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Prevalence of oral conditions and associated factors among schoolchildren in Accra, Ghana: a cross-sectional study

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ABSTRACT

Objective: The impact of oral diseases on children cannot be overemphasized because their effects may go beyond the individual to the household and the community at large. This study aimed to determine the prevalence of common oral conditions in children between the ages of 9 and 16 years in Accra.

Methods: A cross-sectional study was carried out among participants from 16 selected junior high schools in Accra. Their caries experience was assessed using the decayed, missing, and filled teeth (DMFT) index. Other variables recorded were age, sex, previous history of a dental visit, and the presence of other common oral conditions (ie, periodontal disease, traumatised teeth, oral mucosal lesions, neoplasia, cysts, and malocclusion). Summaries and descriptive statistics were generated and reported. The DMFT was compared between subgroups, and the χ^2 test was used to compare outcomes of categorical variables. **Results:** A total of 1118 students participated in the study. This consisted of 37.8% males and 62.2% females. The mean age was 12.8 (standard deviation = 1.7) years. Common oral conditions were found in 49.7% of the participants and the prevalence of caries, periodontal disease, and malocclusion were found to be 13.3%, 30.4%, and 11.3%, respectively. The population's mean DMFT was found to be 0.27 (standard deviation = 0.76).

Conclusions: The prevalence of caries and periodontal disease calls for additional effort to reduce the burden of common oral conditions in Ghanaian children.

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Introduction

Oral diseases have been described by the World Health Organization (WHO) as the most prevalent noncommunicable disease worldwide, affecting some 3.58 billion people.¹ Oral conditions do not only have functional and psychosocial repercussions on affected persons, but they are also indicators of overall well-being.² The impact of oral diseases in children cannot be overemphasized because their effects may go beyond the individual to the household and the community at large.¹

Dental caries in both primary and permanent teeth is considered to be the most common disease in childhood.³ Although distribution and response to the condition may vary according to the geographical location, it has been suggested that more than 51 million school hours are lost each year to dental-related illnesses by school-going children.⁴ Excluding the indirect and intangible costs, dental caries has also been reported to incur some US\$298 billion in direct treatment alone to the global economy, making up a proportionate 4.6% of worldwide health expenditures.⁵ Current worldwide prevalence rates indicate that 60%-90% of schoolchildren have dental caries,⁶ but percentages seem to vary across different populations, with some reporting lower

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figures.^{7,8} The disease burden in low- and middle-income countries (LMICs), however, is said to be increasing.⁶ Periodontal disease, including gingivitis in children, has gained prominence,⁹ with some reports indicating a very high disease burden.¹⁰

Other oral conditions prevalent in children can include malocclusion, trauma, halitosis, swellings, and congenital and epithelial lesions of the mouth and maxillofacial region.^{11,12} The young, school-going age range of 9-16 is of importance because there is a new awareness of the self from adolescence, and this stage also presents a period when there is considerable development of health behaviours, attitudes, and practices.¹³

The oral health care system in Ghana is still evolving, with more emphasis on oral disease prevention. For a country such as Ghana, it is imperative that children are specifically considered in policies and planning regarding oral health. Understanding the current burden of common oral conditions is therefore necessary to drive and inform national and institutional policy directions. However, there is a paucity of data in the literature in this regard. Though some studies have previously investigated the caries experience in similar populations,^{8,14} they did not together explore the burden of other common oral conditions. The objective of this study was, therefore, to provide a current picture of the prevalence of common oral conditions in children between the ages of 9 and 16 years.

Methods

Ghana is an emerging economy in West Africa, currently with an estimated population of about 30 million. It is geopolitically divided into 16 regions, with Accra, the capital city in the Greater Accra region, being 1 of the most populous cities in the country. Children 10-16 years of age in Greater Accra were estimated to account for 9.6% of the region's population at the last census.¹⁵

This study was a cross-sectional survey among selected Ghanaian public school students between the ages of 9 and 16 years. The study was conducted as part of a screening program carried out in Accra to commemorate the World Oral Health Day in Ghana, in March 2018, an event organized by the Ghana Dental Association and the Health Ministry of the government of Ghana. Sixteen (16) peri-urban public schools across Accra, out of 20 randomly selected public schools, responded to the invitation to participate in the study. Three schools attributed their decline to conflict with their academic calendar, and 1 school reported technical challenges with their means of transport. The sample size of 348 was obtained with the formula: $S = (z^2 \times \sigma^2) / d^2$, where z is the z value (1.96 for 95% confidence level); d = distance on either side of mean in confidence interval (0.05); and σ = standard deviation (0.476 from an estimated decayed, missing, and filled teeth [DMFT] evaluation of a Ghanaian population).¹⁴ Students from all the schools were consecutively selected to participate in the exercise and randomly assigned to the investigators.

Individuals included in the study were current students, aged between 9–16 years, who, on the day of the oral examination, were willing to participate and had consent from their

parents or guardians. Nineteen students declined to participate for various reasons.

Background information and medical history data was collected using a pretested semistructured questionnaire with personal interviews. This was followed by a thorough oral examination, using direct visual screening with tongue blades in broad daylight. Examiners, being a team of 8 qualified and certified dental surgeons, were calibrated through a series of intensive training before the study. Interexaminer errors, after the training were within the range of ± 1.0 for DMFT measures of randomly selected patients, and the inter-examiner correlation was greater than 0.7. During the training and calibration, the examiners were also trained to record data directly onto the entry sheets designed for the study to minimise errors. Patients for calibration were selected from and examined at the University of Ghana Dental School Clinic, Accra. Variables recorded included age (9-12 yrs/13-16 yrs), sex (male/female), and previous dental visit (yes/no). Evidence of the presence of periodontal disease (present/absent), traumatised teeth, oral lesions, neoplasia, cysts, and malocclusion were also recorded for each patient, as well as the DMFT resulting from dental caries.

Only definite teeth cavitations were recorded as dental caries.¹⁶ Conditions classified as malocclusion were Class I, II, and III malocclusions, with or without severe crowding, and an anterior open bite. Periodontal disease was defined as the presence of at least 1 of the following: bleeding on brushing (determined by a positive history), inflamed gingiva with or without visible supragingival plaque or calculi, swollen gingiva, receded gingiva, and appreciably mobile permanent teeth.¹⁷ All cases of malocclusion, periodontal disease, and neoplasms were verified by on-site orthodontists, periodontists and a maxillofacial surgeon. Anterior tooth traumatic injury was captured as teeth with clinical signs, including fracture, discolouration, and tooth displacement, confirmed by a positive history. Dental caries was considered present through component 'D' other than 0 in the DMFT index. Likewise, malocclusion, periodontal disease, neoplasms, and epithelial lesions were considered present with their clinical manifestations and positive history confirmed by the respective specialists.

All variables were entered in Microsoft Excel 2007 and analysed using Stata 14 statistical software (StataCorp.). Analysis included all children who were examined. Background characteristics for all respondents were described, and proportions for variables reported. A Wilcoxon rank-sum test (Mann-Whitney U test) was used to compare the DMFT between subgroups, and binary logistic regression was used to determine the factors associated with the presence of periodontal disease and malocclusion. A χ^2 test was also used to compare categorical variables with consequent test of significance assuming a confidence of 95% and an alpha level of 0.05. Fisher exact test was used where applicable for smaller subgroups.

Appropriate referrals were sent to parents of children in need of dental care. Oral hygiene education was also given to all participants. The study was approved by the Ethical Review Board of the College of Health Sciences, University of Ghana, ensuring ethical standards of the Institutional Research Committee and the Helsinki Declaration of 1964 and its later amendments. Consent and assent were obtained from parents and study participants, respectively.

Table 1 – Background characteristics of respondents.

Variable	Number (N)	Percentage (%)
Sex		
Male	423	37.8
Female	695	62.2
Age		
9-12 years	460	41.1
13-16 years	658	58.9
Previous dental visits		
Yes	75	6.7
No	1043	93.3
Occlusion		
Normal	992	88.7
Malocclusion	126	11.3
Periodontal disease		
Present	340	30.4
Absent	778	69.6

Results

A total of 1137 children met the inclusion criteria. However, 11 students complained of ill health, and an additional 8 were dropped due to inconsistencies with the consent. Finally, 1118 students participated in the study, representing a response rate of 98.3%. This consisted of 37.8% males and 62.2% females (Table 1). With a range of 9 to 16 years, the mean and median ages were 12.8 years (standard deviation = 1.7) and 13 years, respectively.

Diseases of the periodontium accounted for the highest number of conditions seen in the mouth. Individuals with gingival and periodontal diseases were more than 2 times the proportion of students with caries (Figure 1). Although 50.3% of the population were clinically free of any oral disease, 21 (1.9%) had evidence of trauma to the anterior teeth, of which only 1 (4.8% of the subpopulation) had undergone treatment. Twelve students were identified with swellings of the maxillofacial region. One hyperpigmented lesion on the labial mucosa was found. Only 1 (8.3%) out of the 12 individuals found to have maxillofacial swellings had previously sought medical consultation or management.

The prevalence of caries was 13.3% and that of periodontal disease was 30.4% (Figure 1). Among all carious permanent teeth, the lower first molars were the most affected. This was followed by the mandibular second molars and maxillary first and second molars, respectively (Figure 2). No anterior teeth were affected by caries.

In all, common oral conditions were found in 556 participants (49.7%), thus requiring some needed professional care at the time of the examination. Of these, 61.9% were males, and 38.1% were females.

The mean DMFT of the entire population was 0.27 (standard deviation = 0.76), with no observable differences between the subgroups (Table 2). The presence of caries in this study did not change significantly with sex, age variation, periodontal disease, or the presence of malocclusion.

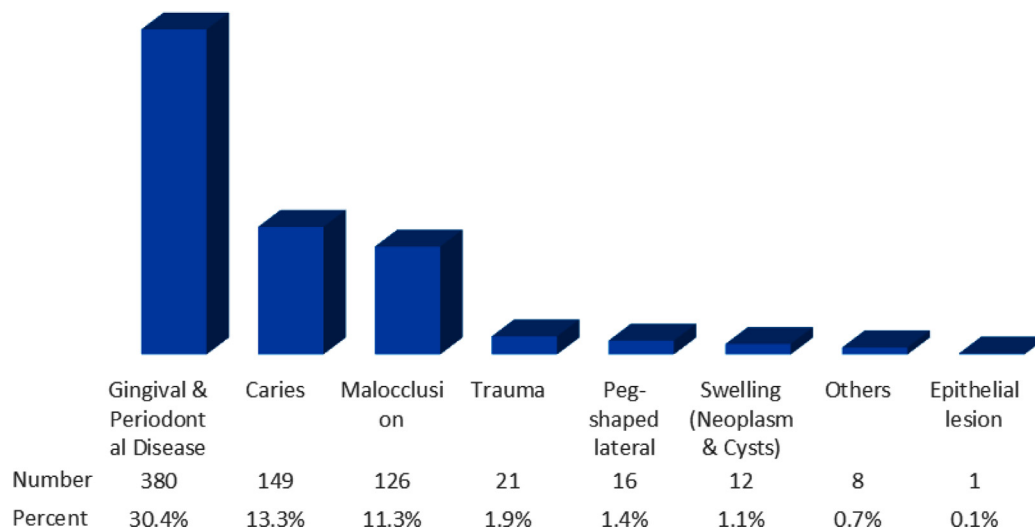
Cross-tabulation between periodontal disease and other variables (Table 3) showed that age category and previous dental visits varied significantly for the presence of periodontal disease (respective P- values of .001 and .011). Sex and malocclusion did not, however, show any significant variation with the occurrence of periodontal disease among the study population. The odds of having periodontal disease if one was a child who had never visited the dentist were 2.24 times that of a child who visited the dentist (Table 3).

Again, females were more likely to have a malocclusion compared to males (odds ratio = 1.53; Table 4), while the number of males involved in an anterior traumatic event were 3 times the number of females.

Discussion

The aim of this study was to determine the prevalence of common oral conditions among a children 9 to 16 years of age in Accra, Ghana. With a population mean DMFT of 0.27, the prevalence of caries was determined to be 13.4% and that for periodontal disease was 30.4%.

The Sustainable Development Goals (SDG) advocate for ensuring healthy lives and promoting well-being for all, at all ages, with a specific goal to achieve universal health coverage

**Fig. 1 – Prevalence of common oral conditions.**

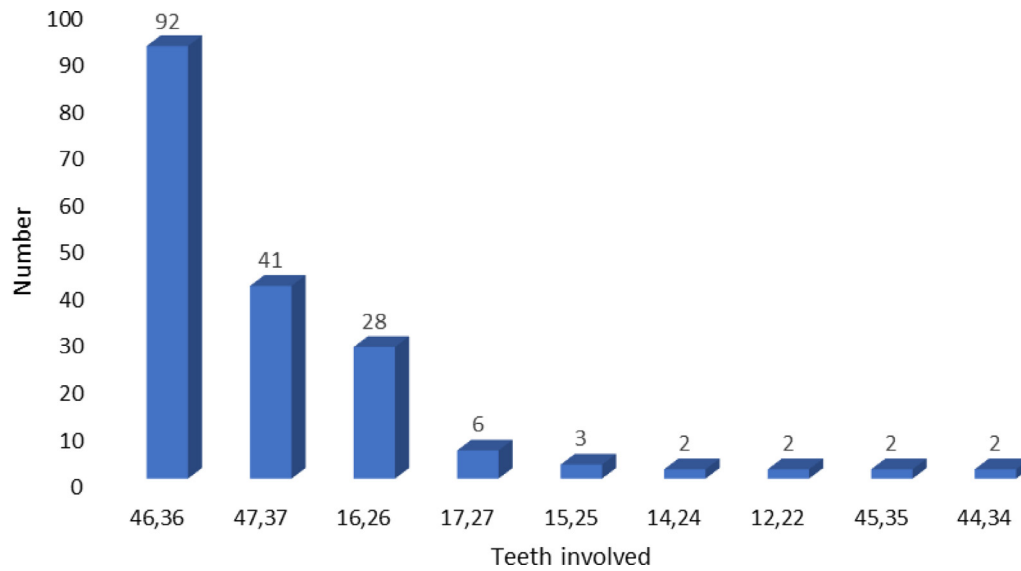


Fig. 2 – Pattern of carious permanent teeth among adolescents.

Table 2 – Caries and associated factors among Ghanaian children.

Variable	Caries, N (%)	X ² (P value)	Mean DMFT	Mann-Whitney test for DMFT (P value)	OR	CI
Sex		.634		.994		
Female	90 (13.0)		0.28		Ref	
Male	59 (14.0)		0.26		1.09	0.77-1.55
Age		.231		.918		
13-16 years	81 (12.3)		0.28		Ref	
9-12 years	68 (14.8)		0.25		1.24	0.87-1.75
Previous dental visits		.292		.444		
Yes	7 (9.3)		0.23		Ref	
No	142 (13.6)		0.28		1.43	0.64-3.19
Occlusion		.291		.331		
Normal	136 (13.7)		0.23		Ref	
Malocclusion	13 (10.3)		0.28		0.72	0.40-1.32
Periodontal disease		.747		.743		
Absent	102 (13.1)		0.26		Ref	
Present	47 (13.8)		0.28		0.94	0.65-1.36

DMFT = decayed, missing, or filled teeth; OR = odds ratio.

¹Fisher exact test used where applicable

and access to quality essential health care services.¹⁸ The oral health of any community, therefore, plays a significant role in the pursuit of this goal. The disease burden of several oral conditions have been widely reported, with variation in percentages, suggesting that it differs among different populations. The WHO published a worldwide caries prevalence of 60%-90% but has been reported that to be 32.6% among a similar age group to what is reported here in India,¹⁹ 4%-40% in Nigeria,²⁰ and 13% in other studies in sub-Saharan Africa.²¹ A study done to determine the prevalence of dental caries among 12-year-old schoolchildren in Ghana 30 years ago (1991) established a 13% prevalence.²² Similar to a study 11 years later,⁸ this survey shows a disease burden of 13.3% among school-going children. Not only do these figures indicate that our population possibly has a comparatively lower prevalence of caries but that the disease burden has

remained fairly constant over the past 3 decades. Both conclusions are at variance with a report from a global epidemiological study that suggests higher prevalence and worsening disease burden in LMICs.²³ The findings reported here, however favourably compares with studies in Benin and Nigeria.^{20,21} The mean DMFT of the entire population was 0.27. It was found to be 0.62 among 12-year-olds in India,¹⁹ and 0.25 among 12- to 15-year-olds in Nigeria.²⁰ Our observation, however, differed slightly among the different variables. With the assumptions of this study, caries was not found to be associated with sex, age variation, or the presence of malocclusion among the children. Further exploration into specific risk factors is required, while biological and anatomical differences in cariogenesis among different ethnicities and population groups may still be a fertile area for investigation. Though not significant for previous dental visits or

Table 3 – Periodontal disease and associated factors among Ghanaian children.

Variable	Number, N (%)	X ² value*	P value	OR	CI
Sex		1.342	.247		
Female	120 (17.3)			Ref	
Male	220 (52.0)			1.17	0.89-1.52
Age		8.883	.001		
13-16 years	107 (16.3)			Ref	
9-12 years	233 (50.6)			1.81	1.38-2.37
Previous dental visits		6.539	.011		
No	328 (31.4)			Ref	
Yes	12 (16.0)			2.24	1.19-4.22
Occlusion		0.119	.730		
Normal	300 (30.2)			Ref	
Malocclusion	40 (31.7)			0.93	0.63-1.39

OR = odds ratio.

* Fisher exact test used where applicable

Table 4 – Malocclusion and associated factors among Ghanaian children.

Variable	Number, N (%)	X ² value*	P value	Crude OR	CI
Sex		4.88	.027		
Male	67 (9.6)			Ref	
Female	59 (14.0)			1.53	1.05-2.21
Age		0.299	.585		
9-12 years	49 (10.7)			Ref	
13-16 years	77 (11.7)			1.11	0.76-1.63
Dental visits		1.799	.180		
Previous visit	12 (16.0)			Ref	
First visit	114 (10.9)			1.66	0.87-3.19

OR = odds ratio.

* Fisher exact test used where applicable

periodontal disease, a slightly higher proportion of children with periodontal disease had dental caries in this study.

The term 'periodontal disease' refers to a spectrum of pathologies affecting the surrounding structures of the teeth: the gums, periodontal ligament, cementum, and alveolar bone. As was included in our case definition, periodontal disease, depending on the extent, may present as reddening of the gum, bleeding on brushing, recession of the gums loss of bone, tooth mobility' and tooth loss.^{24,25} Periodontal disease was reported to have a prevalence of 30% and 90% across different populations in Nigeria.^{21,25} We, however, found a periodontal disease prevalence of 30.4% among our peri-urban population in Accra, with its presence being associated with the age category and the history of dental visits.

Without measuring the orthodontic treatment need, our study found 11.3% of the population to have a malocclusion. This finding is at variance with results of 34.8%, 47.2%, and 59.4% in Iran, Turkey, and Saudi Arabia, respectively.²⁶⁻²⁸ Malocclusion generally describes an abnormal occlusion in which teeth are not in a normal position in relation to adjacent teeth in the same jaw or the opposing teeth when the jaws are closed. Orthodontists, however define it as an appreciable deviation from ideal occlusion,²⁹ thereby reducing subjectivity in determining what is a malocclusion.

There was a 1.9% prevalence of anterior tooth traumatic injury, for which a proportionate number were males. Traumatic dental injury was found to have occurred in 11.4% of a

school population in Nigeria,³⁰ 18.5% in a 3- to 5-year-old Sudanese population,³¹ and 9.3% in a 12-year-old Indian population.³² This study, however, reports the prevalence of individuals with evidence of anterior traumatic injury, thus excluding individuals who might have had a traumatic dental injury without necessarily having any sign or symptom, as demonstrated in other studies. Using the methodology reported here, our findings were comparable to a community-based survey in Brazil that reported the prevalence of anterior trauma to permanent teeth as 0.15%.³³

The findings reported here highlight an unmet need for oral health care among children in Ghana. For example, the 6.7% of our participants who had previously seen a dentist is disproportionate to the nearly 50% who were found to have at least, one oral condition, and needing professional care. The prevalence rate of caries and periodontal disease also calls for diversification in reducing the burden of oral conditions in Ghanaian children. Although the current dentist-to-population ratio of about 1:70,000 will influence any proposed solution, oral hygiene education needs to be intensified to empower individuals and to improve community health behaviours regarding oral health. Ghana has yet to see a robust oral health policy that would direct the provision of oral health services and its development. Areas of oral health education, promotion, disease prevention, and control require a critical appraisal and input into the national agenda. This also underscores the call by WHO to promote oral health

in Africa, addressing the 7 priority oral diseases (dental caries, periodontal diseases, oral cancers, noma, oral manifestations of HIV and AIDS, orofacial trauma, and cleft lip and palate) by packaging and integrating oral health care into primary health care, targeting schools and communities.³⁴

This study investigated only a few risk factors and variables, which is a notable limitation, as is the use of crude clinical parameters and the inclusion of only children who attend public schools. Although the study design itself might limit inference of findings to the general population, this survey provides valuable estimates and information for further studies in this particular setting across several areas within the country and subregion.

Conclusions

The burden of dental caries among children in Accra has not changed in the past 30 years. With dental caries and periodontal disease being common problems among school-going children 9 to 16 years of age in peri-urban Accra, there is need for expansion of efforts to improve access to dental visits, while reducing the burden of common oral conditions in Ghanaian children.

Conflict of interest

None disclosed.

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