

Insights from the
SQ-LNS
TASK FORCE

Small-Quantity Lipid-Based Nutrient Supplements (SQ-LNS) For The Prevention Of Child Undernutrition

Historical perspective, progress towards
achieving scale, and current challenges and
opportunities



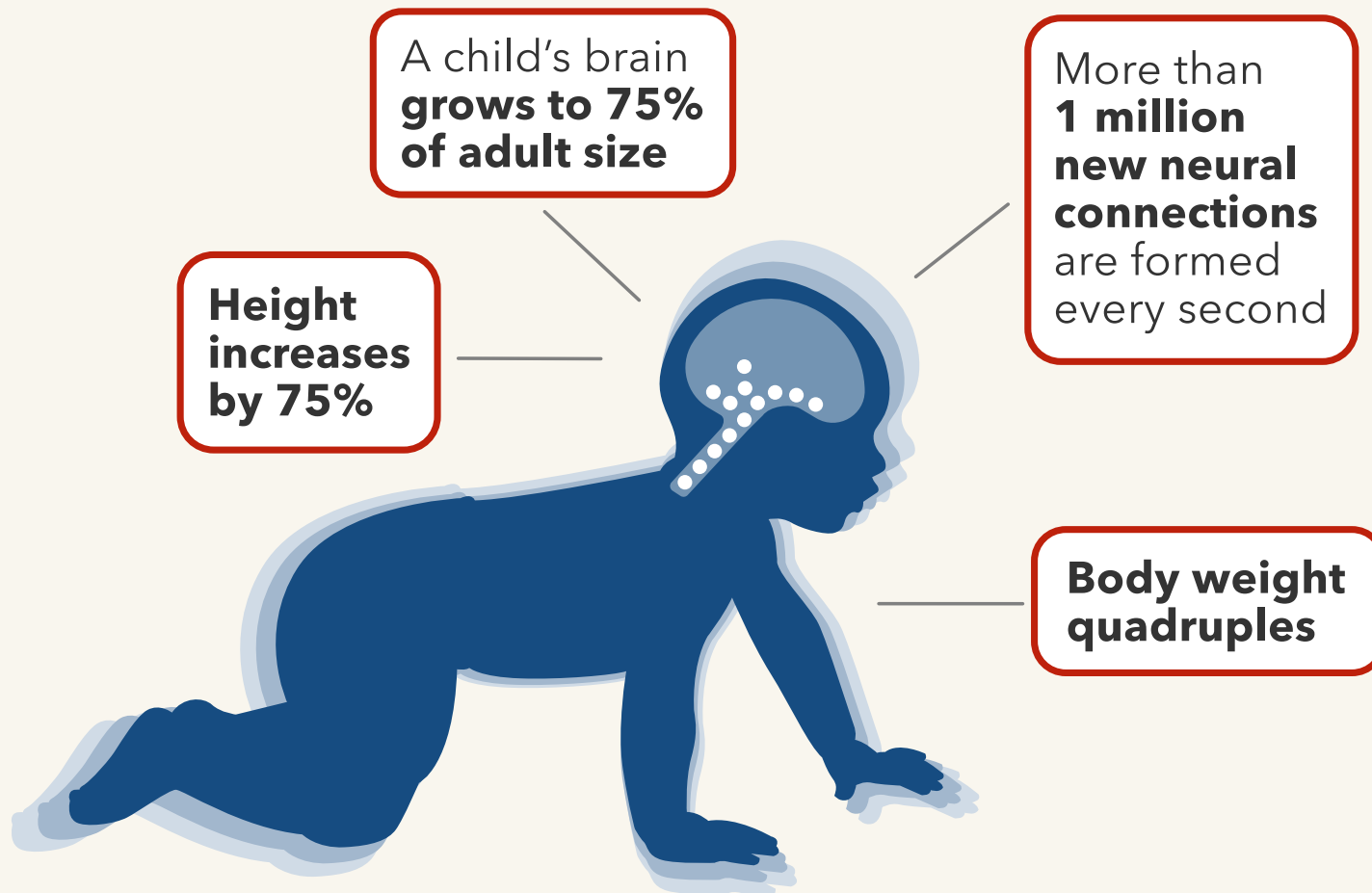
BACKGROUND & EVIDENCE BASE FOR SQ-LNS

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THE GLOBAL CRISIS OF CHILDREN'S DIETS IN EARLY LIFE

During their first 2 years, children have extraordinary nutrient needs

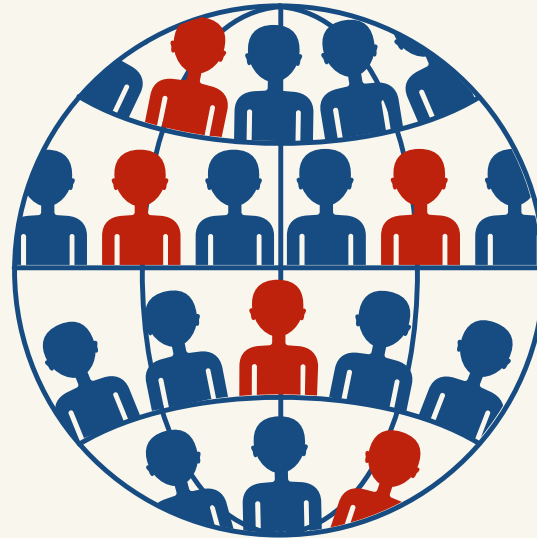


Source: Unicef Fed to Fail, Unicef Child Food Poverty

THE GLOBAL CRISIS OF CHILDREN'S DIETS IN EARLY LIFE

Yet, most children under 2 are not fed according to global recommendations

Globally, 1 in 4 children experience severe food poverty*



*Severe food poverty is defined as intake of two or fewer food groups per day

Poor diet and feeding practices early in life lead to stunting and wasting



STUNTING

Stunting increases rapidly between 6 months and 23 months of age



WASTING

More than half of all children with wasting are younger than 2 years of age

Source: Unicef Fed to Fail, Unicef Child Food Poverty

INFANTS AND YOUNG CHILDREN NEED A NUTRIENT-DENSE DIET



High nutrient needs for growth and development



Small amounts of complementary foods consumed



Therefore, complementary foods need to be very high in nutrient density (amount of nutrient per 100 calories)



Inadequate consumption of nutrient dense foods can lead to nutrient gaps

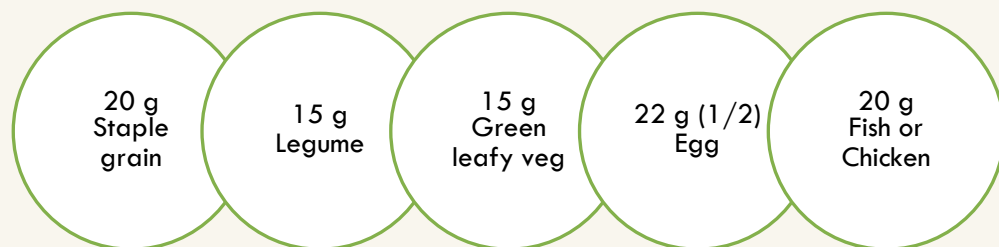


CHALLENGES TO MEETING NUTRIENT NEEDS OF INFANTS

Examples of iron and zinc:

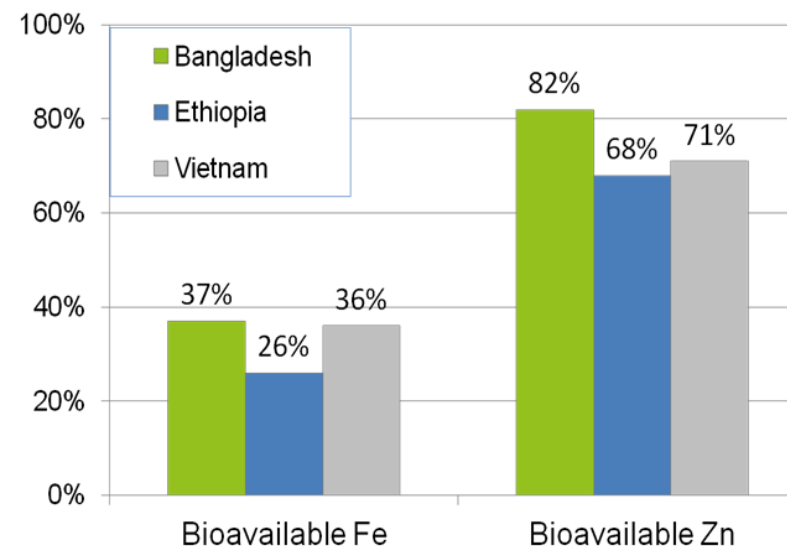
- Even with a high quality complementary food diet, it is challenging to meet iron and zinc needs.
- Per 100 calories of foods other than breast milk, breastfed infants need 4 times as much zinc and 9 times as much iron as an adult male.

Example of a 5 food group diet:



Source: Vitta BS, Dewey KG. Identifying micronutrient gaps in the diets of breastfed 6-11-month-old infants in Bangladesh, Ethiopia and Viet Nam using linear programming. Washington, DC: Alive & Thrive, 2012

Percentage of recommended amount met by diet for infants 6-8 mo of age*



* For breastfed child 6-8 mo of age, assuming 67% kcal comes from breastmilk.

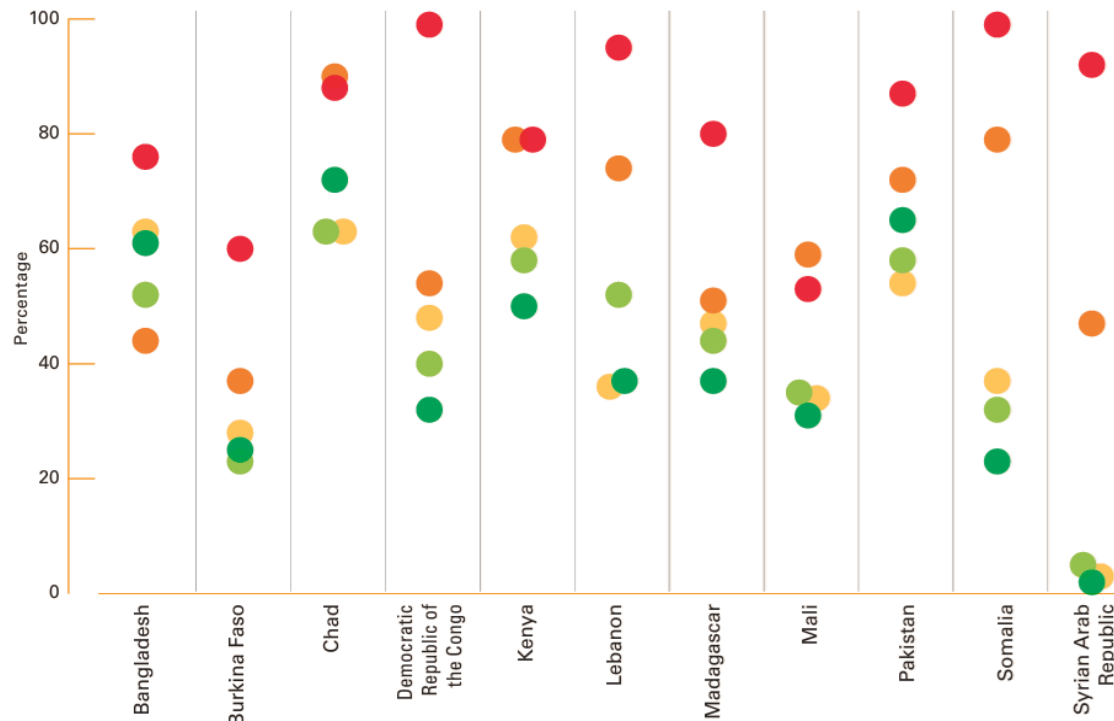
MEETING NUTRIENT NEEDS FOR CHILDREN 6-23 MONTHS IS UNAFFORDABLE FOR MANY FAMILIES

- Without fortified products, meeting nutrient needs requires a diet with a high proportion of nutrient-dense animal-source foods.
- This is unaffordable for many households in LMICs.
- Consequently, global prevalence of iron-deficiency anemia and other micronutrient deficiencies is very high at 6-24 months of age.

FIGURE 16: Percentage of parents and caregivers reporting barriers to the feeding of young children, by barrier type

Source: UNICEF rapid assessments. Data are not nationally representative, except for Mali.

- Financial
- Access
- Knowledge
- Time
- Agency



Source: United Nations Children’s Fund (UNICEF). *Child Food Poverty. Nutrition Deprivation in Early Childhood. Child Nutrition Report, 2024.* UNICEF, New York, June 2024.

¹Additional information on the affordability of nutritious foods: Ryckman et al. *Nutrition Reviews* 2021 <https://www.gainhealth.org/resources/reports-and-publications/affordability-nutritious-foods-complementary-feeding>

OPTIONS FOR MEETING NUTRIENT NEEDS OF BREASTFED INFANTS & CHILDREN, 6-24 MO

- Dietary diversification and selection of nutrient-rich complementary foods
 - Challenging to meet iron needs
 - Access & cost are often barriers
- Fortified products
 - Fortified foods for infants and young children
 - Home fortification
 - Micronutrient powders
 - Complementary food supplements, e.g. small-quantity lipid-based nutrient supplements (SQ-LNS, ≤ 20 g/d)

Dewey KG & Vitta BS. Strategies for ensuring adequate nutrient intake for infants and young children during the period of complementary feeding. *Alive & Thrive Technical Brief Issue 7*, Nov 2013.

<http://www.aliveandthrive.org/resources/technicalbriefs>

LIPID-BASED NUTRIENT SUPPLEMENTS

APPLICATION

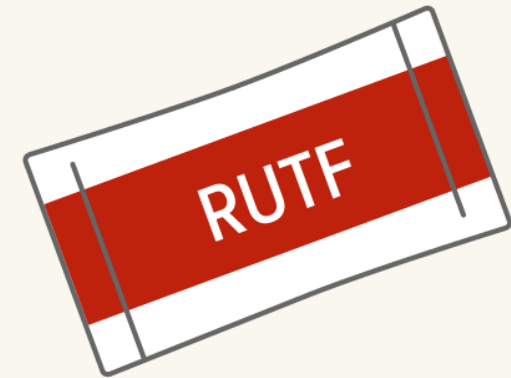
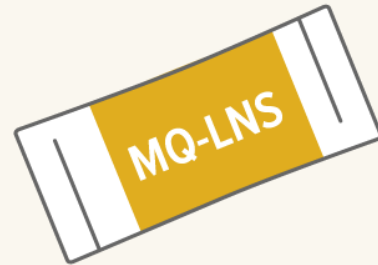
PREVENTION

TREATMENT

SMALL QUANTITY

MEDIUM QUANTITY

LARGE QUANTITY



~100 calories &
~20 grams per sachet



~270 calories &
~50 grams per sachet



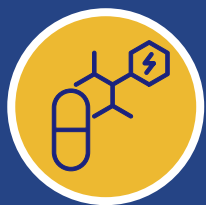
~540 calories &
100 grams per sachet



~500 calories &
92 grams per sachet

SMALL QUANTITY, INTENTIONALLY

Designed for prevention of undernutrition among children 6-23 months of age



Contain micronutrients in a dose of ~ 1 RDA

- Provides energy, protein, multiple micronutrients and essential fatty acids
- Common formulation uses peanut, milk powder, and oil; other tested use chickpeas, lentils or soy
- Fills nutrient gaps commonly found in complementary feeding diets



Ration size is small* in order to:

- Avoid displacement of breastmilk and nutrient-rich foods
- Ensure the entire ration and full dose of micronutrients can be consumed in one day
- Minimize cost

*Ration size: ~20 g/100-125 kcal per day

INITIAL RESEARCH COMPARING OPTIONS (~1997-2007)

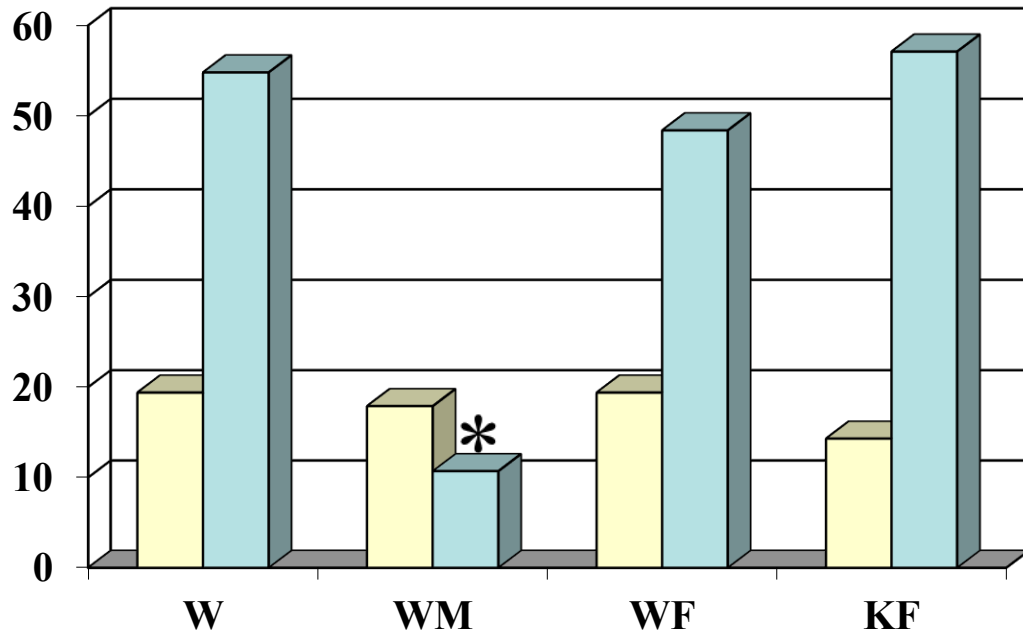
Research in Ghana to compare traditional, enhanced and fortified complementary foods

Randomized trial with 208 breastfed infants who received different complementary foods (~300 kcal/day) from 6 to 12 months of age:

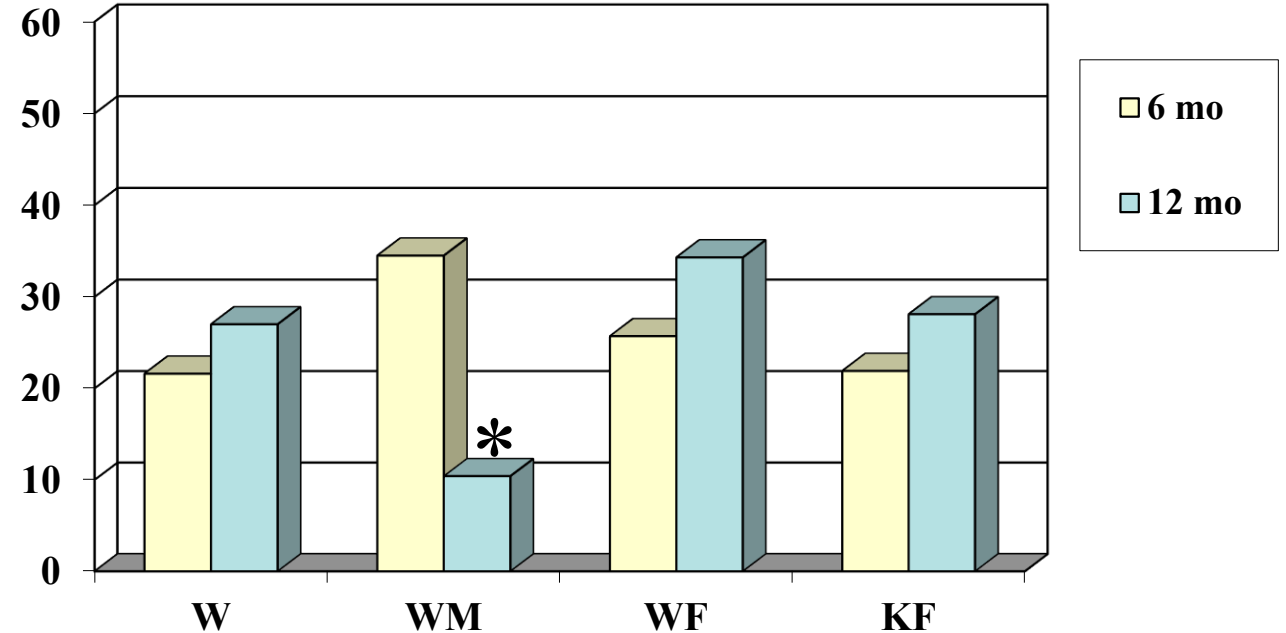
- Weanimix (maize/soybean/groundnut blend)
- Weanimix fortified with vitamins & minerals
- Weanimix with 20% fish powder
- Koko (fermented maize) with 20% fish powder

Reference: Lartey, A., Manu, A., Brown, K.H., Peerson, J.M., Dewey, K.G. A randomized community-based trial of the effects of improved, centrally processed complementary foods on growth and micronutrient status of Ghanaian infants at 6-12 mo. *Amer J Clin Nutr* 1999; 70:391-404.

Only the fortified product (WM) reduced iron deficiency and vitamin A deficiency



Iron deficiency: % with low plasma ferritin (< 12 ug/L) at 6 and 12 mo



Vitamin A deficiency: % with low plasma retinol (< 0.7 umol/L) at 6 and 12 mo

Infants consumed only ~120-260 kcal/day of each product, less than the amount provided

Research in Ghana to compare 3 types of micronutrient products for home fortification of complementary foods

- Randomized trial with 313 breastfed infants assigned to receive, from 6 to 12 months of age:
 - Micronutrient powder (6 vitamins & minerals)
 - Crushable tablet (16 vitamins & minerals)
 - SQ-LNS (19 vitamins & minerals, plus energy, protein, fat)
- Compared with a non-intervention group (96 infants)
- All 3 types of home fortification were well accepted and all improved iron status, but only SQ-LNS improved growth
- SQ-LNS group:
 - No growth faltering between 6 & 12 months of age
 - Anemia reduced from 32% to 10%
 - Percentage of infants able to walk independently at 12 months was doubled (from 25% to 49%)

Reference: Adu-Afarwuah, S., Lartey, A., Brown, K.H., Zlotkin, S., Briend, A., Dewey, K.G. Randomized comparison of 3 types of micronutrient supplements for home fortification of complementary foods in Ghana: Effects on growth and motor development. *Am J Clin Nutr* 2007; 86(2):412-20.

EXPANDING THE EVIDENCE BASE FOR SQ-LNS (2008-2019)

Development and evaluation of lipid-based nutrient supplements (LNS) for prevention of malnutrition: an innovative, food-based approach



The International Lipid-Based Nutrient Supplements (iLiNS) Project

Funded by the Bill & Melinda Gates Foundation

www.iLiNS.org



iLiNS Project Objectives

1. Develop low-cost, acceptable SQ-LNS formulations for target groups *[tested acceptability in all 3 sites]*
2. Evaluate the efficacy of formulations for infants and young children differing in dose (10, 20 & 40 g/day) and milk content *[iLiNS-DOSE trial completed in Malawi, n=1932]*
3. Determine the optimal amount of zinc to include in SQ-LNS for infants and young children *[iLiNS-ZINC trial completed in Burkina Faso, n=3266]*
4. Evaluate the efficacy of SQ-LNS for pregnant and lactating women *[iLiNS-DYAD trials completed in Ghana and Malawi, n~1300 per site]*
5. Investigate the economic dimensions of SQ-LNS for prevention of malnutrition *[completed in all 3 sites]*
6. Coordinate efforts, build capacity and use results to inform nutrition policy and programs *[LNS Research Network]*

DEMONSTRATING IMPACT ACROSS VARIOUS SETTINGS

Meta-analysis and Individual Participant Data (IPD) Meta-analysis (2019-2021)

SQ-LNS INDIVIDUAL PARTICIPANT DATA (IPD) ANALYSIS

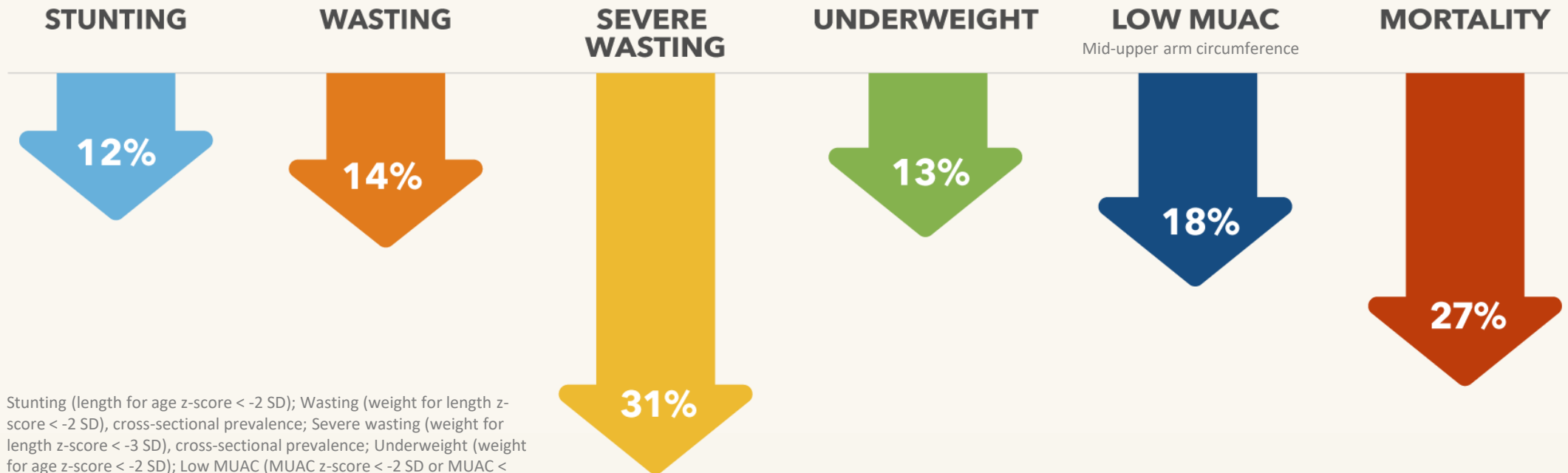
TOTAL OF 14 TRIALS INCLUDED; 9 COUNTRIES; >37,000 CHILDREN

Country	Author	Trial name	Age at start (mo)	Duration (mo)	Participants
Bangladesh	Christian 2015	JiVitA-4	6	12	4218
Bangladesh	Dewey 2017	RDNS	6	18	2478
Bangladesh	Luby 2018	WASH-Benefits	6	18	4633
Burkina Faso	Hess 2015	iLiNS-ZINC	9	9	2626
Burkina Faso	Becquey 2019	PROMIS-BF	6	12	2651
Ghana	Adu Afarwuah 2007		6	6	194
Ghana	Adu Afarwuah 2016	iLiNS-DYAD-G	6	12	1040
Haiti	Iannotti 2014		6-11*	3-6**	300
Kenya	Null 2018	WASH-Benefits	6	18	6649
Madagascar	Galasso 2019	MAHAY	6-11*	6-12**	3390
Malawi	Ashorn 2015	iLiNS-DYAD-M	6	12	664
Malawi	Maleta 2015	iLiNS-DOSE	6	12	943
Mali	Huybregts 2019	PROMIS-M	6	18	2937
Zimbabwe	Humphrey 2019	SHINE	6	12	3676
Zimbabwe	Prendergast 2019	SHINE (HIV-exp)	6	12	667

(Dewey et al. Am J Clin Nutr 2021). PROMIS, Innovative Approaches for the Prevention of Childhood Malnutrition; RDNS, Rang-Din Nutrition Study; SHINE, Sanitation, Hygiene, Infant Nutrition Efficacy Project. *Children enrolled between 6 and 11 mo of age. **Intervention duration varied between intervention groups or among children.

GROWTH AND MORTALITY

Small-Quantity Lipid-Based Nutrient Supplements at 6-23 months of age reduce:

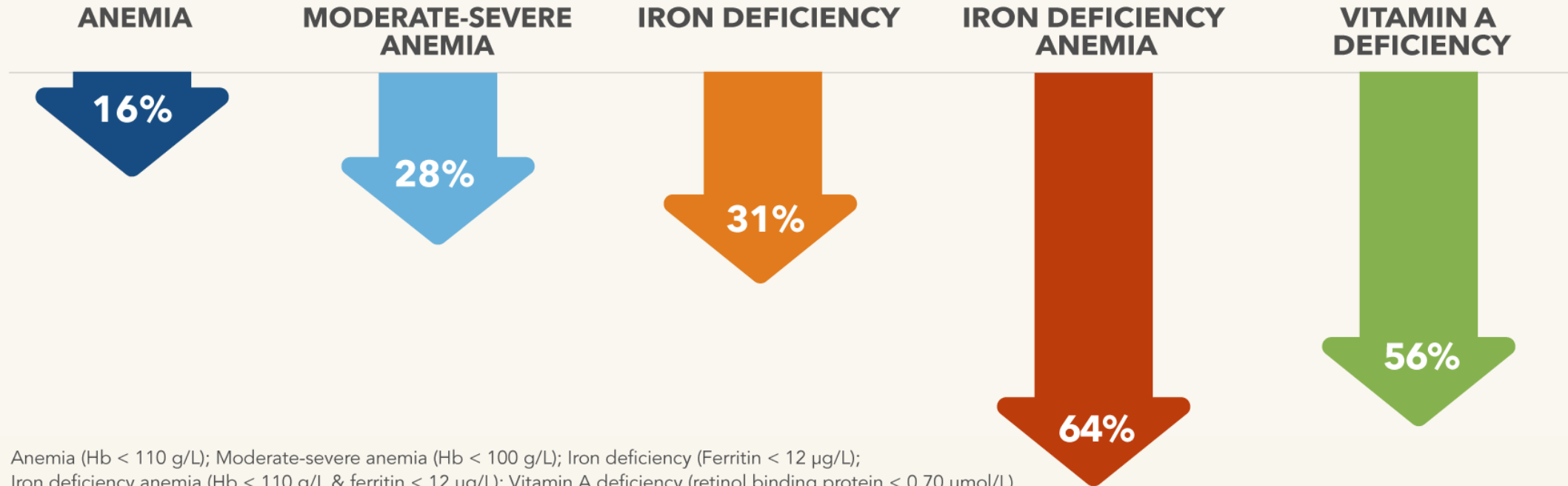


Stunting (length for age z-score < -2 SD); Wasting (weight for length z-score < -2 SD), cross-sectional prevalence; Severe wasting (weight for length z-score < -3 SD), cross-sectional prevalence; Underweight (weight for age z-score < -2 SD); Low MUAC (MUAC z-score < -2 SD or MUAC < 125 mm)

¹ Based on IPD and meta-analyses conducted by Dewey et al. and Stewart et al. (Dewey, AJCN, 2021: <https://doi.org/10.1093/ajcn/nqab278>; Stewart, AJCN, 2020: <https://doi.org/10.1093/ajcn/nqz262>; Dewey, AJCN, 2022: <https://doi.org/10.1093/ajcn/nqac232>).

ANEMIA AND MICRONUTRIENT STATUS

Small-Quantity Lipid-Based Nutrient Supplements at 6-23 months of age reduce:



¹ Based on IPD and meta-analysis conducted by Wessells et al, (Wessells, AJCN, 2021: <https://doi.org/10.1093/ajcn/nqab276>).

CHILD DEVELOPMENT

Small-Quantity Lipid-Based Nutrient Supplements at 6-23 months of age reduce:

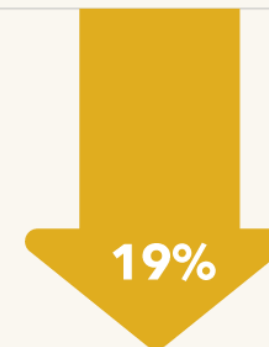
**DELAYED LANGUAGE
DEVELOPMENT**



**DELAYED MOTOR
DEVELOPMENT**



**LOW SOCIAL-EMOTIONAL
DEVELOPMENT**



¹ Based on IPD and meta-analysis conducted by Prado et al. (Prado, AJCN, 2021: <https://doi.org/10.1093/ajcn/nqab277>).

Note: The lowest decile (10%) of development outcome scores was used as a proxy for children who may be at the greatest risk of experiencing developmental delay.

CONSIDERATIONS FOR TARGETING: ANALYSIS OF EFFECT MODIFIERS

Study-level characteristics examined:

- Region (Africa vs S.Asia)
- Stunting burden
- Malaria prevalence
- Community water & sanitation coverage
- Duration of supplementation
- Child age at enrollment
- Frequency of contact
- Compliance

Household, maternal, or child-level characteristics examined:

- Household SES
- Household water or sanitation
- Household food security
- HOME environment
- Maternal age, height, BMI
- Maternal education
- Maternal depressive symptoms
- Child sex or birth order
- Season of assessment

In general, there were benefits seen across nearly all strata of community-level, household-level, and individual-level characteristics.

All children have an opportunity to benefit.

CONSIDERATIONS FOR TARGETING: ANALYSIS OF EFFECT MODIFIERS

- **In households with a lower SES**, there were greater effects on developmental outcomes
- **In communities with a higher stunting burden**, there were greater effects on developmental outcomes
- **In communities with poorer WASH conditions**, there were greater effects on severe wasting, but lesser effects on iron deficiency anemia
- **In households with more severe food insecurity**, there were greater percentage point reductions in acute malnutrition and underweight

Targeting on the basis of population-level SES or burden of undernutrition is worth considering.

Such settings are also associated with greater risk of infection/inflammation. Consider co-packaging with other complementary interventions.

PART OF A BIGGER PICTURE

Not intended as a stand-alone intervention —
integration into a core package of interventions is vital



Core interventions include:

- Robust communication with caregivers
- Counseling and support for breastfeeding
- Promotion of diverse, nutritious diets



Potential delivery platforms:

- Well-child visits
- Growth monitoring and promotion programs
- Child health and immunization days
- Malaria prevention programs
- Screening for moderate and severe wasting
- Social protection programs