Prevalence of Dental Caries and Predisposing Factors in Obio-Akpor Local Government Area of Port Harcourt

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ABSTRACT

Background: Dental caries is a common oral health disease of global interest. The burden of the disease and predisposing factors must be determined before a preventive programme could be designed, but relevant data from community-based studies are not common in Rivers State.

Aims and Objectives: This study was designed to determine the prevalence and predisposing factors to caries development in the Local Government Area (LGA).

Materials and Methods: This was a descriptive cross-sectional study carried out among adult residents in Obio-Akpor LGA of Rivers State. An interviewer-administered questionnaire was used to collect personal data and caries predisposing factors, while oral examination was carried out to determine caries severity and oral hygiene status using DMFT and OHI-S indexes respectively. The sample size (240) was determined using the formula for descriptive studies.

Results: The mean (SD) age was 32(SD=1.113) years. Most of the participants were married, of Ikwerre ethnicity, skilled workers, earned<100 dollars, and most had secondary education. Most seldom/never used tobacco products. Also, most of the participants ate fresh fruits every day or several times a week, and most also ate a cariogenic diet every day or several times a day. Most used fluoride toothpaste once a day and most did not use floss. Most of them had also never seen a dentist. The prevalence of untreated caries was 64.2%. DMFT score=0.91 (very low). The OHI-S = 3.3. (>3 indicates poor OHI).

Conclusions: The DMFT index was low while OHI-S was high. Poor oral hygiene status, oral healthcare utilisation, and cariogenic diets predisposed the participants to caries.

INTRODUCTION

Dental caries remains one of the most prevalent non-communicable diseases worldwide.[1,2] It has been reported that 2.3 billion people have untreated carious permanent teeth (tooth decay) globally.[3] It is, therefore, a disease of public health concern due to its impact on the economy and the quality of life of people, and it is a major indicator of oral health burden worldwide.[4]

Dental caries is defined as the destruction of the enamel layer of the tooth by acids produced by the action of bacteria on sugar.[1] It is a dynamic disease with very high morbidity potential.[4,5] Recent epidemiological reports indicate that there is increase in the surge of dental caries in developed countries, where the disease had previously been considerably controlled.[3,6] In developing countries, however, studies have revealed that the burden of caries is increasing,[1-4] perhaps because of the increasing shift to cariogenic diet.[1,4] Reduction in mean DMFT had been reported in some industrialised countries, unlike in developing countries where an upward trend had been observed.[7]

Dental caries in adults varies in its distribution and severity from one community and nation to the other.[8] The prevalence of dental caries in Nigeria varies between 4% and 40%, and the mean DMFT/dmft varies between 0.5 and 3.[9,10] In a national survey in Malawi,[11] an overall prevalence of 37.4% was reported. The mean decayed, missing, and filled teeth (DMFT) in the Saudi population was 3.34.[12] In East Africa, the overall pooled prevalence of dental caries was 45.7%.[13] High DMFT scores were reported in Sudan (3.15) and Uganda (2.88).[13] The mean DMFT among adults who were ≤24years in one South African study[2] showed a DMFT of 5, 93.7% of all the age groups studied presented with caries.

Dental caries is a multi-factorial disease in which bacterial plaque, diet, host tissues, and genetic and environmental factors interplay over a period of time to cause tooth decay.[5] Local and general risk factors have been added to these interdependent factors. Among local risk factors are the form and arrangement of teeth, enamel developmental defects, recent caries experience/active carious lesions, special health care needs/disabilities, cariogenic biofilm and biofilm retentive factors, salivary factors-flow, buffer capacity, and viscosity (biologic factors). General risk factors include age, sex, ethnicity (demographic factors), geographic location, social class, education, including occupation and income (socioeconomic factors). Diet as a predisposing parameter is related to the amount of sugar consumed, frequency of ingestion, form, consistency, stickiness of the cariogenic diet, and its retention time, fluoride dentifrice use, oral hygiene habits, and preventive dental care (behavioural factors).[5] Smoking and alcohol ingestion have also been implicated.[14-16]

To plan for effective caries prevention programmes, it is important to first determine the burden of caries in the population, and identify susceptible individuals and the predisposing factors.[14-16] It is after then that conscious and fruitful efforts can be made to modify the risk factors. Most of the studies on caries in the city of Port Harcourt[8,9,17-19] are either hospital-based, school-based, or limited to a group of individuals or one community. Community-based studies involving many communities in a local government are not common. This implies that data for effective preventive programme for caries is grossly inadequate in Port Harcourt. This study was therefore, designed to determine the prevalence and predisposing factors to caries development in Obio-Akpor Local Government Area (LGA) of Port Harcourt, Rivers State, Nigeria.

PATIENTS AND METHODS

This was a descriptive cross-sectional study carried out among adult residents in Obio-Akpor LGA of Rivers State, Nigeria. Obio-Akpor is a LGA in the city of Port Harcourt,

one of the major centres of economic activities in the State. The LGA covers 260 km^2 and population projection for Rivers in 2006 showed a population of 462,350. There are 57 communities in the LGA, each with varying degrees of development.[20] Ethical clearance for the study was obtained from the Ethical and Research Committee of our institution.

The inclusion criteria were males and females aged between 18 and 74years who had lived in the LGA for at least 6 months, were dentate, and were willing to participate in the study. Those who were ill or not disposed to responding to the questionnaire and those who were not at their homes at the time of the study were excluded from the study. The sample size (240) was obtained using the formula for descriptive studies.[21]

A multi-stage sampling method was used in this study.

Stage 1. This involved selection of four communities out of the fifty-seven communities in Obio/Akpor LGA by simple random sampling method of balloting.

Stage 2. This involved selection of three clans from each of the selected four communities by simple random sampling method of balloting. Identification of households that had adults who were between 18 and 74years in age in each of the 3 selected clans was done, followed by a proportionate allocation of the sample of 240 to the 12 clans.

Stage 3. This involved selection of the allocated sub-sample of adults by systematic sampling method from each of the 12 clans using the identified households with adults as sampling frame. In households with more than one adult, the oldest adult was selected. This was to ensure that no more than one adult was selected from a household. The selected adults in the identified households were thereafter approached and those who gave consent were served the structured interviewer-administered questionnaire.[21]

The structured questionnaire was pre-tested among 22 selected adults (10% of the sample size) who met the selection criteria for the study in a randomly selected community in Port Harcourt LGA, Rivers State. The study instrument was used to capture the socio-demographic characteristics, financial capacity of the respondents, awareness of suffering from tooth decay, data on predisposing factors and oral health care utilisation.

Data were collected over a period of eight weeks and four trained research assistants were involved. Also, intraoral examination was carried out by the principal investigator with sterile gloves, in an upright chair, under natural light, and with the aid of a sterile Community Periodontal Index (CPI) probe and dental mirror. The diagnosis of dental caries was made using the World Health Organization (WHO) Oral Health Assessment criteria for adults (WHO, 2013).[22]

The objective of the intraoral examination was to determine the caries severity using DMFT (Decay, Missing, Filled Teeth) index and to determine the oral hygiene status using the simplified oral hygiene index (OHI-S)-Greene and vermillion.[23]

DMFT Index for adult(WHO, 2013).[22]
Very low = <5.0
Low =5.0–8.9
Moderate =9.0–13.9
High >13.9

The Oral Hygiene Index is composed of the combined Debris Index and Calculus index.[23]

Criteria for classifying debris

0. No debris or stain present.
1. Soft debris covering not more than one third of the tooth surface, or presence of extrinsic stains without other debris regardless of surface area covered.
2. Soft debris covering more than one third, but not more than two-thirds of the exposed tooth surface.
3. Soft debris covering more than two-thirds of the exposed tooth surface.

INFERENCE

0-1.2=Good oral hygiene

1.3-3.0=Fair oral hygiene

3.0-6.0= Poor oral hygiene

Table 1: Distribution of Socio-demographic Characteristics

Variables	Frequencies (n=240)	Percentage (%)
Gender		
Male	114	47.5
Female	126	52.5
Marital status		
Single	75	31.3
Married	137	57.1
Divorced	1	0.4
Separated	5	2.1
Widow	22	9.2
Tribe		
Eleme	4	1.7
Etche	5	2.1
Igbo	24	10.0
Ikwere	166	69.2
Ogoni	6	2.5
Opobo	2	0.8
Others	33	13.8
Religion		
Christianity	217	90.4
Islamic	2	0.8
Others	21	8.8
Highest level of education		
None	38	15.8
Primary	16	6.7
Secondary	117	48.8
Tertiary	69	28.7

Most of the respondents (31.7%) earned between ₦20,001 and ₦40,000. This was closely followed by those who had no income (29.2%). In terms of occupation, most of the participants were skilled workers (31.7%) and professionals (30.0%) as shown in table 2.

Table 2: Distribution of Monthly Income and Occupation of the Respondents

Variables	Frequencies (n=240)	Percentage (%)
Income (Naira)		
None	70	29.2
≤20,000	41	17.1
20,001 - 40,000	76	31.7
40,001 - 60,000	32	13.3
60,001 - 80,000	6	2.5
≥80,000	15	6.3
Occupation		
Unemployed	48	20.0
Unskilled	44	18.3
Skilled	76	31.7
Professionals	72	30.0

*1 USD is about 415.088Naira

Table 3 showed that most of the respondents seldom/never smoked cigarettes 220(91.7%), cigars, 223(92.9%), and pipe,230(95.8%), while 210 (87.5%) and 222 (92.5%) respectively seldom/never chewed tobacco or used snuff.

Table 3:Social History of the Respondents

Variables	Frequencies (n=240)	Percentage (%)
Smoke cigarette?		
Seldom/Never	220	91.7
Several times a month	1	.4
Once a week	5	2.1
Several times a week	4	1.7
Everyday	10	4.2
Smoke cigar?		
Seldom/Never	223	92.9
Several times a month	1	.4
Once a week	5	2.1
Several times a week	1	.4
Everyday	10	4.2
Engage in pipe smoking?		
Seldom/Never	230	95.8
Several times a Month	10	4.2
Chew tobacco?		
Seldom/Never	210	87.5
Once a week	13	5.4
Everyday	17	7.1
Use snuff?		
Seldom/Never	222	92.5
Everyday	18	7.5

Table 4 revealed that most of the participants, 121(50.4%), often eat fresh fruits every day, and 84(35.0%) eat biscuits, cakes, and cream cakes every day. In addition, most of the respondents 101(42.1%) reported that they eat sweet pies and buns every day, while most of them, 118(49.2%) indicated that they seldom/never eat jam or honey. Most of the participants, 145(60.4%) and 119(49.6%) seldom/never take chewing gum containing sugar or lick sweets/candy respectively.

Table 4: Frequency of Intake of Cariogenic Foods

Variables	Frequencies (n=240)	Percentage (%)
Eat fresh fruit?		
Seldom/Never	19	7.9
Several times a month	5	2.1
Once a week	46	19.2
Several times a week	44	18.3
Everyday	121	50.4
Several times a day	5	2.1
Eat sweet pies and buns?		
Seldom/Never	39	16.3
Several times a month	9	3.8
Once a week	71	29.6
Several times a week	3	1.3
Everyday	101	42.1
Several times a day	17	7.1
Eat jam or honey?		
Seldom/Never	118	49.2
Several times a month	40	16.7
Once a week	47	19.6
Several times a week	12	5.0
Everyday	23	9.6
Chew gum containing sugar?		
Seldom/Never	145	60.4
Several times a month	5	2.1
Once a week	17	7.1
Several times a week	3	1.3
Everyday	49	20.4
Several times a day	21	8.8
Lick sweets/candy?		
Seldom/Never	119	49.6
Several times a month	17	7.1
Once a week	27	11.3
Several times a week	8	3.3
Everyday	52	21.7
Several times a day	17	7.1

Most of the respondents 65(27.1%) drink lemonade, Coca-Cola, or other soft drinks every day, whereas 102(42.5%) participants seldom/never drink tea with sugar. Likewise, most of the respondents 138(60.4%) seldom/never drink coffee with sugar (Table 5).

Table 5: Frequency of Intake of Cariogenic Drinks

Variables	Frequencies (n=240)	Percentage (%)
Take soft drinks like Coca Cola?		
Seldom/Never	59	24.6
Several times a month	27	11.3
Once a week	56	23.3
Several times a week	16	6.7
Everyday	65	27.1
Several times a day	17	7.1
Drink tea with sugar?		
Seldom/Never	102	42.5
Several times a month	17	7.1
Once a week	30	12.5
Several times a week	25	10.4
Everyday	53	22.1
Several times a day	13	5.4
Drink coffee with sugar?		
Seldom/Never	138	57.5
Several times a month	41	17.1
Once a week	26	10.8
Several times a week	22	9.2
Everyday	11	4.6
Several times a day	2	0.8

Most of the respondents,210(87.5%) claimed that they used toothpaste for tooth cleaning. Out of those who used toothpaste, 198 (82.5%)used fluoride-containing toothpaste (Table 6). Eighty-eight (36.7%) used toothpaste once a day while 83 (34.6%) used it twice or more a day. Table 6 also shows that 238(99.2%)used toothbrushes, 87 (36.3%) of the respondents changed their toothbrushes once in 3months, while 117(48.8%) indicated that they changed their toothbrushes once in 6 months. Most of the participants 148(61.7%) also used toothpicks to clean their teeth.

The result on the use of floss, charcoal, and chewing stick/miswak shows that majority, 215 (89.6%), 192 (80.0%) and 180 (75.0%), do not use floss, charcoal, and chewing stick/miswak tooth cleaning aids respectively.

Table 6: Distribution of Oral Hygiene Practices

Variables	Frequencies (n=240)	Percentage (%)
Do you use of toothpaste?		
Yes	210	87.5
No	8	3.3
Not sure	22	9.2
Use fluoride -containing toothpaste?		
Yes	198	82.5
No	24	10.0
Not sure	18	7.5
How often do you use them?		
Never	24	10.0
2-times a week	45	18.8
Once a day	88	36.7
2 or more times a day	83	34.6
Do you use toothbrush?		
Yes	238	99.2
No	2	0.8
How often do you change your toothbrush?		
Once in three months	87	36.3
Once in 6 months	117	48.8
Once yearly	15	6.3
When bristles get spoilt	16	6.7
I don't know when exactly	5	2.1
Do you use toothpicks?		
Yes	148	61.7
No	92	38.3
Do you use floss?		
Yes	25	10.4
No	215	89.6
Do you use charcoal?		
Yes	48	20.0
No	192	80.0
Do you use chewing stick/miswak?		
Yes	60	25.0
No	180	75.0

One hundred and one respondents (42.1%) had never seen a dentist, 27 (11.3%) had not seen a dentist for more than five years, 10 (4.2%) had not seen a dentist for more than 2 years, while 26 (10.8%) had not seen a dentist for more than a year but less than a two-year period. In addition, 6(2.5%) had not seen a dentist between a six- and 12-month period, while 70 (29.2%) saw a dentist in less than 6 months.

Sixty-eight respondents (28.3%) were not aware that they had carious tooth (hole). One hundred and fifty-four respondents (64.2%) had a carious tooth (D) each. Twenty-four teeth were missing (M) on account of caries while 45 filled teeth (F) were identified. A DMFT index of 0.91was recorded.

A plaque index of 1.7 and calculus index of 1.7 were recorded, and this indicates a moderate accumulation of plaque and moderate accumulation of supragingival and/or sub-gingival calculus respectively. Therefore, the OHI-S (Plaque index +Calculus index) was 3.3 and this indicates poor oral hygiene.

DISCUSSION

Dental caries is related to socio-demographic variables.[1,14,15] The mean age reported in this study 32 (SD =1.113) years fell within those reported in related studies[17,24] and the 3rd peak age range for caries.[3,18] Most of the respondents in this study were of Ikwerre ethnicity who were the indigenous people in Obio/Akpor LGA. Caries is sometimes associated with ethnicicty.[24,25] The explanation for this observation has been linked to education and income inequalities.[1,24]

In this study, most of the respondents were educated, earned less than 100 dollars, and were either skilled or professionals. These could have contributed to the low caries prevalence recorded in this study. However, conflicting reports exist in the literature on the relationship between caries and socio-economic factors. It is believed that educated people are likely to have more information relating to caries, and higher income that would allow them to eat proper meal, buy tooth cleaning aids, utilise oral health care facilities more, and practice good oral hygiene measures. It has also been argued that individuals with higher social standing and economic power have higher risk of caries because of exposure to cariogenic diets.[25,26] Generally, individuals with lower socio-economic capability tend to jettison proper meals for sugar-rich junk. A previous study showed that indigenous people with low income are more susceptible to caries.[4,24]

Less than 10% of the of the respondents in this study use tobacco regularly. This is consistent with the findings in Dominican Republic but contrary to the findings in India.[24] Smoking has been associated with dental decay.[14,15,25,26] The reported mechanism linking dental caries to smoking suggests that smoking has effects on caries-related bacteria. In addition, existing literature reveals that smokers tend to have bad eating habits, pay less attention to oral health care, and, unlike non-smokers, they rarely access professional oral health care and tend to show poor compliance after treatment.[14,15,25,26] The marked difference in the proportion of smokers in these studies may be related to differences in culture, weather, and religion.

About half of the respondents often ate fresh fruits every day. Fruits have good nutritional value and are highly recommended for its health benefits.[27] However, a previous study revealed that exposure to a high level of acidic fruit consumption was associated with increased caries,[28] but this view remains controversial. Acidic fruits for example, lemons, limes, grapes, pineapples, etc., should therefore be taken with caution to reduce the risk of caries. Furthermore, the present study found that 34.2% of the respondents drank soft drinks like lemonade and Coca-Cola every day or several times a day, while 42.1% ate biscuits, cakes, and cream cakes, sweet pies and buns every day. The dietary habits of the participants showed that some of the participants engaged in dietary habits that could predispose to caries, going by the direct relationship that exists between caries and sugar exposure as demonstrated by Stephan. However, it has been reported that extrinsic sugars (added during cooking) are more cariogenic than the intrinsic sugars found in fruits and vegetables. Non-cariogenic sweeteners like xylitol, sorbitol, etc., are therefore recommended as alternatives to the fermentable sugars.[5] Miller in his own study showed that oral bacteria produce acid in the presence of fermentable carbohydrates that dissolve hard tooth structure leading to cavitation.[29]

Plaque accumulation is another significant factor in caries development. The oral hygiene habits of the participants were not satisfactory in that only 34.6% reported twice or more daily brushing. Sound tooth brushing prevents plaque accumulation; hence, bacteria action on cariogenic diet that leads to acid production is reduced. The results differ from that of Islas-Granillo et al[30] where 53.2% of their participants reported brushing their teeth at least once a day, and

50.4% used fluoride-containing paste as against 71.3% and 87.5%recorded in this study. This may be related to differences in dental awareness, levels of education, and socio-cultural practices. The use of mouth wash and floss was, however, low in both studies. The need for these items is often poorly appreciated and most individuals prefer toothpick which is easier to apply. The results also show that the respondents do not replace their toothbrush regularly and in time. Thus,the inappropriate oral hygiene habits and techniques of the participants became evident in their poor oral hygiene (high OHI-S). A fair oral hygiene was previously reported by Olabisi et al.[17] Good oral hygiene is therefore necessary for the caries-protective impact of the fluoride-containing toothpaste to be felt on the teeth. We recommend proper tooth brushing technique, regular replacement of toothbrush, use of fluoride containing toothpaste, mouth wash, and visits to the dentist every six months.

Findings in this study revealed that only 29.2% of the participants had visited a dentist within the last six months, and 2.5% between the last six months and one year period. This lends credence to the findings by Aikins and Braimoh[31] who reported that <22.4% of their respondents utilised oral health services in the past 12 months. Poor oral health care utilisation behaviour is exhibited when there is poor awareness, phobia for dental treatment, poverty, or poor access to dental clinic, and it is a known caries risk factor.[32]

The poor oral hygiene status of the participants could account for the reason why most of the participants (64.2%) presented with caries. The finding was higher than those previously reported in the city of Port Harcourt[9,16], Malawi[11] and East Africa[13], but lower than that reported in a South African study[2]. Differences in sampling method, sample size, and whether the study was hospital or community based may be responsible for the contrasting results. Out of the 154 participants who were found with caries, only 68 knew that they had tooth decay. This is understandable because individuals with caries only get to know when food packing begins to occur or when the caries becomes symptomatic. Recent caries experience and active carious lesion is one of the factors that creates micro environment that predisposes to tooth decay.

In terms of DMFT score, the 0.91 recorded in this study was very low compared to 3.57 reported by Omitola and Arigbede[9] in a clinic-based study, but it was consistent with 0.67 ± 2.0 reported by Olabisi et al.[16] in a community-based study. The finding supports the DMFT range of 0.5-3 that had been reported in similar studies[9,10]in our environment. Much higher DMFT values were reported in meta-analysis studies for Saudi Arabia[12] and east African countries[13] Dental caries prevalence is expressed as the mean DMFT value.[33] When the DMFT score was analysed, the scores for the 'M' and 'F' components were low in this study because of poor oral health services utilisation by the participants. A patient who visits the dentist regularly will benefit from preventive oral health care and tooth restoration; hence, the need for tooth extraction would be reduced. Lack of preventive dental care and presence of active caries have been listed among the predisposing factors to caries.[16] However, the literature is currently equivocal[33,34] on the effect of acidic fruits on dental caries, necessitating further research to resolve the controversy.

CONCLUSION

The prevalence of untreated caries in the study was high. However, the DMFT index indicates a very low severity. The OHI-S was also high. The predisposing factors to caries development in this study were poor oral hygiene, ingestion of cariogenic diets, and poor oral health care utilisation.

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