

Comparison of Dental Caries and Oral Hygiene Status of Children in Suburban with those in Rural Population of Southwestern Nigeria

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ABSTRACT

Objective: To compare prevalence of dental caries, oral hygiene status and associated risk factors of children in suburban and rural communities in the Southwest region of Nigeria. **Material and Methods:** Secondary data was extracted from cross-sectional researches conducted in two study locations involving 8 to 12 year olds. Data retrieved included age, gender, family structure, socioeconomic status, oral hygiene and dental caries. Caries assessment was done using WHO Oral Health Survey methods. Oral hygiene data was collected using Simplified Oral Hygiene Index (OHI-S) by Greene and Vermillion. Statistical significance was established at $p < 0.05$. **Results:** The prevalence of dental caries in Group A and Group B study participants were 13.4% and 22.2% respectively. Children from rural community had significant higher caries prevalence ($p = 0.00$) and poorer oral hygiene ($P = 0.00$) compare with their counterparts in the suburban community. There was a significant association between oral hygiene, age and dental caries in suburban participants ($p = 0.02$) while among the rural participants there was significant association between gender and dental caries ($p = 0.04$). Children with poor oral hygiene have increased odds of having dental caries compared to children with good oral hygiene in the two study communities. **Conclusion:** Dental caries was more prevalent among the rural dwellers than the sub-urban dwellers. There is a need to make oral health care services/products available, accessible and affordable for the rural community.

Keywords: Dental Caries; Oral Hygiene; Rural Population; Suburban Population; Social Class.

Introduction

Dental caries still remains one of the most commonly occurring oral infections affecting children worldwide [1,2] and it is a major reason for absenteeism from school and loss of working hours by the parents [3,4].

The aetiology of dental caries is multifactorial with many associated risk factors which include, but not limited to gender, parents' socio-economic status and educational level, family structure, birth-rank, dietary pattern, consumption of refined carbohydrates between meals and oral hygiene practices [5-7].

The greatest burden of oral diseases has been shown to be on the less advantaged and socially marginalized populations [8]. While studies have shown decline in dental caries among the industrialized countries, the prevalence continues to increase in developing and low-income countries [9].

The decline in caries experience in high-income countries has been attributed to increased access to oral health care and preventive measures. Whereas, the increase in caries experience in low-income, resource-poor nations is believed to be due to an increase in refined sugar consumption, lack of prevention-oriented oral health systems with low availability or use of fluorides and lack of access to oral healthcare facilities among other things [10].

Prevalence of dental caries also varies within the same country. In Nigeria, various studies have reported different caries prevalence depending on the study setting, the socioeconomic status and the study location [4,11]. Nigeria is a developing West African nation which is classified as either a low- or a middle-income economy [12]. The high/middle socioeconomic groups live in urban or suburban areas while a larger percentage of the low-income groups live in rural communities with poor or lack of access to oral health care facilities and/or access to preventive oral health care. This may impact negatively on the oral health status of the children living in these communities. On the contrary, some studies have shown lower caries prevalence in rural communities [13,14] when compared with urban or suburban communities. It is important to have adequate data and information on the pattern of dental caries prevalence and distribution from different community settings in the country so as to channel the limited resources to the more dental caries prone children.

The aim of this study therefore was to compare the dental caries prevalence among 8 to 12 year old children in suburban and rural communities in Southwest Nigeria and determine the associated risk factors for dental caries. This will help develop policies and stimulate further large-scale studies across the whole country.

Material and Methods

Study Group

The data used for this study were secondary data from studies in the two study locations. They were cross-sectional studies that involved 8 to 12 year-old primary school children in suburban and rural communities.

The suburban community was Ile-Ife, Osun State, Nigeria. The area covers about 1,791 km² with an estimated population based on 2006 population census was 755,260. The rural community on the other hand was Ilisan-Remo in Ikenne Local Government Area of Ogun State, Nigeria, which covers 144 km² with an estimated population of 118,735 based on the 2006 national population census for the entire Ikenne Local Government.

Sample Selection

In the two studies, the samples were selected from both private and public primary schools for equal representation. The details of the studies sample selection had been reported in the previous publication by Oyedele et al. [15] and Oyedele et al. [16].

Data retrieved for this study from both studies included the age, gender, family structure, socioeconomic status, oral hygiene and dental caries. The socioeconomic status was determined using the scoring index by Bernard [17], which has also been used in previous studies [16,18].

Dental Caries Data

The data on dental caries was retrieved; caries assessment was done using WHO Oral Health Survey methods [19]. Dental caries was determined using decayed, missing and filled teeth (DMFT/dmft) index. The children were then classified into two groups; those with caries as present and those without caries as absent.

Oral Hygiene Data

This was collected using Simplified Oral Hygiene Index (OHI-S) by Greene and Vermillion [20]. Their oral hygiene status was then classified as good, fair or poor.

Data Analysis

Data retrieved from the two previous studies were analyzed using STATA (STATA/MP 13). Prevalence of dental caries was determined using descriptive analysis. Association between the age, gender, socioeconomic status, family structure dental caries and oral hygiene was determined using Chi-square. Inferential analysis was done to determine the relationship between dental caries, oral hygiene, age, gender, socioeconomic status and family structure. For the purpose of this inferential analysis model, oral hygiene was further reclassified into good and poor, good oral hygiene and dental caries present were used as the reference variables in the model. Statistical significance was established at $p \leq 0.05$.

Ethical Consideration

The ethical approval for the two primary studies was given by the Ethics and Research Committee of the Obafemi Awolowo University Teaching Hospital (ERC/2011/06/03) and Babcock University Health and Ethic Committee (BUHREC/335/16). The studies were conducted after obtaining informed consent from the parents/legal guardians of the study participants and assent from the pupils.

Results

Nine hundred and thirty-two and 465 children were screened for dental caries and oral hygiene status in the sub-urban (Group A) and rural (Group B) communities respectively.

There was equal gender distribution in Group A (Sub-urban community) study participants whereas for Group B (Rural community), there were a slightly higher percentage of female participants 240 (51.6%) compared with the males 225 (48.4%) (Figure 1). Participants aged 12 years were most prevalent accounting for 30.6% in Group A while participants aged 8 years occurred most in Group B 182 (39.1%).

The socioeconomic distribution of the participants showed that in Group A, about 67.7% were of middle and low socioeconomic status, whereas in Group B, 75.1% were of middle and low socioeconomic status. Majority of Group A and B study participants stayed with both parents, however, there was a slightly higher proportion of the study participants in Group B staying with single parents 68 (14.6%) when compared with Group A 103 (11.1%) (Table 1).

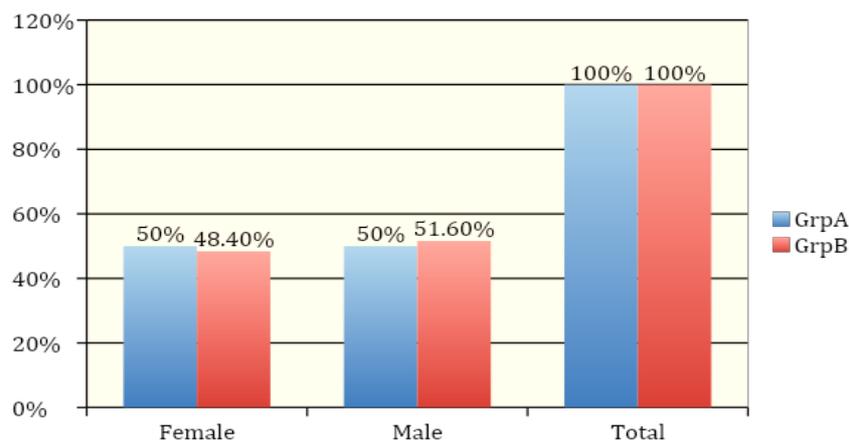


Figure 1. Gender distribution of the study participants.

Table 1. Sociodemographic variables of the participants.

Variables	Group A (Sub-Urban Community)		Group B (Rural Community)	
	N	%	N	%
Gender				
Female	466	50.0	240	51.6
Male	466	50.0	225	48.4
Age				
8-10	469	50.3	321	69.0
11-12	463	49.7	144	31.0
Socio-Economic Status				
High	301	32.3	116	24.9
Middle	191	20.5	157	33.8
Low	440	47.2	192	41.3
Family Structure				
Both Parent	763	81.8	321	69.1
Single Parent	103	11.1	68	14.6
Step Parent	66	7.1	76	16.3
Total	932	100.0	465	100.0

The prevalence of dental caries in Group A study participants was 13.4% while a prevalence of 22.2% was found in Group B. There was significant association between the two study centers with regards to dental caries prevalence; children from rural community had higher caries experience ($p=0.00$) (Table 2).

There was a significant difference in dental caries distribution across the ages among Group A ($p=0.000$). But this was not so among Group B ($p=0.31$) study participants. The highest prevalence of dental caries ($p=0.02$) occurred in the younger age groups in both study centers but this was more significant in Group A study participants when compare with Group B study participants.

Table 2 also showed that there was significant association between dental caries and oral hygiene status (OH) among Group A study participants ($p=0.02$) as against Group B study participants ($p=0.31$). In the two groups also, children with poor oral hygiene recorded the highest prevalence of dental caries but this was more significant among Group A study participants.

There was no difference in dental caries prevalence distribution across the gender among Group A ($p=0.77$) but among Group B study participants, males had higher distribution of dental caries when compared with their female counterparts (26.2 vs 18.3; $p=0.04$). No statistically significant difference was found among different socioeconomic status and family structures; however, there was a higher percentage of dental caries among the low socioeconomic status in Group B whereas among Group A higher caries prevalence was

recorded among participants from high socio-economic status. Prevalence of caries was higher among children living with both parents in the rural community compared with children from the suburban population where dental caries was higher among children living with single parents.

Table 2. Association between dental caries, OH and socio-demographic variables.

Variables	Dental Caries			
	Group A		Group B	
	Present N (%)	Absent N (%)	Present N (%)	Absent N (%)
Oral Hygiene				
Good	45 (10.2)	396 (89.8)	7 (15.2)	39 (84.8)
Fair	53 (15.5)	290 (84.5)	50 (21.2)	186 (78.8)
Poor	27 (18.2)	121 (81.8)	46 (25.1)	137 (74.9)
p-value	0.02		0.31	
Age (Years)				
8-10	75 (16.0)	394 (83.0)	72 (22.4)	249 (77.6)
11-12	50 (10.8)	413 (89.2)	31 (21.5)	113 (78.5)
p-value	0.02		0.83	
Gender				
Female	64 (13.7)	402 (86.3)	44 (18.3)	196 (81.7)
Male	61 (13.1)	405 (86.9)	59 (26.2)	166 (73.8)
p-value	0.77		0.04	
Socio-Economic Status				
High	49 (16.3)	252 (83.7)	23 (19.8)	93 (80.2)
Middle	24 (12.6)	167 (87.4)	34 (21.7)	123 (78.3)
Low	52 (11.8)	388 (88.2)	46 (24.0)	146 (76)
p-value	0.20		0.69	
Family Structure				
Both Parent	105 (13.8)	658 (86.2)	77 (24.0)	244 (76.0)
Single Parent	13 (12.6)	90 (87.4)	11 (16.2)	57 (83.8)
Step Parent	7 (10.6)	59 (89.4)	15 (19.7)	61 (80.3)
p-value	0.75		0.32	
Total	125 (13.4)	807 (86.6)	103 (22.2)	362 (77.8)

Chi-square statistic of dental caries association between the two study areas: $X^2 = 18.19$; $p = 0.00$.

Figure 2 showed the trend in the distribution of dental caries across all age groups. In group A, dental caries peaked at 9 years while among group B, it peaked at 12 years.

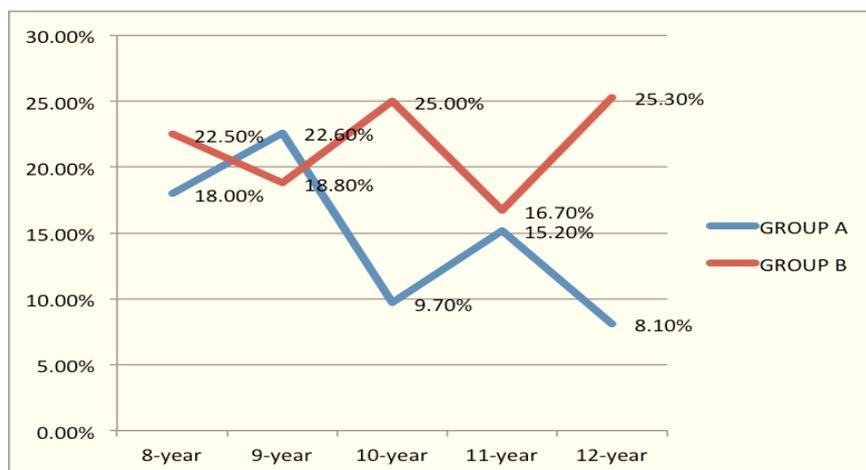


Figure 2. Trend in age distribution of dental caries.

The OH status of Group A study participants showed that 441 (47.3%) had good oral hygiene while in Group B only 46 (9.9%) had good oral hygiene. There was a higher percentage of participants with poor oral hygiene among Group B when compared to group A (39.4% vs 15.9%). Association of OH between the two study centers showed that children from suburban community had better oral hygiene compared with children from the rural community ($p=0.00$).

There was no significant difference in oral hygiene status across age groups among Group A participants ($p=0.07$) while a statistically significant difference at $p=0.001$ was observed among Group B participants. Among Group A study participants, more male participants had poor OH compared to their female participants who had good OH, while among Group B study participants more females had poor oral hygiene. However, these findings were not significant. There was no significant difference in OH status across socioeconomic status and across the family structure in both study groups (Table 3).

Table 3. OH status based on age, gender, socioeconomic status and family structure.

Variables	OH Status					
	Group A			Group B		
	Good N (%)	Fair N (%)	Poor N (%)	Good N (%)	Fair N (%)	Poor N (%)
Age (Years)						
8-10	232 (49.5)	175 (37.3)	62 (13.2)	34 (10.6)	183 (57.0)	104 (32.4)
11-12	209 (45.1)	168 (36.3)	86 (18.6)	12 (8.3)	53 (36.8)	79 (54.9)
p-value	0.07			0.001		
Gender						
Female	228 (54.8)	171 (32.5)	67 (12.7)	25 (10.4)	117 (48.8)	98 (40.9)
Male	213 (45.7)	172 (36.9)	81 (17.4)	21 (9.3)	119 (52.9)	85 (37.8)
p-value	0.40			0.67		
Socio-Economic Status						
High	155 (51.5)	108 (35.9)	38 (12.6)	9 (7.8)	64 (55.2)	43 (37.0)
Middle	86 (45.1)	77 (40.3)	28 (14.6)	17 (10.8)	85 (54.1)	55 (35.1)
Low	200 (45.5)	158 (35.9)	82 (18.6)	20 (10.4)	87 (45.3)	85 (44.3)
p-value	0.15			0.32		
Family Structure						
Both Parent	362 (47.4)	275 (36.1)	126 (16.5)	38 (11.8)	167 (52.1)	116 (36.1)
Single Parent	50 (48.5)	38 (36.9)	15 (14.6)	4 (5.9)	33 (48.5)	31 (45.6)
Step Parent	29 (43.9)	30 (45.5)	7 (10.6)	4 (5.2)	36 (47.4)	36 (47.4)
p-value	0.54			0.13		
Total	441 (47.3)	343 (36.8)	148 (15.9)	46 (9.9)	236 (50.8)	183 (39.4)

Chi-square statistic of OH association between the two study areas: $X^2 = 211.36$; $p=0.00$.

Table 4 showed that there is a significant relationship between dental caries and oral hygiene in Group A study participants, children with poor oral hygiene have increased odds of having dental caries compared to children with good oral hygiene (OR 1.79, CI 1.21-2.65, $p=0.004$). Similarly among Group B study participants, children with poor oral hygiene are 1.7 times more likely to have dental caries compared to those with good oral hygiene. This was however not significant (OR 1.74, CI 0.75-4.04, $p=0.20$).

This study showed that in Group A, older age group 11-12 years had reduce odds of having dental caries when compared with aged 8-10 years (OR 0.65, CI 0.44-0.97, $p=0.04$). This finding was however contrary to that of Group B where older age group had increased odds of having dental caries compared to the younger age group but this was however not significant.

There was an increased odds (1.1) of having dental caries among the females of Group A, while among Group B, it was reduced (0.5) when compared with males. These were however not statistically significant.

Socio-economically, among Group A study participants, middle and low socioeconomic group participants had reduced odds of having dental caries compared with participants from high socioeconomic group (OR 0.76, CI 0.45-1.30, p=0.32; OR 0.75, CI 0.48-1.17, p=0.20). These findings were not statistically significant. On the contrary, in Group B study participants, children from middle and low socioeconomic groups have increased odds of having dental caries compared with those from high socioeconomic status but this was not statistically significant as well (OR 1.12, CI 0.62-2.05, p=0.70; OR 1.24, CI 0.70-2.19, p=0.46). The result of the analysis also showed that there was reduced odds of having dental caries in children from single parents and children staying with stepparents in both study groups but this was not significant.

Table 4. Regression analysis to determine impact of oral hygiene and socio-demographic variable on dental caries in rural and suburban study participants.

Variables	Group A			Group B		
	OR	95% C.I	p-value	OR	95% C.I	p-value
Oral Hygiene						
Good	1	-	-	1	-	-
Poor	1.79	1.21-2.65	0.004	1.74	0.75-4.04	0.20
Age (Years)						
8-10	1	-	-	1	-	-
11-12	0.65	0.44-0.97	0.04	1.03	0.63-1.68	0.90
Gender						
Male	1	-	-	1	-	-
Female	1.10	0.75-1.62	0.61	0.64	0.41-1.01	0.06
Socio-Economic Status						
High	1	-	-	1	-	-
Middle	0.76	0.45-1.30	0.32	1.12	0.62-2.05	0.70
Low	0.75	0.48-1.17	0.20	1.24	0.70-2.19	0.46
Family Structure						
Both Parent	1	-	-	1	-	-
Single Parent	0.98	0.53-1.84	0.96	0.59	0.29-1.19	0.14
Step Parent	0.85	0.37-1.94	0.69	0.81	0.43-1.53	0.51

Table 5 showed results of regression analysis to determine the relationship between OH and age, gender, socioeconomic status and family structure. There were reduced odds of having good oral hygiene among the older age in group A and Group B study participants (Group A: OR 0.87, CI 0.66-1.13, p=0.29; Group B: OR 0.82, CI 0.41-1.66, p=0.58). These findings were however not statistically significant. There was an increased odds of having good oral hygiene in females compared with males, but that was not significant. In Group A study participants, the odds of having good oral hygiene was reduced in children from middle and low socioeconomic homes when compared to study participants from high socioeconomic homes. Whereas, in Group B study participants There was increased odds of having good oral hygiene among children from middle and low socioeconomic strata. These was however not statistically significant as well.

Table 5. Regression analysis to determine impact of socio-demographic variable on oral hygiene in rural and suburban study participants.

Variables	Group A			Group B		
	OR	95% C.I	p-value	OR	95% C.I	p-value
Age (Years)						
8-10	1	-	-	1	-	-
11-12	0.87	0.66-1.13	0.29	0.82	0.41-1.66	0.58
Gender						
Male	1	-	-	1	-	-
Female	1.15	0.88-1.49	0.30	1.22	0.66-2.29	0.53

Socio-Economic Status						
High	1	-	-	1	-	-
Middle	0.79	0.55-1.15	0.21	1.43	0.61-3.37	0.41
Low	0.82	0.60-1.11	0.22	1.40	0.61-3.20	0.43
Family Structure						
Both Parent	1	-	-	1	-	-
Single Parent	1.09	0.72-1.65	0.65	0.49	0.17-1.42	0.19
Step Parent	0.93	0.56-1.56	0.79	0.41	0.14-1.19	0.10

Among Group A study participants, children from single parents had increased odds of having good oral hygiene compared with those with both parents but children staying with step parents had reduced odds of having good oral hygiene compared with those staying with both parents. Whereas, among Group B study participants children living with a single parent and step-parent had reduced likelihood of having good oral hygiene compared to children living with both parents.

Discussion

This study explored the differences in the prevalence of dental caries in two different locations and settings. It compared sub-urban population (Group A) with rural population (Group B), looking at their caries experience and associated factors. The prevalence of dental caries in sub-urban population (Group A) was 13.4% while the prevalence of dental caries in the rural population (Group B) was 22.2%.

There was significant association between dental caries and age among Group A study participants, the relationship showed that older children had higher dental caries prevalence compared with others.

There was strong association between oral hygiene, age and dental caries among Group A study participants. Statistically significant associations were also observed between caries and gender as well as age and oral hygiene status of Group B study participants.

The differences in caries prevalence between the two study communities were found to be statistically significant with the rural community recording higher caries experience when compared to the suburban population ($p=0.00$). This finding was similar to a study by Okoye and Ekwueme [21]. However, this study was at variance with a similar study in Saudi Arabia where no difference was reported in caries prevalence between the rural and urban communities. This was attributed to economic stability of the country that provided equal opportunities for both rural and urban dwellers [22].

The prevalence of dental caries among Group A study participants was low compared to a previous Nigerian studies [23-25]. This low prevalence may be attributed to increased awareness about oral health in this sub-urban population, owing to the presence of School of Dentistry in the locality and its impacts through community oral health programs. Esan et al. [26], conducted a study in the same locality where they assessed the impact of school oral health programs on the oral health status of the children and reported a positive impact of these programs. This emphasized the positive role of oral health awareness campaigns in reducing oral health diseases.

On the contrary, there was higher caries prevalence reported among Group B study participants, similar to other studies from other rural communities in Nigeria [21,27]. This study location is a rural community with higher percentage of participants of low socio-economic status, who have little or no access to adequate oral health care services. Though the community also hosts a tertiary institution, this is a young institution with no dental school at present. Among the Group A study participants, older age groups had reduced odds of having dental caries compared to the younger age group whereas among Group B study

participants, the older age group had increased odds of having dental caries. This may be due to close monitoring of the younger age groups by their parents compared to the older age groups who may have been left to cater for themselves.

The oral hygiene status of the Group A study participants was associated with their dental caries experience where children with poor oral hygiene were seen more likely to have more dental caries than those with good oral hygiene. Likewise, among Group B study participants, children with poor oral hygiene had 1.75 fold increase in dental caries compared with those with good oral hygiene. The impact of oral hygiene on dental caries has been widely reported by many studies which indicates that children with poor oral hygiene have increased caries experience when compared with children with good oral hygiene [28,29].

In addition, among Group B study participants, children from middle and low socioeconomic status had over one fold increase in dental caries prevalence when compared to their counterparts from Group A. This may be due to inadequate financial capacity to purchase oral health care dentifrices which are important to prevent dental caries [21] in addition to lack of access to dental care and awareness. The socioeconomic status also played an important role in the oral health of these children, as oral healthcare products containing fluoride for caries prevention may not be easily accessible to children from the low socioeconomic group in a rural community and especially in a country where two fifths 40.1% of the total population was classified as poor or living below the poverty line [30].

The oral hygiene profile of the groups of study participants showed that children from the sub-urban population had better oral hygiene when compared with those from the rural community ($p=0.00$). The higher percentage of poor oral hygiene among rural dwellers was also observed by Akinyamoju et al. [13]. This again lends credence to the impact of socioeconomic status on the oral health of the children.

Male children from middle to low socioeconomic status have reduced odds of having good oral hygiene when compared with their counterparts from high socioeconomic status. This was similar to previous study by Oyedele et al. [16] where it was shown that children from low socioeconomic status had poor oral hygiene when compared with those from high socioeconomic status.

One of the limitations of the study was failure to determine the level of untreated dental caries in the study groups. This may give a better reflection of the impact of dental caries on the study population. Also there is a need to further determine other risk factors in the study populations.

Conclusion

Dental caries was more prevalent among the rural dwellers than the sub-urban dwellers. Age and oral hygiene were associated with dental caries. There is a need to make oral health care services/products available, accessible and affordable for the rural community.

Authors' Contributions

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All authors declare that they contributed to critical review of intellectual content and approval of the final version to be published.

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None.

Conflict of Interest

The authors declare no conflicts of interest.

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Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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