From the Field: Improving fetal and infant growth in vulnerable populations

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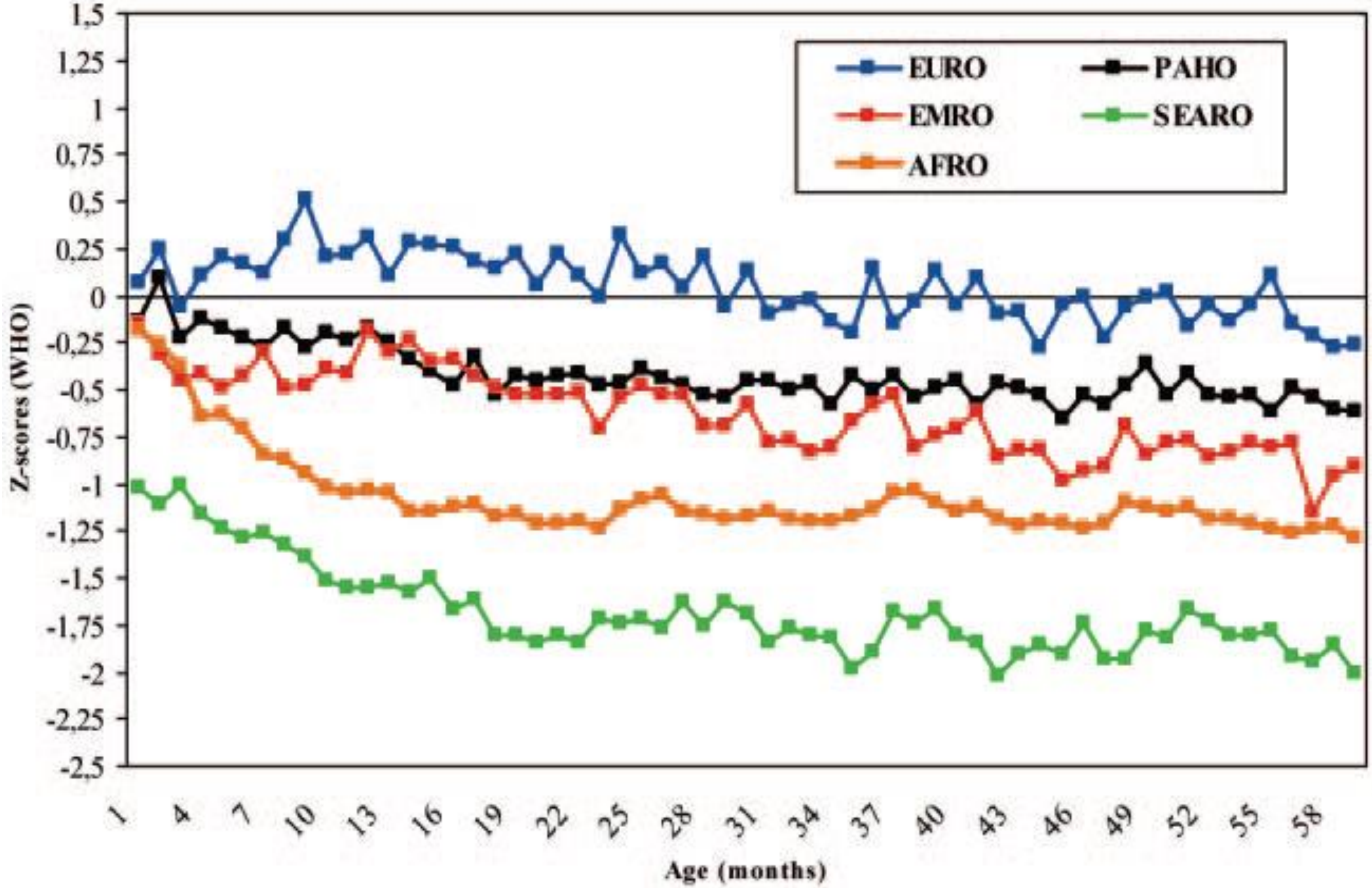
Outline

- Fetal and infant growth in vulnerable populations
  - Growth faltering begins prenatally
  - Continues until about 24 mo of age
- Impact of small-quantity lipid-based nutrient supplements (SQ-LNS) consumption in Ghana
- Final recommendations

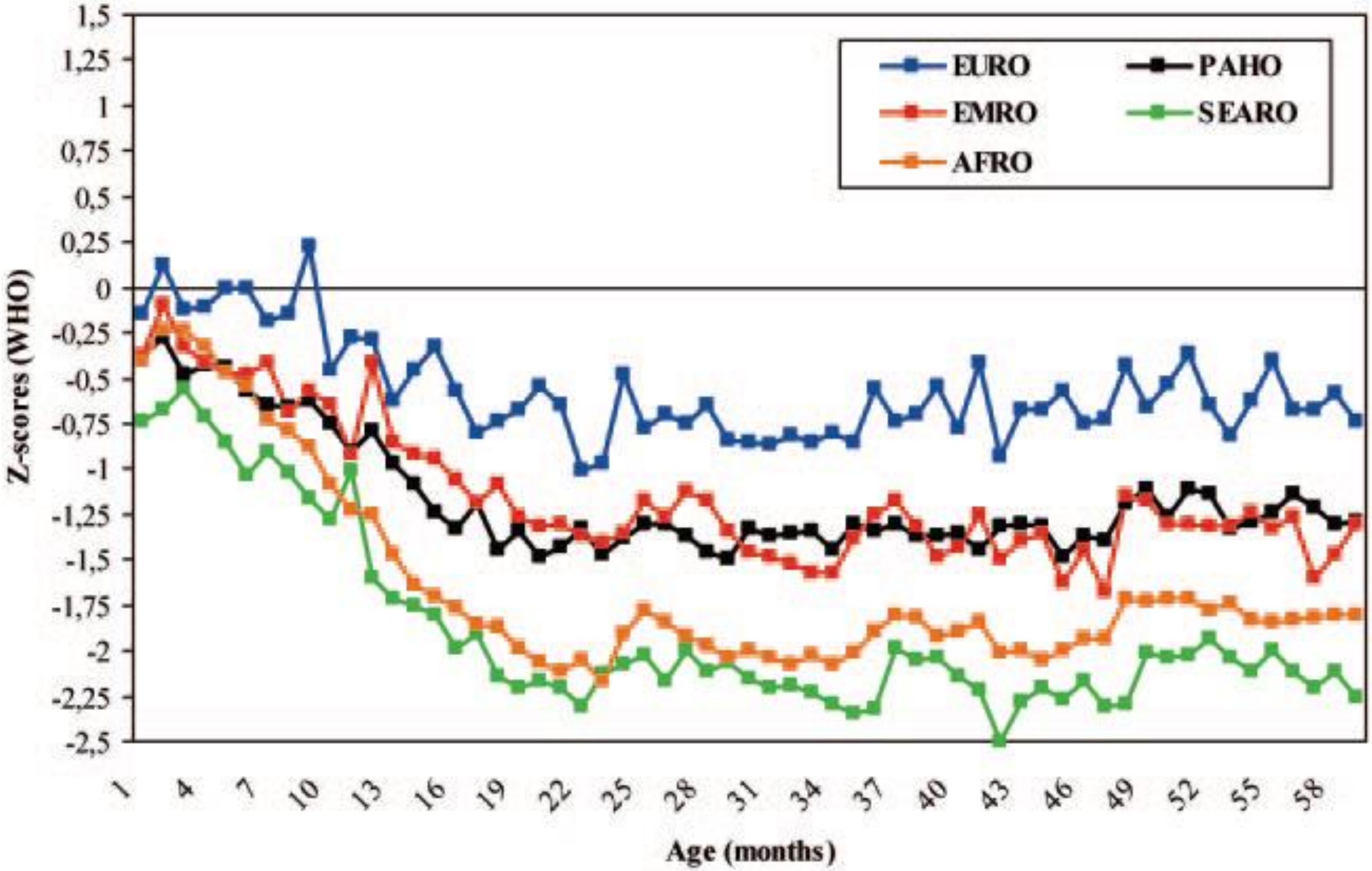
At birth, for most regions of the world, average weight-for-age z-scores are already below the WHO standard



- Z-scores decline moderately, then peaks at ~24 mo

EURO, Europe and Central Asia; EMRO, North Africa and the Middle East; AFRO, Sub-Saharan Africa; PAHO, Latin America and the Caribbean; SEARO, South Asia. Source: Victora et al, 2010. Pediatrics 125: e473–e480.

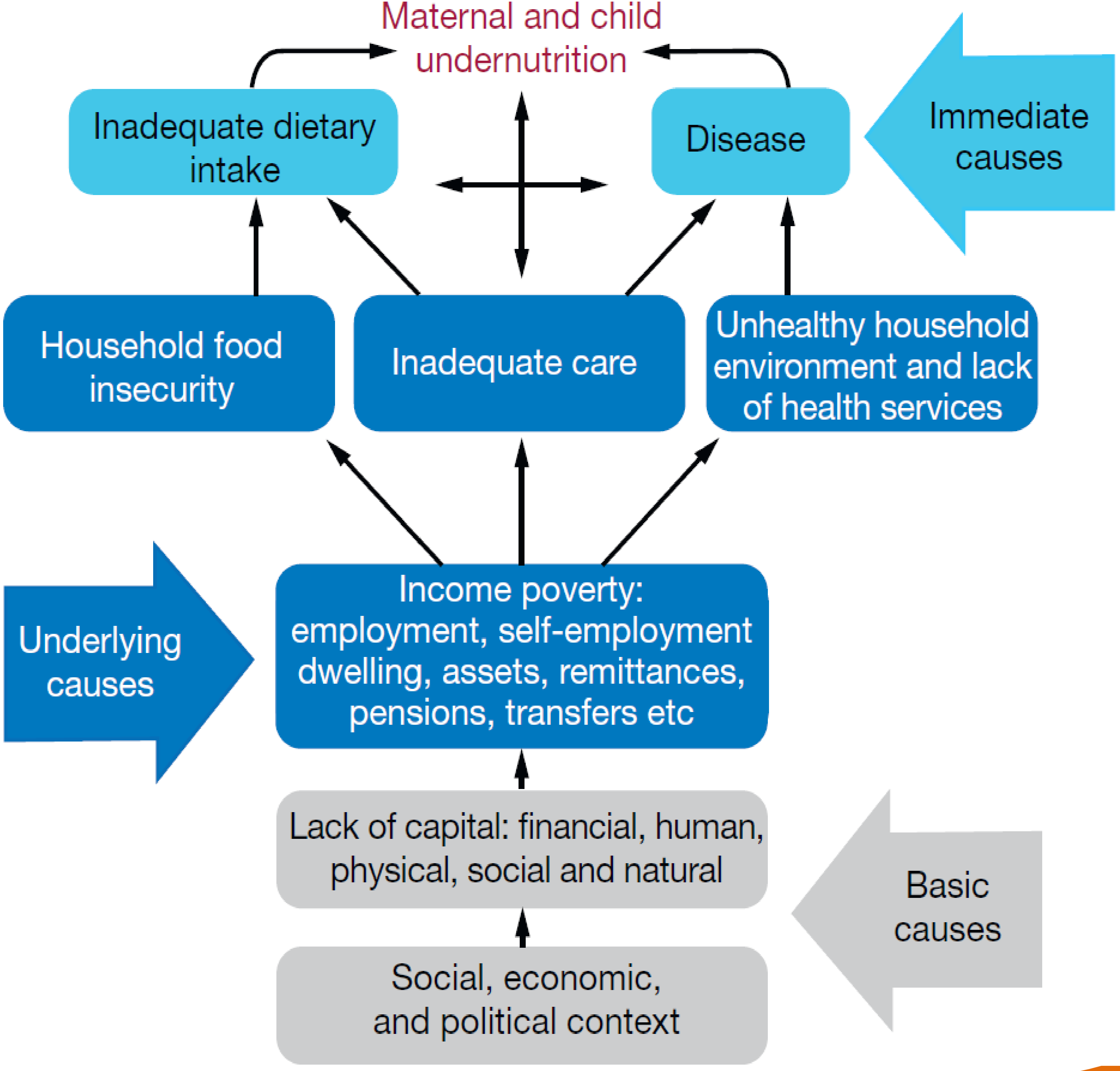
At birth, average height/length-for-age z-scores are well below WHO standard, for most regions of the world



- Z-scores decline sharply until ~ 24 mo

EURO, Europe and Central Asia; EMRO, North Africa and the Middle East; AFRO, Sub-Saharan Africa; PAHO, Latin America and the Caribbean; SEARO, South Asia. Source: Victora et al, 2010. Pediatrics 125: e473–e480.

Growth faltering has many causes



Source: Unicef, 2011 (https://www.unicef.org/nutrition/training/2.5/4.html

Inadequate nutrient intakes are a major cause of fetal and infant growth faltering

Maternal, eg.

- Inadequate GWG
- Protein/energy
- Multiple micronutrients
- Iodine

→ Intra-uterine growth restriction

Child, eg.

- Protein/energy
- Zinc

→ Impaired growth (stunting, underweight, wasting)

One reason for inadequate dietary intakes is the high nutrient needs during pregnancy and lactation

		Percentage increase over NPNL RDA	
Nutrient	NPNL	Pregnancy	Lactation
Protein	46 g	54	54
Vitamin A	700 µg	10	86
Vitamin C	75 mg	13	60
Vitamin B_6	1.3 mg	46	54
Folate	400 µg	50	25
Iodine	150 µg	47	93
Iron	18 mg	50	-50
Zinc	8 mg	38	50

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Also, the high nutrient needs during infancy and childhood are difficult to meet

Nutrient	RDAs for adult male (per kg body weight)	% increases in DRIs for infants and young children	
		6 mo[2]	12 mo[2]
Energy[4]	44 kcal[5]	84	84
Protein	0.7 g	65	43[3]
Vitamin A	13 µg	292	300
Vitamin C	1.3 mg	292	300
Vitamin E	0.2 mg	150	150
Thiamin	0.02 mg	50	50
Riboflavin	0.02 mg	100	100
Niacin	0.2 mg	50	100
Vitamin B_6	0.02 mg	-50	50
Folate	5.7 µg	44	46

Nutrient	RDAs for adult male (per kg body weight)	% increases in DRIs for infants and young children	
		6 mo[2]	12 mo[2]
Vitamin B_{12}	0.03 µg	67	67
Calcium	14 mg	79	93
Copper	13 µg	92	77
Iodine	2 µg	600	600
Iron	0.1 mg	-100	1000[3]
Magnesium	6 mg	-33	33
Phosphorus	10 mg	30	190
Selenium	1 µg	100	100
Zinc	0.2 mg	50	50[3]

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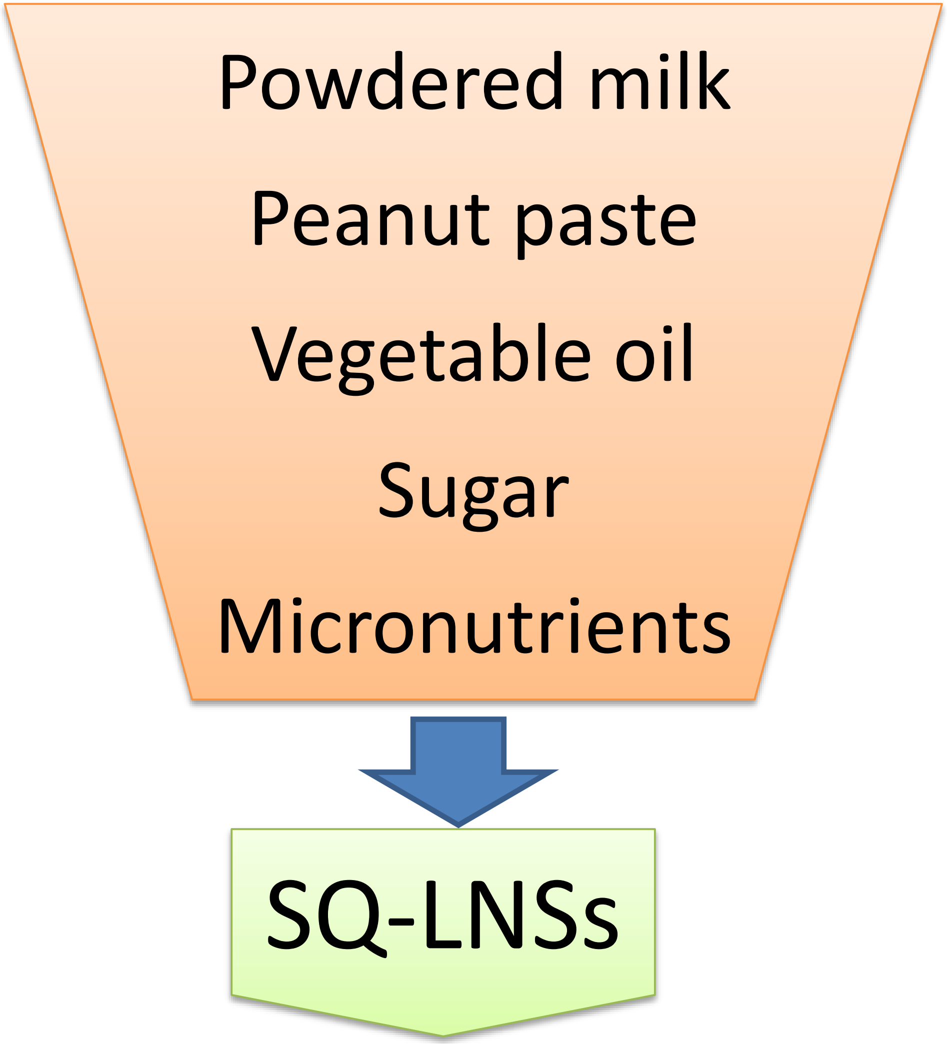
Our project developed the Small-quantity lipid-based nutrient supplements (SQ-LNSs) for enriching local diets (1)



Arimond M, Zeilani M, Jungjohann S, Brown KH, Ashorn P, Allen LH, Dewey KG. Considerations in developing lipid-based nutrient supplements for prevention of undernutrition: experience from the International Lipid-Based Nutrient Supplements (iLiNS) Project. Mat Child Nutr epub May 2013.

Small-quantity lipid-based nutrient supplements (SQ-LNSs) is nutrient-dense

- Typically 20 g/day
- Currently women (LNS-P&L) and children (LNS I&C).
- Includes 22 vitamins & minerals usually 1*x* – 2*x* RDA or Adequate Intakes (AI) or maximum amount that can be added (eg. Ca, P, K, Mg)
- Essential fatty acids (linoleic acid and alpha-linolenic acid)
- Protein, fat, and 118 kcal energy
- Mixed with small amount of home-prepared food

Arimond M, Zeilani M, Jungjohann S, Brown KH, Ashorn P, Allen LH, Dewey KG. Considerations in developing lipid-based nutrient supplements for prevention of undernutrition: experience from the International Lipid-Based Nutrient Supplements (iLiNS) Project. Mat Child Nutr epub May 2013.

We designed the iLiNS-DYAD trial to evaluate the efficacy of LNS for pregnant & lactating women plus LNS for children 6-18 mo

Group	Pregnancy	Lactation	6-18 mo
LNS	LNS-P&L	LNS-P&L	LNS-I&C
MMN	MMN	MMN	
IFA	Fe + Folic acid	Placebo (Ca)	

Main hypotheses:

1) SQ-LNS consumed in pregnancy promotes fetal growth
2) ”Comprehensive SQ-LNS use” promotes healthy growth by 18 months of age

Findings: SQ-LNS and Fetal growth (1)

- Prenatal SQ-LNS supplementation:
  - ➢ Increased birth weight compared with IFA and MMN
    - (including WAZ, and BMIZ, and trend toward reducing LBW).
  - ➢ In pairwise comparison with IFA
    - increased mean birth wt by +85 g (WAZ +0.19 and BMIZ +0.21)
    - reduced risk of LBW by 39%

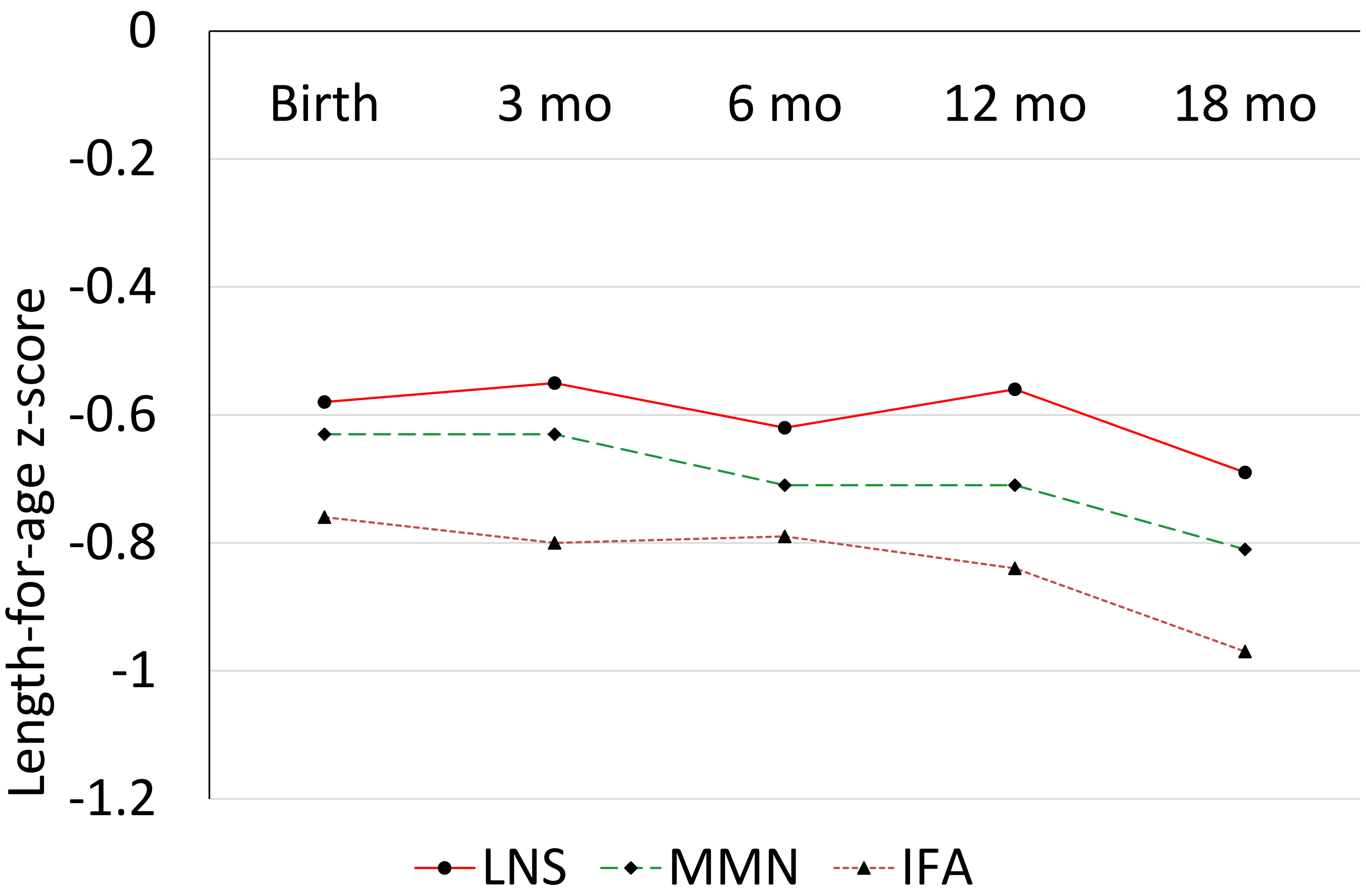
Findings: SQ-LNS and Fetal growth (2)

- Effect of SQ-LNS more pronounced in first-time mothers:
  - Increased mean birth length, weight, and head circumference when compared to IFA.
  - Similar differences when comparing with MMN.

Findings: SQ-LNS and child growth by 18 mo of age

- SQ-LNS provided through much of the "first 1000 days" :
  - ➢ Increased attained length and weight compared to IFA group
    - \+0.85 cm; +0.28 in LAZ; +0.30 kg; +0.24 in WAZ
  - ➢ Reduced the prevalence of stunting compared to IFA (8.9% v.15.1%).

Length-for-age z-score from birth to 18 mo of age



Conclusions

SQ-LNS consumption:

- improved birth outcomes among primiparous women; the impacts were consistent for weight, length, head circumference
- reduced stunting by 18 mo of age; impact is attributable to differences in size at birth

Interpretation (1)

- Prenatal SQ-LNS supplementation may help offset the influence of risk factors for small birth size in vulnerable women.

- Low rate of stunting by 18 mo of age (12%) in Ghana suggests fewer constraints on child growth, hence nutrition-only interventions may be effective.

Research recommendation

- Investigate reasons for response to LNS intervention in some but not in other contexts
- In contexts such as Ghana, would milk-containing LNS be more efficacious than LNS without milk?
- Assess LNS interventions in the context of programmatic initiatives that integrate nutrition into more comprehensive strategies

Action recommendations

- Use of SQ-LNS in programs should be preceded by a needs assessment/situation analysis
- Program planners should begin with a smaller-scale program, before taking it to scale.
- LNS intervention may be accompanied by adequate access to health care and/or better sanitation and hygiene or stronger response

Acknowledgments

University of Ghana

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Thank you