



# Magnitude of Dental Caries and Its Associated Factors Among Governmental Primary School Children in Debre Berhan Town, North-East Ethiopia

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**Background:** In Ethiopia, oral health prevention and treatment have gotten low attention in the government, and the existing dental services are privately owned and thus expensive. Hence, this study aimed to assess the prevalence of dental caries and its associated factors among governmental primary school children in Debre Berhan town, Ethiopia, 2019.

**Methods:** An institutional-based cross-sectional study was conducted from January 30 to February 14/2019. A total of 417 primary school children were selected using computer-generated simple random sampling and interviewed using structured and pretested questionnaires. Data were coded, entered, and cleaned using Epi-data version 3.1 and export to SPSS version 22 for analysis. Binary logistic regression analysis was employed to test the association between dependent and independent variables. P-value less than 0.05 was taken as significant association. Finally, the result of this study was present by text, tables, and graphs.

**Results:** Out of the 396 study participants, 135 (34.1%) had dental caries. Of these, more than half, 95 (59.37%) had the pre-molar decayed. Two hundred eighty-five (72.0%) of them were cleaned their teeth. The Independent predictors of dental caries were drinking sugared tea [AOR= 2.034, 95% CI: (1.223–3.385)] and food particle on their teeth [AOR= 6.709, 95% CI: (3.475–12.954)], which had shown a significant association with dental caries.

**Conclusion:** The over magnitude of dental caries was relatively high and found to be a public health problem. Drinking sugar tea, presence of food particles, or dental plaque were significantly associated with dental caries. In contrast, merchant occupation reduced the chance of dental caries. Giving health education to minimize drinking sugar tea and cleaning their teeth after consumption of sugar tea should be given attention.

**Keywords:** dental caries, children, associated factors, Ethiopia

## Background

Dental caries is one of the global oral health problems, which cause the destruction of the hard parts of a tooth by the interaction of bacteria and fermentable carbohydrate.<sup>1</sup> Now a day dental caries are on the rise to become major public health problems worldwide, it is estimated that 2.4 billion people suffer from caries of permanent teeth and out of them around 486 million children suffer from caries of primary teeth.<sup>2</sup> Dental caries has detrimental consequences on children's quality of life by inflicting pain, premature tooth loss, undernutrition, and finally influences overall growth and development.<sup>3–6</sup> Although poor oral health is not life-threatening, it causes tooth pain, eating impairment, the loss of tooth, delay language development, decrease educational concentration in school, and has a high financial burden on the

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families.<sup>7,8</sup> In many countries, access to dental care is not equitable, leaving poor children and families underserved.<sup>9,10</sup> Fortunately, it is preventable, with almost all risk factors modifiable. According to WHO guidelines the prevention and control approaches range from changing personal behavior to working with families and caregivers to public health solutions such as building health policies, creating supportive environments, and health promotion and orientation of health services towards universal health coverage.<sup>11</sup>

Dental caries is also a progressive infectious process with a multifactorial aetiology.<sup>12,13</sup> Dental caries has high morbidity potential.<sup>7</sup> The frequent intake of sweets, dry mouth, and poor oral hygiene increase the chances for cavities.<sup>14</sup> The early childhood caries pattern changes at age three and begins to affect the first and second primary molars in developing countries including Ethiopia.<sup>15,16</sup> The prevalence of dental caries among pre-school children of developed nations has been declining over the past few decades.<sup>17,18</sup> However, it is still high among pre-schoolers of developing nations.<sup>19–21</sup> Numerous studies have revealed the magnitude of dental caries was reported as 43.6% in Thailand,<sup>22</sup> 70.4% in china,<sup>23</sup> 63.4% in India,<sup>24</sup> and 73% in Eastern Saudi Arabia.<sup>25</sup>

The burden of dental caries is increasing rapidly in low- and middle-income nations, and, is particularly severe among children living in deprived communities.<sup>26,27</sup> The prevalence of dental caries in Africa was reported to be varied from 12.6% to 24.1% in Nigeria,<sup>28,29</sup> 43.3% in Kenya,<sup>30</sup> and 30.5% in Sudan.<sup>31</sup> A study done in Ethiopia indicated that dental caries was 21.8% in Bahir Dar,<sup>32</sup> 47.4% in Addis Ababa,<sup>33</sup> 36.3% in Gondar Town,<sup>34</sup> and 48.5% in Finote Selam.<sup>10</sup> Overall, dental caries may influence children's development and their participation in important daily activities.<sup>6</sup>

According to the report of different study sex, age, dietary habits, education, and oral hygiene status are associated with an increased prevalence of dental caries.<sup>30,32,35</sup> Likewise, the growing consumption of sugared foods in the developing world, poor tooth-brushing habits, poor oral hygiene, and low level of awareness about dental caries are some of the factors that increased the levels of dental decay.<sup>28,36–38</sup> On the contrary, frequent tooth brushing was a lower chance of having decayed.<sup>5</sup>

To the best of our knowledge, in Ethiopia few studies about demographic and socio-economic variables as risk factors of dental caries had been published.<sup>33,34</sup> However, oral health prevention and treatment have gotten low attention in

the government and the existing dental services are privately owned and expensive. As the finding of previous studies shows, dental caries are the public health problem among school children and there was no published research on the magnitude of dental caries in primary school children in the study area. Therefore, the objective of this study was to assess the magnitude of dental caries and its associated factors among governmental primary school children in the Debre Berhan town, Ethiopia.

## Patients and Methods

### Study Design and Setting

An institution-based cross-sectional study was conducted from January 30 to February 14/2019. This study was conducted in Debre Berhan town primary school's students. The Debre Berhan town is located in North Shoa Administrative Zone, Amhara National Regional State, Ethiopia. It is located at a distance of 130 km, North East of Addis Ababa (capital city of Ethiopia), 682 km the capital city of Amhara regional state Bahir Dar. The total population size of the district was putted as 108,876 out of which 49,259 were male and 59,617 were female.<sup>39</sup> The town had 10 governmental primary schools, and the total numbers of primary school students were 7198 students, out of these the study subjects was 3607 students.<sup>40</sup>

### Study Participants

Children from governmental primary school students who are grades 1–8, present in school during the data collection period, those living in Debre Berhan town for at least six months and consent to participate were included in the study. Aged greater than or equal to 18 years, those who were mentally ill and unable to hear were excluded from the study.

### Sample Size Estimation

The sample size was calculated using a single population proportion formula with an assumption of 95% confidence level, 5% degree of precision, and the proportion of dental caries, 21.8%.<sup>32</sup> After adding a 10% non-response rate and 1.5 designs effects the final sample size of the study was 417.

### Sampling Procedure

Our study sample was obtained by a two-stage cluster sampling technique. In the first stage, out of ten governmental primary schools, four schools were selected by using a simple random sampling technique and the sample size

was allocated proportionally to each selected school, based on the number of students. In the second stage, the study participants were selected from each grade and sections of the selected schools by a simple random sampling technique using a computer-generated method proportionally to the number of students in each and sections. A list of the students were taken from their rosters in the respective class.

## Data Collection

A structured questionnaire prepared in English was developed from different previous similar literatures<sup>10,32,36,41</sup> which contain socio-demographic data, and factors associated with dental caries. A face-to-face interview was used to collect the data. To ensure the quality of the data, the questionnaire was initially developed in English and translated into local language, Amharic by experts and then back to English. Before going to the actual data collection, the questionnaire was pretested in a similar setting outside the study district 5%<sup>21</sup> in model kutir 1 primary school to increase the validity and reliability of data collection tools. The questionnaire was modified based on the response after the pre-tested and modification was made in the final version of the data collection tool. The training was given to data collectors and supervisors for one day before the actual data collection task and trained guide was prepared to facilitate the training. Other than the outcome variables the data were collected from 5 BSC nursing students. All data collectors were trained on their responsibilities for the purposes of the study, how to collect the data, how to maintain confidentiality, and how to ensure genuine replies to questions. Lastly, the principal investigator was strictly following the overall activities of the data collection on a daily base to ensure the completeness of the questionnaire and to give further clarification.

## A Dental Examination

It was carried out for all selected children by one trained dental doctor using World Health Organization (WHO) dental caries diagnosis guideline with the Decayed, Missed, filled Tooth (DMFT) index under natural daylight.<sup>42</sup> A tooth was recorded as decayed when a carious lesion or both carious lesions and a restoration are present at enamel or detectably softened wall or floor. It was also recorded as missing when it has been extracted due to caries and a permanent or temporary filling is present, or when a filling is defective but not decayed is counted as a filled tooth. The intra examiner

agreement was evaluated by re-assessing a 10% random sample of the children on the same day. The dental assistant without the knowledge of the examiner performed the selection of children for duplicates.

## Data Processing and Analysis

Data were coded, cleaned, entered, and edited using Epi-data version 3.1 and exported to SPSS version 22 for analysis. Descriptive statistics, like frequency and percentage, were used depending on the nature of the variable. All variables, which become significant with a p-value of  $\leq 0.25$  in the bivariable analysis was fitted into the multivariable logistic regression. Variables with a p-value of  $\leq 0.05$  at multivariable analysis were considered as significantly associated with the outcome variable. In the model variable selection technique was successive stepwise backward elimination. Confounding and effect modification was checked by looking at regression coefficient change greater than or equal to 15% and multi-collinearity was checked using the variance inflation factor using a value of  $< 10$  as a cut-off point. Adjusted Odds Ratio (AOR) with 95% confidence interval (CI) was used to see the strength of the association between dependent and independent variables. Finally, the finding of the study was displayed by using texts, tables, and figures.

## Results

### Socio-Demographic Characteristics of the Study Participants

A total of 417 eligible primary school students were interviewed with a nearly 95% response rate. The mean age of participants was 12.74 (SD $\pm$ 2.556) with a range of 11–14 years old. More than half, 218 (55.1%) of students were females. Nearly half, 197 (49.71%) of students were 11–14 ages. Most of the study participants 293 (74%) of the respondents were married. Regarding the residency majority of participants, 334 (84.3%) was urban (Table 1).

### Food Consumption Pattern, Dietary Habits and Practices Related to Oral Hygiene

According to our study, most 307 (77.5%) of the students were getting meals three times per day. Fifty-four (13.6%) of the participants drank coffee with sugar. Most, 307 (77.5%) of the students were drank soft drinks. One hundred twenty-nine (32.6%) of the study participant were eating sweet food.

**Table 1** Socio-Demographic Characteristics of the Study Participant in Debre Berhan Town, Ethiopia, 2019

Variable	Category	Frequency	Percent (%)
Sex of participant	Female	218	55.1
	Male	178	44.9
Age of participant	7–10	93	23.48
	11–14	197	49.74
	15–19	106	26.76
Educational status	1–4	131	33.1
	5–8	265	66.9
Educational status of fathers	Illiterate	78	19.7
	Can read and write	102	25.8
	Grade 1–8	91	23.0
	Grade 9–12	66	16.7
	Diploma and above	59	14.9
Educational status of the mother	Illiterate	130	32.8
	Can read and write	88	22.2
	Grade 1–8	89	22.5
	Grade 9–12	60	15.2
	Diploma and above	29	7.3
Residency	Urban	334	84.3
	Rural	62	15.7
Marital status	Married	293	74.0
	Single	5	1.3
	Divorce	61	15.4
	Widowed	37	9.3
Occupation of parents	Farmer	80	20.2
	Merchant	131	33.1
	Government employee	101	25.5
	Private worker	84	21.2

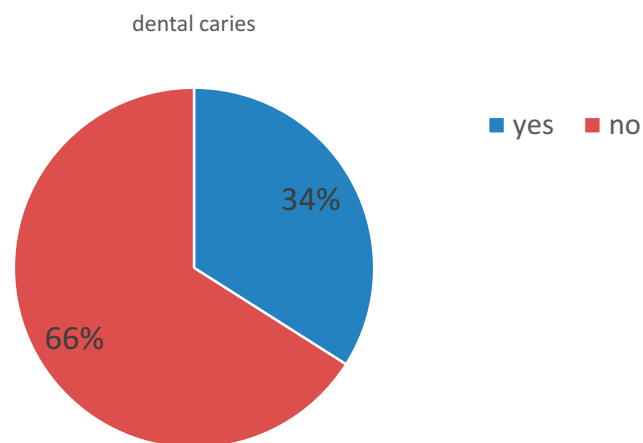
Majority 373 (94.2%) of the student often uses sweet food and drinks. In our study most, 285 (72.0%) of them were cleaned their teeth. Out of them, 15 (5.62%) cleaned teeth after every meal. However, nearly half 132 (46.32%) of children cleaned their teeth once per day. Similarly, nearly half 140 (49.12%) of children were cleaned their teeth morning. Among the participants, 128 (44.91%) of them were used toothbrush with paste. However, 122 (42.81%) and 33 (11.58%) were used toothbrush with media and only a toothbrush, respectively to clean their tooth (Table 2)

**Table 2** Consumption Pattern, Dietary Habits, and Practice Related to Oral Hygiene of the Study Participants in Debre Berhan Town, Ethiopia, 2019

Variable	Category	Frequency	Percent (%)
Get meal per day	Once per day	1	0.03
	Three times per day	307	77.53
	Four times per day	88	22.23
Ate breakfast	Bread with tea	311	78.5
	Pasta or mokoroney	18	4.5
	Injera with wot	65	16.4
	Kinche	2	2.05
	Others	2	0.5
Drink sugar tea	Yes	151	38.1
	No	245	61.9
Drink sugar coffee	Yes	54	13.6
	No	342	86.4
Drink soft drink	Yes	307	77.5
	No	89	22.5
Eat sweet food	Yes	129	32.6
	No	267	67.4
How often use sweet food?	Daily	6	1.5
	Once per day	17	4.3
	Occasionally	373	94.2
Food particle or plaque	Yes	280	70.7
	No	116	29.3
Use toothbrush	Yes	285	72.0
	No	111	28.0
Frequency of toothbrush	After every meal	15	3.8
	Twice per day	53	13.41
	Once per day	132	33.3
	Sometimes	85	21.5
Time of brushing	Morning	140	35.4
	Before bed	1	0.3
	Mixed	62	15.7
	No fixed	82	20.7
Type of brushing	Toothbrush with paste	128	32.3
	Only toothbrush	33	8.3
	Mefakia	122	30.8
	Charcoal	2	0.5

## Magnitude of Dental Caries

Out of the 396 study participants, 135 (34.1%) had dental caries (Figure 1). More than half, 95 (59.37%) of the students had pre-molar dental carries. According to our



**Figure 1** Prevalence of dental caries of study participant in Debre Berhan town, Ethiopia, 2019.

study, 28 (7.1%) had missed teeth. Of these, nearly half 12 (42.86%) of the missed teeth was pre-molar.

## Factors Associated with Dental Caries

According to this study, children who drank sugared tea frequently had 2 times [AOR=2.03% CI: (1.22; 3.38)] a chance of developing dental caries than those who drank sugared tea rarely. Similarly, students who had food particles on their teeth were 7 times [AOR= 6.70, 95% CI: (3.47; 12.95)] more likely to develop dental caries than those who did not have food particle on their teeth. However, dental caries among children, whose parents' occupation of a merchant was 53% [AOR= 0.47, 95% CI: (0.24; 0.91)] less likely chance of developing dental caries compared to those who had a private worker parent. On the other hand, students who ate sweet foods at any time point during the study period were 57.8% less likely [AOR= 0.42, 95% CI: (0.24; 0.71)] to develop dental caries than those who does no ate sweet foods, and we are 95% confident that the true value is lying between 29% and 76% (Table 3). No confounding, effect modification, and multi-collinearity were observed in this study.

## Discussion

The current study was aimed to assess the magnitude of dental caries and its associated factors among governmental primary school children in Debre Berhan town, north-east Ethiopia. According to this study, the magnitude of dental caries among school children was 34.1%. Our finding was in line with a study done in the Tigray region (35.4%).<sup>43</sup> However, the result was higher than studies

conducted in Bahir Dar (21.8%),<sup>32</sup> Nigeria (24.1%),<sup>28</sup> Sudan (30.3%),<sup>31</sup> and Pakistan 14.5%.<sup>44</sup> But lower than other studies in Kenya 43.3%<sup>30</sup> and Finote-Selam (48.5%),<sup>10</sup> Saudi Arabia (83%)<sup>45</sup> ad Eretria (78%).<sup>46</sup> The possible explanation about the variations might be the dental health consideration and the awareness level of most of the Ethiopians; including Debre-Berhan town school students is low. Another possible explanation might be the different study area and period.

Based on this study, the prevalence of dental caries was higher in male students 61 (34.27%) than females 74 (33.9%). This result was not supported by the studies done in Bahir Dar,<sup>28</sup> Finote-Salam<sup>32</sup>, and in Kenya.<sup>30</sup> This discrepancy might be due to other co-founding factors like brushing habits and dietary habits.

According to the present study, the magnitude of dental caries among participants aged group 7–10 was 34 (36.56%). In line with a study conducted, in Bahir Dar, the proportion of dental caries was 33.3%<sup>32</sup> in children from 6 to 10 years of age. The magnitude of dental caries was 47 (35.9%) among grade 1–4 students. Our finding is higher than a study in Bahir Dar the proportion of dental caries was 23 (31.9%) and 9(12.2%) among children from grades 1–4 and 5–8, respectively. The possible reason might be when the age and education level increases the awareness about dental caries and oral health may be increased.

Concerning the residence in this study, the students who were living in rural 25 (40.32%) had a higher prevalence than urban area 110 (33%). This finding was supported by studies done in Zimbabwe<sup>47</sup>. However, this result was not inlined with Finote-Selma's study and in Uganda.<sup>10,48</sup> The possible reason may be the awareness of oral hygiene in rural is low.

According to the current study, 128 (32.2%) children used a toothbrush with paste to clean their teeth, whereas 122 (30.8%) children used a traditional small stick of wood (termed as Mafaqiya) made of a special type of plant to clean their teeth. However, the study done in Bahir Dar city reported that 67.6% of children cleaned their teeth using a traditional small stick of wood (Mafaqiya) for maintaining oral hygiene.<sup>32</sup> This might be due to the poor habit and improper usage of the tooth-brushing sticks in the country.

Recent studies showed that more than half, 95 (59.37%) of the respondents had the pre-molar decayed and 28 (7.1%) had missed teeth. Out of them about nearly half, 12 (42.86%) of missed teeth were pre-molar. This finding is in line with a study done in Finote-Selam study, dental caries was most



**Table 3** Factors Associated with Dental Caries of Study Participant in Debre Berhan Town, Ethiopia, 2019

Variables	Dental Caries		COR(95% CI)	AOR(95% CI)
	No	Yes		
Educational level of participant father				
Illiterate	51	27	2.07(0.94:4.55)	1.36(0.57:5.12)
Can read and write	62	40	2.52(1.19:5.34)*	1.92(0.55: 6.68)
Grade 1–8	55	36	2.56(1.19:5.48)*	1.33(0.38:4.61)
Grade 9–12	46	20	1.70(0.74:3.87)	0.99(0.29:3.34)
Diploma and above	47	12		
Educational level of participant mothers				
Illiterate	84	46	2.09(0.79:5.52)	0.76(0.18:3.18)
Can read and write	55	33	2.30(0.84:6.23)	0.94(0.22:3.98)
Grade 1–8	59	30	1.94(0.71:5.29)	0.74(0.18:3.02)
Grade 9–12	40	20	1.91(0.67:5.45)	0.93(0.24:3.65)
Diploma & above	23	6		
Occupation of parent				
Farmer	52	28	0.59(0.31:1.11)	0.51(0.24:1.08)
Merchant	90	41	0.50(0.28:0.88)*	0.47(0.24:0.91)*
Gov't employee	75	26	0.38(0.20:0.70)*	0.62(0.26:1.46)
Private worker	44	40		
Drink sugar tea				
Yes	86	65	1.89(1.23:2.89)*	2.03(1.22:3.38)*
No	175	70		
Drink sugar coffee				
Yes	31	23	1.52(0.84:2.73)	1.23(0.61:2.46)
No	230	112		
Eat sweet food				
Yes	94	35	1.61(0.39:1.98)	0.42(0.24:0.71)*
No	167	100		
Frequency of tooth brush				
After every meal	7	8	1.02(0.56:1.83)	1.31(0.64:2.67)
Twice per day	38	15	1.99(0.65:6.01)	7.93(0.94:66.41)
Once per day	92	40	0.68(0.32:1.44)	3.27(0.40:26.48)
Sometimes	54	31	0.75(0.42–1.34)	0.19(0.03:1.02)
No	70	41		
Time of tooth brushing				
Morning	93	47	1.01(0.56:1.83)	—
Before bed	1	0	0.87(0.49:1.54)	4.10(0.78:21.43)
Mixed	45	17	0.00(0.00,—)	0.000(0.00,—)
No fixed	52	30	0.65(0.32:1.34)	0.214(0.02:1.71)
No	70	41		
Presence of food particle on teeth or plaque accumulation				
Yes	160	120	5.05(2.79:9.12)*	6.70(3.47:12.95)*
No	101	15		
Health education by television				
Yes	108	44	0.68(0.44:1.05)	0.75(0.44:1.28)
No	153	91		

**Notes:** \*Indicates that the variables significantly associated with the outcome at bivariable and multivariable analysis 95% level of significance (<0.05).

prevalent in premolar (42.2%).<sup>10</sup> Besides, this result is in line with a study done in Nigeria, which reported (46.5%).<sup>28</sup> This might be due to its first eruption and main role in mastication.

Based on the current study, dental caries among not brush teeth were 41 (36.9%). Our finding was lower than a study in Finote-Selam 76.9% of students never brush their teeth had dental caries.<sup>10</sup> This variation might be an awareness gap, study area, and period. The current study showed that children's parents with occupations of merchants were 53% less likely to develop dental caries compared to those private workers. However, in another study no association between parent occupation and dental caries. Hence, further study is needed to be conducted to investigate the possible association of occupation and dental caries.

According to this study, students who drinking sugared tea frequently were 2 times more likely to develop dental caries than those who drinking sugared tea rarely. This result was not supported by other studies.<sup>10,32</sup> This variation might be due to the different habits of drinking sugared tea across different areas and in the current study, most participants did not brush their teeth after drinking sugared tea.

The current study reported that students who have food particles or plaque on their teeth were 7 times more likely to develop dental caries than those who did not have food particles on their teeth. This finding is in line with a study done in Bahir Dar.<sup>32</sup> According to this study, students who eat sweet foods frequently found to be 2.4 more likely to develop dental caries than those who use sugared foods sometimes. This study is in line with, the study conducted in Finote-Selam,<sup>10</sup> and Kenya.<sup>30</sup>

These research findings would provide important baseline information and evidence regarding the overall magnitude of dental caries and its associated factors. Despite extensive efforts, the result of this study is subject to certain limitations; first, the cross-sectional nature of the study design impossible to form causal relationships between exposure and outcome variables. Second, behaviour aspects of the children cannot understand merely by the quantitative study. Third, the detection of dental caries using dental mirrors and radiology was not possible because of a lack of instruments and laboratory setup.

## Conclusion

The over the magnitude of dental caries was relatively high. Drinking sugar tea, presence of food particle, or dental plaque was found to be significantly associated with dental caries. In contrast, merchant occupation.

## Abbreviations

AOR, adjusted odds ratio; COR, crude odds ratio; SPSS, Social Package Statistically Software; WHO, World Health Organization.

## Data Sharing Statement

All relevant data are in the manuscript. However, the minimal data underlying all the findings in the manuscript are available from the corresponding author on reasonable request.

## Ethics and Consent Statement

This study was conducted in accordance with the Declaration of Helsinki. Ethical clearance was obtained from the Debre Berhan University, Institute of Medicine, and College of Health Sciences Ethical Board. A letter of permission was obtained from the Department of Paediatrics and Child Health Nursing. After that permission was obtained from the Debre Berhan Town Education Bureau and each primary school. Informed verbal consent was obtained from all study participants before the interview. Confidentiality of the information was ensured throughout the study.

## Consent

The authors confirm that all caregivers provided informed consent forms. Debre Berhan University approved the verbally informed consent process with the approval number of Ref.no. DBU.R.D 126/2011.

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## Author Contributions

All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare that they have no competing interests.

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