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ORIGINAL RESEARCH

Dental Caries and Associated Factors Among Patients Attending the University of Gondar Comprehensive Hospital Dental Clinic, North West Ethiopia: A Hospital-Based Cross-Sectional Study

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Purpose: Dental caries are an emerging public health problem in developing countries in the last two decades. However, there is a paucity of data on dental caries in northwest Ethiopia. This study investigated the prevalence of dental caries and associated factors in northwest Ethiopia.

Patients and Methods: A hospital-based cross-sectional study was conducted in 368 patients who visited the University of Gondar Comprehensive Hospital Dental Clinic. A systematic random sampling technique was used to select the samples. Data were collected by three qualified dental surgeons using a pre-designed questionnaire modified from a WHO oral health survey and the clinical examination was done using the WHO dental caries diagnosis guideline. Data analysis was done using SPSS 20. Descriptive data were presented in tables and logistic regression analysis was done to identify the possible predisposing factors using odds ratios with 95% confidence interval.

Results: The prevalence of dental caries in this study was 23.64% (95% CI: 19.30, 28.00) with a significant difference between females (30.56%) and males (17.02%). Being female (AOR=2.15 (95% CI: 1.31, 3.52), poor oral hygiene practice (AOR=2.44 (95% CI: 1.46, 4.07), being diabetic (AOR=8.15 (95% CI: 3.2, 20.75), low educational level (AOR=1.81 (95% CI: 1.05, 3.1), low monthly income (AOR=3.05 (95% CI: 1.54, 6.02) and halitosis (AOR=10.98 (95% CI: 5.68, 2.24) were significantly associated with dental caries. The mean DMFT score was 1.095±0.24 (SD). The majority of the DMFT (70.59%) was due to decay, while filled tooth accounted for only 2.17% of the DMFT. The DMFT score was higher in females (0.625), urban residents (0.85), and those with montly income of ≤2500 Ethiopian birr (0.86). The mean DMFT was 0.13.

Conclusion: The prevalence of dental caries in the study participants was 23.64% andwas higher in males than females and in diabetic patients. Female gender, poor tooth brushing habits, diabetes mellitus, and halitosis were significant predictors associated with dental caries.

Keywords: dental caries, tooth decay, DMFT, predisposing factors, oral hygiene practice

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Background

Dental caries is a bacterial infectious disease of the hard tissue of the tooth by the interaction of cariogenic bacteria and easily fermentable carbohydrates.[1] Dental caries is one of the major orofacial problem and indicator of the burden of oral

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health throughout the globe.[2,3] Even if, the prevalence of dental caries varies from country to country, it is a fact that the disease has a wide geographic distribution, high prevalence, and graded severity.[2,4] The prevalence was higher in minority and economically poor community.[5]

Dental caries affects the quality of life of the affected patients and highly affect the economy of the individual and society. The presence of carious tooth affects work performance, eating and speaking and also impair the growth and development.[6,7]

In the last two decades, the prevalence of dental caries has declined in developed countries,[8] while it showed a dramatic increase in the developing countries due to unaffordability of the dental services, and unavailability of dental clinics in rural settings.[9] A national survey done in Malawi showed 49.0% of 35–44 years adults had dental caries and the prevalence becomes 49.2% in 65–74 years. Moreover, the mean DMFT was raised as age increases from 12 years (DMFT=0.67) to 65–74 years (DMFT=6.87).[10] A study done in Eritrea showed 78% of the participants had dental caries and the prevalence of dental caries in Ethiopia was ranged from 36.3%-78.2%.[11,12] Another study conducted in Turkey revealed females were 1.83 times at risk of developing dental caries.[13] Lower socioeconomic status has a significant effect on the occurrence of dental caries in adults.[11]

The emerging of increased consumption of fermentable carbohydrates, low level of awareness about oral health, poor tooth brushing habits, and scarcity of dental centers are the possible factors for the increased prevalence of dental caries in developing countries.[14,15] Moreover, change in way of life, eating habits, and socio-demographic factors also increase the prevalence of dental caries.[7,13,16,17]

To date, there is a paucity of data on the prevalence and associated factors of dental caries in the study area. Due to this, the present study aimed to determine the prevalence of dental caries and associated factors in patients who visited the dental clinic of the University of Gondar specialized hospital.

Patients and Methods

Setting

This cross-sectional study was done at the University of Gondar comprehensive Hospital dental clinic from September 1, 2019-December 31, 2019. University of Gondar specialized hospital provides health care services over 5 million people and it's located 750km from Addis Ababa, the capital city of Ethiopia. The dental clinic is one of the Specialty clinics in the hospital that provides inpatient and outpatient dental health services for the population in the area.

Study Participants

All populations in the catchment area were the source population for the study and those who were 6 and above and visited the dental clinic of the University of Gondar would be included in the study. Patients with 6 and above years were examined for dental caries. All patients who visited the dental clinic within the study period and signed the consent form were included and examined for the presence of dental caries.

Exclusion Criteria

- Critically ill patients
- A patient with a dental emergency
- Patients refused to sign the consent

Sampling Technique and Procedure

A sample size of 368 participants was selected using the single population proportion formula

$$N = \frac{Z^2 p\,(1-p)}{d^2}$$

With the following assumptions; The prevalence of dental caries (P) to be 78.2% as estimated in Debre tabor hospital, Ethiopia,[11] confidence level (CI) of 95%, marginal error (d=5), and non-response rate of 10%.

Sampling Procedure

Systematic random sampling would be used (k=4). The first participant was selected by a simple random method.

Data Collection

A structured questionnaire, modified from WHO oral health survey 2013,[18] was prepared and a face to face interview was conducted in the dental clinic. The interview questionnaire was developed in English, translated into the local language of Amharic, and back into English. Two dental professionals reviewed the questionnaire for its clearness, sensitivity to culture, and the presence of appropriate words to the community. A pilot study was done in 40 patients before the administration of data collection. The data collected were socio-demographic characteristics, tooth brushing habits, dietary habits, and other medical conditions. The PI trained the data collectors for 2 days

on how to approach, interview, maintaining confidentiality, and research ethics. A day to day supervision was made by the PI to check the completeness of the questionnaires.

Intra-Oral Examination

The intra-oral examination was done according to the WHO oral health survey guideline[18] using dental probes, dental mirrors, and tissue forceps. A patient was considered to be carious if a lesion in a pit or fissure or on the smooth tooth surface had a detectable softened floor, or undermined enamel. A Tooth was considered to be missing because of caries if a person gave a history of pain and/or the presence of the cavity before extraction. The severity or experience of dental caries was evaluated by using the mean DMFT (permanent tooth) and dmft (primary dentition). The dentist did an intra-oral dental x-ray when it was indicated.

Data Analysis

Each questionnaire was checked for completeness before fed into a computer. The study variables were coded and entered into Epi-Info version 7 and transferred to SPSS version 20 for analysis. Descriptive statistics were computed. The association between the independent variables and dental caries was initially investigated using bivariate analysis and those with a p-value of ≤0. 25 were included in the multivariable analysis. Results were presented using OR with its 95% CI.

Ethical Consideration

Ethical approval was sought from the University of Gondar ethical review board (IRB) before the commencement of the study. Besides, a study permit was acquired from the University of Gondar Department of Dentistry. Written consent was obtained from the participants, and written assent was taken from parents or legal guardians for under 18 years. All patients with pain were managed as an emergency during their visit to the dental clinic.

Results

Socio-demographic characteristics of the participants

The mean age of the study participants was 30±14.766 SD years and 1/3rd of the participants were within the age group of 20–29 years (37.2%). Out of 368 participants, 180 (48.9%) were females. The majority of the study participants were orthodox (89.7%), and from urban residents (78.8%).

More than 2/3rd of the participants (73.6%) had a monthly income of ≤2500 Ethiopian birr and 77.4% of the participants had formal education (Table 1).

Oral hygiene practice of the participants

Table 1 Socio-Demographic Characteristics of the Patients Attended University of Gondar Comprehensive Hospital Dental Clinic (n=368)

Variable		Number	Percent
Age (years)	<20	68	18.5
	20–29	137	37.2
	30–39	92	25.0
	40–49	26	7.1
	≥50	45	12.2
Gender	Male	188	51.1
	Female	180	48.9
Marital status	Single	169	45.9
	Married	184	50.0
	Divorced	15	4.1
Occupation	Farmer	54	14.7
	Student	128	34.8
	Governmental employee	68	18.5
	NGO-employee	9	2.4
	Merchant/Personal business	109	29.6
Religion	Orthodox	330	89.7
	Muslim	23	6.3
	Protestant	8	2.2
	Catholic	7	1.9
Residency	Urban	290	78.8
	Rural	78	21.2
Monthly income	≤2500 ETB	271	73.6
	>2500 ETB	97	26.4
Educational status	Has no Formal education	83	22.6
	Has formal education	285	77.4

More than 2/3rd (73.1%) of the participants had tooth brushing habit and of them, 31.0% had no fixed time to brush their teeth. Only 7.5% of the participants brushed their teeth twice/day. A traditional tooth brushing stick ("Mefakia") (48.7%%) and a toothbrush with paste (49.8%) were the commonly used materials by the participants (Table 2).

Dietary habits, Smoking habits, and other systemic diseases

The majority of the study participants (74.2%) had consumed fermentable carbohydrates. Hot drinks (Tea and coffee) and soft beverages were commonly used carbohydrates by the participants (Table 3).

Twenty-three (8.4%) participants were smokers, 5.9% were diabetic patients (DM) and 3% were hypertensive patients (Table 3).

Table 2 Oral Hygiene Habits and Practice of the Participants (Self-Reported)

The Habit of Tooth Brushing		Number	Percentage
Toothbrush	Yes	269	73.1
	No	99	26.9
Frequency of tooth brushing	≥3 times/day	4	1.5
	Twice/day	20	7.4
	Once/day	76	28.3
	Irregularly	169	62.8
Time of tooth brushing	Before bed	11	4.1
	Morning	117	43.5
	Both in the morning and before bed	27	10.0
	No fixed time	114	42.4
Material for tooth brushing	Mefakia (traditional stick)	131	48.7
	Toothbrush with paste	134	49.8
	Charcoal	4	1.5

Prevalence of Dental Caries

The prevalence of dental caries was 23.64% (95% CI: 19.30, 28.00) and the lower 1st molar was the commonly affected (56.7%) tooth. Females had a higher prevalence of dental caries than Males (30.6% vs 17.0%) and the prevalence was higher in rural residents than the urban residents (30.8% vs 21.7%, p=0.095). The prevalence was high in a patient with halitosis (42.26%), DM (68.2%), and malocclusion (40.0%) (Table 4).

Table 3 Carbohydrate Intake, Smoking and Presence of Other Chronic Medical Illness Among the Study Participants

		Frequency	Percentage
Carbohydrate consumption	Yes	273	74.2
	No	95	25.8
Type of carbohydrate taken	Candy	24	8.8
	Soft beverages	78	28.6
	Chewing gum	33	12.1
	Tea	112	41.0
	Others	26	9.5
Smoking habits	Yes	23	8.4
	No	337	91.6
Frequency of smoking	Sometimes	12	52.2
	Once/day	4	17.4
	3 times/day	4	17.4
	>3 times/day	3	13.0
Diabetic mellitus patient	Yes	22	5.9
	No	346	94.1
History of hypertension	Yes	11	3.0
	No	357	97.0

Decayed, Missed and Filled Tooth (DMFT)

The mean DMFT of the study participants was 1.095±0.24 (SD). The decayed part accounts for 70.59% of the DMFT value and it's lonely contributes 0.78 of the mean DMFT. Filled tooth accounts only 2.17% of the mean DMFT. The DMFT score was higher in females (0.625), urban residents (0.85), and monthly income of ≤2500 Ethiopian birr (0.86) The mean dmft was 0.13 (Table 5).

Logistic Regression Analysis

The factors which had a significant association in the bivariate analysis entered into the multivariable logistic regression model as independent variables for the outcome of dental caries.

The analysis found a significant association between dental caries and gender (AOR=2.15 (1.31 3.52), P=0.002), low educational status (AOR=1.81 (1.05,3.1), P=0.036), monthly income of <2500 Ethiopian birr (AOR=3.05 (1.54, 6.02), P=0.000), poor tooth brushing habit (AOR=2.44 (95% CI: 1.46, 4.07, P=0.004) presence of self-perceived halitosis (AOR=10.98 (5.68, 21.24),P=0.000) and a patient on diabetes mellitus (DM) (AOR=8.15 (3.2, 20.75),P=<0.0001). A patient with a known hypertension history was 2.79 times at risk of developing dental caries, however, the association was not significant (P=0.13) (see Table 6).

Discussion

This study attempted to investigate the prevalence of dental caries among patients attended the University of Gondar Comprehensive Hospital dental clinic. The overall prevalence of dental caries was 23.64% (95% CI: 19.30, 28.00) which was consistent with a study done in Bahir Dar (21.8%),[19] and Nigeria (25.3%),[20] and lower than the study done in Debre tabor Hospital (78.2%), Gondar (36.3%),[12] Addis Ababa (47.4%),[21] Axsum (35.4%),[22] Finote Selam (48.5%),[23] Sudan (42%),[24] Kosovo (72.80%)[25] and Eritrea (78%).[26] This difference might be due to the study population variation and the sociodemographic difference between the countries.

The present study found that dental caries were high in females where females are 2.15 times at risk of developing dental caries (AOR=2.15 (1.31 3.52), p=0.002) which is consistent with a study done in Turkey[27] and Canada.[28]

Table 4 Prevalence of Dental Caries Based on the Sociodemographic Characteristics and Other Factors

Variables		Dental Caries		
		Yes No (%)	No No (%)	P value
Gender	Male Female	32(17.0) 55(30.6)	156(83.0) 125(69.4)	0.002
Age (years)	<20 20–29 30–39 40–49 ≥50	16 (23.5) 32 (23.4) 27(29.3) 4 (15.4) 8(17.8)	52(76.5) 105(76.6) 65(70.7) 22 (84.6) 37(82.2)	0.477
Marital status	Single Married Divorced	36(21.3) 51 (27.7) 0 (0.0)	133(78.7) 133(72.3) 15(100)	0.033
Educational status	Has no formal education Has formal education	27(32.5) 60(21.1)	56(67.5) 225(78.9)	0.061
Occupation	Farmer Student Governmental employee NGO-employee Merchant/personal business	12(22.2) 32(25.0) 8(11.8) 0(0) 35(32.1)	42(77.8) 96(75.0) 60(88.2) 9(100) 74(67.9)	0.013
Religion	Orthodox Muslim Protestant Catholic	75(27.7) 4(17.4) 1(12.5) 7(100)	255(77.3) 19(82.6) 7(87.5) 0(0)	0.098
Residency	Urban Rural	63(21.7) 24 (30.8)	227(78.3) 54(69.2)	0.095
Monthly income	≤25,000 ETB > 2500 ETB	76(28.0) 11(11.3)	195(72.0) 86(88.7)	0.000
Tooth brushing habits	Yes No	51(18.9) 36(36.4)	218(81.1) 63(63.6)	0.001
Consumption of sugary foods	Yes No	71(26.0) 16(16.8)	202(74.0) 79(83.2)	0.045
Smoking habits	Yes No	8(34.8) 63(23.0)	15(65.2) 211(77.0)	0.429
Has Diabetic mellitus	Yes No	15(68.2) 72(20.8)	7(31.8) 274(79.2)	0.000
Hypertension history	Yes No	5(45.5) 82(22.9)	6(54.5) 275(77.1)	0.049
Halitosis	Yes No	75(43.6) 12(6.1)	97(54.4) 184(93.9)	0.000
Malocclusion	Yes No	8(40.0) 79(22.7))	12(60.0) 269(77.3)	0.072

The high prevalence of dental caries in females might be due to the earlier eruption of a tooth in Girls, frequent Snacking by females, and pregnancy.

The prevalence of dental caries was higher in lower-income than higher-income participants (AOR=3.05 95% CI: 1.54, 6.02). The difference in the prevalence of dental caries

Table 5 The Mean DMFT Scores Based on Sex, Residency and Monthly Income of the Participants

Characteristics		Permanent Dentition (DMFT)				Primary Dentition (dmft)			
		Decayed	Missed	Filled	DMFT	Decayed	Missed	Filled	Dmft
Gender	Male Female	126 162	43 64	4 4	0.47 0.63	25 0	15 6	0 0	0.11 0.02
Residency	Urban Rural	225 63	81 26	8 0	0.85 0.24	20 5	14 7	0 0	0.08 0.05
Monthly income	≤2500ETB* >2500ETB*	223 65	87 20	8 0	0.86 0.23	8 17	6 15	0 0	0.04 0.09
		Mean DMFT			1.09±0.24	Mean dmft			.13

Note: *ETB: Ethiopian birr.

Table 6 Multivariate Analyses of Variables Associated with Dental Caries Among Patients Visited the Dental Clinic of the University of Gondar Comprehensive Hospital, Gondar, Ethiopia, 2019

Variables		Dental Caries		AOR (95% CI)	P-value
		No (%)	Yes (%)		
Gender	Male Female	156 (82.9) 125 (69.4)	32 (17.1) 55(30.6)	1 2.15 (1.31 3.52)	0.002
Educational status	No formal education Has formal education	56(66.7) 224(78.9)	27 (33.3) 60 (21.1)	1.81(1.05,3.1) 1	0.036
Monthly income	≤2500 ETB >2500 ETB	195(71.9) 86(88.7)	76(28.1) 11(11.3)	3.05(1.54, 6.02) 1	0.000
Tooth brushing habits	Yes No	218 (81.0) 63 (63.6)	51(19.0) 36 (36.4)	1 2.44(95% CI: 1.46, 4.07,	0.004
Halitosis	Yes No	97(57.7) 180(93.8)	71(42.3) 12(6.2)	10.98 (5.68, 21.24) 1	0.000
History of DM	Yes No	7(31.8) 274 (79.2)	15(68.2) 72(20.8)	8.15(3.2, 20.75) 1	0.0001
History of HTN	Yes No	6 (54.5) 275(77.0)	5(45.5) 82(23)	2.79(0.83, 9.39) 1	0.13

according to the socioeconomic status was observed in a study done in Debre Tabor (AOR = 8.43, 95% CI, 2.6, 27.2).[11] The high prevalence might be due to the unaffordability of dental services and oral hygiene maintaining materials.

A significantly higher prevalence of dental caries was recorded in participants with poor oral hygiene practice than among a subject who had a habit of tooth brushing (AOR=2.44, 95% CI: 1.46, 4.07), which coincides with the results of Finote Selam,[23] Bahir Dar[19] and Debre Tabor.[11] More than 2/3rd (73.1%) of the study participants had tooth brushing habits. However, only 7.5% of the participants brushed their teeth twice/day.

This study found a higher prevalence of dental caries among DM patients than non-DM patients, which is similar to a previous study.[29] A patient with true halitosis was 10.98 times at risk of developing dental caries than a patient without halitosis (AOR=10.98 (5.68, 21.24)). The high prevalence of dental caries might be due to the presence of poor oral hygiene practice and calculus accumulation in patients with self-perceived halitosis.

The mean DMFT of the present study was 1.095 where the decayed part accounts for 70.59% of the DMFT values and the filled tooth accounts only 2.17% of the mean DMFT which is relatively similar to a study done in Jimma[30] and

Finote Selam.[23] However, this result is lower compared with a study done in Eritrea (DMFT= 2.50 (±2.21)),[26] Kenya (DMFT= 3.9),[31] Uganda (DMFT=4.71),[32] and Turkey (11.44).[27]

Limitations

This study had some inherent limitations. First, the study focused on patients who attended the dental clinic and we hope they have some sort of knowledge of dentistry. Even if there are a lot of factors that affect the occurrence of dental caries, we only targeted individual-level factors. So, the coming researchers should focus on factors such as; service providers, barriers, and community water fluoridation.

Strengths of the Study

The first strength was study participants were selected randomly in a systematic way and this reduces the selection bias. The second was the questionnaire was adapted from WHO oral health survey 5th edition and we make some modifications and the pre-test was done on 10% of the participants before the actual study.

Conclusion

The prevalence of dental caries in the study participants was 23.64%, higher in females than males and in diabetic patients. Female gender, poor tooth brushing habits, diabetes mellitus, and halitosis were significant predictors associated with dental caries. To reduce the prevalence of dental caries and minimize its impact on the population oral health education should be given at school level and community-based oral health education programs should be designed.

Abbreviations

AOR, adjusted odds ratio; DMFT, Decayed, Missed and Filled tooth; OR, Odds Ratio; SD, Standard Deviation; SPSS, Statistical package for social sciences; WHO, World Health Organization.

Data Sharing Statement

All the related data are available within the manuscript.

Ethics Approval and Consent to Participate

Ethical clearance was obtained from the University of Gondar IRB office. Before the commencement of the study, a formal letter was given to the department of dentistry. Written consent was obtained from each study participant after explaining the purpose of the study. Parent or legal guardian provided written informed consent (assent) for participants under the age of 18 years. All the participants were informed about the confidentiality of their information. (IRB number: V/P/RCS/05/149/2019).

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Author Contributions

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; gave final approval of the version to be published, and agree to be accountable for all aspects of the work.

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The authors report no conflicts of interest in this work.

References

1. Ndiaye C. Oral health in the African region: progress and perspectives of the regional strategy. *Afr J Oral Health*. 2005;2:2–9.
2. Thorpe S. Oral health issues in the African region: current situation and future perspectives. *J Dent Educ*. 2006;70:8–15.
3. Omitola OG, Arigbede AO. Prevalence of dental caries among adult patients attending a tertiary dental institution in South-South region of Nigeria. *P H Med J*. 2012;6:52–58.
4. Naito M, Yuasa H, Nomura Y, et al. Oral health status and health-related quality of life: a systematic review. *J. Oral Sci*. 2006;48(1):1–7. doi:10.2334/josnusd.48.1
5. Santos AP, dos P, Soviero VM. Caries prevalence and risk factors among children aged 0 to 36 months. *Pesqui Odontológica Bras*. 2002;16(3):203–208. doi:10.1590/S1517-74912002000300004
6. Bagramian RA, Garcia-Godoy F, Volpe AR. The global increase in dental caries. A pending public health crisis. *Am J Dent*. 2009;22(1):3–8.
7. Kathmandu RY. The burden of restorative dental treatment for children in Third World countries. *Int. Dent. J*. 2002;52(1):1–9. doi:10.1111/j.1875-595X.2002.tb00589.x
8. Marthaler TM. Changes in dental caries 1953–2003. *Caries Res*. 2004;38(3):173–181. doi:10.1159/000077752
9. Agbelusi GA, Jeboda SO. Oral health status of 12-year-old Nigerian children. *West Afr. J. Med*. 2006;25(3):195–198. doi:10.4314/wajm.v25i3.28277
10. Msyamboza KP, Phale E, Namalika JM, et al. Magnitude of dental caries, missing and filled teeth in Malawi: national Oral Health Survey. *BMC Oral Health*. 2016;16(1):29. doi:10.1186/s12903-016-0190-3

11. Tafere Y, Chanie S, Dessie T, Gedamu H. Assessment of prevalence of dental caries and the associated factors among patients attending dental clinic in Debre Tabor general hospital: a hospital-based cross-sectional study. *BMC Oral Health*. 2018;18(1):119. doi:10.1186/s12903-018-0581-8
12. Ayele FA, Taye BW, Ayele TA, Gelaye KA. Predictors of dental caries among children 7–14 years old in Northwest Ethiopia: a community based cross-sectional study. *BMC Oral Health*. 2013;13(1):7. doi:10.1186/1472-6831-13-7
13. Namal N, Can G, Vehid S, Koksal S, Kaypmaz A. *Dental Health Status and Risk Factors for Dental Caries in Adults in Istanbul, Turkey*. 2008.
14. Petersen PE, Bourgeois D, Ogawa H, Estupinan-Day S, Ndiaye C. The global burden of oral diseases and risks to oral health. *Bull. World Health Organ*. 2005;83(9):661–669.
15. Okubagzhi GS, Teferra M, Gebre S, et al. Epidemiology of dental caries in a rural highland community, north-western Ethiopia. *Ethiop. Med. J*. 1987;25(3):127–132.
16. Petersen PE. The global burden of oral diseases and risk to oral health. *Bull WHO*. 2005;83:641–720.
17. Žemaitienė M, Grigalauskienė R, Vasiliauskienė I, et al. Prevalence and severity of dental caries among 18-year-old Lithuanian adolescents. *Medicina*. 2016;52(1):54–60. doi:10.1016/j.medici.2016.01.006
18. Organization, W. H. *Oral Health Surveys: Basic Methods*. World Health Organization; 2013.
19. Mulu W, Demilie T, Yimer M, Meshesha K, Abera B. Dental caries and associated factors among primary school children in Bahir Dar city: a cross-sectional study. *BMC Res Notes*. 2014;7(1):949. doi:10.1186/1756-0500-7-949
20. Lawal F, Alade O. Dental caries experience and treatment needs of an adult female population in Nigeria. *Afr. Health Sci*. 2017;17(3):905–911. doi:10.4314/ahs.v17i3.34
21. Berhane HY, Worku A. Oral health of young adolescents in Addis Ababa—a community-based study. *Open J. Prev. Med*. 2014;4(08):640. doi:10.4236/ojpm.2014.48073
22. Zeru T. Prevalence of dental caries and associated factors among aksum primary school students, Aksum Town, Ethiopia. *J Dent Oral Health*. 2019;5(1–5):2.
23. Teshome A, Yitayeh A, Gizachew M. Prevalence of dental caries and associated factors among finote selam primary school students aged 12–20 years, finote Selam Town, Ethiopia. *OHDM*. 2016;12:15–17.
24. Raadal M, ELHASSAN FE, Rasmussen P. The prevalence of caries in groups of children aged 4–5 and 7–8 years in Khartoum, Sudan. *Int. J. Paediatr. Dent*. 1993;3(1):9–15. doi:10.1111/j.1365-263X.1993.tb00041.x
25. Kamberi B, Koçani F, Begzati A, et al. Prevalence of dental caries in Kosovar adult population. *Int J Dent*. 2016;2016:1–6. doi:10.1155/2016/4290291
26. Andegiorgish AK, Weldemariam BW, Kifle MM, et al. Prevalence of dental caries and associated factors among 12 years old students in Eritrea. *BMC Oral Health*. 2017;17(1):169. doi:10.1186/s12903-017-0465-3
27. Namal N, Can G, Vehid S, Koksal S, Kaypmaz A. Dental health status and risk factors for dental caries in adults in Istanbul, Turkey. *East Mediterr Health J*. 2008;14(1):110–118.
28. Lukacs JR, Largaespada LL. Explaining sex differences in dental caries prevalence: saliva, hormones, and "life-history" etiologies. *Am. J. Hum. Biol. Off. J. Hum. Biol. Assoc*. 2006;18(4):540–555. doi:10.1002/ajhb.20530
29. Malvania EA, Sheth S, Sharma A, et al. Dental caries prevalence among type II diabetic and nondiabetic adults attending a hospital. *J. Int. Soc. Prev. Community Dent*. 2016;6(9):S232. doi:10.4103/2231-0762.197202
30. Kebede B, Kemal T, Abera S. Oral health status of patients with mental disorders in southwest Ethiopia. *PLoS One*. 2012;7(6):e39142. doi:10.1371/journal.pone.0039142
31. Crouch S, Dzingle J, Tyus J, et al. Oral health status of adults in rural Meru, Kenya. *OHDM*. 2016;15(1):1–13.
32. Kutesa A, Kasangaki A, Nkamba M, et al. Prevalence and factors associated with dental caries among children and adults in selected districts in Uganda. *Afr Health Sci*. 2015;15(4):1302–1307. doi:10.4314/ahs.v15i4.33

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