Original paper

Association of breastfeeding duration with the development of non-nutritive habits, and transversal and vertical occlusal alterations in preschool children: A cross-sectional study

Ingrid Góngora-León[1,A–F], Catherine Sharlot Alarcón-Calle[1,B–F], Aron Aliaga-Del Castillo[2,C–F], Carlos Flores-Mir[3,C–F], Luis Ernesto Arriola-Guillén[4,5,A–F]

[1] Division of Pediatric Dentistry, School of Dentistry, Scientific University of the South (Universidad Científica del Sur), Lima, Peru
[2] Department of Orthodontics, Bauru Dental School, University of São Paulo, Bauru, Brazil
[3] Department of Orthodontics, Faculty of Medicine and Dentistry, College of Health Sciences, University of Alberta, Edmonton, Canada
[4] Division of Orthodontics, School of Dentistry, Scientific University of the South (Universidad Científica del Sur), Lima, Peru
[5] Division of Oral and Maxillofacial Radiology, School of Dentistry, Scientific University of the South (Universidad Científica del Sur), Lima, Peru

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;
D – writing the article; E – critical revision of the article; F – final approval of the article

Dental and Medical Problems, ISSN 1644-387X (print), ISSN 2300-9020 (online) *Dent Med Probl*. 2023;60(1):47–53

Address for correspondence
Luis Ernesto Arriola-Guillén
E-mail: luchoarriola@gmail.com

Funding sources
None declared

Conflict of interest
None declared

Acknowledgements
None declared

Received on November 18, 2021
Reviewed on December 27, 2021
Accepted on December 29, 2021

Published online on March 24, 2023

Cite as
Góngora-León I, Alarcón-Calle CS, Aliaga-Del Castillo A, Flores-Mir C, Arriola-Guillén LE. Association of breastfeeding duration with the development of non-nutritive habits, and transversal and vertical occlusal alterations in preschool children: A cross-sectional study. *Dent Med Probl.* 2023;60(1):47–57. doi:10.17219/dmp/145416

DOI
10.17219/dmp/145416

Abstract

Background. Breastfeeding has multiple nutritional, immunological and psychological benefits, as well as a positive influence on the development of the stomatognathic system.

Objectives. The present study attempted to determine the relationship between the duration of breastfeeding and the development of non-nutritive habits, and transversal and vertical occlusal alterations in preschool children.

Material and methods. This cross-sectional study involved 155 preschoolers aged 2–5 years from 3 public schools in Lima, Peru. The sample was divided into 2 groups with regard to the duration of breastfeeding: group A ($n = 50$) included infants that had been breastfed for up to 6 months; and group B ($n = 105$) included infants that had been breastfed for 6–12 months. Two trained and calibrated dentists evaluated each group, and clinically determined the presence or absence of transversal or vertical occlusal alterations. Likewise, the children's parents or caregivers were consulted to determine the development of non-nutritive habits.

Results. A significant association was found between breastfeeding duration and the development of the oral breathing habit; groups A and B showed a prevalence of 30.0% and 16.2%, respectively ($p = 0.048$). Likewise, breastfeeding duration affected the appearance of oral breathing (*OR* (odds ratio) = 0.84; 95% *CI* (confidence interval): 0.74–0.96; $p = 0.011$). Furthermore, the use of a bottle for more than 24 months significantly influenced the appearance of oral habits (*OR* = 3.55; 95% *CI*: 1.20–10.55; $p = 0.022$) and open bite (*OR* = 12.12; 95% *CI*: 1.16–126.31; $p = 0.037$).

Conclusions. Breastfeeding duration of 6–12 months was shown to be a protective factor in preventing the appearance of oral breathing. Posterior crossbite (PCB), open bite and deep bite seemed not to be influenced by breastfeeding duration. However, the use of a bottle for more than 24 months significantly influenced the appearance of anterior open bite.

Keywords: habits, breastfeeding, dental occlusion

Introduction

Breastfeeding is the first step in promoting the general health of both babies and their mothers.[1] Breastfeeding has multiple nutritional, immunological and psychological benefits, as well as a positive influence on the development of the stomatognathic system.[2–11] The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend an early start for breastfeeding (within the first hour of life), exclusive breastfeeding for the first 6 months of life, and continued breastfeeding for up to 24 months or more in order to achieve optimal growth, development and health.[12–18]

Breast milk is best for babies because of its immunomodulatory effects and protection against early infections. Early infections are major risk factors for asthma and allergic diseases; protection through breastfeeding may be a pathway that shields against allergic diseases.[19]

Breastfeeding reinforces the physiological nasal breathing of newborns during and after feeding, as they must forcefully close their mouth to suck properly.[20] It is considered a nutritive sucking habit, since it feeds the infant. Contrarily, introducing bottle-feeding early in the infant's life triggers rapid satiety and does not involve as much of a sucking effort. This leads the newborn to satisfy its suction desire through non-nutritive suction – sucking on objects that do not provide food, such as fingers, pacifiers or toys.[21,22]

Sucking fingers and/or pacifiers are the most common non-nutritive sucking habits among infants. The early introduction of a pacifier and/or a feeding bottle may confuse the newborn's sucking reflex, resulting in premature weaning. Non-nutritive habits can cause different alterations of dental occlusion depending on their frequency, intensity and duration. Dental occlusion alterations are developmental disorders that occur in the dentofacial structure, comprising the jaw, tongue and facial muscles.[5] The baby's sucking during breastfeeding stimulates the balance between the internal and external restraining forces of the facial musculature. This allows the appropriate development of the stomatognathic system and the adequate growth of the craniofacial complex, which can play an important role in preventing occlusal disorders in the child's primary dentition.[3,5,7,23–25]

Breastfeeding has been reported to protect against occlusal alterations in the primary dentition. Some studies report protection against occlusal alterations after 6 months of breastfeeding, and other emphasize the need for longer periods of breastfeeding for greater benefits.[3,5,15,26,27] However, only 40% of infants worldwide are exclusively breastfed for the first 6 months.[27] This average reduces to 37% in low- and middle-income countries.[28] It is known that when a baby is weaned after receiving breastfeeding, if a bottle is offered as a substitute, and used for a long time and at high frequency, it can overshadow the benefits of breastfeeding. Well-designed studies make it possible to identify whether prolonged breastfeeding is a protective factor against the appearance of harmful habits, or transversal and vertical occlusal alternations. They allow us to know the consistency of the results in a specific association. Given this context, the main purpose of the present study was to determine the association between the duration of breastfeeding and the development of non-nutritive habits, and transversal and vertical occlusal alterations in children aged 2–5 years from Lima, Peru.

Material and methods

This study was approved by the Ethics Committee at the School of Dentistry of the Scientific University of the South (Universidad Científica del Sur), Lima, Peru (No. of approval: 000444). The parents or legal guardians of the children signed the informed consent forms prior to participation in the study.

The sample was composed of 155 children aged 2–5 years, of both genders, from 3 public schools in Lima, Peru. They were distributed into 2 groups based on the duration of breastfeeding: group A (n = 50) included children that had been breastfed for 0–6 months; and group B (n = 105) included children that had been breastfed for more than 6 months and up to 1 year.

Children with systemic diseases, uncooperative, with morphological alterations, not breastfed from birth, with tooth decay injuries that covered more than 50% of the tooth surface, or whose parents did not provide consent to their participation were excluded.

Non-nutritive habits, and transversal and vertical occlusal alterations were clinically evaluated by 2 previously trained and calibrated examiners.

Evaluation of non-nutritive habits

Digital sucking was evaluated through the presence or absence of a digital callus on at least 1 finger, validated with the child's caregiver's response to the survey, and the presence of some type of characteristic related to sucking in the oral cavity, such as disturbances in the arch form, wrinkled, chapped or blistered fingers, ulceration or corn formation, etc.

Labial sucking was determined through clinical observations. It was considered as present in the children who unconsciously sucked their lips during the evaluation process, presenting a constantly moisturized lower lip. The observations were corroborated by the child's caregiver's response to the survey.

To assess atypical swallowing, children were asked to swallow their saliva. Then, they were asked to eat crackers. Thus, liquid and food swallowing were observed. The following criteria were checked: effortless lip sealing; lingual interposition; movement of the head or other parts

of the body; tension of the mentalis muscle; tension of the orbicularis oris muscle; leakage of food; and noise. Children were considered to swallow atypically when they met at least 3 of these criteria.

Oral breathing was assessed through the child's caregiver's response to the survey on whether the child snored or drooled at night. Furthermore, 7 clinical criteria were also taken into account: presence of eye shiners; characteristics of the nostrils; dry lips; underdeveloped maxillary bone due to the lack of maxillary sinus development; lip incompetence; palate type; and anterior open bite, as well as a breathing test that consisted in positioning a mouth mirror over the child's nostrils. Oral breathing was considered present when a child met at least 5 of these criteria.

Also, the children's parents or caregivers were asked to fill in a questionnaire; it included questions about the child and the mother, the type and duration of breastfeeding, the use of a bottle and the duration of bottle-feeding, the presence of habits such as digital or labial sucking, atypical swallowing, the type of breathing (either nasal or oral), snoring, and drooling.

Evaluation of transversal occlusal alterations

Posterior crossbite (PCB) was clinically evaluated; it is considered present when the vestibular surfaces of the upper molars fit behind the vestibular surfaces of the lower molars. It can be unilateral if no midline shift exists, but in general, PCB is bilateral. Likewise, 2 types were considered for the diagnosis of a complete PCB – buccal, when the upper jaw completely covered the lower jaw, or lingual, when the lower jaw completely covered the upper jaw.

Evaluation of vertical occlusal alterations

Open bite was clinically evaluated by measuring the distance between the incisal edges of the maxillary and mandibular central incisors. The end-to-end incisor relationship or the negative overbite condition were considered open bite.

Deep bite was clinically evaluated by measuring the coverage percentage of the upper central incisor on the vestibular surface of the lower central incisor; deep bite was considered present when the coverage was more than 30%.

Study error

All evaluations were performed again for all variables by the same examiner after a 10-day interval. The intra-examiner concordance was evaluated with the kappa coefficient, achieving values greater than 0.9 for all the outcome variables.

Statistical analysis

Statistical analysis was performed using IBM SPSS Statistics for Windows, v. 25.0 (IBM Corp., Armonk, USA). The χ^2 test was used to analyze the possible associations between breastfeeding duration and the presence of non-nutritive habits or occlusal alterations. Subsequently, logistic regression analysis was performed to identify the presence of risk factors with regard to the outcome variables. The duration of breastfeeding (in months), the duration of bottle use (in months), gender, age, the parents' educational level, and the number of children in the family were considered predictor variables. The overfit method was used. At first, a primary regression considering all predictor variables was performed. Then, a final regression selecting only the variables with a p-value <0.25 was performed. The significance level was set at $p < 0.05$ for all tests.

Results

The gender distribution is shown in Table 1. Breastfeeding duration was significantly associated with oral breathing ($p = 0.048$); the possible oral breathing was lesser in children that had been breastfed for more than 6 months (Table 2). No other statistically significant associations were found (Tables 1–3).

The logistic regressions showed that the use of a bottle for more than 24 months significantly influenced the appearance of non-nutritive habits (*OR* (odds ratio) = 3.55; 95% *CI* (confidence interval): 1.20–10.55; $p = 0.022$) (Table 4). Breastfeeding duration (*OR* = 0.84; 95% *CI*: 0.74–0.96; $p = 0.011$) and gender (*OR* = 0.22; 95% *CI*: 0.07–0.69; $p = 0.009$) significantly affected the development of oral breathing (Table 5). The probability of the occurrence of the oral breathing habit was greater in the case of shorter breastfeeding duration and in girls (Table 5).

Regarding occlusal alterations, the use of a bottle for more than 24 months significantly influenced the appearance of anterior open bite (*OR* = 12.12; 95% *CI*: 1.16–126.31; $p = 0.037$). Furthermore, boys were found to be less likely to have anterior open bite (*OR* = 0.27; 95% *CI*: 0.08–0.99; $p = 0.048$). Older preschool children appeared to be less likely to present PCB (*OR* = 0.10; 95% *CI*: 0.02–0.54; $p = 0.007$). Finally, the youngest children in the family presented a decreased likelihood of having deep bite (*OR* = 0.45; 95% *CI*: 0.26–0.77; $p = 0.003$) (Table 6).

Discussion

There are few studies regarding the minimum duration of breastfeeding that protects newborns against the development of non-nutritive habits or dental occlusion alterations,

Table 1. Gender distribution in both evaluated groups

Group	Gender		Total	*p*-value
	M	F		
Group A	27 (54.0)	23 (46.0)	50 (100)	
Group B	48 (45.7)	57 (54.3)	105 (100)	0.391
Total	75 (48.4)	80 (51.6)	155 (100)	

Data presented as number (percentage) (*n* (%)). M – male; F – female. Fisher's exact test.

Table 2. Associations between the duration of breastfeeding and the appearance of oral habits

Oral habit		Group A *n* = 50	Group B *n* = 105	Total *N* = 155	*p*-value
Appearance of oral habits	absent	23 (46.0)	57 (54.3)	80 (51.6)	
	present	27 (54.0)	48 (45.7)	75 (48.4)	0.391
	total	50 (100)	105 (100)	155 (100)	
Digital sucking	absent	44 (88.0)	98 (93.3)	142 (91.6)	
	present	6 (12.0)	7 (6.7)	13 (8.4)	0.352
	total	50 (100)	105 (100)	155 (100)	
Labial sucking	absent	36 (72.0)	74 (70.5)	110 (71.0)	
	present	14 (28.0)	31 (29.5)	45 (29.0)	1.000
	total	50 (100)	105 (100)	155 (100)	
Atypical swallowing	absent	28 (56.0)	63 (60.0)	91 (58.7)	
	present	22 (44.0)	42 (40.0)	64 (41.3)	0.728
	total	50 (100)	105 (100)	155 (100)	
Oral breathing	absent	35 (70.0)	88 (83.8)	123 (79.4)	
	present	15 (30.0)	17 (16.2)	32 (20.6)	0.048*
	total	50 (100)	105 (100)	155 (100)	
Snoring	absent	32 (64.0)	81 (77.1)	113 (72.9)	
	present	18 (36.0)	24 (22.9)	42 (27.1)	0.121
	total	50 (100)	105 (100)	155 (100)	
Drooling	absent	28 (56.0)	60 (57.1)	88 (56.8)	
	present	22 (44.0)	45 (42.9)	67 (43.2)	1.000
	total	50 (100)	105 (100)	155 (100)	

Data presented as *n* (%). * statistically significant (Fisher's exact test).

Table 3. Associations between the duration of breastfeeding and the appearance of posterior crossbite (PCB), open bite and deep bite

Bite		Group A *n* = 50	Group B *n* = 105	Total *N* = 155	*p*-value
PCB	absent	47 (94.0)	101 (96.2)	148 (95.5)	
	present	3 (6.0)	4 (3.8)	7 (4.5)	0.682
	total	50 (100)	105 (100)	155 (100)	
Open bite	absent	42 (84.0)	93 (88.6)	135 (87.1)	
	present	8 (16.0)	12 (11.4)	20 (12.9)	0.290
	total	50 (100)	105 (100)	155 (100)	
Deep bite	absent	20 (40.0)	39 (37.1)	59 (38.1)	
	present	30 (60.0)	66 (62.9)	96 (61.9)	0.728
	total	50 (100)	105 (100)	155 (100)	

Data presented as *n* (%). Fisher's exact test.

Table 4. Binary logistic regression to identify the predictor variables for the appearance of oral habits

Predictor variable		Appearance of oral habits			
		OR	95% *CI*		*p*-value
			lower limit	upper limit	
Duration of breastfeeding [months]		1.02	0.97	1.08	0.424
Duration of bottle use [months]	<12	–	–	–	0.069
	13–24	1.88	0.75	4.75	0.180
	>24	3.55	1.20	10.55	0.022*
Gender	F	–	–	–	–
	M	1.11	0.51	2.40	0.790
Age [years]		0.91	0.61	1.34	0.628
Number of children in the family		0.78	0.52	1.18	0.241

OR – odds ratio; *CI* – confidence interval; * statistically significant. R^2 = 7.2% (Cox–Snell).

Table 5. Binary logistic regression to identify the predictor variables for the appearance of oral breathing

Predictor variable		Oral breathing			
		OR	95% *CI*		*p*-value
			lower limit	upper limit	
Duration of breastfeeding [months]		0.84	0.74	0.96	0.011*
Duration of bottle use [months]	<12	–	–	–	0.386
	13–24	1.62	0.35	7.47	0.538
	>24	2.75	0.62	12.24	0.185
Gender	F	–	–	–	–
	M	0.22	0.07	0.69	0.009*
Age [years]		–	–	–	–
Parents' educational level	secondary education	–	–	–	–
	college graduate	0.92	0.22	3.92	0.915
Number of children in the family		0.81	0.43	1.52	0.505

* statistically significant. R^2 = 24.2% (Cox–Snell).

and they report varied results.[28–30] Previous systematic reviews generally found a protective effect of breastfeeding on allergic outcomes, although many studies had methodological limitations.[20] Although breastfeeding is reported to protect against lower respiratory tract infections during infancy, such protection has not been clearly demonstrated for asthma.[26] Children who are breastfed generally adopt nasal breathing due to the hermetic mouth seal during sucking, thus reducing their susceptibility to allergies; consequently, they develop fewer non-nutritive habits and fewer occlusal alterations.[19] To confirm this relationship, more studies are needed. In this regard, this study sought

Table 6. Binary logistic regression to identify the predictor variables for the appearance of posterior crossbite (PCB), open bite and deep bite

Predictor variable		PCB				Open bite				Deep bite			
		OR	95% *CI*		*p*-value	*OR*	95% *CI*		*p*-value	*OR*	95% *CI*		*p*-value
			lower limit	upper limit			lower limit	upper limit			lower limit	upper limit	
Duration of breastfeeding [months]		0.92	0.73	1.16	0.479	0.93	0.81	1.07	0.294	1.06	0.99	1.14	0.107
Duration of bottle use [months]	<12	–	–	–	0.231	–	–	–	0.105	–	–	–	0.347
	13–24	3.55	0.20	64.30	0.392	6.73	0.61	73.96	0.119	0.47	0.16	1.40	0.175
	>24	0.54	0.02	15.48	0.716	12.12	1.16	126.31	0.037*	0.49	0.15	1.61	0.238
Gender	F	–	–	–	–	–	–	–	–	–	–	–	–
	M	0.26	0.03	2.59	0.249	0.27	0.08	0.99	0.048*	1.88	0.81	4.38	0.144
Age [years]		0.10	0.02	0.54	0.007*	0.62	0.30	1.27	0.189	1.00	0.64	1.57	0.999
Parents' educational level	secondary education	–	–	–	–	–	–	–	–	–	–	–	–
	college graduate	0.47	0.03	8.68	0.614	4.58	0.60	34.90	0.142	1.60	0.55	4.65	0.389
Number of children in the family		0.40	0.07	2.20	0.291	1.97	0.96	4.02	0.063	0.45	0.26	0.77	0.003*

* statistically significant. R^2 = 15.8% for PCB; R^2 = 23.7% for open bite; R^2 = 16.6% for deep bite (Cox–Snell).

to determine the association between breastfeeding duration, the development of non-nutritive habits, and transversal and vertical occlusal alterations in children aged 2–5 years from Lima, Peru. The aim was to demonstrate whether prolonged exclusive breastfeeding for more than 6 months acts as a protective factor against the development of non-nutritive sucking habits or occlusal alterations. For this purpose, data collected through questionnaires and clinical assessments was analyzed.

The findings of this study reinforce the notion that a longer breastfeeding period may lead to a decrease in the occurrence of some non-nutritive habits, specifically oral breathing, and more consistency about this association is now available. The group that had been breastfed for more than 6 months had a significantly smaller percentage of children with oral breathing (16.2%) (Table 2). In addition, the regression results showed that breastfeeding duration was a protective factor against this habit (Table 5). To understand how breastfeeding duration works as a protective factor against oral breathing, it should be noted that during breastfeeding, babies adopt nasal breathing due to the hermetic mouth seal which occurs during suction, reinforcing nasal respiration during feeding. During suction, children open, protrude, close, and retrude their jaws, developing the entire muscular system of masseter, temporal and pterygoid muscles. Additionally, the temporomandibular joint is stimulated during breastfeeding and the anteroposterior growth of the mandibular body is expected. Conversely, during bottle-feeding, the tongue is positioned lower and further back, and the lips are separated; therefore, the tongue propulsion is weaker. Furthermore, pterygoid muscles and masseters are used less, because, due to the lingual depression at the time the baby carries out the passage of the food, they cannot be synchronized with respiration, thus increasing the probability of oral breathing.[31,32] Breastfeeding promotes nasal respiration due to suction, and this results in the adequate craniofacial development and prevents respiratory infections.[33,34]

Breastfeeding is promoted for its multiple benefits, both nutritional and psychological. There is consensus among different institutions and organizations that in order to guarantee its benefits, breastfeeding should be the exclusive source of feeding for a baby for 6 months or more in low- and middle-income countries.[7,14,22] Our findings reinforce these recommendations and the role of breastfeeding with regard to oral breathing.

Furthermore, exclusive breastfeeding is strongly and inversely associated with the frequency, intensity and duration of the use of a bottle, which can lead to occlusal alterations. The use of baby bottles is extremely popular for several reasons. One very important reason is that many mothers go to work and cannot breastfeed their children. The prolonged use of a bottle could be associated with the lack of knowledge of parents about its harmful effects and how it can influence occlusal alterations in children. We found that the use of a bottle for more than 24 months significantly influenced the appearance of open bite (Table 6). Furthermore, we found that the duration of bottle-feeding was a risk factor with regard to the appearance of oral habits (Table 4). Hence, bottle use should be avoided. Contrarily, the duration of breastfeeding was not related to the occurrence of transversal or vertical occlusal alterations (Table 6). However, we identified some factors that affected the outcome variables, for instance, boys were found to be less likely to have anterior open bite (*OR* = 0.27; 95% *CI*: 0.08–0.99; p = 0.048), older preschool children appeared to be less likely to present PCB (*OR* = 0.10; 95% *CI*: 0.02–0.54; p = 0.007) and the

youngest children in the family presented a decreased likelihood of having deep bite (*OR* = 0.45; 95% *CI*: 0.26–0.77; p = 0.003) (Table 6). Although these predictor variables showed an influence on the appearance of various types of malocclusion, we must remember that they can be accompanied by several environmental factors, and that a genetic factor should always be taken into account.

As this was a meticulous study, we found some challenges when carrying it out, especially when collecting essential information from the parents and/or guardians. Further research with larger populations is needed for more general conclusions. Even though both groups had different sample sizes and the size of group A was considerable (50 participants), so the results should not have been affected, yet other studies with different samples might corroborate the results of the present study.

Our findings are relevant to the promotion of public health, pediatric dentistry and orthodontics. Clinicians should be aware of the benefits of prolonged exclusive breastfeeding. Therefore, they can educate laypeople on the correct practice of exclusive breastfeeding to obtain all of its benefits. Finally, the results of this study allow us to conclude that preschool children who have prolonged breastfeeding have a lower probability of presenting oral breathing. In addition, the prolonged use of a baby bottle can produce occlusal alterations and lead to the presence of anterior open bite in children.

Conclusions

Breastfeeding duration of 6–12 months was shown to be a protective factor in preventing the appearance of oral breathing. Posterior crossbite, open bite and deep bite seemed not to be influenced by breastfeeding duration. However, the use of a bottle for more than 24 months significantly influenced the appearance of anterior open bite.

Ethics approval and consent to participate

This study was approved by the Ethics Committee at the School of Dentistry of the Scientific University of the South (Universidad Científica del Sur), Lima, Peru (No. of approval: 000444). The parents or legal guardians of the children signed the informed consent forms prior to participation in the study.

Data availability

The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Consent for publication

Not applicable.

ORCID iDs

Ingrid Góngora-León https://orcid.org/0000-0003-3143-7945
Catherine Sharlot Alarcón-Calle https://orcid.org/0000-0003-4665-191X
Aron Aliaga-Del Castillo https://orcid.org/0000-0003-3963-1742
Carlos Flores-Mir https://orcid.org/0000-0002-0887-9385
Luis Ernesto Arriola-Guillén https://orcid.org/0000-0003-0010-5948

References

1. Gupta BD, Purohit A. How to keep a child healthy? *Indian J Pediatr*. 2017;84(11):859–864. doi:10.1007/s12098-017-2384-3
2. Hernandez P, Kisamore AN. Gradual weaning and oral care management of prolonged breast-feeding based on family preferences. *J Am Dent Assoc*. 2017;148(6):392–398. doi:10.1016/j.adaj.2017.01.025
3. Hermont AP, Martins CC, Zina LG, Auad SM, Paiva SM, Pordeus IA. Breastfeeding, bottle feeding practices and malocclusion in the primary dentition: A systematic review of cohort studies. *Int J Environ Res Public Health*. 2015;12(3):3133–3151. doi:10.3390/ijerph120303133
4. Brownell EA, Hagadorn JI, Lussier MM, et al. Optimal periods of exclusive breastfeeding associated with any breastfeeding duration through one year. *J Pediatr*. 2015;166(3):566–70.e1. doi:10.1016/j.jpeds.2014.11.015
5. Peres KG, Cascaes AM, Peres MA, et al. Exclusive breastfeeding and risk of dental malocclusion. *Pediatrics*. 2015;136(1):e60–e67. doi:10.1542/peds.2014-3276
6. Pereira Lopes TS, de Deus Moura LdFA, Pinheiro Lima MC. Breastfeeding and sucking habits in children enrolled in a mother–child health program. *BMC Res Notes*. 2014;7:362. doi:10.1186/1756-0500-7-362
7. de Barros Miotto MH, Caxias FP, de Souza Campos DM, Emery Ferreira LdFP, Barcellos LA. Breast feeding as a protection factor to avoid non-nutritive sucking habits. *Rev CEFAC*. 2014;16(1):244–251. doi:10.1590/1982-021620142113
8. Salone LR, Vann WF Jr., Dee DL. Breastfeeding: An overview of oral and general health benefits. *J Am Dent Assoc*. 2013;144(2):143–151. doi:10.14219/jada.archive.2013.0093
9. Galán-Gónzalez AF, Aznar-Martín T, Cabrera-Domínguez ME, Domínguez-Reyes A. Do breastfeeding and bottle feeding influence occlusal parameters? *Breastfeed Med*. 2014;9(1):24–28. doi:10.1089/bfm.2013.0027
10. Bueno SB, Bittar TO, de Lima Vazquez F, Meneghim MC, Pereira AC. Association of breastfeeding, pacifier use, breathing pattern and malocclusions in preschoolers. *Dental Press J Orthod*. 2013;18(1):30.e1-6. doi:10.1590/s2176-94512013000100006
11. Voi Trawitzki LV, Anselmo-Lima WT, Melchior MO, Grechi TH, Valera FC. Breast-feeding and deleterious oral habits in mouth and nose breathers. *Braz J Otorhinolaryngol*. 2005;71(6):747–751. doi:10.1016/s1808-8694(15)31243-x
12. World Health Organization (WHO). Infant and young child feeding: Model chapter for textbooks for medical students and allied health professionals. Geneva, Switzerland: World Health Organization; 2009. https://apps.who.int/iris/handle/10665/44117. Accessed August 23, 2021.
13. Yonezu T, Arano-Kojima T, Kumazawa K, Shintani S. Association between feeding methods and sucking habits: A cross-sectional study of infants in their first 18 months of life. *Bull Tokyo Dent Coll*. 2013;54(4):215–221. doi:10.2209/tdcpublication.54.215
14. Casagrande L, Ferreira FV, Hahn D, Unfer DT, Praetzel JR. Breast and bottle-feeding and the development of the stomatognathic system [in Portuguese]. *Rev Fac Odontol Porto Alegre*. 2008;49(2):11–17. doi:10.22456/2177-0018.3032
15. Peres KG, Chaffee BW, Feldens CA, Flores-Mir C, Moynihan P, Rugg-Gunn A. Breastfeeding and oral health: Evidence and methodological challenges. *J Dent Res*. 2018;97(3):251–258. doi:10.1177/0022034517738925
16. López Rodríguez YN. Infant oral motor function as a stimulus for craniofacial growth [in Spanish]. *Univ Odontol*. 2016;33(74). doi:10.11144/Javeriana.uo35-74.fmol
17. Limeira AB, Aguiar CM, de Lima Bezerra NS, Câmara AC. Association between breastfeeding and the development of breathing patterns in children. *Eur J Pediatr*. 2013;172(4):519–524. doi:10.1007/s00431-012-1919-x

18. Eidelman AI. Breastfeeding and the use of human milk: An analysis of the American Academy of Pediatrics 2012 Breastfeeding Policy Statement. *Breastfeed Med*. 2012;7(5):323–324. doi:10.1089/bfm.2012.0067
19. Narbutytė I, Narbutytė A, Linkevičienė L. Relationship between breastfeeding, bottle-feeding and development of malocclusion. *Stomatologija*. 2013;15(3):67–72. PMID:24375308.
20. Oddy WH. Breastfeeding, childhood asthma, and allergic disease. *Ann Nutr Metab*. 2017;70(2):26–36. doi:10.1159/000457920
21. Lopes-Freire GM, Cahuana Cárdenas AB, Suarez de Deza JE, Ustrell-Torrent JM, Oliveira LB, Boj Quesada JR Jr. Exploring the association between feeding habits, non-nutritive sucking habits, and malocclusions in the deciduous dentition. *Prog Orthod*. 2015;16:43. doi:10.1186/s40510-015-0113-x
22. Bishara SE, Warren JJ, Broffitt B, Levy SM. Changes in the prevalence of nonnutritive sucking patterns in the first 8 years of life. *Am J Orthod Dentofacial Orthop*. 2006;130(1):31–36. doi:10.1016/j.ajodo.2004.11.033
23. Fernandes de Holanda AL, dos Santos SA, Fernandes de Sena M, Fernandes Ferreira MA. Relationship between breast- and bottle-feeding and non-nutritive sucking habits. *Oral Health Prev Dent*. 2009;7(4):331–337. PMID:20011750.
24. de Arruda Telles FB, Ferreira RI, Magalhães LdNC, Scavone H Jr. Effect of breast- and bottle-feeding duration on the age of pacifier use persistence. *Braz Oral Res*. 2009;23(4):432–438. doi:10.1590/s1806-83242009000400013
25. Romero CC, Scavone H Jr., Garib DG, Cotrim-Ferreira FA, Ferreira RI. Breastfeeding and non-nutritive sucking patterns related to the prevalence of anterior open bite in primary dentition. *J Appl Oral Sci*. 2011;19(2):161–168. doi:10.1590/s1678-77572011000200013
26. Carrasco-Loyola ML, Villena-Sarmiento RS, Pachas-Barrionuevo FM, Sánchez-Huamán YD. Lactancia materna y hábitos de succión nutritivos y no nutritivos en niños de 0–71 meses de comunidades urbano marginales del cono norte de Lima. *Rev Estomatol Herediana*. 2009;19(2):83–90. https://www.redalyc.org/pdf/4215/421539352003.pdf. Accessed August 23, 2021.
27. Rajeshwari K, Bang A, Kumar V, et al.; Infant and Young Child Feeding Chapter, Indian Academy of Pediatrics. Infant and young child feeding guidelines: 2010. *Indian Pediatr*. 2010;47(12):995–1004. PMID:21220795.
28. Victora CG, Bahl R, Barros AJ, et al. Breastfeeding in the 21st century: Epidemiology, mechanisms, and lifelong effect. *Lancet*. 2016;387(10017):475–490. doi:10.1016/S0140-6736(15)01024-7
29. Nunes de Sousa FR, Taveira GS, Dantas de Almeida RV, Nascimento Padilha WW. The breastfeeding and relationship between malocclusion and deleterious oral habits [in Spanish]. *Pesquisa Brasileira em Odontopediatria e Clínica Integrada*. 2004;4(3):211–216. https://www.redalyc.org/articulo.oa?id=63740309. Accessed August 23, 2021.
30. Melleiro Gimenez CM, Alves de Moraes AB, Bertoz AP, Bertoz FA, Ambrosano GB. First childhood malocclusion's prevalence and its relation with breast feeding and infant habits [in Portuguese]. *Rev Dent Press Ortodon Ortop Facial*. 2008;13(2):70–83.
31. Fonseca Thomaz EB, Teixeira Cangussu MC, Oliveira Assis AM. Maternal breastfeeding, parafunctional oral habits and malocclusion in adolescents: A multivariate analysis. *Int J Pediatr Otorhinolaryngol*. 2012;76(4):500–506. doi:10.1016/j.ijporl.2012.01.005
32. Sánchez-Molins M, Carbó JG, Gaig CL, Ustrell Torrent JM. Comparative study of the craniofacial growth depending on the type of lactation received. *Eur J Paediatr Dent*. 2010;11(2):87–92. PMID:20635843.
33. Moral A, Bolibar I, Seguranyes G, et al. Mechanics of sucking: Comparison between bottle feeding and breastfeeding. *BMC Pediatr*. 2010;10:6. doi:10.1186/1471-2431-10-6
34. Arifeen S, Black RE, Antelman G, Baqui A, Caulfield L, Becker S. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. *Pediatrics*. 2001;108(4):E67. doi:10.1542/peds.108.4.e67