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Original Article

The Influence of Feeding Methods on the Development of Nonnutritive Sucking Habits and Anterior Open Bite

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Abstract

Background: Breast milk is a highly nutritious food for children which affects the craniofacial development. Breastfeeding also plays a significant role in muscle function and alignment of the teeth in dental arch. Given the resources in determining the evaluation of malocclusion and harmful oral habits, in this study we aimed to determine the effect of child feeding methods on non-nutritive sucking habits and anterior open bite.

Methods: In this cross-sectional study, 191 children aged 3 to 6 years from different kindergartens of Hamadan city were studied. Data were based on the questionnaires that were answered by parents. Then children were classified into the following 4 groups based on the history of breast-feeding: G1- bottle fed, G2- breast fed for less than 6 months, G3- breast fed for 6 to 12 months, G4- breast fed for more than 12 months. Children were examined for the presence of anterior open bite. Data were collected and analyzed by statistical tests. Pearson chi-squared test, logistic regression and Fisher exact tests were used.

Results: The statistical analyses showed that demographic characteristics such as children's age and birth order, maternal education, employment, and family income had no impact on child feeding methods and there was no significant relationship between them. Moreover, no meaningful relationship was found between non-nutritive sucking habits and feeding methods. Results showed that there was a significant relationship between feeding methods and incidence of anterior open bite.

Conclusions: Feeding methods affect the prevalence of anterior open bite, and by increasing the duration of breast-feeding, prevalence of anterior open bite can be reduced.

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Background

Genetic and environmental factors influence the development of craniofacial complex including jaws, dental arches, tongue, and facial muscles. Sucking activity may also affect the development of the craniofacial complex. Sucking, swallowing, and chewing are oral-facial activities that are important in maxillofacial development, growth and alignment of the teeth (1).

Sucking behaviors are categorized into 2 groups: nutritive and non-nutritive. Nutritive sucking can be breast feeding or bottle feeding (2).

In breast feeding, masseter and temporalis muscles are involved, which lead to the normal development of maxillofacial complex (3).

Sucking behavior in breast feeding also makes the lips closed enough, tongue in proper position and hard palate shaping normally; therefore the alignment of teeth is proper and malocclusion is decreased. However, the bottle feeding mechanism is different and other muscles are involved. The strong force on teeth may also affect teeth alignment. Therefore 2 different feeding methods, breast-feeding and bottle feeding, have different effects on jaws and the development of dental arches (4).

Highlights

1. Feeding methods, may affect on the prevalence of anterior open bite .
2. Breastfeeding duration more than six months reduces the risk of anterior open bite significantly.
3. Breastfeeding Showed no meaningful effects on the presence of nonnutritive sucking habits.

Several studies have shown that nutritive feeding method is an important factor in developing malocclusions (5). There is also a close relationship between feeding duration and development of malocclusion; so a longer breastfeeding period decreases the abnormalities of occlusion (6).

Non-nutritive sucking behavior is common in 3-6-year-old children (7). Learning and psychoanalysis are 2 different theories that explain why a human baby wants

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to suck and why this habit continues after birth. However, both theories agree that this behavior is due to natural evolution (7). The prevalence of sucking habits is reported between 20% to 30% (1) that includes finger sucking or thumb sucking and pacifier use. Thumb sucking is much more frequent than pacifier use (7). Pacifier using stops earlier than finger sucking. It was shown that more than 90% of children who use pacifier stop it before age 5 and 100% of them stop it before 8. However, theoretically pacifier use is often an easier habit to stop, in comparison with finger sucking, but there is no absolute control over finger sucking. Stopping pacifier use may lead to finger sucking that is a second habit which should also be stopped (7).

The malocclusion symptoms which appear with non-nutritive habits depend on the direct pressure of lips and chicks to the teeth and change in this pressure during resting time (8). The most important factor in malocclusion damages is the duration of sucking habits. Studies have shown that nutritive habits have significant effects on the non-sucking behaviors. The duration of nutritive habits is also an important factor in prevalence of non-nutritive habits (5).

Based on the important role of feeding methods in children's growth and development, American Academy of Pediatric Dentistry (AAPD) and American Academy of Pediatrics (AAP) have provided and updated the educational instructions about nutritive feeding methods. Both academies agree that breast feeding is the best nutritive feeding method. Regarding the shortage of educational sources about the effects of feeding methods on the development of malocclusions and harmful oral habits, AAPD emphasizes informing about the advantages of breast-feeding (9,10). The current study assessed the effects of feeding methods on the non-nutritive sucking habits and prevalence of malocclusions such as anterior open bite.

Methods

At first, children were examined then they were selected based on the inclusion and exclusion criteria. All children included in the study met the following criteria: systemically healthy, no sign of permanent teeth eruption, without mouth breathing habit, absence of extensive caries lesions, crown destruction or proximal restorations that could compromise occlusion, absence of early loss of primary teeth and/or dental anomalies, absence of orofacial clefts or any other developmental anomalies, having no speech or orthodontic therapy, without any syndrome or disorder, and non-use of breast pump by the parents. Two hundred sixty children met the inclusion criteria.

To assess anterior open bite, children's occlusion was clinically examined in the room lights.

Anterior open bite is defined as the lack of incisal contact between anterior teeth in centric relation. Parents received questionnaires and totally 191 questionnaires were filled out completely. Demographic items, including children's gender (male or female), birth order (first child, second, …), mother's employment status (employed or unemployed) and educational level (elementary, middle school, high school and associate degree or more) as well as family income were compared. Then children were assigned into 4 groups according to breast-feeding duration: G1- bottle fed, G2- breast-feeding for a period less than 6 months of age, G3- breast-feeding between 6 and 12 months of age, G4- breast-feeding for a period longer than 12 months of age. Four groups were compared according to the prevalence of non-nutritive sucking and anterior open bite.

Data were analyzed using chi-square, logistic regress, and Fisher exact tests.

Results

Demographic items, involving children's gender, birth order, mother's employment status and educational level as well as family income were compared as shown in Table 1.

In G1, G2, G3, G4, the frequency of anterior open bite was 25% (4 out of 16), 11.4% (4 out of 35), 2.9% (1 out of 34), and 1.9% (2 out of 106), respectively (Table 2).

As shown in Table 3, based on logistic regression analysis, breast-feeding may have effects on the prevalence of anterior open bite ($P=0.01$). There was no significant difference between G1 and G2 ($P=0.226$), but anterior open bite was meaningfully prevalent in G1 in comparison with G3 and G4 that had breast-feeding longer than 6 months ($P=0.04$ and 0.01, respectively) (7). In G1, 12.5% (2 out of 16); in G2, 8.57% (3 out of 35); in G3, 2.94 %(1 out of 34); and in G4, 1.88% (2 out of 106) of children used pacifier. The results are shown in Figure 1.

According to Regression analysis, there was no meaningful relationship between feeding method and pacifier habits ($P=0.183$). In G4 with breast-feeding longer than 12 months, the obtained P value was 0.054 which was close to the test level and indicated that there can be a significant relationship between breast-feeding and increased open bite prevalence according to sample volume (Table 4).

Moreover, 6.25% of children in G1 (1 out of 16), 8.57% in G2 (3 out of 35), 2.9% in G3 (1 out of 34), and 4.7% in G4 (5 out of 106) had finger sucking habits; the results are

Table 1. Comparison of *P* Value for Demographic Items and Their Effects on Feeding Methods

Demographic Items	Statistical Test	*P* Value
Gender	Pearson chi-squared test	0. 461
Birth Order	Fisher exact test	0.225
Mother's education level	Fisher exact test	0.81
Mother's employment status	Pearson chi-squared test	0.695
Family Income	Fisher exact test	0.835

Table 2. Frequency of Anterior Open Bite

Anterior Open Bite Prevalence	Bottle Feeding	Breast-Feeding		
	G1 (non- breastfed)	G2 (shorter than 6 months)	G3 (interruption between 6 and 12 months)	G4 (longer than 12 months)
Yes, No. (%)	4 (25)	4 (11.4) 4	1 (2.9)	2 (1.9) 2
No, No. (%)	12 (75)	31 (88.6)	33 (97.1)	104 (98.1)
Total number of the children	16	35	34	106

Table 3. Feeding Methods and Anterior Open Bite Prevalence Analyzed by Logistic Regression

Feeding Methods	Regression Slope	Error Criteria	Odds Ratio	95% CI		*P* Value
				Upper	Lower	
G1 (bottle feeding)	-	-	-	-	-	-
G2 (breast-feeding shorter than 6 months)	- 0.949	0.785	0.387	1.802	0.083	0.226
G3 (breast-feeding interruption between 6 and 12 months)	-2.398	1.168	0.091	0.897	0.009	0.04
G4 (breast-feeding longer than 12 months)	-2.853	0.918	0.058	0.349	0.01	0.02

shown in Figure 2.

As shown in Table 5, there was no meaningful relationship between feeding methods and finger sucking habits ($P = 0.05$).

Discussion

Breast milk is an ideal nutrition that reduces infant mortality as well as preventing diseases. It decreases the risk of obesity, allergies, and gastrointestinal diseases and supports baby's immune system. Breast-feeding supports infants' emotional needs.

In 2010, the World Health Organization (WHO) recommended keeping breast-feeding at least for 6 months.

Breast-feeding also has an effect on the craniofacial development as well as stimulating the growth and development of orofacial system. In breast-feeding, oral muscles are more involved in comparison with their involvement in bottle feeding (3,11).

Malocclusion is a disorder of maxillofacial development

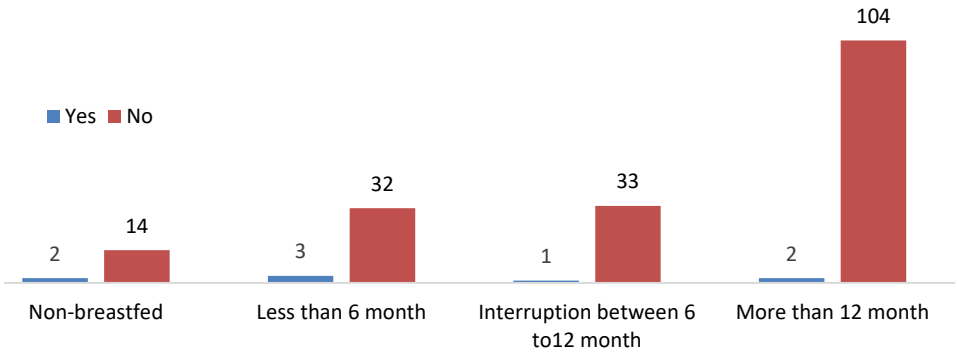

Figure 1. The Frequency of Pacifier Use.

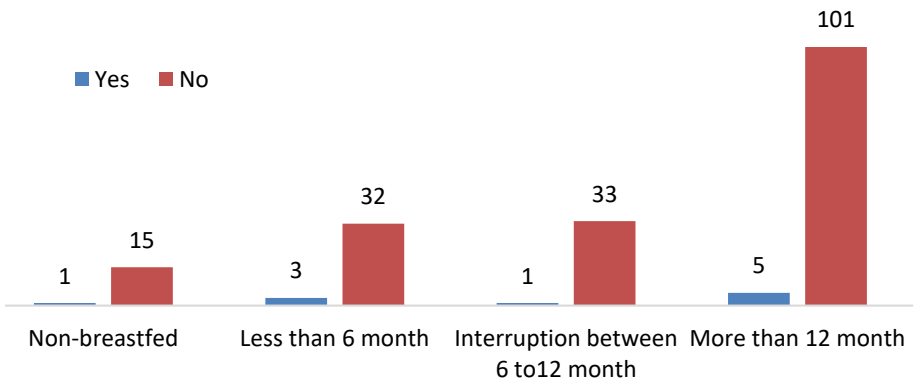

Figure 2. The Frequency of Finger Sucking.

Table 4. Regression Analysis of the Relationship between Frequency of Pacifier Use and Feeding Methods

Feeding Methods	Regression Slope	Error Criteria	Odds Ratio	95% CI		*P* Value
				Upper	Lower	
G1 (bottle feeding)	-	-	-	-	-	-
G2 (breast-feeding shorter than 6 months)	-0.421	-0.967	0.656	4.371	0.099	0.663
G3 (breast-feeding interruption between 6 and 12 months)	-1.551	1.266	0.212	2.534	0.018	0.221
G4 (breast-feeding longer than 12 months)	-2.005	1.040	0.135	1.033	0.018	0.054

Table 5. Regression Analysis of the Relationship between Frequency of Finger Sucking and Feeding Methods

Feeding Methods	Regression Slope	Error Criteria	Odds Ratio	95% CI		*P* Value
				Upper	Lower	
G1 (bottle feeding)	-	-	-	-	-	-
G2 (breast-feeding shorter than 6 months)	0.341	1.196	1.406	0.135	14.669	0.776
G3 (breast-feeding interruption between 6 and 12 months)	-0.788	1.448	0.455	0.027	7.766	0.586
G4 (breast-feeding longer than 12 months)	0.198	1.130	0.743	0.081	6.799	0.792

that affects the patient aesthetically and functionally, and the treatment is costly. Therefore, prevention of malocclusion is more important than treatment even with the new methods which cost a lot. Parents should be aware of beneficial effects of breast-feeding on maxillofacial and dental system. Based on the studies by AADP, breast-feeding is highly recommended due to its protective effects against malocclusions and deleterious oral habits (12,13).

The aim of the current study was to assess the effects of feeding methods on non-nutritive sucking habits and the prevalence of anterior open bite in children. The results showed that 8.37% of children were bottle fed and 91.63% were breastfed indicating the high frequency of breast-feeding in the community. There are different statistics in different countries based on the culture and economy. The other factor that may affect the feeding methods is mother's educational state.

In this study there was no meaningful relationship between feeding methods and mother's educational level and employment status. This result is not in agreement with the study results of Cwiek et al in 2010. They reported that bottle feeding is much more prevalent in industrial countries compared with breast-feeding. This result may be due to the difference in economic status and mother's educational level between two investigated communities. Our study was carried out in a developing country in which there are fewer educated and employed mothers, while they evaluated the feeding methods in a developed country (3). Nonetheless, the current study corroborated other studies in which there was a meaningful relationship between feeding methods and the prevalence of malocclusion, such as anterior open bite, in children.

In 2011, Romero et al found that prolonged breast-feeding may have protective effect against developing anterior open bite, therefore non- breastfed children presented higher risk of having anterior open bite in comparison with the children who were breastfed longer than 12 moths and this result is in agreement with our findings (6).

Romero et al also reported that longer duration of breast-feeding reduces the risk of anterior open bite (6). In breast-feeding, the involved muscles are different from those involved in bottle feeding. Bottle feeding makes children reluctant to breast-feeding therefore children's physiological need for food is only met but the need for sucking is not met and it leads to non-nutritive sucking such as finger sucking or pacifier use. In this study, no meaningful relationship was found between feeding methods and non-nutritive sucking habits.

According to the study by Montaldo et al, children who were bottle fed showed higher tendency for non-nutritive sucking habits compared with those who were breast fed (7). But the result of the present study showed that there is not any meaningful relationship between breast-feeding and finger sucking habit, however the relationship between pacifier use and breast-feeding was very close to a significance level and with a greater sample volume, more meaningful relationship would be achieved.

In 2010, Kobayashi et al reported a different result; they indicated that feeding methods are important factors in the prevalence of non-nutritive sucking habits and children who were breastfed longer showed less non-nutritive sucking habits (4).

In a review study on 34 papers from PubMed database, the relationship between feeding methods and maxillofacial development was investigated and the results showed that in some studies feeding methods had some effects on nonnutritive sucking habits and in other there was no effect. They also found that based on the studies from 1999 to 2011, prolonged breast-feeding diminishes the risk of acquiring non-nutritive sucking habits (14).

The difference between the results of the present study and those of others may be due to some factors such as

different sample volume, inclusion and exclusion criteria, group classification, assessing malocclusion and the other factors.

Totally our results corroborates the WHO in that breast-feeding is highly recommended at least for 6 months.

Our findings indicated that children who were breastfed longer than 12 months showed 1.9% prevalence of anterior open bite while in bottle fed children, it was 25%; therefore longer duration of breast-feeding diminishes the risk of anterior open bites.

Conclusions

In this study the relationship between children feeding methods and occurrence of anterior open bite was assessed and the results indicated that feeding methods may affect the prevalence of anterior open bite, and breast-feeding for more than 6 months reduces the risk of anterior open bite significantly. However, breast-feeding showed no meaningful effects on the presence of non-nutritive sucking habits.

Authors' Contribution

All authors contributed to subsequent and final drafts.

Ethical Statement

This article was performed as under graduated thesis and approved by Deputy of research and technology.

Conflict of Interest Disclosures

The authors declare that they have no conflict of interests.

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