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Original Article

Assessing Dental Caries and Related Factors in 12-Year-Old Nigerian School Children: Report from a Southeastern State

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Abstract

Background/Aim: Dental caries is one of the most common diseases in the world and a common health problem among children. The aim of this study was to assess dental caries and related factors using the Decayed Missing and Filled Teeth (DMFT), Significant Caries Index (SiC), Restorative and Met Need indices in 12-year-old schoolchildren in a Southeastern State of Nigeria. **Materials and Methods:** A cross-sectional descriptive study of 360 twelve year old students selected by multistage sampling method from four schools in Enugu. Sociodemographic and behavioral data on dietary and oral health-care practices were collected using questionnaires, followed by an intraoral examination of each participant in accordance with the WHO criteria to determine their individual DMFT. Total and mean DMFT were obtained. SiC, Restorative Index (RI), and Met Need Index (MNI) were calculated. Data analysis was performed using the SPSS version 20. $P \leq 0.05$ were accepted as statistically significant. **Results:** The prevalence of caries was 54.4%. Mean SiC/DMFT ratios of private and public school participants were 2.29/0.78 and 2.83/1.59, respectively. A zero RI and 0.02 MNI values were observed for all participants. Twelve (6.9%) public schoolchildren did not brush every day, although nearly 100% of them consumed cariogenic diet regularly. **Conclusion:** Despite low DMFT, number of teeth with untreated caries mirrored by zero RI and MNI values was high. Unhealthy dietary habits, suboptimal oral hygiene practices, and possibly lack of perception of gravity of caries were key influential factors. Efforts should be geared toward bridging these gaps through effective prevention program in schools.

Keywords: 12 years old, decayed missing and filled teeth, dental caries, significant caries index

Introduction

Oral diseases, especially dental caries are major health problems globally.[1] Dental caries affects both sexes, all races, all socioeconomic ranks, and all age groups and continues to be a universal health problem among children.[2,3] In developing countries, changes in living conditions due to urbanization and adoption of Western lifestyles are often considered potential risk factors for the incidence of caries. In recent years, its prevalence and severity in most industrialized countries have declined substantially unlike what has been attained in developing countries of sub-Saharan African region. Reasons proffered for this disparity include changes in dietary habits and inadequate exposure to fluorides in developing countries and preventive oral health care programs adopted in the industrialized environs.[4] Dental caries restrict activities in school and at home causing millions of school hours to be lost annually worldwide. Moreover, the psychosocial impact of this disease often significantly diminishes quality of life.[5] For children in particular, dental caries not only causes pain and discomfort, it interferes with food intake affecting physical development in the form of malnutrition. It also affects ability to communicate and learn; school attendance and academic performance; and places a financial burden on the parents.[6]

In 2003, Hobdell *et al*. developed the new global goal for oral health 2020 for the promotion of oral health globally. One of its targets for dental caries is to reduce the Decayed

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Missing Filled Teeth (DMFT), particularly the D component at age 12 years by a defined percent with special attention to high-risk groups within populations.[7] According to the World Health Organization (WHO),[8] the prevalence of dental caries among school-aged children is estimated to be as high as 60%–90% in some countries. Studies confirm that low social class increases the risk of developing high levels of dental caries. Parents' low educational level and professional situation (employed/unemployed) also play an important role in the child/adolescent oral health status.[9-11] A study conducted among school children aged 8–12 years in Pakistan reported a caries prevalence of 90%.[12] The prevalence of dental caries was higher between students belonging to family having less income and lower between students belonging to family having high income.[12] A report from the United Arab Emirates on 12-year-old age group found DMFT ranging from 1.6 to 3.24.[13] National Oral Health Survey in India reported caries prevalence of 51.9% at the age of 5 years, 53.8% at 12 years, and 63.1% at 15 years, respectively.[14]

In Africa, caries prevalence and mean DMFT are low compared to industrialized countries with mean DMFT among 12-year-old school children between 0.5 and 2.6.[15] Caries prevalence in Nigeria varies between 4% and 40% and mean DMFT/dmft between 0.5 and 3.5.[16-18] The prevalence increases with age, higher in urban than in rural population and more in private than in public schools.[16] A study conducted among secondary school children (11–16 years old) residing in a rural community in Enugu State reported a mean DMFT of 0.85 ± 1.50 with caries prevalence of 35.5%.[19] These values were higher than those from an earlier study in an urban community in Enugu, where a caries prevalence was 24.1% and DMFT was 0.45 ± 0.53.[20]

A summary of reports from some similar studies on the prevalence of dental caries and DMFT among 12 years old in other parts of the country and the world is shown in Table 1.

Although reports of DMFT studies abound, those highlighting Significant Caries Index (SiC), Restorative Index (RI), and Met Need Index (MNI) are rare in our environment. Hence, the aim of this study was to assess dental caries and related factors in 12-year-old school children in Enugu, Southeastern, Nigeria using DMFT, SiC, RI, and MNI while exploring the role of the health belief model (HBM) on their attitude and behavior toward oral health.

Materials and Methods

Study design and protocols

A cross-sectional descriptive study involving junior students of four Secondary schools selected by simple random method from the list of Secondary schools in Enugu. Ethical clearance was gotten from the Committee for Research and Ethics, University of Nigeria Teaching Hospital, Enugu. Permission was obtained from the School Authorities and the children's caregivers. With assured confidentiality, all participants gave verbal consent in accordance with the principles outlined in the Declaration of Helsinki. Children also benefitted from a free dental examination carried out.

sample size determination and selection

Sample size was determined using the formula:[35]

$$n = \frac{z^2 p\left(1 - p\right)}{e^2}$$

Where n is the minimum sample size; p is the proportion of children with dental caries estimated to be 35.5% from a previous study;[20] z = 1.96 at 95% confidence interval; e is degree of precision (5%), and nonresponse rate of 2% was factored in. This yielded a total of 359.04 which was rounded off to 360. From the lists of private and public Secondary schools in Enugu metropolis obtained from the State Ministry

Table 1: Decayed missing and filled teeth and significant caries index of 12-year-olds from some similar studies

Authors (years)	Location	Caries prevalence (%)	Mean DMFT	SiC Index
Okeigbemen (2004)[16]*	Benin, Nigeria	33.0	0.51	-
Adekoya-Sofowora *et al*. (2006)[21]	Ife, Nigeria	13.9	0.14	-
Agbelusi and Jeboda (2006)[22]	Lagos, Nigeria	24.6	0.46	-
Udoye *et al*. (2008)[20]*	Enugu, Nigeria	24.1	0.35	-
Braimoh *et al*. (2014)[23]*	Port Harcourt, Nigeria	15.4	0.21	-
Cypriano *et al*. (2008)[24]	São Paulo State, Brazil	93.1^	5.54^	9.62^
Nurelhuda *et al*. (2009)[25]	Khartoum, Sudan	30.5	0.42	1.4
Shafiezadeh *et al*. (2011)[26]	Tehran Province, Iran	64.6	1.36±0.86	-
Gökalp *et al*. (2010)[27]	Turkey	61.1	1.9±2.2	4.33
Vizzotto *et al*. (2013)[28]	Brazil	23.0	0.84±1.31	-
Bhayat and Ahmad (2014)[29]	Medina, Saudi Arabia	57.2	1.53±1.88	3.63±1.66
Ndanu *et al*. (2015)[30]#	Accra, Ghana	17.4	1.138±0.476	-
Elias-Boneta *et al*. (2016)[31]	Puerto Rico	69.0	2.5±0.12	5.6±0.12
Poudyal *et al*. (2015)[32]	Karnataka, India	-	1.45	2.85
Andegiorgish (2017)[33]	Eritrea	78.0	2.50±2.21	4.97±1.9
Riatto *et al*. (2018)[34]	Spain	-	1.6±2.6	3.2

*Study participants were 12-15 years; ^High caries group, #Mean age: 12.01±1.52 years. DMFT – Decayed Missing and Filled Teeth, Sic Index – Significant Caries index

of Education, we selected 2 public and 2 private schools by simple random sampling. Ninety 12-year-old schoolchildren were selected from Junior Secondary School Classes 1 and 2 in each school by simple random sampling to make up the 360.

Data collection and analysis

Data were collected within a 3-month period; sociodemographic and behavioral data on dietary and oral health-care practices were obtained using questionnaires. An intraoral examination using blunt dental probe and plane mirror to determine the individual Decayed Missing and Filled Teeth (DMFT] was carried out with each participant seated on a chair using natural daylight for illumination and following WHO criteria for epidemiological studies.[36] Teeth were considered carious when there was visual and/or tactile evidence of a carious lesion. Early stages of dental caries were excluded, and teeth with questionable lesions were considered as sound.

Total and mean DMFT was obtained for the study population; SiC, RI and MNI were calculated. The SiC index is the mean DMFT of one-third of the participants with the highest DMFT scores. RI is the ratio of filled teeth to the total filled, and decayed teeth (F/F+D) percent and the MNI represents the ratio of missing and filled teeth to total decayed, missing, and filled teeth (M + F/DMF) percent.[37]

Data analysis was carried out using the Statistical Package for the Social Sciences (SPSS version 20 Inc. Chicago IL, USA) and Microsoft Excel. All children who needed dental treatment were referred to the Dental clinic of a nearby Teaching Hospital.

Results

Three hundred and sixty 12-year-old participated in this study; 226 (62.8%) males and 134 (37.2%) females. Table 2 shows the gender distribution and consumption of cariogenic food according to their school type. The timing and frequency of tooth-brushing are captured in Table 3, with 12 (6.9%) students in public school reporting not brushing every day. The oral hygiene activities undertaken by the participants after consuming sugary food and snacks are shown in Figure 1; 42.2% of the public school students did not brush nor rinse their mouth after such exercise.

Table 2: Gender distribution and consumption of cariogenic food by participants according to school type

	School type		Total
	Private, *n* (%)	Public, *n* (%) (%)	
Gender			
Male	102 (54.8)	124 (71.3)	226 (62.8)
Female	84 (45.2)	50 (28.7)	134 (37.2)
Cariogenic food			
Yes	176 (94.6)	171 (98.3)	347 (96.4)
No	10 (5.4)	3 (1.7)	13 (3.6)
Total	186 (51.7)	174 (48.3)	360 (100)

A total of 294 (70.7%) permanent first molars were decayed; 236 (56.7%) of all the decay occurred in the mandible, and there was no filled tooth [Table 4]. The overall prevalence of caries was 54.4%; mean SiC/DMFT of private and public school participants were 2.29/0.78, and 2.83/1.59, respectively. Males had higher DMFT, but lower SiC value than females and the overall mean DMFT was 1.17 ± 0.27 [Table 5]. The MNI value for all the participants was 0.02 given that six first permanent molars had been previously extracted due to caries. The RI value was zero for all categories.

Discussion

This study provides information on the prevalence of dental caries and oral health behavior in a representative sample of 12 years old in Enugu, an urban population in the South-Eastern part of Nigeria. The study was centered on 12-year-old children since the age is acknowledged by WHO as a global monitoring age for dental caries for international comparisons and monitoring of disease trend.[15] Participants in this study comprised school children from both government and private schools to give a balanced overview from all the social, economic, and cultural communities that would provide a true picture of the caries condition in the population studied.

The prevalence of dental caries in the study population was 54.4% which is considerably high when compared with the past studies carried out in the same city[17,20] and other parts of the country.[16,23] The higher caries prevalence in the present study could be due to sampling variations and possibly, an increased caries occurrence since the time the earlier studies in the same setting were conducted. Overall mean DMFT value fall within the WHO's low category corroborating other studies in our environment.[15-19] Relativity (ratio) of SiC index to DMFT was more pronounced in the private than the public school children buttressing the fact that individuals in private school had lower DMFT scores than their public school counterparts as captured in our data. The obtained ratio is at par with what was found by some foreign studies listed in Table 1.[24,29,31,33]

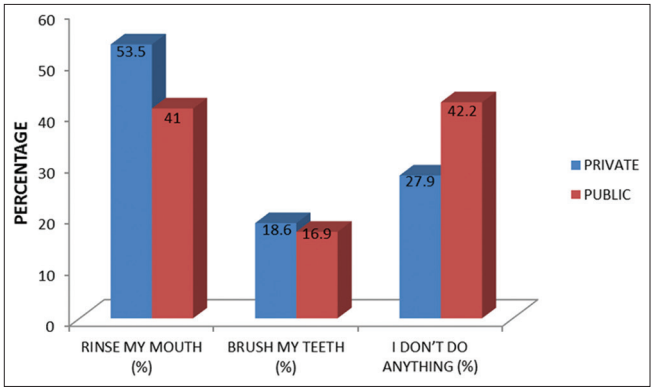

Figure 1: Oral hygiene activity of the respondents. 53.5% of private school children at least rinse their mouth after consumption of sugar containing and food. 42.2% of public school children neither brush nor rinse mouth

Table 3: Tooth brushing habits of participants according to school type

	Frequency of tooth brushing			
	Once daily, *n* (%)	Twice daily, *n* (%)	Thrice daily, *n* (%)	Not every day, *n* (%)
Private school	168 (90.3)	16 (8.6)	2 (1.1)	-
Public school	156 (89.7)	6 (3.4)	-	12 (6.9)
	Timing of tooth brushing*			
	First thing in morning, *n* (%)	After eating breakfast, *n* (%)	Last thing at night, *n* (%)	Anytime I feel like, *n* (%)
Private school	158 (84.9)	24 (12.9)	8 (4.3)	-
Public school	156 (89.6)	4 (2.3)	4 (2.3)	4 (5.8)

*Multiple responses. Only a small percentage brushed last thing at night in both private and public school and 12 (6.9%) in public school do not brush every day

Table 4: Decayed, Missing, and Filled Teeth of the participants according to tooth type and jaw

Decayed teeth (*n*)		Summary	
Right	Left	Total number of teeth affected (%)	
		According to tooth type, *n* (%)	According to Jaw, *n* (%)
Tooth 14 (2)	Tooth 26 (64)	1st molars=294 (70.7)	Mandibular: 236 (56.7)
Tooth 15 (2)	Tooth 27 (22)	2nd molars=116 (27.9)	Maxilla: 180 (43.3)
Tooth 16 (66)	Tooth 35 (2)	Other teeth=6 (1.4)	
Tooth 17 (24)	Tooth 36 (80)	Total=416	
Tooth 46 (84)	Tooth 37 (36)	*P*=0.001	
Tooth 47 (34)			
Missing teeth	**Missing teeth**	**Total number**	
Tooth 16 (4)	Tooth 36 (2)	6	
Filled teeth	**Filled teeth**	**Total number**	
None	None	0	

FDI Tooth notation was used. The numbers in brackets represent the number of that particular tooth affected by dental caries. FDI – Federation dentaire internationale (World Dental Congress)

Table 5: Decayed, Missing, and Filled Teeth, significant caries index, restorative index, and met need index values of the participants

	n	CP	Decayed teeth	Missing teeth	Filled teeth	Total DMFT	Mean DMFT	SiC Index	RI	MNI
School type										
Private	186	66	142	4	-	146	0.78±0.43	2.29	-	0.03
Public	174	130	274	2	-	276	1.59±0.11	2.83	-	0.01
Gender										
Male	226	124	271	-	-	271	1.20±0.09	2.48	-	0.00
Female	134	72	145	6	-	151	1.13±0.44	2.66	-	0.04
Total	360	196	416	6	-	422	1.17±0.27	2.57	-	0.02

CP – Caries present, DMFT – Decayed, Missing, and Filled Teeth, Sic Index – Significant Caries index, RI – Restorative Index, MNI – Met need index

Furthermore, the values of the RI and MNI in the present study were worrisome as they portray the proportion of the disease that has been treated.[37] The zero RI value for both private and public school children and the negligible overall MNI similar to reports from Ibadan, Nigeria[2] may be reflections of poor access to health care which is a function of level of awareness coupled with financial constraints that affect demand and utilization of oral health care.[38,39]

Another observation made in this study was that decayed component constituted the major part of caries index reinforcing lack of knowledge, awareness, and motivation toward their oral health. First permanent molars were mostly affected; their early eruption compared to other molars predisposes them to longer exposure to refined carbohydrates. Furthermore, teeth in lower jaws were more affected than the maxillary teeth. Braimoh *et al*.,[23] had attributed this to significant plaque accumulation, stagnation point for food and debris, and faster progression of caries in the mandibular teeth. However, this calls for further investigations that will relate eruption times with caries development and progression in a similar population.

Considering the disparity in DMFT of public school children (1.59) as against that of private school (0.78) despite

comparable consumption of cariogenic diet, we were of the opinion that their tooth-brushing habit and other oral hygiene activities were key contributing factors. While 8.6% of private school attendees brushed their teeth twice daily, 6.9% of public school children did not brush every day [Table 3] and 42.2% neither rinsed nor brushed their mouth after consumption of cariogenic food [Figure 1]. These preventive habits adopted by some of the private school children compared to their public school counterparts may have mitigated the potential damage from frequent high sugar consumption.

At the backdrop of exploring HBM, participants in this study may not have perceived tooth decay as a serious illness requiring medical help evidenced by the number of untreated decayed teeth. Perhaps, due to the absence of pain or discomfort arising from caries at the time of the study, the cue to seek dental check-up and/or treatment was lacking. Furthermore, it could be that the children had little knowledge of the causes of dental caries as alluded to in a previous study where older students had little knowledge of the causes of dental diseases.[40] The HBM has been used to develop effective interventions on health-related behaviors, with the aim of increasing perceived susceptibility to and perceived seriousness of a health condition by providing education on the prevalence and incidence of the disease.[41] The role of sociobehavioral and environmental factors in oral diseases, particularly dental caries formation cannot be overemphasized. Hence, regular oral health education in schools may bridge the gap between oral health knowledge and behavior in attaining good oral health and at the same time, increase the motivation to reduce untreated tooth decay in this significant age group. More so, schools remain a fertile environment to provide effective oral health education to children as indirectly, families and community members can be reached.[42] Despite the limitation of recall bias which may characterize the information gotten from self-reported oral health care and dietary practices, results obtained in this study could serve as a tool for quantifying and tackling dental caries in this population.

Conclusion

Although, the mean DMFT was low, number of untreated dental caries was very high as reflected in zero RI and very low MNI. Efforts should be geared toward bridging the gaps. Therefore, oral health promotion in schools to teach these students the importance of oral hygiene, and the need to utilize oral health care services is recommended. Second, oral health examination should be carried out on the students by trained personnel at the beginning or end of each term to forestall the inception or detect early carious lesions.

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Conflicts of interest

There are no conflicts of interest.

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