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Research Article

Prevalence of Dental Caries and Its Associated Factors among Primary School Children in Ethiopia

Anguach Shitie,[1] Rahel Addis,[2] Abebe Tilahun,[3] and Wassie Negash[2]

[1]*College of Medicine and Health Sciences, Wollo University, Dessie, Ethiopia*
[2]*College of Medicine and Health Sciences, Debre Berhan University, Debreberhan, Ethiopia*
[3]*College of Medicine and Health Sciences, Haramaya University, Harar, Ethiopia*

Correspondence should be addressed to Anguach Shitie; anguachshitie20@gmail.com

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Background. Dental caries (decay or cavities) is a breakdown of teeth as a result of bacteria. Dental caries is one of the preventable oral health problems and the most common chronic diseases in childhood. Poor dental and oral health affect the quality of children's life. *Objectives*. To estimate the prevalence of dental caries and its associated factors among primary school children in Alem Ketema, North Showa, Ethiopia. *Methodology*. An institution-based quantitative cross-sectional study was conducted on 422 primary school children, from February 9 to March 8, 2020. Pretested structured questionnaire and oral examinations were conducted by using the WHO criteria (DMFT) index to collect the data. The data were entered into Epi-Data 3.1 software, and analysis was carried out using SPSS version 23 and variables with P value ≤0.05 in the multivariable binary logistic analysis were considered as a cut-point to declare statistical significance. *Result*. The prevalence of dental caries was 46.9% (95% CI: 42.1, 51.7). The mean Decayed, Missing, and Filled Teeth (DMFT) index was 1.28 (±1.21). Being male (AOR = 1.975, 95% CI = 1.067–3.66), lack of parents' insistence (AOR = 2.052, 95% CI = 1.079–3.902), lack of oral health education program (AOR = 4.753, 95% CI = 1.69–13.38), history of dental aches (AOR = 2.88, 95% CI = 1.55–5.32), and poor habit of mouth wash (AOR = 4.74, 95% CI = 2.55–8.79) were found significantly associated with dental caries. *Conclusion*. The prevalence of dental caries was higher and a common public health problem among school children. Lack of parent's insistence, sex, dental ache history, poor practices of mouth wash, and lack of oral health education were significant predictors of dental caries. Therefore, oral health education program and parents encouraging their children to practice oral hygiene are important to prevent dental caries.

1. Introduction

According to the World health organization (WHO), dental caries (tooth decay) is defined as the destruction of the enamel layer of the tooth by acids produced by the action of bacteria on sugar [1]. It is widely known that dental caries is one of the preventable oral health problems and the most common chronic infectious, childhood diseases [2]. Dental caries is highly prevalent and has a negative impact on children's quality of life, and is a major public health problem in the whole world [3].

It is estimated that nearly 3.5 billion people are affected by oral disease in the world [4]. Approximately 2.4 billion or 36% of the world population have dental caries in their permanent teeth [5]. More than 530 million of children lose their primary teeth due to dental caries [4]. Due to lack of health education and insufficient preventive measures, there is a high prevalence of morbidity that highly affects the health status of children [6]. In the United States, dental caries is the most common chronic childhood disease. It is five times more common than asthma [5]. In England, over 60,000 children aged 0–19 years were admitted to hospital to have teeth removal under a general anesthesia [7]. Dental caries remains highly prevalent in most of the developing countries [8].

Dental caries results from a complex interaction of factors like host susceptibility, bacteria, diet, and time (duration). The bacteria and sugary food act together to form

acid productions that result in the formation of teeth cavitation [9]. Consequently, the acid destroys the enamel surface; if the process is not seen, it will result in progressive destruction of the tooth [10]. Dental caries is highly increasing among children due to the excessive consumption of sugary substances, poor oral hygiene, lack of fluoride exposure, and inadequate health service utilization [11, 12]. Poor oral health can lead to tooth decay which affects the growth and maturation of secondary dentition (permanent dentition) which leads to malocclusion of teeth [9]. Dental caries has many complications like toothache, pulpitis, tooth loss, dental discoloration, and Ludwig angina [5].

Globally, it has been estimated that 60% to 90% of school children have dental caries; this means that six to nine children in every ten are affected by tooth decay [13]. Oral health affects both physically and psychologically [14]. Children with dental caries have difficulties in sleeping, playing, eating, performing academic activity and communication problems due to missing, discolored, or damaging teeth. Generally, it affects children's physical growth, self-esteem, and social development [15].

Dental caries has a high financial burden on parents of affected children [16]. In high-income countries, dental treatment is costly with 5% of the total health expenditure and 20% of out-of-pocket health expenditure [4]. The burden of oral health in the United States is annually over 20 million working days and 51 million school hours are lost alone due to oral disease and its treatment [17]. In low- and middle-income countries, the incidence of dental caries is rapidly increasing among children and adults [18]. Oral health impacts general health, dental infection increases risk of pneumonia, gum disease can complicate diabetes, and oral bacteria are associated with infective arthritis and associated with endocarditis inflammation of the heart's inner lining [19]. A healthy mouth not only enables the nutrition of the physical body, but also enhances social interaction and promotes self-esteem and feelings of well-being [20, 21].

Schools have a major role in promoting and implementing health problems like dental caries. Schools are the best center for effectively implementing the comprehensive healthcare program as children are easily accessible at school [22]. In Ethiopia, oral health problems, prevention, and treatment get inadequate attention in the government so the identification of prevalence and risk factors will help to suggest interventions in order to reduce dental caries.

2. Objectives

The aim of this study is to assess the prevalence of dental caries and associated factor among primary school children in Alem Ketema, North Showa, Ethiopia, 2020.

3. Methodology

3.1. Study Area and Period. The study was conducted in Alem Ketema town, which is located in North Showa Zone, Amhara region, and has a total population of 33,669. It is located 180 kilometers away from the capital city of Addis Ababa and 142 kilometers away from Debre Berhan city, at an elevation of 1,885 meters. Alem Ketema has 2 primary schools, one secondary school, and one preparatory school. It also has one district hospital, one health center, and three private clinics and three pharmacies. The study was conducted from February to March 2020.

3.2. Sampling Technique. The school was selected by simple random sampling technique. Study participants were selected using a systematic random sampling technique with every interval of 5 from the student list using the formula $K = N/n$. The first student was selected using lottery method.

3.3. Study Population. Primary school children in the selected primary school were the study population.

3.4. Inclusion Criteria. All primary school children who were attending class during the data collection period, and their parents were included in this study.

3.5. Sample Size Determination. The sample size was calculated using a single population proportion formula by considering the following assumptions, a prevalence of 48.5% of dental caries in primary school children based on a similar study done in Finote Selam Town primary school [9], 95% confidence level, and marginal of error 5%:

$$n = \frac{za^2}{2p}\frac{(1-p)}{d^2},$$
$$n = (1.96)^2 \times 0.485\frac{(1-0.485)}{0.05^2}, \quad (1)$$
$$n = 383,$$

where level of significance = 5% (0.05) and nonresponse = 10%, $n = 422$.

Finally, 10% non-response rate was added to the calculated sample size.

For the second objective, the sample size for associated factors was determined using Epi info version 7 at confidence interval $(1-\alpha) = 95\%$ and power $(1-\beta)$ of 80% was calculated by considering factors like grade level, habit of cleaning teeth, and consumption of sweet food. Finally, the calculated sample size for independent factors was smaller than the prevalence. So, the largest one, the prevalence sample size 422, was taken (Table 1).

3.6. Data Collection Tools, Method, and Data Quality Assurance. The data were collected using a pretested structured questionnaire from student's parents or caregiver. Data were collected by face-to-face interviews by two trained female diploma nurses. The data collectors were selected based on familiarity with the study area and local language. Two days of training was given, and pretest was done on five percent of the sample, to assess the clarity of the question, their competence, and understanding of the data collector. Double data entry was

Table 1: Sample size calculation for research on dental caries among primary school children, Ethiopia, 2020.

Associated factors	Reference	Dental caries (%)		AOR	Sample size
		Yes	No		
Grade-level	[23]	31.9	12.2	3.9	162
Cleaning teeth	[23]	16	36.6	2.6	195
Consumption of sugar	[9]	50.4	17.6	3.41	100

done to maintain the quality and consistency of data. Entry errors were checked and corrected by going back to the questionnaires.

3.7. Oral Examination. Clinical examinations for dental caries were performed by one dentist. Dental examination was performed on each child by using a disposable glove, daylight, dental mirror, and wooden spatula. The dental caries diagnosis protocol was obtained from WHO dental caries diagnosis guideline, by using the Decayed, Missing, and Filled Teeth (DMFT) index which is one of the most widely used methods in oral health for assessing dental caries prevalence.

3.8. Measurements

DMFT: the sum of the number of decayed (D), missing due to caries (M), and filled (F) teeth in the permanent teeth

Mean DMFT: the sum of individual DMFT values divided by the sum of the population or examined population

Dental aches: pain or inflammation in or around the tooth, often caused by tooth decay or infection

3.9. Statistical Analysis. The data were checked for its completeness and were entered using Epi-Data 3.1 and exported to SPSS software and analysis was carried out using statistical package for social sciences (SPSS) version 23. The data were summarized and organized using tables, texts, and chat. The reliability test was done with a Cronbach Alpha test, and it was 0.75. Variables with 95% CI and P value <0.25 during the bivariate analysis were entered into multivariable analysis. Multi-co-linearity test was carried out to see the correlation between independent variables using a multi-co-linearity coefficient and by variance inflation factor (VIF). Hosmer-Lemeshow was used to test model fitness (0.94). Finally, variables with P value less than or equal to 0.05 in multivariable analysis were considered significant.

4. Results

4.1. Sociodemographic Characteristics. A total of 422 children participated in this study which gives a response rate of 100%. The mean age of the children was 10.9 (SD ± 2.3). More than half of children 242 (57.3%) were aged 11–14. Around two hundred twenty-three (52.8%) of the children were grades 5–8. About two hundred forty-six (58.3%) of the respondents were male (Table 2).

4.2. Dietary- and Oral Hygiene-Related Characteristics. From the total children, 365 (86.5%) consumed sweet food, of whom 114 (31.1%) consumed daily and 144 (34.1%) used bottled food during childhood period. One hundred sixty-five (39.1%) of children were practicing tooth brush. The majority of the children, 355 (84.1%), did not use toothpaste. From the total children, one hundred twenty-four (29.4%) of parents insisted that their children clean their teeth. One hundred sixty-nine (40.0%) of children have experienced dental ache (Table 3).

4.3. Prevalence of Dental Caries. The prevalence of dental caries in this study was 198 (46.9%) with 95% CI (42.1−51.7). The mean Decay, Missing, and Filled Teeth (DMFT) index was 1.28 (±1.21) among the study participants; none of them had filled treatment (Figure 1).

4.4. Factors Associated with Dental Caries. Bivariable and multivariable logistic regression analysis was carried out to determine the association between independent variables and dental caries. Hence, in the bivariable analysis, sex, age, grade level, consumption of sweet food, habit of brush teeth, history of dental aches, oral health education, lack of parent insistence, and poor mouth wash after food were associated with dental caries whereas. On multivariable logistic regression, sex, history of dental aches, lack of oral health education, lack of parents' insistence, and poor mouth wash after food were the independent predictors of dental caries.

In this study, male children were 2 times more likely to have dental caries than females (AOR = 1.97 95% CI = 1.067–3.66). Children who had a history of dental aches were 3 times more likely to have dental caries (AOR = 2.88 95% CI = 1.55–5.32). Children with lack of oral health education were 4.7 times more likely to have dental caries (AOR = 4.753 95% CI = 1.69–13.38). Children who had poor mouth wash after food were 4.7 times more likely to develop dental caries than children who practiced mouth wash after food (AOR = 4.74 95% CI = 2.55–8.79). Children whose parents lacked insistence were 2 times more likely to develop dental caries (AOR = 2.052 95% CI = 1.079–3.902) (Table 4).

5. Discussion

This study tried to assess the prevalence of dental caries and its associated factors among primary school children. Based on the findings, the prevalence of dental caries in this study was 46.9% (95% CI 42.1, 51.7). This is consistent with study done in Finote Selam and Chennai (India) [8, 24]. The prevalence of dental caries in this study was relatively higher than a study done in Aksum (35.4%) and Bahir Dar (21.8%) [11, 25] but was lower than a study conducted in Najran, Saudi Arabia (71.5%), Eritrea (78%), Tamil Nadu (63.9%), and Brazil (55.5%) [26–29]. This difference might be due to

Table 2: Sociodemographic characteristics of primary school children in Alem Ketema, North Shewa, Ethiopia, 2020 ($n = 422$).

Variables	Frequency N (%)
Age	
7–10	180 (42.7)
11–14	242 (57.3)
Sex	
Male	246 (58.3)
Female	176 (41.7)
Residency	
Urban	416 (98.6)
Rural	6 (1.4)
Grade level	
1–4	199 (47.2)
5–8	223 (52.8)
Religion	
Orthodox	415 (98.3)
Catholic	7 (1.7)
Mother's education level	
Illiterate	168 (39.8)
Can read and write	106 (25.1)
Grade 1–8	64 (15.2)
Grade 9–12	50 (11.8)
Above grade 12	34 (8.1)
Father's education level	
Illiterate	56 (13.3)
Can read and write	127 (30.1)
Grade 1–8	96 (22.7)
Grade 9–12	92 (21.8)
Above grade 12	51 (12.1)

sample size difference and sociodemographic differences like age category and sex.

In this study, the mean DMFT was 1.28 which was higher compared to study done in Ferozepur (India) [23], Finote Selam [23], and Nigeria [24, 30]. This might be due to poor oral hygiene practice and dietary habits. However, the value was lower compared to a study done in Iran [31], Eritrea [27], and Mumbai (India) [22]. It might be due to that filled teeth might be missed during examination.

Sex of the children was one of the factors significantly associated with dental caries in this area. Males were 2 times more likely to have dental caries than female. This finding was similar to a study conducted in Bihar (India) [32] and Nigeria [30]. The reason could be due to the difference in sex composition of the sample. In contrast to this study, in Iran females were 1.4 times more likely to have dental caries [33]. This may be due to lower salivary flow rate, tooth eruption, and females acquiring their teeth earlier than males [34].

This study found that children with dental aches were 3 times more likely to have dental caries; similarly findings were obtained in Bahar Dar where children with dental aches were 6.3 times more likely to have dental caries [11] and a study conducted in Aksum showed that children who had dental pain were 1.8 times more likely to have dental caries [25]. This might be due to the fact that the dental aches may be associated with poor habit of tooth cleaning and exposure to sweet drinks and food.

Table 3: Dietary- and oral hygiene-related characteristics of Alem Ketema Primary School children, North Shewa, Ethiopia, 2020 ($n = 422$).

Variables	Frequency (%)
Consumption of sweet food	
Yes	365 (86.5)
No	57 (13.5)
Frequency of consumption	
Daily	114 (31.1)
2-3*days	179 (48.9)
Once a week	73 (19.9)
Bottle food childhood	
Yes	144 (34.1)
No	278 (65.9)
Drink soft drink	
Yes	329 (78.0)
No	93 (22.0)
Teeth brush habit	
Yes	165 (39.1)
No	257 (60.9)
Frequency of bushing	
Twice/day	22 (5.2)
Once/day	37 (8.8)
Sometime	106(25.1)
Material use to clean	
Tooth brush	67 (15.9)
Local chew stick	98 (23.2)
Toothpaste use	
Yes	67 (15.9)
No	355 (84.1)
Parent insistence	
Yes	124 (29.4)
No	298 (70.6)
Dental aches	
Yes	169 (40.0)
No	253 (60.0)
School health education	
Yes	239 (56.6)
No	183 (43.4)
Habit mouth wash	
Yes	233 (55.3)
No	189 (44.8)

In this study, lack of oral health education program was significantly associated with dental caries. This result is similar to those studies conducted in Nepal and Bangladesh; children who did not receive oral health education were significantly associated with having dental caries [3]. This might be those children who are getting health education might have got different educational messages regarding factors contributing to dental caries and have good knowledge about how to prevent dental caries.

According to this study, lack of parent's insistence on their children for cleaning their teeth was significantly associated with dental caries. This study was supported by a study done in Mumbai (India) [22]. This might be due to the fact that the lack of parents' insistence for children may be associated with behavioral characteristics of the children like poor habit of cleaning their mouth and consuming a lot of sweet food which is associated with dental caries.

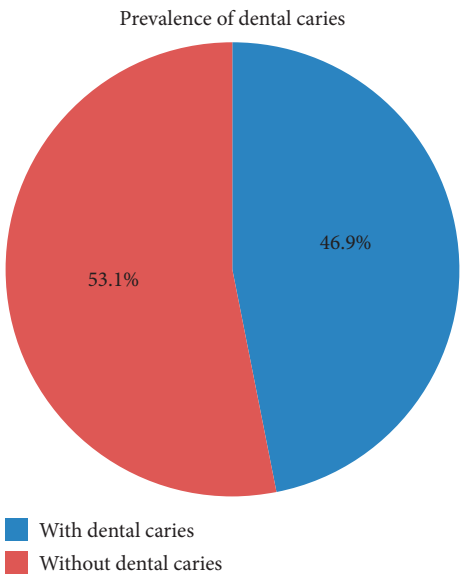

Figure 1: The prevalence of dental caries among primary school children in Alem Ketema, North Shewa, Ethiopia, 2020.

Table 4: Factors associated with dental caries among primary school student in Alem Ketema town, North Shewa, Ethiopia, 2020.

Variables	Yes (%)	No (%)	COR (CI: 95 (%))	AOR (CI: 95 (%))
*Sex				
Male	142 (57.7)	104 (42.3)	2.926 (1.950–4.390)	1.975 (1.067–3.656)*
Female	56 (31.8)	120 (68.2)	1	1
Age				
7–10	109 (60.6)	71 (39.4)	2.639 (1.774–3.925)	2.029 (0.770–5.345)
11–14	89 (36.8)	153 (63.2)	1	1
Grade level				
1–4	118 (59.3)	81 (40.7)	2.604 (1.757–3.860)	1.352 (0.508–3.597)
5–8	80 (35.9)	143 (64.1)	1	1
Consumption of sweet food				
Yes	183 (50.1)	182 (49.9)	2.815 (1.508–5.256)	1.224 (0.454–3.298)
No	15 (26.3)	42 (73.7)	1	1
Tooth brushing				
Yes	66 (40.0)	99 (60.0)	1	1
No	132 (51.4)	125 (48.6)	1.584 (1.066–2.354)	1.089 (0.570–2.081)
*Dental aches				
Yes	104 (61.5)	65 (38.5)	2.706 (1.812–4.043)	2.875 (1.555–5.317)*
No	94 (37.2)	159 (62.8)	1	1
*Oral health education				
Yes	22 (75.9)	7 (24.1)	1	1
No	97 (42.0)	134 (58.0)	4.342 (1.783–10.570)	4.753 (1.688–13.379)*
*Parent insistence				
Yes	82 (66.1)	42 (33.9)	1	1
No	142 (47.7)	156 (52.3)	2.145 (1.387–3.317)	2.052 (1.079–3.902)*
*Mouth wash after food				
Yes	66 (28.3)	167 (71.7)	1	1
No	132 (69.8)	57 (30.2)	5.860 (3.844–8.932)	4.739 (2.555–8.790)*

*Significance.

This study had also shown that children who were having poor mouth wash after food were 4.7 times more likely to develop dental caries. This finding is supported by a study conducted in Mumbai (India) [22] and a study done by Tamil Nadu (India) where children who had poor habit of mouth wash were of higher odds of developing dental caries [28]. Having poor wash after food may cause the accumulation of food between the teeth and create good environment for bacterial growth which causes dental caries.

5.1. Limitation of the Study. The limitation of the study was difficulty of radiological examination at a filled level which might reduce the actual magnitude of the problem.

6. Conclusion

In this study, the prevalence of dental caries was higher and a common public health problem among school children. Sex, dental ache history, lack of health education, lack of parent's insistence to their children to clean their teeth, and poor practices of mouth wash after food were the factors associated with dental caries among school children.

Abbreviations

DBU: Debre Berhan University
DMFT: Decayed, Missing, and Filled Teeth
OHE: Oral health education
SPSS: Statistical Package for Social Sciences
WHO: World Health Organization.

Data Availability

Full data for this research are available from the corresponding author upon request.

Ethical Approval

Ethical clearance was obtained from Debre Berhan University College of Health Science and Department of Public Health. A letter of cooperation was written to Alem Ketema Primary School local authorities.

Consent

Written informed consent was obtained from parents and legal guardians of those students before interview and dental examination. The objective of the study was told briefly to the participants, and each volunteer was requested upon informed consent to give the request information as an interview. Only participants who agree were interviewed after their full consent and confidentiality was ensured, including not mentioning their names in any communication.

Disclosure

No funding bodies were involved in the manuscript writing, editing, approval, or decision to publish.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors contributed to the design of the study and the interpretation of data.

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