Prevalence of dental caries and evaluation of mean DMFT index among secondary school students in Asmara, Eritrea.

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ABSTRACT:

Objective: Dental caries is an irreversible, microbiological infectious disease of the hard structure of the teeth which affects the population worldwide. The purpose of the study was to determine the prevalence of dental caries and to assess mean DMFT index among secondary school students in Asmara, Eritrea.

Methods: A descriptive cross-sectional study was performed on 330 students (135 boys and 195 girls) between January and May 2018, using simple random sampling method. Students aged 14-17 years were interviewed with a pre-structured questionnaire and clinical examination was conducted in the classroom by the investigators using examination gloves, mouth mirror, and dental explorer under natural light.

Results: The overall prevalence of dental caries was 67.9%. The mean Decayed, Missed and Filled Tooth (DMFT) value for all ages was 2.1. Female children had higher mean DMFT value of 2.50 compared with 1.56 for males ($P > 0.05$). Majority of the DMFT score was contributed by "DT" component and maximum mean DMFT (3.18) was observed among students that consumed sugary food several times a day. No association was observed between mean DMFT and the frequency of dental visit among the study population.

Conclusion: The study indicated that a significant portion of the students were having dental caries. This implies the necessity of oral health education and dental caries preventive strategies to be implemented on community-based and school-based programs.

Keywords: Dental caries; Prevalence; DMFT index.

INTRODUCTION: Dental caries is characterized by demineralization of inorganic portion and destruction of organic substance of a tooth due to bacteria action on dietary sugar.[1] Streptococcus mutans and Lactobacilli bacteria are most implicated in the etiology of dental caries.[1,2,3]Dental caries is the most prevalent oral disease affecting around 90% of school children.[4] It is generally believed that dental caries is a multifactorial disease caused by acid producing bacteria, fermentable carbohydrate and a susceptible tooth structure over a period of time.[5] If left untreated, dental caries can result in severe pain and other serious health problems like dentoalveolar abscess, destruction of bone and spread of infection via blood stream.[6] The tooth surface level is in a state of dynamic process of demineralization and remineralization process. Cariogenic bacteria in the biofilm metabolize carbohydrate for energy and produce lactic acid as a byproduct. When these organic acids are present for extended period of time, they can lower the pH to a critical level (below 5.5), shifting the equilibrium towards demineralization thereby resulting in tooth decay[7-10]. According to World Health Organization (WHO), the prevalence of dental caries among school age children ranges from 60% to 90%.[11] In African countries, it was reported to be 43.3% in Kenya[12], 48.5% in Ethiopia[13] and 55% in Nigeria[14]. In 2002, the prevalence of dental caries in Eritrea was more than 50%.[15] In Eritrea, there is no study on prevalence of dental caries among secondary school children using DMFT index, although anecdotal evidence suggests that the magnitude of this oral health problem may be significant in the population. This population based cross-sectional study aimed to determine the current prevalence of dental caries among secondary school

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students in Asmara and to asses mean DMFT score.

METHODS

The study was a school based cross-sectional study carried out in three out of 14 public secondary schools in Asmara (Barka Secondary School, Keih-Bahri Secondary School and Isaac Teweldemedhin Secondary School) using simple random selection in the period between January and May 2018. Sample size was calculated to be 330 using confidence level of 95% and 5% precision using Epi-Info 7 software calculator[16]. Students from the representative schools were included if they were from age 14-17 years. Multistage simple random selection method was used to recruit students to the study. Students with orthodontic braces[17] and teeth extracted or filled for reasons other than dental caries were excluded. Prior to commencement of data collection, ethical learance was obtained from the ethical research committee board of Orotta School of Medicine and Dentistry (OSMD) and Ministry of Health, Asmara, Eritrea. Verbal Informed consent was obtained from the parents through the school directors and parents'committee. Data were collected over a period of two months using a structured author administered questionnaire and clinical examination. The questionnaire included socio-demographic characteristics and risk factors for dental caries as shown in tables of the results section. The oral examinations were taken in the school classrooms under natural light on a wooden chair positioned near the window using sterile examination gloves, protective gowns, face mask, mouth mirror and dental explorer. The examiners worked in pair with one performing examination and the other filling the proforma. The data collection procedure was supervised by the head of the department of dental public health at Orotta School of Medicine and Dental Medicine. The World Health Organization (WHO) caries diagnostic criteria for decayed, filled and missing (DMFT index) was applied. Based on visual-tactile examination, a tooth was considered as carious either visually if it had cavitation, surface roughness, opacification, discoloration or detection of softened tooth structure after probing with explorer. The collected data were entered into a questionnaire form created in Epi-Info version 7.1 software. Data analysis was conducted using Epi-Info 7.1, Microsoft Excel 2013, and SPSS version 18. The mean and standard deviation of DMFT of all the sociodemographic and selected characteristics were obtained. Absence of caries was considered when DMFT score was zero and presence of caries was considered when DMFT score was greater than zero. Mean DMFT was categorized in a severity scale according to the WHO: very low prevalence (0 – 1.1), low prevalence (1.2 – 2.6), moderate prevalence (2.7 – 4.4), high (4.5 – 6.5) and very high prevalence group (≥6.6)[18].

RESULTS

This study included a total of 330 students from three randomly selected high schools in Asmara. All students were enrolled in the school and were present during the examination. Out of the 330, 195 (59.1%) were females and 135 (40.9%) were males. The prevalence of one or more dental caries was 224 (67.9%) out of the 330 studied students. Among those with dental caries, 63.4% had 1-3 DMFT score, 30.3% had 4-6 DMFT score and 6.3% had 7-9 DMFT score. Table 1 shows the socio-demographic characteristics and the prevalence of dental caries among the study population.

There was a very strong correlation between age and mean DMFT (r = 0.91). The mean DMFT was shown to

Table 1: Distribution of dental caries with socio-demographic characteristics

Socio-demographic Characters		Frequency (%)	With dental caries (%)	Without dental caries (%)
Age	14	56 (17.0)	27 (48.2)	29 (51.8)
	15	85 (25.8)	61 (71.8)	24 (28.2)
	16	109 (33.0)	73 (67.0)	36 (33.0)
	17	80 (24.2)	63 (78.8)	17 (21.3)
Sex				
	Female	195 (59.1)	144 (73.8)	51 (26.2)
	Male	135 (40.9)	80 (59.3)	55 (40.7)

increase with age. There was a higher DMFT score in females compared to males ($p < 0.05$) but both fell under "low" severity scale. Educational background of parents was inquired and the mean DMFT was lowest among those with illiterate mother and/or father. From those with educated parents, there was a decreasing trend of mean DMFT with an increase in the level of education ($r = -0.99$).

Table 2: DMFT Prevalence and Severity Scale according to Socio-demographic data (Mean ± Standard Deviation)

	D	M	F	DMFT Index	Severity Scale
Socio-demographic Data					
Age					
14	1.02 ± 1.38	0.04 ± 0.19	0.00	1.04± 1.41	Very low
15	1.93 ± 1.81	0.20 ± 0.61	0.07 ± 0.48	2.20 ± 2.08	Low
16	1.84 ± 2.00	0.24 ± 0.62	0.02 ± 0.13	2.10 ± 2.10	Low
17	2.14 ± 1.97	0.55 ± 0.97	0.09 ± 0.36	2.78 ± 2.40	Moderate
Gender					
Female	2.10 ± 1.99	0.33 ± 0.78	0.06 ± 0.37	2.50 ± 2.29	Low
Male	1.36 ± 1.61	0.18 ± 0.53	0.02 ± 0.19	1.56 ± 1.76	Low
Father's educational level					
Illiterate	1.13 ± 0.99	0.63 ± 1.06	0.00	1.75 ± 1.28	Low
Primary	1.97 ± 2.08	0.36 ± 0.76	0.03 ± 0.25	2.36 ± 2.28	Low
Secondary	1.84 ± 1.90	0.24 ± 0.65	0.07 ± 0.39	2.15 ± 2.17	Low
Tertiary	1.63 ± 1.72	0.23 ± 0.69	0.00	1.85 ± 1.99	Low
Mother's educational level					
Illiterate	1.00 ± 1.20	0.60 ± 1.12	0.00	1.60 ± 1.59	Low
Primary	1.96 ± 2.07	0.34 ± 0.78	0.00	2.30 ± 2.28	Low
Secondary	1.84 ± 1.86	0.20 ± 0.55	0.07 ± 0.39	2.11 ± 2.10	Low
Tertiary	1.42 ± 1.59	0.32 ± 0.91	0.06 ± 0.36	1.81 ± 2.14	Low

Students with DMFT score above zero were 224 (67.9%) - that is 144 (64.3%) females and 80 (35.7%) males. The components of the DMFT index stratified by gender are depicted in figure 1

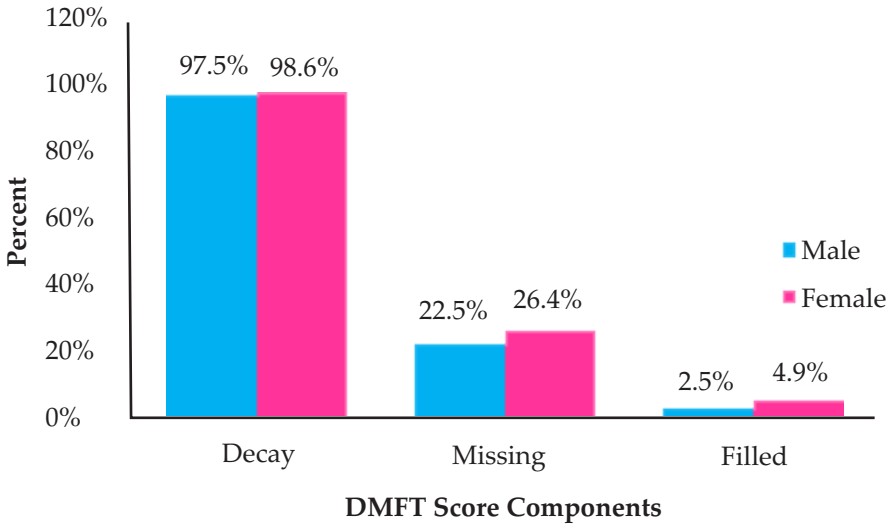

Figure 1: Components of DMFT Score Stratified by Gender

Common risk factors for dental caries such as brushing frequency, dental floss usage, sugar consumption and visit to a dentist were assessed and compared with the mean DMFT index score and components, as shown in Table 3. Students who brush their teeth twice or more per day had their mean DMFT score in the "low" severity scale compared to those once per day whose mean DMFT was in the "moderate" severity. Only three students reported regular flossing habit. The correlation between frequency of sugar consumption and mean DMFT was strong (r=0.85). Mean DMFT increased with higher frequency of sugar consumption. Two hundred (60.6%) of the students had never had any visit to a dentist, 124 (37.6%) visited when necessary such as in pain and six (1.8%) had regular annual visit to a dentist. Among those with dental caries, 121 (54%) reported no visit at all to a dentist, 99 (44.2%) visited when necessary and 4 (1.8%) had regular annual dental visit. No reliable association was observed between mean DMFT and the frequency of dental visit among the study population.

Table 3: DMFT Prevalence according to oral hygiene habits and sugar consumption (Mean ± Standard Deviation)

	D	M	F	DMFT Index	Severity Scale
Brushing Frequency					
Once a day	2.27± 2.02	0.44 ± 0.95	0.09 ±0.49	2.80 ± 2.29	Moderate
Twice or more	1.91± 2.04	0.29 ± 0.63	0.15 ± 0.5	2.35 ± 2.45	Low
Using dental floss					
Yes	1.67 ± 2.89	0.00	0.00	1.67 ± 2.89	Low
No	1.80 ± 1.88	0.27 ± 0.70	0.05 ± 0.31	2.12 ± 2.12	Low
Sugar consumption					
Once a month	1.52 ± 1.69	0.26 ± 0.70	0.05 ± 0.43	1.83± 2.00	Low
Once a week	1.79 ± 1.87	0.21 ± 0.73	0.00	2.00 ± 2.11	Low
Several times a week	2.00 ± 2.17	0.29 ± 0.65	0.05 ± 0.28	2.34 ± 2.48	Low
Once a day	1.82 ± 1.80	0.29 ± 0.73	0.05 ± 0.25	2.16 ± 2.03	Low
Several times a day	2.73 ± 2.24	0.27 ± 0.47	0.18 ± 0.60	3.18 ± 2.09	Moderate
Visit to dentist					
Never	1.64 ± 1.87	0.12 ± 0.51	0.00	1.76 ± 1.94	Low
Once a year	1.67 ± 1.97	0.50 ± 1.22	0.00	2.17 ± 3.06	Low
Twice a year	0.00	0.00	0.00	0.00	
When necessary	2.06 ±1.89	0.51 ± 0.84	0.12 ± 0.50	2.69 ± 2.28	Moderate

DISCUSSION

Dental caries is a recognized pandemic school children problem that needs attention[4]. At present no published studies have been conducted in Eritrea that describes the DMFT index status among secondary school children. The students between the ages of 14 to 17 were selected because almost all secondary school children in Eritrea fall in to this age group. The overall prevalence of dental caries among the study population was 67.9%, which is within the WHO oral health reports (60%-90%)[4]. The prevalence of dental caries in Eritrea in 2002 was more than 50%.[15] Our finding showed a percentage increase compared to this study as well as to those studies conducted in Kenya (43.3%)[12], Ethiopia (48.5%)[12], and Nigeria (55%)[14]. The variation of the prevalence can be possibly attributed to the inherent differences in the study sample population and the time at which the study was done. Apart from that, factors such as use of oral health services, oral hygiene habits and frequency of sugar consumption are expected to have a role in the prevalence[14]. The mean DMFT value in our study was 2.1, which is within the low prevalence group according to World Health Organization (WHO).[18] There is paucity of data in the literature regarding mean DMFT values concerning the age group in our study. However, compared to a similar study conducted in the neighboring country Ethiopia, which reported mean DMFT of 1.3, our population had a higher DMFT[13]. The prevalence of dental caries and mean DMFT value is usually associated with socio-demographic variables such as age gender, and educational background in the family[19]. Several studies demonstrate the strong association between

age and the prevalence of dental caries[19-22]. Our findings were consistent with the bulk of the literature. The prevalence of dental caries was lowest (48.2%) in the 14 year-old students and highest (78.8%) among the 17 year-old. Similarly, the mean DMFT value corresponds with the prevalence in those age groups, strengthening the association found with age.

Gender wise, the prevalence of dental caries in females is mostly shown to be higher than in males in many studies[12,,13]. Our study documents that more females suffered from dental caries (73.8%) compared to males (59.3%). Although the mean DMFT score was in the low severity scale in both, there was a statistically significant difference in the mean DMFT value between females (2.50) and males (1.56). Although some studies provide speculations for the gender variation in caries, there is no dependable explanation as to why our female population had higher DMFT score than their male counterparts[23,24].

It seems logical to everybody's mind to believe that better parental education would foster improved oral hygiene in their children. Unexpectedly, our results seem to show in contrary. The mean DMFT score was lowest among those with an illiterate mother and/or father compared to those who were born to educated parents. However, there was a pattern of decrease in mean DMFT along with increased level of education among those who came from educated parents. There was no statistical significance for this association. Nevertheless, we assume illiterate parents might have relied on some useful traditional oral hygiene habits in a consistent manner and trained their children as well. Our finding does not imply that the children of educated parents are more at risk of dental caries than those of illiterate ones. As shown in the figure 1 above, the "DT" component accounted for almost all the DMFT score in our study followed by "MT" and then "FT". The components of the score showed a very low value for filled teeth. This could indicate a reduced access and utilization of available oral health services. The dominance of the 'DT' component also showed that, even from those who had access to oral health services, majority might have preferred extraction to filling. However, these possible explanations should be specifically studied with the main objective of identifying the treatment rate and preferences of dental caries in our population. The distribution of the DMFT score components in our study can be used as a proxy indicator for the lack of awareness on the advantage of tooth preservation by restorative dental treatment. The standard recommendation for healthy frequency of brushing is twice or more in a 24 hour period. As presented in Table 3, the DMFT value for the students that used to brush once a day was higher (2.81) than those who brushed twice or more (2.35) and was categorized in moderate and low severity scale respectively. This is due the fact that dental caries can be prevented by regular brushing habits[12]. Out of the total 330 school children, only three students reported use of dental floss regularly. This showed that knowledge and use of dental floss in secondary school children in the study area is poor. Higher intake of free sugar is an important dietary risk factor for the prevalence of dental caries[25]. In our study, it was found that, as the frequency of sugar consumption increased, the mean DMFT value was also elevated. Majority of the students (54%) with dental caries never visited a dentist and none out of the total students investigated reported visiting a dentist twice a year. The higher prevalence of decayed teeth and lack of adequate dental visits in our study population might indicate that untreated caries is a major problem in the study area, resulting from either poor or total lack of dental awareness for oral health.

Despite the strengths, there were inherent limitations. The three schools investigated ideally might not have been representative of all the secondary schools in Asmara city. The information obtained from students on socioeconomic status and oral hygiene habits may not be reliable. Moreover, the distribution of dental caries within the arch, tooth type and tooth surface were not explained in the study due to short allotted time of contact with students hindering a more comprehensive examination to be conducted. The clear limitations of DMFT index using WHO criteria for diagnosis of dental caries might under- or over-estimate the prevalence of dental caries. This is because, DMFT values are not related to the number of teeth at risk, overestimates active carious lesion, and is of little use in studies of root caries[26].

CONCLUSION

This study found that the prevalence of dental caries was high among the secondary school students. Although the mean DMFT value was within the "low prevalence" group, the number of untreated caries was very high with very low restorative index. The reason for low restorative index of the students was not addressed in our study but lack of awareness and

limited access to treatment could be implicated. Therefore, this necessitates developing strategies to improve the awareness of the students on maintaining good oral hygiene habits. This could be achieved through community-based and school-based prevention programs such as introducing as well as constantly monitoring oral health education and promotion. Furthermore, encouraging various ways of dental caries preventive methods such as application of proper brushing technique, proper use of flossing, fluoride application, and regular dental visits among others will not be out of place. We also recommend this study to stimulate others to conduct further and detailed prospective study on risk factors associated with dental caries.

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