Early childhood caries assessment and related risk factors among a group of lebanese preschool children: a cross-sectional study

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Abstract

OBJECTIVE: The study aimed to assess the prevalence of Early Child Caries and its associated risk factors among a group of Lebanese preschool children.
MATERIALS AND METHODS: An observational, cross-sectional study design that included 388 children recruited from different schools in Beirut, Lebanon. The parents were interviewed to answer a questionnaire developed by the World Health Organization (WHO, 1997) and Caries Assessment Risk tool developed by the American Academy of Pediatric Dentistry (AAPD, 2019). Then, caries prevalence was assessed by examining the children using the WHO decayed, missed or filled primary teeth (dmft) index and the rating scores of dental caries were classified as very low <1.2, low 1.2 – 2.6, moderate 2.7 – 4.4 and high 4.4 (WHO, 1997).
RESULTS: The mean age of the children was 4.03 ± 0.82 years. The prevalence of ECC was 71.1% and the mean dmft index was noted to be 3.11 ± 3.67. Based on the risk assessment results, 68% of the preschool children had high caries risk whereas 32% had low caries risk. A statistically significant differences in mean dmft scores were noted in which 3-years-old children exhibited a lower mean dmft value compared to 4 and 5 years olds (p<0.001). In addition, a significant difference was also found in dmft scores between middle socioeconomic status (SES) schools and low SES schools (p=0.016).

Keywords: Early Childhood Caries, Children, Risk Assessment, Socio-demographic Factors

Introduction

ECC is defined as the presence of one or more decayed, missed or filled primary tooth in children under six years old (AAPD, 2021). ECC starts as white spot lesions along the gingival margin of maxillary deciduous incisors, leading to a complete crown destruction in the progression of caries (Kawashita et al., 2011). The main risk factors in the development of ECC can be categorized as microbiological, dietary, and environmental risk factors (Anil & Anand, 2017). ECC affects both the child's oral and general health. Although it is largely a preventable condition, it is considered as a major oral health problem, mainly in socially disadvantaged populations and remains one of the most common childhood diseases worldwide (Goswami, 2020).

The ECC prevalence has been reported between 1% and 12% in developed countries but is as high as 70% in developing countries. The underlying risk factors for ECC in different populations have been studied throughout different developed countries (Rai & Tiwari, 2018); however, minimal epidemiological studies described the status of ECC in Lebanon. It is of prime importance to build strong baseline data that can help in identifying ECC and, furthermore, aid in planning appropriate treatment plans and implementing essential preventive measures.

The risk assessment techniques utilized in medical practices can provide enough data to precisely measure a person's susceptibility to disease and allow for preventive interventions. Caries risk assessment (CRA), however, (1) enhances the treatment process of the disease rather than treating its outcome, (2) aids in individualizing preventive discussions as it allows an understanding of the disease factors for a specific patient, (3) individualizes, chooses, and decides on the frequency of a patient's preventive and restorative treatment and (4) predicts the progression or stability of caries (AAPD, 2019).

Therefore, the purpose of the present study is to assess the ECC prevalence and its associated risk factors among a group of Lebanese preschool children from different SES schools, assuming that ECC don't differ among different study variables.

Materials and Methods

Study Settings:
This is an observational, cross-sectional study to determine the status of ECC among a group of Lebanese preschoolers. The study was conducted between December 2021 and March 2022 in which four schools in Beirut, Lebanon, were enrolled from two socioeconomic classes (middle and low). All children between the ages of 3 and 5 years were randomly selected. The study was approved by the scientific and ethical review committee and institutional review board at Beirut Arab University (BAU IRB code: 2022-H-0098-D-M-0480).

Population Settings:
The sample size was calculated using the free calculator on Raosoft.com. The total sample size required was 388 participants considering a 5% margin of error, 95% confidence level and population size of 445,000 (World Population Review)
All children who were medically compromised, definitely negatively cooperated (based on Frankl classification) during the dental examination, or whose parents refused to participate in study were excluded.

Data Collection
Clinical examination was done by one trained and calibrated examiner (κ=87%). The examiner interviewed the preschool children's parents at school premises to ensure that the questionnaires were understood and completed. The child's dental status was then evaluated using the dmft index described by the WHO. The dental status was evaluated using dmft index according to the World Health Organization oral health surveys and the rating scores of dental caries were classified as very low <1.2, low 1.2 – 2.6, moderate 2.7 – 4.4 and high 4.4 (WHO, 1997). The American Academy of Pediatric Dentistry (AAPD) developed the Caries Risk Assessment (CRA) tool to help in assessing the caries development risk levels and identifying individual's specific behaviors or risk factors (AAPD, 2019). The CRA tool includes risk factors (social, behavioral, medical, clinical factors), protective factors and disease indicators. The WHO questionnaire demonstrates the assessment of associated risk factors through gathering data that focuses on socioenvironmental determinants and modifiable risk factors of oral health in children (WHO, 2013). The questionnaire includes questions concerning the child's gender and age, place of residence, oral health status and oral hygiene habits. It also includes dietary habits, personal or social issues experienced due to oral cavity problems and parents' educational level. The Kolmogorov-Smirnov normality test was conducted and showed that our data were not normally distributed. Qualitative data were presented as frequencies and percentages whereas quantitative data were presented as median, range, mean, and standard deviation values. The Mann-Whitney U test and Kruskal-Wallis test were used for comparisons between two groups and more than two groups respectively. Furthermore, Dunn's test was used for pair-wise comparisons when the Kruskal-Wallis test was significant. The significance level was set at $p \leq 0.05$ and statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp. (IBM Corp., 2015).

Results

Demographic Data
The study sample included 388 children where 193 children were boys (49.7%) and 195 children were girls (50.3%). The mean age of the children was 4.03 ± 0.82 years. As for the geographic location, 62.6% and 37.4% of participants lived in urban and peri-urban areas respectively. The demographic variables are presented in Table 1.

Table 1. Frequencies (n) and percentages (%) for demographic data of the study participants.

Demographic Data	n	%
Gender		
Boy	193	49.7
Girl	195	50.3
Age		
3 y	125	32.2
4 y	126	32.5
5 y	137	35.3
Location		
Urban	243	62.6
Peri-urban	145	37.4
School		
Middle Socioeconomic Status	175	45.1
Low Socioeconomic Status	213	54.9

Clinical Examination
Among clinical examination, 9% of participants had non-cavitated (incipient/white spot) lesions or enamel defects, 71.7% of participants had previous history of caries (visible cavities/ fillings/ missing teeth) with mean dmft index of 3.12 ± 3.67 (Table 2).

Dental Caries Index
The present study showed a statistically significant difference in mean dmft values between age groups where 3-year-old children exhibited the lowest value compared to older groups ($p<0.001$). Also the mean value of dmft scores were significantly lower among middle SES schools in compared to low class group (p=0.016). (Tables 3 and 4)

Dental Care
Dental care had also revealed that 36.4% of the participants had dental visits in the past 12 months, 63.1% didn't had have visits or received dental care in the past 12 months. The common reason for last dental visit was pain or troubles with teeth, gum or mouth in which 45.4% was shown in responses. As regards to the frequency of dental cleaning, it was common to clean once/day (43.3%) followed by twice or more times/day

Table 2. Descriptive statistics for clinical examination.

Clinical Examination	n	%
1. Child has non-cavitated (incipient/white spot) caries or enamel defects	35	9
2. Child has visible cavities or fillings or missing teeth due to caries	276	71.7
3. Child has visible plaque on teeth	40	10.3
4. Decayed teeth (d): [Mean (SD), Median (Range)]	2.86 (3.44), 2 (0-18)	
5. Missing teeth (m): [Mean (SD), Median (Range)]	0.06 (0.29), 0 (0-3)	
6. Filled teeth (f): [Mean (SD), Median (Range)]	0.19 (0.67), 0 (0-6)	
7. dmft index: [Mean (SD), Median (Range)]	1.11 (3.67), 2 (0-18)	

Table 3. Frequencies (n) and percentages (%) for dmft.

	dmft = 0		dmft >0		Mean ± SD	p-value
	n	%	n	%		
Gender						
Boy	48	12.4	145	37.4	3.06 ± 3.18	p = 0.765
Girl	62	15.9	133	34.3	3.16 ± 3.53	
Age						
3 y	51	13.1	74	19.1	0.85 ± 0.86	p<0.001*
4 y	31	8.0	95	24.5	3.66 ± 3.07	
5 y	28	7.2	109	28.1	4.68 ± 3.91	
School						
Middle SES	57	14.7	118	30.4	2.66 ± 2.78	p = 0.016*
Low SES	53	13.6	160	41.3	3.48 ± 3.74	

Table 4. Multiple Comparison between Age and dmft.

Multiple Comparisons							
Dependent Variable: dmft							
	(I) Age	(J) Age	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Dunnett T3	3 years	4 years	-2.81073*	.28395	.000	-3.4964	-2.1251
		5 years	-3.83083*	.34320	.000	-4.6592	-3.0025
	4 years	3 years	2.81073*	.28395	.000	2.1251	3.4964
		5 years	-1.02010	.43189	.056	-2.0579	.0177
	5 years	3 years	3.83083*	.34320	.000	3.0025	4.6592
		4 years	1.02010	.43189	.056	-.0177	2.0579

*The mean difference is significant at the 0.05 level.

(21.9%). Tooth brush and toothpaste were the only cleaning method reported by all participants. Moreover, 35.7% of participants reported using fluoridated tooth paste while 42.1% didn't know if the used toothpaste was fluoridated or not.

Dietary Habits
The majority of participants consumed cariogenic food, in which 88.9% of the participants had biscuits, cakes, cream cakes, sweet pies, buns and 62.3% of the participants had sweets/candy several times. The majority of participants had high consumptions of fresh fruits (89.7%) several times, while those who consumed tea with sugar were low (24.8%). Moreover, almost half of the participants (49.8%) were given milk daily.

Risk Factors, Protective Factors and Risk Assessment
Children who had snacks between meals showed the highest percentage of participants (68.3%) in risk factors and 42.5% of the mother/primary caregiver had active decay in the past 12 months. Regarding the protective factors, 21.9% of the participants brushed daily and

6.7% of the participants received fluoride varnish in the past 6 months. As for the risk assessment, 32% of the participants had a low caries risk compared to 68% of the participants who had a high caries risk.

Discussion

ECC is recognized as a major public health problem due to its high prevalence and negative health impacts if left untreated (Naidu et al., 2016). The present study assessed the prevalence of ECC and its associated risk factors among a group of Lebanese preschool children who aged between 3 and 5 years.

The mean dmft value of children aged between 4 and 5 years were significantly higher than 3 years old children (p<0.001), indicating that the level of caries increases with age. Also, the current study's prevalence of ECC was still high (71.7%) and yet is similar to that reported in 2023 by Tabbara (70.4%) (Tabbara, 2023). This is reflected by the fact that as children increase in age, they become more susceptible to certain dietary and behavioral attitudes, which increase their teeth's susceptibility to decay.

Children with low SES had significantly higher dmft scores compared to children from middle SES (p<0.001). SES influences dental caries and is determined by the educational level, health beliefs and accessibility to health care information (Sarumathi et al., 2013). In addition, the low frequency of tooth brushing can be contributed to the low SES in the current study. In contrary, a higher frequency of tooth brushing was seen in Freire and colleagues' study due to parental supervision and guidance during teeth brushing (Freire et al., 2022).

The majority of the participants (45.3%) visited a dentist due to pain but only 19% continued the treatment. This is reflected by the participants' inability to afford non-urgent treatments or receive dental care in the past 12 months (63.1%) due to the severe economic crisis that Lebanon was going through and therefore, not all participants were capable of continuing their dental treatments or receive dental care as costs of treatments were expensive. This result corroborates with results of other studies (Bulut & Bulut, 2020; Alshahrani et al., 2018; Murshid, 2016). In contrary, free regular check-ups are offered in countries with free public dental health care services, allowing 90% of children to attend regular checkup appointments as in Norway (Åstrøm et al., 2022).

The importance of fluoride lies in the exertion of its anti-cariogenic action through inhibiting tooth demineralization, promoting tooth remineralization and inhibiting plaque bacteria (Nassar & Brizuela, 2022). Participants reported that they neither used nor knew if they used fluoridated toothpaste which is a reflection of parental limited knowledge about fluoride which interprets the high caries level in the current study. However, children having lower prevalence of dental caries was a reflection of parents having a better awareness regarding fluoride. The revealed results of the dietary habits explain the high caries prevalence and the high risk of forming initial lesions. Children usually do not have control over their food choices as their eating habits were shaped by their parents (Samaddar et al., 2021), and parents pamper their children with inexpensive, high-sugar-content snacks that contribute to tooth decay (Athavale et al., 2020). One assumption regarding these findings could be attributed to cultural factors, as Middle Eastern countries including Lebanon, habitually include high sugar snacks in children's diet intake (Elamin et al., 2018). The frequent consumption of sugary snacks and beverages causes a frequent drop in the saliva's pH and its acidic media to attack the tooth surface, breaking down the enamel and developing dental caries. Furthermore, snacks such as sweets and candies can adhere to the teeth surface for a period of time, causing an interaction between the bacteria and these sugars, leading to caries development. In addition, children were exposed to high-risk factors associated with dental caries, noting that their mothers had active dental caries and those children had frequent sugar exposure per day. Mothers are the primary source of *Streptococcus mutans*, and during the first two years of a child's life, the degree of vertical transfer of bacteria increases in response to the mother's poor oral hygiene, exposure to sugar, and snacking frequency (Anil & Anand, 2017).

A significant deficiency concerning the protective factors in relation to dental caries was present in brushing daily using fluoridated toothpaste, which was a reflection of parents' lack of supervision and parental awareness. Another protective factor deficiency was observed in receiving fluoride from a health professional, which resulted from Lebanon's economic crisis that left parents unable to afford the costs of topical fluoride treatments.

The high caries risk percentage can be explained by the presence of visible cavities or fillings or missing teeth due to caries, visible plaque and non-cavitated (incipient/white spot caries) or enamel defects. In contrary, a study reported that the majority of their participants were of moderate risk (71.3%) with less missing teeth due to caries and less visible plaque (Muhson et al., 2020).

In conclusion, ECC among children is certainly a global problem, with consequences extending beyond its clinical signs and symptoms. Our results revealed a deficiency in oral health care knowledge, and therefore, oral hygiene education through awareness campaigns and educational programs is mandatory, along with nutrition promotion campaigns that aim in providing consultation on dietary habits.

Limitations

This cross sectional study was conducted between December 2021 and March 2022 where the pandemic disease - Covid-19; was still restricting the country. Therefore, difficulties were faced in getting access to variety of schools from different socioeconomic statuses and in different locations in Beirut. Moreover, due to the fear of spreading Covid-19, many schools rejected the request of being part of the study.

Informed Consent Statement
Informed consent was obtained from all subjects involved in the study. Written informed consent has been obtained from the patients to publish this paper.

Conflicts of Interest: The authors declare no conflict of interest.

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