

# Correlation of Feeding Practices and Dental Caries among Preschool Children of Jazan, KSA: A Cross-sectional Study

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## ABSTRACT

**Objective:** Breastfeeding is integral for the healthy development of infants during the first year of life. The objective of this study was to investigate the feeding practices and their effect on dental health among Saudi children in rural Jazan, the southern region of Saudi Arabia.

**Materials and methods:** A cross-sectional study was conducted among 330 participants from two villages namely Baish and Abu-Areesh of Jazan Province, Kingdom of Saudi Arabia. Mothers whose children were above 2 years of age agreed for a face-to-face interview to discuss about feeding practices followed for their children. Later, these children underwent a complete dental examination.

**Results:** In this study, it was found that a majority of mothers, 203 (61.15%) of them breastfed their children for less than a year, 105 (31.8%) of them breastfed for 2 to 4 years, and the remaining 22 (6.6%) of them breastfed for more than 4 years. Two hundred and forty-nine (75.15%) moms reported that they added sugar to milk while feeding and 259 (78.4%) mothers reported using sugar with pacifiers. Increased incidence of caries was seen with a statistically significant difference in children who were fed during sleep ( $p = 0.038$ ), when the infant's teeth were not brushed after feeding ( $p = 0.004$ ), and when sugar was added while feeding ( $p = 0.001$ ).

**Conclusion:** Prevalence of dental caries was high in children who were fed during sleep and also in those kids using pacifiers containing sugar. Oral hygiene practices were also inadequate and positively associated with dental caries. These findings are suggestive of developing general and oral health interventions for children and also educating mothers on appropriate feeding practices.

**Keywords:** Bottle feeding, Breastfeeding, Dental caries, Oral hygiene.

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## INTRODUCTION

The importance and necessity of breastfeeding is well-established globally. In Saudi Arabia, the law is based on the Quran and the Hadiths, or the sayings of Prophet Muhammad. The Quran instructs its followers to breastfeed children for 2 complete years saying that "The mothers shall give suck to their offspring for two whole years for him who desires to complete the term. But he shall bear the cost of their food and clothing on equitable terms" (2:233). The World Health Organization (WHO) and the United Nations Children's Fund (UNICEF) recommend that mothers should breastfeed babies exclusively for the first 6 months and then continue breastfeeding along with other weaning foods for up to 2 years or later.<sup>1,2</sup> Mothers should slowly start introducing semisolid and solid foods soon after the infant completes 6 months of age. Numerous studies have been carried out in Saudi Arabia regarding infant feeding practices. The studies reported that infant feeding among mothers in the country is less than optimal.<sup>3</sup> The research conducted at a University Hospital in western Saudi Arabia regarding infant feeding practices reported that breastfeeding rates were 90% for infants in the first 6 months of life but dropped to 72% soon after that. Mothers gave various justifications for such drastic drop in rates, such as inadequate milk supply (50%), their role as working mothers (12.7%), and lifestyle (10%), which prevented them from exclusively breastfeeding kids during the first 6 months. It was noted that the most common impediment to sustain breastfeeding through the recommended period was the general misconception among mothers regarding adequacy of milk supply.<sup>3</sup> In another recent study (2014) regarding breastfeeding practices adopted by Saudi mothers, babies were mixed fed (introduction of feeding bottle)

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even during the first month of infancy which is quite shocking.<sup>4</sup> The discussion of bottle feeding and breastfeeding, and its association with dental caries remains unsolved. There is always a disagreement between the findings of authors regarding the correlation between bottle feeding and dental caries, and breastfeeding and caries. Therefore, we need studies to clarify the connection between these factors and make things clear.<sup>5</sup>

The objective of the present study was to investigate the feeding practices and their effect on dental health among Saudi children in rural Jazan, the southern region of Saudi Arabia, and its correlation with dental caries.

## MATERIALS AND METHODS

A cross-sectional study was carried out in two villages namely Baish and Abu-Areesh of Jazan Province, Kingdom of Saudi Arabia. Before starting the study, ethical clearance was obtained from the Institutional Review Board (IRB). The sample size required for this study was estimated with a power of 80% and a 95% confidence interval for the prevalence of 50%. Thus, the sample size needed for this study was 330 subjects from both genders. Written informed consent was obtained from the willing participants and data required for the study were collected from the subjects' moms through a face-to-face interview regarding feeding practices followed for their kids with the help of a self-administered structured questionnaire. Following this, the kids were subject to a complete dental examination with the help of a mouth mirror, a probe, and a flashlight.

The questionnaire consisted of three sections. The first section probed into the demographic details of the kid including the kid's age and gender followed by the second section which included parent-related information. This consisted of in-depth information on the feeding practices and oral hygiene practices followed by mothers every time during/after a feed. The third section dealt with the dental caries status of the child.

The respective psychometric properties (validity and reliability) of the questionnaire were assessed. Content validity was evaluated by a panel of eight experts which included faculty members. The main purpose was to depict those items with a high degree of agreement among experts. Aiken's V test was used to quantify the concordance between experts for each item and values higher than 0.88 were obtained for all the questions. The feasibility of the questionnaire was assessed by conducting a pilot study among patients attending the college's dental clinic.

Intraoral examination was conducted using standard infection control protocol by four dental students who were trained and calibrated to assess the presence of dental caries in the Public Dental Health, division of Preventive Dental Science Department, College of Dentistry, Jazan University, Kingdom of Saudi Arabia.

Data were entered and analyzed using SPSS version 21 (IBM Corporation, Armonk, New York, USA). Since all variables described in the questionnaire are categorical variables, data were summarized as proportions. Descriptive statistics was calculated; the chi-square test was used to compare demographic data with the feeding practices and oral hygiene practices; and  $p < 0.05$  was considered as statistically significant.

## RESULTS

In the present study, a total of 330 filled questionnaires were analyzed and the response rate was 100%.

Table 1 shows descriptive analysis of study variables.

Overall, 330 parents and children were interviewed and screened, respectively. Out of 330 children, 113 (34.2%) were male participants and 217 (65.8%) were female participants.

The mothers' responses to feeding and oral hygiene practices were analyzed. Fifty (15.2%) children were fed using natural feeding methods, 31 (9.4%) of them were fed using artificial means, and 249 (75.45%) children were fed using a combination of both natural and artificial methods. Most mothers, which totals to 215 (65.15%) of them, informed that their kids were fed during sleeping while only 115 (34.84%) mothers were definite that their children were not fed during sleeping.

**Table 1:** Descriptive analysis of the study variables

<i>Study variable</i>	<i>Percentage</i>	<i>Frequency (N)</i>
Gender		
Male	34.2	113
Female	65.8	217
Type of feeding		
Natural	15.2	50
Artificial	9.4	31
Both	75.45	249
Feeding during sleep		
Yes	65.15	215
No	34.84	115
Time of ceasing breastfeeding		
Less than a year	61.51	203
Between 2 and 4 years	31.8	105
Between 5 and 6 years	3.3	11
More than 6 years	3.3	11
Have you ever noticed a tooth decay in your child?		
Yes	26.66	88
No	13.33	44
Don't know	60	198
Do you brush your child's teeth after feeding?		
Yes	34.84	115
No	65.15	215
Do you add sugar while feeding?		
Yes	75.5	249
No	24.5	81
Do you use a pacifier?		
Yes	50.61	167
No	9.7	32
Don't know	39.6	131
Do you add sugar to the pacifier?		
Yes	78.4	259
No	16	53
Don't know	5.4	18

N—Total number of respondents

When mothers were enquired about how long they continued to breastfeed their kids, surprisingly 203 (61.15%) mothers reported that they fed their children for less than a year, 105 (31.8%) of them reported that they fed for 2 to 4 years, and the remaining 22 (6.6%) of them responded that they fed for more than 4 years. An enquiry was also conducted among mothers if they had ever noticed tooth decay in their children for which only 88 (26.66%) of them responded as yes and 44 (13.33%) replied as no while a majority of them (198 which is 60%) were unsure about it.

Only 115 (34.84%) mothers reported that they brushed their child's teeth after feeding and the remaining 215 (65.15%) mothers reported not following this practice.

A majority of 249 (75.15%) mothers reported that they added sugar to milk while feeding, whereas only 81 (24.5%) mothers clearly informed that they had never ever added sugar to milk before a feed. A total of 167 (50.61%) mothers used pacifiers, 32 (9.7%) mothers never used pacifiers, and 131 (39.6%) mothers were not aware of pacifiers. Two hundred and fifty-nine (78.4%) mothers

reported using sugar with pacifiers, 53 (16%) of them did not use sugar with pacifiers, and 18 (5.4%) of them were unaware of pacifiers. Table 2 describes the association of gender with study variables.

A statistically significant difference was seen between the gender and feeding while sleeping with a  $p = 0.001$ , tooth decay with a  $p = 0.019$ , adding sugar while feeding with a  $p = 0.001$ , with the use of pacifier with a  $p = 0.001$ .

No statistically significant difference was seen between gender and type of feeding, duration of breastfeeding, brushing the child's teeth after feeding, or adding sugar to milk while using a pacifier. Table 3 describes the relationship between feeding habits and tooth decay.

Kids suffered from increased tooth decay when they were fed using a combination of both natural and artificial methods of feeding but the results were not statistically significant. Increased incidence of caries was seen with a statistically significant difference in children who were fed during sleeping with a  $p$  value of 0.038, when child's teeth were not brushed after feeding with a  $p$  value of 0.004, when sugar was added while feeding with a  $p$  value of 0.001, with the use of pacifier as well as adding sugar with pacifier with a  $p$  value of 0.001. It was also observed that there was an increase in tooth decay rates among kids when breastfeeding did not continue

**Table 2:** Gender variation of the study variables

Variable	Gender		p value
	Male	Female	
Type of feeding			0.305
Natural	13	37	
Artificial	13	18	
Both	87	162	
Feeding while sleeping			<b>0.001*</b>
Yes	97	118	
No	16	99	
Time of ceasing breastfeeding			0.179
Less than a year	64	139	
Between 2 and 4 years	44	61	
Between 5 and 6 years	3	8	
More than 6 years	2	9	
Have you noticed a tooth decay in your child?			<b>0.019*</b>
Yes	37	51	
No	20	24	
Don't know	56	142	
Do you brush your child's teeth after feeding?			0.224
Yes	34	81	
No	79	136	
Do you add sugar while feeding?			<b>0.001*</b>
Yes	104	145	
No	9	72	
Do you use a pacifier?			<b>0.001*</b>
Yes	38	129	
No	10	22	
Don't know	65	66	
Do you add sugar to the pacifier?			0.389
Yes	84	175	
No	21	32	
Don't know	8	10	

\*Significant  $p$  value obtained using Chi-square analysis

up to the child's first birthday but this increase in rate was simply insignificant.

## DISCUSSION

Breastfeeding is recognized as the optimal nutrition for infant health and development. World Health Organization recommends that women exclusively breastfeed their kids for a full 6 months and then continue breastfeeding them for at least 24 months and beyond along with introducing healthy solid and semisolid foods. In Saudi Arabia, the law is based on the Quran and the Hadiths, or the sayings of Prophet Muhammad. The holy book instructs its followers that breastfeeding must be performed until 2 years of age. There are numerous studies that have elaborated that breastfeeding is not only beneficial for infants but also beneficial for mothers in various ways. The mom is at a reduced risk of diseases and could even enjoy blissful weight loss when she breastfeeds her infant. Breastfed children, on the contrary, receive ideal nutrition, are at a reduced risk of diseases, loaded with essential antibodies, promote normal weight distribution, and are at a minimal risk of obesity. Breast milk is rich in protein content but low in sugar content. Studies have shown that sugar-containing breast milk might be cariogenic causing tooth decay.<sup>6,7</sup> Dental caries is a major oral health problem that affected more than 2.4 billion people (more than quarter of the world's population) worldwide in the year 2010.<sup>8</sup> A high prevalence of dental caries was evident among children in Saudi Arabia with an estimated prevalence of approximately 80%.<sup>6</sup> Other areas that top

**Table 3:** Relation of feeding habits with tooth decay

Feeding habits	Tooth decay		p value
	Yes	No	
Type of feeding			0.268
Natural	39	11	
Artificial	27	4	
Both	216	33	
Feeding while sleeping			<b>0.038*</b>
Yes	162	44	
No	109	15	
Time of ceasing breastfeeding			0.221
Less than a year	145	27	
Between 2 and 4 years	94	11	
Between 5 and 6 years	8	3	
More than 6 years	8	3	
Do you brush your child's teeth after feeding?			<b>0.004*</b>
Yes	75	27	
No	199	29	
Do you add sugar while feeding?			<b>0.001*</b>
Yes	134	68	
No	47	81	
Do you use a pacifier?			<b>0.001*</b>
Yes	74	96	
No	18	14	
Don't know	98	30	
Do you add sugar to the pacifier?			<b>0.001*</b>
Yes	156	48	
No	49	13	
Don't know	35	29	

\*Significant  $p$  value obtained using Chi-square analysis

the dental caries risk chart include Latin America, Middle East, and South Asia.<sup>7</sup> The WHO emphasizes the need to reduce the global burden of dental caries to benefit from optimal health. Consequently, in the year 2003, WHO and Fédération Dentaire Internationale (FDI) World Dental Federation set global goals for achieving better oral health by 2020 for guide planners and policymakers requesting them to improve the oral health status in their respective population.<sup>9</sup> Unfortunately, knowledge gaps concerning the availability of baseline data on oral health and population-specific key modifiable factors for dental caries restrict the ability of many developing nations and semi-developed countries, including Saudi Arabia, to achieve the goals set by WHO.<sup>10</sup> Most importantly, caries affecting deciduous tooth is known as early childhood caries (ECC). This is one of the major concerning factors regarding the oral health of growing kids. The causative factors of ECC include prolonged feeding habits and bottle feeding. Pediatric dentistry organizations, such as the American Academy of Paediatric Dentistry and the Japanese Society of Paediatric Dentistry, referred to breastfeeding as a potential risk for ECC in their policy statements.<sup>9,10</sup> Whereas, reviews of epidemiological studies have found the relationship between breastfeeding and ECC to be inconclusive.<sup>11,12</sup> A few studies suggest that breastfeeding may promote dental caries<sup>13-15</sup> while other studies have not found any association.<sup>16</sup> Therefore, we sought to examine the association between breastfeeding and feeding practices, and their effect on dental caries.

### Feeding Practices in Infants

Most mothers included in our study fed their kids naturally as well as artificially. The results here were similar to the survey conducted by Abdulaziz et al., who observed that 68.4% mothers used mixed feedings.<sup>17</sup> Mothers who used mixed feedings informed that they fed their kids artificially during daytime and naturally during nighttime. Such characteristics of partial breastfeeding was also seen in the study performed by Ogbeide et al.,<sup>18</sup> but none of the studies including ours could ascertain the amount of time an infant was fed naturally (breastfed) or artificially (infant formula) and the rate of breastfeeding initiation. It was very clear that, a greater number of children were fed during sleeping. This was in stark contrast with a survey conducted in Australia which showed that breastfeeding moms slept by their infant's side to facilitate easy nighttime feedings compared to those who formula-fed their children.

A majority of mothers stopped breastfeeding by the child's first year of age which reinstates the importance of breastfeeding even more than before. Human milk should be the standard and exclusive method of infant feeding during the first part of an infant's life for healthy upbringing of children. But this practice is not even close to WHO recommendations. Our study results were similar to the study results of Al-Jassir et al.<sup>3</sup> who observed that mothers continued to breastfeed beyond the recommended 6 months. The primary reason for ceasing breastfeeding beyond 1 year was mainly due to insufficient milk supply from the breastfeeding mom.<sup>3</sup>

Our study clearly showed that breastfeeding mothers were unaware of the simple ways of maintaining their child's teeth after feeding or were not even close to realizing the presence of a decay in their baby's teeth. This might be mainly due to certain factors, such as socioeconomic status, parents' education levels, and access to proper dental care facilities. Motivating and educating new mothers to follow oral hygiene care practices soon after every feed is the need of the hour. Most mothers who added sugar while feeding followed mixed feeding habits. Previous study results showed that 40% kids were on mixed feeding practices (breast as well as bottle feeding) and 5%

were fed on bottle during their first month of life.<sup>19</sup> The habit of using pacifiers and adding sugar with pacifiers was a common occurrence in our study. The sad fact here is that mothers are often not advised to refrain from using pacifiers until after breastfeeding has been well-established. The importance of using pacifiers and its effects on the infant's oral healthcare must be clearly explained to every new mother. The use of pacifiers might be a marker of various difficulties faced during breastfeeding including reduced stimulation during breastfeeding rather than being simply a cause for early introduction of top feeding. The primary disadvantage of using pacifiers includes early cessation of breastfeeding. A study conducted by Pineda et al. revealed that it was the low-socioeconomic status group that had higher usage of pacifiers.<sup>20</sup>

### Feeding Habits and Dental Caries

We observed dental decay in kids who were fed naturally as well as artificially and, also in those children, who were fed during sleeping. This may be due to milk formula supplementation and fluids alongside the concentration of sugar in such supplements.

Prolonged bottle feeding or breastfeeding during nighttime, contact of milk to the tooth surface for a longer time than needed and improper oral hygiene practices are few important factors that contribute to the development of carious lesions. The first eruption of primary tooth occurs around 6 months of age and is at a serious risk of exposure to bovine milk or supplements. Such continuous exposure and pooling of milk around the tooth are primary contributors toward dental caries.

Many studies have shown no relationship between natural feeding (breastfeeding) and dental caries.<sup>21</sup> Recent studies in the UK and US have shown that human and bovine milk can cause dental caries, but the prevalence rate is very less. This might be because of, both breast or bottle feeding during daytime and nighttime that prolonged for a continuous period of until at least 24 months.

In our study, the prevalence of dental caries was predominantly seen in those children who were breastfed for 1 year continuously. The results were similar to a survey conducted by Kato et al.<sup>21</sup> who observed that exclusively/partially breastfed infants for a period of at least 6 to 7 months were at an elevated risk of dental caries. But the same results are in complete contrast with studies performed by Kramer et al.,<sup>22</sup> Nunes et al.,<sup>23</sup> and Iida et al.<sup>24</sup> who proved that breastfeeding history (exclusive, partial, or mixed) had nothing to do with early childhood dental caries. Quite a few other studies by Tham et al.,<sup>25</sup> Benjamin et al.,<sup>26</sup> Peres et al.,<sup>27</sup> and Tanaka and Miyake<sup>28</sup> showed that breastfeeding continuously for >18 months was associated with an increased risk of caries.

### Pacifier and Dental Caries

Studies have shown that the use of pacifiers for a prolonged period may cause dental caries, and some confusion exists whether sweetened milk or sweet substance applied to the pacifier leads to dental caries. A study conducted by Peressini<sup>29</sup> does not prove a stable association between pacifier use and ECC. Our research showed that the risk of caries occurrence was greater when mothers used pacifiers with/without sugar applied on it. Some other studies conducted by Petti et al.<sup>30</sup> and Serwint et al.<sup>31</sup> observed that use of sweetened pacifiers increased the risk of dental caries. We could not establish the time of application, the duration of use of pacifiers, and also whether the pacifier was used during nighttime or daytime. Some of these factors need to be studied thoroughly and results fetched accurately to arrive at a conclusion whether or not pacifiers are involved in the occurrence of dental caries.



## LIMITATIONS

As feeding history was obtained retrospectively from mothers in a face-to-face interview, there is a constant possibility of a recall bias which is a primary limitation. Other factors that certainly could affect oral health status include socioeconomic status and general health of the mother during lactation period. Oral hygiene and dietary practices of children can have a lasting impact on their dental caries experience.

## CONCLUSION

In the present study, it was noticed that most mothers preferred both artificial feed and natural feed methods. It was also observed that feeding practices continued for a maximum period between 1 year to 6 years. Highest occurrence of dental caries was seen in those kids who were fed during sleep and also in children who were fed with pacifiers containing sugar. Children, or mothers of these kids, did not adhere to suggested oral hygiene practices and hence, a greater number of kids suffered from dental caries. These findings suggest that it is better to develop general and oral health interventions for such children with utmost emphasis given on educating mothers on appropriate feeding practices.

Further studies with more elaborate breastfeeding assessment methods are essential to determine the cariogenic nature of breastfeeding. Meanwhile, given the numerous benefits of breastfeeding, mothers should definitely be encouraged to breastfeed their infants.

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