

Feeding, Artificial Sucking Habits, and Malocclusions in 3-year-old Girls in Different Regions of the World

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ABSTRACT

Purpose: The way babies and young children are reared is important to their health and development. Extensive breast-feeding has also been shown to reduce the development of artificial sucking habits like digit or pacifier-sucking. The aim of this study was to determine feeding methods, artificial sucking habits, and the presence of malocclusions in 3-year-old girls living in different regions of the world.

Methods: Children from the following countries were involved in the present study: (1) Brazil (Porto Alegre); (2) Japan (Niigata); (3) Mexico (Mexico City); (4) Norway (Oslo); (5) Sweden (Falköping); (6) Turkey (Istanbul); (7) and the United States (Iowa City, Iowa). During the interview and examination, the following variables were evaluated and registered: (1) breast-feeding and bottle-feeding; (2) duration and frequency; (3) sucking habits; (4) posterior and anterior crossbites; and (5) other malocclusions/normal occlusion.

Results: The prevalence of breast-feeding was very high in all groups, ranging between 78% and 98%. The prevalence of bottle-feeding in the different areas was also high. Except for Iowa City, the prevalence of digit-sucking was relatively low. Pacifier-sucking is fairly popular in most areas, with the exception of Niigata. The prevalence of normal occlusion in different cities ranged from 38% to 98%.

Conclusions: There are considerable differences in feeding, as well as artificial sucking habits, in different areas of the world and at different periods. (*J Dent Child* 2005;72:25-30)

KEYWORDS: FEEDING, FINGER-SUCKING, MALOCCLUSION, PACIFIER

The way babies and young children are reared is important to their health and development. Breast-feeding has been the most common method of feeding and is considered by most as the superior way to feed infants. Be-

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tween the 16th and 19th centuries, however, in some areas of central northern Europe that are now Germany and Austria, it was common to feed the child artificial food since breast-feeding was regarded as unclean.¹ Also, in the northern part of Sweden and Finland, artificial feeding was common and thought to be the cause of a high infant mortality (50%) in the early 1800s.²

Extensive breast-feeding has been shown to reduce the development of artificial sucking habits like digit or pacifier-sucking.³ This correlation was probably much stronger in ancient times, when the baby normally was breast-fed "on demand" (ie, was allowed to suckle when it wanted to and for as long as it wanted).⁴ Among the upper class in France, it became popular in the 12th century to use wet nurses. Sometimes, the wet nurse stayed with the child's parents, but it was more common to use a young woman from the countryside to care for the baby in their own home for about 2 years.⁴

In the mid-18th century in Europe, however, Hunter⁵ and Rosén von Rosenstein⁶ stated that it was essential for the mother to breast-feed her own child to avoid milk fever. Upper-class mothers had to breast-feed themselves and started to schedule the breast-feeding periods 4 to 6 times a day to reduce the inconvenience this activity had on their social life. The reduced opportunity to suckle made the baby more prone to develop artificial sucking habits.

Different objects were introduced to satisfy the sucking urge of young children. Sucking bags were the forerunners of the modern pacifiers. They consisted of a piece of gauze or thin cloth soaked in a mixture of sweet gruel or a solution of sugar or honey in water squeezed free of excess fluid and given to the child to suck.⁷⁻⁹ Additionally, strips of rug were used. They were knotted to enclose various food-stuffs. These rug bags contained pieces of bread, grain, meat, or fish. The various foods were moistened in the infant's mouth or by using honeyed milk, brandy, etc.⁷ In the second part of the 19th century in Europe, a rubber pacifier, visibly similar to the one used today, was introduced.

Substitute feeding of babies has been practiced for a very long time, even though it was not common. Remnants of nursing bottles have been found in children's tombs from several thousand years ago. In 1429, the monk von Louffenburg wrote a poem on body care and included some instructions about the care of young children. The poem is interesting because Louffenburg was the first to depict a feeding bottle with a design that is still used today.¹⁰

The change in feeding methods has been most pronounced in the western world in the first and middle part of the 20th century. The increase in the number of women working outside the home further contributed to an increase in artificial feeding methods. During the late part of this period, breast-feeding became even less popular, while artificial sucking habits became more frequent. In the 1970s in Sweden, only 4% of the children were breast-fed at 6 months of age.¹¹ After this period, however, breast-feeding started to become more popular. In 1997, 67% of children still suckled at 6 months of age.³ Despite this considerable increase in breast-feeding and breast-feeding time, artificial sucking habits—especially pacifier-sucking—has not decreased in Sweden. In fact, the opposite has occurred.¹²

Numerous studies have registered a correlation between artificial sucking habits in young children and malocclusions.^{3,11-25} The most serious effect is the increased incidence of posterior crossbite but anterior open-bite and postnormal canine and molar relationships have also been frequently reported.

There are considerable differences in feeding, as well as artificial sucking habits in different areas of the world and



Figure 1. Area of study: Brazil (POA); Japan (NIG); Mexico (MXC); Norway (OSL); Sweden (FAL); Turkey (IST); and United States (IOW).

also at different periods of time. Tradition, cultural influences, and how babies are reared are possible influential factors. Therefore, the aim of this study was to determine the feeding methods, artificial sucking habits, and presence of malocclusions in various groups of 3-year-old girls living in different areas of the world. This study was limited to girls because artificial sucking habits are more common and intense among girls, with a greater effect on the occlusion.^{11,25}

METHODS

Children from the following countries (Figure 1) were involved in the present study: (1) Brazil (Porto Alegre); (2) Japan (Niigata); (3) Mexico (Mexico City); (4) Norway (Oslo); (5) Sweden (Falköping); (6) Turkey (Istanbul); and (7) the United States (Iowa City, Iowa).

Sixty 3-year-old girls from each of 5 of these populations were randomly selected out of a larger sample participating, such as in The Iowa Fluoride study,²⁶⁻²⁹ whose mothers consented to participation for their children. The Swedish and Mexican sample did not quite fulfill the sample size criteria, but still took part in the study. The Swedish group consisted of 3-year-old girls followed from birth. Because of attrition, the group's size decreased from 60 to 49 by the time the children were 3 years old. The Mexican group's size was 58 children.

Investigators were pediatric dentists, orthodontists, or community dentists. Before these investigations started, the investigators who carried out studies in Oslo, Falköping, Istanbul, and Mexico City met in Oslo to standardize the questionnaire and registrations and to calibrate the results (February, 2003). Investigators from Niigata, Porto Alegre, and Iowa City were calibrated by letters, as they were unable to travel to Europe at the time.

Before the mothers were interviewed and the children examined, it was emphasized that study participation was voluntary. The interviews and examinations were carried out by dentists and, in several cases, assisted by specially trained nurses. During the interview and examination, the following variables were evaluated:

Table 1. Prevalence of Breast-feeding and its Duration in Various Samples Evaluated in the Present Study

Location of subjects evaluated	Nos. and % of girls who started to breast-feed		Mean duration among those who started to breast-feed
	N	%	Mos
Brazil (POA)	47	78	7
Japan (NGT)	55	92	9
Mexico (MXC)*	57	98	13
Norway (OSL)	58	96	11
Sweden (FAL)	54	90	8
Turkey (IST)	59	98	11
USA (IOW)	55	92	3

*Only 58 girls.

1. breast-feeding, bottle-feeding, duration, and frequency;
2. sucking habits;
3. posterior and anterior crossbites;
4. other malocclusions/normal occlusion.

RESULTS

BREAST-FEEDING (Table 1)

The prevalence of breast-feeding was very high in all groups, ranging between 78% and 98%. The mean duration of breast-feeding ranged between 3 and 13 months in the various samples.

BOTTLE-FEEDING

Bottle-feeding prevalence in the different samples was also high. Almost all 3-year-old girls used or had previously used a nursing bottle for various periods of time.

DIGIT-SUCKING (Table 2)

Digit-sucking prevalence in the different samples ranged between 2% and 55%. Except for the Iowa City sample, the prevalence of digit-sucking is rather low. Those who start a digit-sucking habit, however, have difficulty discontinuing it. In Falköping and Oslo, none of the digit suckers had stopped their habit at 3 years of age.

PACIFIER-SUCKING (Table 3)

Pacifier-sucking prevalence in the different samples ranged from 0% to 82%. Pacifier-sucking is fairly popular in most areas, with the exception of Niigata.

MALOCCLUSION (Table 4)

Normal occlusion prevalence in the different samples ranged from 38% to 98%. The data was not available for the Swedish and Mexican groups. For these groups, however, anterior and posterior crossbites have been registered.

Table 2. Prevalence of Digit-/Finger-/Thumb-sucking in Various Samples Evaluated in Present Study

Location of subjects evaluated	Nos. and % of girls who started a digit-sucking habit		Mean duration among those who started a digit-sucking habit
	N	%	Mos
Brazil (POA)	8	13	30
Japan (NGT)	17	28	20
Mexico (MXC)*	7	12	19
Norway (OSL)	13	22	36
Sweden (FAL)	6	10	36
Turkey (IST)	1	2	24
USA (IOW)	33	55	22

*Only 58 girls.

Table 3. Prevalence of Pacifier-sucking and its Duration in Various Samples Evaluated in Present Study

Location of subjects evaluated	Nos. and % of girls who started a pacifier-sucking habit		Mean duration of experience
	N	%	Mos
Brazil (POA)	49	82	32
Japan (NGT)	0	0	0
Mexico (MXC)*	3	5	9
Norway (OSL)	29	48	32
Sweden (FAL)	43	72	35
Turkey (IST)	30	50	16
USA (IOW)	26	43	30

*Only 58 girls.

Table 4. Prevalence of Malocclusions in Various Samples Evaluated in Present Study

Location of the subjects evaluated	Unilateral-bilateral crossbite		Anterior crossbite		Class II canine relation		Normal occlusion	
	N	%	N	%	N	%	N	%
Brazil (POA)	8	13	1	2	15	25	26	43
Japan (NGT)	0	0	1	2	0	0	59	98
Mexico (MXC)†	6	10	1	2	*	*	*	*
Norway (OSL)	12	20	*	*	*	*	23	38
Sweden (FAL)‡	2	4	1	2	*	*	*	*
Turkey (IST)	4	7	2	3	1	3	53	88
USA (IOW)	8	13	6	10	17	28	30	50

*Not registered.

†Only 58 girls.

‡Only 49 girls.

DISCUSSION

BREAST-FEEDING

Currently, in most parts of the world, mothers breast-feed their babies. This is a significant change compared to only 1 or 2 generations ago. For example, in Sweden in the 1970s, only 20% of mothers started to breast-feed,^{30,31} and less than 4% of mothers breast-fed their children at 6 months of age.¹⁴ Conversely, present findings suggest that 90% started to breast-feed and 67% were still breast-feeding at 6 months. Similar trends were also observed in Norway.³²⁻³⁴

In old Japan, rural villagers used to primarily feed their babies from their own breasts. When mothers did not have an adequate supply of milk, they obtained breast milk from a neighbor that had more. To replace wet nursing, bottle-feeding was introduced in Japan after 1867. In 1974-1975, the Japanese government emphasized the World Health Organization's breast-feeding recommendations. The steady decline in breast-feeding throughout Japan was reversed. Thereafter, physicians strongly supported breast-feeding.³⁵ In the present study, 92% of Niigata girls were breast-fed.

In Brazil 10 years ago, the breast-feeding rate was 46% in children 0 to 3 months old, and breast-feeding on average lasted 9 months.³⁶ In the present study, 78% of girls in the Porto Alegre sample were breast-fed.

In a 2003 study, Kargul et al³⁷ indicated that 83% of the girls evaluated in Istanbul were breast-fed. In the present study, 98% of the Istanbul sample were also breast-fed. In 1958, only 11% of American children were breast-fed.²² In the current findings, 92% of the girls were breast-fed. Breast-feeding in this group, however, was for a much shorter period than was observed in other samples.

BOTTLE-FEEDING

Bottle-feeding was found to be very popular in the different samples evaluated, and the nursing bottle was normally used until at least 1½ to 2 years of age. In the United States, it is currently stated that predominant bottle-feeding between 0 and 6 months of age was associated with the development of a pacifier habit.³⁷ There are reasons to note, however, that the bottle is used differently in many regions. In Sweden, most children up to the age of 2 to 3 years are fed gruel 1 to 2 times daily from a nursing bottle. Normally, it is the first and last meal of the day, and it consists of 200 to 250 ml of high-caloric gruel that serves as a full meal. In the other studied areas, it seems that the young children are given milk, water, juice, or other beverages in the bottle. The bottle is just a way to facilitate drinking.

In a new study, Kargul et al³⁸ stated that 61% of the girls examined in Istanbul were bottle-fed, compared to 67% in the present study. A decade ago, bottle-feeding prevalence was 48% in Japanese children,³⁹ however, it was 83% in the present group. The figures obtained for the Swedish and Norwegian samples were 76% and 62%, respectively.

Prevalence of sucking and feeding habits in Brazil seems to differ from state to state as a result of ethnic and cultural differences. According to the United Nations, Rio Grande do Sul

has a high human development index, comparable with some European countries. In the present study, 95% of the Porto Alegre sample was bottle-fed, compared to a bottle-feeding prevalence of 35% and 75%⁴⁰ in other parts of the country.

DIGIT-SUCKING

Except for Iowa, the prevalence of digit-sucking is rather low. In the United States, the prevalence of digit-sucking in 4-year-olds was found to be 46% in 1958²² and 55% in the present sample. In this same sample, breast-feeding was practiced mostly for 3 months, which is a relatively short period compared to the study's other samples. It may be possible that this behaviour triggers digit-sucking. In a study on Istanbul girls, a prevalence of 8% digit-sucking³⁸ was observed, and there seems to be no preference for finger or thumb-sucking.

In Sweden, only 10% of the girls were digit suckers. According to Larsson,^{3,11,41,42} the prevalence of digit-sucking has diminished from 30% to 10% over the last 40 years. A prevalence as high as approximately 50% has been reported in the mid-20th century.⁴³

Larsson⁴⁴ suggested an explanation for the significant differences in the prevalence and duration of breast-feeding between today's rearing of babies and the situation among our ancestors. This author stated: "The infant has a sucking instinct that varies in degree among individuals, but is usually powerful. After the child's first cereal or mother's milk, a surplus sucking urge often remains. The extent of this surplus is dependent on the extent of the original urge, on how much of it has been spent on the original urge, and on how much of it has been spent on the intake of nourishment. The surplus sucking urge may be either frustrated or re-channelled.

For the child, the most attractive method (and probably the most original) is unrestricted, sometimes non-nutritive sucking. If this possibility is not available, the child must choose between digit and pacifier-sucking to obtain satisfaction. If the surplus sucking urge is not so strong, it can probably be diverted and the child can find satisfaction through physical closeness and cuddling/stimulation."

In 1975, finger-sucking prevalence was found to be 31% in 3-year-old Japanese children.³⁵ The present study found a similar prevalence of 28% almost 30 years later.

PACIFIER-SUCKING

There is some evidence that pacifiers may do less harm to the dentition, particularly because pacifier habits are often spontaneously shed at about 2 to 4 years of age.⁴⁵ In Niigata, none of the girls had a pacifier-sucking habit. In 1975, however, Takeuchi³⁵ found the prevalence of pacifier-sucking to be 6% in 3-year-old Japanese children. It does seem that the pacifier is less common in Japan than in the rest of the investigated areas.

In 1994, 85% of 2-year-old children in a Brazilian community were found to be pacifier suckers.⁴⁶ The sample of girls from Porto Alegre in the present sample seems to have the same potential for sucking pacifiers. In 2003, Kargul et al³⁸ observed that Istanbul girls have a pacifier-sucking prevalence of 38%. In the present study, 50% of the Istanbul sample used a pacifier.

In Sweden, the prevalence of pacifier-sucking is also high. In this study, 72% of the girls had the habit. Corresponding figures have been noted in other studies of Swedish children.⁴² The prevalence has increased from less than 50% since the 1960s.⁴¹ Compared to the situation in the 1960s, the children in this study also sucked the pacifier longer. In the present study, only 10% had abandoned the habit at 3 years of age, while in the 1960s most children stopped before that age.

In the Norwegian study, the pacifier-sucking rate was relatively high (48%), but not quite as high as in the Swedish sample. In a previous study,⁴⁷ a prevalence of 40% to 50% had been registered.

MALOCCLUSIONS

Great differences in the prevalence of malocclusions were registered in this study. Only 1 of the Japanese girls had a malocclusion, an anterior crossbite. In the Oslo sample, only 38% of the children had normal occlusion. The high prevalence of malocclusions among the Norwegian children was probably due to the high prevalence and long duration of artificial sucking habits.

CONCLUSIONS

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

1. The prevalence of breast-feeding was over 78% in the countries studied around the world.
2. Almost all 3-year-old girls used or had used a nursing bottle for some time.
3. The prevalence of digit-sucking was rather low, with the exception of girls in Iowa.
4. Pacifier-sucking is fairly popular in most areas; however, none of the Japanese girls experienced the habit.
5. The prevalence of normal occlusion in the different samples ranged from 38% to 98%.

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