Analysis of Biological Pathways to Better Understand the Double Burden of Malnutrition and to Inform Action Planning
RATIONALE AND BACKGROUND

Low- and middle-income countries face an increasing double burden of malnutrition (DBM) and disease. Food insecurity, undernutrition and infectious diseases, overweight, obesity and related non-communicable diseases (NCDs) coexist in many countries, communities and households, across all levels of economic development and may occur in the same individual at different stages in the life-course. Nutrition and the risk for NCDs are closely linked; underweight, overweight and obesity, have a direct impact on the global increase in NCDs. These conditions are associated with an increase in infant and young child morbidity and mortality; overweight and obesity in adolescence; low psychomotor development and economic potential as well as increased risk of NCDs, disability and death in later life. Evidence suggests that nutrition and health of adolescent girls and mothers (before, during and after pregnancy and lactation) and foetal and infant nutrition in the first thousand days, combined with the influence of other environmental factors can all predispose to childhood overweight and obesity and NCDs later in life. Inappropriate lifestyles, which include unhealthy feeding practices and limited physical activity, among others, may perpetuate these conditions throughout the life-course. Metabolic programming is influenced by epigenetics, gut microbiome and potentially endocrine disrupting factors, however the mechanisms are yet to be fully understood.

Initial consensus to focus on DBM was reached at the International Congress of Nutrition in 2014. Since then, nutrition has been placed at the highest level globally following major policy promulgations explicit anchoring of nutrition in the sustainable development goals (SDGs) post 2015 and the declaration of the UN Decade of Action on Nutrition from 2016-2025. Thus now we have an unprecedented unique opportunity to act together to fight malnutrition in all its forms.

The IAEA held a workshop in Vienna, Austria from 3-5 October 2017, jointly with WHO and UNICEF, on analysing biological pathways to better understand the double burden of malnutrition and to inform action planning. Fifty participants from UN Organizations (WHO, UNICEF, IAEA, FAO), academia, policy, Ministries of Health and non-governmental organizations took part in the workshop.

The purpose of this workshop was to obtain a better understanding of the biological pathways related to the DBM and their interaction with environmental factors to inform effective interventions and action planning.

This report presents key discussion points and take-home messages around biology, policy, implementation and how to measure the DBM.

AIM OF THE WORKSHOP

1. To review evidence on the magnitude of the double burden of malnutrition.
2. To provide an update on driving factors associated with the double burden of malnutrition and the underlying biological pathways.
3. To review country experiences with the implementation of interventions designed to address the double burden of malnutrition, their effectiveness, challenges and opportunities.
4. To discuss methodological issues related to diagnosis of the double burden and malnutrition and assessment of the effectiveness of programmes to address it.
5. To identify a framework for addressing knowledge gaps and additional research needs in alignment with global nutrition targets.
6. To make recommendations on double-duty actions to prevent the double burden of malnutrition across sectors.
WHAT THIS WORKSHOP ADDED

What is the state of knowledge?

- The immediate causes of the DBM are inter-generational factors and early life nutrition, rapid dietary shifts to poor quality diets, and lack of physical activity.
- Underlying societal drivers for undernutrition, overweight and obesity are the same, and there is a need for integrated nutrition actions, the double-duty actions, tailored to address both forms of malnutrition.
- Optimal nutrition in early life is minimizing the risk for undernutrition as well as overweight and obesity.
- Breastfeeding is considered the optimal nutrition in early infancy.

What are the current interventions?

- The current approach to addressing malnutrition is mainly through specific programmes addressing either undernutrition or overweight and obesity.
- Policy approaches to address the DBM with an increased focus on healthy nutrition includes taxation and marketing regulation of unhealthy beverages and foods, and enabling environments for healthy eating and physical activity in public institutions.

Gaps, challenges and barriers identified

Improved understanding of biological pathways is required about:

- Defining a clear biological link between undernutrition in early life and risk of overweight and obesity.
- Delicate balance between metabolic capacity and metabolic load (e.g., using isotope techniques to assess the impact of early undernutrition on the metabolic capacity and its long term effects on the ability to manage metabolic loads).
- Effects of breastfeeding on later risk of overweight and obesity.
- Potential unintended long term effects of nutrition and health interventions.
- Relation between the degree of adiposity and the risk of NCDs in different populations.
- Role of environmental factors (chemicals with endocrine disruptive properties, mycotoxins, the protective effects of a healthy microbiome) in the DBM.
Gaps, challenges and barriers identified

Strengthening the link between biology and implementation for sustainable action:

- Nutrition messages should be packaged in a way that other sectors, including non-State actors and informal businesses, can relate and commit
- People’s perspectives on health and nutrition should inform the development of interventions
- The translation of global recommendations into contextually relevant actions must be improved

Nutrition actions targeting the DBM need to take its complex nature into account:

- The focus of nutrition programmes is often too narrow. The DBM should be addressed at the local, regional, country and international level in order to acknowledge its complexity
- It is necessary to explore how existing nutrition interventions might be retrofitted in the light of the DBM

Improved methods are needed to assess the DBM and its immediate drivers:

- Improved measurement of exclusive breastfeeding at the population level
- Simple index expressing the DBM at population as well as individual level
- Methods to evaluate the effect of double-duty actions, including isotope techniques
Key messages from session 1 & 2

- The DBM occurs at national, regional, household and individual level. It affects all regions in a largely heterogeneous manner
- Increased access to cheap, energy-dense foods coupled with physical inactivity drive the DBM menace
- All forms of malnutrition share common systemic drivers which require common solutions
- Food is not the only response, important to consider other areas such as the built environment, access to clean water
- Need to define where to start; i.e. early in life or preconception
- Stable isotope techniques can complement routine methods with accurate measures of body composition and breast milk intake
- Translation of evidence into policy and programmes is slow due to policy resistance and limited ability of revised guidelines to be implemented in the decentralized primary health care system
- In most contexts, both forms of malnutrition cluster in socially deprived population groups; refugees and displaced people are at increased risk of DBM
- While body mass index (BMI) is a practical and valuable marker for health, it is imprecise as an indicator for adiposity and generally underestimates adiposity at population level

The rapid shifts in the stages of the Nutrition Transition and the Double Burden of Malnutrition in low and middle income countries

Barry POPKIN presented on the nutrition transition in low- and middle-income countries (LMIC) that although progress has been made globally on stunting and wasting, the prevalence of overweight and obesity is increasing. Rapid shifts in access to high-fat foods and sugary beverages in combination with a lack of physical activity is the obvious driver of the increasing rates of overweight and obesity. The global food systems have made high energy foods and beverages available at a low price, even in the smallest and most remote villages. These shifts in diet, food systems and technological advancement have occasioned an adverse metabolic load on a biological system that has been preserved over the centuries since the emergence of the modern human in Africa.

The Double Burden of Malnutrition: How do we get out?

Boyd SWINBURN presented strategies to get out of the DBM and emphasized that while many evidence-based guidelines are at hand, the evidence is not put into action due to policy resistance and inertia in implementation. All forms of malnutrition share a common set of systemic drivers linked to the global food system. Therefore, the double-duty actions articulated to address the DBM should target the food systems and its underlying determinants of nutrition-related diseases. There are five key elements to consider: supply and demand mechanisms, business models, governance, well-being and social equity, and environmental sustainability.
Situation Analysis from Africa

Shane NORRIS presented the African perspective focusing on rates of stunting and female obesity across the continent. While stunting rates in children less than five years of age remain above 30% in West and East Africa, the rates of female obesity are highest (from 10-40%) in Northern and Southern Africa. Rapid economic growth since 2000 has mainly occurred in the North and South of the region. Examples from South Africa showed large gender disparities in adult obesity with female obesity occurring at much higher level than male obesity. With data from South Africa, Mr Norris demonstrated that this disparity starts already in prepuberty. In the South African context, the rates of female obesity and overweight steadily increased from around 12% at age 10 towards more than 40% at age 20. At the same time, male overweight and obesity rates remained more or less stable around 10-15% throughout adolescence. Generally, in societies with high gender inequality, obesity rates are higher in females than in males. On the other hand, adolescent pregnancy is common in South Africa, which leads to increased risk of preterm birth, low birth weight, and stunting. The distribution of DBM across Africa is heterogeneous between and within countries in the backdrop of high infectious disease burden, early marriage and rapid dietary and lifestyle transitions.

Situation Analysis from Asia Pacific

Emorn UDOMKESMALEE demonstrated that while the Asia-Pacific region hold the largest number of stunted children in the world, an alarming nearly 10% of children under the age of five is being wasted, and the rate of adult as well as childhood overweight is rapidly increasing along with the rapid economic transition in the region. The increase over the last two decades has been larger in Asia-Pacific compared to other regions. The pattern of DBM is diverse in Asia-Pacific, largely depending on the stage of the nutrition transition. During the last decade, the increase in child overweight and obesity was particularly steep in South-East Asia (4.1% in 2005 to 7.2% in 2016) and Oceania (6.3% in 2005 to 9.6% in 2016). The combined overweight and obesity prevalence in adults in Oceania has reached an alarming 70% of which obesity accounts for almost half. There are country-unique issues such as very high prevalence of obesity in the Pacific Islands, while stunting is a significant problem in South-East Asia such as Timor Leste, Cambodia, Lao PDR, Myanmar, Indonesia and the Philippines. The wide variation within the region provides an opportunity to share experiences, learn from similar contexts and implement actions to address the DBM timely.
Situation Analysis from Latin America

Manuel RAMIREZ examined the DBM in Latin America and stressed that the DBM needs to be considered at national, household and individual level. At household level the typical example is an obese mother and a stunted child, but there are large variations within the region underlining the complexity of the DBM. The Institute of Nutrition of Central America and Panama (INCAP) in Guatemala calculated the expected prevalence of DBM, at household as well as individual level. To express this expected prevalence, the household DBM of adult female obesity and childhood stunting, the prevalence of each condition would be multiplied to get the DBM index \(((\text{adult overweight} \times \text{childhood stunting})/100)\). This technique elucidated various patterns for different forms of DBM (household level childhood stunting with adult obesity, individual level anaemia with overweight in females etc.). The patterns differed, not only between forms of the DBM, but also between countries, with some forms of the DBM clustering in certain population groups (indigenous) while other forms were generally occurring less frequently than expected, i.e. either one or the other form of malnutrition dominating. Overall, the approach was able to demonstrate that the DBM is definitely present at national level throughout Latin America, but at household and individual level unevenly distributed across population groups, with indigenous people being at considerably increased risk of the DBM. Mexico was mentioned as the only country in the region that has addressed DBM at policy level.

Adding to the situation analysis based on new IAEA data

Finally, Christine SLATER presented data from a large combined set of data collected in IAEA supported studies from 20 Member States in Africa, Asia and Latin America. Based on samples from 723 infant-mother pairs using isotope techniques to accurately and objectively assess intake of breast milk and water from other sources it was demonstrated that mothers’ report of exclusive breastfeeding at 3 months was overestimating the rate of exclusive breastfeeding. While, across regions, the reported exclusive breastfeeding was 63%, the isotope technique revealed that less than half of these (21%) had been exclusively breastfeeding, based on the definition of an intake of other sources of water of less than 25 g per day. Using a less strict definition (allowing a water intake from other sources up to 82.3 g per day) exclusive breastfeeding rates were still substantially lower (40%) compared to reported rates (63%). Other studies used isotope techniques to assess body composition and relate it to anthropometry and risk factors for chronic disease in a total of 4651 children and adolescents. These studies confirmed that BMI-for-age (BAZ) might be a good marker for health, but is imprecise for a prediction of adiposity in children. There is a wide variation in fat percent for the same BAZ, and the two indicators are not ranking individuals equally.
Early life nutritional events are critical for becoming a healthy, metabolically robust adult.

The role of the microbiome and environmental hazards in relation to the DBM requires more attention.

Any intervention addressing the DBM must embrace socio-ecological aspects.

The methods used to define the DBM are inaccurate. Stable isotope techniques could assist in improving the tools used to define DBM and evaluating interventions to address it.

Stable isotopes can be used to study determinants of early life substrate turnover in different contexts.

Key messages from session 3

Jonathan WELLS presented a socio-ecological model of the double burden of malnutrition and how the interrelationships between individuals and the social, physical and policy environment contribute to the DBM. He underlined that the DBM may originate in foetal life in the context of maternal physiology. If a woman is facing famine in early pregnancy it may affect the growth factor levels and metabolic profile in her offspring later in life. Food insecurity is generally believed to be associated with stunting and wasting, but in some contexts (e.g. South Africa), food insecurity is rather associated with overweight and obesity. The complex mechanisms underlying the DBM are determined by multi-level connections from individual to macro-level and public policy level. An individual’s agency, or lack of agency, i.e. the capacity to act independently and to make his/her own choices, is associated with all forms of malnutrition. Individuals depend on access to healthy diets, and this needs to be acknowledged at political level.

Berthold KOLETZKO talked about the trans-generational aspects of the DBM and the strong influence of early-life events on the risk of chronic disease in adulthood. Birth weight is as strong predictor for the risk of adult chronic disease, but the underlying mechanisms are still not fully understood. Excess nutrient supply in foetal life (large babies), and rapid catch-up growth following low foetal growth restriction are among the suggested pathways through which birth weight predicts adult disease. Breastfeeding was identified as a very strong protective factor against adult obesity. A randomized study showed that the risk of obesity in children (at 6 years) who were fed conventional infant formula was more than twice the risk following a protein reduced infant formula. Mr Koletzko emphasized that stable isotopes can be used to study biological, genetic and environmental determinants of early life substrate turnover in different contexts. This type of research could facilitate a better understanding of the metabolic regulation of early weight gain and its potential programming effects.

A socio-ecological model of the double burden of malnutrition

Trans-generational impact of the double burden of malnutrition
The double burden of malnutrition across the life course

Chittaranjan S. YAJNIK repeated that preconception and intrauterine conditions are crucial windows of opportunities for modifying the risk of adult disease. India is now the capital of undernutrition and also the capital of diabetes, and is representing a typical example of the health effects of rapid economic growth and nutrition transition. The thin-fat Indian phenotype was discussed, i.e. that Indians in general have more body fat, and more central body fat with the same body dimensions and BMI as individuals from Europe and the US. Intergenerational DBM effects were studied in the Pune maternal nutrition study where three generations are being followed up in an observational cohort study. There has also been a vitamin B12 intervention in the adolescents born in the study to reduce risk of diabesity in their children. The study showed that thin-fat Indian babies were predisposed to prediabetes in early adulthood, even below the BMI usually associated with risk of chronic diseases. While only 8% of males at 18 years of age were overweight or obese, 37% were hyperglycaemic. The tendency was the same in females, but the numbers lower (4% overweight/obese, and 18.5% hyperglycaemic). Socioeconomic and nutritional indicators in late pregnancy (28 weeks) were compared between two generations of pregnant women (mothers and daughters): age at marriage, educational level and height had increased, and glucose metabolism was impaired with significantly higher fasting glucose and insulin levels in 104 pregnant daughters compared to values of their mothers in late pregnancy. Further follow up is expected to provide very interesting information.

The role of the microbiome in the double burden of malnutrition

Clara BELZER explained the current understanding of the role of the microbiome in the DBM. The microbiome, i.e. the totality of the genetic make-up of the billions of micro-organisms inhabiting our intestinal system, is increasingly acknowledged as an extra beneficial organ. Advancing DNA sequencing methods and analytical techniques have enabled the study of variations in the microbiome and its diversity. The gut microbiota, i.e. the total population of intestinal micro-organisms, develops in early life, and usually matures around 3-6 years of age. Diversity and the type of microbes are important for the health protective effect of the microbiome. Again, it was underlined that optimal conditions in early life are pivotal for microbiome diversity and maturation, with vaginal delivery and breastfeeding being important factors for a healthy microbiome. In the future, manipulating the microbiome may play a role in diagnosis, treatment and prevention of certain conditions, including obesity, diabetes, allergy, and malnutrition.
The link between endocrine disruptors and the double burden of malnutrition

Merete EGGESBØ looked at the link between endocrine disruptors and the DBM, reporting that there is substantial evidence for synthetic chemicals causing serious implications to human health. Toxic chemicals, from food production and our immediate environment, even in very small concentrations, may have endocrine disruptive properties causing reproductive and metabolic disorders, but the mechanisms are largely unknown. Pooled data analysis from three European cohort studies demonstrated that perinatal dioxin exposure was associated with 0.5 unit increase in BMI in girls but not in boys at seven years of age. The sex differential effect supports the suggested hormonal mechanisms. Environmental chemicals and toxins may also increase the risk of obesity through a negative impact on the gut microbiota. Unpublished data suggested that while BMI at 2 years was not associated with BMI at 12 years, gut microbiota at 2 years explained 50% of the variability of BMI at 12 years. Maternal microbiota only explained little (5%) of child microbiota at 2 years, and Ms Eggesbø suggested that antibiotics, food preservatives and other environmental exposures are likely to be responsible for the observed reduced diversity and functionality of the microbiota. The list of chemicals with potential endocrine disruptive properties is long, and while some chemicals such as dichlorodiphenyltrichloroethane (DDT) are linked to obesity, others like polychlorinated biphenyl (PCB) are linked to underweight.

The role of mycotoxins contamination in the double burden of malnutrition

Michael ROUTLEDGE discussed mycotoxins such as aflatoxins and fumonisins that contaminate food, and their role in relation to the DBM. Mycotoxin contamination of foods such as maize and nuts occurs during plant growth, harvest and post-harvest storage. A variety of factors are associated with exposure, such as low socio-economic status, climate, soil, storage, and season. High exposure to mycotoxins has been associated with stunting in cross sectional and prospective studies but the causal relation and the potential mechanism has not yet been established. Damage of the intestinal epithelium, disturbance of the insulin-like growth factor (IGF) balance and methylation of DNA have been suggested as possible mechanisms behind the potential effect of mycotoxins on linear growth. Exposure to mycotoxins is best assessed through biomarkers (Aflatoxin albumin adducts in blood (ELISA), and urinary fumonisin (stable isotope assay)). Mr Routledge identified the main research priorities as understanding the contribution of aflatoxin to environmental enteric dysfunction; exploring the effects of multiple mycotoxin exposure; and not least to assess the effect of community interventions reducing exposure to mycotoxins on health outcomes. While total prevention of mycotoxin contamination may be the end goal, there are effective community based interventions to reduce exposure including removal of contaminated commodities or washing of foods before consumption.

In the discussion, it was emphasized that these findings on the biological pathways and the new factors that might contribute to the DBM have to be carefully messaged to policy makers. There is a risk that it will confuse them and paralyse action, although there is already evidence available to implement interventions addressing the DBM. However, a better understanding of the multiple factors contributing to the DBM will ensure effective double-duty actions.
The role of double-duty actions in addressing the double burden of malnutrition

Corinna HAWKES provided the history behind the concept of the double-duty action which evolved from the Global Nutrition Report 2015, and was conceptualized in a policy brief by the WHO in 2017. The term double-duty action was a response to a need for a communication tool encouraging a more holistic approach to nutrition. Most dietary guidelines and assessment tools for dietary quality were developed in the context of undernutrition, in the context of the insufficient diet, and not adequately addressing the healthy diet. In addition, undernutrition interventions and their evaluation do not address and measure the different burdens. The undernutrition and overweight and obesity nutrition communities have been working in separate silos focusing each on their extreme of a non-healthy food and nutrition environment. However, the people facing the different nutrition problems arise from the same community which requires considering the people’s perspective on the DBM. The rationale behind the double-duty action can be summarized in five key points: Efficiency (investments to reduce undernutrition and overweight and obesity simultaneously), Biology (interventions promoting healthy growth will reduce risk of growth failure and nutrition related chronic diseases), Diet (the healthy diet is protective against undernutrition as well as overweight), Opportunity (all forms of malnutrition share delivery platforms in health systems, schools, commercial sector, humanitarian aid, and governance), Collaboration (bringing two disparate communities together in a non-threatening way). The double-duty action is deliberately addressing undernutrition as well as overweight and obesity in nutrition interventions. In the context of the nutrition transition, health messages and interventions must promote healthy diets and physical activity, shifting the focus away from sufficient intake of energy to integrated nutrition actions. One additional consideration was that the nutrition community is very divided on how to engage with the private sector.
**Framework for action and impact across the Decade of Action on Nutrition**

Session 4 continued from day 1 with Francesco BRANCA elaborating on WHO’s framework for action and impact, targeting the DBM across the UN Decade of Action on Nutrition. According to recent data from the Institute of Health Metrics, unhealthy diet and malnutrition are in the top ten risk factors for the global burden of disease responsible for 25% of all deaths. Within the framework of the Decade of Action on Nutrition, WHO is working to support Member States in formulating SMART commitments for action within six areas: 1) Sustainable, resilient food systems; 2) Aligned health systems providing universal coverage; 3) Social protection; 4) Trade and environment; 5) Supportive environment; and 6) Governance. Within these areas, WHO identifies Nutrition Champions that are successfully implementing policies and can be used as role models and establish action networks with other Member States. For example, Norway established the first action network on sustainable fisheries within the Decade on Nutrition framework. WHO guides Member States in designing policies. For example, WHO/Europe has endorsed a set of recommendations to guide legislations on marketing of sugary foods and beverages to children. WHO works with Governments and supports them in making progress towards their nutrition goals.

**UNICEF’s approach to the double burden of malnutrition**

Maaike ARTS presented (via Webex, from New York) UNICEF’s approach to the DBM, and shared some points from the new strategic plan for 2018-2021, which was launched a week prior to the meeting. The new strategy focuses on preventing malnutrition in all its forms, i.e. accommodating the emerging DBM and has five Programme Areas for Nutrition: 1) Early childhood nutrition, 2) Nutrition of school aged children, adolescents and women, 3) Care for children with SAM 4) Maternal and child nutrition in emergencies and 5) Knowledge and partnerships. UNICEF will implement double-duty actions with reference to the principles formulated by WHO, i.e. the do no harm with existing interventions (ensuring no unintended adverse long term effects of e.g. interventions to treat SAM), retrofitting existing interventions to address DBM (promoting breastfeeding, complementary foods) and de-novo actions (prevention of overweight and obesity through policies, regulations, food labelling, and taxes). There is a plan to monitor programme implementation and progress through the use of new indicators including a component of nutrition enabling environments.

**Bridges, linkages and opportunities in addressing malnutrition: double-duty and beyond**

As Barry POPKIN was referring to the do no harm principle, he raised the point that, while there has been massive investments in reducing undernutrition, the effects of these programmes on long term risk of overweight and obesity are not being evaluated. With an immense focus on getting sufficient energy to prevent undernutrition, the healthy diet is receiving minimal attention, and in many contexts weaning foods are mixed with junk foods and sugary beverages. These mal-practices need to be acknowledged and addressed. The policy toolkit including taxation of unhealthy foods and beverages, regulating marketing of foods, abandoning health claims on foods, and ensuring healthy eating in public institutions was highlighted again. He emphasized some pertinent challenges, including how to link different sectors, state and non-state actors, and how to support the private sector in building business models that create viable businesses without compromising the health of people. The NGO sector was also highlighted as an important and obvious partner for action. They have a high degree of action preparedness and often know the community well, and they make things happen. The ultimate goal is to create a culture of healthy eating, and Popkin concluded that we have a long road to travel to reach that goal.
Key messages from session 5

- The convergence between sustainable and nutrition sensitive food systems should be used to articulate win-win opportunities
- Government intentions need to be transformed to guidelines and instruments for assessment, operationalized and implemented
- The complexity of the DBM must be embraced holistically through multi-sectorial approaches for effective control of the DBM
- A multitude of formal sectors including health, agriculture, food industry, trade, education and environment should join forces to tackle the DBM
- Allying with private sector through incentives should be considered
- Civil society, with their insight and action preparedness, are useful partners for implementation

Nutrition-sensitive agriculture and food systems interventions

Charlotte DUFOUR talked about FAO’s work on nutrition-sensitive food systems and described the food system as all the elements that relate to food, i.e. food production, handling, storage, processing, distribution, trade, marketing, consumer demands. The nutrition-sensitive food system focuses on the consumer needs, i.e. access to healthy food and water for all. The convergence between sustainable and nutrition sensitive food systems (what is good for the planet is also good for people and vice versa) should be used to articulate win-win opportunities whereby integration of nutrition in environmental and agricultural sectors will be seen as a benefit rather than a burden. The nutrition sensitive food system approach operates through four entry points: Consumer demands (e.g. nutrition education, food in public institutions, social protection), Food trade and marketing (e.g. controlling food marketing, taxation of unhealthy foods and beverages), Food handling, storage and processing (e.g. preservation of nutrients though improved storage and processing, fortification) and Food production (e.g. diversification, biofortification, urban agriculture). The importance of the private sector as an engine of the food system was emphasized. Economic interest in producing and selling nutritious food will stimulate sustainable change in the food system. FAO has recently published a toolkit (including e-learning modules) on nutrition sensitive food systems.

WCRF International NOURISHING policy framework

Another tool was presented by Bryony SINCLAIR from World Cancer Research Fund International (WCRFI), namely the NOURISHING framework for policy actions to promote healthy diets and reduce overweight, obesity and diet-related NCDs. The framework is accompanied by an extensive database of implemented government policies organized in three domains: Food environment, food systems, and behaviour change communication. With its focus on healthy diets, it can be used as a lens for double-duty actions by learning from already existing and implemented policies aiming at promoting healthy diets, including school food policies, fiscal policies (e.g. taxation), marketing restrictions, diversification of agricultural production and nutrition advice and counselling. The database is regularly updated with newly implemented policies, and published evaluations of included policies. The database is intended for policy makers to identify where action is needed, assess if their approach is sufficiently comprehensive and get inspired by other countries; civil society organizations as a tool to monitor what governments are doing and hold them accountable; researchers to identify available evidence and research gaps, and to monitor and evaluate the impact of policies.

Eight case studies focusing on a wide range of initiatives to address the DBM in various contexts were briefly presented with a focus on impact, challenges and opportunities.

Catherine MAH presented experiences from a set of initiatives to link up with retail stores to promote healthier diets in low-income, sub-urban and rural contexts in Canada. Over 70 cents of every household dollar spent on food in Canada occurs in retail stores; the retail sector has an immense influence on what people eat. Supporting smaller and independent retailers in underserviced communities to innovate and promote healthier options could support vulnerable populations through health, social, and economic mechanisms. Using the retail sector as a strong and influential ally to promote healthier options was identified as an opportunity, but also a challenge as there is a need to integrate the economic and policy context for retailers within food systems that may not be oriented to nutrition sensitivity. Another opportunity is to strengthen methods to evaluate the diverse impacts of retail interventions on food choice, dietary intake and other consumption behaviour.

Manuel RAMIREZ gave the example of the long term follow up of a cluster randomised food supplementation trial in Guatemala, where nutritional supplements were distributed to pregnant and lactating women and their children, from birth to 7 y of age, in the years from 1969-1977, and the health of their offspring monitored until adulthood. The two supplements given were energy drinks, one with a vegetable high-quality protein mixture arising from maize and soy, the other just containing energy from sugar. Both supplements were fortified with micronutrients. The Guatemalan population in which this study was carried out, currently had a very high rate of chronic diseases due to rapid shifts in dietary intake and physical activity in combination with their parents suffering from undernutrition. It was reported that individuals whose mothers received the protein enriched energy supplement had an increased linear growth in early life and a lower risk of cardiovascular disease, diabetes and other chronic diseases in adulthood.
Shoo LEE presented the Canadian Healthy Life Trajectories Initiatives’ (HeLTI) Linked International Intervention Cohorts (HeLTI LIIC) represented by five cohorts in four countries (Canada, China, India and South Africa) as an opportunity to develop novel evidence to the Developmental Origins of Health and Disease (DOHaD) theory. Interventions have not yet been defined but are planned to take place before conception, during pregnancy and in infancy. Context relevant interventions will be embedded in the cohorts with individual or cluster-randomized study designs to assess impact and effects on later child health. The interventions will focus on a holistic approach to NCDs, and will accommodate not only food and nutrition interventions, but also cities, nutrition enabling environments and social protection.

Simon BARQUERA shared experiences with implementing nutrition policies targeting obesity in Mexico. Since the 1970’s, Mexico underwent a fast nutrition transition and while stunting is still widespread, it is facing a national obesity emergency, particularly in indigenous and rural communities, and especially among women. Mexico implemented a set of policy actions targeting obesity, including taxation of sugary beverages, and banning marketing of soda in schools. Taxation proved an effective tool to reduce consumption of unhealthy foods and beverages, and the per capita consumption of sugary beverages was reduced by 5 L per year from 2014-16. The greatest challenge identified was how to involve the food industries in taking responsibility for public health by offering healthier alternatives.

Gladys MUGAMBI, from Kenya, presented experiences from implementing legislation to control the marketing of breast milk substitutes based on an Act of Parliament of 2012. The Kenyan Parliament thereby committed to adopt the WHO International Code of Marketing of Breast Milk Substitutes, which aims to guide countries in supporting and promoting breastfeeding as an ideal food for the healthy growth and development of infants. The monitoring system was established as a joint effort between WHO and the Ministry of Health within different government agencies and institutions. The results were clearly demonstrating that while minimal promotion of breast milk substitutes was observed in public institutions, there were still some violations in private facilities. From an initial monitoring survey, 16% of mothers, all from private facilities, reported to have received samples of breast milk substitutes. A health facility survey also revealed that 18% of facilities had written materials marketing breast milk substitutes. These were predominantly located in private facilities (89%). However, violations are still seen in the private facilities, and there is a need to strengthen the link with them. Promotion of breastfeeding as the best feeding option for young infants seems to have led to behaviour change among women. At least, the reported exclusive breastfeeding rates in Kenya doubled in the period from 2008 - 2017.

Poh Bee KOON presented the magnitude of the DBM in Malaysia and some initiatives to tackle the problem. The majority of established nutrition programmes are targeting undernutrition, although the problem of overweight and obesity is out-numbering stunting and wasting. While stunting has fallen to 8%, childhood overweight and obesity is reaching 20% and increasing in adulthood with an estimated prevalence of almost 50%. However, the awareness of overweight and obesity as a public health concern is new, and programmes and initiatives focusing on overweight and obesity have only recently been introduced. There are a number of initiatives driven by universities, although most of these initiatives are more ad hoc projects and not yet turned into policy actions. One such example is the ToyBox Malaysia project aiming at preventing obesity in early childhood by shaping healthy practices and preferences. The project concept is to focus on healthy behaviours related to food and physical activity of pre-school children, and it engages children, teachers, parents and the community. The project is building on a European model, adapted to the Malaysian context.
Duong Huy LUONG presented how integrating baby friendly initiatives in hospital quality standards of the Ministry of Health in Vietnam has increased the visibility and priority given to baby friendly initiatives in maternity services. This includes early initiation of breastfeeding and counselling on breastfeeding. Despite having implemented baby friendly hospital initiatives since 1994, it was only integrated in the quality standards and monitoring since 2013. It was reported that breastfeeding rates had increased in Vietnam from 2014-2016, and this increase was at least partly attributed to the integration of breastfeeding in hospital quality standards in maternity wards.

Igor SPIROSKI shared experiences with the regulation of meal standards in kindergartens and schools in the Former Yugoslav Republic of Macedonia. After a long period without a focus on nutrition policies, a new set of food-based dietary guidelines were developed in 2014, followed by a set of policies to control the meal standards for foods provided in kindergartens and schools. However, the implementation is challenging, particularly in schools where they depend on caterers because there are no cooking facilities. Also, marketing of foods and beverages is not regulated yet, and procurement of unhealthy school food is widespread. Mr Spiroski expressed concern that until a set of policies has been successfully implemented new states depend highly on the prioritization and commitment of individual government representatives.

Remarks from CARE as NGO representative on double duty actions

The last contribution in the session was provided by Jennifer ORGLE from CARE, representing the NGO sector. CARE is among the implementers addressing inequalities, social injustices and behaviour change. Being in the community gives them a unique insight to the real problems, where the DBM is obvious in many contexts. The NGOs often realize the problems before they are acknowledged at Government level. Most of them focus more on undernutrition although there is a need to address the DBM and its context specific underlying factors. The NGOs often have a good knowledge of local communities and could be used to generate relevant data on contextual factors relevant to tackle the DBM. Due to working inside the communities they have useful insight into local practices and norms such as replacing local foods with cheap imported foods of poor quality, gender inequality issues, social norms and body image (fat means wealthy) etc. and are prepared for action. NGOs and civil society, with their insight and action preparedness, should be acknowledged and considered as important counterparts in implementation.
Key messages from session 7

- Body composition, expressed relative to the height as fat and fat-free mass indices, provides a better tool than BMI to understand the underlying mechanisms of the DBM.
- Physical activity in early life is crucial for health and FFM in later life.
- A DBM index including socio-ecological dimensions in a capability approach would be useful for the evaluation of multi-level actions addressing various stages of the DBM.
- The OMICS approach (e.g. epigenomics and metabolomics) is a promising tool to understand the mechanisms underlying the DBM at molecular level.
- We know little about what works, how it works, and at what cost.
- Complex double-duty actions need to be embraced by complex yet rigorous evaluation methods.

Assessing body composition to better understand the double burden of malnutrition

Jonathan WELLS gave an overview of how body composition measures can contribute to a better understanding of the DBM. Simple anthropometry (weight and height) is used to calculate the body mass index which has several limitations. Apart from being sensitive to errors in height assessment, the BMI does not reflect adiposity well. Body composition expressed relative to the height, as fat and fat-free mass indices, may provide a better tool to understand the mechanisms behind the DBM. The association between low birth weight and chronic disease later in life, exacerbated by rapid postnatal weight gain reflects multiple mechanisms acting on physiological structure and function. Regarding body composition, foetal growth restriction leads to smaller organs, which may reduce long term metabolic capacity for homeostasis. Post-natal stunting is associated with lower subsequent lean mass, and in some populations with increased subsequent adiposity. Mr Wells presented recent research data showing that fat-free mass at birth, not fat mass, was associated with height at 2 years. These data do not support the theory that energy from fat tissue is essential to accumulate lean tissue. Another example where body composition assessment contributed new insights was from a trial looking at differential tissue accretion after treatment of moderate acute malnutrition. The study showed that weight gains after treatment with lipid based supplements, as well as corn soy blends, consisted mainly of lean tissue.

Measuring physical activity across the lifespan and its link to the double burden of malnutrition

Klaas WESTERTERP explained changing patterns in body composition, physical activity and their relation through the life-course. The activity index (AI) is defined as the ratio of total energy expenditure/resting energy expenditure. The typical population level development of AI was presented, and while it increases linearly from birth and stabilizes at about 1.7 at around 15 years of age in girls, it stabilizes at a higher value (1.8) at around 20 years of age in boys. Then the AI is stable throughout adulthood and decreases from 50-90 years of age. Boys accumulate high amounts of fat-free mass (FFM) during growth (reaches a peak at around 25 years of age). In girls, the accumulation of FFM continues longer and reaches its maximum at around 40 years of age, but at a lower level than in boys. Finally, the relation between physical activity and body composition over the life course was illustrated. At population level, physical activity in childhood and adolescence, but not in adulthood was associated with an increase in FFM. Therefore, physical activity in early life is crucial for health and development of lean body mass in later life.
Multi-dimensional indicators of child growth and development

Hinke HAISMA stressed that current measures of malnutrition are mono-dimensional and do not take biological, cultural and social factors into consideration. Other dimensions should be included to reflect a more holistic risk profile. She suggested introducing a capability approach to child growth, including parental and social factors such as health, education and living standards. The Human Development Index (HDI) introduced by the UNDP is an example of a multi-dimensional index. Ms Haisma’s group is working on defining a capability set of parameters to include in a multi-dimensional vector, reflecting malnutrition in all its forms, and including an individual’s opportunities and agency. Beyond physical health, the dimensions considered are for example love and care, mental wellbeing, body integrity, prevalence of low birth weight and chronic diseases, gender inequality, stage of nutrition transition. The idea is to present an analytical framework that can be used to analyse data in a multi-dimensional way (child, household, and societal), and the aim is to use multi-dimensional vector visualization techniques to evaluate effects of changes. Changing one dimension can affect other dimensions, and a good index should be able to capture change in the risk profile in a multi-dimensional manner.

The omics approach in measuring the double burden of malnutrition

Dolores CORELLA presented the omics approach and its potential role in understanding molecular mechanisms involved in the DBM. Briefly, the omics approach uses complex mathematical models to combine genetic, biological and biochemical information with an aim to understand the human organism as an integrated and interacting network of genes, proteins and biochemical reactions. The term omics covers epigenomics, metabolomics, transcriptomics and other fields. The advances in genomics and sequencing techniques have made it possible to investigate the “thrifty genotype” theory and advance it to a new level. Using epigenomics techniques, several genes with high susceptibility to chronic diseases have been identified. Individuals with these genotypes have a higher risk of certain chronic diseases than other genotypes given the same exposure to environmental factors such as dietary intake. It was discussed whether we can escape the risk profile determined by our genes. To some extent the processes of a thrifty genotype may be reversed by modifiable factors, such as dietary factors, physical activity, or even environmental factors. The mapping of the human genome and advances in sequencing techniques coupled with complex mathematical modelling have created new opportunities for understanding biological and biochemical interactions in the human body.

Which data are missing on implementation aspects and impact?

The final presentation in the session was given by Jef LEROY. He addressed the lack of evidence related to nutrition-specific interventions as well as nutrition-sensitive programmes. Due to poor evaluation designs and little effort, we have limited knowledge about what works, how it works, and at what cost. Nutrition-sensitive programmes are complex in nature operating across different sectors and at different levels. The double-duty actions are similarly complex, with multiple inputs, multiple outputs and long term impact. It was emphasized that complex double-duty actions need to be embraced by complex yet rigorous evaluation designs. Before-after designs (without control group) or with-without designs (without baseline) should be avoided, as the results are always inconclusive or even misleading. Randomized controlled designs, although strong, are not always appropriate, but rigorous evaluation strategies embracing the complexity of double-duty actions can assist to understand if, why and how nutrition interventions are effective. The design of evaluations should be guided by a solid understanding of the programme’s intended impact pathways. This will also help identify which intermediate outcomes to assess to better understand the effectiveness of key programme components. A solid evaluation framework for programme and impact evaluation is needed, and should be implemented with rigor through strong partnerships between programme implementers and evaluators.
Outcome of break-out group discussions

Questions addressed in break-out group discussions

SESSION 6: Identifying issues of concern, knowledge and research gaps in interventions

What components have proven successful in intervention packages and what are the missing aspects requiring more evidence in designing successful NO HARM intervention packages to tackle the double burden of malnutrition (DBM)?

What kind of evidence is needed to determine the effectiveness of an intervention package?

What policies can effectively influence modifiable factors related to DBM (e.g. lifestyle, eating habits, obesogenic environment, etc.) and reduce its economic impact?

How could food system approaches be used to address the DBM?

SESSION 8: Identifying knowledge and research gaps on assessment tools and proposing SMART action plans within the framework of the decade of action on nutrition

What are the important measures of success for interventions on the DBM?

What are the innovations/emerging approaches in nutrition measurements for the DBM and when is it appropriate to apply them?

How should SMART nutrition action plans be adjusted to incorporate the double burden of malnutrition?

How do we more effectively connect actors, champions and drivers in non-health determinants of malnutrition, to the global nutrition agenda including the Decade of Action and SDGs?
Effective interventions to tackle the DBM

- Maternal health, education and empowerment. This includes promotion of breastfeeding and improving infant feeding practices

- Healthy dietary and physical activity practices among preschool and school aged children. Environments enabling healthy diets and physical activity in public institutions

- Inequalities (social and gender) are key basic causes for DBM. Inequality aspects must be addressed, not only through a long term vision to eliminate inequalities, but also when designing and evaluating the impact of interventions

- Understanding the context is crucial for packaging health messages into effective interventions. This includes addressing people’s perspectives related to health and local practices, which are important to understand in order to identify potential barriers to successful uptake of interventions

Knowledge gaps and research needs

- Biological mechanisms contributing to the DBM are not fully understood, yet there is sufficient evidence to implement interventions while refining the evidence for effective nutrition actions

- Emerging approaches to understand the biological impact of interventions should focus on breast milk (intake, nutrient and hormone profile, content of toxins and other unwanted agents), physical activity and body composition including brain, muscle, bone, organs, and fat distribution

- Assessing long term impact of factors influencing child growth in early life

- The complexity of the DBM should be embraced by multi-sector implementation strategies and comprehensive and rigid evaluation frameworks should be developed

- Developing a menu of policy and programme options considering de novo approaches and do no harm assessments
Multi-sectoral implementation strategies and food systems

- The holistic food systems approach could be used as a model for promoting multi-sectorial programmes
- Engaging with actors and champions across disciplines need health and nutrition sectors to familiarise with other relevant sectors and their language, paradigms, priorities and processes
- Nutrition should be demystified and win-win opportunities articulated across different sectors and common goals and objectives identified. National plans for action on nutrition should be developed concurrently with nutrition-sensitive policies to ensure integrated action
- Engage with the private sector. The civil society, consumer associations, and even supermarkets that are not directly benefitting from particular products could serve as arenas for promoting healthy living

Assessment of the DBM

- Reference data and thresholds for nutritional deficiencies and excess should be established to facilitate impact assessment of interventions. This applies to acceptable levels of lean tissue and physical function, body fat and its distribution, inflammation, psychosocial stress and cognitive outcomes as well as toxin levels
- A multidimensional capability index of DBM including biological, parental and societal factors would be needed to assess the effect of complex interventions
- Measuring access (affordability and distribution) to healthy food as an indicator of risk of DBM
- Implementation research is important to understand why or why not interventions work; documentation of processes; documentation of cost of interventions
- The use of commercial surveillance data (e.g. Nielsen data, Apple) for public health purposes should be explored
Summary of output from break-out group discussions

Policy framework

- Nutrition must be incorporated in multiple sectors and be placed at a higher level than Ministry of Health or Home Economics, which requires a multi-sectoral policy framework.

- Link nutrition plans to sector budgets, and incorporate targets in all relevant sectors.

- Higher education of health professionals about malnutrition in all its forms.

- Consider a food systems approach (e.g. regulation of the food sector, and interpretive food labelling).

- Promotion of breastfeeding (e.g. baby friendly hospitals and breastfeeding support at workplaces).

- Transform specific undernutrition and overnutrition programmes into broader nutrition programmes.
The workshop was concluded by giving the participants the opportunity to raise questions and give feedback. In general, the feedback from participants was very positive, expressing a high learning outcome.

A point on exploring how new technologies can support the advances to tackle the DBM was raised. Engaging with the modern era by using technology for the benefit of tackling nutrition related problems was brought up in the discussion. Technology could be used to improve methods for dietary assessment, body composition assessment, and also food composition. Artificial Intelligence (AI) could be used to recognize different geographical areas with unhealthy foods. Meanwhile, Augmented Reality (AR) could be used to assess portion sizes and improve dietary assessment methods. Photography has also been used in some settings to estimate dietary intake and food composition. However, these techniques and their appropriate use, including their accuracy and precision, need to be further developed and validated.

From a policy perspective, there is a challenge of coherence to address. Given the complexity of the causes and underlying drivers of the DBM, engagement across multiple sectors and including local communities to provide a people's perspective are essential to tackle the DBM. Successful establishment of multi-sectorial links could create an opportunity for developing a policy framework to tackle every aspect of the DBM. The problem is complex and context specific; and the actions to tackle it must be equally context specific and embrace the complexity.

Finally, Cornelia LOECHL from the IAEA concluded the meeting and thanked participants for their excellent inputs contributing to a wider and deeper understanding on how to tackle the DBM. Following this workshop, a conference on the DBM will be hosted by the IAEA in cooperation with WHO, UNICEF and other major actors in December 2018. It will provide an opportunity to address some of the identified knowledge gaps and research needs in more detail in a larger forum and to develop further action plans to support Member States in reaching their nutrition commitments.

IAEA-WHO-UNICEF Joint Workshop participants at the IAEA's Headquarters.
PARTICIPANT LIST

ALBANIA (REPUBLIC OF):
Mr Alban YLLI
Institute of Public Health

AUSTRALIA:
Ms Anne-Marie THOW
The University of Sydney
Menzies Centre for Health
Policy

AUSTRIA (REPUBLIC OF):
Ms Karin SCHINDLER
Austrian Ministry of Health and Women's Affairs

BELGIUM (KINGDOM OF):
Mr Paluku BAHWERE
Valid International

CANADA:
Mr Shoo LEE
University of Toronto
Institute of Human Development, Child and Youth
Health, Canadian Institutes of Health Research
(CIHR)

Ms Catherine L. MAH
Faculty of Health

Ms Xiangming QIU
Mount Sinai Hospital

DENMARK (KINGDOM OF):
Mr Rasmus CHRISTENSEN
University of Copenhagen
Department of Nutrition, Exercise and Sports
Section for Paediatric and International Nutrition

Ms Charlotte DUFOUR
Consultant

Mr Jo JEWELL
WHO Regional Office for Europe

GERMANY (FEDERAL REPUBLIC OF):
Mr Berthold KOLETZKO
University of Munich Medical Centre
Ludwig-Maximilian-Universität München
Division of Metabolic Diseases and Nutritional
Medicine

GUATEMALA (REPUBLIC OF):
Mr Manuel RAMIREZ-ZEA
Institute of Nutrition of Central America and Panama
(INCAP), Center for the Prevention of Chronic Diseases

HUNGARY:
Mr Imre RURIK
University of Debrecen
Department of Family and Occupational Medicine
Faculty of Public Health

INDIA (REPUBLIC OF):
Mr Chittaranjan S. YAJNIK
King Edward Memorial Hospital and Research Center

KENYA (REPUBLIC OF):
Ms Gladys MUGAMBI
Ministry of Health, Nairobi
Nutrition and Dietetics Unit

MACEDONIA (THE FORMER YUGOSLAV REPUBLIC OF):
Mr Igor SPIROSKI
Institute of Public Health of the Republic of Macedonia
Department of Physiology and Monitoring of Nutrition

MALAWI (REPUBLIC OF):
Ms Chrissie THAKWALAKWA
University of Malawi (UNIMA)

MALAYSIA:
Ms Bee Koon POH
School of Healthcare Sciences
Universiti Kebangsaan Malaysia

MEXICO (UNITED MEXICAN STATES):
Mr Simon BARQUERA
National Institute of Public Health (INSP)
Nutrition and Health Research Center (CINyS)

Ms Angela CARRIEO
National Institute of Public Health (INSP)
Nutrition and Health Research Center (CINyS)
NETHERLANDS (THE):
Ms Clara BELZER
Wageningen University
Department of Agrotechnology and Food Sciences
Laboratory of Microbiology

Ms Hinke HAIMSA
University of Groningen
Department of Demography

Mr Klaas WESTERTERP
Maastricht University
Department of Human Biology

NEW ZEALAND:
Ms Elaine RUSH
Auckland University of Technology
Faculty of Health and Environmental Science

Mr Boyd SWINBURN
University of Auckland and Deakin University

NORWAY (KINGDOM OF):
Ms Merete EGGESBOE
Nasjonalt Folkehelseinstitutt (Norwegian Institute of Public Health), Department of Environmental Exposure and Epidemiology

SEYCHELLES (REPUBLIC OF):
Ms Rosie Anne BISTOQUET
Ministry of Health, Republic of Seychelles
Health Care Agency

SOUTH AFRICA (REPUBLIC OF):
Mr Shane NORRIS
University of the Witwatersrand
MRC/Wits Developmental Pathways for Health Research Unit, Department Of Paediatrics

SPAIN (KINGDOM OF):
Ms Dolores CORELLA
University of Valencia, CIBER Physiopathology of Obesity and Nutrition

SWITZERLAND (SWISS CONFEDERATION):
Mr Francesco BRANCA
Department of Nutrition for Health and Development World Health Organization, Geneva (WHO)

Mr Alessandro DEMAIO
Department of Nutrition for Health and Development World Health Organization, Geneva (WHO)

THAILAND (KINGDOM OF):
Ms Emorn UDOMKESMALEE
Institute of Nutrition
Mahidol University

UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND:
Ms Corinna HAWKES
City University London
School of Arts and Social Sciences
Centre for Food Policy

Mr Michael N. ROUTLEDGE
University of Leeds
School of Medicine
Faculty of Medicine and Health

Ms Bryony SINCLAIR
World Cancer Research Fund International (WCRF)

Ms Christine SLATER
Consultant

Mr Jonathan WELLS
Childhood Nutrition Research Centre
UCL Great Ormond Street Institute of Child Health

UNITED STATES OF AMERICA:
Mr Jef LEROY
International Food Policy Research Institute (IFPRI)

Ms Jennifer ORGLE
CARE

Mr Barry POPKIN
University of North Carolina
Carolina Population Center

Ms Florencia VASTA
Bill & Melinda Gates Foundation (BMGF)

VIET NAM (SOCIALIST REPUBLIC OF):
Mr Duong Huy LUONG
Ministry of Health
Quality Management Division, Medical Services Administration
IAEA TEAM:
Nutritional and Health-related Environmental Studies Section
Division of Human Health

Ms Cornelia LOECHL
Ms Alexia ALFORD
Mr Victor OWINO
Ms Pernille KAESTEL
Ms Beatriz MIRANDA-DA-CRUZ

Interns:
Ms Bianca WOLF
Ms Annisa RAHMAYANTI

Administrative Support:
Ms Monika ATAC-BAUER
Mr Umair ZAHEER