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REVIEW ARTICLE

Effect of breastfeeding promotion interventions on child growth: a systematic review and meta-analysis

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ABSTRACT

Aim: To update a previous systematic review and meta-analyses about the effect of breastfeeding promotion interventions on child growth.

Methods: Studies evaluating the effect of any type of breastfeeding promotion intervention on child weight, length (or height) and weight/height (or BMI) were screened. Papers published between 2006 and 2014 were checked using the following databases: PubMed/MEDLINE, Embase, Cochrane Database of Systematic Reviews, Lilacs and SciELO.

Results: Sixteen studies were added to 19 other studies identified in the previous review, resulting in 35 studies. Meta-analyses of studies reporting on mean weight, length, weight/length or BMI showed that the interventions had no impact on weight or length/height z scores [pooled effect: 0.03 (95% confidence interval: −0.06;0.12) and 0.03 (95% confidence interval: −0.02;0.08), respectively] and had a modest, but significant, reduction in body mass index/weight-for-height z scores [z score mean difference: −0.06 (95% confidence interval: −0.12;0.00)], which was limited to studies from low- and high-incomes settings. For all three outcomes, there was important heterogeneity among studies, which should be taken into account when interpreting the results.

Conclusion: Breastfeeding promotion interventions were not associated with significant changes in weight or length, but led to a modest, albeit significant, reduction in body mass index/weight-for-height z scores.

INTRODUCTION

Breastfeeding can promote infant growth through its nutritional properties and also by reducing incidence and severity of potentially growth-affecting infections, especially diarrhoea and respiratory diseases (1,2), and by improving feeding during illness (3). It is estimated that breastfeeding could prevent 13% of all deaths from preventable diseases in children under five around the world. (4).

Besides preventing growth deficit, especially among poorer populations, breastfeeding may prevent obesity during childhood and adolescence. In a recent meta-analysis published by the World Health Organization (WHO) (5), the authors concluded that breastfeeding might provide some protection against overweight or obesity. This benefit cannot be disregarded in the current global context of increasing prevalence of excess weight in all ages. According to the WHO, the prevalence of obesity in under-fives had increased from 4.2% in 1990 to 6.7% in 2010, with a possible increase to 9.1% by 2020 if the trend continues (6).

The impact of breastfeeding promotion interventions on child growth is not clear, despite the publication in 2008 of a systematic review and meta-analysis to evaluate the impact of breastfeeding promotion interventions on infant nutritional status (7). Most studies included in this review showed positive, albeit not always significant, associations with growth. The meta-analysis of five studies did not provide statistical evidence of an impact of breastfeeding interventions on weight or length at age four months. Apart from the small number of studies and diversity of outcomes

Abbreviations
BMI, Body mass index; WHZ, Weight-for-height z score; WAZ, Weight-for-age z score.

Key Notes

- With the available literature to date, it is not possible to have a conclusive analysis of the impact of breastfeeding promotion interventions on child growth.
- Breastfeeding promotion interventions seem to have little influence on child growth.
- Regardless of the effects of breastfeeding interventions on child growth, breastfeeding promotion must remain a priority, as many other benefits to the child and mother are already well established.

and child age at outcome assessment, very few studies were from low-income settings – none from the African continent – and all were restricted to children under two years of age.

The aim of this systematic review and meta-analyses was to update the previous review on the effect of breastfeeding promotion interventions on child growth, specifically on weight, length/height and body mass index (BMI) or weight-for-length/height. The review excluded observational studies on the association between breastfeeding patterns and child growth, which are difficult to interpret because of selection bias, confounding and reverse causality (8).

METHODS

Literature search

Two independent literature searches were carried out. The focus was on studies that evaluated the effect of breastfeeding promotion interventions, alone or in combination with other strategies, on one of the following outcomes: weight, length or height and weight/height or BMI. The review included studies published in English, Spanish or Portuguese. As the previous review had included articles published before January 2006, manuscripts published between January 2006 and December 2014 were searched. There were no restrictions as to type of intervention or study design, quality of evidence, geographical settings and type of population. Because the review focused on child growth, it was restricted to studies reporting outcomes up to the age of 10 years.

The present review followed the same methodology employed in the previous one. The following databases were searched: PubMed/MEDLINE, Embase, Cochrane Database of Systematic Reviews, Lilacs (Literatura Latino-Americana e do Caribe em Ciências da Saúde) and SciELO (Scientific Electronic Library Online). Additional studies were obtained through a manual search of references from identified studies. Medical Subject Headings terms (Mesh) used were 'breast feeding' [MeSH]; Limits: Clinical Trial, Meta-Analysis, Randomized Controlled Trial, Controlled Clinical Trial, Evaluation Studies. Other terms used were breastfeeding promotion AND infant growth OR weight OR length/height OR body mass index (BMI).

Selection of studies

For the selection of the studies, two independent reviewers (EG and BL) read all titles and abstracts and excluded those studies that were clearly not relevant to the review. The full texts of the remaining manuscripts were examined to identify relevant studies. Disagreements were resolved by consensus. Only studies that compared groups that received an intervention with controls were selected.

Data extraction

Two reviewers independently completed a standardised protocol containing the following information from each manuscript: place of study, study design, population, sample size, follow-up rates, intervention (setting, type, focus and conduction), type of outcome, age at outcome assessment and impact of intervention. The forms were compared, and any discrepancy was discussed until a consensus was reached.

Quality of evidence

The quality of the evidence was assessed employing the same criteria used in the previous review, as follows: 1^{++} – high-quality randomised clinical trials (RCT), including cluster RCTs, with a very low risk of bias; 1^{+} – well-conducted RCTs with a low risk of bias; 1^{-} – RCTs with a high risk of bias; 2^{++} – high-quality nonrandomised intervention studies (controlled nonrandomised trial, controlled before-and-after, interrupted time series), comparative cohort and correlation studies with a very low risk of bias: 2^{+}– well-conducted, nonrandomised intervention studies (controlled nonrandomised trial, controlled before-and-after, interrupted time series), comparative cohort and correlation studies with a low risk of bias; and 2^{-} – nonrandomised intervention studies (controlled nonrandomised trial, controlled before-and-after, interrupted time series), comparative cohort and correlation studies with a high risk of bias. Risk of bias was judged using the criteria adopted by Cochrane reviews (9). Again, any discrepancy between reviewers was discussed until a consensus was reached.

We systematically explored heterogeneity among studies associated with the year of publication, level of evidence, age at anthropometric assessment, setting of the intervention (e.g. facility or community), economic level of country (low, middle or high income) and sample size.

Meta-analyses

To estimate the impact of intervention on the nutritional status of children, we performed meta-analyses. For those studies that provided estimates of the effect of BF intervention at different ages, we chose the closest to six months. Effect measures were reported as standardised mean differences between the intervention and control groups, because the effect of intervention on nutrition was measured using different scales. Heterogeneity among studies was evaluated using the *Q*-test and I-square. If either test suggested the heterogeneity was higher than expected by chance, random-effects model was used to pool the estimates. The per cent of heterogeneity explained by different study characteristics is presented.

RESULTS

We identified 1321 records in all databases searched. After exclusion of duplicated records, title and abstract reading of all papers, and a full text reading of selected papers, 16 publications met all the criteria for inclusion in this review. Thus, with the 19 studies selected in the previous review, there were 35 studies that evaluated the effect of interventions promoting breastfeeding on child growth.

Two intervention studies included in the first review were updated, as new publications reported on outcomes at older

Table 1 Synthesis of evidence of efficacy/effectiveness of interventions promoting breastfeeding on infant growth

Author, year	Country	Design	Sample size	Setting	Focus of Intervention	Outcome	Mean age/range	Efficacy/effectiveness	Quality of evidence
Kramer, 2007 (11)	Belarus	Cluster RCT	I = 8865 C = 8181	Health facilities	EBF and BF for mothers of healthy term infants ≥2500 g	Height, BMI, overweight and obesity	6.5 y	No impact on height, BMI or prevalence of overweight/obesity at 6.5 y	1 + +
Jakobsen, 2008 (22)	Guinea-Bissau	RCT	I = 857 C = 864	Community	EBF for all mothers	Weight and WAZ	7–60, 61–120, 121–150 and 151–180 d	↓ weight (−200 g at 121–150 d and −300 g at 151–180 d) ↓ WAZ (−0.28 at 121–150 d and −0.24 at 151–180 d No impact on weight or WAZ in the first 120 d	1−
Karanja, 2010 (16)	USA	Cluster RCT + quasi-experiment	I_1 = 63 I_2 = 62 C = 80	Community	BF + reduction of consumption of sweetened beverage for American Indians (Family component for I_2)	WAZ, LAZ and BMIZ	24 m and birth to 24 m	↓BMIZ change 0–24 m (−0.75) for I_2 compared to I_1. No impact on WAZ and HAZ change 0–24 m	2−
Thakur, 2012 (27)	Bangladesh	RCT	I = 92 C = 92	Health facilities	EBF for mothers of low birth weight infants	Weight and length	15, 30, 45 and 60 d	↑ weight at 30 (+216 g), 45 (+163 g) and 60 d (+305 g) ↑ length at 30 (+0.7 cm), 45 (+1.1 cm) and 60 d (+1.5 cm)	1−
Louzada, 2012 (13)	Brazil	RCT	I = 200 C = 500	Community	BF + CF for mothers of term infants ≥2500 g	Overweight and obesity	3–4 and 7–8 y	No impact	1+
Wen, 2012 (17)	Australia	RCT	I = 337 C = 330	Community	BF + CF + physical activity + family nutrition for first time mothers >16 y	Weight, length, BMI and obesity	24 m	↓ BMI (−0.38 kg/m^2) No impact on weight or length. No impact on prevalence of obesity	1 + +
Carlsen, 2013 (26)	Denmark	RCT	I = 108 C = 108	Outreach	BF for obese mothers of singleton, healthy, term infants	Weight, WAZ, LAZ, WLZ, BMIZ and obesity	6 m	No impact	1−
Khan, 2013 (21)	Bangladesh	RCT	I = 1607 C = 1607	Community	EBF + maternal food and micronutrient supplementation	Weight, Height, BMI, WAZ, HAZ, BMIZ, underweight, stunting and wasting	4.5 y and birth to 4.5 y	No impact	1−
Mustila, 2013 (14)	Finland	Non-RCT	I = 96 C = 89	Health facilities + community	BF + healthy diet + physical activity for mothers at risk of developing gestational diabetes	BMI, WLZ, overweight and obesity	4, 6 and 12 m, 0–4, 0–6, 0–12 and 6–12 m	No impact	2−

Table 1 (Continued)

Author, year	Country	Design	Sample size	Setting	Focus of Intervention	Outcome	Mean age/range	Efficacy/effectiveness	Quality of evidence
Navarro, 2013 (15)	Dominican Republic	Non-RCT (quasi-experiment-cluster)	I = 193 C = 259	Community	Integral approach (Pastoral), including BF for all mothers	LAZ, BMIZ, overweight, underweight, stunting and wasting	13–24 m	↓ BMIZ (−0.31) ↓ risk of overweight at 151–180 d (OR = 0.43)	2−
Vazir, 2013 (25)	India	Cluster RCT	I_1 = 207 I_2 = 194 C = 199	Community	BF + CF + responsive CF for mothers of all infants	Weight, length and stunting	3, 6, 9, 12 and 15 m	↑ length difference from 3 to 12 m (+0.5 cm). No impact on weight difference from 3 to 12 m	1−
Engebretsen, 2014 (18)	Burkina Faso, Uganda and South Africa	Cluster RCT	I = 1323 C = 1256	Community	EBF for mothers of all infants	WAZ, LAZ, WLZ, underweight, stunting and wasting	21, 45, 120 and 180 d	↓WAZ at 24 w in Uganda (−0.26) ↑WHZ at 12 (+0.19) and 24 w (+0.23) in South Africa ↓WHZ at 12 w (−0.24) in Burkina Faso and at 24 w in Burkina Faso (−0.20) and Uganda (−0.23) ↑risk of wasting at 3 w in South Africa (PR = 7.54), at 12 w in Burkina Faso (PR = 1.86) and at 24 w in Uganda (PR = 2.36)	1 + +
Mazumder, 2014 (23)	India	Cluster RCT	I = 1461 C = 1412	Community	Integrated Management of Neoanatal and Childhood Ilness (IMNCI) for all mothers period	Stunting and wasting	12 m	No impact	1−
Tomlinson, 2014 (19)	South Africa	Cluster RCT	I = 1821 C = 2136	Community	Integrated Management of Childhood Illness (IMCI) + HIV mother-to-child transmission + lactation counselling for mothers >17 y	WAZ, LAZ and WLZ	3 m	↑WAZ (+0.09) ↑HAZ (+0.11). No impact on WHZ	1 + +
Rotheram-Borus, 2014 (24)	South Africa	Cluster RCT	I = 644 C = 594	Community	BF + healthy pregnancy, HIV prevention, alchool use, malnutrition for mothers ≥18 y	Underweight, stunting and wasting	2 w, 6 and 18 m	↓prevalence of underweight at birth, 2 w, 6 and 18 m (11.2% vs 15.1%). No impact on prevalence of stunting and wasting	1−

Table 1 (Continued)

Author, year	Country	Design	Sample size	Setting	Focus of Intervention	Outcome	Mean age/range	Efficacy/effectiveness	Quality of evidence
Schwartz, 2014 (20)	Brazil	RCT	I = 163 C = 160	Health facility + community	BF + CF for mothers ≤19 y of healthy, term, ≥2500 g	HAZ, BMIZ, overweight, obesity and stunting	4–7 y	No impact	1+

RCT = Randomized controlled trial
I = Intervention C = Control
BF = Breastfeeding EBF = Exclusive breastfeeding CF = Complementary feeding WAZ = Weight for age z-score LAZ = Length for age z-score HAZ = height for age z-score BMIZ = Body mass index z-score WLZ = Weight for length z-score WHZ = Weight-for-height z-score d = Day w = Week m = Month y = Year.

ages. One is the Belarus trial, which, after measuring the effect of breastfeeding promotion on growth in the first year of life (10), also measured nutritional outcomes when the children were 6.5 years (11). A second study, after evaluating weight and length at 12–16 months (12), measured BMI at 3–4 years (13).

Table 1 presents a summary of the main characteristics and results of the 16 newly identified, in chronological order of publication. The list of 19 studies from the previous review can be seen elsewhere (7).

Most studies (13 of 16) were randomised clinical trials (RCT) and six were clustered. One was a nonrandomised trial (14), one was a quasi-experiment (15), and one used a combination of cluster-RCT and a quasi-experiment design (16). Only four studies were considered to have a high quality of evidence (1 + +) (11, 17–19): two were conducted in the African continent (18, 19), one in Belarus (11) and one in Australia (17).

The country of intervention, outcomes and age at outcome assessment varied greatly among the studies. This review included studies conducted in Europe, America, Asia, Africa and Oceania, and unlike the prior review, most children were more than six months of age; in four studies, the outcomes were assessed when the children were more than two years of age: between four and eight years in Brazil (13,20), at 4.5 years in Bangladesh (21) and at 6.5 (11) in Belarus.

In most studies (12 of 16), the intervention was carried out in the community, mainly through home visits, delivered by community health workers (16, 19, 21-24) or peer counsellors (15, 18, 25).

Table 2 Characteristics of the studies included in the updated systematic review

Subgroup	Number of publications
Year of publication	
<2006	19
≥2006	16
Level of evidence	
1 + +	9
1 + /1−	16
2	10
Country	
High income	8
Middle income	21
Low income	6
Type of intervention	
BF only	18
BF + CF or other	12
Comprehensive	5
Place of intervention	
Health facility	6
Community/outreach	20
Health facility + community/outreach	9
Mean age at outcome assessment	
≤6 months	19
7 to 24 months	12
>24 months	4

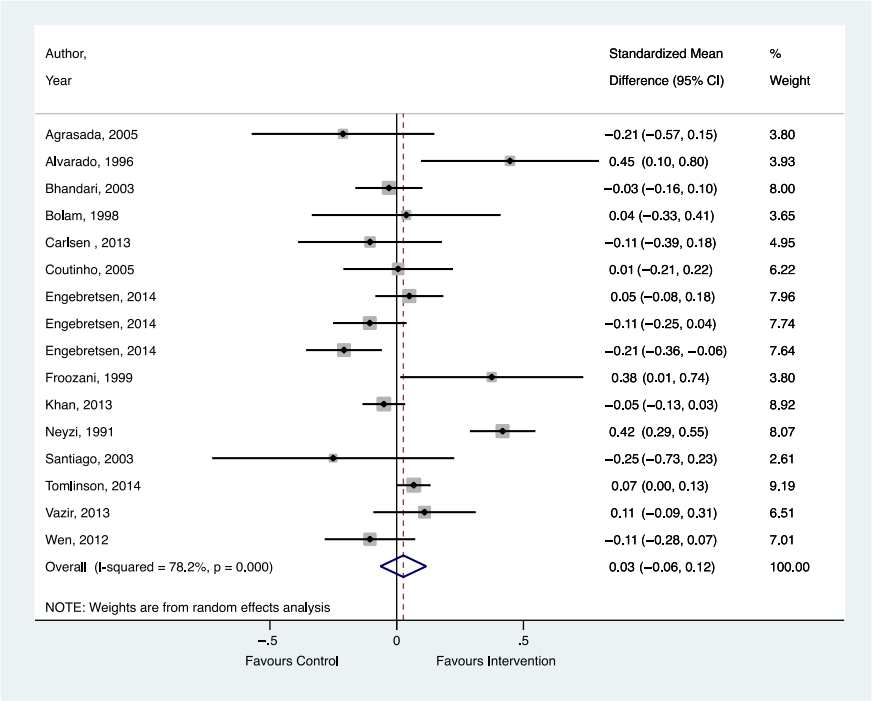

Figure 1 Standardised mean differences in weight in different studies, comparing intervention vs. control groups.

Four studies focused on strategies for special groups, three of them targeting groups at higher risk to have overweight/obese children: indigenous population (16), obese mothers (26) and mothers at increased risk of developing gestational diabetes (14). The fourth study aimed to evaluate an exclusive breastfeeding promotion strategy targeting mothers of children with low birthweight (27).

Characteristics of the 16 studies included in the updated review are summarised in Table 2. The characteristics of the 19 studies from the previous review can be seen elsewhere (7). The meta-analyses evaluating the effect of breastfeeding promotion interventions on mean weight and length/height z scores, and covered, respectively, 14 and 15 studies that provided 16 and 17 estimates, as one study (18) was conducted in three different countries, with variable results. About half of the 35 studies could not be included in the meta-analyses because their authors reported on weight gain during a given age period, or on prevalence of malnutrition, rather than mean anthropometric values at a given age.

The pooled effects, using a random-effects model, suggest slight but nonsignificant increases in mean weight z score [pooled effect: 0.03 (95% confidence interval: −0.06;0.12)] (Fig. 1) and mean length/height z score [pooled z score mean difference: 0.03 (95% confidence interval: −0.02;0.08)] (Fig. 2).

Table 3 shows that the main sources of heterogeneity among studies reporting on mean weight were the intervention setting (with positive effects in health facility interventions) and country income level. Studies in low-income countries had significant, although modest, negative impact on weight [z score mean difference: −0.11 (95% confidence interval: −0.20; −0.02)], whereas those in middle-income countries tended to have positive, although not quite significant, effects [mean 0.11, 95% confidence interval −0.01;022).

Regarding length or height, subgroup analyses show modest but significant increases in the three studies among children aged more than six months [z score mean difference: 0.17 (95% confidence interval: 0.14;0.20)] and in 12 studies of children from middle-income countries [z score mean difference: 0.07 (95% confidence interval: 0.001;0.13)] (Table 4).

Overall, breastfeeding promotion interventions were associated with a modest but significant decrease in mean BMI or weight-for-length/height [z score mean difference: −0.06 (95% confidence interval: −0.12;0.00)] (Fig. 3). The effect was restricted to studies of children from low- and high-incomes countries, but not in middle-income countries, and in smaller studies (sample size less than 500 subjects) compared with larger studies (Table 4).

DISCUSSION

This updated review added new information to the previous review, such as outcome measurements in older ages, data from African countries and results of interventions focused on the prevention of childhood obesity. In addition, the quality of the studies seemed to have improved compared with the studies in the previous review, as only three were classified as level of evidence 2 (compared to seven of 19 in the previous review).

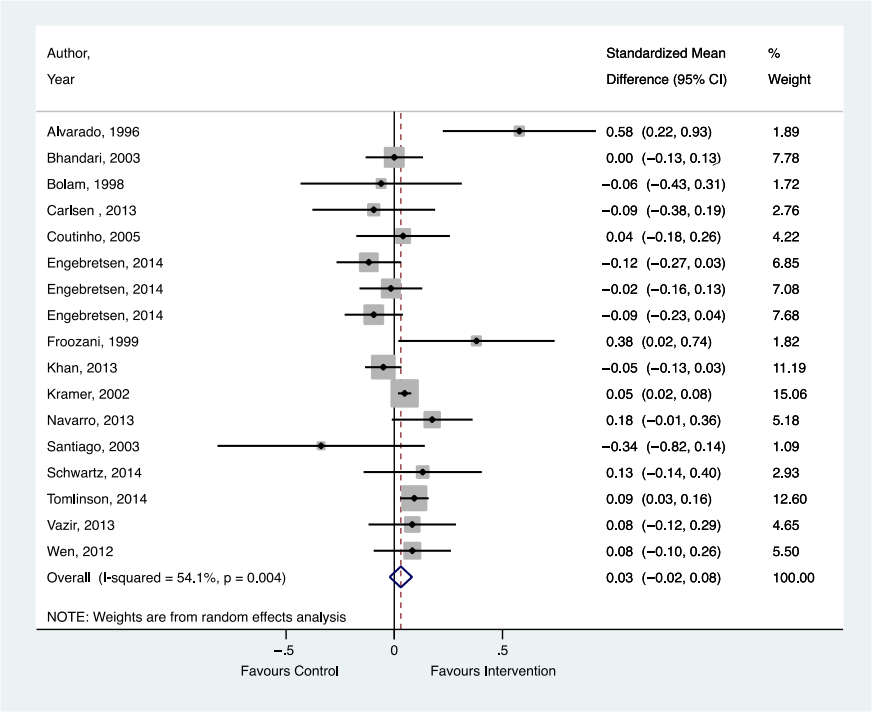

Figure 2 Standardised mean differences in length or height in different studies, comparing intervention vs. control groups.

Although it was possible to identify a reasonable number of studies (a total of 35), it is still not possible to have a conclusive analysis of the impact of breastfeeding promotion interventions on child growth, mainly due to the great variability in the types and impact of interventions on breastfeeding rates, choice of nutritional outcomes, the manner in which results were expressed and ages at outcome measurement. Also, the results varied greatly among the studies, as shown in Table 1. Only half of the interventions had some positive impact, that is presented a statistically significant difference between the intervention and control groups, taking into account the context of the intervention. Thus, it was considered a positive impact for interventions that aimed to reduce overweight/obesity rates when there was a significant reduction in BMI/WHZ, while for interventions whose objective was to reduce malnutrition rates, a positive impact was regarded as a significant increase in weight, length/height or BMI.

According to the results of the meta-analyses, breastfeeding promotion interventions, alone or in combination with interventions with other purposes, were not associated with significant differences in the mean weight and length/height z scores. This result is consistent with the conclusion of a 2012 systematic review on the optimal duration of exclusive breastfeeding that 'no deficits have been demonstrated in growth among infants from either developing or developed countries who are exclusively breastfed for six months or longer' (28).

Interestingly, breastfeeding promotion interventions were associated with a statistically significant, albeit modest, reduction in BMI or weight-for-length/height z scores (WHZ). This finding is consistent with the results of a previous meta-analysis of observational studies by Owen

Table 3 Standardised mean differences in weight, comparing intervention and control groups: random-effects meta-analyses by subgroup, based on 16 studies with information

Study characteristic	Standardised mean difference (95% confidence interval)	% heterogeneity explained	N
Year of publication			
<2006	0.11 (−0.08;0.31)	16.3	8
≥2006	−0.03 (−0.11;0.04)		8
Level of evidence			
1 + +	−0.05 (−0.15; 0.04)	0	7
1 + /1−/2	0.11 (−0.05;0.27)		9
Mean age at anthropometric assessment			
≤6 months	0.04 (−0.06; 0.13)	−3.3	15
>6 months	−0.11 (−0.28; 0.07)		1
Intervention setting			
Community	−0.04 (−0.11; 0.03)	40.5	9
Health facility or other	0.15 (−0.06; 0.36)		7
Country			
Low income	−0.11 (−0.20; −0.02)	27.3	3
Middle income	0.11 (−0.01; 0.22)		11
High income	−0.11 (−0.26; 0.05)		2
Sample size			
<500	0.03 (−0.10; 0.16)	0	9
≥500	0.02 (−0.10; 0.15)		7
Overall	0.03 (−0.06; 0.12)		16

Table 4 Standardised mean differences in length or height, comparing intervention and control groups: random-effects meta-analyses by subgroup, based on 17 studies

Study characteristic	Standardised mean difference (95% confidence interval)	% heterogeneity explained	N
Year of publication			
<2006	0.08 (−0.04;0.20)	0	7
≥2006	0.01 (−0.05;0.08)		10
Level of evidence			
1 + +	0.02 (−0.03; 0.08)	0	7
1 + /1−/2	0.07 (−0.04; 0.18)		10
Mean age at anthropometric assessment*			
≤6 months	0.02 (−0.04; 0.07)	0	15
>6 months	0.17 (0.14; 0.20)		3
Intervention setting			
Community	0.01 (−0.05; 0.07)	0	9
Health facility or other	0.09 (−0.04; 0.22)		8
Country			
Low income	−0.06 (−0.12; 0.01)	23.6	3
Middle income	0.07 (0.001; 0.13)		12
High income	0.03 (−0.13; 0.19)		2
Sample size			
<500	0.11 (−0.01; 0.22)	2.86	10
≥500	0.00 (−0.06; 0.06)		7
Overall	0.03 (−0.02; 0.08)		17

*one study assessed the outcome in both age categories.

et al. (29). They found a small effect of breastfeeding on mean BMI (−0.04 kg/m^2; 95% CI: −0,05, −0,02), but were unable to rule out residual confounding. Two other meta-analyses of observational studies reported protection against overweight or obesity (5,30).

One must take into account that the studies included in this review assessed the impact of breastfeeding intervention, rather than of breastfeeding *per se*. Therefore, the impact on growth may vary accordingly to the effectiveness of the intervention in improving breastfeeding rates. Also, the impact may be diluted if compliance with breastfeeding promotion was low, because studies were analysed on the basis of intent-to-treat.

The study of Engebretsen et al. (18) is an example that the impact of the same breastfeeding intervention on growth may vary from one setting to another. This was a multicountry cluster-randomised trial involving 2579 children distributed in 82 clusters in Burkina Faso, Uganda and South Africa. The focus of the intervention was on the promotion of exclusive breastfeeding, but results varied by country: while in South Africa, the intervention increased WHZ at 12 and 24 weeks; in Burkina Faso and Uganda, it was associated with lower WAZ and WHZ at six months.

Conflicting results were also reported within the same country, as in studies from Bangladesh (21,27)] and India (22,25). In these cases, one possible explanation could be that the interventions were not the same. On the other hand, in South Africa, the three studies all showed positive results, even though the interventions were different (18, 19, 24).

Results contrary to what was expected were found in two studies. In Guinea-Bissau, infants from four to six months of age in the intervention group had significantly lower weights, but none of them were malnourished and median

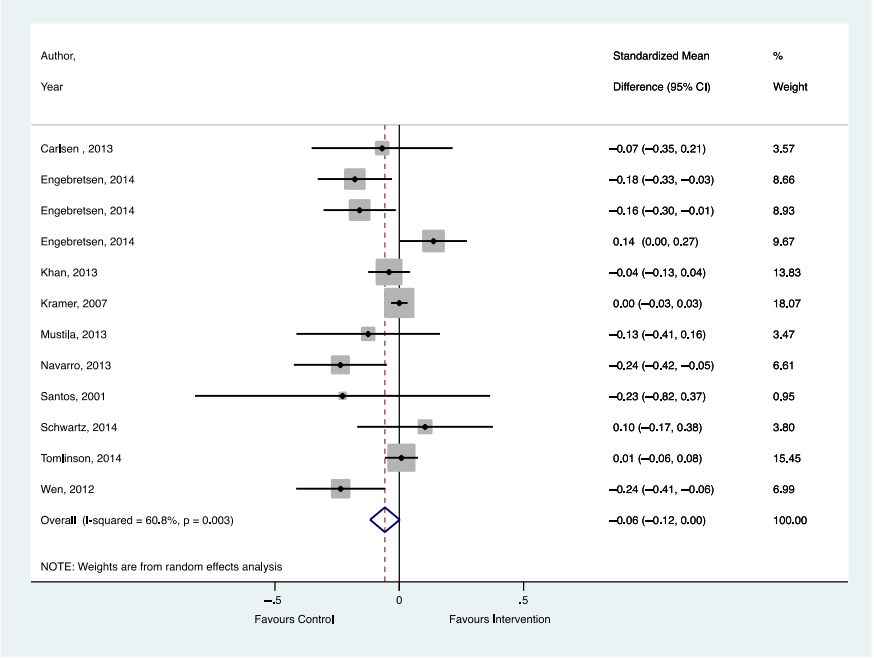

Figure 3 Standardised mean differences in BMI or weight/length or height in different studies, comparing intervention vs. control groups

Table 5 Standardised mean difference in BMI or weight/length or height, comparing intervention and control groups: random-effects meta-analyses by subgroup, based on 12 studies

Study characteristic	Standardised mean difference (95% confidence interval)	% heterogeneity explained	N
Year of publication			
<2006	−0.23 (−0.82; 0.37)	0	1
≥2006	−0.06 (−0.12; 0.00)		11
Level of evidence			
1 + +	−0.08 (−0.17;0.02)	0	5
1 + /1−/2	−0.05 (−0.13;0.03)		7
Mean age at anthropometric assessment			
≤6 months	−0.05 (−0.16; 0.05)	0	6
>6 months	−0.08 (−0.17; 0.02)		6
Intervention setting			
Community	−0.09 (−0.18; 0.01)	0	7
Health facility or other	0.00 (−0.03; 0.03)		5
Country			
Low income	−0.11 (−0.20; −0.02)	44.8	3
Middle income	0.00 (−0.07; 0.07)		6
High income	−0.18 (−0.31; −0.04)		3
Sample size			
<500	−0.15 (−0.26; −0.05)	36.3	6
≥500	−0.03 (−0.09; 0.04)		6
Overall	−0.06 (−0.12; 0.00)		12

z scores were mainly above zero (22). And in the Engebretsen et al. study (18), the intervention was associated with higher prevalence of wasting at three weeks in South Africa, at three months in Burkina Faso and at six months in Uganda, possibly reflecting lower BMI in the intervention groups.

Most studies reviewed were from middle-income countries, where infectious illnesses are less common, and the quality of breast milk substitutes can be assumed to be superior to that in low-income countries. One might therefore expect that studies from low-income countries would show better growth associated with breastfeeding promotion than those in middle-income countries. However, there was no evidence of such effect modification in our results (Tables 3–5), and in fact, the impact on the three studies from low-income settings tended to be somewhat smaller than that on the other studies.

Due to the small number of studies evaluating the effect of breastfeeding interventions on growth of children, the review included studies of interventions with other components in addition to the promotion of breastfeeding, mainly promotion of healthy complementary feeding. It makes difficult to attribute the observed impact on breastfeeding promotion, as the interventions have more than one component. However, given that for the meta-analyses the age at outcome assessment was closest to six months, we can assume that the interventions in this age range were strictly exclusive breastfeeding promotion. Any other component of the intervention in addition to breastfeeding promotion would make any effect only after this age, since the international recommendation is exclusive breastfeeding in the first six months of life.

Finally, it is worthy to mention the lack of impact on the four studies that measured the outcome in children over two years of age (11, 13, 20, 21). The hypothesis that the potential impact of breastfeeding interventions may decrease and even disappear over time should be further investigated. Nevertheless, this is in opposition to the meta-analyses that suggest an association, in observational studies, between breastfeeding and overweight or obesity in adults (5, 30).

CONCLUSION

The effect of breastfeeding promotion interventions on growth varied greatly among the studies. Meta-analyses showed that the interventions were associated with small, nonsignificant increases in weight and length/height z scores, notably in children in the first six months of life, and led to a modest, albeit significant, reduction in BMI/WHZ z scores. For all outcomes, there was substantial heterogeneity among studies, so that these results must be interpreted with caution. Regardless of the present results, breastfeeding promotion must remain a priority in the promotion of child health and nutrition, especially in developing countries, as many other benefits of breastfeeding to the child and mother are already well established.

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