INTERNATIONAL SYMPOSIUM ON
Understanding the Double Burden of Malnutrition for Effective Interventions

Short-term effects of treatment of acute malnutrition:

examples from Uganda and Burkina Faso

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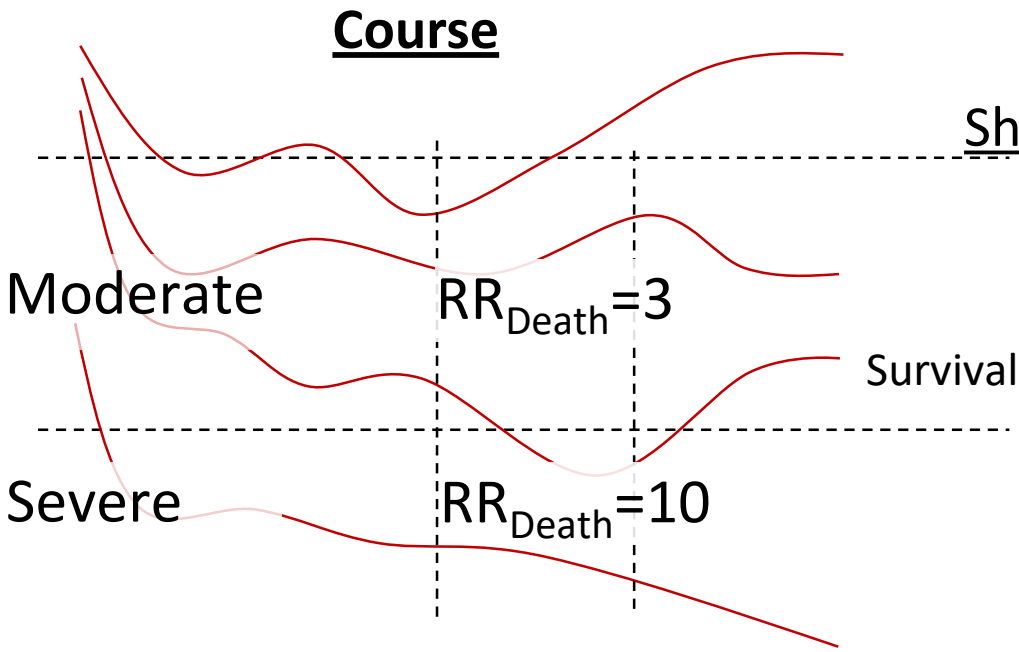
Declaration of potential conflicts of interest

- Has received research grants from ARLA Food for Health, and from Danish Dairy Research Council

- Has research collaboration with food aid manufacturers: GC Rieber Compact, Norway, and Nutriset, France.

Wasting

as defined by weight-for-height Z



Consequences

	Short-term	Long-term
Survival	Development	Education
	Physical activity	Working capacity
	Immunity	Infections
	Metabolism	**Chronic diseases**

---------- **Body composition** ---------

Acute malnutrition

	Definition				
	Weight-height Z		Arm circum-ference (mm)		Oedema
Severe	< -3	OR	< 115	OR	**+**
Moderate	-3 to -2	OR	115 to 125	&	**-**
	Wasting				

Prevalence	**50+ mill**	**?**	**?**
Incidence	**?**	**?**	**?**

Acute malnutrition

	Guidelines	Treatment	Products
Severe	+	100% of E	F-75/F-100 LNS
Moderate	-	50% of E?	CSB?/LNS? Local foods?

CSB: corn-soy blend, given as porridge
LNS: lipid-based nutrient supplement

SAM treatment

an example from Uganda: the FeedSAM study

- Observational study among 122 children with complicated SAM at Mwanamugimu Nutrition Unit, Uganda
- Aim to study refeeding hypophosphataemia or syndrom
- Serum phosphate used as a marker of phosphorus depletion
- At the time of the study, children with diarrhoea were given rice porridge rather than F75/F100 for some days

Changes in plasma phosphate during in-patient treatment of children with severe acute malnutrition: an observational study in Uganda[1]

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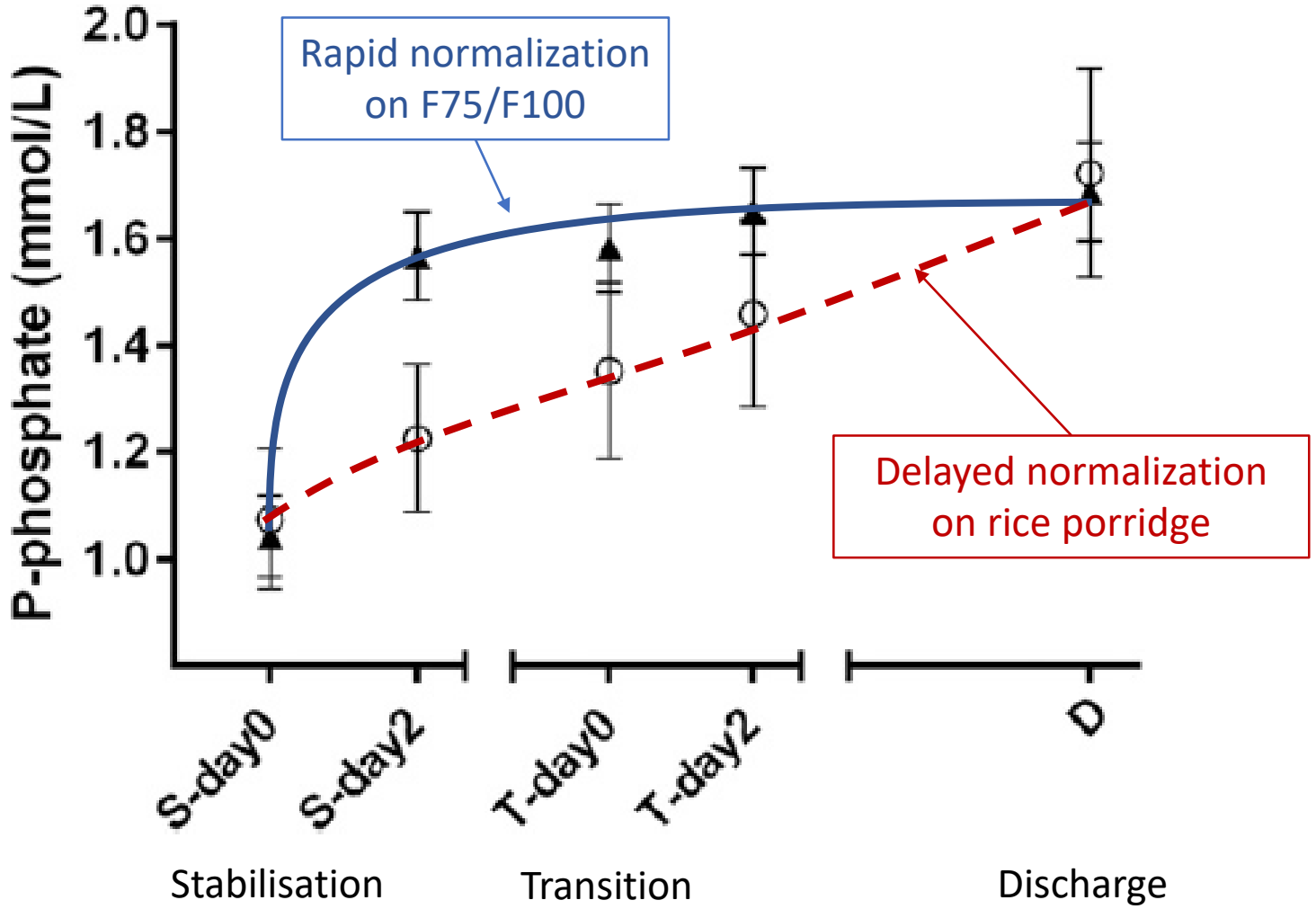
(AJCN, 2016)



Nutrient composition of F-75, F-100, and the rice porridge used during nutritional rehabilitation of children admitted with severe acute malnutrition[1]

Composition	F-75	F-100	Rice porridge[2]
Energy, kcal/L	750	1000	490
Carbohydrate, % of energy	64	45	89
Protein, % of energy	5	10	8
Fat, % of energy	31	45	3
Phosphorus, mg/L	560	579	130

[1]Nutrition information for F-75 and F-100 (Nutriset, France) was obtained from the packages. Nutrition information for the rice porridge was obtained from foodcomp.dk.

[2]Rice porridge prepared from 200 g white rice flour and 1500 mL water.

(Namusoke & Hother, AJCN, 2016)

Risk factors for death in children during inpatient treatment of severe acute malnutrition: a prospective cohort study[1,2]

Maren JH Rytter,[3] Esther Babirekere-Iriso,[3,4] Hanifa Namusoke,[4] Vibeke B Christensen,[5] Kim F Michaelsen,[3] Christian Ritz,[3] Charlotte G Mortensen,[3] Ezekiel Mupere,[6] and Henrik Friis[3]*

(AJCN, 2017)

Risk factors for death in 119 children admitted with severe acute malnutrition

	n[1]	Died (n = 17)	Survived (n = 102)	P	HR (95 %CI)[2]	P
Electrolytes, day 2						
Sodium concentration <135 mmol/L	94	25 (3)	24 (20)	1.00	1.0 (0.3, 3.7)	0.96
Potassium concentration <3.5 mmol/L	94	8 (1)	1 (1)	0.24	2.1 (0.3, 18.5)	0.49
Hypophosphatemia[7]	94	58 (7)	13 (11)	0.001	8.7 (2.5, 30.1)	0.001
Observation and treatment in stabilization phase						
Diarrhea	114	65 (11)	49 (48)	0.24	1.5 (0.6, 4.1)	0.41
Nasogastric tube used	115	41 (7)	22 (22)	0.10	1.8 (0.7, 4.9)	0.27
Oral rehydration solution[8] given	114	35 (6)	14 (14)	0.08	2.7 (1.0, 7.4)	0.050
Oral rehydration solution[8] given, first 2 d	114	18 (3)	12 (12)	0.70	1.5 (0.4,5.2)	0.62
Rice porridge given	114	65 (11)	32 (31)	0.01	3.4 (1.3, 9.4)	0.02
Rice porridge given, first 2 d	114	59 (10)	20 (19)	0.002	5.0 (1.9, 13.3)	0.001

Lack of phosphorus during refeeding may result in refeeding syndrome and death

What happens to survivors given inadequate amounts of P and other growth nutrients

- Body composition?
- Risk of chronic diseases?

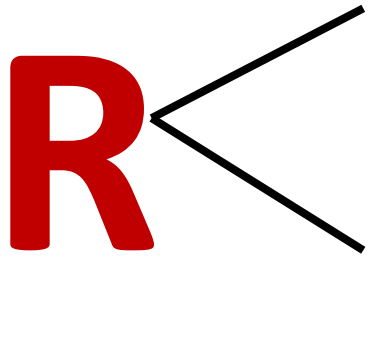
MAM treatment

an example from Burkina Faso: The Treatfood trial

- 2x2x3 factorial trial among 1609 children with MAM
- Aim to estimate effects of key factors in food aid products
- Supplements providing 500 kcal/d for 3 months
  - LNS vs CSB
  - Soy isolate vs dehulled
  - Milk contributing 20 or 50 vs 0% of total protein
- Outcomes
  - Primary: fat-free mass index by deuterium dilution
  - Secondary: iron, physical activity, child development etc

TreatFOOD

2x2x3 factorial



Matrix	Soy quality	Milk (% of protein)		
		0	20	50
CSB	Dehulled	A	B	C
	Isolate	D	E	F
LNS	Dehulled	G	H	I
	Isolate	J	K	L

(Fabiansen, Plos Med, 2017)

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RESEARCH ARTICLE

Effectiveness of food supplements in increasing fat-free tissue accretion in children with moderate acute malnutrition: A randomised 2 × 2 × 3 factorial trial in Burkina

Christian Fabiansen[1,2], Charles W. Yaméogo[1,3], Ann-Sophie Iuel-Brockdorf[1,2], Bernardette Cichon[1,2], Maren J. H. Rytter[1], Anura Kurpad[4], Jonathan C. Wells[5], Christian Ritz[1], Per Ashorn[6], Suzanne Filteau[7], André Briend[1,6], Susan Shepherd[8], Vibeke B. Christensen[2,9], Kim F. Michaelsen[1], Henrik Friis[1]*

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PLoS Med 14(9): e1002387. https://doi.org/10.1371/journal.pmed.1002387

Changes during intervention

	Baseline		3-month		Difference		
	n	Mean	n	Mean	n	Mean	95% CI
FFM (kg)	1489	**5·79 (0·91)**	1425	6·61	1328	**0·85**	**(0·82; 0·87)**
FM (kg)	1489	**1·13 (0·39)**	1425	1·19	1328	**0·06**	**(0·033; 0·084)**
Weight, (kg)	1609	**6·91 (0·93)**	1548	7·81	1548	**0·90**	**(0·88; 0·93)**
Weight-for-height Z	1609	**-2·22 (0·51)**	1548	-1·53	1548	**0·68**	**(0·65; 0·72)**
MUAC (mm)	1609	122·6 (4)	1548	130·1	1548	7·5	(7·2; 7·8)
Length (cm)	1609	70·4 (5·3)	1548	72·9	1548	2·6	(2·5; 2·6)
Height-for-age Z	1609	**-1·70 (1·1)**	1548	-1·86	1548	**-0·17**	**(-0·19; -0·15)**

(Fabiansen, Plos Med, 2017)

Main effects

	Matrix	Soy quality	Milk protein (%)	
	LNS vs CSB	Isolate vs dehulled	20% vs 0%	50% vs 0%
FFMI (kg/m^2)	**0·083 (0·003; 0·163)**	0·038 (-0·042; 0·118)	**0·097 (-0·002; 0·196)**	**0·049 (-0·047; 0·146)**
FMI (kg/m^2)	0·052 (-0·024; 0·127)	-0·003(-0·078; 0·073)	**-0·085 (-0·178; 0·008)**	**-0·064 (-0·155; 0·028)**
FFM (g)	37 (-10; 84)	24 (-23; 71)	40 (-18; 99)	29 (-28; 87)
FM (g)	28 (-12; 67)	1 (-38; 40)	-41 (-90; 8)	-30 (-77; 18)
Weight (g)	**75 (32; 119)**	**36 (-8; 79)***	9 (-45; 63)	20 (-33; 73)
Length (cm)	0·03 (-0·05; 0·11)	0·02 (-0·07; 0·1)	0·03 (-0·08; 0·13)	0·07 (-0·03; 0·17)
Weight-height Z	**0·11 (0·04; 0·17)**	0·05 (-0·01; 0·11)	0 (-0·07; 0·08)	0·01 (-0·07; 0·09)
Knee-heel (mm)	0·4 (-0·2; 1)	0 (-0·6; 0·6)	**0·6 (-0·2; 1·3)**	**0·7 (-0·052; 1·4)**
MUAC (mm)	**1 (0·5; 1·6)**	0·3 (-0·24; 0·85)	0·5 (-0·2; 1)	0·2 (-0·5; 0·9)
Triceps (mm)	**0·16 (0·06; 0·25)**	0·06 (-0·04; 0·16)	-0·05 (-0·18; 0·07)	-0·09 (-0·21; 0·03)

LNS vs CSB increased fat-free mass index
Marginal significant effect of 20%, but not 50%, vs 0% of protein from milk

(Fabiansen, Plos Med, 2017)

Primary and other outcomes

- **Fat-free mass index**
  - LNS increased fat-free mass index
  - Marginal significant effect of 20%, but not 50%, vs 0% of protein from milk

(Fabiansen, Plos Med, 2017)

- Hemoglobin, iron status and inflammation
  - LNS increased hemoglobin and iron status
  - No effects of soy isolate and milk

(Cichon, AJCN, 2018)

- Physical activity
  - No effects

(Yameogo, unpublished)

- Child development
  - No effects

(Olsen and Iuel-Brochdorff, unpublished)

Conclusions

- SAM treatment
  - Inadequately fortified foods may contribute to mortality
  - **What is the effect among survivors?**
    - **Increased fat accretion and risk of chronic disease?**

- MAM treatment
  - LNS vs CSB yields more fat-free tissue and better iron status, but not accompanied by functional benefits
  - Soy quality had no effects, but the role of milk merits further research

  - Not possible to assess overall effect of treatment, but …..
  - overall weight gain was predominantly due to fat-free mass
  - concerns of excessive fat accumulation not justified

Thanks to collaborators ……

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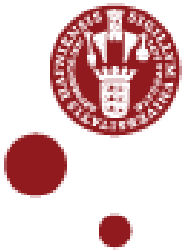

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THANK YOU!