

Association between breastfeeding duration and non-nutritive sucking habits

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Objective To evaluate the relationship between breastfeeding duration and the prevalence of non-nutritive sucking habits in children with deciduous dentition. **Method** A cross-sectional survey was conducted on the mothers of 551 children aged 3 to 6 years, randomly selected from public pre-schools in São Paulo, Brazil. Mothers were asked to complete a questionnaire that included items regarding their children's age, gender, race, method and duration of infant feeding, as well as pacifier use and/or digit-sucking habits. According to the answers pertinent to the method and duration of infant feeding, children were assigned to five groups: 1 – never breastfed, 2 – breastfed for a period shorter than 3 months of life, 3 – breastfed for 3 to 6 months, 4 – breastfed for 6 to 9 months, and 5 – breastfed for 9 months or longer. Data were submitted to the Fisher's exact test with Bonferroni correction for multiple comparisons to analyse possible associations between breastfeeding duration period categories and non-nutritive sucking behaviours. **Results** Pacifier use frequency was high in groups 1, 2, 3 and 4 (85%, 87.6%, 78% and 70%, respectively), in comparison with that in group 5 (38.6%). The prevalence of non-nutritive sucking habits was significantly reduced in children who were breastfed for nine months or longer ($p=0.000$). There were no statistically significant differences in the frequencies of pacifier use and/or digit-sucking habits between genders, regardless of the breastfeeding duration period. **Conclusion** Children aged 3–6 years who were breastfed for nine months or longer had a lower prevalence of non-nutritive sucking habits.

Key words: Breastfeeding, deciduous dentition, sucking habits

Introduction

It has been suggested that breastfeeding is superior to bottle-feeding, as far as the development of the occlusion is concerned (Karjalainen *et al.*, 1999; Labbok and Hendershot, 1987; Øgaard *et al.*, 1994; Viggiano *et al.*, 2004; World Health Organization, 1998). According to Karjalainen *et al.* (1999), early introduction of bottle-feeding, indicating low-impact muscular activity, may interfere with the normal development of alveolar ridges and hard palate.

Righard (1998) and Viggiano *et al.* (2004) explained that breastfeeding and bottle-feeding involve different mechanisms of sucking. The breastfeeding child draws milk, putting both the nipple and areola into the mouth; the movement of lips and tongue contributes more to squeezing than to sucking. The bottle-feeding child uses the tongue with piston-like motion in order to compress the artificial teat against the palate.

Meyers and Hertzberg (1988) mentioned three theoretical mechanisms by which bottle-feeding might contribute to the development of malocclusions: (1) a direct effect of altered sucking mechanics on the growing facial bones of the child, (2) an increased tendency towards abnormal swallowing patterns, and (3) an increased prevalence of non-nutritive sucking habits associated with bottle-feeding.

Based on the *Evidence for the Ten Steps to Successful Breastfeeding*, pregnant women should receive information about the importance of exclusive breastfeeding

for the first six months postpartum, as well as to be encouraged to give no artificial teats or pacifiers to breastfeeding infants (World Health Organization, 1998). In a study of 1,601 mother-infant pairs in Italy, Riva *et al.* (1999) observed that total breastfeeding duration was negatively associated with pacifier use during the first month of life. The results of a randomised clinical trial conducted by Howard *et al.* (2003) added further support to this finding.

Méndez *et al.* (1999) suggested that breastfeeding provides fulfilment of sucking needs and prevents malocclusions. Conversely, Warren and Bishara (2002) assessed the effects of breastfeeding duration, pacifier use and digit-sucking habits on the dental arches and the occlusal characteristics among children in the deciduous dentition phase. No statistically significant differences were found in mean dental arch measurements and occlusal traits of non-breastfed children and those who were breastfed over three different periods: shorter than six months; from six to 12 months, and longer than 12 months.

Warren *et al.* (2001) mentioned some potential harm in continuing non-nutritive sucking habits beyond two years of age, with greater risk of developing malocclusions with longer habit duration, particularly habits persisting to four years of age or beyond. Although the relationships between prolonged non-nutritive sucking habits and malocclusions have been extensively studied (Øgaard *et al.*, 1994; Scavone-Jr *et al.*, 2007; Warren and Bishara, 2002; Warren *et al.*, 2001), more information specifically regarding breastfeeding duration as it is related to

sustained non-nutritive sucking habits is needed.

Many studies suggested a reciprocal relationship between short breastfeeding duration and early start of non-nutritive sucking habits (Aarts *et al.*, 1999; Barros *et al.*, 1995; Howard *et al.*, 2003; Riva *et al.*, 1999; Victora *et al.*, 1997). From an orthodontic standpoint, however, it would be of more interest to establish possible associations between breastfeeding duration and persistence of non-nutritive sucking habits, rather than to study the cause-effect relationship between non-nutritive sucking habits and early cessation of breastfeeding. Moreover, studies aimed at investigating the associations between breastfeeding duration and prolonged non-nutritive sucking habits would be reasonable and justifiable, as breastfeeding counselling is supposed to be included in a set of health education measures that, perhaps, could also contribute to a favourable development of the occlusion in the deciduous dentition.

Thus, the present study was designed to investigate the association between breastfeeding duration and the prevalence of non-nutritive sucking habits, particularly pacifier use and/or digit-sucking, in children aged 3 to 6 years. The null hypothesis stated that there was no relationship between different breastfeeding duration periods and the prevalence of such non-nutritive sucking habits.

Method

The present cross-sectional study is in agreement with the Resolution Act 196/96 from the Brazilian National Committee of Health and was approved by the Ethical Committee in Research of the University of São Paulo City - UNICID.

Data were collected as part of another investigation assessing the prevalence of malocclusions in the deciduous dentition and its related oral myofunctional alterations. This study was conducted in public pre-schools run by the municipality in the eastern region of São Paulo City, the largest urban centre in Brazil and also in South America. These schools are attended by children at 3 to 6 years of age. Some health, demographic, and economic statistics for the areas in which the schools are located were shown to be fairly typical of this population segment from São Paulo City. Out of five public schools contacted, three agreed to participate in the research. Therefore, the sample population consisted of mothers and their children, randomly selected from these three public schools.

After receiving a detailed explanation concerning the purpose of this investigation, parents were given recommendations and advice about preventing malocclusions related to prolonged non-nutritive sucking habits, as requested by the schools' directors in order to provide some dental health education for this population. Subsequently, a total of 693 mothers were asked to complete a questionnaire consisting of socio-demographic items, involving their children's name, date of birth, gender, and race, as well as questions regarding both method and duration of infant feeding. With respect to non-nutritive sucking behaviours, mothers were asked whether their children regularly sucked on pacifiers or developed digit-sucking habits. Foster children and children whose

early feeding history was unknown were not included in the present study.

Children were clinically examined on the basis of some inclusion criteria. Only children with deciduous teeth were selected; children having at least one permanent tooth, erupted or partially erupted were excluded. In addition, children were required to have all deciduous teeth, without cavitated carious lesions that could result in decreased arch length, in order to avoid the influence of this factor on the development of the occlusion in the deciduous dentition. The present study comprised presumably healthy children, without orofacial clefts or any other developmental anomalies that could be detrimental to breastfeeding.

One hundred and forty-two mother-infant pairs (approximately 20.5%) were excluded because: (1) the mothers did not return the questionnaires, (2) the questionnaires were incomplete or answered in an ambiguous fashion that precluded analyses, (3) the parents did not sign the informed consent form, and (4) the children did not meet the inclusion criteria. The study comprised a total of 551 Brazilian pre-school children aged 3 to 6 years. Distribution of children in accordance with the responses to socio-demographic questions is shown in Table 1. Based on the duration of breastfeeding in the early childhood, children were further assigned to five groups:

- 1 *non-breastfed*
- 2 *breastfed for a period shorter than three months*
- 3 *breastfed for three to six months*
- 4 *breastfed for six to nine months*
- 5 *breastfed for nine months or longer*

Two-dimensional cross-tabulation of questionnaire data was performed on breastfeeding duration *versus* non-nutritive sucking habits. The rates of subjects presenting non-nutritive sucking habits in the five feeding categories were then calculated. Combined data were submitted to the Fisher's exact test with Bonferroni correction for multiple comparisons, in order to determine possible associations between total breastfeeding duration and the prevalence of non-nutritive sucking habits. P values of less than 0.00125 were considered statistically significant. This significance level corresponds to a Bonferroni correction of the 5% level adjusted for 40 tests.

Table 1. Socio-demographic characteristics of children studied

<i>Characteristic</i>	<i>n</i>	<i>%</i>
<i>Gender</i>		
Male	256	46.5
Female	295	53.5
<i>Age (years)</i>		
3 to 4	18	3.3
4 to 5	157	28.5
5 to 6	376	68.2
<i>Race</i>		
White	435	79.0
Non-white	116	21.0

Results

The prevalence of pacifier use and digit-sucking habits separately and in combination are shown in Table 2. Data are given for the five different groups of children, independent of gender. No habits indicates absence of non-nutritive sucking habits. It should be noted that pacifier use alone was much more frequent when compared to digit-sucking habits alone, or pacifier use combined with digit-sucking habits, in all groups. Group 5, when compared to groups 1, 2, 3, and 4, showed a substantially higher percentage of children who did not develop non-nutritive sucking habits, whereas the frequency of pacifier use was 38.6% (Table 2). Of the 158 children who were breastfed for nine months or longer, ie 28.7% of the total number of children studied, 55.1% sucked on neither pacifiers nor their digits. Thus, a lower prevalence of non-nutritive sucking habits was observed in children who were breastfed for a period greater than 9 months.

Higher frequencies of pacifier use were noted for the children who were breastfed for three months of life, as well as for those who were breastfed for three to nine months (groups 3 and 4). Considering the prevalence of pacifier use in groups 2, 3 and 4, namely, 87.6%, 78%, and 70%, respectively, it might be inferred that the percentages were also remarkably high in comparison to group 1, which comprises the smallest portion of the total number of children.

The strength of association between breastfeeding duration and the prevalence of non-nutritive sucking habits was analysed using the Fisher's exact test (Table 3).

The prevalence of non-nutritive sucking habits tended to decrease as the total breastfeeding duration period increased. Consistent with this finding and as shown in Table 3, the absence of non-nutritive sucking habits was significantly more frequent in group 5, compared to the other groups. Therefore, a total breastfeeding duration period greater than nine months was associated with a lower prevalence of non-nutritive sucking habits.

There were no statistically significant differences between boys and girls with respect to pacifier use and digit-sucking habits.

Discussion

This cross-sectional study comprised a sample of mother-infant pairs in a population known to have great influence from the western industrialised countries, where most children are pacifier users and/or are digit-suckers. Additionally, in today's industrialised world, the children have plenty of food, through bottle-feeding or in the form of commercially prepared infant soups. Nevertheless, findings in the present study showed that Brazilian mothers from São Paulo City are motivated to breastfeed. Of all the children (n=551), 92.7% were breastfed.

Pacifier use was the most frequent sucking behaviour in the five groups studied. This finding is consistent with that reported by Larsson and Dahlin (1985), who claimed that pacifier-suckers are in the majority compared with digit-suckers. A fewer percentage of children who were breastfed for nine months or longer had non-nutritive sucking habits, specifically pacifier use, in comparison

Table 2. Non-nutritive sucking habits among children concerning the total breastfeeding duration

Group	Pacifier		Digit-sucking		Pacifier + Digit-sucking		No habits		Total	
	n	%	n	%	n	%	n	%	n	%
1	34	85.0	2	5.0	2	5.0	2	5.0	40	100
2	106	87.6	3	2.5	3	2.5	9	7.4	121	100
3	103	78.0	7	5.3	8	6.1	14	10.6	132	100
4	70	70.0	7	7.0	3	3.0	20	20.0	100	100
5	61	38.6	8	5.0	2	1.3	87	55.1	158	100
Total	374	67.9	27	4.9	18	3.3	132	23.9	551	100

Table 3. Association between breastfeeding duration and the prevalence of non-nutritive sucking habits

Group	Pacifier	Digit-sucking	Pacifier + Digit-sucking	No habits
	p value	p value	p value	p value
1-2	0.787	0.599	0.599	0.733
1-3	0.380	1.000	1.000	0.367
1-4	0.087	1.000	0.624	0.038
1-5	0.000*	1.000	0.182	0.000*
2-3	0.048	0.339	0.221	0.512
2-4	0.001	0.191	1.000	0.009
2-5	0.000*	0.359	0.655	0.000*
3-4	0.174	0.592	0.359	0.060
3-5	0.000*	1.000	0.047	0.000*
4-5	0.000*	0.589	0.379	0.000*

After Bonferroni correction, p values of < 0.00125 were considered significant.

* Significant differences.

with those children in groups 1, 2, 3, and 4 ($p=0.000$). Thereafter, an increasing frequency of pacifier use was related to a decrease in total breastfeeding duration. Concerning the digit-sucking habits, the results were inconclusive due to the small number of cases observed.

The prevalence of non-nutritive sucking habits in breastfed children has been widely investigated (Aarts *et al.*, 1999; Benis, 2002; Labbok and Hendershot, 1987; Larsson and Dahlin, 1985; Shoaf, 1979). In some studies, a negative relation was found between breastfeeding and development of both pacifier use and digit-sucking habits (Labbok and Hendershot, 1987; Larsson and Dahlin, 1985; Shoaf, 1979). The total breastfeeding duration period recorded by those authors varied from six to 11 months. In the present study, the number of children with history of non-nutritive sucking habits was observed to decrease significantly as the total breastfeeding duration period has increased. However, this applied only to children breastfed for nine months or longer.

Although Øgaard *et al.* (1994) have suggested that, as with digit-suckers, girls who are pacifier-suckers have greater difficulty stopping the habit than boys, in this study, there were no statistically significant differences between genders with respect to the non-nutritive sucking behaviours. Furthermore, the absence of non-nutritive sucking habits appeared to be greater among girls. Interestingly, in a study of 650 mother-infant pairs visited shortly after delivery and at one, three and six months, Victora *et al.* (1997) reported that pacifier use was more frequent among boys. Certainly, the development and persistence of the so-called non-nutritive sucking habits are related to such factors as insufficient fulfilment of sucking needs, emotional or psychological comfort, as well as the simple learned habit from which pleasure is achieved (Shoaf, 1979).

It remains unclear whether the use of a pacifier shortens the total breastfeeding duration period or whether the mother would have stopped breastfeeding regardless. Several investigations found early weaning to be associated with pacifier use (Aarts *et al.*, 1999; Barros *et al.*, 1995; Howard *et al.*, 2003; Riva *et al.*, 1999; Victora *et al.*, 1997). Victora *et al.* (1997) and Benis (2002) suggested that pacifier use may be a marker of breastfeeding difficulties or decreased maternal motivation to breastfeed, as opposed to being the causal agent in early weaning. It is important to acknowledge that decisions to stop breastfeeding may precede and lead to an increase in non-nutritive sucking habits, rather than non-nutritive sucking habits leading to cessation of breastfeeding (Levy *et al.*, 2002).

There are some limitations when considering the present study's findings. This population-based survey did not cover a fully representative sample of Brazil, given the geographic extension and the multitude of cultural peculiarities of the country. For example, there are great differences between people from the north-eastern and those from the south-eastern regions in terms of behavioural and socio-cultural traits. The retrospective nature of the study did not avoid recall bias. Data on maternal employment and child-care attendance were not collected. In fact, Levy *et al.* (2002) found a significant reduction in breastfeeding for children who sucked on both pacifier and a digit by the age of six weeks. But the effect of

the above-mentioned non-nutritive sucking habits became non-significant when considering 30 or more child-care days. This finding suggests a possible effect of child-care attendance on early weaning. Data on frequency, intensity, and duration of non-nutritive sucking behaviours were not included. In this study, the questionnaire did not include a query about the moment when the non-nutritive sucking behaviours were initiated.

Further investigation is needed to clarify the association between pacifier use and early weaning. Preferably, such studies should have a longitudinal prospective design. The mother-infant pairs should be followed up from the delivery until the early mixed dentition stage, since cross-sectional data are reported by parents and could not be directly validated. Additionally, in well-controlled longitudinal studies, many interesting variables, such as infant feeding methods, development of non-nutritive sucking behaviours, craniofacial growth, and malocclusions in the deciduous dentition, may be more accurately correlated.

Despite the limitations, this study clearly demonstrated that children who were breastfed for nine months or longer had significantly less occurrence of non-nutritive sucking habits at the ages of three to six years. This age range appears to be critical, since a key question is whether spontaneous resolution of certain malocclusions associated to non-nutritive sucking may be observed, in the deciduous dentition, once the habit has been discontinued. Mothers should be warned about the ideal time for discontinuation of non-nutritive sucking habits, which should occur between the third and fourth year of life. After this period, the sucking urge is regarded as a prolonged non-nutritive sucking habit and professional assistance in habit discontinuation may be warranted to minimise the risk of developing malocclusions (Warren *et al.*, 2001).

This report presents a valid contribution to promote breastfeeding. Ideally, it would be best if children were only breastfed and used neither the bottle nor the pacifier. Because this is unrealistic, mothers should be made aware of the benefits attributable to breastfeeding. The advantages of breastfeeding include: breast milk content, with the right balance of nutrients; better internal absorption; fewer nutritional allergies; more favourable psychological development; and better immunologic defences (Meyers and Hertzberg, 1988). The intensity and duration of breastfeeding are closely tied to infant health benefits, including reduced risks for otitis media and diarrhoea. In addition, concurrent maternal fertility reduction and lessened risks for breast and ovarian cancers are highly associated with the practice of breastfeeding (Howard *et al.*, 2003).

Perhaps, breastfed children may be better able to obtain satisfaction of sucking needs, which in turn might result in pacifier use and digit-sucking habits of shorter duration. Therefore, mothers should be encouraged to breastfeed for a period of time as long as biologically and practicably possible. According to the results of the present study, mothers should breastfeed their children for nine months or longer.

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