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B[illegible]: Childhood undernutrition is prevalent in low and middle income countries. It is an important indirect cause of child mortality in these countries. According to an estimate, stunting (height for age Z score < -2) and wasting (weight for height Z score < -2) along with intrauterine growth restriction are responsible for about 2.1 million deaths worldwide in children < 5 years of age. This comprises 21 % of all deaths in this age group worldwide. The incidence of stunting is the highest in the first two years of life especially after six months of life when exclusive breastfeeding alone cannot fulfill the energy needs of a rapidly growing child. Complementary feeding for an infant refers to timely introduction of safe and nutritional foods in addition to breast-feeding (BF) i.e. clean and nutritionally rich additional foods introduced at about six months of infant age. Complementary feeding strategies encompass a wide variety of interventions designed to improve not only the quality and quantity of these foods but also improve the feeding behaviors. In this review, we evaluated the effectiveness of two most commonly applied strategies of complementary feeding i.e. timely provision of appropriate complementary foods (± nutritional counseling) and education to mothers about practices of complementary feeding on growth. Recommendations have been made for input to the Lives Saved Tool (LiST) model by following standardized guidelines developed by Child Health Epidemiology Reference Group (CHERG).

M[illegible]: We conducted a systematic review of published randomized and quasi-randomized trials on PubMed, Cochrane Library and WHO regional databases. The included studies were abstracted and graded according to study design, limitations, intervention details and outcome effects. The primary outcomes were change in weight and height during the study period among children 6-24 months of age. We hypothesized that provision of complementary food and education of mother about complementary food would significantly improve the nutritional status of the children in the intervention group compared to control. Meta-analyses were generated f.oooooooo18c35(

databases. The last date of search was 3 were mean *c a e*

software ANTHRO. In order to investigate that if this exercise introduced any bias in the results, we did sensitivity analyses for the pooled estimates (WMD) with Z scores (primary analysis) and the one with converted Z scores (secondary analysis) and reported the p-value. These estimates were used to generate recommendations for LiST model [9]. The decision about inclusion of an estimate was based on overall GRADE quality of evidence [9].More details about this method are provided in the
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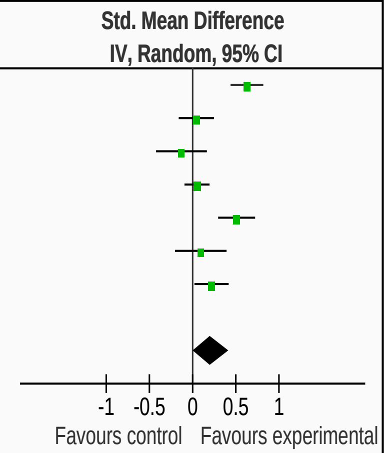
and length (cm) were available from eight studies [26,28-30,33,36,38,41]. For the rest of three studies we back-calculated the change in weight (kg) and length (cm) based on the Z scores given in the study with the help of software ANTHRO.

Pooled results for *c a ge* in weight showed that provision of complementary food (± nutritional counseling) lead to an extra gain of 0.25kg (±0.18) in the intervention group compared to control (Figure 6A). The weighted mean difference for this analysis was 0.34 SD (95 % CI 0.11-0.57, random model), which was not significantly different (p=0.96) from the primary analysis (in Figure 2A). The pooled results for increase in length for the same studies showed an extra gain of 0.54 cm (± 0.38) in the intervention group compared to control (Figure 7A). The weighed mean difference this analysis was 0.25 SD (95 % CI 0.08-0.43, random model), which was also not significantly different (p=0.98) from the primary analysis (in F

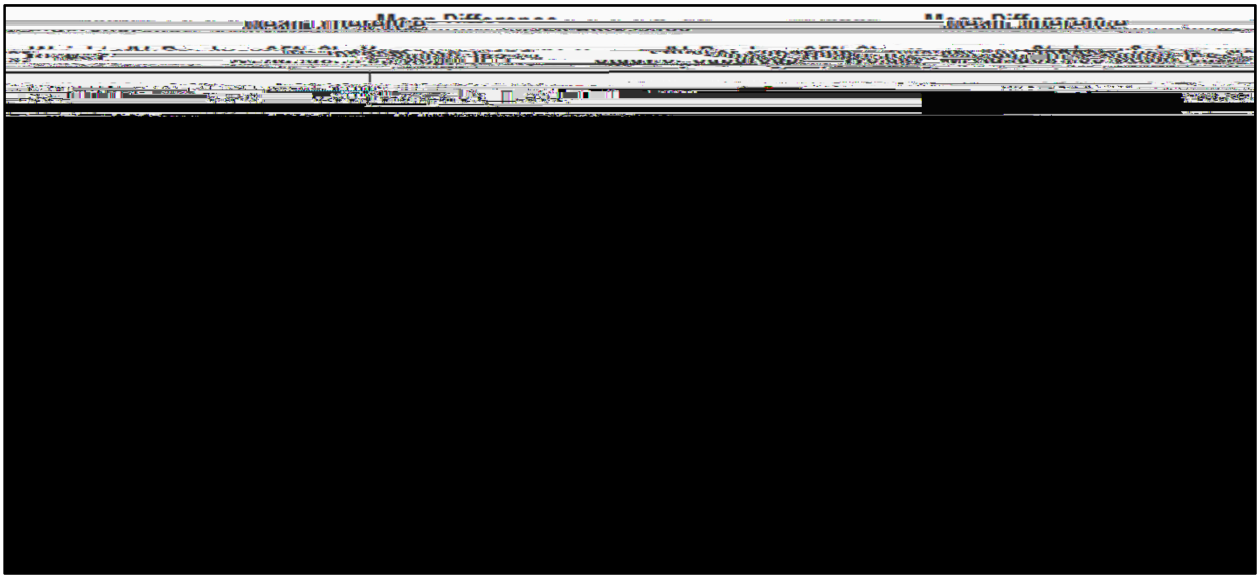
Study or Subgroup	Weight	Std. Mean Difference IV, Random, 95% CI	Year
Guldan 2000	15.0%	0.63 [0.45, 0.81]	2000
Santos 2001	14.7%	0.04 [-0.15, 0.24]	2001
Bhandari 2001	12.7%	-0.13 [-0.41, 0.16]	2001
Bhandari 2004	15.8%	0.05 [-0.08, 0.19]	2004
Penny 2005	14.5%	0.51 [0.30, 0.71]	2005
Roy 2005	12.6%	0.09 [-0.20, 0.38]	2005
Shi 2009	14.8%	0.22 [0.03, 0.41]	2009
Total (95% CI)	**100.0%**	**0.21 [0.01, 0.41]**	

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 42.78$, df = 6 ($P < 0.00001$); $I^2 = 86\%$

Test for overall effect: Z = 2.05 (P = 0.04)



A) With study by Obatolu et al. 2003 [29]



B) Without study by Obatolu et al 2003 [29]

Study or Subgroup	Weight
Walker 1991	3.9%
Bhandari 2001	29.4%
Schroeder 2002	5.5%
Oelofse 2003	1.6%
Santos 2005	6.5%
Roy 2005	9.3%
Lutter 2008	8.3%
Kuusipalo 2006	11.8%
Owino 2007	
Adu-Afarwuah 2007	
Total (95% CI)	

Heterogeneity: Tau² = 0.01; Chi² = 9.59, df = 9 (P = 0.38); I² = 6%
Test for overall effect: Z = 3.58 (P = 0.0004)

removing this study significantly reduced the effect sizes and results became less heterogeneous (Figure 6B and 7B).

Out of eight studies, data on actual increase in weight (kg) were available from six studies addressing education of mothers about complementary feeding [26,27,31, 32,35,40]. For the rest of two studies, changes in weight were back-calculated with the help of 'Z' scores as given in the studies [37,39]. Pooled results from all the studies showed that this intervention lead to an extra weight gain of 0.30 kg (±0.26) in intervention group compared to control (Fig 8). The WMD for this set of studies was 0.30 SD (95 % CI -0.09-0.55, random model) which was not significantly different (p=0.94) from the primary analysis (in Figure 3). Data on actual increase in length was available from five studies [26,27,31,32,35] while it was back-calculated for two studies with help of Z scores [37,39]. Combined data from these seven studies showed that this intervention leads to an extra gain of 0.49 cm (±0.50) cm in the intervention group compared to controls (Figure 9). The effect size for this set of studies was 0.19 (-0.01-0.39, random model) which was not significantly different (p=0.67) from the primary analysis (in Figure 5).

Table 1 gives the qualitative assessment of these pooled estimates according to the grade criteria [9]. The combined results for effect of provision of complementary foods (±nutritional counseling) on weight and height gain were graded as that of ‘moderate’ quality. This assessment was based on presence of significant heterogeneity and the fact that the around half of the effect size was contributed by a single study [29]. In any case, based on the available evidence, provision of appropriate complementary foods (±nutritional counseling) can increase the weight by 0.25 kg (±18) and height by 0.54 cm (± 0.38) in children 6-24 months of age. These estimates had been recommended for inclusion in the LiST model. The pooled estimate for effect of maternal education about complementary feeding on gain in weight and height were also graded as that of ‘moderate’ quality. Both of these estimates were also substantially heterogeneous. Based on available evidence, we recommend an increase of 0.30 kg (± 0.26) in weight and 0.49 cm (± 0.50) in height as effectiveness of maternal education about complementary feeding compared to control, for inclusion in the LiST model.

Although there has been considerable progress in the development and implementation of complementary feeding practices and guidelines [42,43], relatively few reviews have quantified the effectiveness of these strategies in terms of meta-analysis. A previous review conducted for the Lancet Under-nutrition Series showed that provision of complementary food (± nutritional counseling) had a significant effect on improving linear growth (WMD 0.41, 95% CI 0.05-0.76, random model) among food insecure populations [7]. In the same review, nutritional counseling alone in food secure populations was shown to have significant effect on length (WMD 0.25, 95 % CI 0.01-0.49, random model). Dewey et al. (5) reviewed various complementary feeding strategies in depth and provided pooled effect estimates without conducting a formal meta-analysis. Education strategies for caregivers were shown to have an effect on both weight (WMD 0.28 SD, 95 % CI -0.06-0.96) and linear growth (WMD 0.20 SD, 95 % CI 0.04-0.64). Provision of complementary food (as the only treatment) and food supplements combined with nutritional counseling were also associated with positive impact on weight and linear growth [3].

Our results confirm the previously reported positive impact of complementary feeding strategies (provision of complementary food and educational strategies) on growth, however the magnitude and statistical significance of effect size differs from the above mentioned two reviews [3,7] because of differences in methods of meta-analyses. The main difference is that we pooled results for *c a ge* in growth parameters and not that for final attained weights/heights as was done in both the abov-8874(th)-8(at)-340(for)25.50(CI)4th0(fo3I8()-96i6e8417th)-8(en

CI -0.18-0.39) and if we pool the results for *c a e* in height the effect size becomes -0.13 (95 % CI -0.41-0.16). Although both the results were statistically non-significant; seemingly positive impact in first instance

key message was to regularly provide an animal source food to the infant (chicken liver, egg or fish in Peru and eggs in China). The availability and utilization of these foods depends upon the economic contexts and affordability of such foods. This observation suggests that for optimal growth among infants and young children, complementary foods should have high micronutrient density from diverse food sources including animal source foods.

Given the context of food insecurity and poverty in populations with high rates of early childhood stunting, a key question pertains to the effectiveness of provision of food with nutritional counseling? Even though we did not attempt a subgroup analysis to answer this question, due to lack of adequate number of studies, we can evaluate the individual studies. Two efficacy trials where provision of food was combined with maternal nutritional counseling showed that this combination was more effective than education alone [26,37]. In first study from India [26], the food plus education group gained 250 g more weight and 0.4 cm more length than the control group during the 8-month intervention, whereas the education-only group gained only 90 g more than the control group and did not have any advantage in length gain. Similarly in study by Roy et al from Bangladesh [37], results for the education-only group were intermediate between those of the food plus education and control groups. This shows that in certain settings inclusion of a food supplement is more effective than education alone.

Our review has certain limitations. Relatively large numbers of studies had to be excluded due to non-availability of sufficient data to calculate the *change* in growth parameters (weight/height) from the baseline [15-19]. In two of these studies education approaches were evaluated [16,18] and in rest provision of complementary food (±nutritional counseling) was the main intervention [15,17,19]. Other limitations include the fact that in most of the efficacy trials blinding of assessment was not possible mainly because the study design. This might have biased the results in favor of the intervention group. Because most trials used fortified

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