the National Capital Region (39.9%). The prevalence increased as age progressed and socioeconomic status and educational attainment improved. Moreover, overweight/obesity was more prevalent among lifetime abstainers of smoking (33.4%) and alcohol (31.0%) and among physically inactive adults (31.1%). Overnourished adults had significantly higher mean one-day intake of energy, fat and protein than their non-overnourished counterparts and a higher prevalence was noted among those who met the energy (35.5%) and protein (35.5%) requirements. After controlling for the effects of other variables, the factors associated with overweight/obesity among adults included energy adequacy, place of residence, age, civil status, socioeconomic status, educational attainment and smoking status. The situation of malnutrition in the Philippines, i.e. persistent undernutrition problem among children is compounded by the emerging problem of overnutrition among adults. This study provides evidence of selected lifestyle and nutrition-related factors that can be addressed using multi-sectoral or settings-based approaches to halt the increase of overweight/obesity by crafting programs and local policies. Selected lifestyle behaviors found to be associated with overweight and obesity are needed to be monitored and addressed for the prevention and control of selected NCDs.

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**Session Classification**: Poster Session 6

**Track Classification**: Epidemiology
Physical Activity and Adiposity: Findings from the Preventing Obesity among Children in Asia (POCAsia) study

Introduction
The lack of physical activity has been associated with overweight and obesity in children. However, it is unclear whether the relationship between physical activity and adiposity differs by measures of adiposity. This study aims to determine the physical activity level and its relationship with adiposity in a diverse group of children from the multi-country survey, Prevention Obesity among Children in Asia (POCAsia).

Methods
Using standardised procedures, children aged 7 to 12 years were measured on their body weight, height, midpoint waist circumference and body composition using deuterium dilution (D2O) technique. Body mass index-for-age z-scores (BAZ) were calculated using WHO AnthroPlus, while waist-to-height ratio (WHtR) was calculated by dividing waist circumference by height. Physical activity of children was proxy-reported by parents using the Physical Activity Questionnaire for Older Children (PAQ-C).

Results
This study included data of 615 children (297 boys, 318 girls) aged 9.1 ± 1.2 years from Indonesia, Malaysia, Philippines and Thailand. Mean BAZ, waist circumference, WHtR and fat percent from D2O were 0.01 ± 1.60, 58.7 ± 10.0cm, 0.45 ± 0.06, and 27.9 ± 8.8%, respectively. Waist circumference and WHtR were significantly lower, while fat percent were significantly higher among girls. Boys reported higher physical activity (mean PAQ-C score 2.65 ± 0.59) relative to girls (2.33 ± 0.54, p<0.001). PAQ-C scores were negatively associated with fat percent from D2O (r=-0.085, B=-0.13, 95 CI:-0.017,-0.001, p<0.035) after adjustment for sex, age and country.

Conclusion
Higher self-reported physical activity level is weakly correlated with lower adiposity in children. This relationship is found when a more direct measure of adiposity by D2O is used, but not by anthropometric measures of obesity. The use of D2O-derived adiposity measures may be advantageous in understanding the correlates of self-reported physical activity in children.

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**Session Classification**: Poster Session 6

**Track Classification**: Epidemiology
**Association between adiposity measures and metabolic risk factors among Chinese toddlers**

Objectives: Growth during the first 1000 days (from conception to 2 years of age) has long-lasting effects on metabolic health in later life. However, data are scanty concerning the association of adiposity with metabolic risk factors in toddlers. This study aimed to examine the associations between adiposity measures and metabolic risk factors (blood glucose/insulin, serum lipids, and blood pressure) among boys and girls at age 2 years.

Methods: This study examined 573 children (aged 23.9±0.7 months; 51.1% boys) born in 2012-2013, Shanghai, China. We took adiposity measurements including weight, height, skinfold thicknesses (triceps, subscapular and abdominal), and assessed metabolic risk factors including serum glucose, insulin, and lipids (high-density lipoprotein (HDL), low-density lipoprotein (LDL), cholesterol, triglyceride and blood pressure). We used linear regression to evaluate the associations between adiposity measures and metabolic risk factors.

Results: At age 2 years, 3.14% and 0.87% of infants were overweight and obese, 0.52% wasted and 1.05% stunted, respectively. Overweight/obesity was associated with 12 mmHg higher systolic blood pressure (SBP, 95%CI: 8, 16 mmHg), 7 mmHg higher diastolic blood pressure (DBP, 95%CI: 4, 10 mmHg). There were no associations between weight-for-length z score/overweight and serum glucose and lipids levels. Girls had higher skinfold thicknesses at all the three sites (triceps, subscapular and abdominal), higher serum LDL, and lower BMI and blood glucose than boys. There was no sex difference in serum insulin, other lipids, or blood pressure.

Conclusion: In this study, we confirmed sex difference in adiposity measures in children at age 2 years. Overweight/obesity may be associated with higher blood pressure even in infancy. Further independent cohort studies are needed to confirm the findings.

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**Session Classification:** Poster Session 6

**Track Classification:** Biology
Clinical Markers of the Metabolic Syndrome and Insulin Resistance in Youth from Northern Mexico

Background. Obesity in children and adolescents is a growing problem worldwide. In Mexico, almost 4 of every 10 adolescents are overweight or obese. The metabolic syndrome (MS) is highly associated to obesity, and includes abdominal obesity, altered glucose metabolism, dyslipidemia and hypertension. This cluster of cardiometabolic risk factors is generally diagnosed in adults, but the presence of its components is increasing in the pediatric population. One of the initial stages of metabolic alteration could be insulin resistance (IR), but it is not easy to diagnose without specialized blood analyses. Some studies show that clinically useful markers of IR, such as Acanthosis nigricans (AN) might detect early glucose metabolism alterations, but its association with IR has been inconsistent. Our objective was to find the best predictors of insulin sensitivity in youth (9-17 y) from Northern Mexico, including possible new markers such as leptin and adiponectin. Methods. We evaluated anthropometric, body composition, biochemical and clinical parameters (including AN) in 131 participants with a wide range of body size. Leptin and adiponectin were evaluated by radioimmunoassay, abdominal fat content was measured by dual X-ray absorptiometry (DXA) and whole-body composition by deuterium oxide dilution. The MS was diagnosed in participants >10 y using the pediatric International Diabetes Federation (IDF) definition. A multiple linear equation was generated using insulin sensitivity index (ISI0,120) as the dependent variable, and several markers as independent variables: Z-body mass index (Z-BMI), waist circumference, blood lipids, leptin, adiponectin and AN, among others. Several models, including a different number of potential predictor variables were tested. Subjects provided information on pubertal development by a self-applied auto-questionnaire, to adjust the association by the probable influence of puberty on insulin sensitivity. Results. The MS was present in 15% of the participants (17% boys, 14% girls, respectively, p>0.05). Twelve subjects had glucose intolerance, and two had type-2 diabetes. Subjects with altered values of the MS variables had lower insulin sensitivity, higher levels of leptin and lower levels of adiponectin. Participants with at least one component of the MS had higher values of leptin compared to subjects with no components present (p<0.05), and the mean leptin content increased with the number of MS factors. The best predictors of insulin sensitivity were body size (Z-BMI), abdominal fat, leptin, and adiponectin, since they were selected in all the models explored (range of R²=0.68-0.73). AN was not a significant contributor in any of the multiple regression models; nonetheless, participants with AN had a lower insulin sensitivity than participants without AN (p<0.05), as well as altered values of the MS components. Conclusion. In addition to body size and central adiposity, adipokine levels appear to be good markers of insulin sensitivity and could be used to diagnose and monitor earlier metabolic disturbances in youths. AN could be used to explore individuals at risk, but more studies are needed to ascertain its utility as an insulin sensitivity marker in this type of population.

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**Session Classification**: Poster Session 6

**Track Classification**: Assessment
The Prevalence and Economic Burden of Obesity in Hungary

Introduction
The prevalence of obesity is growing continuously worldwide, even in Hungary. Since 1988, when the first professional wide-range evaluation was performed, only limited data were available. Obesity could be considered as the main consequence of unhealthy nutrition, responsible for many pathological alterations in human. Obese patients usually need more health care services.

Methods
Anthropometric parameters were measured, presence of metabolic diseases were questioned in primary&community care settings and in workplaces. Age, BMI, waist circumference, educational level, presence of hypertension or/and diabetes were analyzed statistically and compared with previous data from 1988.
Yearly data of the Hungarian National Health Insurance Fund Administration (NHIFA) were collected, regarding finances of secondary care, hospital services and health insurance reimbursement for medications, based on the International Classification of Diseases (ICD) codes of selected morbidities considering linked to obesity.

Results
Data of 0.55 percent of the population above 18 year were registered in all geographical regions of Hungary (43,287 persons; 17,901 males and 25,386 females), close to the proper national representativeness.
The overall prevalence rate of overweight among men was 40%, while obesity 32%, by women both was close to 32%. In the different age groups of men, the prevalence of overweight and obesity was: 18–34 y = 32.7% and 18.2%, between 35–59 y = 40.1% and 34.4%, over 60 y = 43.5% and 38.8%. Among women, in the same age categories were: 19.6% and 5.7%, 36.8% and 38.7%, 36.5% and 39.7%. Data of BMIs and waist-circumference were presented according to age, by decades and by type of residency as well. The highest ratio of overweight was registered among men with the highest educational level, while highest ratio of obesity among women having the lowest education. Obesity according to BMI and abdominal obesity was the highest in the villages, especially among females. Registered metabolic morbidities were strongly correlated with BMIs and both were inversely related to the level of urbanization.
The estimated total public health expenditures were 58,986 Million HUF (190.3 Million EUR) and the financial contribution of patients was calculated as 25,316 Million HUF (82 Million EUR). These data represent 9.3 % of the whole national health services budget (908,011 Million HUF - 2929 Million EUR)) and 30 % of the whole drug-reimbursement budget (296,024 Million HUF - -955 Million EUR).

Conclusions
Over the previous decades, the ratio of the overweight and even the obese persons increased significantly, it was most prominent among males, mainly in younger generation.
Expenditures for all obesity related pathologies could be estimated between 0.5 - 1 % of the national GDP.
Obesity means a serious medical, public health and economic problem, requires higher public awareness and political support

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Session Classification : Poster Session 6

Track Classification : Epidemiology
Cardiovascular Diseases and Adipose Tissue Depots in Different Anatomic Locations

Introduction. Cardiovascular diseases are often associated with large amount of adipose tissue determined by inadequate nutrition and other unhealthy lifestyle factors. Studies show that not only the amount of adipose tissue but also its distribution is important for the risk of cardiovascular diseases. Visceral adipose tissue (VAT) is associated with higher risk than subcutaneous adipose tissue (SAT). Furthermore, VAT depots on the heart known as epicardial adipose tissue (EAT) have predominant local effects and seem to play a key role in the development of coronary artery and other cardiovascular diseases. Moreover, measurement of VAT depots has been found to provide information above and beyond easily obtainable clinical anthropometric measurements such as body mass index (BMI).

The aim of this study: to assess abdominal and cardiac adipose tissue depots among adults with various cardiovascular diseases.

Methods. The total number of 313 adults aged 30 to 65 years with various cardiovascular diseases was involved. Medical records were used to define disease profiles and form groups of individuals with diagnosed myocardial infarction (MI), coronary artery disease (CAD) without MI, and hypertension (HT) without CAD or MI (respectively, 65, 53 and 141 adults). Control group consisted of 54 individuals with none of these diseases. MI, CAD, HT and control groups were matched for gender, physical activity and consumption of vegetables, fruits, grain products, eggs, fish, meat, milk (and their products). Volumes of EAT and abdominal VAT and SAT were measured on magnetic resonance tomography images. Short-axis end-diastolic cardiac images from the basal plane to cardiac apex were used for measurement of EAT volume. Five transverse abdominal images centered at gender-specific lumbar intervertebral levels (females, L3–L4; males, L2–L3) were used for VAT and SAT volume calculation.

Results. Median age of the individuals with diagnosed MI, CAD or HT was 54(48-58) years, BMI - 28.4(24.8-31.5) kg/m2. Median SAT, VAT and EAT volumes were 5446.2(3988.8-7747.3) cm3, 5642.9(3881.0-8704.7) cm3 and 144.0(117.1-169.0) cm3, respectively. All these variables were lower among controls (p<0.05). Respectively, their medians in the control group were: 46(43-53) years, 24.8(22.3-27.6) kg/m2, 4340.1(2863.1-5927.0) cm3, 3620.6(2657.3-5572.8) cm3 and 107.7(89.4-135.3) cm3. BMI, also SAT and VAT volumes were similar in MI, CAD and HT groups (p>0.05). Age and EAT volume were similar in MI and CAD groups (respectively, 56(50-59) years, 154.1(134.3-178.7) cm3, p>0.05) but were lower in HT group (respectively, 53(45.5-57) years, 129.0(109.1-157.0) cm3, p<0.05).

Conclusions. Larger depots of EAT, also abdominal SAT and VAT are associated with HT, CAD and MI. Measurement of EAT volume may be the most beneficial in stratification of adults by the risk of cardiovascular diseases.

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**Session Classification**: Poster Session 6

**Track Classification**: Biology
Prevalence of pediatric metabolic syndrome and associated risk factors among school age children of 10-16 years living at high altitude region of Himachal Pradesh, India

Introduction: Recently, an increasing trend in the prevalence of Pediatric metabolic syndrome (PMS) amongst children has been documented in different parts of India recently. There is lack of data on the prevalence of PMS amongst school age children living at high altitude regions. To fill in the gap in the existing knowledge, the present study was conducted to assess the prevalence of PMS and its associated risk factors in District Shimla, Himachal Pradesh state, India situated at 2000 meters and above.

Methodology: A school based cross-sectional study was conducted during 2015-2016. Thirty clusters (schools) were identified and from each school 70 children in the age group of 10-16 years were selected. Data was collected on the waist circumference, dyslipidemia, diabetes, blood pressure and physical activity. Fasting venous blood samples were collected for estimation of blood glucose, triglycerides and high density lipoprotein levels amongst the subjects.

Results: The prevalence of PMS using IDF classification was 3.3% and using modified-ATP classification criteria was 3.5%. Risk factors identified to be associated with PMS amongst children were i) male gender ii) high family monthly income iii) sedentary lifestyle iv) consumption of evening snack v) television/computer viewing hours of more than 2 hours and vi) motorized transportation for commuting to school.

Conclusion: High prevalence of PMS was found amongst children residing in high altitude region of India. There is a need to educate children and their parents regarding possible ill health effects of PMS for reducing early onset of cardiovascular disease amongst adulthood.
Prevalence of Adolescent Overweight and Obesity Derived from School Medical Records in Baguio City: Observational Study

Introduction:

Childhood obesity is a rising global health problem including the Philippines. The Philippines is an archipelago which is highly diverse and food accessibility varies from one region to another. Baguio City is situated in the north of Manila within the mountainous region of the Cordilleras. Although rich in agricultural industry in the region, food accessibility and active lifestyle are critical factors for adolescent nutrition. However, limited studies were conducted on Filipino adolescent population health monitoring and surveillance in Baguio City, Philippines.

Objectives:

This study primarily aimed to determine the prevalence of adolescent overweight and obesity using objective measures derived from school medical records in Baguio City. Also, this study aimed to determine if there is a significant difference in the nutrition status of adolescents between public and private secondary schools.

Methods:

Observational data included all height and weight records for enrolled male and female adolescents between 10 to 19 years old from school year 2016-2017. For this study, data will be extracted from selected public and private secondary schools in Baguio City. This study included 8,129 Filipino adolescents in both private (n=2667) and public (n=5462) secondary schools.

Results:

Results showed that the overall prevalence for severely wasted, wasted, normal, overweight and obese were 0.78%, 3.16%, 91.06%, 4.32% and 0.69%, respectively. Overall prevalence rate for combined overweight and obese among males was 4.52% while 3.15% among females in public secondary schools. On the other hand, for private secondary schools, the combined overweight and obesity overall prevalence rate among males was 9.58% while 5.79% among females.

Using independent T-test, combined overweight and obesity overall prevalence of public and private schools were compared which showed statistically significant high among private schools (p-value: <0.01). Furthermore, subset analyses were done in combined overweight and obesity overall prevalence of public and private schools based on age and gender which showed statistically significant difference between the two groups (public versus private schools) for either or both gender and on all age groups except 10-12.99 years old adolescents.

Conclusion:

Baguio City is a highly urbanized city with geographically rich in resources for healthy food. Despite this, there is an existing prevalence of double burden malnutrition in the city. Socioeconomic and cultural factors contribute to this nutrition transition as shown by the statistically significant difference for overall prevalence for combined overweight and obesity between public and private secondary schools on both genders and majority of the adolescent age group. Awareness, surveillance and timely intervention from both local authorities and international counterparts are necessary to address this problem.
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Session Classification : Poster Session 6

Track Classification : Epidemiology
Association of Obesity and Socio-economic status among Women of Childbearing Age Living in Urban area of Morocco

Abstract
Worldwide, obesity is considered as an important public health problem. This study aims to explore the social and economic factors associated with overweight and obesity among women of childbearing age residing in urban area in Morocco. This is a descriptive and analytical study conducted among women (N=240), aged between 15 to 49 years. At recruitment, socio-economic status (SES) of each participant was assessed, anthropometric parameters were recorded, Body Mass Index (BMI), waist circumference and Waist to hip ratio (WHR) were measured to assess overweight and obesity. Data regarding skipped meals breakfast, lunch and dinner were collected using an adapted questionnaire.

The prevalence of overweight and obesity among women of childbearing age was 29.9% and 15.4%, respectively. While for abdominal obesity, the prevalence of overweight and obesity was respectively 39.9% and 60.1%. The results indicate that the prevalence of overweight and obesity among women is higher in women older than 30. A significant association was shown between education level and both BMI and WHR (r1 = -0.23, r2 = -0.17, p < 0.05) respectively and there is also a significant correlation between household size and WHR abdominal obesity (r = 0.21, p = 0.05).

Our results reinforce the necessity to improve the access of all social classes in Morocco to reliable information on the determinants and consequences of obesity and to develop plans for adequate prevention and management of obesity.

Keywords: Overweight, Obesity, Socio-Economic Status, Women of childbearing age, Morocco.

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**Session Classification**: Poster Session 6

**Track Classification**: Epidemiology
Fluid intake among the overweight and obese Iranian adults

Introduction: In Iran, the prevalence of overweight and obesity in 2005 was reported to be 42.8% in men and 57% in women. It has long been suspected that sugary drinks have an etiologic role in the epidemiology of obesity. So the present study was designed as the first research in Iran with a purpose to determine the water and beverages intake of adults’ habitants of Tehran.

Methods: This research was a cross-sectional descriptive study. A total of 572 adults (283 men and 289 women) aged between 18 and 65 years were randomly recruited. The fluid intake information was collected by 7 days of fluid record, similar to the version used in in other countries (Mexico, Turkey, China, Poland, and United Kingdom). By this method, the date, hour, frequency, type, amount, temperature, location, and motivation of drinking fluids was recorded for seven days.

Results: The mean total fluid intake in the subjects was 1941 ± 796 ml (480-6480 ml/l), and the consumption frequency was 9.6 ± 3 time per day (2-24 times).

The mean fluid intake by underweight and normal weight groups was significantly lower than the overweight and obese groups (p <0.001) (Figure 1). It seems that the difference is only due to the high consumption of water and hot beverage (tea) in the last two groups.

The consumption of other beverages, including carbonated and sugary beverages, was not significantly different between various weight groups (Table 1).

Conclusion: The current study shows the intake of the different fluid types in Tehran adults’ population. Even though the highest volume consumed was recorded for drinking water, the mean energy intake from fluids was about 365 calories per day. About 18% of Participants exceeded WHO recommendations for free sugar (<10 % of energy), considering only fluid intake. Our findings represent, in the youth group (18-29 years), in overweight and obese people, the carbonated beverages intake was higher. Since 90% of the beverages were regular, the long-term intake of sugar and calories can increase the weight and obesity in the upcoming years in this age group. In terms of public health, educating adults about the nutritional composition of the different fluids as well as to promote food industry for producing low sugar fluids are needed complementary actions for preventing overweight and obesity.

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Session Classification : Poster Session 6

Track Classification : Epidemiology
Physical activity level assessed by accelerometer and PAQ-C in Tunisian children

Background: Physical Activity (PA) is an important agent in the prevention of chronic diseases such as obesity.

Objectives: To provide preliminary data on physical activity among school children and to correlate the PA with weight status.

Material and Methods: A total of 40 children aged between 8 and 11 years and attending Tunisian schools were recruited. Body composition was determined by the Deuterium oxide dilution technique. PA was determined by the PQA-C (Physical Activity Questionnaire for Older Children). An objective monitoring of physical activity and sedentary time was achieved by use of ActiGraph GT3X + accelerometers.

Results: PAQ-C data demonstrate that 20% of the population had a light PA levels and 80% had a moderate PA levels. Times spend in sedentary (62.37%) and in light (30.80%) activities were higher than that spend in moderate and vigorous (6.83%) activities. Furthermore, almost half of the population spent more than 60 min per day in moderate to vigorous intensity physical activity (MVPA). Average MVPA was significantly higher in normal weight than overweight and obese group (67.68±20.98 vs 49.07±19.09, p=0.007). The proportion of overweight children who spent more than 60 min per day in MVPA was significantly higher than that of normal-weight (60.9% vs 29.4%; p=0.049).

Conclusion: This study indicates that half of school children comply with the health-based guidelines for physical activity and sedentary behavior. Our findings suggest also that obesity was associated with decreases in physical activity in Tunisian children.

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Session Classification : Poster Session 6

Track Classification : Assessment
Magnitude and risk factors of obesity among children aged 8-11 years of primary schools of Bamako

Introduction: In sub-Saharan Africa childish obesity turns furthermore frequent although the malnutrition continues to constitute one of the most responsive epidemiologic problems. In Mali no information exists on the nutritional status of primary school children. The present study is envisaged that the data could serve as baseline data for future studies, as well as inform public health policy.

Method: We assessed children’s nutritional statut, body composition to determine the magnitude of obesity among children aged 8-11 years from primary schools of Bamako. We conducted a randomized descriptive randomized study in six public schools of the district of Bamako from 17 March to 24 May 2015. A total of 92 children (39 boys, 53 girls) aged 8-11 years in grades 3, 4, 5 and 6 from primary schools were recruited. BMI was determining using standard equipments. Body composition was derived from isotope dilution technique.

Results: Based on growth reference BMI-for-age (5-19 years) of WHO classification, children were 7,1% severe thinness, 20,2% thinness, 54,8% normal, 11,9% overweight, 6% obese (1,78% for boys et 4,22% for girls). According body composition means of their total body water (TBW) was 60,60 % ± 7,8, free fat mass (FFM) was 79,13%±10,23 and fat mass (FM) was 20,86%±10,2. Rate of obesity was 26% (for boys FM>25%: 11,9% and for girls FM>30%:14,1%). Rate of high blood pressure was of 12%, 58,7% had not pratices healt, 51,1% had bad attitude in nutrition. Only 16,2% and 15,8% of children had respectively a good knowledge of practices in nutrition and body self-esteem. Among obeses children, 88,9% were sedentaries, 54, 45,8% were hypertensive, 70% had bad practices in nutrition, 87,5% bad self-estimate, 25% had good practices in nutrition, 54,2% were in private school, 55% of their two parents generate income activities. However, among risk factors analyzed, our results showed that statistical relationship was found between child hypertensive and obesity (p = 0, 006, OR=0,152) and body self-esteem (OR=1,207, p = 0, 041)

Conclusion: this study allowed us to see that anthropometric measures underact obesity which is a real problem in ours primaries schools. It important to conduct others studies to understand the etiology of obesity so that measures should focus to prevent this double burden of malnutrition on the health system.

KEY WORDS: obesity, body composition, children, Mali

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Session Classification: Poster Session 6

Track Classification: Epidemiology
Nutritional status and prevalence of diabetes among Artisans in Abeokuta Local Government Area, Ogun State

Diabetes affects a growing number of people and represents one of the primary causes of death among adults. This study was conducted to assess the nutritional status and prevalence of diabetes amongst artisans in Abeokuta South Local Government Area, Ogun State. A simple random sampling technique was used to select 300 respondents and an ethical approval was collected from State Hospital Sokenu Abeokuta. A well-structured questionnaire was designed to collect information on personal and socioeconomic characteristics. An adapted dietary habits questionnaire was used to assess skipping of meals, food preference and snacking pattern of respondents. Lifestyle of respondents was assessed using an adapted lifestyle questionnaire. Physical activity level of respondent was assessed using the adapted W.H.O global activity questionnaire. A random blood glucose check was done using an Allevia Plus glucometer. Also, the anthropometric measurement of respondents was taken using standard instruments. Body Mass index was calculated and classified as underweight, normal weight, overweight and general obesity. Waist-to-hip ratio was calculated and used to assess abdominal obesity. Descriptive statistics such as frequencies, mean and percentages was done. Chi-square was used to test for associations between variables. The average age of respondents was 34.81±9.87, 64% were males and 36% were females. Majority (84.7%) of the respondents were Yoruba and 49.7% had secondary education as the highest level of education. About half (56.0%) of respondents consume visible fat in meats, 55.7% skip meals, 61.3% snacks and 47% snack on fried foods. Few (18.3%) respondents smoke and 61.3% consume alcohol. The prevalence of overweight is 24% and obesity is 4.3% among the respondents. About 12.7% have high waist circumference and 52.7% have abdominal obesity. Few (5.3%) respondents had low physical activity, 29.0% had moderate physical activity and 65.7% had high physical activity level. Prevalence of diabetes and prediabetes is 1% and 4.7% respectively. Abdominal obesity, overweight and general obesity were significantly higher among the female respondents (p<0.05). Skipping of meals and snacking did not have any significant relationship with the body mass index of the respondents (p>0.05). Also, there was no significant relationship between body mass index and diabetes (p=0.95). The prevalence of diabetes was significantly higher (p=0.02) among the older respondents (41-70 years). Pre-diabetes was however predominant among 21 -39 years old respondents. Again, no significant association was observed between snacking, skipping of meals and diabetes (p=0.65; 0.75 respectively). Age, overweight, general obesity and abdominal obesity are risk factors of diabetes among artisans in this study.

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Session Classification : Poster Session 6

Track Classification : Epidemiology
Emerging Lifestyle factors related to rising obesity and noncommunicable diseases in Sri Lanka, a qualitative study.

Introduction

Sri Lanka is considered as having a long tradition of agriculture, with mainly a Buddhism based spiritual background, and people with active lifestyles in a geography of favorable climatic conditions round the year. However many such optimistic attributes appear threatened, with changing lifestyles, attitudes, fast growing economy accompanied by improvised work settings, resulting in overweight and several other health issues. A qualitative observational study was done to identify lifestyle factors that contribute to cause non communicable diseases and DBM in the community.

Methods

The study was done in two stages. During the initial stage observations were made on life styles of patients who were newly diagnosed as having diabetes, malnutrition, cardiovascular disease, hypertension, and some psychosomatic conditions. Observed cohort were patients admitted to the medical wards or attended the clinics of some hospitals situated scattered over the country. Namely, Nawalapitiya, Kegalle, Kilinochchi and Dambadeniya.

During the second stage a cohort of patients who were either diagnosed with such diseases or who were referred to the hospital laboratory to check the lipids, were studied. They were assessed employing a one-on-one semi-structured interview, related to personal health and lifestyle.

Results, Conclusion.

It was revealed, complying with the known fact, that those patients demonstrated an unhealthy lifestyle. Factual findings relevant to the country was the revelation of the tendency to develop noncommunicable diseases in some specific communities, and some behavioral patterns, that were probably of significance in the causation of the diseases in the cohort.

Many incidents of above noncommunicable diseases were observed in individuals who were overseas employees, returned especially from Middle East, despite that they claimed to have no such illness on departure from Sri Lanka.

Professional drivers, especially three-wheeler drivers, demonstrated an unhealthy lifestyle, with the development of non communicable diseases, and a tendency to smoke and abuse alcohol despite the popular belief that they are undernourished and poor. Another vulnerable group identified was the employees working on shift basis with disrupted sleep patterns. In commercial work settings, shift work schedules are increasingly being applied. Further, Stress and disrupted, inadequate sleep, was identified as a factor downgrading nutrition and the quality of life of school children.

Identification of the vulnerable groups and patterns will aid in the process of devising strategies during preventive health initiatives, since then, they can be specifically targeted. As such, we suggest, for example, making it available to measure body composition, of overseas employees on departure and repeated at intervals, using stable isotope techniques. This will make the individual aware of body fat, thus, motivated to resort to appropriate diet and physical activity, since such a measurable value will have a lasting impact on the individual psyche than body weight or abdominal girth. Further, such measure will make, the targeted individuals who generally hold the socio economic myth of assessing the quality of life solely on the rising figure in the bank account, aware, that the same occurs to the fat content in the body, while reverse happens to the health.

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Session Classification : Poster Session 6

Track Classification : Epidemiology
A Decade of Childhood Obesity in Europe – Experiences from WHO/COSI Portugal 2008-2016

Introduction: The WHO Childhood Obesity Surveillance Initiative (COSI/WHO Europe) is an ongoing, systematic process of collection, analysis, interpretation and dissemination of descriptive information for monitoring childhood nutritional status and measure trends in overweight and obesity in children. A surveillance initiative which produces comparable data between European countries and allows the follow up of childhood obesity every 3 years. In Portugal, the 1st data collection took place in 2008 and the 4th in 2016. Although Portugal has consistently been one of the European countries with higher prevalence of childhood overweight (including obesity), it is relevant to identify the progress made in this regard over the COSI rounds.

Aim: To investigate trends in childhood obesity in the context of the WHO/Europe Childhood Obesity Surveillance Initiative (COSI study), in Portugal, between 2008 and 2016. To present data on diet and physical habits of school aged-children as well as their school and family environments.

Methodology: The methodology used in the study follows the common protocol and approach, developed by WHO Europe.

Results: During the last years, COSI Portugal has been showing a downward trend on childhood overweight (including obesity) prevalence: from 37.9% in 2008 to 30.7% in 2016. All Portuguese regions showed a decrease in the prevalence of overweight between the 1st and 4th rounds. Although positive results concerning physical activity were found in 2016 round as only 1.7% of children were physical inactive compared with the corresponding figure in 2008 (19.7%), sedentary behaviours also increased, mainly due to the increased time spent playing computer games 1-2h/day (2008: 12.2% to 2016: 75.5%). School environment features in this regard also showed that most schools provided 90 minutes or more per week of physical education classes to the children from the 1st and 2nd grade, however in 2008 (81.9% and 79.6%) this situation was more common than in 2016 (65.1% and 64.3%). There was no improvement found in the Portuguese children’s healthy eating habits between 2008 and 2016 and although the availability of fresh fruit, at schools, increased (2008: 33.3% vs 2016: 66.5%) free milk offer decreased from 2008: 91.8% to 2016: 74.1%. At European level, Portugal has shown an outstanding improvement regarding the prevalence of overweight and obesity. In 2008, Portugal was the 2nd country with the highest prevalence of overweight and obesity, following Italy (42.5% girls and 49.0% boys) and (17.3% girls and 26.6% boys), respectively, moving to the middle of the chart, at 14th place within 31 European countries, in 2016.

Conclusions: The results support the positive changes concerning childhood obesity over the last 10 years in Portugal, which positioned this country in a better scenario when compared with other countries from the WHO Region. Nonetheless, more action and initiatives are still required to improve the children’s lifestyle habits, as the prevalence of overweight children still remains above the 30%.

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Track Classification : Epidemiology
Characteristics of body composition and cardiovascular risk in women of the Dominican Republic

Introduction. Several studies have associated body composition with most of the major cardiovascular risk factors; which, according to WHO, are unhealthy diets, obesity, physical inactivity, high blood pressure, diabetes and increased lipids; also the consumption of tobacco is considered a cardiovascular risk factor by WHO. According to the WHO, cardiovascular diseases (CVD) are the leading cause of death worldwide, accounting for 30% of all deaths recorded; they affect both sexes equally; More than 80% occur in low and middle income countries. Objective. The objective of the present study was to identify cardiovascular risk factors in women. Methodology. This is a descriptive, exploitative cross-sectional study that was carried out with women who worked in 7 ministries of the Dominican Republic. The recruitment of potential participants was carried out through talks on cardiovascular risk; After that, all attendees interested in participating in the study that would function as a basis for the design of interventions to reduce the occurrence of Cardiovascular Events in the population studied were invited. Those who consented to participate through the signing of informed consent, were made taking anthropometric measurements, taking a blood sample and a questionnaire was carried out where family history of Cardiovascular events was investigated and from which their sociodemographic data was collected. The method of measuring body composition was the use of deuterated water because the measurement of body folds tends to underestimate the body fat of people who exceed the BMI of 34.9. The body mass index was calculated based on the Quetelet index and the waist-hip index according to the WHO table. The data collected were recorded on an Excel sheet and analyzed with SPSS Statistics v.25. Results. The total number of participants was 212. The ages of the participants were between 21 and 62 years old, with a median of 35 years (SD 8.47). 80.2% of the population exceeded the maximum limit of body fat, 17.5% were obese and 27.4% were overweight, obesity is higher in those under 40 years (p <0.05) and those who have waist circumference considered high risk (p <0.05) work in the Ministry of Public Health and the age group between 30 and 39 years is more frequent (p <0.05); Conclusion. The workers of the Ministries studied have risk factors for cardiovascular diseases that are modifiable. Interventions are required to modify the characteristics of the lifestyles considered to be at risk for the aforementioned condition.

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**Session Classification**: Poster Session 6

**Track Classification**: Epidemiology
Ethnic differences in nutritional status and body composition among Malaysian children

Introduction: Ethnic variations in body composition have been reported in previous studies, mainly using anthropometry or bioimpedance assessments. The objective of this study is to explore the differences in body composition among Malay, Chinese and Indian children in Malaysia using deuterium dilution technique (D2O).

Methods: A total of 244 children (78 Malays; 80 Chinese; 86 Indians) aged 7 to 10 years participated in this study. Body weight, height and waist circumference (WC) were measured and body mass index (BMI) was calculated. Weight-for-age (WAZ), height-for-age (HAZ) and BMI-for-age (BAZ) were determined using WHO 2007 growth reference. Each child was given a dose of D2O according to body weight (0.3g/kg). Pre-dose saliva samples were collected prior to dosing, and post-dose samples were collected after 3 h and 3.5 h after the administration of D2O. Deuterium enrichment was analysed by Fourier Transform Infrared Spectrometry (4500 series; Agilent, USA) to obtain percentage of body fat (%BF), total body water (TBW) and fat-free-mass (FFM).

Results: Mean age of the children was 9.00 ± 1.11 years, while mean weight was 30.1 ± 9.4 kg, height 131.5 ± 8.9 cm, and BMI 17.1 ± 3.7 kg/m². Mean %BF was 32.0 ± 8.0%, TBW 15.3 ± 3.3 kg and FFM 19.9 ± 4.4 kg. A significantly greater proportion of Indian children were found to be overweight/obese (O/O) (38.4%) and thin (10.5%), followed by Malay (O/O: 26.9%; thin: 9.0%), and Chinese (O/O: 17.5%; thin: 3.8%) children (Chi2=14.026, p<0.05). Results showed that mean %BF of Indian children were significantly higher (34.7 ± 7.8%) as compared to Malay (30.5 ± 8.4%) and Chinese children (30.7 ± 6.9%, p<0.05).

Conclusion: We found that nutritional status and percentage body fat of children aged 7 to 10 years differ among Malay, Chinese and Indian ethnicities. Although universal strategies to combat childhood obesity are available, future intervention programmes should be poised towards addressing the differences among ethnicities in order to improve the nutritional status of all Malaysian children.

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Behavioural risk factors for cardiovascular diseases and Nutritional anthropometry of students of public tertiary institutions in Abeokuta, Ogun State, Nigeria.

Cardiovascular disease risk is becoming increased among younger age groups and this is a major public health concern. This study assessed behavioural risk factors for cardiovascular diseases and nutritional anthropometry of students in public tertiary institutions in Abeokuta. A descriptive and cross sectional study design was adopted. A total of 350 respondents were recruited for this study using a stratified random sampling. Data on socio-economic characteristics and behavioural risk factors (smoking, alcohol consumption and physical activity status) of respondents were collected using a semi-structured questionnaire. Dietary habit was assessed using a validated structured questionnaire, scored and classified as poor (<54%), fair (55-69%), good (70-84%), excellent (85 ~ 100%) dietary habit while nutritional anthropometry (body weight, height, waist and hip circumferences) were measured using standard procedures. Body mass index (BMI), waist to hip (WHR) and waist to height ratios (WHtR) were calculated. Abdominal obesity (AO) was assessed using WHtR. BMI-for-age of respondents below age twenty was analysed using WHO anthro-plus. Data were analysed for descriptive statistics and Chi-square was used to test for association among variables using statistical package for social science. Results show that most (62.9%) of the respondents were female and within the age-range of 20-24 years. About 42.9% respondents collect monthly stipend above N10,000 monthly, 4.9% of the respondents smoke 40.9% consume alcohol while 65.5% engage in physical activity. Underweight and overweight were more prevalent among female (16.1% and 16.4%) than male (6.1% and 13.7%), while obesity was more prevalent in male (9.2%) than female (5.9%) respondents. Also, high WC and WHR were more prevalent among female (24.3% and 45.2%) than male (3.0% and 0.0%) respondents, however, AO was more prevalent in males (27.5%). Respondents’ monthly stipend was significantly associated with BMI (p=0.000), WC (p=0.006), WHR (p=0.000), AO (p=0.009) and dietary habit (p=0.020). Both smoking and number of cigarettes smoked daily had no significant association with nutritional anthropometry (p>0.05). Alcohol consumption was significantly associated with BMI (p=0.000) and AO (p=0.005) and number of bottles of alcohol consumed was significantly associated with dietary habit (p=0.008), BMI (p=0.000), WC (p=0.000), WHR (p=0.000) and AO (p=0.000). Physical activity was significantly associated with BMI (p=0.001), duration of physical activity was significantly associated with BMI (p=0.00), WC (p=0.001), WHR (p=0.005). Both under- and overnutrition co-exist among the respondents. Dietary habit was significantly associated with WHR (p=0.042) and AO (p=0.040). Socio-economic and behavioural risk factors significantly contribute to overweight, obesity and AO which are risk factors for cardiovascular diseases and many other non-communicable diseases.

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Session Classification : Poster Session 6

Track Classification : Epidemiology

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Background: The double burden of malnutrition has become a global public health issue, particularly in Rwanda, where prevalence of stunting among children under 5 years old is remaining high while overweight and obesity among children under five and women of reproductive age is increasing overtime, as risk factors for non-communicable diseases. The majority of interventions aiming at addressing malnutrition in Rwanda are focusing on under-nutrition while overweight and obesity are becoming a public health threat. Therefore this abstract aims at showing the trends of undernutrition and overweight-obesity in Rwanda in order to help policy makers and programme manager to tackle both forms of malnutrition.

Methods: The systematic review of three recent Rwanda demographic health surveys conducted from 2005 to 2015. The data were disaggregated by socioeconomic status of households: household wealth index, level of education of the mother and place of residence.

Results: The review showed that the prevalence of stunting among children under five years decreased overtime from 51% in 2005 to 44% in 2010 and to 38% in 2015. However, Rwanda is still classified as a country with high prevalence of stunting rate. Place of residence, level of education of the mother and household wealth index were associated with stunting among children under five years old. The prevalence of stunting among children whose mothers were not educated (47% vs 19.3%), those who reside in rural areas (40.6% vs 23.7%) and those whose families were poorer (48.6% vs 20.9%) were higher.

Regarding overweight and obesity among children under 5 years old and women of reproductive age, the prevalence were increasing overtime from 7% to 8% among children under 5 years old and from 12% in 2005 to 16% in 2010 and 21% in 2015 among women of reproductive age. The recent RDHS 2015 showed that among educated women the prevalence of overweight and obesity was higher compared to women with a low level of education (26.5% vs 16.1%). Overweight and obesity were most prevalent among women in highest wealth quintile than in the lowest wealth quintile (36.4% vs 10.7%). The prevalence of women with overweight and obesity living in urban areas was higher compared to than those living in rural (36.8% vs 20.7%). In Rwanda, the STEPS survey showed that obesity is a risk factors of No communicable diseases such cardiovascular diseases, diabetes and cancers.

Conclusion and recommendations:
The findings from this review indicate that both types of malnutrition are a public health concern in Rwanda. However, addressing overweight and obesity in public health policies and interventions is lacking and efforts to tackle malnutrition are focusing on under-nutrition. The promotion of healthy diets and physical activities are needed.

Key words: Stunting, overweight and obesity, double burden of malnutrition

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Malnutrition in all its forms and socioeconomic status in Bolivia: who are more affected?

Background:
Malnutrition in all its forms is a complex public health problem in Bolivia. As in many low and middle income countries main public policies are mainly directed to reduce stunting and anemia, however the prevalence of overweight and obesity is silently increasing. In a country with substantial socioeconomic inequalities the current burden of malnutrition denotes a difficult challenge.

Objective:
The aim of this study was to describe the characteristics of all forms of malnutrition in Bolivia comparing and its association with socioeconomic status; and present the evolution of undernutrition, anemia and overweight/obesity in Bolivia between 2008 -2016 in order to recommend effective public health and nutrition policies to appropriately address this burden.

Design:
We estimated malnutrition’s prevalence by socioeconomic status using the 2008 nationally representative Bolivian DHS, the study comprised 8,432 children <5y, 3,258 women adolescents (15–19 y), and 12,297 women (20–49 y) with available information on anthropometric measurements. The socioeconomic status was calculated based on the DHS wealth index and nutritional status by using WHO 2006 and 2007 standards. Additionally, we use the new DHS study (EDSA 2016) to present the evolution of undernutrition, anemia and overweight/obesity.

Results: Main prevalent problems found in this study were: underfive stunting 23% (95% CI: 22,14-24,29) and anemia 63.11% (95% CI: 60,82-65,40); overweight/obesity in women of 20-49 years old 56,88% (95% CI: 56,01; 57,76). Considering socioeconomic status lower terciles showed the higher prevalence of stunting (>30%) and anemia (>40%) in all ages. Prevalence of overweight/obesity had an upward trend from 10.81% (95% CI:10.02;11.60) in childhood to 29.46% (95% CI: 27,90;31,03) in adolescents women and 56.88% (95% CI: 56,01; 57,76) in women 20 to 49 years; with significant differences (p<0.05) across lower and high terciles (27.69% compared with 32,56%) in adolescent and low and medium terciles (p<0.05) in women (50,92 % compared with 63.08%, respectively). The last national demographic survey shows for children under five years of age a reduction of stunting to 16%, anemia to 53.7% and overweight/obesity 10.1%. For all women in reproductive age anemia decreased to 29.9% and overweight increased to57.7%.

Conclusions: The results reaffirms the existing double burden of malnutrition in Bolivia with high prevalence of overweight and obesity increasing throughout the course of life. Lower socioeconomic terciles have the worst situation of malnutrition. This study calls for public specific policies which need to keep in mind the differential characteristics of malnutrition across the levels of socioeconomic status.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Trends Of Double Burden Malnutrition Among Under Five Children In Malaysia: Findings From A National Landscape Analysis

The double burden of malnutrition among children under five is still one of the major global nutrition problems. Malnutrition is described as the imbalance of nutrients in the body resulting in measurable adverse effects on body composition, function and clinical outcomes. Therefore, a landscape analysis was conducted to explain the trends of malnutrition among children under five years in Malaysia.

Data was obtained from National Health and Morbidity Surveys (NHMS) 2006, 2011, 2015 and 2016. Analysis of malnutrition trends among children under five was performed using Zeta test analysis. NHMS surveys conducted in 2006, 2011 and 2015 employed two-stage stratified cluster sampling design while the NHMS 2016 used birth registrations from the National Registration Department as the sampling frame to select households with children under five. Based on WHO 2007 Classification, malnutrition was determined by the indicators of Z-score for weight-for-age (WAZ), height-for-age (HAZ), weight-for-height (WHZ) and BMI-for-age.

The findings showed that the national prevalence of underweight increased significantly from 12.7% (2006) to 14.4% (2016), remaining a problem of medium public health significance based on the WHO cut-off while the prevalence of stunting has become a problem of borderline low public health significance, increasing from 17.5% in 2006 to 20.5% in 2016. However, the prevalence of wasting significantly reduced from 13.2% to 11.9% in the same time period although it still remained as a serious public health significance. As for the prevalence of overweight, there was only a slight increase from 3.4% in 2006 to 3.8% in 2016.

In conclusion, in the past decade, there is an increase on the prevalence of chronic undernutrition and overweight in Malaysia while there is a reduction on the prevalence of acute undernutrition. Therefore, a concerted multi-pronged strategy to address an urgent need to combat the double burden of malnutrition in the country is warranted. Strengthening and mobilisation of the key stakeholders in the country via multi and trans-sectoral approach to address double burden of malnutrition especially among under five children are crucial.

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**Session Classification:** Poster Session 7

**Track Classification:** Epidemiology
Urban residence is associated with higher prevalence of individual-level double burden of malnutrition in Malawian women

To assess the prevalence of the individual-level DBM in Malawian women. To model the associations between 1- overweight, 2- anemia, 3- micronutrient deficiencies, 4-DBM and urban or rural residence. To test whether the prevalence of the DBM would differ from that expected by chance, assuming the conditions were independent.

We analyzed nationally representative data based on a sample of 723 non-pregnant women of reproductive age (15-49 years) from the 2015-16 Malawi Micronutrient Survey. DBM was defined two ways: 1- co-occurring overweight (body mass index >25 kg/m²) and anemia (hemoglobin adjusted for altitude and smoking <12.0 g/dL) and 2- co-occurring overweight and any micronutrient deficiency (zinc deficiency [<70 μg/dL morning fasted samples, <66 μg/dL morning non-fasting samples, and <59 μg/dL afternoon non-fasting samples], iron deficiency [inflammation-adjusted ferritin <15 μg/L], vitamin A deficiency [retinol binding protein <0.46 μmol/L calibrated to equal retinol <0.7 μmol/L], vitamin B12 deficiency [<150 pmol/L], or folate deficiency [<6.8 nmol/L]). We modeled five associations: between 1- overweight, 2- anemia, 3- micronutrient deficiencies, 4 and 5-DBM with each definition (dependent variables) and residence (independent variable) using unadjusted and adjusted (for wealth, education, age) logistic regression models. The Rao-Scott modified Chi Square test was used to compare the observed and expected prevalence (product of the prevalence estimates of overweight and anemia or micronutrient deficiencies) of DBM.

National prevalence (95% CI) estimates of overweight, anemia, and any micronutrient deficiency were 14.5 (10.6, 18.4), 19.9 (16.5, 23.4), and 72.8 (67.7, 77.8), respectively. The DBM prevalence (95% CI) estimates were 3.4 (1.3, 5.5) and 10.8 (7.0, 14.5) for co-occurring overweight and anemia and co-occurring overweight and any micronutrient deficiency, respectively. Overweight prevalence in women differed by residence [urban 34.4 (25.8, 43.0), rural 12.5 (8.8, 16.2), adjusted prevalence ratio [aPR]: 1.8 (1.3, 2.6)]. Prevalence of either anemia or any micronutrient deficiency did not differ by residence. Co-occurring overweight and anemia prevalence in women did not differ by residence [urban 6.9 (0.6, 13.2) vs. rural 3.0 (0.8, 5.3), p=0.36], whereas urban women were 2-times more likely to have co-occurring overweight and micronutrient deficiencies than rural women [urban 32.6 (24.1, 41.2) vs. rural 8.6 (5.2, 11.9), aPR: 2.4 (1.5, 3.8)]. There were no statistically significant differences in observed and expected prevalence estimates of the DBM, by either definition.

The national co-occurrence of overweight and anemia or micronutrient deficiencies were independent, suggesting that programs need to address these public health problems separately. However, the higher prevalence of overweight and co-occurring overweight and micronutrient deficiencies in urban women, suggests that urban programs need to target both over- and undernutrition to improve women’s health.

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Session Classification : Poster Session 7

Track Classification : Epidemiology

Introduction:
Double burden of malnutrition among children is still the issue in public health in many countries as well as in Vietnam. We describe the changes in the prevalence of malnutrition in Vietnamese children based on National Nutrition Surveillance data conducted by the National Institute of Nutrition, Hanoi, Vietnam.

Methods:
National Nutrition Surveillance data which were conducted every five years by National Institute of Nutrition from 2000 to 2015 in a nationally representative samples to assess the children malnutrition status with sample-size of each survey was around 97,000 children under 59 months old in 63 provinces of Vietnam. The anthropometric assessment on nutrition status is based on 2007 WHO Growth Standard.

Results:
National Nutrition Surveillance data had shown that the prevalence of underweight in under five year old children had been reduced. Prevalence of underweight decreased from 30.1% in 2000 to 14.1% in 2015 with the rate of reduction was 1 percentage point per year; Prevalence of stunting was 43.3% in 2000 to 24.6% in 2015 with the rate of reduction was 1.2 percentage point per year. Prevalence of wasting was 11.1% in 2000 to 6.4% in 2015. The reduction of under-nutrition was different among ecological regions and between urban and rural area. The prevalence of under-nutrition was still high in mountainous area. Besides that, the trend of overweight and obesity among children under five years of age was on the increase from 0.62% in 2000 to 5.3% in 2015 with the rate of increasing was 8.5 folds during 2000 - 2015. The increasing of overweight and obesity was different between urban and rural area. The prevalence of overweight and obesity in 2000 was 0.9% among children living in urban and 0.5% among those living in rural. The prevalence of overweight and obesity in 2015 was 8.3% among children living in urban and 4.7% among those living in rural.

Conclusion:
There is an upward trend in overweight and obesity among children under five years in both urban and rural areas; Weight control and prevention of overweight and obesity need to be timely and appropriate for different target groups. Proper nutrition from early childhood is required for the prevention of obesity and decreasing the risk of chronic diseases in later life.

Key words: double burden, malnutrition, stunting, overweight, obesity, children, Vietnam.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Acceptance of sugar reduction in processed foods among Moroccan population

Background: High sugar consumption is one of the real problems that have swamped the world because of the known nutritional transition. In Morocco, a national action plan to reduce consumption of sugar, salt and fat 2017-2021 has been developed to strengthen the prevention of different non-communicable diseases and to achieve the goals outlined by ICN2 by 2025. The purpose’s study was to assess acceptance of yogurts with different percentage reduction of sugar by the Moroccan population and to determine the level of sugar reduction in yogurt.

Methods: A sample of 201 participants (age > 15 y.) was studied. Acceptance of yoghurt taste was tested using different concentrations 166.5; 149.8; 133.2; 116.5; 99; 83.2 mM/l, corresponding to the reduction of sugar of 0%, -10%, -20%, -30%, -40% and -50%, respectively, compared available yogurt in local market and based on taste, "Just About Right" (JAR) to define the acceptability scores of different yogurts. In addition, purchase intent scales were used to evaluate different yogurts.

Results: High acceptability was remarked for Yogurts containing -20% and -30% added sugar with 81% and 74% of respondents. Results from JAR score, yoghurt with 20% (133.2mM/l) and 30% (116.5 mM/l) reduction were defined as “just about right” by 42.7% and 44.3% respectively. The strong purchase intention was noticed for the sucrose concentration of 149.8 mM / l, while just 35.8% and 40.3% of participants, confirmed the purchase of yogurt with a concentration of 133.2 mM / l and 116.5 mM / l respectively.

Conclusion: The findings of this study indicated that the yogurts acceptability is major for those with -20% and -30% of added sugar. Hence, the need of advocating the dairy industry in order to engage them in the sugar reduction policy and to participate in achieving the national strategy of sugar reduction in Morocco.

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**Session Classification:** Poster Session 7

**Track Classification:** Policy implications
Child growth patterns in Rwanda

The main objective of the present study is to describe the child growth patterns in Rwanda in the last 15 years by using data from 2000, 2005, 2010 and 2015 Demographic and Health Surveys (DHS); and 2012 and 2015 Comprehensive Food Security and Vulnerability Analysis (CFSVA). Stunting, or low height for age, is caused among other factors, by long-term insufficient nutrient intake, frequent infections and diseases. Wasting, or low weight for height, assesses also malnutrition prevalence among children and is the result of acute significant food shortage and/or disease. Lastly, overweight is another form of malnutrition that has been associated with the development of non-communicable diseases.

Height for Age Z-scores (HAZ) and Weight for Height Z-score (WHZ) were used to analyze Rwandese child growth patterns. HAZ and WHZ were calculated using Software WHO Anthro (version 3.2.2., 2011) and macros using WHO 2006 growth standards. The size of the sample varied along the surveys and years from 3.542 children under five in 2015 DHS to 6.087 children under five in 2000 DHS. In order to identify child nutritional spatial disparities, the nationally representative surveys were split by districts and urban/rural areas.

Both wasting and stunting prevalence trends in Rwandese children under five decreased in the period from 2000 to 2015. Wasting started high in 2000 with 8.2% and has gradually declined reaching 2.2% in 2015 DHS. Geographical disparities in stunting were found. Whereas Kicukiro and Gasabo had the lowest rates of stunting (17.7% and 22.6% in 2015 DHS), Ngorero and Nyabihu registered the highest (57.3% and 55.8% in 2015 DHS). The distinction between urban and rural status shows clearly that the stunting prevalence is higher in rural areas. Predictably, the highest prevalence of overweight existed among urban areas reaching 10.8% in 2015 DHS. The national obesity trend shows a slight increase over the years in DHS. We also calculated the number of children with both overweight and stunting. The national prevalence of this double condition (stunted and overweight) started at 4.1% in 2000 DHS and ended at 3.2% in 2015 DHS, demonstrating an appreciable decline.

Although Rwanda has made progress towards meeting the 2025 World Health Assembly (WHA) global target on stunting, the prevalence among under five children continues to be high. Our findings illustrate a gently decrease in wasting and stunting prevalence in children in Rwanda during the last 15 years. While wasting has achieved an acceptable prevalence, the prevalence of stunting remains very high. CFSVA and DHS prevalence numbers for stunting and wasting do not differ greatly. Overweight is another form of malnutrition that seems to be increasing among children in Rwanda. These findings suggest that the double burden of malnutrition is present among Rwandese children.

Finally, to assess nutrient intake and diet adequacy, the Individual Dietary Diversity Score (IDDS) will be calculate and used as a determinant of stunting and overweight in regression controlling by other health and sociodemographic variables.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Prevalence of underweight, overweight and obesity and their associated risk factors amongst geriatric population living at high altitude region of rural Uttarakhand, India

Introduction: A high prevalence of malnutrition, as characterized by underweight (UW) and overweight (OW), has been reported among the geriatric population in India. The geriatric population has an increased risk of malnutrition due to physiological changes such as reduced metabolic rate, loss of appetite, difficulties in chewing and various co-morbidities. UW among the elderly can cause impaired muscle function and immune dysfunction that increases the risk of infection and mortality. OW among the elderly, on the other hand, may contribute to the onset of chronic non-communicable diseases such as diabetes, hypertension and CHD, functional decline and disability, and increased mortality. Earlier studies conducted in India suggest that identification of the risk factors associated with malnutrition in the geriatric population plays an important role in prevention of morbidity and mortality among them. The majority of these studies have been conducted in plains regions of the country. Lifestyle factors such as diet and physical activity are different in plains as compared with high-altitude regions of the country. We do not have scientific evidence on the risk factors associated with UW and OW among the geriatric population living in high-altitude regions of India; hence the present study was conducted to fill the gap in the existing knowledge.

Methodology: Community-based cross-sectional study was conducted in a high-altitude region of Nainital District, Uttarakhand State, North India. Data were collected amongst community-dwelling geriatric subjects (n=981) aged 60 years or above on sociodemographic profile and anthropometric parameters. Weight and height measurements were utilized for calculation of BMI. Nutrient intake data were collected using 24 h dietary recall.

Results: We found that 26·6 % of the elderly subjects were underweight (BMI<18·5 kg/m2). Overweight (BMI 25·0–29·9 kg/m2) and obesity (BMI≥30·0 kg/m2) was seen among 18·0 % and 4·6 %, respectively. Risk factors such as low level of education and income, chewing problems and lower number of meals were found to be associated with underweight. On the other hand, risk factors for overweight/obesity were lower age and high income. We observed that geriatric subjects with low BMI had lower dietary intakes of nutrients than those with normal BMI. Earlier studies conducted in other countries have also reported similar associations. Further weight loss due to inadequate dietary intake among these UW geriatric subjects may increase their risk of developing disability, compromised immune function, increased susceptibility to acute illnesses and reduce survival rate. Conversely, the percentage adequacy and nutrient intakes were documented to be significantly higher among OW/OB than UW and normal-weight geriatric subjects, possibly due to overall higher quantity of food consumed by the former. The diets of the geriatric subjects were found to be high in fat density (double the RDA) and low on nutrient density.

Conclusions: There is a need to develop and implement intervention strategies to prevent underweight, overweight and obesity among the geriatric population of India.

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**Session Classification:** Poster Session 7

**Track Classification:** Epidemiology
Prevalence of the double burden of malnutrition in households of Niamey city in Niger

• Introduction
In Niger few studies were interested on the problems of overload diseases. The 2006 Niger Demographic and Health Survey, NDHS[1] showed according to Body Mass Index (BMI), the energetic deficiency (BMI lest than 18.5) was 19% while 13% of Niger women had a high BMI (25 or over). According to survey using STEPS [2] approach for chronic diseases risk factor surveillance, realized on December 2007 into general population: 21.2 % of population has high blood pressure and 4.3 % has diabetes. In the 15-64 age groups, 3.2% are obese and 22.4% are overweight. At 2012, NDHS [3] revealed that 2 % of children were overweight while at the same time, the SMART [4] national survey revealed a prevalence of global acute malnutrition of 14.8% among children aged 6-59 months. The double burden of malnutrition can be a reality in Niger.

This study conducted as part of a Master’s thesis in public health, Human Nutrition option at the Institute of Public Health, was interested in this issue by targeting households of Niamey city.

• Methods
A selection of neighborhoods according to the socioeconomic level of households has permitted to consider two neighborhoods supposed to be those of affluent households (Plateau and Recasement) and two neighborhoods supposed to be those of disadvantaged households (Talladjé and Koira Tégui). In each neighborhood, 25 randomly selected households were surveyed. Into the households, one mother and all her children with 2 to 11 years were chosen for anthropometric measurements. For double burden of malnutrition determination, approach used by Zeba [5] in Ouagadougou was privileged for which, the double burden of malnutrition in household is the presence of a mother who is overweight / obese (according to the BMI) and at least one undernourished child according to one of the three index (Weight / Height, Height / Age and Weight / Age).

• Results
Table (attached): Presence of the double burden of malnutrition according to household’s socioeconomic level of neighborhoods in Niamey city

The prevalence of double burden of malnutrition found by this study in Niamey city is 23% and it is not significatevely different between neighborhoods that are supposed to be socio-economically different. It is 28% at Talladjé, 20% at koira Tégui, 32% at Plateau and 12% at Recasement.

• Conclusion
This study, although carried out on a small scale, showed that the “double burden” families in which coexist a child with a global deficiency and a mother who is over weighted or obese are observed in Niger and in urban areas. The problem of over- and under-nutrition is not simply a problem of the rich or the poor, respectively, because there is no significant difference between neighborhoods that are supposed to be socio-economically different. These results demonstrate research needs in large scale on double burden of malnutrition in Niger.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Body composition in Gambian women: impact and implications of rural-to-urban migration and the nutrition transition.

The Gambia, West Africa is experiencing various types of transition, including nutritional and epidemiological. Rapid urbanisation and the influence of globalisation are resulting in shifts in diet and lifestyle, with a related rise in NCDs. Yet, the prevalence of micronutrient deficiencies, infectious diseases, and undernutrition is still high. We have investigated whether migrating to an urban environment impacted anthropometry and body composition. This research formed part of a larger study of the impact of migration and nutrition transition on bone health in Gambian women living in rural and urban areas of The Gambia.

Data were collected for two groups of pre-menopausal women aged 35.0 to 50.9 years: urban migrant (n=58) and rural (n=81). Both groups spent their formative years in the same rural setting, and urban women were known to have migrated when aged ≥16 years. Participants had dual energy x-ray absorptiometry (DXA) and peripheral quantitative CT (pQCT) bone and body composition measurements including total lean and fat mass, and regional (android and gynoid) fat mass. Data were also collected on bone phenotype and biochemistry, food and nutrient intakes, physical activity, socio-demographic characteristics, vitamin D status, and 24hr urinary mineral outputs.

There was no significant difference in age between groups. Median age at migration for urban women was 18.5 (16.5 to 21.9) years, with an average 23.8 (18.9 to 28.6) years spent in the urban environment. The groups were of similar height (p>0.05). However, urban women were significantly heavier (p<0.001): urban 67.7 (55.3 to 79.4) kg and rural 58.3 (51.6 to 67.3) kg, with a between group difference of 13.6%. Difference in weight was attributable to significantly greater fat mass in the urban group: urban 27.0 (18.3 to 35.4) kg and rural 17.4 (13.7 to 23.2) kg, and this was primarily in the android region. Fifty-six percent of urban and 30% of rural women were overweight or obese (BMI ≥25). Of those classified as obese, 7% and 2% (urban and rural respectively) were severely or morbidly obese. Several women were underweight, 11% versus 3% of urban. Dietary data indicated that consumption of fruit and vegetables was lower in the urban group and energy from fat was higher. Differences were reflected in the urban group’s higher potential renal acid load.

Overweight and underweight exist in both rural and urban regions of The Gambia, with a higher prevalence of obesity and central adiposity in urban areas. Further work is needed to understand the impacts, implications, and determinants on risk of NCDs, with the aim of developing appropriate interventions for both rural and urban contexts.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Socioeconomic Factors Associated with the Double Burden of Malnutrition among Women in Mozambique: A Cross Sectional Analysis of Demographic and Health Surveys from 1997 to 2011

Background
A comprehensive analysis of the malnutrition status of Mozambican women of reproductive age to guide nutrition-related policy-making is needed. This study aimed to estimate the prevalence and trends in overweight, underweight, and overweight and anemic in Mozambican women. Geographical clusters of overweight women were identified. In addition, socioeconomic factors associated with overweight and underweight were analyzed.

Methods
Data from the 1997, 2003 and 2011 Mozambican DHS of women 15 – 49 years were used in this study. Pregnant women were excluded. Body mass index (BMI) was coded as <18kg/m² for underweight, 18.5kg/m² – 24.99kg/m² for normal weight, ≥ 25kg/m² for overweight. Hemoglobin levels was categorized as 120 g/l or higher for non-anemic and <120 g/l for anemic. Descriptive statistics were used to estimate prevalence whereas, logistic regression models were used to analyze the association between household wealth and education and BMI categories in SAS adjusting for other confounding sociodemographic factors like age. Finally, the Getis-Ord Gi* statistic was calculated with the hotspot analysis tool in ArcGIS to identify districts in Mozambique with a clustering of overweight women.

Findings
3,485, 10,535, and 12,202 women were included in our analysis of the 1997, 2003 and 2011 MDHS, respectively. From 1997-2011, underweight prevalence declined from 10.9% to 8.5%. Contrastingly, overweight prevalence increased from 9.2% in 1997 to 16.4% in 2011. These trends were statistically significant (p <0.001). The prevalence of overweight and anemic was estimated at 7.3% for 2011 (no data for other years). Clusters of overweight women were found in districts located in Panda and Chibuto districts in Gaza and Inhambane Province. Household wealth and education had a positive and negative statistically significant association with overweight and underweight respectively. Individuals from richest wealth quintile were 11 times as likely to be overweight (OR 10.56; 95% CI 7.04 - 15.83) and had a 40% decreased odds of being underweight (OR 0.60; 95% CI 0.43 - 0.85) compared to those in the poorer wealth quintile. Individuals from middle wealth quintile were twice as likely to be overweight (OR 2.18; 95% CI 1.53 - 3.11) and had a 39% decreased odds of being underweight (OR 0.61; 95% CI 0.47 - 0.79). Women with secondary or higher education had a 38% increased odds of being overweight (OR 1.38; 95% CI 1.11 - 1.71) and a 32% decreased odds of being underweight (OR 0.68; 95% CI 0.51 - 0.90) compared to those with no education.

Interpretation
Our study reveals the existence and location of a double burden of malnutrition in Mozambique and the sociodemographic drivers such as household wealth and education. Although underweight prevalence is plummeting, overweight prevalence is increasing. Increasing socioeconomic status may place Mozambican women at increased risk of overweight and obesity due to access to surplus or unhealthy foods and sedentary behaviors. Targeted interventions for this at-risk group is warranted.

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Session Classification : Poster Session 7

Track Classification : Assessment
Overweight, obesity, underweight and sarcopenia in the elderly of Latin America and the Caribbean

Background. Current societies are characterized by an increase in the prevalence of overweight and obesity, which is a general problem of the adult population and has an important impact on public health, in comparison with underweight figures. This situation also occurs in the elderly, but in these ages, sarcopenia is prevalent; it is identified among other aspects by decline of the skeletal muscle mass associated with age, in correspondence with a loss of function, identified with a low strength muscle and a slow walking speed. These entities coexist with significant implications in the quality of life of these people. The purpose is to provide preliminary data on body composition and functionality and some health and nutrition related outcomes in older adults from the Latin America and the Caribbean region. Methods. Cross-sectional study including 1046 volunteers over 60 years of age (31% men and 69% women) from ten countries (Argentina, Brazil, Chile, Cuba, Guatemala, Honduras, Jamaica, Mexico, Peru and Uruguay) from the IAEA project RLA6073 on sarcopenia were considered. Anthropometric variables (weight, height and waist circumference) to calculate Body Mass Index (BMI) and to determine abdominal adiposity. Body composition by deuterium dilution (using Fat mass index: FM/H2 and Fat-free mass index: FFM/H2), and bioelectrical impedance analysis were collected. Maximum grip strength (MGS), gait speed in 6 meters (GS6M) and the Timed up and Go (TUG) test were applied to assess impaired physical performance. The measurements were performed in all subjects by standardized protocols. These measurements were used to assess overweight, obesity, underweight and sarcopenia indicators. The appendicular skeletal muscle mass, corrected by height squared (ASMM) was calculated from Latin-American equations. To identify sarcopenia indicators, were considered cutoff point for MGS (female <17Kg and male <25Kg), TUG 10s and GS6M <1m/s. In the statistical processing, the General Linear Model (GLM) on FM/H2 and FFM/H2 (main effects: sex, manual strength and performance indicators, and controlled by the BMI and the ASMM) and the Principal Component Analysis (PCA) were used, among others. Results. According to BMI about 42% of the elderly are overweight and 26.7% are obese, with a predominance of females. Underweight is uncommon (2.8%) and the abdominal adiposity is about 80%. The indicators related of sarcopenia showed prevalence of low muscle strength (28%), a 48% had impaired in GS6M test, low risk values in TUG test and the muscle mass declined. The results of the GLM expressed the significant influence (p=0.000) of overweight and muscle mass on FM/H2 and FFM/H2. The TUG is only important associated with sex. Similarly, only the impact of MGS and the GS6M on FFM/H2 are significant when they are associated with sex. The PCA highlights the contribution of muscle mass in the FFM, the BMI account for excess body fat; the performance indicators are more affected in elder who have higher adiposity. Conclusion. This study confirms a high prevalence of overweight, obesity and sarcopenia indicators in Latin America and the Caribbean elderly.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Double Burden of Malnutrition and Chronic Disease Risk Among Mother-Child Dyads within the Same Household in Urban Poor Settings in India

Introduction
Under-nutrition and over-nutrition have long been treated as distinct public health problems, each with its own underlying factors. However, with urbanization, changing lifestyle and dietary patterns of populations in developing countries, the co-existence of under-nutrition and over-nutrition within countries, communities and households has become inevitable especially in context with poor segments of the population. Developing countries, including India, has primarily focused on the high prevalence of undernutrition and no national policies/programmes are there to address overnutrition/obesity. The purpose of the study was to find out the prevalence of different forms of malnutrition within the same households in urban poor settings in India and their potential determinants.

Methods
A cross-sectional study of 350 mother-child dyads (children aged 3-5 years) from urban poor settings of Delhi, India. Anthropometric measurements (weight, height, waist-circumference, hip circumference in mothers and weight, height, MUAC in children) were taken from a stratified random sample of mothers aged >18 years with children aged 3-5 years. Households were categorised into different forms of malnutrition based on prevalence of underweight, stunting, wasting and overweight/obesity in children, with corresponding proportions of underweight and overweight/obesity in mothers, based on BMI, waist circumference and waist-hip ratio.

Results
Of the 350 mother-child dyads, the prevalence of underweight child-overweight mother (UC/OM) defining double malnutrition was found to be 20% compared to 23% normal child and normal mother (NC/NM) which was taken as the reference group, corresponding households were UC/UM 3%; UC/NM 5%; NC/OM 30%; NC/UM 7%; OC/NM 3%; OC/OM 7%; OC/UM 2%. A large proportion (40%) of overweight/obese mothers respectively had stunted (21%) and severely stunted children (14%). Among, all dual malnutrition households, the odds of being at chronic disease risk among mothers as assessed from waist circumference and waist height ratio was 3.1 (95% CI 2.2-4.5). Significant predictors of dual burden households (p<0.05) includes maternal short stature, mother’s and father’s low level of education, reduced physical activity and ease to junk food availability.

Conclusion
We documented the existence of double burden of malnutrition characterized by a high prevalence of undernutrition in early in life, with high levels of overweight/obesity in adulthood, particularly among mothers in the same households. Undernutrition and overnutrition are coexisting within the same household wherein members have a similar exposure to environmental contributors such as poor nutrition, infection, poverty etc. Therefore, it is imperative to understand the pathways for this concurrent situation and redirect present policy and programs to meet this emerging challenge.

*Households represents: UC-Underweight child; NC- Normal weight child; OC- Overweight child; UM-Underweight mother; NM- Normal weight mother; OM- Overweight mother

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Session Classification: Poster Session 7

Track Classification: Epidemiology

The Philippines is among the Southeast Asian countries that continue to suffer from the “double burden of malnutrition,” or the co-existence of under-and-over nutrition among its people. Under-nutrition greatly affects Filipino children below five years old while overnutrition was prevalent among adults aged 20 to 59 years.

The Filipino citizenry’s nutritional status is defined through the conduct of National Nutrition Surveys (NNS) every five years and Updating Surveys every two to three years in between NNSs by the Department of Science and Technology’s Food and Nutrition Research Institute (DOST-FNRI) utilizing a multi-stage stratified sampling design. The DOST-FNRI conducts nutritional assessment using Anthropometry, Biochemical, Dietary and Clinical methods.

Based on the latest Updating Survey by the DOST-FNRI in 2015, undernutrition among children below five is still a public health problem where stunting (33.4%) and underweight (21.5%) remained high in magnitude and severity while wasting was 7.1%. Over two decades, stunting prevalence manifested a decline from 44.5% in 1990 to 30.0% in 2013; however, it rose again to 33.4% in 2015. Underweight prevalence followed the same downward trend as stunting from 27.3% in 1990 to 20.0% in 2013 and increased again to 21.5% in 2015. Wasting prevalence was relatively unchanged. Overweight/obesity, on the other hand, was a problem of public health significance among adult Filipinos, from 16.6% in 1993 the prevalence almost doubled at 31.1% in 2015.

Using multiple regression analysis, factors that significantly influence undernutrition among children include child’s age (p<0.000), household’s wealth status (p<0.000), household’s food security status (p<0.003), child’s energy intake (p<0.007) and drinking water given to the child (p<0.044).

Overnutrition among Filipino adults was significantly influenced by age, sex, work status, energy intake, household’s wealth status, household’s food security status, presence of electricity, place of residence and physical activity. Adults belonging to age group 40-49 years old (p<0.000), are female (p<0.000), who are working (p<0.012), who are meeting their energy intake (p<0.007), who are in the richest wealth quintile (p<0.000), whose households are food secure (p<0.006), have electricity (p<0.047), living in urban areas (p<0.001) and are physically inactive (p<0.000) are more at-risk to overnutrition.

The double burden of malnutrition is an important concern that needs to be addressed in the Philippines. The government cannot solve the problem alone, strong partnerships and open engagement of all stakeholders from all sectors including the family are required given the important role that each play to address the malnutrition problem, especially stunting and obesity.

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**Session Classification**: Poster Session 7

**Track Classification**: Epidemiology
The double burden of malnutrition and its agreement with body composition indicators in Latin American children and adolescents. The SAYCARE Study.

Background: Undernutrition in childhood has traditionally been a major concern for public health in low and middle-income countries. However, rapid changes in lifestyles contributed to the increase in the prevalence of obesity and other chronic diseases. Coexistence of excess body weight with growth deficit is known as the "double burden of malnutrition". Anthropometry is a simple and recognized method to assess body composition, although it has limitations. Body mass index (BMI) provides information about total body mass but doesn’t discriminate between fat mass and fat free mass.

Objectives: (I) to assess body composition indicators in Latin American children and adolescents belonging to the South American Youth/Child cARDiovascular and Environmental (SAYCARE) study and (II) to assess the agreement between the double burden of malnutrition classification and the excess of body fat in children and adolescents.

Methods: Subjects were selected from seven participating cities (Buenos Aires, Medellin, Lima, Montevideo, Santiago, Sao Paulo y Teresina) stratified by age and sex. Anthropometric standard procedures included weight, height, circumferences and skinfolds. According to nutritional status, the population was classified in: low height/overweight (LH/OW, double burden of malnutrition), low height/normal weight (LH/NW), normal height/overweight (NH/OW) and normal height/normal weight (NH/NW). Fat mass index (FMI) and Fat free mass index (FFMI) were used as body composition indicators, and Z-scores were computed using linear regression analyses and then entered as residuals into further analyses. Comparisons between categories according to the nutritional status were performed by analysis of variance. Agreement between the double burden classification and excess body fat classification (FMI>1SD) was performed using the Kappa test. ROC curves were designed to assess the ability of the double burden of malnutrition, using ZBMI and a composite index using the sum of ZBMI and Zheight (ZBMI+(Zheight X -1)), to identify subjects with excess body fat.

Results: In children, FMI z-scores were: 0.37 ±0.73 (Mean ±SD) in the group of the double burden, and -0.55 ±0.36, 0.74 ±0.90 and -0.46 ±0.49 in the LH/NW, NH/OW and NH/NW groups, respectively. In adolescents, the values were: 1.46 ±1.21, -0.61 ±0.72, 1.07 ±0.98 and -0.61±0.70 in the same groups, respectively. The Kappa coefficient showed a low agreement between the double burden of malnutrition classification and the excess of FMI (k=0.02 and 0.14 in children and adolescents, respectively). However, the ROC curves showed a good ability of the double burden of malnutrition classification to identify subjects with excess FMI. The areas under the ROC curves were 0.972 for ZBMI (CI: 0.957, 0.988) and 0.783 for composite ZBMI and Zheight (CI: 0.726, 0.840) in children; and 0.956 for ZBMI (CI: 0.937, 0.975) and 0.862 for composite ZBMI and Zheight (CI: 0.825, 0.898) adolescents.

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**Session Classification**: Poster Session 7

**Track Classification**: Epidemiology
Sugar Taste Thresholds in Moroccan population

Introduction: As under developing countries, Morocco is also a victim of the nutritional transition characterized by a food imbalance that is based on high sugar consumption (95g/p/d) directly involved in triggering serious health problems. Action plans are then necessary to conduct at the national level as part of the prevention of various diseases. Therefore, the purpose of this study is to define the threshold of perception of sweet taste “sucrose” among the Moroccan population and to evaluate differences according to sex and age groups.

Methods: This cross-sectional and simple-blind experimental study was conducted among 199 subjects aged from 15 years and over. For each subject, anthropometric characteristics were measured. Sucrose threshold perception was determinate based on the validated 3-AFC test method for 9 prepared solutions (1000ml) of sucrose at different concentrations ranging from 0 to 243 mmol / l.

Results: The results show that 91.96% of the studied population perceives sweetness at a high threshold of 27 mmol / l. A high sweet sensitivity were observed in women (124), but no significant difference (P> 0.05), according to sex, was found for perception of sweet taste at all concentrations. Concerning BMI status, the major part of our study population was restricted in normal status for all concentrations and no significant difference was noted.

Conclusion: The present study showed that Moroccan population is in risk of different diseases linked to its high sweet perception threshold. Therefore, it is strongly recommended to reduce sugar consumption in order to combat non-communicable disorders, who have become the leading cause of death in the world.

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**Session Classification**: Poster Session 7

**Track Classification**: Epidemiology
Prevalence and inequality in double burden of malnutrition in Pakistan: analysis of national level cross-sectional survey data

ABSTRACT:

Introduction: Pakistan is one of the many developing countries facing highest double burden of malnutrition. The aim of this study was to assess the prevalence and inequality in double burden of malnutrition in Pakistan in order to guide policy makers and government agencies to achieve the Sustainable Development Goals and Global Targets for Nutrition 2025.

Methods: The analysis was based on Pakistan Demographic and Health Survey (PDHS) 2012-13. Data on 4,285 children under-five years and 4,170 women 15-49 years were assessed for nutritional status. The wealth index was used as proxy indicator for socioeconomic status of households. The concentration index was calculated for the whole sample, as well as for subcategories defined as area of residence (urban and rural) and the sex of children.

Results: The prevalence of stunting and underweight in children under-five years was 45% and 30%, respectively. Boys were more likely to be stunted (48%) and underweight (33%) than girls (42%) and (27%). More than half of children whose size at birth was very small or small were stunted and 40% were underweight. Children whose mothers were underweight (BMI <18.5) had the highest levels of stunting (55%) and underweight (44%), while those whose mothers were overweight or obese (BMI ≥25) had the lowest levels of stunting (35%) and underweight (19%), respectively. Children in rural areas were more likely to be stunted (48%) and underweight (33%) than those in urban areas (37%) and (24%). Stunting and underweight ranges from a low of 21% and 10% among children whose mothers had a higher education to 55% and 39% among those whose mothers were illiterate. Children in the poorest households were almost three times as likely to be stunted (62%) and underweight (48%) than children in the wealthiest households (23%) and (16%), respectively. About 14% of women were underweight and 40% were overweight or obese. Rural women are more likely to be underweight (17%) than urban women (7%). The prevalence of overweight or obese was higher in urban women (54%) than rural women (33%). Women with no education were more likely to have a lower mean BMI than those with a secondary or higher education (23.6 kg/m2 and 26.0 kg/m2, respectively). Mean BMI showed a steady increase with increasing wealth, from 21.3 kg/m2 among women in the lowest wealth quintile to 27.1 kg/m2 among those in the highest quintile.

Conclusion: There are substantial inequalities in the prevalence of double burden of malnutrition in Pakistan, and failure to tackle these inequalities is a cause of continued social injustice since many decades. Moreover, reducing the overall rate of double burden of malnutrition does not necessarily lead to a reduction in inequality. Therefore, policy makers and government agencies should take into account the distribution of double burden of malnutrition across all socioeconomic groups and in rural and urban areas.

Key Words: Prevalence, Inequity, Double Burden, Malnutrition, Pakistan

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**Session Classification**: Poster Session 7

**Track Classification**: Epidemiology
Existence of Double Burden of Malnutrition among Filipino Children in the same Agegroups: Is there a Difference in the Nutrients Intake?

Introduction: This study aims to assess the prevalence of underweight and overweight children in the same agegroups and evaluate if differences exist in their usual nutrients intake.

Methods: Data were from a nationally representative sample of 8992 children aged 3-12y who participated in 2013 National Nutrition Survey. Dietary intake was collected using 24-h dietary recall. A second 24-h recall was collected from 50% of the sample on a non-consecutive day. Usual intakes and distributions of energy and nutrients were estimated in three subgroups: preschoolers (3-5y, n=2427), younger and older schoolchildren (6-9y, n=3594 and 10-12y, n=2971 respectively) using PC-side program from Iowa State University. Nutrients reported included protein, calcium, iron, zinc, vitamin C, thiamine, riboflavin, vitamin A, vitamin B6, vitamin B12 and folate. Energy inadequacy was assessed by Estimated Energy Requirements (EER) calculated using the equation of the Institute of Medicine and sedentary physical activity level. The prevalence of nutrient inadequacy is estimated as the proportion of individuals with usual intakes below the EAR-EAR cut-point method. Children 3-9y was classified as underweight if weight-for-age Z-score is <-2SD (WAZ <-2 SD); and BMI-for-age Z-score <-2SD (BAZ<-2 SD) for children 10-12y. Children 3-5y was classified as overweight if weight-for-height Z-scores >2SD (BAZ >2 SD) and BMI-for-age Z-scores >1SD (BAZ >1 SD) for 6-12y (WHO, 1995)

Results: The prevalence of underweight among preschool children, younger and older schoolchildren is 22%, 30% and 16% respectively while the prevalence of overweight is 4%, 9% and 10% respectively.

The average energy intake of underweight preschoolers is 14% lower than EER and 3% lower in younger schoolchildren; and 10% higher than EER among older schoolchildren. Inadequate intake of carbohydrate as percent of total energy intake was 5% among preschoolers; 2% among younger and older schoolchildren. Fats as percent total energy was 34% inadequate among preschoolers, 52% among younger schoolchildren, 47% among older schoolchildren.

The average energy intake of overweight preschoolers is 4% higher than EER, 8% higher among younger schoolchildren and 5% higher among older schoolchildren. Inadequate intake of carbohydrate as percent of total energy intake was 24% among preschoolers and 6% among younger and older schoolchildren. Fats as percent total energy was 7% inadequate among preschoolers, 11% among younger schoolchildren; 21% among older schoolchildren.

For underweight, percentages below EAR were: thiamine (56-74%), riboflavin (57%-83%), vitamin C (64-90%), folate 68-91%, iron (84-97%) and calcium (92-96%). For overweight, percentages below EAR were: folate (50-79%) and calcium (58-84%).

Conclusions: High prevalence of double burden of malnutrition co-exists in the same agegroups of children. The prevalence of energy inadequacy was higher among underweight than overweight children. Inadequacy of fat is lower among overweight than underweight children while inadequacy in carbohydrate was higher in overweight than underweight children. The main source of energy therefore for underweight is carbohydrates while overweight was fats.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Level of cadmium, lead and hemoglobin in the blood of pregnant mothers metallurgical center Oroya Peru

Introduction.- The contamination of the environment by lead, cadmium in metallurgical zones its deadly effect on health and nutrition, in maternal perinatal groups is a priority in the world.

Objective.- To determine the relationship of cadmium, lead and hemoglobin levels in maternal blood, in the city of La Oroya, Peru.

methods.- Observational, cross-sectional descriptive study. Samples were obtained from 40 pregnant women, residing in the city of La Oroya for at least 2 years, in the operation stage of Pb, copper and zinc smelters. Blood samples were obtained from the pregnant woman before delivery and after the birth samples of hemoglobin were taken. The Cd and Pb level of these samples was evaluated by atomic absorption spectrometry with graphite furnace. The analysis was performed with the statistical package SPSS version 22.

Results - Information was collected from 40 normal deliveries, the average levels of lead in maternal blood 21.6136 ± 31.6736ug / dl, cadmium 6.1033 ± 11.1942 ug / dl, hemoglobin 7.1197 ± 8.9035 g / dl. Significant correlation coefficients of lead of maternal blood were found and hemoglobin level was -0.268 evaluate = 0.047, cadmium and lead in maternal blood 0.760 pvalue = 0.000 and the correlation of cadmium in maternal blood and hemoglobin level = -0.066 pvalue = 0.343, it was not significant.

Since the statistic r = -0.311 is less than the critical value r = -0.304 it is located in the critical region, which indicates that we must reject the null hypothesis and consequently accept the alternative hypothesis. Therefore, we conclude that for a level of confidence at 95%, there is a significant negative relationship between lead in maternal blood and hemoglobin level. Since the statistic r = 0.760 is greater than the critical value r = 0.304 this is located in the critical region, which indicates that we must reject the null hypothesis and consequently accept the alternative hypothesis. Therefore, we conclude that for a 95% confidence level, there is a significant relationship between lead and cadmium in maternal blood. The pregnant mothers had high concentrations of lead and cadmium, low concentrations of hemoglobin in maternal blood. Higher levels of lead concentration lower levels of hemoglobin, at higher levels of lead concentration higher levels of cadmium concentration in maternal blood.

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Session Classification : Poster Session 7

Track Classification : Epidemiology
Girls and Boys protagonists of food habit improvement through a school garden

Introduction. Aim of this work is to show the school garden as an integrator of nutrition education together with the experience of the entire process of alimentacion-nutricion.

Methods. It is a communitary essay, in 2 primary public schools, located in the rural area. Multiple methodological triangulation was used to evaluate the intervention. Nutritional status, perception of the participation and diet was evaluated before and after the intervention. The intervention consists in the implementation of a school garden, workshops of nutrition, gardening and food preparation.

The articulation of the information allows a comprehensive appreciation of the food processes and the active role of children in the various expressions of their experience both direct activities.

Results. 193 children were analyzed, 128 in the case group and 65 in the control group. A school garden of 100m2 was installed. 7 nutrition, gardening and culinary technique workshops were implemented in the case group. In both groups children receive nutrition theory classes that are part of the school program.

Anthropometric data shows a greatest significant increase in IMC Z-score and in wrist/height index in de control group.

According to group interviews, children rebuild collectively step by step the process of construction of the school garden and recognize its benefits in the short and long term in health, ecology and economy.

Conclusions. Children identify their participation in the school garden as a positive experience related with health, coexistence, happiness and proud. School gardening together with nutrition and culinary technique workshops is a participative experience for children that can modify their eating habits and help preventing malnutrition.

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Session Classification : Poster Session 8
The burden of iron and folic acid deficiency: case of the Impact study of the consumption of fortified wheat flour with elemental iron and folic acid on the nutritionnal status of women of childbearing age in Morocco

Background:
Despite the fact that maternal mortality has declined significantly lately in Morocco, there are still signs of high prevalence of micronutrients deficiencies in a large segment of the population. The aim of this study is to evaluate the impact of consumption of fortified wheat flour with elemental iron and folates on the status of women of childbearing age (15 to 49y).

Methods:
The study was conducted in 38 health centers. SES assessment and hemoglobin test were performed for 2151 non-pregnant women. Blood samples were withdrawn from subsamples to determine the serum ferritin and folic acid.

Results:
The results showed that 34.2% of analyzed women were anemic (hemoglobin <12 g / dl). Anemia affects the rural region as much as the urban and suburban. It is more prevalent among young women (15 to 20y). The level of women education slightly influences the rate of anemia. Thus, the percentage of anemic women is higher among women with little or no education and decreases depending on the level of education. The subsampling for iron deficiency (n = 213) and folic acid deficiency (n = 470) showed that 28.2% of women of childbearing age have iron deficiency (serum ferritin <15µg / l) and 30.4% have a folic acid deficiency (folate<3 ng / ml).

Conclusion:
After five years of marketing of wheat flour fortified with elemental iron there was no improvement in iron status of women in childbearing age. A change of the premix into iron EDTA may be a solution.

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Session Classification : Poster Session 8

Track Classification : Interventions
Proposing a conceptual framework for developing contextual solutions for double burden of malnutrition: Application of the mainstreaming nutrition initiative assessment

Background: Double burden of malnutrition has been on the increase in Low and Middle-Income Countries (LMIC) in the world. Developing adequate policies to tackle this menace can be difficult, it is norm to focus on undernutrition and with little intervention on emerging overnutrition. This could be for lack of tools on how best to address contextual malnutrition profiles in sub-regions or countries. This comprehensive method can help to identify options of possible, plausible and feasible options for interventions, improvement to already existing intervention and to develop systematic solution to support reduction of both kind of malnutrition concurrently.

Discussion: The paper proposes and illustrates the application of the mainstreaming nutrition initiative framework as a tool for the development of contextualised interventions that can effectively target double burden of malnutrition. Based on the tenets of the Mainstreaming Nutrition Initiative framework by Menon and colleagues (2011), the proposed conceptual framework advocates the integration of epidemiology, operational and political analysis. The subsequent implementation of contextual interventions. Applying this framework to the problem of double burden in two Nigerian states – Kebbi and Anambra State, it ensures that only solutions that can pragmatically address epidemiology, operational issues while gaining political support are advocated for. The added value provided by the framework lies in its comprehension, theoretical basis, underpinning pragmatic philosophy, diagnostic and exploratory nature and face validity.

Conclusion: Contextual nutrition solutions have mostly applied at best two of the domains, the integration of the epidemiology, operational and political factors has not been widely used in practice. A conceptual framework that can assist in systematically developing contextual interventions may facilitate this. It also adds significant value to existing nutrition frameworks by incorporating multiple essential assessment domains and linking the analysis of these assessments to develop implementable and realistic solutions. Analytically, it’s use would aid the development of better solutions than one/two domains alone. The study encourages examination and utilisation of the tool by others in assessment and for guiding the development of malnutrition interventions for reduction and elimination of all kinds of malnutrition.

Keywords: Conceptual framework, Mainstreaming nutrition, Double burden, Political economy, Operational assessment, Contextual interventions

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Session Classification : Poster Session 8

Track Classification : Interventions
Impact of Obesity on Plasma Leptin and Effect of Auricular Acupuncture on Co-Morbidity in Childhood

Introduction: Obesity in children and young people is defined as BMI at or above the 95th percentile for young people of the same age and sex. BMI is a person’s weight in kilograms divided by the square of a person’s height in meters. It is moderately related to direct measures of body fatness. Recently, there are growing evidence that obese children are greater risks of several metabolic disturbances including: diabetes, dyslipidemia, hypertension, cardiac and non-alcoholic fatty liver. Auricular acupuncture is a recent complementary modality for treatment of childhood obesity and decreasing its risks and complications. Objective is to show the impact of auricular acupuncture on weight reduction, lipid, fasting insulin and serum leptin on a sample of obese children.

Methodology: The study was conducted on 34 obese children (6-12) years old from outpatients clinic CMD centre of excellence NRC. They were divided into groups: gpA subjected to auricular acupuncture, balanced healthy low caloric diet, and exercise with follow up for 12 weeks and gpB sham auricular acupuncture, balanced healthy low caloric diet and exercise with follow up for same time as gpA. Results: There were a significant reduction in body weight, BMI, WC, cholesterol LDL, insulin resistance in gpA in comparison to gpB with (p value ≤ 0.001). In the same time, there were a significant reduction in serum insulin and leptin in gpA in comparison to gpB with (p value ≤ 0.005). Conclusion: Auricular Acupuncture can be used safely as adjuvant therapy in management of childhood obesity with reduction of its associated co-morbidity.

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Session Classification: Poster Session 8
Track Classification: Interventions
Building a productive future generation through tailored nutrition interventions for adolescent girls.

Background.
Out of the total Sri Lankan population of 20.4 million 16% accounts adolescents, with a male to female ratio close to one. Out of them, over 75% are attending schools and the proportion of school going girls is slightly higher than that of boys. In 2017, more than 1/4th of adolescents were thin and over 10% were stunted. However, declining trend of low Body Mass Index of 15 years old female students was observed over 2007-2017 from 27.9% to 16.2%. Considering the adolescent girls as future mothers targeted interventions to combat poor dietary habits and sedentary lifestyles leading to double burden of the malnutrition are designed in the past and continues. National Nutrition Policy too advocates and support promotion of adolescent nutrition while National Strategic Plan on Adolescent and Youth Health (2018-2025) incorporated some innovative evidence based nutrition interventions for adolescence to realize their full potential for growth.

Methods.
Review of National Surveys and available literature such as existing strategic action plans and planned activities as well as best practices were carried out.

Results.
For all school attending adolescents intervention packages are delivered through school health programme including nutrition assessment, identification of nutritional status, weekly iron and folic acid supplementation and treatment for worm infestation, nutrition counseling, referral for specialized management. However, implementation of school canteen policy needs to be monitored to prevent the overweight and obesity. Mid day meal programme is in place for school children in vulnerable areas to reduce underweight. Nutrition awareness programmes are carried out in schools and vocational training centers on Food Based Dietary Guidelines for Sri Lankans and low cost locally available healthy food and weight management.

Adolescent and Youth Friendly Health Service (AYFHS) centers and nutrition clinics established in local hospitals and at the field level carry out the necessary nutrition interventions for adolescents especially paying attention to out of school adolescents and monitor for improvement. These interventions and adolescent health website ‘Yowun Piyasa’ create awareness and empower adolescents to reach their nutrition goals.

National Strategic Plan on Adolescent and Youth Health (2018-2025) recognizes effective ways to address social factors that contribute to adolescent nutrition in particular. Intervention packages are developed recognizing importance of identification of vulnerable young persons with regard to social factors, evidence based targeted programs for vulnerable adolescent groups. As computer literacy among females is ever-increasing even among out of school adolescents, use of digital technology to promote healthy dietary behaviours and physical activity among them is identified in the Strategic Plan.

‘Mother support groups’ established under the guidance of the field health workers, empower parents of adolescents with multi sector activities and making platform for experience sharing with best practices of households to address the double burden of malnutrition.

Conclusion.
As adolescent nutrition indicators needs improvement, health services reformed the strategic plan and existing adolescent nutrition promotion programmes with new evidence based interventions while continuing best practices.

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Session Classification : Poster Session 8

Track Classification : Policy implications
Kuwait Nutritional Surveillance System (KNSS): A tool for monitoring effectiveness of the double burden diseases intervention programmes.

Background:
The State of Kuwait established Nutrition Surveillance System (KNSS), which has been running for more than 20 years. It has been described by WHO as one of the well progressing surveillance systems in the region. KNSS has been designated to collect, analyse, and disseminate data yearly from Kuwaiti population groups on various aspects of nutrition. Among children, it gathers data on infants feeding and breastfeeding practices, anthropometric measurements and haemoglobin level. It also collects data on anthropometric measurements of Kuwaiti adults in addition to the levels of cholesterol, blood glucose and haemoglobin. It is run by The Food and Nutrition Administration (FNA) at The Ministry of Health (MOH), Kuwait.

Methods:
Kuwait Nutritional Surveillance System (KNSS) collects data from Kuwaiti citizens using standardized data collection forms through personal interviews conducted by trained data collectors who are employed for this purpose. The data are collected throughout the year on various settings which cover the six governorates of Kuwait from various age groups that include children ≤ 24 months, children >2 years and ≤ 5 years, school children >5 years and ≤19 years and adults >19 years.

Results:
Completed data forms are checked for completeness and consistency before data entry; and then entered into the database system. Body Mass Index (BMI) is calculated; underweight, overweight and obesity are defined using WHO growth standards and references for children or WHO cut-off points for adults. Data are also analysed to search for secular trends that cover longer periods of time. Annual reports are prepared and distributed to all relevant departments and Ministries in Kuwait. Finally, the results are forwarded to the WHO database managers, which can be accessed via the WHO website of the Nutrition Landscape Information System (NLIS) (www.who.int/nutrition/nlis). A trend report is issued every five years.

Conclusion:
KNSS report data provide regular and updated information on the nutritional status of Kuwaiti population (children and adults) and the influencing factors. The system also aims to provide nationwide information on the trends of nutritional status on all age groups by tracking nutritional status over time. This information also provides a basis for the decisions made by those responsible for policy, planning and the management of programmes related to improvement of nutritional status of Kuwait population. KNSS data is considered a valuable tool to identify prevalent nutrition-related problems, to identify high risk groups, to monitor trends, to target resources for program planning, and to evaluate the effectiveness of interventions and programs.

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Session Classification : Poster Session 8

Track Classification : Assessment
Community Based Intervention: Potential Impact of Low Cost Nutrient–rich Foods to Alleviate Malnutrition Among Children Under 5 Years of Age

Background: Food insecurity, chronic hunger and malnutrition continue to trouble, millions of people throughout the developing world. Malnourished children lack essential micronutrients whose deficiency has serious consequences on health and learning ability. The millets, pulses and oilseeds provide excellent source of essential amino acids, numerous minerals and vitamins.

Methods: The study was an attempt to find the effect of composite flour prepared with millet, pulses and oil seed based 'Ladoo' in improving the nutritional status of malnourished children under 5 years of age. Composite flour was prepared by using soaked whole wheat flour (WF), ragi flour (RF), green gram flour (GGF), soy flour (SF) and roasted groundnut (RG) and analyzed for proximate composition, minerals, vitamin content, antioxidants and antinutritional factors using standard procedures. On the basis of nutritional analysis, composite flour was utilized for the development of value added food products and incorporated into four conventional recipes at different levels. Sensory evaluation was done by using 9 point hedonic scale. Chemical constituents were determined of the developed food products by using standard procedures. Data were collected from 382 children randomly by interview method from mothers or care givers. A cross-sectional community based descriptive study was conducted by using scientific questionnaire to collect general information, child health and sanitary condition, height, weight, MUAC, Head and Chest Circumference. Dietary intake was collected by using 24 hour dietary recall method and the average nutrient intake was calculated by food consumption tables and compared with RDA. Clinical signs and symptoms were also recorded. Out of 382 children, 114 of whom were malnourished, were selected for the dietary supplementation. Supplementation of 100g low cost "Ladoo" providing 369 kcal energy, 17.43g protein and 15.74 mg iron per day was administered to the subjects of experimental group for four weeks. Nutrition education materials were also developed to teach the mothers of the children about the importance of foods to cure malnutrition by using knowledge test schedule.

Results: Results showed that the selected children (N=382) were grouped into mild malnutrition (n=124), moderate malnutrition (n=212) and severe malnutrition (n=14). Due to supplementation, "Ladoo" had significant effect on all the anthropometric measurements; height, weight, MUAC, chest and head circumference and grade of malnutrition slightly comes positively from moderate to mild and mild to normal. Control group was found slow and non significant change in all the anthropometric indices after experimental period. Nutrition education was found to exert significant positive influence on the gain in knowledge about nutrition.

Conclusion: The consumption of cereals, pulses and oilseed are playing a significant role in alleviating nutritional insecurity among low-income and vulnerable groups through optimization of nutrients in the formulation of supplementary foods improves diet quality.

Key words: Malnourished children, Dietary supplementation, Nutritional status, Composite Flour, children

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Session Classification : Poster Session 8

Track Classification : Interventions
Agronomic biofortification of sprouts: A low cost intervention for addressing double burden of malnutrition

Introduction: Malnutrition is characterised by the paradoxical condition of mineral deficiency and obesity in many developing countries like India at the individual and national level. A pressing need exists for economical nutritional interventions to balance the situation. This paper discusses agronomic biofortification of sprouts as a simple and low cost intervention strategy for addressing the double burden of malnutrition. Legume, seed and cereal sprouts have been considered as a healthy food with increased availability of nutrients and health components. Roasted sunflower seeds are a popular snack item consumed all over the world. Here, we present our work on mineral fortification of sunflower seed sprouts. These seeds are widely available at a low cost in most countries, particularly to the economically poor population.

Methodology: In the present study, the impact of different mineral elicitors (Calcium chloride/CaCl2, Ferric ethylene diamine tetra-acetic acid/FeIII-EDTA, Sodium selenate/Na2SeO4, and Zinc sulphate/ZnSO4) on agronomic biofortification of sunflower sprouts was investigated. The concentration of essential minerals (Fe, Ca, Zn, Se, Mg, P) in the sprouts was analysed using ICP-OES. Phytochemical content and antioxidant quality of fortified sunflower sprouts was also determined. Various culinary products were formulated to evaluate their suitability for nutrition intervention and assessed for consumer acceptability.

Results: All mineral elicitors increased the calcium content of the sprouts significantly (p < 0.05) with Sodium Selenium treatment showing the maximum increase (five-fold) compared to control sprouts (untreated). Ferric-EDTA bio-fortified sprouts exhibited a two-fold increase in the iron content compared to unfortified sprouts. All the mineral elicitors except calcium chloride significantly increased Zn, Se and Mg content in the biofortified sprouts. Sprouts elicited with sodium selenate was found to have highest increase in all the essential minerals. Phytic acid content was significantly reduced as a result of germination which could play a possible role in increasing mineral bioavailability. All the treatments induced a significant increase (P < 0.001) in the concentration of total flavonoids and total phenolics in the treated sprouts. CaCl2 and ZnSO4 treated sprouts showed a pronounced increase in the 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity and ferric reducing antioxidant power (FRAP), respectively, compared to control samples. All the culinary products scored high to very high acceptability.

Conclusion: Thus, agronomic biofortification could be used to increase the mineral density of sprouts. Being a functional food, fortified sprouts could be used as a low cost nutritional intervention for addressing the double burden of malnutrition for preventing micronutrient deficiency and lifestyle related diseases. Further studies are being carried out for common legumes and staple cereals. The biological uptake of minerals from these fortified sprouts is being investigated using microbial model systems to be followed by stable isotopic techniques for evaluation in humans.

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Session Classification : Poster Session 8

Track Classification : Interventions
Nutritional evaluation of food security policies during the economic crisis. The case of Greece

Introduction:
Since the beginning of austerity in 2009 there has been a 40% increase in the prevalence of food insecurity across Europe (1). The Fund for the European Aid to the Most Deprived (FEAD) has been running across the European Union (EU) and since 2016 in Greece with an aim to provide material (e.g. food) and non-material aid to the most vulnerable populations. So far little is known about its effectiveness in improving the dietary habits of its beneficiaries.

Methods:
In Greece, FEAD delivers food-aid through both Centralized and Decentralized Supplies. The analysis used a simulation approach, upon which data from both supplies were collected in order to calculate the food provision entitlement of each participant, and eventually its contribution to their dietary needs. In the case of the Centralized Supplies, the Operation Guide of FEAD (1st Edition) was used. This guide details the food aid entitlement of each participant based on the size of the household. For the Decentralized Supplies, due to lack of specific operational guide, a food balance sheet approach was utilized. Data for the period January 2016 to December 2017 were retrieved and analyzed to calculate the individual entitlement per participant in kilograms separately for each regional social partnership. Food provisions were categorized in seven food groups: fruits, vegetables, grains, meat and substitutes, dairy, oils and free sugars. Based on the WHO nutritional recommendations (2) food provisions were transformed from kilograms to portions and then the percentage of the recommended intake for each food group separately was calculated. Only the foods provided by FEAD were analyzed and no data on background/existing dietary intakes were analyzed.

Results:
FEAD, in general, provides less than 16% of the recommended intake for any food group, with fruits being the main focus (sum of means 15.4%) as compared with dairy (sum of means 6.0%). Oils and vegetables are considered the outliers (sum of means 24.5% and 3.4%, respectively). Hence, there is great variability among the food groups both for the centralized and decentralized supplies. It seems that the program tends to favor smaller households with more than threefold difference in the food provisions per person between one and eleven people households.

Conclusion:
The setup of FEAD at the time of the analysis, showed a relatively small contribution of the program to the dietary needs of the beneficiaries (less than 16%) with great potential for inequalities. These inequalities are skewed towards large households and have an inconsistent geographical pattern (potentially linked to the program’s execution per social partnership). Similar disparities are seen in the food group level and are augmented with the increasing volume of food provisions. A review of the existing operational guide of the first food security policy in Greece is recommended in order to improve its nutritional impact.

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Session Classification : Poster Session 8

Track Classification : Policy implications
Micronutrient rich indigenous rice varieties as a potential solution for double burden of malnutrition – A systematic review

Introduction: Double burden of malnutrition is prevalent in many countries all over the world. The co-existence of obesity and mineral deficiency conditions such as anaemia has been observed at the population level due to consumption of poor quality food. Rice is the staple food of more than half of the world’s population and greater than 3.5 billion people depend on rice for more than 20% of their daily calories. Malnutrition is reported to be highest in developing countries. Though, white rice is a good source of calories it is insufficient in many of the essential micronutrients. This problem needs to be resolved by using a solution which does not compromise on the peoples’ preference for their staple diet. Hence, there is strong need to identify and quantify micronutrient rich traditional rice varieties with good bioavailability.

Methodology: Electronic databases Google scholar, Scopus, PubMed, Medline and Cochrane database were systematically and comprehensively searched for studies reporting micronutrient content and (OR) mineral bioavailability of rice varieties from different countries until April 2018. The search terms included the following combination of keywords: (“Micronutrients” OR “vitamins and minerals”) [All Fields] AND (“Oryza sativa” OR “rice” OR “rice grain”) OR (“Pigmented Oryza sativa OR “pigmented rice” OR coloured rice). After screening, 28 relevant published scientific articles and 3 books were found. An additional search included the key terms (“Mineral bioavailability” OR “Mineral absorption”) AND (“Oryza sativa” OR “rice” OR “rice grain”) OR (“Pigmented Oryza sativa OR “pigmented rice” OR coloured rice) which resulted in 4 scientific published articles. Relevant information from traditional literature (3) and unpublished sources (7) was also included. Studies on genetically modified varieties were excluded.

Results: The systematic review helped to ascertain the mineral content of over 178 rice varieties across the globe. Majority of the traditional pigmented and non-pigmented rice varieties have been reported to contain around 25 – 40 % higher mineral content (Ca, Fe, Mg, P, Zn etc.) and 16-18 % higher vitamin content (Vit E, β-carotene etc.) than the polished white rice varieties. Some of the nutrient rich traditional rice varieties include MR159 from Malaysia (K and Mg rich), IR72 from Malaysia (Zn rich), Chinese black rice Kala4 (Fe rich) and some Indian varieties Karungkuruvai (Fe and P rich), Neelam samba (Ca rich), Kalanamak (K rich), Njavara (Vitamin E rich) etc. Review revealed lack of mineral bioavailability studies in these rice varieties.

Conclusions: The systematic review indicates that many indigenous and pigmented rice varieties to be micronutrient dense. These rice varieties have also been reported to contain varied health promoting compounds so they can also be used in nutrition intervention for combating the double burden of malnutrition. There is great need and scope for further research as there are many more indigenous rice varieties which need to be profiled for various essential micronutrients. Few recent have used stable isotope techniques for determining the mineral bioavailability in biofortified rice varieties. This method can be adopted to study the mineral bioavailability in nutrient dense indigenous rice varieties.

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Session Classification: Poster Session 8

Track Classification: Biology
Micro-farmed greens: A viable approach to address food security and micronutrient malnutrition

Introduction: As the world’s population increases at an unprecedented rate, there is urgent need to review the agricultural practices and food systems to maximise production within limited space. While agronomists are working on increasing the yields to ensure sufficient supply of foods, a pertinent nutritional problem posing threat at the individual, community and global level is micronutrient malnutrition. The last two decades have seen a renewal of interest in novel produce which can be dense source of micronutrients. Micro-farming of green leafy vegetables and other food crops is a greener alternative in this direction and can be cultivated in just about any locale. The focus of the study was to ascertain the micronutrient density and quality with special reference to essential minerals in ten such self-cultivated microgreens.

Methods: The cultivation of ten different microgreens was standardised in cocopeat medium, under tropical climatic conditions in terms of various yield quality parameters. The microgreens were analysed for their macroelemental (Ca, Mg, K, P, Na) and microelemental (Fe, Zn, Se) profile using ICP-OES. Ascorbic acid (AsA), and oxalic acid (an inhibitor of mineral absorption) were also determined using enzyme-based assays. Bioavailability was predicted using micronutrient/micronutrient (Ca/P, Ca/Mg, Na/K, K (Ca+Mg), Fe/AsA) and oxalic acid/micronutrient (Ox/Ca, Ox/Fe, Ox/Mg) ratios. Mineral quality index (MQL) was computed using suitable algorithm. The economics of micro-farming of these greens were also worked out in terms of the production cost and expected market price.

Results: The standardised growth parameters favoured increased shoot population density, good yield, and early harvest within a period of 6 to 14 days for the microgreens. Among the ten microgreens analysed, fennel was found to contain the highest concentration of Ca, K and Na. Spinach had highest Mg and Zn content, red roselle ranked top in terms of P and Se while highest iron content was obtained in mustard microgreens. Highest ascorbic acid was recorded in red roselle microgreens, followed by French basil and fenugreek. Least oxalic acid content was found in mustard microgreens, followed by red roselle and fennel microgreens. Based on the computed ratios, maximum calcium bioavailability was predicted in mustard and fennel microgreens. Most of the microgreens had desirable Na/K and K/(Ca+Mg) ratios. Highest iron bioavailability was predicted in mustard microgreens as indicated by the Fe/AsA and Ox/Fe ratios. Based on the MQL, the order of microgreens was as follows – red roselle > French basil > radish > fenugreek > sunflower > spinach > carrot > mustard > fennel > onion. The expected market value was found to be five to eleven-fold greater than the production cost of the microgreens.

Conclusion: The study has indicated micro-farming of greens to represent a viable eco-friendly alternative to enhance the food and micronutrient security of the population and aid in the economic stability of the rural and urban poor. It also warrants further validation on mineral bioavailability using in-vitro and in-vivo techniques.

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Session Classification : Poster Session 8

Track Classification : Interventions
A cluster randomized controlled trial to assess the double burden of malnutrition among pregnant women and impact of nutrient-based interventions on nutritional status in infants at 6 months in Thatta and Sujawal districts of Sindh, Pakistan

Introduction: Similar to many developing countries, Pakistan is facing the double burden of malnutrition, defined as the coexistence of stunted, wasted, underweight children and underweight or overweight mothers within the same household. The objective of this study was to assess the double burden of malnutrition and impact of nutrient-based interventions on nutritional status in infants at 6 months of age in community settings by the government primary health care system in Thatta and Sujawal districts in Pakistan.

Methods: A cluster randomised controlled trial was conducted in Thatta and Sujawal districts in Pakistan during 2014-2017. A total of 2030 pregnant women were enrolled during pregnancy and infants were followed until 6 months of age. Pregnant women received a monthly ration of 5 kg (i.e. 165 gram/day) of wheat soya blend (WSB) during pregnancy and first six months of lactation period.

Results: The prevalence of underweight (BMI <18.5) among pregnant women was significantly higher in control than intervention group (23.9% & 20.0%, p=0.03), but overweight or obesity was similar in both groups (9.2% vs 9.2%, p=0.96) at baseline. A significant risk reduction in stunting (RR=0.85, 95% CI; 0.73-0.98, p=0.02), wasting (RR=0.78, 95% CI; 0.66-0.94, p=0.00) and underweight (RR=0.79, 95% CI; 0.70-0.90, p<0.00) was noted in infants at 6 months of age in intervention compared to control group. The compliance of WSB during pregnancy was 70%. Sixty-eight percent of pregnant women reported sharing of WSB with family members. Early initiation of breast feeding (RR=0.85, 95% CI; 0.73-0.99, p=0.03), maternal height (RR=0.86, 95% CI; 0.76-0.97, p=0.01), diarrhoea (RR=0.85, 95% CI; 0.74-0.99, p=0.03) and acute respiratory infection (RR=0.86, 95% CI; 0.74-0.98, p=0.02) was associated with reduction in stunting in infants at 6 months of age.

Conclusion: The findings of our study reveal coexistence of underweight and overweight/obesity among pregnant women as well as stunting, wasting and underweight in children at 6 months of age within the same household in the study area. Interventions that reduce the risk of not only stunting but also wasting and underweight in children at 6 months of age may be a potential factor that can guide the Government and funding agencies in nutrition investments.

Keywords: Wheat Soya Blend, Double Burden, Malnutrition, Stunting, Wasting

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Session Classification :  Poster Session 8
The cost of the Double Burden of Malnutrition: Social and economic impact. Case studies from Chile, Ecuador and Mexico

The objective of the study is to promote dialogue between governments and policymakers on important changes to the nutritional landscape, and to serve as a powerful advocacy tool which helps to position the fight against all forms of malnutrition at the center of public policies.

The methodology distinguishes two dimensions of analysis. The retrospective incidental dimension estimates the effects and costs generated by malnutrition on health, education and productivity, which have affected the population of a country in a given year (i.e. 2014). The prospective dimension allows projecting, for a given time horizon, the future effects and costs associated with health treatments, years of school repetition and productivity losses resulting from malnutrition affecting the population of each country in a year.

Results show that, in 2014, undernutrition generated a total cost of USD 2.6 billion in Ecuador (2.6% of GDP), and USD 21.5 billion in Mexico (1.7% of GDP), when the dimensions of health, education and productivity are considered. Approximately 95% of the higher cost corresponds to the loss of productivity in both countries. In Chile, undernutrition is considered to be eradicated; for this reason, the study does not include estimates of costs related to undernutrition.

The future cost of lost productivity due to undernutrition, expressed in net present value, is USD 1.8 billion for 2014 in Ecuador and USD 11.4 billion in Mexico, estimated for the entire period of analysis (i.e. until 2078, the year in which the analysed cohort turns 65 years old). These figures, expressed as annual equivalent cost (AEC) amount to USD 60.4 million and USD 403.9 million, respectively.

In the case of the economic impact associated with overnutrition, it was estimated that the total cost in 2014 was USD 493 million in Chile (0.2% of GDP), USD 7.3 billion in Mexico (0.6% of GDP) and USD 1.7 billion in Ecuador (1.7% of GDP).

During the 2015–2078 period, the total cost associated with overnutrition, expressed as AEC, slightly exceeds USD 1.0 billion in Chile, USD 3.1 billion in Ecuador, and USD 13.1 billion in Mexico. Although the heavy weight of the cost for the health system is maintained.

In summary, the total cost of the double burden of malnutrition in 2014 is USD 493 million in Chile, USD 4.3 billion in Ecuador, and USD 28.8 billion in Mexico. These values represent 0.2%, 4.3%, and 2.3% of GDP for each country, respectively. In Chile, health care costs concentrate the greatest proportion of costs with respect to the total, while in Ecuador and Mexico, the greatest concentration of costs is in lost productivity due to undernutrition.

In conclusion, malnutrition is evolving toward the double burden in Latin America, expanding the dimensions of food insecurity and inequality. The data presented includes clear indicators of the economic consequences of all forms of malnutrition, and provides decision-makers with evidence for designing nutrition policies to address this public health issue.

As next steps actions, WFP and ECLAC will replicate the study in El Salvador, Guatemala, and Honduras and the Dominican Republic.

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Session Classification : Poster Session 8
The Impact of School Feeding Programmes in reducing Iron Deficiency Anaemia among Primary School Children in Developing Countries: A Systematic Review and Meta-analysis of randomized Controlled trials.

Background: Children in developing countries may survive the critical stage of the first 1000 days of life but may still carry unresolved micronutrient deficiencies into school age. Iron deficiency anaemia is the commonest forms of micronutrient deficiency which affects school age children. School feeding programmes may provide an opportunity to reduce the micronutrient deficiencies in the light of limited nutrition interventions that target school age children in developing countries.

Objective: The objective of this systematic review was to examine the evidence on the impact of school feeding programmes in reducing iron deficiency anaemia among primary school children in developing countries.

Search Method: Systematic searches were carried out for trials and observational studies using PUBMED, Web of Science and Cochrane library. The reference lists of relevant articles were also hand searched.

Design: A systematic review and meta-analysis was conducted on randomized controlled trials which evaluated changes in haemoglobin, serum ferritin and dietary iron intake following school feeding interventions. A random effects model was applied to calculate the mean differences for the net changes in the study outcomes which were all evaluated as continuous variables. Sub group analysis was conducted to explore the effects of covariates such as fortification status of meals, type of meals and severity of anaemia on the net pooled effect.

Results: Sixteen studies were included in this review of which six were observational studies and ten were randomized control trials. The meta-analysis was conducted on nine RCTs in which the overall effect of school feeding on haemoglobin showed a significant increase among school feeding participants with considerable variation among studies (MD = 0.22g/dl; 95% CI 0.01 – 0.43; p<0.05; I²=80%). Children who were fed in school had increased serum ferritin concentrations compared to controls (MD = 7.43µg/l; 95%CI 0.02 – 14.84; p<0.05; I²=88%; n=6 trials). School feeding was also found to have a positive effect on dietary iron intake. (MD = 1.88mg; 95%CI 0.95 – 2.81; p<0.0001; I²=96% n=9 trials). Conclusion: School feeding can improve dietary iron intake of primary school children leading to improved haemoglobin and serum ferritin concentrations and thus have a potential to reduce iron deficiency anaemia.

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Track Classification : Interventions
Performance of biofortified climbing common bean genotypes (Phaseolus vulgaris L.) across different locations in Tanzania.

Common beans is an important key source of nutrition food in the world as source of protein, dietary fiber, minerals and vitamins also as source of income to their low income people in developing and developed country. In Tanzania about 44% of children under 5 years old suffer from stunted growth low height-for-age, low weight-for-height, low weight-for-age while 72% are anemic. Introduction of cheap sources and economic feasible fortified crops such as high iron and zinc beans is the complementary approach to reduce malnutrition. The objective of this study was to assess yield performance and identify criteria which farmers use in selection of the new improved common beans technology.

Five high iron climbing common bean genotypes MAC 44 (80.3 mg/kg), RWV (78 mg/kg), MAC9 (64 mg/kg), MAC49 (66.6 mg/kg) and Selian (35.2 mg/kg) were planted in three replications at Selian and Lambo both in the Northern zone, Uyole southern zone, Maruku Western zone of Tanzania. Data was collected were grain yield, diseases (leaf spot, anthracnose, common bacteria bright), and farmers’ preference criteria. Data analysis were done by using Genstat 15th edition software. Genotypes showed significance difference (P≤0.05) for grain yield and diseases. Grain yield ranged from 1538kg/ha to 3530 kg/ha. Genotypes RWV1129 was the best genotypes for grain yield with 3091 kg/ha at Selian site in 2014/2015 where as MACC44 had a high yield of about 3530kg/ha at Selian site in 2015/2016 season. Farmers participatory variety selection for new improved bean genotypes depicted best three criteria as high yield, high market demanded, and resistant to diseases. Genotypes MACC44 and RWV 1129 were the best genotypes accepted by farmers due to high yield, and high market value and recommended for registration as variety to be cultivated and consumed as supplement iron deficient vulnerable groups.

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Session Classification: Poster Session 8

Track Classification: Interventions

Introduction: The Uganda Nutrition Action Plan 2011-2016 calls for nutrition to be integrated into activities across multiple sectors at district level. The Government of Uganda, Office of the Prime Minister, CUAMM, and stakeholders have collaborated to strengthen multi-sectoral planning for nutrition, working closely with District Nutrition Coordination Committees (DNCCs), which coordinate, plan, and provide oversight to multi-sectoral nutrition activities.

Objective: To strengthen multi-sectoral nutrition planning in seven districts of Uganda.

Method: In 2016-2017, a process to help DNCCs integrate nutrition activities into the work of multiple sectors was piloted in seven districts of Karamoja sub-region. The process used a multi-stakeholder partnership approach that included: 1) consensus-building to harmonize sector priorities and develop common district level nutrition objectives; 2) development of tools and guidelines; 3) capacity strengthening in nutrition and planning; 4) cross-district experience sharing and learning; and 5) effective communication for plan approval.

Results: All seven districts integrated nutrition in their district development plans and developed District Nutrition Action Plans (DNAPs), which serve as a framework for integrating nutrition into district work plans and two have been approved by district councils. Nutrition activities have been included in all district annual work plans and budgets, which will be funded with existing resources.

Conclusions: This multi-sectoral nutrition planning process can be replicated using planning tools and guidelines and integrated into existing government planning processes. Keys to success include: an enabling policy environment, engaging district leadership throughout the process, advocacy for adoption of plans, and technical and logistical support from partners. Lessons learned include: districts often have untapped resources that can be used for nutrition and must be sensitized to consider using them, learning about progress in other districts encourages districts to finalize DNAPs and push for their approval, relevant data at the district level is often inadequate for detailed planning and should be strengthened.

Key words: Multisectoral, Planning, Nutrition, Local Government
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**Session Classification**: Poster Session 8

**Track Classification**: Policy implications
Impact of an outreach support on the exclusive breastfeeding at the age of 6 months

Background and aims
Breast milk provides the ideal nutrition for infants. It has a nearly perfect mix of vitamins, protein, and fat – everything your baby needs to grow. And it’s all provided in a form more easily digested than infant formula. Breast milk contains antibodies that help your baby fight off viruses and bacteria.
In our country, the rate of exclusive breastfeeding is not sufficiently yet.
The aim of the study is to show that the use of a support counseling in breastfeeding can increase its duration.

Methods
Comparative prospective study from November 2012 to April 2013 on 400 women who delivered at the maternity Souissi Rabat. Divided into two groups one of which received support counseling AM. Moms We followed for a period of 6 months. The primary outcome studied was breastfeeding rates.

Results
The average duration of exclusive breastfeeding was 4 months and half against 3 months in the control group.
At a postnatal week, the rate was 76% against 11.5% in the second group with a significant difference, p = 0.00, the additional milk was given in 16% against 31% in the control group, and verbena (11 vs72%, 5%).
A 6 month breastfeeding rate was 79% against 58% in the control group (P0.00), with an exclusive breastfeeding rate of 58% in the study group and 19% in the control group (p = 0.000). 36% of women gave formula milk versus 63% in the control group, no woman has given the verbena in both groups.

Conclusion
Support counseling can have an impact on the duration of breastfeeding by increasing the duration and especially the duration of exclusive breastfeeding. Indeed this support has improved some practices of mothers in breastfeeding as early addition of other liquids.

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**Session Classification**: Poster Session 8

**Track Classification**: Interventions
Introduction
There is high prevalence of Non Communicable Diseases (NCD) in Fiji. This appears to be attributed to the high consumption of readily available imported processed calorie-dense foods with a reduction in physical activity. The aim of this paper is to review the various policies, organizations’ programmes and projects related to agri-nutrition and health and examine gaps and effectiveness in addressing NCD.

Methods
A dual process was used for data collection; collation and review of several documents (including policies, framework, strategies or guidelines, reports and publications) and stakeholder face-face consultations to ensure a comprehensive coverage of the issues pertaining to agriculture, nutrition and health. A total of 32 stakeholders were consulted and about 33 reports and publications were collated and examined. Information gathered was synthesized and validated at a national workshop.

Results
Review of policies and other related documents were obtained from five major government ministries; Economy, Health, Agriculture, Education, and Women, which revealed limited alignments between them in addressing the agri-nutrition challenges in Fiji. The various reports and publications gathered, revealed increasing prevalence of non-communicable diseases, without any agricultural-nutrition intervention.

More than 23 governmental and non-governmental organizations appear to be working on food and nutrition security and agriculture/nutrition programmes in Fiji that implemented over 34 major agriculture, nutrition and health initiatives/programs. Most of these programmes seemed to focus on specific commodities, mainly for economic empowerment, livelihood and sustainability, without nutrition-sensitive component and without evaluation in the impacts of these programmes. Moreover, the 2017 priority commodities for the Ministry of Agriculture were taro, ginger, rice and kava, which focused on food security, income and livelihood, export earnings and import substitution. Furthermore, women’s participation in agricultural, especially in commercial agriculture is limited, where only about 1% of the 33,000 registered farmers are females.

Nine major gaps identified include; (1) lack and weak agriculture and nutrition link in the National Development Plan and Policies and within the various line ministries; (2) lack of commitment and poor coordination of the Fiji Plan of Action in Nutrition with multi-stakeholders and partners; (3) absence of a food and nutrition security policy; (4) lack of nutrition sensitive agriculture policies and programs; (5) lack of gender sensitive agriculture; (6) lack of gender disaggregated data; (7) lack of research on the relationship between agriculture and nutrition outcomes; (8) limited awareness and availability of nutrient dense foods and (9) conflicting messages between promotion of local foods and project implemented by Government Ministries.

Conclusion
There is great potential to synergise agriculture, nutrition and health sectors, while incorporating gender inclusiveness with targeted agri-nutrition interventions for improving nutrition outcomes in Fiji. This may require a new paradigm for agriculture not only to increase production, income and reduce poverty but also to improve nutrition outcomes through inter-sectoral and multi-stakeholder partnerships.

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Session Classification : Poster Session 8

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Impact of wheat flour fortification program on micronutrient status in Jordan (2002-2010)

Objective
To decrease micronutrient deficiency level, Jordan has undertaken two national micronutrients fortification programs, a salt iodization initiated in 1995 and wheat flour fortification program initiated in 2002.

Background
Micro nutrient malnutrition is a public health problem in Jordan. The flour fortification program was officially launched in 2002. Bread made from wheat flour is a staple food in Jordan. Since the inception of the program, the government of Jordan has provided premix for fortification of wheat flour at no cost to mills in support of the government’s mandate that all mills fortify wheat flour. Wheat flour millers fortify Mowahad wheat flour (73-78% extraction rate). Flour was initially fortified with iron (dried ferrous sulfate) and folic acid. In March 2006, the program was expanded to include zinc, niacin, and vitamins A, B1, B2, B6, and B12. In June 2010, ministry of health formally added vitamin D. Since the inception of the flour fortification program, the Government of Jordan allocated an annual budget to provide premix at no cost to all wheat flour mills in Jordan in support of the government’s mandate that all wheat flour mills fortify flour.

Method
A nationally representative cross-sectional surveys was conducted in 2002, and 2010 to measure the change in micronutrient deficiency levels in 2002 compared to 2010. The target population for this survey was defined as the universe of all Jordanian households, with recruitment of all eligible preschool children (12-59 months) and women of childbearing age (15 – 49 years of age) within selected households.

Result
Among women, mean serum ferritin concentrations were significantly higher in 2010 compared with 2002 (21.3 vs. 18.3 ng/mL), there was no statistically significant difference in mean hemoglobin concentrations or prevalence of anemia (29.2% vs. 29.3%), iron deficiency (35.1% vs. 38.7%) or iron deficiency anemia (19.1% vs. 20.0%). Among the subsample of women (n=393) for whom RBC folate concentrations were measured in 2010, 13.6% of women were deficient 82.9% of women were folate insufficient.

Children
Among children, mean serum ferritin concentration was significantly higher in 2010 compared with 2002 (24.4 vs. 18.1ng/mL), but there was no statistically significant difference in mean hemoglobin. In 2010 and 2002, the prevalence of anemia was 16.6% vs. 20.2%; prevalence of iron deficiency, 13.7% vs. 26.2; and prevalence of iron deficiency anemia, 4.8% vs. 10.1, respectively.

Conclusion
Between 2002 and 2010, significant improvement was observed in the prevalence of iron deficiency in children, but not in women. The mill monitoring data show that program was only partially implemented in the beginning. Ministry of Health established an effective monitoring system for all flour mills to measure the extent of compliance to the fortification program. Fully implemented program could be expected to improve the micronutrient status of the population. 2018 micronutrient deficiency survey, will be conduct to assess micronutrient status and the effectiveness of the flour fortification program.

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Sweetened Beverage Tax in the Philippines: a Department of Health Perspective on its Successful Passage

Background
While the Philippines continue to have very high stunting rates among children, obesity has become an emerging concern with almost 10% of Filipino adolescents overweight. In response, the Sweetened Beverage (SB) Tax was proposed on June 30, 2016. Concerns against the proposal included the misconception that SBs are nutritious, the low regard of lawmakers on the problem of obesity, and the perceived low political profitability of the tax proposal among lawmakers seeking reelection. Despite organized opposition from beverage industries and allied lawmakers, the SB Tax was signed into law on December 19, 2017. This document describes strategies for its successful passage through the Philippine Department of Health’s (DOH) perspective.

Methods
Document review was carried out on official transcripts from public consultations and Congressional hearings. Themes related to catalyzing events and key arguments in favor of the SB Tax were identified and validated through interviews with DOH point persons involved in the policy development and legislative process negotiations.

Results
Twenty-five (25) documents were retrieved from the archives of the 17th Congress. Four (4) DOH point persons responsible for the policy were interviewed. Two (2) key strategies catalyzed SB Tax passage:

1. Leveraging cross-sectoral expertise
With the aim of raising revenues, the Department of Finance (DOF) and allied lawmakers merged the SB tax proposal into the proposed national comprehensive tax reform, and engaged DOH to defend the necessity of the SB tax. The DOH framed the SB Tax as a justifiable collection: to finance Universal Health Coverage reforms, and to disincentivize excessive SB consumption. There was consensus among DOH informants that merging the SB Tax within the broad tax reform secured its place in high-level policy discourse. Policy design was also favorable to both revenue and health goals. The broad tax on all sweetened non-alcoholic products can minimize potential unhealthy substitution. The simplified volumetric tax collects more revenue from those with excessive consumption, and minimizes opportunities to evade tax obligations.

2. Redirecting the health argument
Lawmakers had low regard for the problem of obesity. Thus, discourse was redirected outside conventional non-communicable disease (NCD) arguments in order to win them over. The “alarming” oral health argument was leveraged, with 88% of Filipinos having dental caries and toothache being cited by the Department of Education as the top reason for school absence. The economic argument framed repercussions of unmanaged obesity and diabetes that lead to end stage renal failures - costing the government’s National Health Insurance Program PhP 8 billion (USD 406.3 million) for claims on hemodialysis benefits in 2016 alone.

Conclusion
The Philippine experience demonstrates that harnessing dual benefits of public policies by leveraging cross-sectoral expertise of the DOF and DOH enabled the successful passage of the SB Tax despite opposition. Redirecting the discourse for the SB Tax outside conventional NCD arguments through alarming oral health and economic figures was also key. This experience can inform countries framing their arguments for similar fiscal interventions that aim to address obesity at the population level.
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