



PREVALENCE AND DETERMINANTS OF DENTAL CARIES AMONG SCHOOL CHILDREN IN MORO LOCAL GOVERNMENT AREA, KWARA STATE, NIGERIA

BY

Yusuf Funsho Issa¹, Saheed Olalekan Rabi², Muhammad Fawaz Abubakar³, Barakat Olajumoke Kolawole⁴

¹Department of Community Medicine and Primary Health Care, Kwara State University, Malete, Nigeria

²Department of Physiology, Kwara State University, Malete, Nigeria

³Department of Pharmacology and Therapeutics, Kwara State University, Malete, Nigeria

⁴Department of Public Health, Kwara State University, Malete, Nigeria



Abstract

Background: Dental caries is one of the neglected health issues for which most children and adults suffer. Untreated caries is the most common of all 291 medical diseases recorded by the Global Burden of Disease, which affects about 3.1 billion people worldwide.

Objective: This study aims to assess the prevalence, associated factors, and oral health practices related to dental caries among primary school children in selected primary schools in Moro Local Government Area of Kwara State, Nigeria.

Methodology: A descriptive cross-sectional survey research design was utilized to examine the prevalence and factors associated with dental caries among children in the selected primary schools in Moro Local Government Area, Kwara State, Nigeria. Data were collected using questionnaires conducted among 288 participants sampled through multistage sampling.

Results: Although there is a high level of awareness about dental caries (80.2%), there is also inadequate knowledge and practice of prevention measures. The majority of the children (70.1%) brushed their teeth once daily, while 3.1% brushed their teeth twice daily. Very few parents (16%) helped their children brush their teeth. Less than ten percent (6.9%) had ever attended a dental clinic, while 93.1% had never attended one. The consumption rate of sugary snacks was very high (65.6%). Class level ($p < 0.001$), family size ($p = 0.046$), and parental help while brushing ($p < 0.001$) were significantly correlated with dental caries experience.

Conclusion: There are significant problems with oral health among school children in this area. These include insufficient knowledge, poor practice, and unhealthy eating habits. It is imperative that comprehensive oral health programmes are developed within the schools and the community in general to reverse the current trend. It is highly recommended that efforts be made to increase knowledge and promote oral health within school and family settings.

Key Words: Dental caries; Fluoride, Oral hygiene; Plaque; Tooth decay

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Introduction

Dental caries is a multifactorial disease that entails the demineralization of the enamel, dentine, and cementum, the three types of dental hard tissues (1). It is also the consequence of interactions between host factors (teeth and saliva), dietary sugars, and microorganisms such as the genus of *Streptococcus mutans* and *Lactobacillus* (2). Untreated caries is the highest cause of disease burden amongst the 291 illnesses, with 3.1 billion people suffering from this disease in

the Global Burden of Disease (3). The disease burden changes from one population to another and is often affected by socioeconomic determinants together with other related illnesses of non-communicable diseases (4). Over the last three decades, the incidence of dental caries has been on the rise, even though it is a preventable disease (5). Just about 60% of the population can access basic oral healthcare services in the world today (6), exacerbating disease burden in vulnerable groups. There are four important components for dental caries: bacteria biofilm (plaque), fermentable

carbohydrate, hard dental tissue and time, and personal and oral environmental factors significantly contribute to its occurrence (7).

A comprehensive assessment is necessary for dental caries especially in order to assess the risk for caries and carious lesions activity which will help in developing treatment approaches that can vary from one patient to another depending on each patient's dental habits. For example, zirconia crowns have been employed for restorative purposes because they are considered to be relatively efficacious and aesthetically acceptable as compared to stainless steel crowns that are conventionally utilized for restoring primary teeth (3). Dental caries is highly prevalent disease that has an adverse impact on the quality of life, nutritional intake, speech articulation, and academic performance of school-going children (8). Although much attention has been devoted to improving oral health on a national and global level, dental caries continues to be an under-addressed issue amongst children. In the case of rural settings, there is limited information available on the oral health conditions, which makes the development of effective preventive measures difficult (9). Inadequate screening for dental diseases, inadequate teaching of oral health education in school curriculum, and socioeconomic limitations in access to healthcare have contributed to the problem (10).

The prevalence of dental caries has been steadily increasing among school-age children in Nigeria. Several socioeconomic, dietary, behavioral, and environmental risk factors may account for this problem (4). Some of these factors include poor oral hygiene habits, excessive sugar intake, poor parental supervision, low education attainment, lack of fluoride in drinking water or toothpaste, and poor accessibility to dental healthcare (11). Rural communities, where there are disparities in infrastructure and education, are prone to developing dental caries at an alarming rate. Dental caries cause health issues in both the oral cavity and the body generally. Individuals suffering from dental caries usually cite diets, oral hygiene habits, feeding behaviors, low birth weight, genetic disorders of teeth enamel, oral health awareness, attitudes, practices, financial status, sociocultural, and socioeconomic conditions (12). There has been an increase in the prevalence of dental caries in the community because of poor coordination of oral health programmes.

The World Health Organization (WHO) has reported that about 3.7 billion people suffer from oral conditions with an increased rate in children because free sugars contained in foods, syrups, and fruit juices are changed into acid in children's teeth (6). The figures show an increase in prevalence of oral diseases among children in developing nations where up to 70% of people suffer compared to 1–12% in developed nations (13). Oral health disparities among children in low-and middle-income countries (LMICs) vary regionally, with factors contributing to the disparities being quality of care, access to dental care, costs of dental treatment, oral health literacy and education (13). It is essential to understand the prevalence and determinants of caries among

school-age children to undertake preventive measures through school health education programmes (4).

This study aimed at assessing the prevalence, associated factors, and oral health practices related to dental caries among primary school children in selected primary schools in Moro Local Government Area of Kwara State, Nigeria. It was hypothesized that there is no significant relationship between socio-demographic characteristics of primary school children in Moro LGA and prevalence of dental caries. The results will provide information essential in designing health education and preventative measures that should be put in place by health practitioners. This study will create awareness regarding oral health issues that require intervention by the general public, including parents, teachers, and school authorities.

Review of Literature

Empirical Framework

Prevalence of Dental Caries

Dental caries is a common chronic condition that affects approximately 2.5 billion people worldwide, and it has a considerable impact on both dental and general well-being (6). There is significant variability in the prevalence rates of the condition across different regions, age groups, socioeconomic statuses, and the availability of oral healthcare services. The prevalence is still quite high in low- and middle-income nations such as several African states due to poor access to oral healthcare, low oral hygiene, and high sugar intake levels (14). For example, caries prevalence in Nigerian children is known to vary from 12% to 45%, depending on location and age groups (16). On the other hand, a much lower prevalence rate (8.5%) was observed among 6-12-year-old children in rural areas of Nigeria as a result of the traditional diet and lack of sugary foods (36). One more study conducted in Kenya found the prevalence of dental caries among 3-5-year-olds to be 53.4% because of the impact of socio-economic factors and oral hygiene practices (37). Some of the causes of variation between the results can be population differences and diets

Oral Hygiene Practices and Knowledge of Dental Caries

Tooth brushing, flossing, and mouth rinsing are crucial for oral health maintenance. Tooth brushing with fluoride toothpaste is recommended at least two times per day to promote enamel strength and prevent cavities (17). Tooth flossing eliminates food debris and plaque between teeth and reduces the risk of interproximal caries and gingivitis (20). Fluoride mouth rinse reduces bacteria and freshens breath; it prevents tooth decay and promotes dental health among those with a high risk of oral infections (21). In a Nigerian study, 62.5% of the respondents exhibited poor dental caries knowledge, while 37.5% showed good dental caries knowledge (38). Good dental caries knowledge was associated with improved oral hygiene practices such as brushing teeth twice a day (78.6% vs. 43.8%), flossing (35.7% vs. 12.5%), and rinsing with mouthwash (42.9% vs. 18.8%) compared with poor dental caries knowledge groups (39). Also, an Indian study reported 55.6% of the subjects had low

dental caries knowledge, while 44.4% had high dental caries knowledge (40). High dental caries knowledge was associated with twice daily brushing (92.3% vs. 61.5%), flossing (46.2% vs. 23.1%), and mouth washing (38.5% vs. 15.4%) compared with poor dental caries knowledge groups (39).

Dietary Habits and Its Association with the Development of Dental Carries

Regular intake of sugars helps promote acid generation due to the action of the cariogenic bacteria, resulting in demineralization of the tooth enamel, leading to the formation of cavities (22). Intake of sugar-sweetened beverages was associated with root caries development and an increased risk of decayed, missing, and filled teeth (23, 24). On the contrary, dietary items such as milk and dairy products have been suggested to be associated with a reduction in caries because these foods contain calcium that facilitates enamel remineralization (25). Nevertheless, one study from Sweden indicated that sugar intake was not associated with elevated caries risk among children with good oral hygiene habits (40).

Factors Associated with Dental Caries Among School Children

There are many behavioral factors that are known to influence the development of caries amongst children who attend school. The lack of knowledge regarding proper brushing methods, excessive sugar intake, and parental negligence of the child’s oral health have been established to be the contributing factors (26-28). Nonetheless, contrary to the above findings, studies conducted in Finland showed that children with high sugar intake and regular use of fluoride varnish along with dental visits have less incidence of caries than others (28). Social-economic factors, including a family’s financial status, level of parental education, and work obligations, have also been known to be critical contributors to the problem (21,30). Inadequate use of fluoride, limited availability of dental facilities, and school-based oral healthcare programs have been found to increase the chances of developing caries (15,25,26). Nevertheless, a recent study from South Africa suggested that low socio-economic children of educated parents performed well with respect to their dental health because of enhanced awareness and health utilization rates (29).

Health Interventions to Decrease the Prevalence of Dental Caries

Interventions that work include oral health promotion campaigns, water fluoridation, school-based prevention projects, nutritional guidelines, restrictions on sugar intake, and increasing access to dental care (27, 28). Educating people will help dispel myths, instill healthy behaviors, and ensure early diagnosis and treatment. These interventions, when applied, will have a great effect on lowering the prevalence rate, particularly among marginalized communities. A Brazilian study showed that interventions aimed at educating the community about oral health had positive effects in reducing caries prevalence in school children (38). On the other hand, a Kenyan study found that although there were school-based prevention programs, the

prevalence rate was high since the interventions had not been fully implemented (31).

Conceptual Framework

The current study has used a conceptual model that focuses on the relationship between demographic characteristics, socioeconomic status, and oral health characteristics, leading to the oral health-related quality of life. The conceptual model states that the demographic characteristics (including age, gender, and number of siblings) play a crucial role in affecting the socioeconomic status of a person (like household crowding, income based on minimum wage, socioeconomic status classification, school enrolment, and parents' age). In turn, socioeconomic status leads to some important oral health characteristics that include tooth brushing frequency, sugar consumption, health literacy, and dental caries. The oral health factors led directly to the oral health-related quality of life of a person, as shown in Figure 1. The conceptual model shows that the social determinants, such as demographic characteristics and socioeconomic status, affect the health outcome through oral health behavior directly and indirectly. The conceptual model is consistent with the World Health Organization’s Social Determinants of Health framework (40).

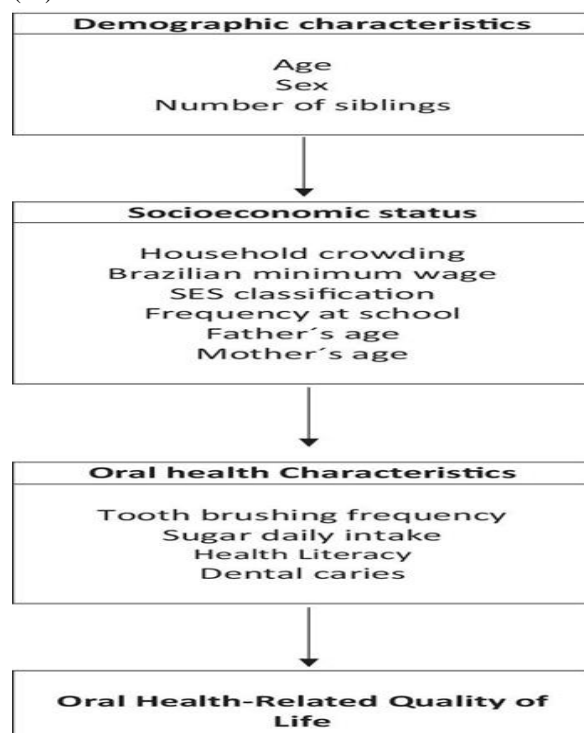


Fig. 1. Conceptual Framework

Source: Dietary Patterns and Oral Health (18).

Materials and Methods

Study Design and Setting

A descriptive cross-sectional study assessed the prevalence and determinants of dental caries among children aged 6-12 years in primary schools in Moro LGA, Kwara State, North-central Nigeria. Moro LGA, with headquarters in Bode Sa’adu, covers approximately 3,272 km2 and has an estimated population of 213,448, predominantly Yoruba. The LGA



offers various health services through Primary and secondary health care facilities, including maternal and child health, health education, and referrals. However, accessing oral health services is challenging due to facility locations. The educational sector is also growing, with public and private primary schools managed by the Kwara State Universal Basic Education Board, though infrastructure and resources vary.

Study Population and Eligibility Criteria

The study population consisted of all school children aged between 6 and 12 years who enrolled and registered for the 2025/2026 academic session, within both public and private primary schools located in Moro LGA. School children aged 6-12 years with parental consent and available on the day of data collection constituted the participants in this study, while those lacking parental consent and unavailable on the day of data collection, or having any systemic diseases and mental conditions were excluded from participating in this study.

Sampling and Sample Size Calculation

Cochran's formula was used for the calculation of the sample size, based on the prevalence rate of 27% of dental caries obtained in a previous study (14), with a confidence level set at 95% and a marginal error set at 5%. The calculated sample size was 337; however, only 320 gave parental consents to participate in the study; hence, 160 questionnaires were distributed in each of the public and private schools.

Sampling Technique

The study utilized a multistage sampling technique method, which consisted of four stages. In stage one, four communities (Malete, Elemere, Shao, and Bode Sa'adu) were selected via simple random sampling. In the second stage, two primary schools, that is, a public and a private school, were chosen from each community, leading to eight primary schools in all, with the allocation of pupils chosen from each school proportional to the population of pupils in the respective schools. In stage three, the proportion of sample size assigned to each school was further subdivided proportionally across the six classes (Basic 1 to Basic 6) in each school. The fourth stage involved selecting pupils for each class through systematic random sampling from the class registers (used as the sampling frame), where the sampling interval was obtained by dividing the population of each class by the sample size.

Instrument and Methods of Data Collection

The data were gathered using a pretested, validated, semi-structured questionnaire that covered information on sociodemographic attributes, occurrence of dental caries, awareness, oral hygiene practices, dietary patterns, and access to dental services. The questionnaire was pre-tested with 10% of the calculated sample size to ensure reliability and validity. The questionnaire was available in English and was administered through face-to-face interviews by eight trained research assistants, with the support of class teachers in the selected schools.

Analysis of Data

Data obtained from survey questionnaires were recorded on a protected database and analyzed using Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistics were applied in the analysis, such as frequency distribution and measures of central tendency. The chi-square test and logistic regression analysis were employed in examining associations between variables. The confidence level adopted in the analyses was 95%, while the significant level was $p < 0.05$.

Measurement of the Variables

The dependent variable is the prevalence of dental caries, and it is measured by means of a yes-no measure from the report or observation of dental problems. Some of the independent variables in this study include sociodemographic factors such as age, sex, class, and religious affiliation, among others. The level of knowledge or awareness about oral health was measured through some structured questions, where answers can be considered as adequate or inadequate. Oral health practice includes frequency and adequacy of brushing teeth, fluoride toothpaste use, and dental visit frequency, which were rated as good, moderate, or poor. Dietary patterns were measured through frequency of consumption of sugary foods and beverages and were classified as high risk, moderate risk, or low risk. Access to dental health care facilities was measured as adequate or inadequate depending on availability and access cost.

Consent and Methods of Protection of Human Subjects

Informed consent was sought from the parents of the school children through a signed consent form with either a signature or thumbprint from the parents/guardians of the school children. Anonymity and confidentiality of all collected data were ensured throughout the entire period of conducting the research. This study involved minimal risk to the school children, and the benefits of the research exceeded the risks posed. Voluntary participation in this study was guaranteed, and it was carried out in line with the principles of the Declaration of Helsinki; participants were aware of their rights to withdraw from the study without any penalties. All data were stored in an encrypted computer system to ensure confidentiality according to ethical guidelines approved by the Kwara State Ministry of Health.

Ethical Considerations

The ethical approval of this study was obtained through approval ERC/MOH/2026/02/600 from the Ethical Review Committee of the Kwara State Ministry of Health. Moreover, permission and clearance to conduct the study were obtained from the Parent Teachers Association and Head Teachers of selected schools to ensure their collaboration. The respondents were not coerced in any form or lured in order to take part in the study.

Results

Of the 320 questionnaires distributed, 288 were duly completed and returned, yielding a high response rate of 90%. The analysis was therefore based on the completed 288 questionnaires and the findings are as presented below:

Socio-demographic Characteristics of Respondents

The respondents were predominantly female (81.3%), with the majority aged 9-12 years (68.1%).

Nearly nine-tenths (87.8%) of the respondents were Yoruba by tribe, and almost three-quarters (72.2%) were Muslims. More than one third of the respondents come from households with 8 members (41.7%), and 25.0% have 5 members, indicating a trend toward larger families. The commonest occupation among mothers is trading (53%), and one tenth been work as civil servant (10%). One fifth of the respondents' fathers are farmers (20%), while most of them are civil servants (40%). About four-fifths (84%), of parents do not assist their children with brushing teeth, highlighting a potential gap in oral health support (Table 1).

Table 1: Demographic Profile of Respondents N=288

Variable	Frequency(n=288)	Percentage
Age (Years)		
5-8	92	31.9
9-12	196	68.1
Sex		
Female	234	81.3
Male	54	18.7
Class		
Primary 1-3	158	54.9
Primary 4-6	130	45.1
Tribe		
Yoruba	253	87.8
Hausa	23	8.0
Igbo	0	0.0
Fulani (Others)	12	4.2
Religion		
Islam	208	72.2
Christianity	80	27.8
Traditional	0	0.0
Family Size (Household Members)		
3-6	138	47.9
7-10	150	52.1

Mother's Occupation

Trader	153	53
Farmer	58	20
Civil servants	29	10
Self employed	48	17

Father's Occupation

Trader	72	25
Farmer	58	20
Civil Servant	115	40
Self employed	43	15

Do Parents Help with Brushing?

Yes	46	16.0
No	242	84.0

Prevalence of Dental Caries and Tooth-Related Experiences

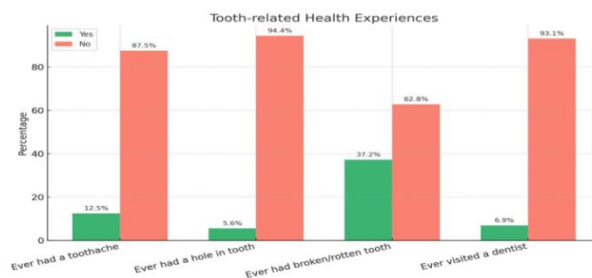


Fig. 2: Prevalence of Dental Caries Experience Among Respondents

More than a third (37.2%) of the respondents have had a broken or rotten tooth, while nearly nine-tenths (87.5%), have never experienced a toothache. The prevalence of dental caries (defined as having had a hole, broken or rotten tooth) found in this study is 37.2% (Figure 2). Less than a tenth (6.9%), have visited a dentist for a tooth-related problem, and this points to a limited access to or utilization of dental care services.

Awareness and Knowledge of Dental Caries

More than three quarter (80.2%) of respondents have heard of dental caries, majorly via friends/family (88.7%) and a few through their school teachers (28.1%). Quite unusual, none (0.00%) of the respondents reported receiving information about dental caries from radio/television, internet/social media, or health workers. Eating sweets (37.8%) and not brushing teeth (36.5%) were believed to cause tooth decay. More than two-thirds (70.1%) of the respondents brush their

teeth once a day, suggesting a need for improved oral hygiene practices (Table 2).

Majority (88.9%) of the respondents believed that brushing teeth can prevent tooth decay, but about one tenth (11.1%) were unsure. Less than one fifth (16.0%) of respondents reported receiving help from their parents or guardians when brushing their teeth. Although the overall level of awareness of dental caries among respondents was high (87.9%), a quarter (25%) of the respondents are still unsure of the cause of dental caries, indicating some level of confusion or lack of understanding about the specific factors contributing to tooth decay (Table 2).

Table 2: Awareness and Knowledge of Dental Caries among Respondents N=288

Variable	Frequency	Percentage
Have you heard of dental caries or tooth decay?		
Yes	231	80.2
No	57	19.8
If Yes, what is the source of your information?		
<i>(Based on 231 respondents who answered "Yes" to Q14)</i>		
Parent	18	7.8
Radio/Television	0	0.0
School Teacher	65	28.1
Internet/Social Media	0	0.0
Health Worker	0	0.0
Friends/Family	205	88.7
What do you think causes tooth decay?		
Not brushing teeth	105	36.5
Eating too many sweets	109	37.8
Germ in the mouth	0	0.0
Don't know	74	25.7
How often should you brush your teeth?		
Once a day	202	70.1
Twice a day	86	29.9
Only when dirty	0	0.0

Don't know 0 0.0

Can brushing teeth prevent tooth decay? Yes

256 88.9

No 0 0.0

Don't know 32 11.1

Do your parents or guardians help you?

Yes 46 16.0

No 242 84.0

Awareness of Dental Caries

High 260 87.9

Low 28 12.1

Oral Hygiene Practices

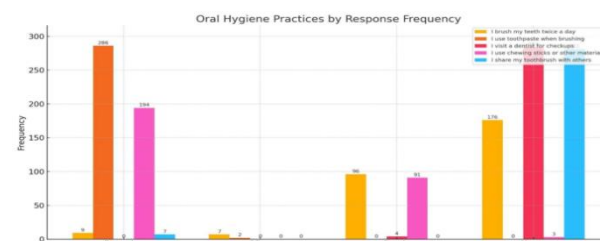


Fig 3: Oral Hygiene Practices Among Respondents

Close to two thirds (61.1%) of the respondents never brush their teeth twice a day, and almost all (98.6%) never visit a dentist for regular checkups. Only a small fraction of respondents (3.1%) brush twice a day every day, and more than two thirds (67.4%) admitted to using chewing sticks or other materials every day. Nearly all (99.3%), use toothpaste when brushing, and never share their toothbrush (97.6%), indicating a positive aspect of their oral hygiene routine (Figure 3).

Dietary Habits and Association with Dental Caries

More than three quarters (79.9%) of the respondents never consume sweet snacks before bedtime, suggesting some awareness of healthy eating habits. Nearly two-thirds (65.6%), often consume sugary snacks like sweets, biscuits, or chocolate, while two-thirds (65%) of the respondents never take sugary soft drinks. This indicates a high frequency of sugary snack consumption, which can contribute to tooth decay and other health issues (Table 3).

Table 3: Dietary Habits and Association with Dental Caries N=288

Statements	Often	Rarely	Never
I eat sugary snacks like sweets, biscuits, chocolate	189 (65.6%)	59 (20.5%)	40 (13.9%)
I take sugary soft drinks (e.g., soda, juice)	57 (19.8%)	44 (15.3%)	187 (65.0%)



I eat fruits like oranges, bananas, apples	51 (17.7%)	187 (65.0%)	50 (17.4%)
I take sweet snacks before bedtime	0 (0.0%)	58 (20.1%)	230 (79.9%)
I consume dairy products like milk, cheese, yogurt	50 (17.4%)	50 (17.4%)	188 (65.3%)

Access to Dental Health Services and Fluoride Use

Majority (93.1%) of respondents have never visited a dental clinic or seen a dentist, and nearly all (95.8%) are not a regular patient of a dental clinic. Notably, none (0.00%) of the respondents routinely visit a dental clinic once a year, but close to two thirds (65.3%) rely on a dentist when they have a tooth problem. Majority (93.1%) of the respondents use fluoride toothpaste when brushing their teeth, and more than two thirds (68.1%) have received oral health education at school, which is indicative of some positive oral health practices (Table 4).

Table 4: Access to Dental Health Services and Fluoride Use N=288

Statements	Frequency	Percent
Have you ever visited a dental clinic or seen a dentist?		
Yes	20	6.9
No	268	93.1
How often do you visit a dental clinic?		
Regularly (at least once every year)	0	0.0
Occasionally (only when there is a problem)	12	4.2
Rarely (once in several years)	0	0.0
Never	276	95.8
Who usually provides treatment when you have a tooth problem?		
Dentist at a clinic	188	65.3
Pharmacist or chemist	33	12.5
Traditional healer	0	0.0
Parent or guardian	0	0.0
No treatment is given	67	23.3
Do you use fluoride toothpaste when	268	93.1

brushing your teeth?

Yes		
No	20	6.9

Have you ever received oral health education at school?

Yes	196	68.1
No	92	31.9

Association between Sociodemographic Variables and Prevalence of Dental Caries

Chi-square test examined the relationships between the sociodemographic factors and the prevalence of dental caries among children by use of broken/rotten teeth as an indication of the experience of caries. According to the findings, class level, number of people in a household and parental help in brushing are significantly related to dental caries (Table 5). Higher class levels within the primary level indicated higher prevalence of caries among children, and this could be attributed to the ability to report on oneself and the accumulated experience of cariogenic factors. Larger families also had higher prevalence rates of caries possibly because of lack of close supervision, sharing of toothbrushes or insufficient funds. Importantly, children without any parental help when brushing experienced caries significantly compared to other children. However, there was only a borderline significant relationship between age groups ($p = 0.056$) and caries, suggesting a possible trend but lacking statistical significance. Gender, tribe and mother's occupation were also not significantly associated with caries prevalence. Summarily, Class level ($p < 0.001$), family size ($p = 0.046$), and parental help with brushing ($p < 0.001$) are significantly associated with dental caries experience, highlighting the importance of socio-demographic factors in oral health outcomes (Figure 4).

Table 5: Association between Sociodemographic Variables and Prevalence of Dental Caries

Variable	χ^2	Df	p-value	Significance
Age group	9.210	4	0.056	Not significant
Gender	0.088	1	0.767	Not significant
Class (Educational level)	22.870	5	<0.001	Significant
Tribe	1.120	2	0.570	Not significant
Family size	9.670	4	0.046	Significant
Mother's occupation	1.880	3	0.598	Not significant



Parental help with brushing 20.860 1 <0.001 Significant

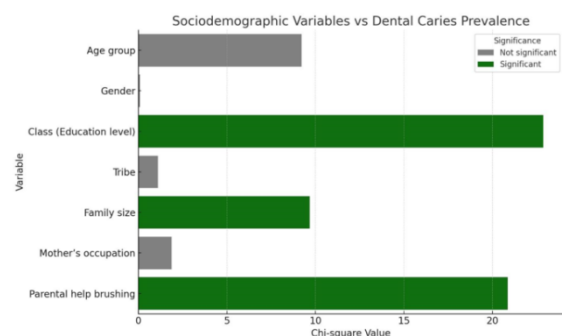


Fig. 4: Summary of Association Between Sociodemographic Characteristics and Prevalence of Dental Caries Using Chi-square

Association between Sociodemographic Factors and Dental Caries Experience

Logistic regression analysis was conducted to determine the association between the sociodemographic factors and the probability of having dental caries (having a hole, cracked, or decayed tooth) in 288 school children. The older children, aged 12 years, were twice as likely to suffer from dental caries compared to younger children aged 6 years (OR= 2.104; 95%CI: 1.003-4.415; p=0.049). The chances of suffering from dental caries among other children aged 8, 10, and 11 years were relatively high but statistically insignificant (age 10: OR=1.328; p=0.443). Children from households with 8 members (OR=2.078; p=0.028) and 10 members (OR=2.436; p=0.039) had a higher likelihood of reporting dental caries than those from smaller households comprising ≤5 members. The risk of suffering from dental caries was significantly higher among the children whose parents did not assist them in brushing teeth (OR=3.014; 95%CI: 1.223-7.429; p=0.017). Other factors, such as sex, religion, tribe, and class at school, had no significant relationship with caries experience. The occupation of mothers and fathers was found to have no significant influence on dental caries (for instance, fathers as civil servants: OR = 1.873; p = 0.087). In summary, age at 12 years, large family size, and parental failure at helping children brush their teeth were significantly associated with caries experience (Table 6).

Table 6: Logistic Regression Analysis on Sociodemographic Factors and Dental Caries Experience

Variable	Odds Ratio [95% Confidence Interval]	P > z
Age (Years)		
6 (ref)	Reference	
8	0.821 [0.374 – 1.804]	0.624
10	1.328 [0.639 – 2.758]	0.443
11	1.785 [0.751 – 4.240]	0.191
12	2.104 [1.003 – 4.415]	0.049 *

Sex

Female (ref)	Reference	
Male	1.213 [0.604 – 2.438]	0.588

Class

Primary 1 (ref)	Reference	
Primary 1-3	0.934 [0.414 – 2.106]	0.867
Primary 4-6	0.524 [0.173 – 1.591]	0.253

Tribe

Yoruba (ref)	Reference	
Hausa	1.892 [0.735 – 4.866]	0.186
Fulani/Others	2.512 [0.841 – 7.503]	0.099

Religion

Islam (ref)	Reference	
Christianity	0.683 [0.347 – 1.345]	

Family Size

≤5 (ref)	Reference	
<6	1.456 [0.639 – 3.318]	
>6	2.078 [1.081 – 3.995]	0.028 *

Mother's Occupation

Trader (ref)	Reference	
Farmer	1.142 [0.537 – 2.429]	0.732
Civil Servant	0.892 [0.358 – 2.224]	0.803
Self-employed	1.569 [0.734 – 3.352]	0.245

Father's Occupation

Trader (ref)	Reference	
Farmer	1.287 [0.578 – 2.863]	0.539
Civil Servant	1.873 [0.912 – 3.847]	0.087
Self-employed	0.964 [0.416 – 2.236]	0.932

Parental Help with Brushing

Yes (ref)	Reference	
No	3.014 [1.223 – 7.429]	0.017 *

Association between Sociodemographic Factors and Dental Caries Awareness

Logistic regression analysis was done to determine the relationship of socio-demographic variables with the possibility of having high awareness towards dental caries by the respondents. As compared to those 6-year-old children (reference category), children who are 10, 11, and 12 years old had higher odds for high awareness. This means that children at the ages of 10, 11, and 12 were 2.2 times, 3 times, and 3.5 times, respectively, more likely to have high awareness than those who belonged to the reference category ($p = 0.034$; $p = 0.007$; $p = 0.001$). This denotes a positive and significant relationship between age and awareness. Regarding the education level of children, respondents from the Primary 4, Primary 5, and Primary 6 levels had higher odds of being aware than those in the reference category (Primary 1 level). The estimated odds of these children belonging to Primary 4, Primary 5, and Primary 6 levels are 2.3 times, 2.7 times, and 3 times, respectively.

As far as the children’s ethnicity is concerned, the children from Fulani and other minority tribes showed much lower probability of high awareness as opposed to Yoruba children ($OR = 0.483$, $p = 0.043$). Furthermore, the odds of high awareness of children from families with 8 and 10 members were decreased ($OR = 0.482$ and $OR = 0.403$; $p = 0.031$), which can mean that a large number of family members may affect access to oral health knowledge and education. Mothers’ employment was one of the factors that affected the likelihood of children’s awareness of dental caries. Specifically, children whose mothers worked as civil servants were more than two times as likely to be aware of dental caries as compared to the children whose mothers worked as traders ($OR = 2.093$, $p = 0.039$). The children who received help from their parents while brushing teeth showed almost threefold increase in the probability of high awareness ($OR = 3.024$, $p = 0.004$). Neither gender, nor religious background, nor father’s occupation made a significant impact on dental caries awareness. In summary, Age, class level, tribe, family size, mother's occupation, and parental help with brushing are significant predictors of dental caries awareness, with older children, those in higher classes, and those receiving parental help being more likely to have high awareness (Table 7).

Table 7: Logistic Regression Analysis on Sociodemographic Factors and Dental Caries Awareness Odds Ratio [95% Confidence

Variable	Interval]	P > z
Age (Years)		
6 (ref)	Reference	
8	1.412 [0.665 – 2.999]	0.371
10	2.207 [1.062 – 4.586]	0.034 *
11	2.964 [1.346 – 6.526]	0.007 *
12	3.518 [1.681 – 7.364]	0.001 *

Sex		
Female (ref)	Reference	
Male	0.768 [0.397 – 1.486]	0.430
Class		
Primary 1 (ref)	Reference	
Primary 2	1.211 [0.577 – 2.540]	0.611
Primary 3	1.504 [0.608 – 3.719]	0.377
Primary 4	2.323 [1.013 – 5.326]	0.046 *
Primary 5	2.741 [1.220 – 6.160]	0.014 *
Primary 6	3.076 [1.362 – 6.947]	0.007 *
Tribe		
Yoruba (ref)	Reference	
Hausa	0.631 [0.252 – 1.576]	0.325
Fulani/Others	0.483 [0.238 – 0.978]	0.043 *
Religion		
Islam (ref)	Reference	
Christianity	1.289 [0.672 – 2.472]	0.442
Family Size		
≤5 (ref)	Reference	
6	0.721 [0.323 – 1.608]	0.425
8	0.482 [0.248 – 0.937]	0.031 *
10	0.403 [0.176 – 0.924]	0.031 *
Mother’s Occupation		
Trader (ref)	Reference	
Farmer	0.783 [0.349 – 1.754]	0.551
Civil Servant	2.093 [1.036 – 4.226]	0.039 *
Self-employed	1.318 [0.630 – 2.759]	0.460
Father’s Occupation		
Trader (ref)	Reference	
Farmer	0.946 [0.439 – 2.038]	0.884
Civil Servant	1.642 [0.866 – 3.113]	0.129
Self-employed	1.129 [0.523 – 2.439]	0.755
Parental Help with Brushing		
No (ref)	Reference	
Yes	3.024 [1.419 – 6.443]	0.004 *

Discussion

The current study found that the largest percentage of the study participants were female (81.3%), the majority being between the ages of 9 and 12 (68.1%). Yoruba was the

predominant ethnicity in the study (87.8%), while 72.2% belonged to the Muslim religion. The majority of those interviewed had large families. It is also evident that about 84% of the parents did not help their children brush their teeth. Similar results were reported in earlier studies conducted in Nigeria (1,2), with the exception of the gender of the study participants. This could have been a result of the methodology employed in sampling.

A relatively high prevalence of dental caries was observed among the schoolchildren participating in this study, with a high percentage (37.2%) reporting that they have either broken or rotten teeth. This percentage is significantly less compared to what was noted in a previous Nigerian study (52.1%) (25). In addition, this figure is less compared to the results of a similar study conducted in Kenya on children between 3-5 years of age, which showed a prevalence rate of 53.4%, indicating the significance of socioeconomic conditions and good oral hygiene practices (31). On the other hand, this prevalence is relatively high compared to a prevalence rate of 8.5% of dental caries in children between 6-12 years of age reported in another study conducted in rural areas of Nigeria and attributed to their diet (30). There can be different reasons why there is such an inconsistency in these results due to differences in study populations, dietary preferences, and availability of oral health care. Also, there seems to be an inconsistency between the global and local prevalence rates of dental caries in terms of what has been seen in the available literature. According to available literature, there is a prevalence of dental caries cases, particularly for children and adolescents, in Sub-Saharan Africa (15,16). Contrarily, in this study, there is a relatively low prevalence of symptoms associated with dental caries within the population sample chosen. The results from this study show a very low presence of signs and symptoms of dental caries among the respondents in relation to toothache (12.5%) and holes in the tooth (5.6%). On the other hand, the highest prevalence of dental caries symptoms was seen in relation to having a rotten or broken tooth (37.2%).

With respect to awareness and knowledge of dental caries, eight out of ten (80.2%) study participants were aware of dental caries and had received this information from friends/relatives (88.7%) and school teachers (28.1%). This rate of awareness is better than what has been noted in some studies in Nigeria (14). The high rate of awareness in this study is in contrast with another study conducted in Nigeria, in which 62.5% of participants had low knowledge regarding dental caries, and 37.5% had high knowledge (32). Participants with high knowledge had better oral hygiene habits, like twice daily tooth-brushing (78.6% vs 43.8%), flossing (35.7% vs 12.5%), and mouth rinsing (42.9% vs 18.8%) than those who had low knowledge (32). Similar results have also been noted in a study in India, where 55.6% of participants had low knowledge about dental caries and 44.4% had high knowledge (40). In the latter study, participants with high knowledge had better oral hygiene practices, such as twice daily tooth-brushing (92.3% vs 61.5%), flossing (46.2% vs 23.1%), and using mouthwash

(38.5% vs 15.4%) than those with low knowledge (40). The high percentage of 80.2% of the respondents who were familiar with dental caries in the present study reveals that there is relative awareness among people regarding oral disease, with their friends and family as the major sources of information on dental caries (88.7%) and their school teachers (28.1%). The presence of such sources of knowledge reveals a critical deficiency in organized oral health education, indicating that there has been no involvement of health care professionals in the delivery of accurate information. In contrast, previous studies have emphasized the need for health education programs in schools and the involvement of health care professionals in conveying dental information (4,11).

It was established in this study that almost two-thirds of the respondents (61.1%) never brushed their teeth twice in a day, while almost all the respondents (98.6%) never went for regular visits to dentists. These are unhealthy practices and are consistent with results from similar studies conducted in low-income regions (10,11). In addition, over two-thirds of respondents (70.1%) brush their teeth once a day, while 29.9% brush twice a day. The majority of the respondents (88.9%) were of the opinion that brushing their teeth prevents decay. This is consistent with dental health practices. However, from this study, only 3.1% of the respondents brushed twice in a day, whereas a majority (61.1%) never brushed twice in a day, while 33.3% rarely brushed twice in a day.

The results of this study pose some dietary issues and indicate critical deficiencies in nutritional practices and oral disease susceptibility knowledge. Based on studies by Zabokova (18) and Hassan & Othman (19), diets rich in fermentable carbohydrates, particularly sugars, sweetened beverages, and snacks, stimulate acid-producing bacteria in the mouth, resulting in dental erosion and, ultimately, tooth decay. There is substantial evidence of the direct connection between sugar consumption and higher caries susceptibility, with several longitudinal investigations validating these relationships among various groups (18). In the present study, 65.6% of participants reported regular consumption of sugary snacks, 19.8% reported regular consumption of sugary beverages, and 13.9% and 15.3% never consumed them, respectively. It is important to note that, while most individuals (79.9%) never consumed sweet snacks at night, a positive practice, the overall rate of sugary snack consumption throughout the day is considerably high.

According to this study, 93.1% of the respondents used fluoride toothpaste, while most respondents used toothbrushes rarely, which lessens the benefit provided by the toothpaste. One of the interesting findings of this study is that 67.4% of respondents use chewing sticks daily for cleaning. This finding indicates the high popularity of natural oral hygiene among people in Nigeria and other African countries. Although there are claims that chewing sticks, such as Miswak, have antimicrobial properties and can be effectively used for plaque removal, their effect depends upon their correct use, which often does not happen. These natural teeth cleaners cannot substitute for the modern way of tooth

cleaning, especially when it comes to caries prevention (6). There is an absence of preventive care among respondents, as 98.6% never visited a dentist. The majority (93.1%) of the respondents had never been to any dental facility. This is supported by previous reports of studies in Nigeria (14) and highlights the challenges faced at the systemic level in accessing dental care. This supports the results of WHO (6) and Odunyemi et al. (4), who emphasized that limited access to dental care among Nigerians plays an important role in the development of preventable dental diseases such as dental caries. Additionally, it was shown that children from poorer families but with educated parents in South Africa had superior oral health because of increased awareness and use of the facilities, thus refuting the claim that socioeconomic status is the only factor (37).

Significant associations were found between class level ($p < 0.001$), family size ($p = 0.046$), and parental help with brushing ($p < 0.001$) and dental caries. Similar results appeared in Kenya (31) and India (13). Logistic regression showed higher caries risk in 12-year-olds, children from larger families, and those without parental help. These results mirror findings from Ethiopia (8) and Brazil (38). Age, class, mother's job, and brushing also correlated with caries awareness.

Limitations of the Study

This study has several limitations. First, the cross-sectional design of this study makes it impossible to come up with conclusions regarding the cause-and-effect relationship between sociodemographic characteristics and dental caries; hence, the study concentrated on associations and not causations. Second, the use of self-reports in the measurement of some of the variables (e.g., oral hygiene habits, dietary habits) may introduce recall bias, and could also be subjective since no clinical assessment of the teeth was made. Third, this study only looked at primary school children from Moro LGA, which means its results may not be applicable to other groups or locations.

Mitigation Steps and Suggestions for Future Studies

In order to compensate for these shortcomings, the research adopted a reliable and well-validated questionnaire that had been previously tested for validity and relevance of the research results. Interviews in person were held to avoid recall errors in the process of data collection. Simple and straightforward questions were asked in addition to conducting an anonymous survey among participants. Sampling procedures were adopted in order to provide representativeness of the study sample. Moreover, the methods used in the current research and its limitations are fully explained, which makes it possible to interpret and replicate the results obtained by using another methodology.

Future studies can use longitudinal research methods to establish causation concerning the effects of sociodemographic variables on dental caries. The population sample for future research studies can also be expanded to include more states apart from Edo State in Nigeria. Other research topics that future researchers could consider include

establishing the major barriers to seeking oral health care services, evaluating the effectiveness of health programs such as the oral health care program, and determining how socioeconomic status affects oral health. In addition, future research studies should ensure that qualitative research is conducted to uncover the cultural aspects that affect oral health. Lastly, future research studies about dental caries in this locality should include clinical assessment of the teeth.

Conclusion and Recommendations

The study showed major gaps in knowledge, practices, and dental service availability for primary school children in the Moro Local Government Area of Kwara State, Nigeria. While awareness of dental caries was satisfactory, misconceptions about the causes and a lack of preventive practices were concerns. Caries prevalence was high, suggesting limited use of dental services. Class level, family size, and parental involvement were key sociodemographic factors affecting caries experience and awareness.

In light of the information provided above, the government needs to launch and implement a school-based oral health education programme aimed at educating pupils from different classes on how to properly brush their teeth, what to eat to prevent tooth decay, and how to go through regular dental check-ups. Access to such dental services needs to be increased through community outreach. Additionally, parents need to be involved in this process since parental supervision plays an important role in encouraging pupils to practice oral health care procedures like brushing.

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Contributions by Authors

Conception and design of the study, as well as supervision of data acquisition and revisions to the paper, were done by Y.F.I. Contribution to design and analysis of data, as well as preparation of the draft for the paper, was done by M.F.A, B.O.K. Literature review and data analysis and interpretation were contributions of Y.F.I and S.O.R. Data acquisition and manuscript preparation were contributions of S.O.R., M.F.A. and B.O.K. participated in data analysis and manuscript preparation. All the authors approved the final version of the manuscript and agreed on its publication.

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Competing Interests

The authors have no conflicts of interest to declare.

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