

# A Cross-Sectional Study on the Oral Health of the Infants and Toddlers at the National Guard, Jeddah, Saudi Arabia

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## Abstract:

**Background:** The high prevalence of dental caries among preschool children had been reported in literature. However, studies on dental caries and related problems among infants and toddlers in Saudi Arabia are lacking.

**Aim:** This study assessed the oral health status of the infants and toddlers in the Iskan Primary Health Care (PHC) Center for the National Guard in Jeddah, Saudi Arabia.

**Settings and Design:** The assessment included 151 children between the ages of 5 to 36 months during 2015 to 2016.

**Materials and Methods:** The caregivers were provided with a structured questionnaire. Oral examinations on the children were based on the WHO's assessment form and criteria.

**Statistical Analysis:** Frequency, mean, standard deviation, and regression analysis were used for the risk assessment of the caries.

**Results:** Dental caries was reported in 9% of the children in the Center, and 95.5% of them were categorized as severe early childhood caries (S-ECC). More than half of the children were bottle-fed. About 70% of the caregivers never cleaned their children's mouth. The caries among the children was highly associated with bottle-feeding during their sleep.

**Conclusions:** Nocturnal bottle-feeding, failure to clean the children's mouths, and the use of cleaning materials other than toothpaste were identified as the risk factors that promoted the development of caries among the children. With these findings, we recommend that the mothers and the medical professionals should be trained on necessary oral health practices. Early preventive dental health services within the National Guard health services should be initiated.

**Key words:** infants and toddlers; dental caries; Saudi Arabia; feeding practices; national guard; early dental visit; oral hygiene; dental trauma

**Running title:** Ba-Akdah et al.: A study on the oral health of the infants...

## Introduction

The most commonly diagnosed oral disease in young children is dental caries, which is often associated with poor oral hygiene practices. [1,2] Early childhood caries (ECC) is a major health concern among preschool children, which has serious impacts on their physiological development, mental

health, and their quality life. [3,4] The WHO considers dental caries as the third most prevalent chronic disease and as a global pandemic.[5] Several studies found out that poor diet, not brushing the teeth, and the use of non-fluoridated toothpastes are the main factors in developing deciduous dental caries among preschool children.[2,6-9] The limited oral health knowledge

of parents and the poor diet of their children had greatly impacted on the oral health of their children. [10]

The prevalence of ECC has been reported as high as 90% globally [11] and 80% among preschool children in Saudi Arabia. [12] According to the WHO, the prevalence of dental caries among children in Saudi Arabia is moderate to high, [13] with the significantly high levels observed in some regions. [14,15] Although meta-analysis in KSA showed a higher prevalence of caries in deciduous teeth, compared to that in the permanent teeth, [16] no studies yet was reported about the prevalence of caries in infants and toddlers.

The risk on the early damage of the deciduous teeth of less than six-year old children had been attributed to various factors, with the parents' level of knowledge and perceptions as the main contributing factors. [17] Early tooth damages were directly related to the practices of the parents, such as allowing their children to sleep with feeding bottles and to have a high intake of sugar. [18] Parents can influence their children's oral health from a very young age, which plays an important role in maintaining good oral hygiene. [19,20] So, parents must be educated about preventive oral health, including the importance of early and regular dental visits, proper feeding and oral hygiene practices, and right diets. Parents commonly have low levels of awareness about the importance of early visits to the dentist. [21-33]

Parents take their child to the dentist, only when there is a traumatic injury or when the child is in pain. [23] Several studies had also shown that parents did not have adequate knowledge of childhood caries, especially on the primary dentition. [22,24,25] The educational background and the low socioeconomic status of the parents had been linked to poor oral hygiene and the prevalence of dental caries in children. [23,26] Thus, it is imperative to focus intervening efforts on the education of parents about appropriate oral health care and on the importance of regular dental visits for their children. There are very few studies in Saudi Arabia that dealt with the levels of the knowledge and perceptions of parents about the oral health of their young children. Thus, we designed our study to assess the oral health status of the National Guard (NG) infants and toddlers, in addition to the evaluation on the attitudes and perceptions of the parents towards oral health practices on their young children. Oral health data can provide scenarios for appropriate dental measures to improve the oral health standards for children in Saudi Arabia. The knowledge gained from the children of the NG will facilitate the design and implementation of preventive oral health programs that are geared towards the oral health education of parents across the Saudi regions.

## Methodology

### Study design and setting

This study was designed to evaluate the dental health of children in the NG. The First Dental Visit program was initiated as a collaboration between the Dental Department of the King Abdulaziz Medical Center (KAMC) and the Family Medicine Department of the Iskan Primary Health Care Center in Jeddah. The data were collected from 2015 to 2016 from 151 pediatric children. Each visit lasted 15 to 30 minutes, which involved the completion of questionnaires and consent form, and the intraoral examinations on the children by the dentists. Fluoride varnish was applied to the deciduous teeth of each child. Each caregiver was also provided with information on good oral hygiene practices, a toothbrush, a child's toothpaste, and oral health brochures.

## Ethical consideration

The approval on the ethical conduct of this study was obtained from the King Abdullah International Medical Research Center through approval no. RYD-18-417780-132904. The caregivers provided their consents to participate in this study through consent forms, duly signed by them. The children's dental files were assigned study codes and were made confidential.

## Data collection

A structured interview was carried out with the parents or caregivers during their visits to the Center. The questionnaire was modified from the WHO global health questionnaire. [27] The first section detailed the demographic data on the child and the caregiver. The second section covered the medical history of the child. The third section assessed the knowledge and practices of the caregiver towards the oral health of the child.

The WHO assessment for intraoral examination includes the charting of primary dentition. The dmft scoring indices were used to record the child's teeth with caries. For the oral hygiene assessment, the Green and Vermillion plaque index, [28] known as the "simplified Oral Hygiene Index" (OHI-S), was used. The oral hygiene indices were divided into good (0–0.6), fair (0.7–1.8), or poor (1.9–3). The WHO coding was used to assess the levels of dental trauma, the oral mucosal lesion types, the location of the oral lesion, and the urgency of dental intervention.

## Statistical analysis

For descriptive statistics, the mean and standard deviations or frequencies and percentages were applied. The collected data were analyzed using the Student's t-test, Chi-square, or ANOVA.

All data were processed using SPSS, version 25. P-values of less than 0.05 were considered significant.

## Results

### Sample characteristics

The samples for this study consisted of 165 infants and toddlers, but only 151 of them were included in this study. Their ages ranged from five months to 40 months, with a median age of 13 months. Their mean age was 15.7 months (SD: 7.9). Nearly half of the children (49%) were less than 12 months old, almost all were medically healthy, and 91% of them were never seen by a dentist. More than a quarter of them had their first tooth during their sixth month (28.5%), and a third, between 6 and 12 months (35%). Only 3% of the caregivers reported about previous oral complaints of the children. Milk feeding through the bottle during the day (58.9%) and during sleep time (46.4%) were the most dominant practices, followed by breastfeeding during the day (21.8%) and at night time (22.4%). About 70% of the caregivers never cleaned their children's mouth. Only 19.9% of them had used toothbrushes to clean their children's teeth, and only 11.9% had used the correct toothbrush sizes. Table 1 summarizes the modes of feeding and the oral hygiene practices of the caregivers.

Variables	Categories	Participants, n (%)
	6–12 m	74 (49.0)

Age group	12–18 m	28 (18.5)
	18–24 m	29 (19.2)
	24–36 m	20 (13.3)
Medical status	Healthy	146 (97.0)
	Medically compromised	5 (3.0)
	6 months	32 (21.2)
	9 months	28 (18.5)
Vaccination booked	12 months	24 (15.9)
	18 months	29 (19.2)
	24 months	38 (25.2)
Child's first visit to the dentist	Done	13 (8.6)
	Never	138 (91.4)
	≤6 m	43 (28.4)
	6–12 m	33 (35.4)
Age of first tooth erupted	>12 m	4 (2.7)
	not erupted	40 (26.5)
	not recorded	11 (7.3)
Child oral complaint	No	146 (96.7)
	Yes	5 (3.3)
<b>Feeding practice</b>		
	Breast feeding	33 (21.8)
	Bottle milk feeding	89 (58.9)
Day time	Combined feeding	22 (14.6)
	Stopped feeding	6 (4.0)
	Missed	1 (0.7)
	Breast feeding	34 (22.4)
	Bottle milk feeding	70 (46.4)
Sleep time	Bottle juice feeding	4 (2.6)
	Combined feeding	9 (6.0)
	Stopped feeding	33 (21.8)
	Missed	1 (0.7)
<b>Oral hygiene practices</b>		
	Toothbrush	30 (19.9)
Oral hygiene method	Cloth	16 (10.6)
	Miswak	2 (1.3)
	None	103 (68.2)
	Never cleaned the mouth	105 (69.5)
Frequency of cleaning (daily)	Regularly cleaned	28 (18.5)
	Intermittently cleaned	18 (12.0)
	Adult's toothbrush	3 (2.0)
Type of toothbrush	Children's toothbrush	18 (11.9)
	None	128 (84.8)
	Not applicable	2 (1.3)

**Table 1:** Feeding and oral hygiene practices of the 151 infants and toddlers in this study

The profiles of primary caregivers are presented in **Table 2**.

Variables	Categories	Participants, n (%)
Primary care	Mother Maid	127 (84.0)
	Grandmother Others	15 (10.0)
		2 (1.0)
		7 (5.0)
Education	Postgraduate degree University	43 (28.5)
	degree Diploma	2 (1.3)
	High school Intermediate school	2 (1.3)
	Primary school Missed	47 (31.1)
	None	8 (5.3)
		22 (14.6)
		21 (13.9)
	6 (4.0)	
Work status of the mothers	Working Not working	127 (84.0)
		24 (16.0)
Oral health problems	Caries Missing teeth Pain	83 (55.0)
	None	6 (4.0)
	Other	3 (1.9)
		58 (38.4)
	1 (0.7)	
Oral hygiene methods	Toothbrush Miswak	143 (94.7)
	None Missed	4 (2.6)
		1 (0.7)
		3 (2.0)
Daily brushing frequency	Regular daily brushing Three times	141(93.3)
	Twice Once Intermittet	24 (16.0)
	None Missed	96 (63.4)
		21 (13.9)
		6 (4.0)
		1 (0.7)
	3 (2.0)	

**Table 2:** Profile of the 151 caregivers in this study and their oral health and hygiene practices

Working mothers comprised the majority of the questionnaire respondents. More than half of them (55%) finished high school or university education and were concerned about having dental caries. Majority of them reported that they regularly practice brushing their teeth daily.

**Status of the oral health of the infants and toddlers**

The median number of erupted teeth of the infants and the toddlers was 6 teeth, with a mean of 7.6 (±7 SD). The most frequently erupted deciduous teeth were the anterior lower, followed by the upper teeth. Clinical examinations revealed that dental caries was found in only 14 infants and toddlers. Decay score was reported in 2 out of four infants, with ages of less than 12 months old, while the other 10 toddlers, older than 12 months old, had decay scores that ranged between 1 and 10 [Table 3].

Age (m)	d score
33	4
32	5
26	2
26	8
24	2
20	7
16	10
14	2
14	4
13	1
10	2
9	2
7	2
6	2

**Table 3:** Decay scores of the 14 infants and toddlers with caries, based on their ages during the time of the study

Table 4 summarizes the status of the primary dentitions of the children. Their mean dmft score was 4.8. Their decay scores ranged from 0 to 10 teeth per child, with a mean of 0.48 ( $\pm 1.58$  SD).

Tooth No.	Erupted, N (%)	dmft, N/(%)	Dental Plaque, Score: N (%)	Dental Trauma, Score: N (%)
			0: 11 (73.3)	
<b>55</b>	15 (9.9)	0	1: 3 (20.0)	0
			3: 1 (6.7)	
			0: 53 (94.6)	
<b>54</b>	56 (37.1)	3 (5.4)	1: 2 (3.6)	0
			3: 1 (1.8)	
			0: 37 (92.5)	
<b>53</b>	40 (26.5)	3 (7.5)	1: 2 (5.0)	0
			2: 1 (2.5)	
			0: 62 (78.5)	
<b>52</b>	79 (52.3)	5 (6.3)	1: 13 (16.5)	0
			2: 4 (5.1)	
			0: 56 (60.9)	
<b>51</b>	92 (60.9)	10 (10.9)	1: 29 (31.5)	3: 1 (1.1)
			2: 6 (6.5)	
			3: 1 (1.1)	
			0: 10 (66.7)	
<b>65</b>	15 (9.9)	1 (6.7)	1: 4 (26.7)	0
			3: 1 (6.7)	
			0: 52 (94.6)	
<b>64</b>	55 (36.4)	3 (5.5)	1: 2 (3.6)	0
			3: 1 (1.8)	
			0: 37 (92.5)	
<b>63</b>	40 (26.5)	1 (2.5)	1: 2 (5.0)	0
			2: 1 (2.5)	
			0: 63 (78.8)	
<b>62</b>	80 (53.0)	6 (7.5)	1: 14 (17.5)	0
			2: 3 (3.8)	
			0: 58 (63.0)	
<b>61</b>	92 (60.9)	12 (11.0)	1: 28 (30.4)	3: 1 (1.1)
			2: 5 (5.4)	
			3: 1 (1.1)	
			0: 18 (81.8)	
<b>75</b>	22 (14.6)	1 (4.5)	1: 2 (9.1)	0
			2: 1 (4.5)	
			3: 1 (4.5)	
			0: 53 (94.6)	
<b>74</b>	56 (37.1)	6 (10.7)	2: 2 (3.6)	0

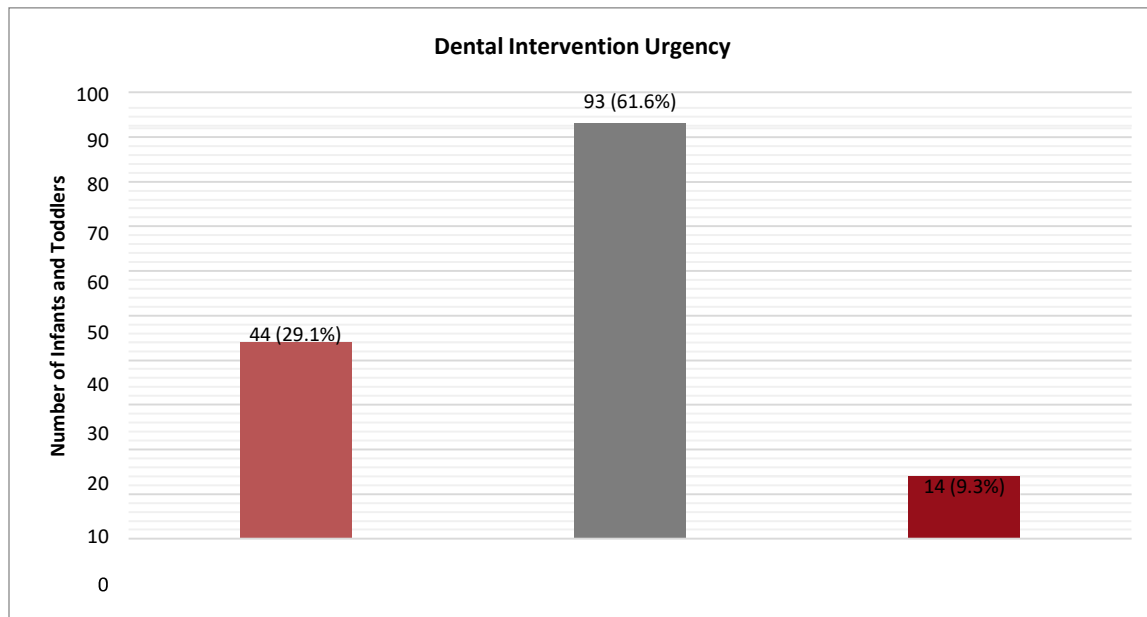
			3: 1 (1.8)	
73	40 (26.5)	0	0: 38 (95.0)	0
			1: 2 (5.0)	

**Table 4:** Dental status of the primary dentitions of the pooled sample

Their missing and filled scores were zero. Those teeth with caries belonged mostly to the central incisors. Overall, 84% of the children exhibited the results of good oral hygiene, with low plaque levels, and only about 3% had heavy plaque scores. The second deciduous molars (#55, #65, and #85) were the teeth that were covered with the most plaque, while the incisors were mostly plaque-free. Dental trauma involving the enamel and the dentin

fracture was observed in 1.1% of the children. No oral mucosal lesion was reported.

More than half of the children (62%) required preventive dental care, and 29% of them did not need any type of treatment [Figure 1]



**Figure 1:** Dental intervention needs of the infants and toddlers in the KAMC

Only 9.3% of the children needed referrals for comprehensive dental treatments. In predicting the factors associated with dental caries, a log linear regression model was used. The children, who were bottle fed, were 2.2 times more likely ( $P < 0.0001$ ) to have caries, compared to those who were not bottle-fed [Table 5]. In contrast, the children, who were breast-fed were

0.8 times more likely ( $P = 0.02$ ) to experience dental decay. The risk difference on the use of toothpastes was 13, with  $P < 0.0001$ , which suggests a significant increase in the level of risks, compared to those who never use a toothpaste [Table 5].

Variable	Risk Difference	95% CI	*P-value
Formula feeding	2.2	(1.6, 2.8)	<0.0001*
Breast feeding	0.8	(0.1, 1.5)	0.02*
Gauze	-11.2	(-12.8, -9.5)	<0.0001*
First teeth present (ref: 8 mos.)	0.6	(0, 1.3)	0.05
>12 m	0.2	(-1, 1.4)	0.72
Frequency of cleaning once	-0.4	(-0.9, -0.02)	0.04*
Use of toothpaste (ref: never)	13.0	(11.8, 14.3)	<0.0001*
Number of teeth present	0.5	(0.3, -0.7)	<0.0001*

\*P value less than 0.05 is considered significant.

**Table 5:** Linear regression model of the significant predictor factor for dental caries among the children study

## Discussion

Our study determined for the first time the oral health status of the National Guard's infants and toddlers. This study revealed that majority of the children required preventive dental care. Their mothers' practices of oral hygiene on their children was remarkably poor. Although only a few of children (9%) in our study had dental caries, those with caries were categorized to have S-ECCs and high caries risks. Several longitudinal studies had highlighted the importance of regular dental examination among children to monitor the progress of dental caries in their deciduous teeth. In a recent study, 36.7% of preschool children without any caries in their deciduous teeth during their first dental visits had developed caries after their first visit, as confirmed on their follow-up visits two years later. [29] Children with previous caries were found to experience a higher risk of developing new caries lesions later on. [29] Similarly, a study in China reported that 29.7% of the children, aged 3-4 years old, developed dental caries mainly in their first deciduous molars during their first follow-up visits a year after their first visits. [30] These incidences were attributed to the rampant exposure of the newly-erupted deciduous teeth to the initial colonization of bacteria, which had progressed toward the development of dental caries. [30] In our sample, majority of the deciduous teeth that were affected by caries were those of the anterior teeth. This difference, compared with the results of other studies, could be due to the younger ages of our samples, i.e., <3 years, and the exposure of the children's anterior teeth to the highly prevalent bottle feeding of the children. Other than dental decay, traumatic dental injury is one of the common causes of early tooth restorations on the deciduous teeth of preschool children. [31,32] Epidemiological studies suggest that the incidence of dental trauma is likely to exceed that of the dental caries in young children. [31,33] Currently, the incidence of dental injury related to the deciduous teeth among related only with the upper central incisors. young children is reported to be as high as 42%.<sup>34</sup> In Saudi Arabia, the incidence of dental trauma was reported to be between 12–48%, which had also been the most common reason of the dentists to carry out primary tooth restoration.<sup>35</sup>

Our study reports for the first time that the incidence of dental trauma among infants and toddlers, aged 5–36 months old, in Saudi Arabia was found to be relatively low at 1% and was This difference, compared to those from previous works, is also effected by the setting of the trauma, as most reported dental traumatic injuries tended to happen among children in schools. [33]

Despite the recommendations of the American Academy of Pediatrics about the first dental visit of a child to be within six months after the first tooth eruption, [36] none of the children in our sample had ever visited a dentist prior to our assessment. The sentiments among parents related to first dental visit is consistent with those reported in literature. The parents preferred that their children's first dental visit should be done at a later age rather than within their first 12 months. Globally, parents preferred their children's first dental visit, when their children are 2 to 5 years old. [37,38] A study in Riyadh found out that majority of the children had their first dental visits, with pain as their main reason, when they were between 3–5 years old. [39] Similarly, other studies in Saudi Arabia reported that the parents' attitudes towards dental visits during their children's first year were unfavorable. Many parents considered the ages of 3 to 6 years as the appropriate ages for their children's first dental visits. [40-42]

While most mothers had personally observed good oral hygiene, this practice was not translated into effective practices on the oral health care for their children. The caregivers in this study demonstrated a considerable lack of dental knowledge as reflected by their responses regarding their feeding habits and their oral hygiene practices for their young children. Nearly half of them had used bottle feeding during sleep time, which significantly correlated with the high incidence of caries. Many of the mothers did not use any method of teeth cleaning for their young children. Those who used a toothbrush comprised only a very low number of caregivers. Consistent with these findings, other studies in Saudi Arabia also had reported that most parents showed a positive attitude towards their children's oral health, but there was a lack of knowledge and awareness by these parents about the causative factors of ECC, in particular, on their feeding practices.[10,22,43] The majority of the mothers in these studies also had self-perceived dental health issues that were related to caries. Previous studies had further reported the significant association between parental perceptions on their dental health and the oral hygiene habits of their children.<sup>10,44,45</sup> In Saudi Arabia, the lack of dental knowledge among parents is one of the barriers to the good management of oral diseases.<sup>46</sup> Most of the children in our study required preventive oral hygiene care, such as the application of fluoride, which further highlighted the need to prioritize the continuing oral health care education for the caregivers. Further education of the parents and the early awareness about the good effects of oral health care can result to a considerable improvement of the oral health status of their children in the long term. [10,47,48]

Our study findings demonstrate the importance of oral health knowledge, especially those that are related to the deciduous teeth and the timing of the caregivers in carrying out an early dental visit for their infants and toddlers. The responses of the caregivers further highlight the need for better education on oral hygiene and to further raise greater awareness among parents about the oral health care of young children.

## Limitations of the study

The limitations of this study, such as its cross-sectional design, the lack of randomization of the sampling, and the collection of limited data, which possibly had introduced biases, had warranted the careful interpretations of the results. Future studies should collect more data over a longer period to monitor the children over time to observe the effects of early dental visits of children with S-ECC or the effects of preventive dental treatments. There is also the need to explore other potential barriers to the access on early and regular dental services.

## Conclusions

This study determined the frequency of dental caries among the infants and toddlers in the Baby Clinics of the Iskan Primary Health Care (PHC) Center for the National Guard in Jeddah,

Saudi Arabia. The results of this study provided a glimpse and highlighted the potential impacts of the practices of the caregivers, particularly the mothers, on the oral health of their young children in the Kingdom of Saudi Arabia.

Our study found out that the risk factors associated to the incidence of caries among the infants and toddlers are related to these practices: 1) the practice of nocturnal bottle feeding, 2) the failure to clean the children's mouths, and 3) the use of cleaning materials other than toothpastes in



cleaning the mouths of the children. Knowing these caries-affecting factors, we recommend to further educate and train caregivers and mothers about preventive practices and measures of oral care. The institution of dental programs should be put into place to intensify dental care awareness among mothers, especially about the importance of early first dental visit, healthy diet, and the proper use of feeding bottles during the sleeping times of the young children. Oral preventive programs will ultimately lead to improved oral health care and reduce the prevalence of caries among the infants and the toddlers in the Saudi communities.

**Author contributions:** R. Ba-Akdah, M. Eid, and A. Nooh designed the study; M. Eid and O. Balkhair collected the data and encoded them to Excel; M. Alsairafi, M. Baharoon, H. Althbiti, E. Hawsawy, and N. Alshaaby processed the data in SPSS and analyzed the data; R. Ba-Akdah and M. Alsairafi drafted the manuscript; M. Alghamdi, N. Alhagan, and A. Nooh carried out the preparation for the early dental visit program. All authors reviewed and approved the final version of the manuscript for submission.

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### Conflict of Interest

All authors declared that they have no conflicts of interest in this study and its publication.

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