

# **Evidence for the Effects of Complementary Feeding Interventions on the Growth of Infants and Young Children in Low- and Middle-Income Countries**

*Rebecca Heidkamp*

Complementary feeding interventions, which aim to improve dietary intake of children 6–23 months of age, were ranked among the top 10 effective interventions to address child undernutrition in low- and middle-income countries (LMIC) by the *Lancet* Nutrition series [1]. Given the implications for strategic planning and resource allocation by governments, donors and researchers, it is important that the underlying evidence base be continuously synthesized and clearly articulated.

Three recent systematic reviews provide pooled estimates for two categories of complementary feeding interventions on length and weight gain of children aged 6–23 months in LMIC [2–4]. Meta-analyses have recognized limitations but remain our primary tool for synthesizing evidence across intervention trials. To account for the heterogeneity in measurement approaches, continuous outcomes may be reported as relative standardized mean differences (SMD) rather than absolute mean differences (MD). Generally, an SMD of 0.2 SD is considered a small, of 0.5 SD a medium and of 0.8 SD a large effect [5].

*Education-Only Interventions.* Complementary feeding education interventions promote optimal caregiver practices related to continued breastfeeding, age-appropriate food choice, food preparation methods as well as frequency and style of feeding. The two most recent systematic reviews examining the impact of complementary feeding education alone on growth of children in LMIC are published by Lassi et al. [3] in 2013 and Imdad et al. [2] in 2011. Lassi et al. identified 10 trials of education-only interventions meeting inclusion criteria compared to 8 by Imdad et al.; 7 studies are included in both reviews. Both reviews limited study inclusion to controlled intervention trials among children under 23 months of age

**Table 1.** Summary of pooled estimates from two recent meta-analyses of effects of complementary feeding education interventions on length and weight gain among children 6–23 months of age in LMIC

	Lassi et al. [3] (2013)		Imdad et al. [2] (2011)	
	SMD (95% CI)	studies, n	SMD (95% CI)	studies, n
Length gain	0.23 SD (–0.00, 0.45)	6	0.21 SD (0.01–0.41)	7
Food secure	0.35 SD (0.08, 0.62)	4	–	–
Food insecure	0.00 SD (–0.15, 0.16)	2	–	–
Weight gain	0.26 SD (–0.00, 0.52)	7	0.30 SD (0.05–0.54)	8
Food secure	0.40 SD (0.02, 0.78)	4	–	–
Food insecure	0.06 SD (–0.13, 0.25)	3	–	–

in LMIC with available data on change in weight and/or length. They further restricted their analyses to trials with a 6-month minimum intervention duration that did not selectively enroll malnourished children. Using CHERG methods, both reviews graded the quality of evidence for each outcome as ‘moderate’.

The 2 reviews reported similar pooled effect sizes for length and weight gain (table 1) compared to no intervention controls. Imdad et al. [2] also reported the absolute difference (MD) in length gain [0.49 cm (95% CI 0.00–0.999); 7 studies] and weight gain [0.30 kg (95% CI 0.04–0.55); 8 studies]. Lassi et al. [3] reported pooled estimates for several additional growth metrics including weight-for-age and length-for-age z-scores and stunting (not shown).

Lassi et al. presented a subanalysis by food security status in which trials were classified as food secure or food insecure based on a country level per capita income cutoff of USD 1.25/day. In the subanalysis (table 1), significant differences were only observed in food-secure populations. The differences are consistent with the rationale that food-secure populations have more resources to implement promoted feeding practices and therefore a higher potential to benefit from education-only interventions than food-insecure populations. Neither review attempted to pool by delivery platform, intensity, age group, duration or other implementation-related factors.

*Provision of Foods or Specially Formulated Supplements with or without Nutrition Education.* In pooling estimates for this second category of complementary feeding interventions, it is assumed that the nutritional supplement drives all of the observed effect on growth (not the optional educational component). Lassi et al. identified a total of 7 trials compared to 11 in the study by Imdad et al. for interventions providing food or

**Table 2.** Summary of findings from three recent meta-analysis of growth effects of complementary feeding interventions that provide food or nutrient supplements with or without education to children 6–23 months of age in LMIC

Imdad et al. [2] (2011)			Lassi et al. [3] (2013)		Kristjansson et al. [4] (2015)			
					RCT		CBA	
SMD (95% CI)	MD (95% CI)	studies, n	SMD (95% CI)	studies, n	MD (95% CI)	studies, n	MD (95% CI)	studies, n
<i>Height gain, cm</i>								
0.19 (0.04, 0.33)	0.43 (0.19, 0.65)	10	0.34 SD (-0.09, 0.78)	4	0.27 (0.07, 0.48)	9	0.52 (-0.07, 1.1)	7
<i>Weight gain, kg</i>								
0.22 SD (0.06, 0.38)	0.14 (0.05, 0.24)	10	0.43 SD (-0.42, 1.27)	4	0.12 (0.05, 0.18)	9	0.24 (0.09, 0.39)	7

nutrient supplements with or without education. A third more recent systematic review by Kristjansson et al. [4] examined growth outcomes for food supplementation interventions among children aged 3–59 months, with 23 studies in LMIC included in their meta-analysis. Pooled estimates for RCTs and controlled before and after studies (CBA) were reported separately. The majority of the subjects across the 23 studies were 6–23 months old. Across the 3 reviews, the quality of evidence for each pooled outcome was categorized as ‘moderate’ based on GRADE/CHERG criteria [6] except for those reported by Kristjansson et al. using CBA trials, which were all rated ‘very low’.

Despite the variability in the studies included, pooled effect sizes for height gain and weight gain are consistent across the analyses (table 2). Relative effect sizes (SMD) are small (<0.5) and significant only in the study by Imdad et al. The absolute effects on length (MD) reported by Imdad et al. include both RCTs and CBAs, and fall consistently between the independent pooled estimates for RCTs and CBAs reported by Kristjansson et al. Among the RCTs of the latter study, the effects of interventions providing high-energy supplements (>60% DRI) on height compared to control were large and statically significant [MD 0.62 cm (95% CI 0.13–1.11); 2 studies] in comparison to those providing medium (30–59% DRI) [MD 0.16 cm (95% CI -0.09 to 0.41); 5 studies] or low energy (0–29% DRI) supplements [MD 0.25 cm (95% CI -0;05 to 0.55); 1 study]. There were no statistically significant differences in weight gain across subgroups. Additional subanalyses presented by Kristjansson et al. suggest trends towards improved growth outcomes for younger and/or more malnourished children, for interventions involving center-based

compared to home-based feeding and for multifaceted interventions compared to single-strategy interventions. However, small sample sizes limit the ability to draw conclusions.

*Conclusion.* Evidence from controlled trials consistently points to complementary feeding interventions making a small but significant impact on growth of children 6–23 months of age in certain LMIC contexts (e.g. education-only in food-secure populations). However, at present, there is not a sufficient evidence base (in terms of number and variety of large-scale controlled trials) to support meaningful categorization and comparison of growth effects across intervention designs (e.g. facility- vs. community-based education), delivery factors (e.g. duration and intensity of supervision) and/or contextual variables (e.g. age, food security and baseline nutritional status).

## References

- 1 Bhutta ZA, Das JK, Rizvi A, et al: Evidence-based interventions for improvement of maternal and child nutrition: what can be done and at what cost? *Lancet* 2013;382:4520477.
- 2 Imdad A, Yakoob MY, Bhutta ZA: Impact of maternal education about complementary feeding and provision of complementary foods on child growth in developing countries. *BMC Public Health* 2011;11(suppl 3):S25.
- 3 Lassi ZS, Das JK, Zahid G, Imdad A, Bhutta ZA: Impact of education and provision of complementary feeding on growth and morbidity in children less than 2 years of age in developing countries: a systematic review. *BMC Public Health* 2013;13(suppl 3):S13.
- 4 Kristjansson E, Francis DK, Liberato S, et al: Food supplementation for improving the physical and psychosocial health of socio-economically disadvantaged children aged three months to five years. *Cochrane Database Syst Rev* 2015;3:CD009924.
- 5 Cohen J: *Statistical Power Analysis for the Behavioral Sciences*. Hillsdale, Erlbaum, 1988.
- 6 Walker N, Fischer-Walker C, Bryce J, et al, CHERG Review Groups on Intervention Effects: Standards for CHERG reviews of intervention effects on child survival. *Int J Epidemiol* 2010;39(suppl 1):i21–i31.