

The Prevalence of Early Childhood Caries and Its Related Risk Factors among Preschool Children in Makkah, Saudi Arabia

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ABSTRACT

Background: Dental caries in preschool children is a major dental public health problem. It refers to early childhood caries (ECC) and defined as “the presence of one or more decayed, missing (due to caries), or filled tooth surfaces in any primary tooth in a child aged less than 6 years”. Early identification of dental caries will provide a chance for identification of children who have a high risk and initiate a preventive intervention for them.

Objective: To determine the prevalence of ECC among preschool children in Makkah, Saudi Arabia, in relation to specific risk factors.

Methodology: A cross sectional study was conducted in the city of Makkah, Saudi Arabia, on 491 healthy preschool children, males and females, aged 3-5 years from public and private nursing schools. The data was collected using a questionnaire and clinical examination. Utilizing the collected data, the ECC risk factors including; demographic criteria, parents educational background, and oral hygiene measures, the frequency and type (fluoridate or non-fluoridate). The total dmft was calculated and ECC was measured according to severness combined with different etiology.

Results: Snack types, milk types, age and mother education the most significant detected risk factors regarding ECC prevalence the chi square (p values) are 52.883 (0.000), 19.333 (0.000), 8.439 (0.013), 12.475 (0.042) respectively. Conclusion: Implementation of educational and prevention programs for expecting parents, pre-pregnant parents and to children starting from 3 years old to raise the awareness regarding the importance of oral hygiene.

Keywords: Caries prevalence, Caries risk factor, Early Childhood Caries, dmft

INTRODUCTION

Early childhood caries (ECC) is a major oral health problem that affects many preschool children worldwide. Several alternative terms have been used to describe the cavities that occur in the primary teeth of infants and young children, including “nursing or baby bottle mouth,” “milk bottle syndrome,” and “early infant decay.”⁽¹⁾ ECC is multifactorial disease that has been classified by many research groups over the last 20 years. The most popular

classification systems have been based on the ECC severities (three types) combined with the different etiologies.⁽²⁾

- **Type I (mild) ECCs:** The existence of isolated carious lesions involving the molars and incisors.
- **Type II (moderate) ECCs:** Labiolingual carious lesions affecting the maxillary incisors.
- **Type III (severe) ECCs:** Carious lesions affecting all of the teeth, including the lower incisors.⁽³⁾

Many studies have determined the ECC prevalence; for example, a study conducted in Canada among Hutterite preschool children found an ECC prevalence of (53%), a mean decayed/extracted/filled teeth (deft) value of (2.8), and severe ECCs in (42.4%) of them. ⁽⁴⁾ Another study conducted in Sardinia reported that the ECC prevalence was (15.99%) among preschool children. ⁽⁵⁾ When considering the various classification systems and the broad etiological risk factors, it was determined that the caries risk increased with a lower parental educational level and an increased number of siblings. ⁽⁵⁾ In Karachi, one study demonstrated that the dental caries prevalence in preschool children was (51%), the mean decayed/missing/filled teeth (dmft) score was (2.08), and the distribution of the mean dmft values increased with age. ⁽⁶⁾ In Saudi Arabia, one study in Jeddah reported that the dental caries prevalence among preschool children ranged from (70-76%). ⁽⁷⁾ Moreover, a study of preschool children in Riyadh demonstrated that the overall caries prevalence was (74.8%), with a mean dmft score of (6.1). ⁽⁸⁾

The aim of this study was to determine the ECC prevalence among preschool children in Makkah, Saudi Arabia, and to assess the ECC risk factors.

RESEARCH DESIGN AND METHODS

This was a cross-sectional study designed to determine the ECC prevalence among 3–5-year-old children from nursery schools in Makkah.

Sample

A total of 491 healthy children (both males and females) from 3 to 5 years old were included in this study. All of their parents signed informed consent forms. The samples size (376) was calculated using a power analysis at 95% confidence level and 5% confidence interval value.

Sampling Technique

A stratified cluster sampling technique was used to select the sample. A total of 127 nursery schools are distributed throughout

five major regions in Makkah. From each region, two schools were randomly selected (one public school and one private school). Two classes from each nursery school were selected randomly, and all of the children in the selected classes were included in the study.

Data Collection

The data was collected using a questionnaire and a clinical examination.

Questionnaire

A well-designed questionnaire that was translated into Arabic was used. This questionnaire included questions about each child's demographic characteristics (number of siblings and their sequence, parents' educational levels and jobs, and monthly family income), oral hygiene measures (frequency, type, and fluoridated or nonfluoridated toothpaste), supplemental oral hygiene measures, milk type used during infancy, number of main meals per day, and snack types.

Clinical Examination

The clinical examination was conducted by six trained and calibrated Umm Al-Qura University dental school examiners. During the examination, each child sat on an ordinary chair in daylight conditions, while artificial light was used in other schools. The examination was conducted using a different disposable dental probe and mirror for each child. The total dmft score was calculated according to the World Health Organization caries diagnostic criteria. ⁽⁹⁾ The ECCs were measured according to their own criteria. ⁽¹⁰⁾

Validity and Reliability of the Data

Six examiners were trained and calibrated by the professor of public health before starting the study in order to ensure that the clinical examinations were standardized. The questionnaire was piloted using 20 children before the final distribution in order to ensure its validity.

Statistical Analysis

The data was entered using the Microsoft Excel program (Microsoft Corporation, Redman, WA, USA). The collected data was statistically analyzed using IBM SPSS

Statistics for Windows (Version 24.0; IBM Corp., Armonk, NY, USA). The numerical data was statistically analyzed by calculating the mean and standard deviation; then, a t test and a one-way analysis of variance were performed for the comparison. For the categorical data, the frequencies were calculated, and a chi-squared test was used to make the comparisons between the groups. A p value of 0.05 or less was considered to be statistically significant.

RESULTS

A total of 491 children were included in this study (220 males and 271 females); 323 of them were selected from public schools and 168 were selected from private schools (Table 1).

With regard to the ECC risk factors, there was a statistically significant association between the ECC prevalence and the child's age, and the prevalence increased with the child's age. The results showed that (11.1%) of the 3-year-old children, (22.2%) of the 4-year-old children, and (66.7%) of the 5-year-old children had severe ECCs. When considering the socioeconomic factors, the most prevalent risk factor was the mother's educational level, which showed a significant difference ($p=0.042$). With regard to the mild, moderate, and severe ECC types, the ECC prevalence decreased in those children who had highly educated mothers. However, the father's educational level had no significant effect on the ECC prevalence ($p=0.081$).

Table(1). The prevalence of Early Childhood Caries among preschool children and its related risk factors.

Variables	ECC Type	Free	Mild	Moderate	Sever	X ² (P value)
		N (%)	N (%)	N (%)	N (%)	
Age	3y	22 (12.4%)	22 (9.8%)	3 (4.2%)	2 (11.1%)	8.439 (0.013)*
	4y	61 (43.5%)	62 (27.6%)	19 (26.8%)	4 (22.2%)	
	5y	94 (53.1%)	141 (62.7%)	49 (69%)	12 (66.7%)	
School Type	Public	100 (56.5%)	116 (51.6%)	39 (54.9%)	13 (72.2%)	3.356 (0.715)
	Private	77 (43.5%)	109 (48.4%)	32 (45.1%)	5 (27.8%)	
Gender	Male	96 (54.2%)	48 (37.3%)	30 (42.3%)	10 (55.6%)	12.475 (0.095)
	Female	81 (45.8%)	141 (62.7%)	41 (57.7%)	8 (44.4%)	
Mother Education	Non-Educated	14 (7.9%)	11 (4.9%)	10 (14.1%)	2 (11.1%)	12.496 (0.042)*
	Low	35 (19.8%)	62 (27.6%)	21 (29.6%)	4 (22.2%)	
	Moderate	119 (67.2%)	141 (62.7%)	37 (52.1%)	12 (66.7%)	
	High	9 (5.1%)	11 (4.9%)	3 (4.2%)	0 (0%)	
Father Education	Non-Educated	16 (9%)	20 (8.9%)	12 (16.9%)	4 (22.2%)	14.134 (0.081)
	Low	59 (33.3%)	66 (29.3%)	18 (25.4%)	9 (50%)	
	Moderate	86 (48.6%)	124 (55.1%)	35 (49.3%)	4 (22.2%)	
	High	16 (9%)	15 (6.7%)	6 (8.5%)	1 (5.6%)	
Father Income	Low	24 (13.6%)	36 (16%)	16 (22.5%)	4 (22.2%)	7.901 (0.209)
	Moderate	130 (73.4%)	153 (68%)	43 (60.6%)	14 (77.8%)	
	High	23 (13%)	36 (16%)	12 (16.9%)	0 (0%)	
Milk Types	Breast Feeding	48 (27.1%)	76 (33.8%)	29 (40.8%)	7 (38.9%)	19.333 (0.000)*
	Bovine Milk	79 (44.6%)	111 (49.3%)	35 (49.3%)	11 (61.1%)	
	Both	50 (28.2%)	38 (16.9%)	7 (9.9%)	0 (0%)	
Snack	Yes	158 (89.3%)	211 (93.8%)	67 (94.4%)	17 (94.4%)	3.510 (0.107)
	No	19 (10.7%)	14 (6.2%)	4 (4.6%)	0 (0%)	
Snack Types	Carbohydrated	85 (48%)	163 (72.4%)	61 (85.9%)	18 (100%)	52.883 (0.000)*
	Non-Carbohydrated	73 (41.2%)	48 (21.3%)	6 (8.5%)	0 (0%)	
Teeth brushing Frequency	0	15 (8.5%)	12 (5.3%)	8 (11.3%)	3 (16.7%)	13.800 (0.305)
	1	62 (35%)	85 (37.85)	27 (38%)	5 (27.8%)	
	2	81 (45.8%)	107 (47.6%)	31 (43.7%)	9 (50%)	
	3	17 (9.6%)	20 (8.9%)	5 (7%)	0 (0%)	
	4	2 (1.1%)	1 (0.4%)	0 (0%)	1 (5.6%)	
Oral Hygiene Axillaries	Yes	34 (19.2%)	45 (20%)	8 (11.3%)	5 (27.8%)	3.829 (0.675)
	No	143 (80.8%)	180 (80%)	63 (88.7%)	13 (72.2%)	

*significant difference at a p value of less than 0.05

X²: Chi square test.

When considering the two different types of schools, those children from the private schools had lower ECC prevalences in the mild, moderate, and severe ECC groups (48.4%, 45.1%, and 27.8%, respectively) when compared with the ECC prevalences among the public school children (51.6%, 54.9%, and 72.2%, respectively). In addition, an increase in the tooth brushing frequency was related to decreases in the prevalences of the three ECC types, with no statistically significant difference ($p=0.3050$). In relation to the

milk types, those children who consumed bovine milk showed the highest ECC percentages (49.3%, 49.3%, and 61.1% for mild, moderate, and severe, respectively), with a significant difference, from the children who consumed other types of milk ($p=0.000$). With regard to the snack types, those children eating snacks containing carbohydrates exhibited high prevalences among all of the ECC types, with a significant difference between the children eating carbohydrate and noncarbohydrate snacks ($p=0.000$).

dmft component	Male		P value	Female		P value	F (P value)
	Public	Private		Public	Private		
	Mean \pm SD	Mean \pm SD		Mean \pm SD	Mean \pm SD		
dt	2.58 \pm 3.486	2.28 \pm 3.42	0.940	3.52 \pm 4.121	2.87 \pm 3.11	0.539	2.833 (0.038)*
mt	0.129 \pm 0.818	0.115 \pm 0.658	0.998	0.066 \pm 0.394	0.083 \pm 0.306	0.996	0.334 (0.801)
ft	0.232 \pm 0.998	0.326 \pm 1.056	0.910	0.152 \pm 0.525	0.383 \pm 1.189	0.268	1.521 (0.208)
Total	2.853 \pm 3.686	2.557 \pm 3.326	0.950	3.735 \pm 4.209	3.266 \pm 3.307	0.784	2.435 (0.064)

Table(2). The mean dmft values and its components among males and females regarding the school types.

*significant difference at p level less than 0.05
F: One-way ANOVA test

Table 2 shows that there were no statistically significant differences between the public and private male schools with regard to the dmft component scores [decayed teeth (dt), missing teeth (mt), and filled teeth (ft); $p=0.940$, $p=0.998$, and $p=0.910$, respectively] and the dmft total score ($p=0.950$). In the female schools, there were no statistically significant differences between the public and private female schools with regard to the dt, mt, and ft scores ($p=0.539$, $p=0.996$, and $p=0.268$, respectively) and the dmft total score ($p=0.784$). However, there was a statistically significant difference between the males and females with regard to the dt scores ($p=0.038$).

With regard to the gender, there were higher mean dt and dmft values (3.236 and 3.527, respectively) in the female group, with significant differences between the males and the females ($p=0.015$ and $p=0.016$, respectively). However, there were no significant differences in the mean mt and ft values among the males and females ($p=0.341$ and $p=0.793$, respectively) (Table 3).

Table(3). The mean values of dmft and its components regarding males and females.

dmft component	Male	Female	t (P value)
	Mean \pm SD	Mean \pm SD	
dt	2.4409 \pm 3.45	3.236 \pm 3.718	5.922 (0.015)*
mt	0.122 \pm 0.745	0.073 \pm 0.357	0.91 (0.341)
ft	0.277 \pm 1.025	0.254 \pm 0.889	0.069 (0.793)
Total	2.713 \pm 3.515	3.527 \pm 3.836	5.89 (0.016)*

*significant difference at p level less than 0.05

DISCUSSION

The aim of the present study was to determine the ECC prevalence and the related risk factors among preschool children in Makkah, Saudi Arabia. This was the first epidemiological study of the ECC prevalence conducted within Makkah, which reveals the importance of this research.

The ECC classification used in this study was developed by Wayne, ⁽²⁾ and it is utilized by the American Academy of Pediatric Dentistry. For this method, the locations of the carious lesions are used to classify the ECC severities. Referring to a specific ECC type provides a better understanding and clarification of the seriousness of the ECC problem for dental professionals and the general public. It can help increase the knowledge of the ECC

type distribution in a population, which also provides an easier comparison with other populations, as well as more effective preventive strategies. ⁽²⁾

The present study showed that the ECC prevalence was (64%), which was fairly similar to the results of study in Riyadh that reported an ECC prevalence of (69%). ⁽¹¹⁾ However, higher ECC prevalences were found in other areas of Saudi Arabia: (77.73%) in Aseer ⁽¹²⁾ and (72.77%) in Dawadmi. ⁽¹³⁾ In the United Arab Emirates, the ECC prevalence was (74.1%) in Ras Al-Khaimah, ⁽¹⁴⁾ which was similar to the high results reported in Sudan (71.4%). ⁽¹⁵⁾ With regard to more developed countries, the ECC prevalences were (53%), in Canada ⁽⁴⁾ and (17.36%) in Kosovo. ⁽¹⁶⁾ Thus, the ECC prevalence varies around the world.

The results of the present study showed that the ECC prevalence increased with age, which may be attributed to the changes in the dietary habits as children grow older. ⁽¹⁷⁾ Other reasons include the decreasing parental role in oral hygiene practices and the subsequent increase in the duration of the teeth being exposed in the oral cavity. ⁽⁶⁾ Similar results were found in studies from Riyadh, ⁽¹¹⁾ Sudan, ⁽¹⁵⁾ and Bosnia and Herzegovina. ⁽¹⁸⁾ However, a study conducted in Dawadmi found no statistically significant difference with regard to the age of the children. ⁽¹³⁾

The effects of sugar on the dentition are lifelong. Bacteria depend on the sugar contained in the diet to produce the acids that are responsible for tooth decay; therefore, snacks containing carbohydrates and a cariogenic diet were found to be strongly related to ECC development with statistically significant results. ⁽¹⁷⁾ These results were also found in studies conducted in Bosnia and Aseer, ⁽¹²⁾ Herzegovina, ⁽¹⁸⁾ and Trivandrum. ⁽¹⁹⁾

When considering the milk type, the present study found that consuming bovine milk was an ECC risk factor, which coincided with the results reported by Sitana and Sudeshni in a study conducted in

Khartoum. ⁽²⁰⁾ However, a study in Brazil reported that dental caries were not clearly related to that type of feeding. ⁽²¹⁾

The mother's educational level was a significant ECC risk factor, because the mother plays an important role in her child's behavior with regard to dental health and oral hygiene measures. ⁽²²⁾ The present study showed that those children with uneducated mothers and mothers with low educational levels had higher caries prevalence than those children with highly educated mothers. These results are supported by the results of a study by Al-Meedani and Al-Dlaigan in Riyadh. ⁽¹¹⁾ However, another study conducted in Sudan found that the mother's educational level was not significantly related to the ECC prevalence. ⁽¹⁵⁾

The results of studies conducted in Riyadh, ⁽¹¹⁾ Norway, ⁽²³⁾ and China ⁽²⁴⁾ showed a positive relationship between the number of siblings and ECC prevalence. This is likely due to the different focus, care, and time given to the child by the parents. All of these variables may justify the variety of risk factors reported among different populations.

In the present study, the female children had more decayed teeth than the male children. This may be explained by the fact that the teeth erupt earlier in females than in males; therefore, the teeth are exposed for a longer period of time to cariogenic risk factors in the oral cavity, physiological and hormonal differences, and different dietary habits and behaviors. ⁽⁶⁾ Similar findings were reported in a study conducted in Aseer. ⁽¹²⁾ However, in a study conducted in Sudan, there was no association between the child's gender and the ECC prevalence. ⁽¹⁵⁾ With regard to the school type, the children from the private schools had a lower ECC prevalence when compared with the children from the public schools. This may be because the socioeconomic status and quality of life have diverse relationships with dental decay and dental treatment. ⁽²⁴⁾ The authors of this study rationalized that the parents who paid

for their children's education provided more dental care, and they were more careful about their children's general and oral health.

CONCLUSIONS

- The female children had a significantly higher number of decayed teeth than the male children.
- No significant differences were found between the male and female children with regard to missing or filled teeth.
- A significant difference was found between the public and private female school children with regard to decayed teeth.
- The ECC prevalence increased with age.
- A strict prevention and follow up program should be implemented for children starting at 3 years old.
- The ECC prevalence was inversely related to the mother's educational level.
- An educational program should be provided to raise the awareness of expecting parents and pre-pregnancy couples to emphasize the importance of the oral hygiene measures that should be applied.
- Drinking bovine milk and consuming carbohydrate containing snacks are risk factors related to an increased ECC prevalence.

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