



# Breastfeeding duration and eating behavior in early childhood: a systematic review


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## Abstract

*Objectives:* to analyze the influence of breastfeeding duration on eating behavior in children aged two to six years.

*Methods:* this review was conducted by PRISMA guidelines. SciELO, Lilacs, Embase, and PubMed databases were researched by using a specific syntax, for studies published from 2000 to 2020. The Joanna Briggs Institute Critical Appraisal checklist was used to assess the risk of study bias.

*Results:* a total of 26,211 articles were identified, of which seven were included in the study. The results showed a significant association in four studies. All authors used their own questionnaires to assess breastfeeding exposure; there was no standard classification of exclusive and total breastfeeding duration. The breastfeeding duration was associated with reduced food neophobia, lower scores on the food responsiveness subscale, and lower 'picky eating' behavior. Validated instruments were predominantly used to assess the outcome of eating behavior; however, this assessment was not similar between studies.

*Conclusion:* a significant association was observed between breastfeeding duration and eating behavior in children aged two to six years. Further research should be conducted to describe the mechanisms involved in this association.

**Key words** Breastfeeding, Eating behavior, Child, Systematic review



## Introduction

The eating behavior is defined as a complex interaction of physiological (e.g., hunger and satiety), psychological (e.g., learned food preferences, knowledge, and motivations), environmental (e.g., availability of food, the context in which food is provided, size of the plate or portions) and genetic (e.g., preference acquired in early life for sweet or salty flavors) factors.<sup>1,2</sup> Eating behavior is indirectly molded by observing others' influences,<sup>2</sup> for example, the family members' eating behavior serves as a model for the child's development and his/her eating behavior.<sup>3</sup>

Childhood is a critical period for establishing adequate eating habits. It is assumed that self-regulatory eating preferences and behaviors are influenced by infant feeding practices.<sup>4</sup> The first sensory experiences occur when there is a transfer of flavors in the amniotic fluid in the uterus, influenced by maternal feeding,<sup>4,6</sup> and the child continues experiencing flavors through human milk.<sup>7</sup> Because of the importance of human milk for a child's health, the World Health Organization (WHO) recommended that children should be exclusively breastfed for up to six months of life and that breastfeeding should be continued until two years of age or longer.<sup>8</sup> Later on, children who had received human milk had a better acceptance of certain foods, such as fruit and vegetables.<sup>9,10</sup> In the preschool stage, from two to six years of age, children generally have a more stable growth rate and nutrition has less influence on growth during this period,<sup>11</sup> occurring as an expected adaptive response to decreasing appetite.<sup>12</sup> In childhood, eating behavior traits are associated with important health outcomes, such as anthropometric indicators,<sup>13</sup> cardiometabolic risk biomarkers,<sup>14</sup> adiposity,<sup>15</sup> 'picky eating' with lower vegetable consumption,<sup>16</sup> and eating disorders.<sup>17</sup>

The association of eating behavior in childhood with short- and medium-term health outcomes motivated the creation and validation of numerous instruments for assessing eating behavior in children.<sup>18</sup> Among these instruments are The Children's Eating Behavior Questionnaire (CEBQ),<sup>19</sup> Preschooler Feeding Questionnaire (PFQ),<sup>20</sup> Infant Feeding Questionnaire (IFQ),<sup>21</sup> Nutrition Screening Tool for Every Preschooler (NutriSTEP)<sup>22</sup> and Oregon Research Institute Child Eating Behavior Inventory (ORI-CEBI).<sup>5</sup>

The CEBQ, a self-administered questionnaire, contains 35 questions divided into eight subscales so that four subscales investigate behaviors that reflect the 'food approach' and the other four subscales reflect behaviors related to 'food avoidance', where parents report the occurrence of specific eating behavior in their children in Likert scale of five points, with the score ranging from one to five: never (1), rarely (2), sometimes (3), often (4) and always (5).<sup>14</sup> PFQ assesses children's nutrition during the preschool years and the questionnaire items were designed to explore constructs

about infant feeding practices and overweight.<sup>20</sup> IFQ is a self-administered 28-item questionnaire that measures maternal dietary practices and beliefs and is used to assess infant feeding during early childhood.<sup>21</sup> NutriSTEP is a screening tool designed to identify children aged three to five years who are at nutritional risk.<sup>22</sup> Finally, the ORI-CEBI addresses the following constructs: interactions during child feeding times, child and parent affection during feeding, refusal to eat, selective feeding, restrictive feeding, overfeeding, and problematic eating behavior.<sup>5</sup>

Previous studies evaluating the impacts of eating behavior in children have shown that 'picky eating' behavior is associated with low micronutrient intake, increased risk of low weight and growth in the first years of life, and overweight and obesity in adolescents.<sup>22</sup> Additionally, a study conducted in Brazil with 335 children showed that the subscale of the questionnaire 'food approach', by CEBQ questionnaire, was associated with being overweight in childhood.<sup>6</sup>

The purpose of this systematic review was to analyze the influence of breastfeeding duration on eating behavior in children aged two to six years.

## Methods

Eating behavior is a complex term with several different focuses, thus, for this review, the expression was considered the set of actions or attitudes that are related to the act of eating, not being defined as a preference, habit, or acceptance of a particular food.

This systematic review was first conducted in November 2018 and updated in October 2020. The research protocol was previously registered in the International Prospective Register of Systematic Reviews (PROSPERO) under registration number CRD42019118773 and conducted according to the Preferred Reporting Items for Protocol Systematic Reviews and Meta-Analysis (PRISMA).<sup>23</sup> This research was carried out using a search strategy with terms selected from Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH): 'eating behavior', 'breastfeeding', and 'early childhood', that characterized the research question structured according to the population, exposure, comparison, and outcome (PECO) method (Table 1). A thorough literature search was performed in the following databases: Scientific Electronic Library Online (SciELO), *Literatura Latino-Americana e do Caribe de Ciências da Saúde* (Lilacs), Embase, and PubMed.

**Table 1**

Acronym for the Population, Exposure, Comparison, and Outcome method (PECO).	
Population	Healthy children
Exposure	More exposure to exclusive and total breastfeeding
Comparison	Less exposure to exclusive and total breastfeeding
Outcome	Eating behavior aged two to six years

The inclusion criteria were: (i) studies published from 2000 to 2020, (ii) clinical studies in humans and studies with children aged up to six years, and (iii) studies that relate exclusive and/or total breastfeeding duration with eating behavior - regardless of whether there was an association or not. While the exclusion criteria were: (i) studies published in languages other than Portuguese, English, or Spanish, and (ii) and studies with a population with comorbidities that affected eating behavior.

The study selection process consisted of four steps: identification and exclusion of duplicate articles, screening of articles (inclusion criteria and reading titles and abstracts), evaluating entire papers for eligibility, and selecting articles for inclusion in the review. The identified articles were independently assessed by three researchers (BCE, GLC and MBM). Any disagreements were resolved through discussion. A flowchart of the study selection process is presented in Figure 1.

The Joanna Briggs Institute (JBI) Critical Appraisal tools<sup>24</sup> were used to assess the methodological quality of the studies. Specifically, JBI critical appraisal checklist for cohort and cross-sectional studies were used (Table 2). In the JBI critical appraisal checklist, each question has four answer options: yes (Y), no (N), unclear (U), and not applicable (NA). The checklist for cohort and cross-sectional studies has 11 and eight items, respectively.

## Results

The initial search yielded a total of 26,211 publications. After excluding duplicates, 25,426 remained. These were screened using the inclusion criteria of the present review by reading titles and abstracts. This screening resulted in the exclusion of 25,396 articles, resulting in 30 articles.

The articles were read in full and subsequently, 25 were excluded for the following reasons: the article was a narrative review (n=1), the article was a conference summary (n=1), participants were younger or older than the specified age group (n=12), discordant exposure (n=3) and different outcomes (n=8), resulting in five studies for review. After updating the search, two publications were added, for a total of seven studies.

The seven studies included were reviewed and data were extracted (Table 3). The studies that met the inclusion criteria were published from 2011 to 2020 and included four cohort studies<sup>25-28</sup> and three cross-sectional studies.<sup>4,29,30</sup> The total number of study participants was 13,053, with a range of 129<sup>30</sup> to 4,779<sup>26</sup> children. The ages ranged from two to six years. Participants were evaluated from different countries, including Holland,<sup>5,26</sup> Denmark,<sup>27</sup> Brazil,<sup>30</sup> Canada,<sup>4</sup> the United States<sup>29</sup> and Singapore.<sup>28</sup>

All authors developed their own questionnaires to assess breastfeeding duration,<sup>4,28,29</sup> and there was no standard classification of exclusive or total breastfeeding duration. Specht *et al.*<sup>27</sup> categorized exclusive breastfeeding (EBF) as 0-1 month, 2-3 months, 4-5 months, and 6-10 months, Barse *et al.*<sup>26</sup> categorized breastfeeding (BF) as 0-2 months, 2-4 months, 4-6 months, and  $\geq 6$  months, and EBF was categorized as never breastfed, partially breastfed, and exclusively breastfed. In the study by Shim *et al.*,<sup>29</sup> EBF was categorized for 3 months and 6 months. Borkhoff *et al.*<sup>4</sup> evaluated the total duration of BF as a continuous variable and used the following cut off points for analysis: no breastfeeding, 0-6 months, 6-12 months, 12-18 months, 18-24 months, and 24-36 months. The duration of EBF, in Möller *et al.*<sup>25</sup> study was categorized as no breastfeeding and <1, 1-2, 3-6, and  $\geq 6$  months.

**Figure 1**

Flowchart of study selection.

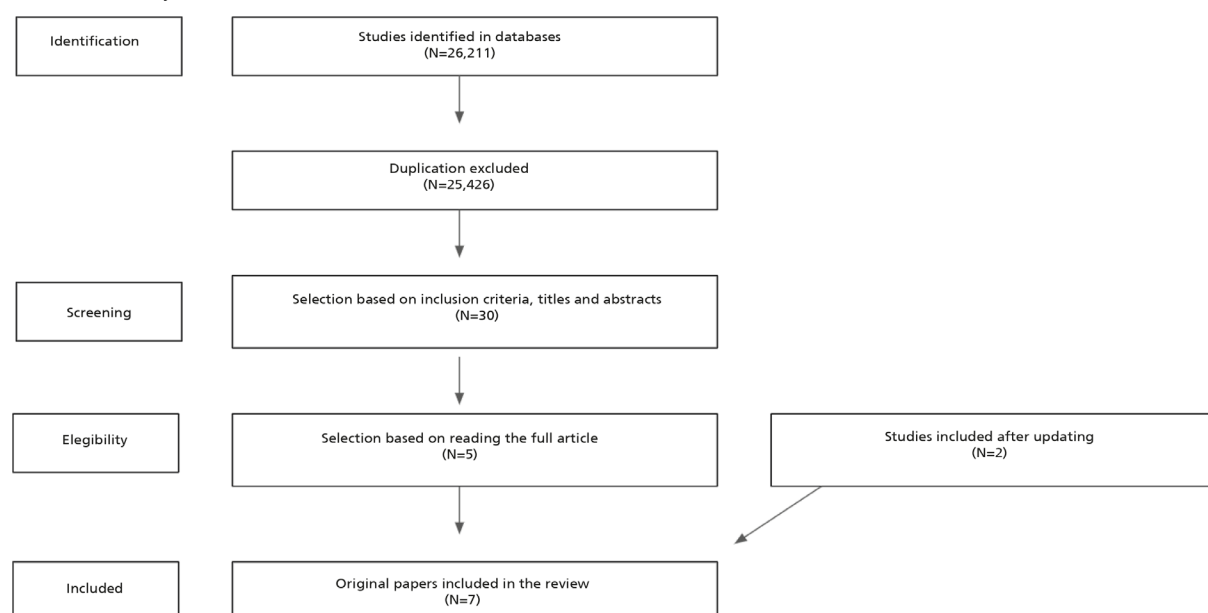


Table 2

JBI Critical Appraisal Checklist for Cohort Studies and JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies.													
Nº	Cohort studies	1	2	3	4	5	6	7	8	9	10	11	Overall appraisal
01	Möller <i>et al.</i> <sup>25</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	Y	Include
02	Barse <i>et al.</i> <sup>26</sup>	Y	Y	Y	Y	Y	Y	Y	U	Y	NA	Y	Include
03	Specht <i>et al.</i> <sup>27</sup>	Y	Y	Y	Y	Y	Y	U	Y	Y	NA	Y	Include
04	Pang <i>et al.</i> <sup>28</sup>	Y	Y	Y	Y	Y	Y	Y	Y	Y	NA	Y	Include
Nº	Cross-sectional studies	1	2	3	4	5	6	7	8				Overall appraisal
05	Shim <i>et al.</i> <sup>29</sup>	Y	U	N	U	Y	Y	Y	Y				Include
06	Borkhoff <i>et al.</i> <sup>4</sup>	Y	Y	U	N	Y	N	Y	Y				Include
07	Maranhão <i>et al.</i> <sup>30</sup>	Y	Y	N	Y	Y	Y	Y	Y				Include

Y = Yes; N = Not; U = Unclear; NA = Not applicable.

Pang *et al.*<sup>28</sup> classified exposure to breastfeeding as low (EBF <3 months), intermediate (EBF 3-4 months), or high (EBF >4 months). Finally, Maranhão *et al.*<sup>30</sup> categorized EBF into ≤6 months and >6 months.

The instruments validated to assess eating behavior were: CEBQ, PFQ, and Kerzner's criteria.<sup>25,26,30</sup> The other three studies used their own questionnaires,<sup>4,27,29</sup> and of these, two evaluated the outcome through 'picky eating' behavior<sup>27,29</sup> and the other used the NutriSTEP<sup>4</sup> eating behavior scale and subscale. Studies that used the CEBQ assessed eating behavior through the subscales: 'food fussiness',<sup>25,28</sup> and 'satiety responsiveness'.<sup>25</sup> All studies considered variables such as maternal age, maternal schooling, sex of the child, gestational age, and birth weight to perform adjustments to the statistical analyses.<sup>4,25-30</sup>

Given that a higher NutriSTEP score indicates greater nutritional risk, Borkhoff *et al.*<sup>4</sup> demonstrated an association between eating behavior and (i) decreasing trend in NutriSTEP score for children who were breastfed for 0-6 months ( $\beta = -0.14$ ; CI95% = -0.29; 0.004), (ii) significant decrease in NutriSTEP score for children breastfed for 6-12 months ( $\beta = -0.20$ ; CI95% = -0.33; -0.07) and no significant change after 12 or more months of breastfeeding ( $\beta = 0.09$ ; CI95% = -0.07; 0.24).

Shim *et al.*<sup>29</sup> demonstrated that children who were breastfed exclusively for 6 months had lower odds of developing (i) food rejection odds ratio (OR)=0.19 (CI95%=0.06; 0.69) and (ii) food neophobia OR=0.25 (CI95%=0.07; 0.89).

Maranhão *et al.*<sup>30</sup> study found no statistically significant association between BF, >6 months and ≤6 months ( $p=0.58$ ) and eating behavior. The researchers used a convenience sample and did not present statistical power in the methodology. In addition, EBF was assessed

retrospectively, which increases the risk of recall bias as eating behavior was assessed in children aged two to six years.

However, Möller *et al.*<sup>25</sup> found an association between EBF duration and the eating behavior of five-year-olds in the adjusted analysis. The authors observed that children who were EBF between 1-2.9 months had a lower 'food responsiveness' score  $\beta$  0.03 (CI95%=0.01; 0.06).

Barse *et al.*<sup>26</sup> observed the dose-response relation between any BF and 'fussy eating'  $\beta$  0.06 (CI95%=-0.10; -0.02). However, never-breastfed children did not differ in their food agitation score from children with a recommended BF duration ( $\geq 6$  months). The authors did not present the statistical power of the study as the original study was designed to assess other outcomes.

Specht *et al.*<sup>27</sup> found a lower OR (OR adjusted = 0.35; CI95%=0.16; 0.76;  $p=0.008$ ) of picky eating behavior in children with EBF for 4-5 months in a sample at risk for overweight and mothers with low socioeconomic status. Additionally, 51% (n=280) of the original sample was excluded for having missing information, with 221 breastfeeding data and 59 for the outcome variable (picky eating behavior), and 41% for having missing data at the 15-month follow-up. The authors did not present the statistical power and report in the methodology that they classified children as picky and non-picky to analyze the main outcome.

Additionally, Pang *et al.*<sup>28</sup> investigated the outcome in a cohort study that applied different questionnaires at follow-up. The adjusted analyzes showed a statistically significant lower difficulty in child feeding  $\beta$  -0.2 (CI95%=-0.4; 0.0) and 'food fussiness'  $\beta$  -0.38 (CI95%=-0.70; -0.06) at 3 years of age in children with EBF for 4 months and supplemented for 6 months.

Table 3

Characteristics of studies included in the systematic review.

Author/year	Country	Sample and design	Main purpose	Exposure and instrument	Outcome and instrument	Age (years)	Statistical Analysis	Main results
Specht <i>et al.</i> <sup>27</sup> 2018	Denmark	263 Cohort	Investigate if exclusive breastfeeding duration was associated with pickiness or intake of vegetables; fruit, starchy foods or sugar-sweetened beverages in obesity prone normal weight children.	Exclusive breastfeeding duration Own questionnaire	Eating behavior Own questionnaire	Two to six	Logistic regression analyses	<ul style="list-style-type: none"> <li>- 20.2% of the children were only exclusively breastfed until age 0-1 month, and 14.8% were exclusively breastfed until age 6-10 months; 52.9% of the children were exclusively breastfed until age 4-5 months.</li> <li>- Picky eating behavior was observed in 16.0% of the children and 46.4% were a little picky at baseline.</li> <li>- It was observed a lower OR of picky eating behavior among those exclusively breastfed until 4-5 months and those exclusively breastfed for 0-1 month in both crude (OR crude = 0.51; CI95%=0.27; 0.98, <math>p=0.04</math>) and adjusted analyses (OR adjusted = 0.35; CI95%=0.16; 0.76; <math>p=0.008</math>).</li> <li>- The mean duration of breastfeeding was 5.1 months (SD=3.8 months).</li> </ul>
Barse <i>et al.</i> <sup>26</sup> 2017	The Netherlands.	4,779 Prospective cohort	Investigate if a longer duration of any breastfeeding as well as early complementary feeding would be related to less fussy eating at four years of age.	Breastfeeding duration Own questionnaire.	Fussy eating behavior CEBQ	Four	Linear regression and sensitivity analyses	<ul style="list-style-type: none"> <li>- It was observed a dose-response relation between any breastfeeding duration and fussy eating (OR= -0.06; CI95%=-0.10; -0.02)</li> <li>- Never breastfed children did not differ in their food fussiness score from children with a recommended breastfeeding duration (<math>\geq 6</math> months).</li> <li>- Children who were breastfed between 2 and 4 months or between 4 and 5 months did not differ from children who were breastfed for at least 6 months either in their food fussiness score.</li> <li>- Children who were breastfed for a short period of time (between 1 day and 2 months) had 0.70 points higher food fussiness score (CI95%=-0.27; 1.12) than children with a breastfeeding duration of 6 months or longer.</li> <li>- Children who were exclusively breastfed for at least 4 months did not differ significantly in their food fussiness scores from children who were partially breastfed at 4 months (OR=-0.33; CI95%=-0.04; 0.70) or never breastfed (OR=-0.32; CI95%=-1.01; 0.38).</li> </ul>
Möller <i>et al.</i> <sup>25</sup> 2012	The Netherlands	3,624 Prospective birth cohort	Investigate if a long exclusive breastfeeding duration and late introduction of solid foods would be associated with healthy eating behavior.	Exclusive breastfeeding duration Own questionnaire	Eating behavior CEBQ	Five	$\chi^2$ test, ANOVA and linear regression analyses	<ul style="list-style-type: none"> <li>- 467 children were exclusive breastfed for 6 months.</li> <li>- In the crude analyses and after adjustment for maternal and child factors, children who were exclusively breastfed for 3-6 months scored higher on food responsiveness than children who received exclusive breastfeeding for at least 6 months.</li> <li>- Exclusive breastfeeding duration was not associated with later eating behavior.</li> </ul>

Pang et al. <sup>28</sup> 2020	Singapore	970	Cohort	Examine the relationship between breastfeeding exposure and subsequent eating behaviors	Breastfeeding duration Own questionnaire	Eating behaviors PFQ and CEBQ	three and six	Linear regression	<ul style="list-style-type: none"> <li>- The majority of study children had either low or intermediate exposure to breastfeeding during infancy (44.3% and 43.5% respectively); 12.2% had high breastfeeding exposure.</li> <li>- At 3 years, mothers in the high breastfeeding group reported less difficulty in child feeding than those in the low breastfeeding group.</li> <li>- It found no significant associations between breastfeeding exposure and the CEBQ measure of satiety responsiveness at 3 or 6 years.</li> <li>- Children in the high breastfeeding group had significantly lower levels of reported food fussiness at 3 years than those in the low breastfeeding group; this trend was weaker and no longer significant at the age of 6 years.</li> <li>- Children who had been exclusively breastfed for 3 months in infancy had reduced the OR of presenting a preference for specific food-preparation methods during their preschool years.</li> </ul>
Shim et al. <sup>29</sup> 2011	United States	129	Cross-sectional	Investigate the association between infant-feeding practices and picky eating behavior in preschool-aged children	Exclusive and total breastfeeding duration Own questionnaire	Picky eating behavior Oregon Research Institute Child Eating Behavior Inventory	two to three	Logistic regression model	<ul style="list-style-type: none"> <li>- Exclusive breastfeeding during the first 6 months had lowered the OR of each indirect measure of limited variety: preference for specific food preparation methods by 78%, food rejection by 81%, and food neophobia by 75%.</li> <li>- Any breastfeeding and breastfeeding initiation showed only a statistically insignificant tendency of risk reduction in the development of picky eating behavior.</li> </ul>
Borkhoff et al. <sup>4</sup> 2018	Canada	2,987	Cross-sectional	Examine the association between total breastfeeding duration up to 36 months of age and later nutrition outcomes at three to five years of age.	Total breastfeeding duration Own questionnaire	Nutrition outcomes NutriSTEP	Three to five	Linear regression and restricted cubic spline modeling	<ul style="list-style-type: none"> <li>- The majority of children were breastfed (92%) and the mean total breastfeeding duration was 11 months.</li> <li>- Every 1 month increase in total breastfeeding duration was associated with a decrease in eating behaviors score of -0.03 (CI95%=-0.04; -0.02).</li> <li>- It was confirmed a nonlinear relationship between total breastfeeding duration and NutriSTEP eating behavior subscores.</li> <li>- Half of the children were exclusively breastfed until 4 months of age (49.7%) and 6.7% never received breast milk.</li> </ul>
Maranhão et al. <sup>30</sup> 2018	Brazil	301	Cross-sectional	Identify the prevalence of feeding difficulties in preschoolers, its association with epidemiological factors and past eating practices, as well as its repercussion on nutritional status.	Breastfeeding duration Own questionnaire	Feeding difficulties Kerzner's criteria	Two to six	$\chi^2$ test, t-student and linear regression	<ul style="list-style-type: none"> <li>- The occurrence of child feeding difficulties was reported by 25.1% of mothers.</li> <li>- Specific feeding difficulty was found in 37.2% of cases, with a predominance of "highly selective intake" (25.4%).</li> <li>- Feeding practices in the infant period were not associated with current feeding difficulties.</li> </ul>

CEBQ = Children's Eating Behavior Questionnaire; PFQ = Preschooler Feeding Questionnaire; OR = Odds Ratio; CI95% = Confidence Interval; SD=Standard Deviation.

Of the seven studies included, four of them demonstrated that EBF or BF duration had a positive effect on children's eating behavior, such as healthier eating behavior,<sup>4</sup> reduced food neophobia, lower scores on the 'food responsiveness' subscale<sup>25</sup> and lower 'picky eating' behavior.<sup>27</sup>

## Discussion

This systematic review identified seven studies that assessed the influence of breastfeeding duration on infant feeding behavior in children aged two to six years. Four studies demonstrated a positive association outcome such as healthier eating behavior,<sup>4</sup> reduced food neophobia, lower scores on the 'food responsiveness' subscale<sup>25</sup> and lower 'picky eating' behavior.<sup>27</sup>

Researchers differ in their definition of exposure to breastfeeding, and their assessment of this exposure. Specht *et al.*<sup>27</sup> and Möller *et al.*<sup>25</sup> evaluated EBF, whereas Shim *et al.*<sup>29</sup> and Borkhoff *et al.*<sup>4</sup> did not differentiate between EBF and non-EBF, and Borkhoff *et al.*<sup>4</sup> assessed BF duration. However, it is important to highlight the risk of memory bias present in retrospective assessments.

Different methods of analyzing eating behavior outcomes were also used. Of the four studies that found a positive association, Möller *et al.*<sup>25</sup> and Borkhoff *et al.*<sup>4</sup> applied a validated instrument, respectively: the CEBQ, where only four of the eight scales were used, and the NutriSTEP, where only one scale was applied to assess the outcome, losing its validation. The other two studies used their own questionnaires, which depended on the parent's perception of their children's eating behavior.<sup>27,29</sup>

All the studies that found no association<sup>25,28,30</sup> evaluated EBF. Barse *et al.*<sup>26</sup> and Pang *et al.*<sup>28</sup> also evaluated the total BF duration, and exposure was assessed through regular interviews during the child's first year of life, without risk of memory bias, unlike Maranhão *et al.*<sup>30</sup> study that measured the exposure retrospectively and did not clearly describe how this measurement was performed.

Eating behavior was assessed by the included studies using validated instruments. Barse *et al.*<sup>26</sup> used the CEBQ, but only the food agitation scale. Pang *et al.*<sup>28</sup> used the PFQ and CEBQ, but only two scales for each instrument (food difficulty and concerns about eating and response to satiety and food agitation, respectively). Maranhão *et al.*<sup>30</sup> used the Krezner criteria. There is no variation in the criteria used to evaluate eating behavior in these studies, but two authors used fewer scales of validated instruments than studies that found an association between breastfeeding and eating behavior. It is important to mention that Barse *et al.*<sup>26</sup> declared the existence of a conflict of interest due to a relationship with a company producing artificial milk substituted for human milk.

A critical analysis of the studies allowed the identification of several limitations. First, the use of different methods to assess exposure and outcome caused a lack of standardization among the studies. Second, there were differences in the sample sizes among the studies and a significant range in age at which the outcome was assessed. Third, the results of the studies might have been affected by memory bias for information collected retrospectively. And for last, there might have been flaws in the parental perception of children's eating behavior. In early childhood, there is a slowdown in growth and an adaptive food neophobia, and the child may not meet parental expectations, causing a distorted view of them in relation to feeding.<sup>11,23</sup> We believe that these limitations are not enough to disconsider the findings of this review, due to the importance of eating behavior in early childhood obesity prevention.<sup>31</sup>

Despite strong evidence of the benefits of BF in relation to short- and long-term health outcomes,<sup>9</sup> the results described above highlight the need for more research using validated questionnaires to assess feeding behavior, prospective research, and accurate measures of breastfeeding (exclusive and total) to understand the mechanisms involved. An important question is whether BF as a behavior-modifying factor can be weakened or canceled over time, especially after three years of age, by other environmental factors to which the child is exposed, such as parental care style, parents' food behavior, and the social environment. The development of eating behavior is a complex process of biological and cultural nature, which makes the study of this phenomenon challenging for researchers.

Most of the studies evaluated in this systematic review (four out of seven) showed a positive association (healthier eating behaviors, reduced food neophobia, lower 'food responsiveness', and lower 'picky eating' behavior) between BF duration and infant feeding behavior in children aged two to six years. There is a clear need for more homogeneous studies on this topic to understand the complexity of the mechanisms involved in this association.

## Authors' contribution

Ergang BC, Caprara GL, Machado MB: writing, data analysis and review of the manuscript. Moreira PR: writing and review of the manuscript. Hagen MEK: review of the manuscript. Bernardi JR: review of the manuscript and research guidance.

The authors approved the final version of the article and declare no conflict of interest.

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