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REVIEW ARTICLE

Prepregnancy weight excess and cessation of exclusive breastfeeding: a systematic review and meta-analysis

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Abstract

Recent studies have identified a relationship between maternal body mass index during prepregnancy (BMI) and exclusive breastfeeding (EBF), which is less common among mothers with higher BMI. The purpose of this literature review is to provide a pooled effect for the association between maternal excess weight during prepregnancy and cessation of exclusive breastfeeding. A systematic review was performed using articles present in six databases (PubMed, Scopus, Web off Science, Science direct, CINAHL and LILACS) published till February 2017. Studies investigating the association between excess maternal weight during prepregnancy and cessation of exclusive breastfeeding were included in the review. A meta-analysis using random effects to obtain a pooled effect of the studied association was conducted only with studies reporting odds ratio (OR) or available data for the calculation. Univariate meta-regression was performed to evaluate possible sources of heterogeneity. Egger's tests were also performed to verify possible publication bias. From the 6889 studies identified, 102 were read in full and 17 were included in the meta-analysis, providing 28 estimates for the association. Overall, a positive association was observed between maternal excess weight during prepregnancy and cessation of exclusive breastfeeding (ES: 1.60 (95% CI: 1.47, 1.74), I^2: 93.2%). According to the used independent variables, no sources of heterogeneity were identified between studies Bias in publication was found. Maternal excess weight during prepregnancy was associated with cessation of exclusive breastfeeding. A standardized measure for exclusive breastfeeding is still needed for estimating its duration, in addition to further studies in developing countries to understand what could explain the heterogeneity of the findings.

Introduction

Breastfeeding has several short-term and long-term health benefits [1–4]. Evidence suggests that breastfeeding protects against infectious diseases and reduces infant morbidity and mortality [3, 5]. To strengthen the importance of breastfeeding, the World Health Organization (WHO) approved the recommendation for exclusive breastfeeding (EBF), defined as ingestion of only maternal breast milk without ingestion of water, herbal teas, and other types of milk or solid food, for children until the age of 6 months [6]. However, the prevalence of EBF, till the child is 6 months old, is still considered low, and a recent global study identified a prevalence of 35.7% of EBF [7].

Over the past decades, prevalence of overweight and obesity has drastically increased [8], especially among women in the fertile age [9, 10]. In addition to the health consequences on women, overweight and obesity can play an important role in children's health when women get pregnant [11–13]. Previous studies have shown that women with higher BMI before pregnancy are less likely to initiate and keep up with breastfeeding [14–21].

Some reasons that were pointed out for mothers with higher BMI either to not initiate or to discontinue breastfeeding early included psychological, physical, and biological aspects [22]. A possible biological explanation would be the decrease in lactogenesis II; there is also evidence that the delay in milk descent is associated with maternal obesity [23]. Physical and psychological factors complement each

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other and are motivated by problems related to self-esteem and depression [24, 25].

Studies have also identified a relationship between maternal prepregnancy BMI and EBF [16,26–28], showing a strong relationship with early alimentary introduction among mothers with higher BMI [17, 29]. These data may represent a risk considering the importance and benefits of EBF for the child's health in the medium and long term [30].

Although the relationship between maternal prepregnancy BMI and breastfeeding has been studied previously, no meta-analysis has focused specifically on the association between pregestational excess of weight and cessation of EBF. In this context, the aims of this study were (1) to systematically review the literature on the association between prepregnancy maternal BMI and cessation of EBF; and (2) to quantify this association by carrying out a meta-analysis.

Methods

Search strategy

A systemic review was carried out according to the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) [31]. The systematic literature review was conducted in six major databases (PubMed, Scopus, Web off Science, Science direct, CINAHL, and LILACS) by using the following search terms: ("Breastfeeding" OR "Lactation" OR "Breastfeed" OR "Breastfed" OR "Human milk" OR "Infant feeding") AND ("Body mass index" OR "Overweight" OR "Obesity") AND ("Female") AND ("Humans"). Each database has its specific search forms for combining terms, and adjustment for this was performed. All studies published till 13 February 2017 were considered.

Eligibility

Original articles that evaluated the association between maternal prepregnancy BMI and EBF were included. References cited in the articles were also evaluated. Papers were excluded if (1) the focus was on a specific population, such as hypertensive and diabetic women; (2) the study was focused on gestational weight gain; (3) the study was intervention and experimental in design; (4) it was a qualitative study; (5) the study involved maternal BMI that was not taken during prepregnancy; (6) the study did not include EBF or did not provide data to calculate the estimates. When reported, odds ratio (OR) and respective standard errors or 95% confidence intervals (CIs) were extracted. If these data were not reported or could not be calculated, we contacted the first author of the study via email or ResearchGate (www.researchgate.net). If the authors could either not be contacted or were not able to supply the data, we excluded the study.

The outcome of the study was cessation of EBF. EBF was classified according to the WHO, which consists of breast milk only, not including the intake of other types of milk, water, herbal teas and solid food [6]. The recommendation is up to 6 months of age; however, some authors still consider it to 4 months of age [16, 27, 32]. The studies used different cutoff points for EBF (≤1 month, 2 months, 3 months, 4 months, and 6 months of age of the children), but in the analysis, we adopted the following categories:≤1–3, 4, and 6 months. For studies that did not report cessation of EBF, the OR was calculated.

The investigated exposure was prepregnancy maternal BMI, which was calculated by prepregnancy weight and height (BMI = weight (kg) / [height (m)]^2). Usually the BMI cutoff points are as follows: underweight (BMI < 18.5 kg/m^2), normal weight (BMI between 18.5 and 24.99 kg/m^2), overweight (BMI between 25 and 29.99 kg/m^2), and obesity (BMI ≥ 30 kg/m^2) [10]. However, other cutoff points were used for the articles selected for this meta-analysis. For the purpose of analysis, cutoff points for prepregnancy maternal BMI were pooled to investigate possible differences among the studies. In the case of five studies [16, 28,33–35] additional pooled effects were carried to increase comparability.

The selection process was carried out by independent reviewers (TRF and AW). In cases of disagreement a third reviewer (GIM) was involved. The following information was extracted from eligible articles: author, year of publication; country; survey year; study design; sample size; BMI prepregnancy cutoff points; outcome characteristics (EBF definition and time); and adjustment.

Data management and statistical analyses

Initially, the pooled association between prepregnancy BMI and cessation of EBF was calculated using random-effects meta-analysis. To explore the heterogeneity sources of this association, a series of meta-regression was conducted. In this case, the variables EBF duration (≤1–3 and 4–6 months), overweight and obesity (defined by the studies), sample size (<500, 500–1000 and >1000), prepregnancy maternal BMI cutoff points (18.5–24.9; 25.0–29.9; ≥30.0 kg/m^2; 19.1–26.0; 26.1–29.0; >29.1; 25.0–29.9; and ≥30.0 kg/m^2), adjustment (yes/no), and country of study (developed/developing) were included; however, the data from the studied country were not presented.

To evaluate the pooled effect size (ES), we used the random-effects models and evaluated the heterogeneity among studies using the I^2 statistics [36]. Univariate meta-regression was performed to evaluate the pooled effect

according to the characteristics of the studies. Funnel plots and the Egger's test were used to evaluate publication bias in accordance with maternal prepregnancy BMI (overweight and obesity) and cutoff points of EBF (≤1–3; 4; and 6 months). Analysis was performed using Stata 12.1.

Results

The search identified 6889 studies. After title and abstract reading, 102 manuscripts were selected for full-text reading. Most of the studies were excluded as they either did not report the association between prepregnancy maternal BMI and breastfeeding, or did not differentiate EBF from any breastfeeding. After full review of the remaining papers, 17 studies were considered for inclusion in the meta-analysis (Fig. 1). These papers provided 28 estimates of the association between prepregnancy BMI and cessation of EBF.

Characteristics of the papers included in this review are shown in Table 1. All studies but one were cohort studies. The studies were carried out in the United States (USA) ($n = 9$), Brazil ($n = 2$), China ($n = 1$), Australia ($n = 1$), Denmark ($n = 1$), France ($n = 1$), Belgium ($n = 1$), and Norway ($n = 1$). Of all the studies, four had sample size <500, three between 500 and 1000, and 10 studies with a sample of >1000 individuals. With respect to the EBF time, the studies evaluated at ≤1 month ($n = 4$), 2 months ($n = 2$), 3 months ($n = 6$), 4 months ($n = 3$), and 6 months of age of the children ($n = 2$). Five studies used a cutoff point of <18.5, 18.5–24.9, 25.0–29.9, and ≥30.0 kg/m^2 to classify prepregnancy maternal BMI and, also, seven studies were adjusted in the analysis (Table 1).

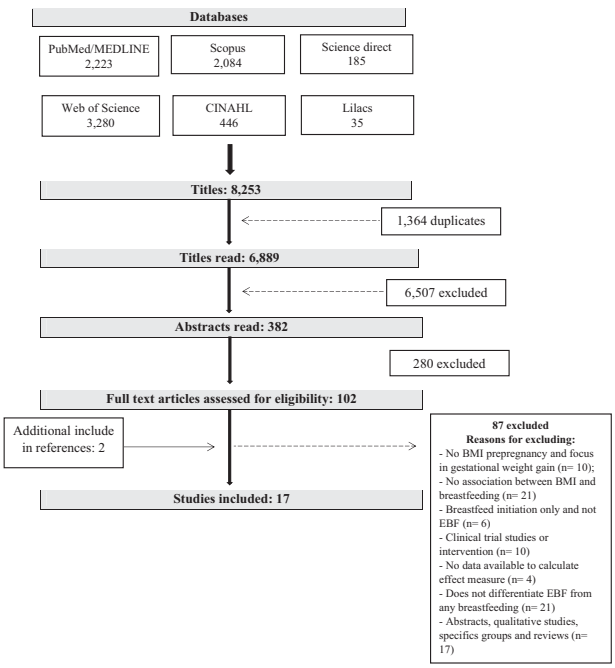

Fig. 1 Flowchart reporting the process for selection of papers for inclusion in the meta-analysis

The pooled association between prepregnancy BMI and cessation of EBF is presented in Fig. 2. Mothers with excess weight were 60% more likely to interrupt EBF as their counterparts [ES: 1.60 (95%CI: 1.47; 1.74, I^2: 93.2%)]. The measures of effect studies included in the meta-analysis are in the same direction, suggesting a positive association between excess weight during prepregnancy and cessation of EBF (Fig. 2). Even when three studies, which used the closest definition of EBF (that would be "full breastfeeding"), were disregarded in the analysis, the pooled effect was still around 60% more likely to interrupt EBF for the excess-weight mothers (data not shown).

When meta-regression was conducted (Table 2), no significant differences were observed in relation to the EBF time ($P = 0.17$), overweight and obesity categories ($P = 0.17$). In addition, no differences were identified for the other independent variables (Table 2).

The funnel plot suggests publication bias for the studies with positive results (Fig. 3). According to Egger's test, there is publication bias for the classification of prepregnancy maternal BMI for both overweight ($P < 0.001$) and obesity ($P = 0.03$). Nevertheless, using the Egger's test, it was possible to identify possible publication bias for both the cutoff points of EBF ($P < 0.001$).

Discussion

Prepregnancy maternal overweight and obesity increase the odds of cessation of EBF. We observed heterogeneity between the studies included in meta-analysis in the two BMI categories. According to the results, a dose-response relationship was identified in the pooled effect of overweight and obesity, with higher odds of EBF cessation among mothers who were obese during prepregnancy. However, in meta-regression, this relationship loses statistical significance, suggesting that this dose-response relationship would be by chance.

There are some biological and psychological explanations for the investigated association. The biological explanation is the theory that being overweight and obese may decrease or delay the release of lactogenesis II, which is also responsible for the lowering of breast milk [22, 23]. In addition, there is a chance that mechanical breastfeeding can be impaired in cases of mothers with excess weight, as babies find the milk suction process difficult due to the large size of the mother's breasts [22]. Regarding psychological aspects, it would be a more body-image approach that the mother has, which in many cases may lead to embarrassment in breastfeeding or in exposing herself, thereby having

Table 1 Articles included in the systematic review and meta-analysis. ($n = 17$)

Author, year, country	Survey year	Sample size	Study design	BMI prepregnancy cutoff points	EBF definition and evaluated time	Adjustment for confounders
Kugyelka et al., 2004, USA	1998–2000	2257	Longitudinal	19.1–26.0 Kg/m^2; 26.1–29.0 Kg/m^2 e > 29.1 Kg/m^2	The length of EBF after discharge was defined as the last time the mother/caregiver reported feeding only breast milk without adding infant formula or nonhuman milk. Time: 6 months	Maternal age, education and parity, infant gestational age and birth weight, smoking at first prenatal visit, and delivery by cesarean section.
Baker et al., 2007, Denmark	1999–2002	37,459	Longitudinal	<18.5 Kg/m^2; 18.5–24.9 Kg/m^2; 25.0–29.9 Kg/m^2; 30–34.9 Kg/m^2; 35–39.9 Kg/m^2; ≥ 40.0 Kg/m^2	Full breastfeeding (in weeks and months). Time: 4 months	Gestational Weight Gain (trhee categories), presence of a spouse or partner during early pregnancy, maternal occupation in early pregnancy, parit, maternal smoking during pregnancy, mode of delivery, physical activity during late pregnancy, and infant sex.
Mok et al., 2008, France	2005	222	Longitudinal	18.5 Kg/m^2; ≥ 25.0 Kg/m^2	Full breastfeeding (in months). Time: 3 months	No adjustment
Fernandes et al., 2012, Brazil	2005–2008	592	Cross-sectional	18.5–24.9 Kg/m^2; 25–29.9 Kg/m^2 ≥ 30.0 Kg/m^2	Recall of 24 h to obtain breastfeeding status. Provision of water, tea, juice, other milk or other foods besides breast milk on the day before the interview was considered early introduction of non-breast milk foods and fluids (EINB). Time: 1 month.	Maternal education and smoking during pregnancy
Guelinckx et al., 2012, Belgium	2006–2007	200	Longitudinal	<18.5 Kg/m^2; 18.5–24.9 Kg/m^2; 25–29.9 Kg/m^2 ≥ 30.0 Kg/m^2	EBF defined as breast milk consumption only. Time: 3 months	No adjustment
Mehta et al., 2012, USA	2001–2005	550	Longitudinal	<18.5 Kg/m^2; 18.5–24.9 Kg/m^2; >25.0 Kg/m^2	Recall of 24 h: "How many times a day (24 h) wasyour baby fed these foods during each of these months?" Women responded for the following foods: breast milk, infant formula, cow's milk, soy milk, cereals, tea, juice, fruitsor vegetables, and meats. Time: 3 months.	No adjustment
Visram et al., 2013, USA	2008–2010	22,131	Longitudinal	18.5–24.9 Kg/m^2; 25–29.9 Kg/m^2 ≥30.0 Kg/m^2	Consumption of breast milk only. Time: hospital discharge.	Maternal age, neighborhood family income, neighborhood education level, area of residence, parity, 1st trimester visit, prenatal classattendance, type of healthcare providers, infants small for their gestational age, maternal diabetes, type of delivery and infant NICU admission.
Hauff et al., 2014,USA	2005–2007	2824	Longitudinal	<25.0 5 Kg/m^2; 25.0–29.9 Kg/m^2 e≥30.0 Kg/m^2	The duration of EBF referred to the period during which the infant received only breast milk and no other liquids or solids. Time: 1 month	Marital status, education, intended duration of breastfeeding, and actual return time to work +psychosocial variables.
Sharma et al., 2014, USA	2005–2007	726	Longitudinal	<25.0 5 Kg/m^2; 25.0–<30.0 Kg/m^2 e≥30.0 Kg/m^2	Was calculated as the infant's age at the midpoint between the last questionnaire when the mother reported feeding only breast milk and the first questionnaire when a food or liquid other than breast milk was introduced. Time: 4 months	No adjustment

Table 1 (continued)

Author, year, country	Survey year	Sample size	Study design	BMI prepregnancy cutoff points	EBF definition and evaluated time	Adjustment for confounders
O'Sullivan et al., 2015, USA	2005–2007	1731	Longitudinal	18.5–24.9 Kg/m^2 and ≥30.0 Kg/m^2	The basis of the infants 7-d food-frequency recall at the time the questionnaire was completed. If an infant consumed any breast milk in the previous 7 d, it was coded as anybreastfeeding. If an infant consumed only breast milk with no formula, food, or water in the previous 7 d, it was coded as exclusively breastfeeding. Time: 2 months	No adjustment
Cox et al., 2015 Australia	2010–2011	427	Longitudinal	<30.0 Kg/m^2 and ≥30.0 Kg/m^2	Exclusively breastfed if they had received only breast milk since birth, with the exception of drops or syrups consisting of vitamins, mineral supplements or medications. Time: 4 months	No adjustment
Kachoria et al., 2015 USA	2004–2011	71,653	Longitudinal	18.5–24.9 Kg/m^2; 25.0–29.9 Kg/m^2; 30–34.9 Kg/m^2; 35–39.9 Kg/m^2; ≥40.0 Kg/m^2	EBF determined by if no other liquids or foods had been introduced by 12 weeks. Time: 3 months	No adjustment
Mei et al., 2015, China	2009–2010	2220	Longitudinal	18.5 Kg/m^2, 24.0 Kg/m^2, and 28.0 Kg/m^2	EBF was defined according to the WHO definition. Time: 3 months	No adjustment
Winkvist et al., 2015, Norwegian	1999–2008	49,669	Longitudinal	18.5–24.9 Kg/m^2; 25.0–29.9 Kg/m^2; 30–34.9 Kg/m^2; ≥ 35.0 Kg/m^2	Full breastfeeding: The definition of full breastfeeding as described by WHO, which precludes any use of infant formula, other milk, or solid food. Time: 6 months	No adjustment
Castillo et al., 2016, Brazil	2004	3757	Longitudinal	<18.5 Kg/m^2; 18.5–24.9 Kg/m^2; 25–29.9 Kg/m^2 ≥30.0 Kg/m^2	EBF was considered only breast milk. Time: 3 months	No adjustment
Kitsantas et al., 2016, USA	2005–2007	2387	Longitudinal	<19.8 Kg/m^2; 19.8-< 26.0 Kg/m^2; 26.0–29.0 Kg/m^2 and >29.0 Kg/m^2	Breast-feed exclusively (breast milk only), self-reports maternal. Time: 2 months	Maternal age, race/ethnicity, education, smoking and gestational diabetes, infant gender and birth weight.
Martinez et al., 2016 USA	2008–2011	480	Longitudinal	25.0- 29.9 Kg/m^2; 30.0–34.9 Kg/m^2; 35–39.9 Kg/m^2; ≥40.0 Kg/m^2	By the WHO as an infant's consumption of breast milk only, no other liquids or solids (not even water), allowing only for token amounts of medical fluids. Time: Hospital discharge	Sociodemographic variables, (maternal age, marital status, level of educational and employment status); Geographic origin and whether the patient was referred to the Special Supplemental Nutritional Program for Women, Infants, and Children; Infant outcomes (sex, infant birth weight, gestational age and size for gestational age); Maternal biomedical factors (Parity, delivery method, gestational diabetes and hypertension in current pregnancy, tobacco use in the past year and trimester of first prenatal care visit).

EBF exclusive breastfeeding, *BMI* body mass index.

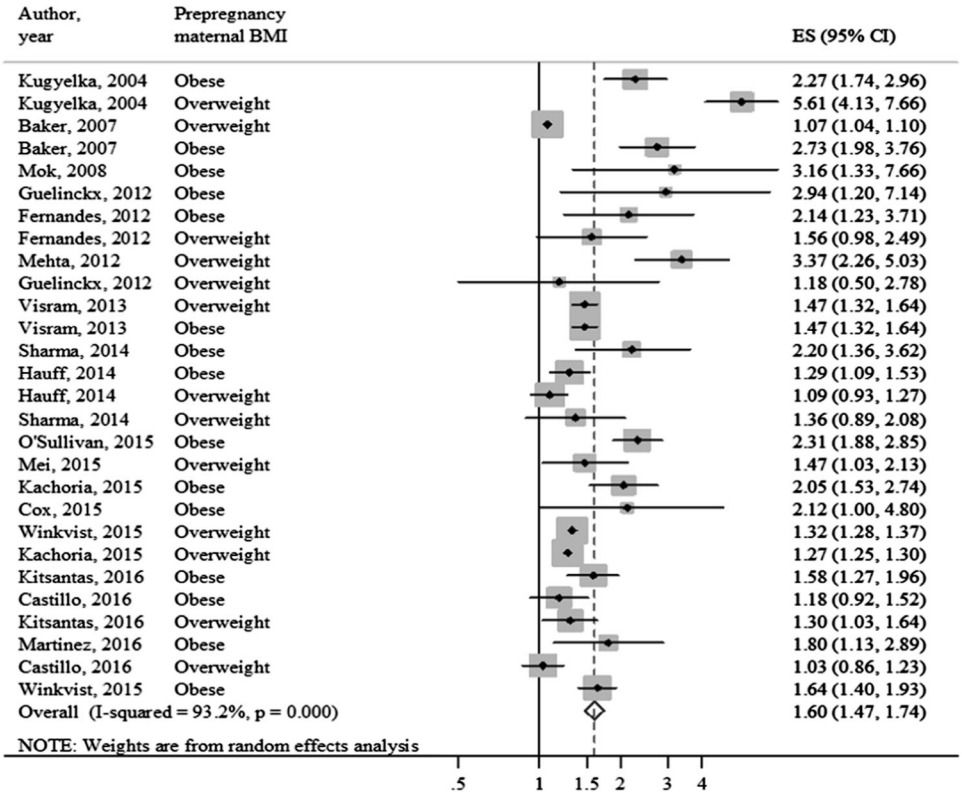

Fig. 2 Meta-analysis on the association between prepregnancy maternal BMI and cessation of EBF (random effect). BMI body mass index; CI confidence interval; ES effect size. ($N = 28$)

an impact on mental health soon after delivery [23–25,37]. In addition to these factors, socioeconomic, cultural, and pregnancy-related aspects may contribute to a greater cessation of EBF among prepregnancy overweight and obesity mothers [22, 38].

Another important fact to highlight is that breastfeeding, whether exclusive or not, is a cultural issue that varies among countries [7]. In this meta-analysis, it was not possible to identify using the sensitivity analysis whether the country conducting the study would be a source of heterogeneity, as most studies were conducted in developed countries, not allowing sufficient power to detect possible differences. According to a recent review on breastfeeding [7], EBF among children under 6 months of age was higher in low-income countries, followed by the low-middle income countries. Furthermore, in the same study, it was observed that the prevalence of children who did not receive breast milk exclusively at 6 months was 63% in medium-high income countries, which was higher than in low-income countries (53%) [7]. Another important limitation that must be acknowledged is the lack of power to investigate the possible sources of heterogeneity in this study; however, only 17 studies were included in the meta-analysis, making the explanation of the findings possible.

As for EBF duration, the existence of some heterogeneity between the cutoff points adopted in the studies to describe the prevalence of EBF was evidenced in this review and meta-analysis [16, 26, 34, 39, 40]. Even with the WHO recommendation that EBF should be until the child has completed 6 months of age, it is known that this is still a challenge considering that most children receive some other types of milk, liquids, and even solid food before the recommended age group [16, 29]. However, it is important to highlight the relevance of these studies to promote existing policies on the subject, especially as prepregnancy maternal excess weight is an important risk factor causing the cessation of EBF.

In this context, studies have shown that one of the factors contributing to the cessation of EBF is the early introduction of other types of milk and solid food [16, 29]. In addition, it was also observed that early feeding is associated with prepregnancy maternal nutritional status; that is, mothers with excess weightwere more prone to early introduction of other types of food when compared to eutrophic mothers [29]. These findings suggest a greater impact on the health of the child, such as an increase in the likelihood of overweight and obesity in childhood [29].

Although BMI is a non-objective measure that does not distinguish fat mass from slim mass [41, 42], it is considered to be the best source of information on nutritional status in surveys where more accurate measures, such as body composition, are not present. In addition, in cases where the mother has self-reported prepregnancy weight, an underestimation may be expected, especially in the

Table 2 Meta-analysis showing heterogeneity sources and meta-regression of the associations between prepregnancy maternal and cessation of exclusive breastfeeding (28 estimates from 17 studies)

Variables	n°	ES pooled (95% CI)	I^2 (%)	Meta-regression OR ($IC_{95\%}$)	P	% Heterogeneity explained (R^2)
EBF						
≤ 1–3 months	19	1.51 (1.36; 1.67)	82.6	Index		14.9
4–6 months	9	1.89 (1.57; 2.28)	96.9	1.25 (0.90; 1.74)	0.17	
Prepregnancy BMI						
Overweight	13	1.42 (1.28; 1.57)	95.3	Index		3.57
Obese	15	1.82 (1.59; 2.10)	73.6	1.24 (0.91; 1.70)	0.17	
Cutoff points BMI						
18.5–24.9 / 25.0–29.9 /≥30.0 Kg/m^2	18	1.52 (1.39; 1.66)	93.6	Index		4.59
19.1- 26.0 / 26.1–29.0/>29.1 Kg/m^2	4	2.24 (1.27; 3.97)	95.1	1.35 (0.87; 2.10)	0.17	
25.0–29.9/≥30.0 Kg/m^2	6	1.41 (1.15; 1.74)	59.7	0.92 (0.61; 1.37)	0.66	
Sample size						
<500	16	1.71 (1.42; 2.06)	94.7	Index		−1.76
500–1000	5	2.03 (1.44; 2.85)	63.4	1.18 (0.74; 1.86)	0.47	
>1000	7	1.39 (1.30; 1.49)	77.2	0.87 (0.60; 1.25)	0.51	
Adjustment						
No	15	1.53 (1.39; 1.69)	85.3	Index		−4.69
Yes	13	1.70 (1.40; 2.05)	95.0	1.01 (0.73; 1.40)	0.94	

CI confidence interval, *ES* effect size, *OR* odds ratio, *EBF* exclusive breastfeeding, *BMI* body mass index

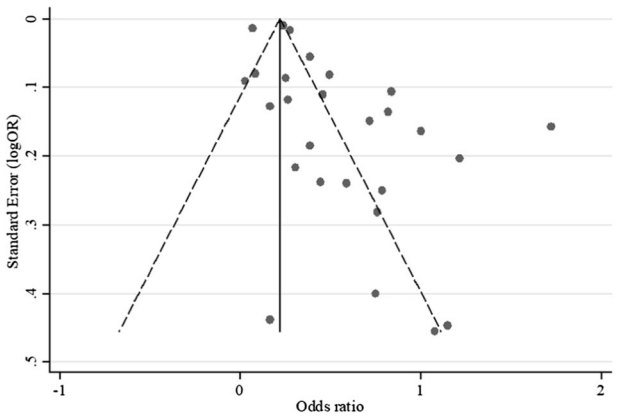

Fig. 3 Funnel plot suggesting bias publication of the effects measured of the studies included in meta-analysis (28 estimates from 17 studies)

overweight and obese women groups [43]. Therefore, the effect of the association could be even greater considering that the exposure may still be underestimated in some cases. Heterogeneity between the use of BMI cutoff points was also evidenced among the studies, with the need to perform groupings to optimize the analysis. Some studies do not use the current WHO [8, 10] reference, and can also generate a classification bias. Therefore, it is strongly recommended that the studies evaluate the cutoff points of maternal pre-pregnancy BMI to maintain comparability between what already exists in the literature.

Few studies performed full control of confounding, including, mainly, demographic, socioeconomic, behavior, and gestational variables [16, 28, 33, 39, 40, 44, 45]. Effect measurement tended to be greater when adjusted, suggesting an underestimation of effect measurement in studies not using this analysis strategy. More studies are needed using the strategy for confounding control for greater data robustness, as it was not possible to identify heterogeneity in the present study. In this meta-analysis, some measures of effect had to be calculated. As these measures are OR, they are expected to have greater magnitude when compared to other measures of effect. In addition, in some cases it was possible to calculate only the gross measures, which may generate even greater magnitude of the association because it is not adjusted for the factors, as it has been said that few studies have made adjustments.

Further longitudinal studies evaluating prepregnancy maternal BMI and cessation of EBF should be performed. However, there is a need for understanding the specific reasons motivating overweight mothers to discontinue breastfeeding. There is knowledge about biological [37, 46], psychological [24, 47], and, though incipient, cultural questions [48], but there is still a need for further studies. Ideally, these studies for a better understanding of the association evidenced could focus more on the qualitative collection of these causes.

Some limitations of this review and meta-analysis should be considered. There is heterogeneity among the included studies, even though none of the variables actually

explained this difference. It is believed that, even when performing the tests, there are different forms of pre-pregnancy maternal BMI operation, which may support few of the heterogeneities. Another important point is the collection of EBF, in which there were more than three classifications. However, even with these distinctions and the chosen form of categorization of these variables (BMI and EBF) for the analyses, sensitivity analyses were performed in the way they were collected and no other results were observed (data not shown).

Another limitation to be informed is the need to calculate the ORs for some studies. However, sensitivity analyses were performed to investigate possible differences between studies originally with ORs and those in which there were transformations and no significant differences were found. Although this is believed, the measure of effect on OR overestimates the magnitude of associations. Also, it should be highlighted that the three articles included in the meta-analysis used the closest definition of EBF, which would be "full breastfeeding". It is known that this would not be the most adequate definition, but, considering that the authors justified the use and showed that they had the concern to prioritize this variable as only breast milk, they were included in this meta-analysis. In addition, analyses were performed disregarding these three studies, and the pooled effect was still around 60% more likely to interrupt EBF for the excess-weight mothers.

Published bias regarding EBF and excess of weight (overweight and obesity) was observed. It was possible to identify that the studies with positive results are more frequently published and that there is a gap in the literature about positive or not expected results. This may actually show a bias, but it may also be that there is only a positive and strong association between BMI and EBF. However, the fact that there are some negative results draws attention to the great possibility of publication bias.

Conclusions

More studies are needed, mainly to assess the cessation of EBF and that may have greater comparability with respect to the cutoff point of EBF duration. There is also a need to use comparable cutoff points (most commonly used by WHO) for the classification of prepregnancy maternal BMI (overweight and obesity). Further efforts to understand the possible determinants, confounders, and even mediators of this association should also be emphasized.

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Author contributions TRF participated in all stages of the manuscript (definition and search in databases, selecting, reading articles, extracting data, and analyzing), interpreted the results, and wrote down the text. AW participated in the selection, reading of articles, and review of the manuscript. GIM participated in reading the articles, collaborated with data analyses, and did a critical review of the manuscript. BPN collaborated with data extraction, data analysis, and critical review of the manuscript. ADB guided and critically reviewed the manuscript.

Conflict of interest The authors declare that they have no conflict of interest.

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