



# Nonnutritive Sucking Habits and Anterior Open Bite in Brazilian Children: A Longitudinal Study

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## Abstract

**Purpose:** The purpose of this longitudinal study was to assess the relationship between nonnutritive sucking habits and anterior open bite in 305 4- to 5-year-old children attending state schools in the city of Recife, Brazil.

**Methods:** The data were collected by interviewing the children's mothers or guardians and through clinical examinations carried out by 1 calibrated examiner ( $\kappa=1$ ). Bivariate analyses (Pearson chi-square, McNemar, and Stuart-Maxwell tests) were used for the statistical analysis.

**Results:** The prevalence of sucking habits was low, and the sample showed reductions after 1 year of follow-up. The prevalence of anterior open bite decreased from 33% to 29% after 1 year. A significant association was found between anterior open bite and sucking habits. Open bite self-correction was associated with the abandoning of deleterious habits.

**Conclusions:** The low prevalence of nonnutritive sucking habits and its reduction during the period studied seem to reflect a natural tendency in preschool children. Even presenting a slight reduction, the high prevalence of anterior open bite draws attention to the importance of longitudinal studies to support scientific evidences for early clinical intervention. (*Pediatr Dent* 2005;27:369-373)

**KEYWORDS:** NONNUTRITIVE SUCKING HABITS, ANTERIOR OPEN BITE, CHILD

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The concern over nonnutritive sucking habits and associated malocclusions is evident from the number of articles appearing in scientific journals in recent years.<sup>1-8</sup> Nonnutritive sucking is a common behavior among young children in different populations (Table 1).<sup>2,7,9-17</sup>

Some authors reported that the use of objects resembling mother's breasts is not a modern practice.<sup>18-20</sup> The earliest records were found in Roman children's burials, where pottery nipples in the shapes of breasts were found.<sup>18</sup> The present-day pacifier was probably preceded by what was called a "sugar rag" or "sucking bag." These were made from rags or chamois into which bread crumbs, milk, and sugar were placed and used to feed and comfort children.<sup>18-20</sup>

On the other hand, a study by Larsson on 81 juvenile medieval skulls with primary and mixed dentitions concluded that the prevalence of malocclusions of the type attributable to continued finger sucking or sucking of dummy-like objects was very low in the material studied.<sup>22</sup>

Larsson also cited further studies showing that, in some American and African tribes, the finger-sucking habit was extremely rare and the suction of objects as pacifiers did not seem to exist. Moreover, in the studies carried out by the same author from 1964 to 1977, the prevalence of these habits proved to be 75% to 95% in occidental industrialized countries.

The remarkable difference in the prevalence of dummy- and finger-sucking habits between different countries and epochs suggested that modern western society may contain in itself the clue as to the genesis of nonnutritive sucking habits.<sup>22</sup>

A number of authors agree that nonnutritive sucking habits may have developed as a result of the industrialization and modernization of society. This requires the participation of women in the work force and leads to a reduction of the natural breast-feeding period of children who, consequently, became more likely to adopt the habit of sucking fingers and pacifiers.<sup>2,7,8,21-23</sup>

Prevalence of nonnutritive sucking habits is variable and depends on many factors including sex, birth rank, feeding method, and socioeconomic status.<sup>7</sup> Though common in industrialized countries where up to 95% of infants may

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Table 1. Prevalence of Sucking Habits in Different Studies

Author(s)	Year	Country	Age in years	Sample	Pacifier-sucker (%)	Digit-sucker (%)
Zadik <sup>9</sup>	1977	Israel	0-7	333	70	23
Svedmyr <sup>10</sup>	1979	Sweden	1-10	462	62	16
Mod��r, Odenric, Lindner <sup>11</sup>	1982	Sweden	4	588	78	10
Larsson, Ogaard, Lindsten <sup>12</sup>	1992	Sweden	3	245	70	18
		Norway	3	175	37	12
Adair et al <sup>13</sup>	1995	USA	2-4	218	55	Not reported
Bayardo et al <sup>14</sup>	1996	Mexico	2-15	1,600	Not reported	11
Farsi, Salama <sup>7</sup>	1997	Saudi Arabia	3-5	583	38	11
Vadiakas, Oulis, Berdouses <sup>15</sup>	1998	Finland	3-5	316	55	23
Warren et al <sup>16</sup>	2000	USA	1	794	38	31
			2	606	25	22
			3	496	10	14
			4	221	5	12
Larsson <sup>17</sup>	2001	Sweden	0-3	60	72	6
Katz, Rosenblatt, Gondim <sup>2</sup>	2004	Brazil	4	330	29	8

display some sucking habit, it has not, as yet, been detected in some developing countries.<sup>7,23</sup>

Associations between nonnutritive sucking habits and anterior open bite in primary dentition have been shown in several studies (Table 2).<sup>2,3,5,7,10,13</sup>

Zardetto, Rodrigues, and Stefani<sup>24</sup> evaluated the characteristics of dental arches and some functional structures in 61 Brazilian children aged 36 to 60 months old. Anterior open bite was present only in those children who had pacifier-sucking habits. The authors concluded that children who sucked pacifiers, compared to those who had never sucked pacifiers, showed a higher prevalence of alterations in the relationship of the dental arches and oral myofunctional structures.

Chevitaress  , Valle, and Moreira<sup>4</sup> evaluated the prevalence of malocclusion and its relationship with nonnutritive sucking habits in 112 Brazilian children ages 4 to 6 years old. The results demonstrated the presence of malocclusions at 76%. The nonnutritive sucking habits were related to 35%,

and the open bite was the most prevalent malocclusion in the population studied (31%). The authors concluded that nonnutritive sucking habits were the decisive etiological factor.

In 2004, Katz, Rosenblatt, and Gondim<sup>2</sup> assessed the relationship between nonnutritive sucking habits, facial morphology, and malocclusions in 330 Brazilian children at 4 years of age. The results demonstrated that a large subset (68%) of children had presented with nonnutritive sucking habits at some time in their lives. Anterior open bite was detected in 36% of children, and a significant association was found between this malocclusion and nonnutritive sucking habits. The authors drew attention to the magnitude of the problem in childhood and emphasized the need of longitudinal studies to support clinical practice guidelines for the target population.

There are few longitudinal studies on the relationship between nonnutritive sucking habits and anterior open bite. Likewise, there are few Brazilian studies on the most

Table 2. Prevalence of Anterior Open Bite According to Pacifier- or Digit-sucking Habits in Different Studies

Author(s)	Year	Country	Nature of study	Sample	Age in years	Anterior open bite (%)	
						Pacifier-suckers	Digit-suckers
Adair et al <sup>13</sup>	1995	USA	Cross-sectional	218	2-4	17	Not reported
Farsi, Salama <sup>7</sup>	1997	Saudi Arabia	Cross-sectional	583	3-5	36	50
Karjalainen et al <sup>5</sup>	1999	Finland	Cross-sectional	148	3	18	
Warren, Bishara <sup>3</sup>	2002	USA	Cohort	547	0-1	5	5
					1-2	4	0
					2-3	0	0
					3-4	0	15
					4-5	25	37
Katz, Rosenblatt, Gondim <sup>2</sup>	2004	Brazil	Cross-sectional	330	4	88	52

prevalent malocclusions in childhood and their associated factors. This is particularly true for the Northeast region of the country.

The purpose of this longitudinal study was to assess the relationship between nonnutritive sucking habits and anterior open bite among 4- and 5-year-old children attending state schools in the city of Recife, Pernambuco, Brazil.

## Methods

This study is a longitudinal follow-up of subjects from a previous cross-sectional study.<sup>2</sup> It was conducted in public schools attended by a lower-income population in the city of Recife, the capital of the state of Pernambuco in the northeastern region of Brazil.

This research was reviewed and approved by the Ethics Committee of the Pernambuco State University—Brazil. Data were collected in 2 separate phases (the first carried out in 2002 and the second in 2003) via a questionnaire, and clinical examinations were performed by a single calibrated examiner.

A pilot study was conducted with 100 4-year-old children. Results from the pilot study were used to determine the sample size of the main study and to test both the questionnaire and clinical procedures.

The representative sample was calculated to be 252 children. This number was increased by 30% for possible losses during the study period. Thus, the initial sample consisted of 330 4-year-old children.

Children were randomly sampled and selected from 14 of the 153 schools by a stratified randomized sampling technique. Schools were randomly selected from the administrative regions according to the number of schools in each region.

The present study set out to assess digit- and pacifier-sucking habits. The questionnaires included questions on sex, date of birth, and history of nonnutritive sucking habits and were completed during personal interviews with each child's mother or guardian.

Occlusion was assessed with the jaws in centric occlusion. The examiner was blind to the questionnaire data on each child. The examinations were performed under natural light in a classroom using tongue blades, gloves, and masks.

When the posterior teeth were in occlusion, anterior open bite was recorded as the presence of a lack of vertical overlap equal to or greater than 3 mm between the primary incisors.

Excluded from the sample were children:

1. whose parents did not authorize participation in the study;
2. with extensive cavities or extensive restorations, accentuated occlusion wear and tear, and early loss of primary teeth;
3. with alterations in the number, size, and shape of their teeth, syndromes, or systemic dysfunctions with repercussions for craniofacial growth;
4. undergoing orthodontic treatment;
5. with cleft palates.

A second criterion was adopted because the loss of dental structure, mainly in the cusp region, can imply the reduction of the vertical dimension and the inversion of the occlusal contacts in posterior teeth. The presence of extensive cavities including occlusal surfaces might lead to a false diagnosis of posterior crossbite or anterior open bite.

To test intraexaminer reliability, 33 children were re-examined at least 1 week later for each of the 2 data collection phases. Kappa values ranged from 0.90 to 0.95.

The data were statistically analyzed with SPSS software version 7.5<sup>25</sup> and SAS system version 8.2.<sup>26</sup> Bivariate analysis, Pearson chi-square test, McNemar test, and Stuart-Maxwell test were used for the statistical analysis. Significance was predetermined at  $P < .05$ .

## Results

During the sample selection phase, only 10 children did not meet the criteria for the study. After a year of follow-up, the dropout rate was 7% ( $N=25$  children). These children were not included in the final sample because of the following criteria:

1. extensive caries ( $N=11$ );
2. early loss of primary molars ( $N=5$ );
3. more than 2 consecutive failures to attend examinations ( $N=2$ );
4. failure to find children in school or in their homes ( $N=5$ ).

No systematic difference was detected between children who failed to complete the study and those who did. Ultimately, the study sample consisted of 305 children.

At the beginning of the study, the children's ages ranged from 4 years to 4 years, 11 months, with the average age being 4 years, 5 months. By the end of the study, their ages ranged from 5 years to 5 years, 11 months, the average age being 5 years, 7 months. The proportion of boys to girls at both the beginning and the end of the study was approximately 50%.

A statistically significant reduction in the prevalence of nonnutritive sucking habits ( $P < .001$ ) was observed. The prevalence of pacifier use fell from 28% (initial examination) to 19% (final examination). The prevalence of digit-sucking also showed a reduction from 8% to 7%.

Sucking habits were not found to be associated with gender ( $P=.632$  and  $P=.218$ , for the initial and final examinations, respectively). A statistically significant reduction of the prevalence of anterior open bite was observed. The final prevalence (29%) was significantly lower ( $P < .05$ ) than that at initial examination (33%). Anterior open bite was also not found to be associated with gender ( $P=.647$  and  $P=.450$ , for the initial and final examinations, respectively). A statistically significant association was found between the occurrence of anterior open bite and sucking habits at both examinations ( $P < .001$ ; Table 3).

Table 3 shows the initial and final prevalence of anterior open bite according to sucking habits. At the initial examination, it was observed that 71% of the children with anterior open bite had pacifier-sucking habits. The prevalence of anterior open bite among children with digit-sucking habits at the final examination was 13%.

**Table 3. Prevalence of Anterior Open Bite According to Sucking Habits**

Sucking habits	AOB (initial examination)*				AOB (final examination)*			
	Yes		No		Yes		No	
	N	%	N	%	N	%	N	%
No sucking	16	16	179	88	20	23	205	95
Pacifier-sucking	73	72	12	6	52	59	5	2
Digit-sucking	13	13	12	6	16	18	7	3
Total	102	100	203	100	88	100	217	100

\*Stuart-Maxwell test;  $P < .001$ .

An increase in anterior open bite prevalence was verified among children with no sucking habits (16% at initial examination, 23% at final examination) and among children with digit-sucking habits (13% at initial examination, 18% at final examination). Among children with pacifier-sucking habits, the prevalence fell from 71% to 59% after a year (Table 3).

Regarding children who exhibited sucking habits at the beginning of the study ( $N=112$ ), 30% ( $N=34$ ) had abandoned these habits by the end. No statistically significant association was found between the abandoning of sucking habits and gender ( $P=.218$ ).

Self-correction of anterior open bite was associated with the breaking of sucking habits ( $P < .001$ ; Figure 1). Regarding the 102 children who exhibited anterior open bite at the beginning of the study, 29 (28%) presented self-correction of this malocclusion (Figure 1).

Anterior open bite was associated with the children's behavior in relation to sucking habits; 100% of the 55 children who persisted in their sucking habits until age 5 exhibited no self-correction of this malocclusion (Figure 1).

The greatest percentage of anterior open bite self-correction was observed among children who had abandoned their sucking habits by the final examination (78%). It was found that 35% of the children without any history of sucking habits presented anterior open bite self-correction, whereas 65% continued to exhibit this condition (Figure 1).

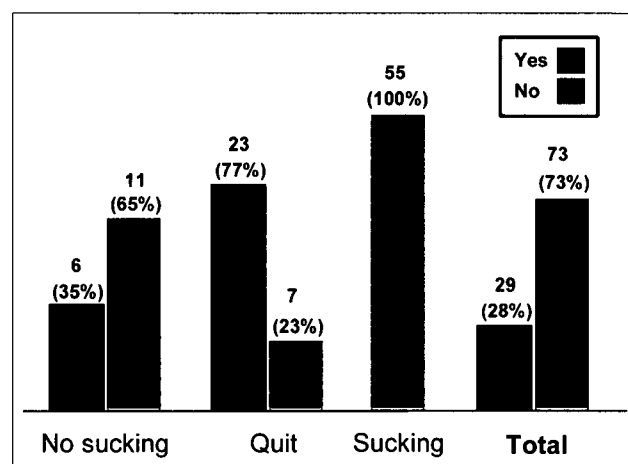


Figure 1. Prevalence of anterior open bite self-correction according to sucking habits.

## Discussion

The longitudinal nature of this study was appropriate for investigating the possible effect of a risk factor (nonnutritive sucking habits) in the occurrence of anterior open bite, especially since no intervention was carried out on the sample, which could have masked the results.

The sample was representative of the population studied, having been calculated on the basis of the

data obtained by means of a pilot study. The percentage of loss to the overall sample (7%) may be considered as "loss by chance." It produced no significant effect on the results of the investigation, as it was considerably less than 20%.

The prevalence of digit- and pacifier-sucking habits was lower than that found in other studies.<sup>7,9-11,13</sup> This has probably occurred as a result of distinct regional and cultural characteristics.

After 1 year, a 12% reduction in the prevalence of the pacifier-sucking habit was observed, whereas the prevalence of the digit-sucking habit showed an incidence of 5%. This result reflected a natural tendency among preschool children toward abandoning the pacifier-sucking habit. Otherwise, the findings suggest that the habit of digit-sucking is more difficult to abandon than that of pacifier-sucking, for it may act as a substitute for the latter.

Sucking habits were not associated with gender. This finding differs from other studies that found sucking habits to be more frequent among girls.<sup>8,27,28</sup>

Anterior open bite was associated with sucking habits. This finding is in accordance with several studies.<sup>3,5,7,10,13</sup> Some studies, however, presented discrepant results regarding the prevalence of this malocclusion among 4- and 5-year-old children presenting sucking habits.<sup>3,7,10,13</sup> This could be explained by differences in the age group and methodology of each study.

The prevalence of anterior open bite presented a reduction of 33% to 29% after 1 year. This reduction was statistically significant, reflecting the self-corrective character of this malocclusion over time and its association with the abandoning of sucking habits.

On the other hand, even considering this reduction, a high percentage of children still presented anterior open bite. Authors reported that many cases of open bites would resolve spontaneously before the age of 12 due to the abandonment of nonnutritive sucking habits and the maturation of the swallowing pattern.<sup>29</sup> Therefore, a longer period of follow-up of this sample is needed to supply scientific evidences to justify the early clinical intervention.

There was a high prevalence of children who continued to exhibit anterior open bite after 1 year of follow-up, but who did not have a history of sucking habits (65%; Figure 1). This finding highlights the multifactorial etiology of anterior open bite.

Breathing and swallowing patterns also constitute etiological factors of anterior open bite. These, however, were not considered in the present investigation due to diagnostic difficulties presented by the unfeasibility of carrying out complementary examinations within the scope of the study.

## Conclusions

Based on this study's results, the following conclusions can be made:

1. The low prevalence of nonnutritive sucking habits and its reduction during the period studied seem to reflect a natural tendency in preschool children.
2. Even presenting a slight reduction, the high prevalence of anterior open bite draws attention to the importance of longitudinal studies to support scientific evidences to early clinical intervention.

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