Caries Risk Assessment among 6- to 12-Year-Old Public and Private School Children in Benin City, Nigeria—a pilot study

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ABSTRACT

Objective: To assess the caries risk of children aged 6 to 12 years in public and private schools in Benin City, Edo State, Nigeria
Methods: A descriptive cross-sectional study was conducted among 210 schoolchildren aged 6 to 12 years in public and private schools in Benin City, Edo State. Data collection was done with the aid of a researcher administered American Dental Association (ADA) caries risk assessment form. A Chi-square test was used to test associations between two categorical variables at a 5% level of significance.
Results: Data was obtained from two hundred and ten (210) participants, aged 6 to 12 years with a mean age of 9.81±1.5. Majority of the participants were females (52.4%), 10-year-olds (27.6%) and those whose parents are manual workers (52.4%). Among the 210 children, 18(8.6%) were in low, 124(59.0 %) in moderate and 68(32.4 %) in the high-risk category. The most prevailing variable for the moderate risk category was the non-establishment of dental home while for the high-risk category, it was the frequent/prolonged in-between meals, sugary food or drinks exposure per day. Bivariate analysis revealed that there was an increased percentage of respondents in the high caries risk category with increasing age, among those children whose parents are manual workers, and those in public schools. Binary logistic regression analysis revealed that males were less likely to have a high caries risk; private school attendees were less likely to have high caries risk; respondents whose parents were manual workers were more likely to have high caries. The relationship between the socioeconomic status of parents and school type with caries risk category was statistically significant. ($p < 0.05$)
Conclusion: The moderate risk was the predominant caries risk category in this study population. Frequent/prolonged in-between meals, sugary food or drinks exposure per day was the most dominant factor for high risk, and respondents whose parents are manual workers are more likely to have high caries risk.
Key words: caries risk assessment, school-aged children, ADA tools

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INTRODUCTION

The health of children, and their future, is intimately linked to the health of a community, state, country and our planet, as children are the future generation.[1] Considering that oral health plays a vital role in the general health of an individual, it can be inferred that the oral health status of children invariably determines the general health status of a nation at large. Age 6-12 is significant in the development of children because it is a phase in childhood when children acquire the knowledge of the norms and values of a society.[2] The acquired knowledge equips them to be contributing members of society. Unfortunately, at this age, many children have a high number of carious teeth.[3] This high incidence of caries has been associated with irregular and ineffective oral hygiene habits and frequent snacking on foods high in sugar.[3]

Dental caries, a disease characterized by the localized destruction of susceptible hard dental tissues is a major problem of public health interest.[4,5] This disease is one of the most prevalent diseases affecting about 50% of children across the globe.[6] Globally, during the past decades, a decline has been reported in the incidence of dental caries in children.[7] However, this decrease in caries incidence varies across different populations. In Nigeria, the incidence of caries is still well above the epidemic threshold.[8] In Benin, a prevalence of 21.9% was reported by Chukwumah et al.[9] This high prevalence of caries has necessitated the need for a new approach to caries prevention, one of which is caries risk assessment.

Caries Risk Assessment (CRA) is the determination of the likelihood of the incidence of caries (i.e. the number of new cavitation or incipient lesions) during a certain period or the likelihood that there will be a change in the size or activity of the carious lesions already present.[10] CRA is essential as the basis for the successful management of dental caries and a critical part of patient-centred caries management.[11] Numerous models or tools have been published with four well-known ones: CAMBRA, Cariogram, American Dental Association (ADA), and American Academy of Pediatric Dentistry (AAPD) CRAs.[12] They have been developed, modified and adapted to assist clinicians in determining a patient's risk, selecting the appropriate management based on an individual's caries risk level and useful in determining the appropriate recall interval for each patient.

Anusha and Parangimalai, [13] in their work using the ADA model for the assessment of caries risk, reported a risk level of 2%, 40.8% and 57.2% for low, moderate and high caries risk respectively. In another study by Kemparaja et al[3] on the usefulness of CRA in the prediction of future caries, authors found that children in the low caries risk group did not develop new carious lesions by the end of a two-year follow up while those in the higher caries risk group developed new carious lesions at follow up.

There are a few previous studies on the risk factors for caries in Nigerian children; [8,14] however, the literature search did not reveal any literature on caries risk assessment among Nigerian Children using any of the published CRA tools. The outcome of studies using CRA tools will assist in the decision-making process for the prevention and management of caries and ultimately go a long way towards reducing the prevalence of dental caries by proper caries risk assessment.

Aim: To assess caries risk of children aged 6 to 12 in public and private schools in Benin City, Edo State.

MATERIALS AND METHODS

Ethical consideration

The protocol for this study was reviewed and approval granted by the Ethics and Research Committee of the University of Benin, Benin City, Nigeria with REC approval number: **CMS/REC/2019/075**. Written Informed consent for study participation was obtained from parents of all the children while assent was also obtained from children aged 12years. Only children who were willing to participate and whose ages were within the study age bracket were recruited into the study. Pupils with special needs (mental, physical and medical) were excluded from the study.

Study design/population/setting

A cross-sectional study design was conducted among children aged 6 to 12 years, recruited from 215 public and 177 private schools in Benin City, Edo State, Nigeria. Benin City has three local government areas. It is the Capital and largest city of Edo State, situated on a branch of the Benin River and lies along the main highways from Lagos to the Niger Bridge at Asaba and the eastern states.

Sample size/Sampling

The sample size was calculated using the formula for sample size determination in cross-sectional studies[15] and a value of 210 participants was obtained using a p-value from a similar study[9]. A multistage sampling technique was used to select participants from 215 public and 177 private schools in the 3 LGAs in Benin City. The sample was first proportionally distributed amongst the LGAs by dividing the

calculated sample size by the number of LGAs. A total of 70 study participants was obtained for each LGA. Following this, the sample was distributed equally between the private and public schools in the LGAs in a ratio of 1:1 given a sample of 105 pupils from public schools and 105 pupils from private schools. Each public and private school was selected from the sampling frame based on a constant of K = 6 (This constant was chosen from the least number of schools in a local government). Thus every 6th school in each local government was selected for the study. In each school, the classes with the highest number of pupils within the study's age range were selected. Recruitment in each school continued till the sample size for the school was reached.

Data collection tool

Data were collected with the use of the American Dental Association (ADA) caries risk assessment form for children (Age >6) which was slightly modified by the researcher. The form has four sections: Bio-data, Contributing Conditions, General Health Conditions, and Clinical Conditions. An intra-oral examination was carried out with the use of a wooden spatula and bright natural light to check for the presence of any carious lesion (active or arrested), the presence of a missing tooth or teeth, exposed root surfaces, interproximal restorations, severe dry mouth, visible plaque, restoration overhangs, dental/orthodontic appliances and unusual tooth morphology. The modification made in this study was on one of the factors under the contributory conditions: 'Dental home, established patients of record, receiving regular dental care in a dental office'. This factor was modified to read, 'any previous visit to a dental office'. This was because the concept of 'dental home' is not popular in Nigeria. More so, most dental office visits are usually motivated by pain-related symptoms.[21] The three sections in the form outside the biodata have 4, 5 and 9 questions for low, moderate and high caries risk categories respectively, given a total of 18 questions. Each section has a total of 18, 14 and 7 factors which were assessed for low, moderate and high-risk categories respectively.

Data analysis

Data were retrieved from the filled ADA caries risk assessment form, entered, cleaned, coded and analysed using the Statistical Package for Scientific Solution (SPSS) version 20.0. The analysed data was presented in form of frequency distribution tables. Chi-square test was used to evaluate the association between categories of caries risk and the socio-demographic background and logistic regression evaluated the demographic predictor of caries risk. The level of significance was set at 0.05.

Scoring system

All positive responses in any (low, moderate or high-risk) column were noted. Low risk was indicated where only conditions in low risk were checked; Moderate risk, was where only conditions in "Low" and/or "Moderate Risk" columns were present; High risk was where one or more conditions in the "High Risk" column was present.

RESULTS

A total of two hundred and ten (210) study participants with ages ranging from 6 to 12 years and a mean age of 9.81±1.5 were recruited for the study. Those aged 10 years were in the majority (27.6%) and the least was those aged 6 years old (2.9%). The sample comprised 122 females (58.1%) and 88 males (41.9%). Manual Workers Social Class (MWSC) were in the majority 52.4%, an equal percentage (50%) each for school type and most of the participants were in primary (basic) 3 (29.0%) [**Table 1**].

Figure 1: Majority (59%) of the participants fell into the moderate caries risk category with only 19(9%) in the low caries risk category.

Tables 2 and 3: Analysis of the variable most responsible for moderate and high caries risk categories showed that the 'non-establishment of dental home' (41.4%) was predominant for moderate risk while 'frequent/prolong in-between meals, sugary food or drinks exposure per day (77%) was more in the high-risk category.

Table 4: Bivariate analysis of the caries risk categories and demographic characteristics of participants revealed an increased percentage of respondents in the high caries risk category with increasing age, more in children whose parents are manual workers and in public schools. A relationship exists between the socioeconomic status of parents and school type with caries risk category which was statistically significant. ($p < 0.05$)

Table 5: Binary logistic regression analysis revealed that with increasing age, there was an increased likelihood of increased caries risk with an odds ratio of 1.859. ($p > 0.005$ (95% CI = 0.939 – 2.287). Males were less likely to have a high caries risk with an odds ratio of 0.776. ($p = 0.646$) (95% CI = 0.263 – 2.287). Private schools' attendees were less likely to have high caries risk with an odds ratio of 0.387. ($p = 0.192$) (95% CI = 0.093 – 1.414) Respondents whose parents were manual workers were more likely to have high caries risk with an odds ratio of 6.437. This

association was statistically significant (p = 0.023) (95% CI = 1.292 – 32.426).

Table 1: Socio-Demographic Characteristics of Respondents' Risk

Variable	Frequency (N =210)	Percent (%)
Age (Years)		
6&7	13	6.2
8	29	13.8
9	40	19.0
10	58	27.6
11	37	17.6
12	33	15.7
Gender		
Male	88	41.9
Female	122	58.1
Parent's Socioeconomic Class		
Manual Workers	110	52.4
Farmers	7	3.3
Non-Manual Workers	93	44.3
Class of Respondents		
Primary 2	16	7.6
Primary 3	61	29.0
Primary 4	58	27.6
Primary 5	44	21.0
Primary 6	31	14.8
School Type		
Public	105	50.0
Private	105	50.0

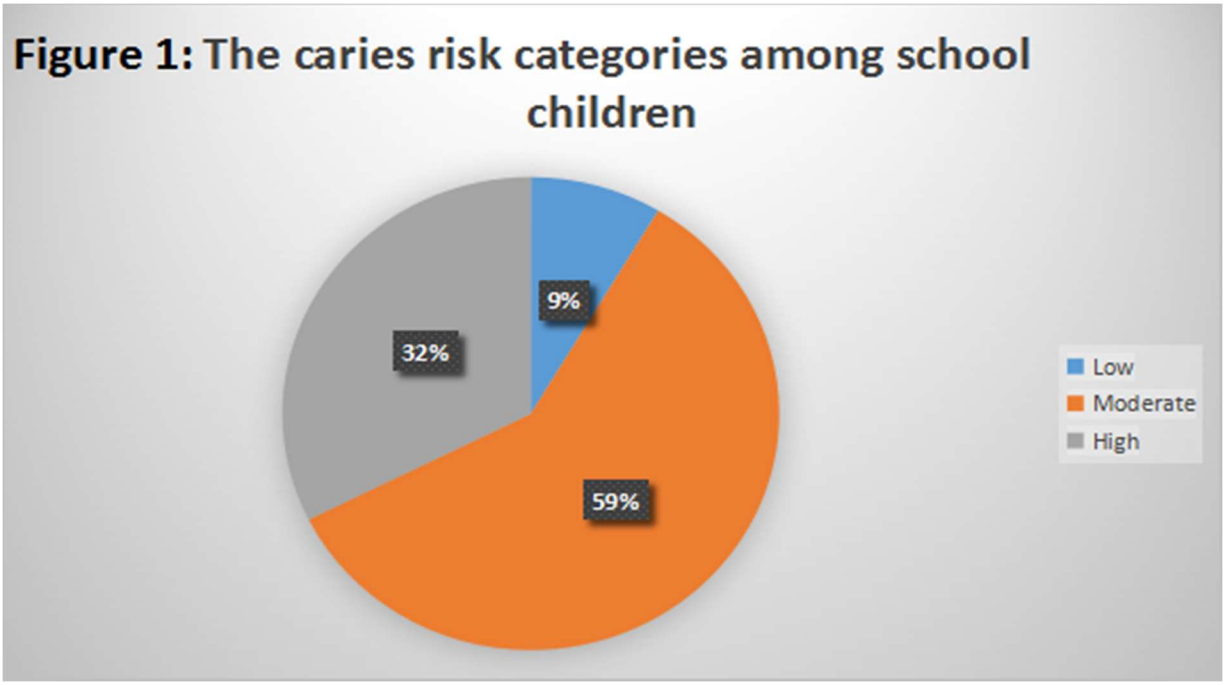

Figure 1: Frequency of Caries Risk Categories

Table 2: Frequency of Variables for Moderate Caries Risk Category

Risk factor variable For moderate risk	Frequency	Percentage (%)
No Fluoride exposure	2	0.5
Caries experience of mother, caregiver and/or other siblings in the last 7 to 23 months	41	9.6
Non-establishment of dental home	177	41.4
Presence of 1 or 2 new carious lesions in last 36 months	31	7.2
Presence of visible plaque	161	37.6
Presence of unusual tooth morphology	16	3.7
Total	**428**	**100**

Table 3: Frequency of Variables for High Caries Risk Category

Risk factor variable For high risk	Frequency	Percentage (%)
Frequent/prolong in-between meals sugary food or drinks exposure/day	60	77.0
Caries experience of mother, caregiver and/or other siblings in the last 6 months	14	18.0
Presence of 3 or more new carious lesions or restorations in the last 36 months	4	5.0
Total	**78**	**100**

Table 4: Socio-Demographic Characteristics of Respondents and Caries Risk Category

Variable	Caries Risk Category				
	Low N(%)	Moderate N(%)	High N(%)	Total 100%	P value
Age (Years)					
6&7	1(7.7)	12(92.3)	0(0.0)	13	0.264
8	4(13.8)	17 (58.6)	8(27.6)	29	
9	3(7.5)	25(62.5)	12(30.0)	40	
10	5(8.6)	35(60.3)	18(31.0)	58	
11	4(10.8)	19(51.4)	14(37.8)	37	
12	1(3.0)	16(48.5)	16(48.5)	33	
Gender					
Male	8(9.1)	48(54.4)	32(36.4)	88	0.530
Female	10(8.2)	76(62.3)	36(29.5)	122	
Parent's Socioeconomic Class					
Manual Workers	2(1.8)	61(55.5)	47(42.7)	110	0.024
Farmers	1(14.3)	3(42.9)	3(42.9)	7	
Non-Manual Workers	15(16.1)	60(64.5)	18(19.4)	93	
School Type					
Private	14(13.3)	70(66.7)	21(20.0)	105	0.043
Public	4(3.8)	54(51.4)	47(44.8)	105	
Class of Respondents					
Primary 2	2(12.5)	13(81.3)	1(6.3)	16	0.097
Primary 3	2(3.3)	36(59.0)	23(37.7)	61	
Primary 4	3(5.2)	35(60.3)	20(34.5)	58	
Primary 5	7(15.9)	21(47.7)	16(36.4)	44	
Primary 6	4(12.9)	19(61.3)	8(25.8)	31	

Table 5: Predictors of the caries disease among respondents

Variables	*B*eta	P-value	Odds ratio	95% C.I. for Odds ratio	
				Low	High
Age(years)	0.620	0.075	1.859	0.939	2.287
Gender					
Male	-.253	0.646	0.776	0.263	2.287
Female*			1		
Parent's social class					
Non-manual workers*			1		
Farmers	-1.803	0.198	0.165	0.011	2.561
Manual workers	1.868	0.023	6.473	1.292	32.426
School Type					
Private	-.951	0.192	0.387	0.093	1.414
Public*			1		
Class of Respondents					
Primary 2*			1		
Primary 3	2.629	0.151	13.859	0.383	501.614
Primary 4	2.915	0.030	18.455	1.329	256.188
Primary 5	2.111	0.055	8.256	0.952	71.629
Primary 6	0.070	0.932	1.072	1.216	5.318

*Reference category

DISCUSSION

Risk assessment for caries is a critical part of patient-centered caries management. It assists clinicians in selecting the appropriate management based on an individual's caries risk level as well as in the institution of an appropriate recall schedule. An ideal risk assessment model should be inexpensive, easy to use and time-efficient with a high degree of accuracy in caries predictive value.[16] The ADA caries form is one when modified to meet the needs of an environment, will be of tremendous use in caries risk assessment. In this study, this assessment is a starting point in the evaluation of the participant's health status.

In this study, the majority of the participants were in the moderate risk category, which is in agreement with some previous studies;[17,18] but at variance with another similar study.[13] The moderate risk category reported could be attributed to the dominant factor of the risk profile; "Non-establishment of dental home" which in this study was modified to mean the absence of any previous dental office visit, and "presence of visible plaque" which could be due to poor tooth brushing habit. The reason for the variation may be attributed to the range in the age group of the study participants, which was a mixed and permanent dentition group compared to the exclusively mixed dentition group by Anusha and Parangimalai.[13]

The increasing prevalence of caries with increasing age in the high caries risk may be attributed to the fact that the amount of money given to these children by their parents increases with the increasing age. Thus, these children have more money to spend on cariogenic foods and drinks. This finding is in agreement with that of Park et al.[19]

In addition, this study revealed that females are more likely to have a high caries risk than males. This finding is similar to a previous study by Ferraro and Vieira.[20] The higher susceptibility of females to caries may be attributed to the difference in salivary composition and flow rate, hormonal fluctuations, dietary habits and genetic variations. Furthermore, systemic diseases associated with caries have also been found to have an association with the female gender.[20]

In this study, children whose parents are manual workers were more likely to have a high caries risk. This could be because parents who are manual workers belong to a lower socioeconomic status. Their children may experience financial, social and material deprivations. These children's access to a healthy environment and social resources such as medical and dental care may also be compromised. And their beliefs about health and lower perceived need for dental care could lead to neglected self-care and lower utilization of preventive health services.[21]

The majority of the study participants from public schools were in the high-risk category while a majority of those in private schools were in the moderate-risk category. This finding suggests that

participants in private school were less likely to develop caries which in agreement with the study by Mitha et al.[17] It is also in agreement with the widely held opinion that the private school children are from a relatively higher socioeconomic family status and, as a result, they are closely monitored during tooth brushing.[22]

CONCLUSION

The moderate caries risk was the predominant risk category in this study population. The high-risk caries category increased with increasing age and females were more susceptible. More so, frequent/prolonged in-between meals, sugary food or drinks exposure per day was the most dominant factor for high risk. Respondents whose parents are manual workers are more likely to have a high caries risk.

RECOMMENDATIONS

- Early dental visits for children; at least on or before their first year birthday as well as regular dental visits.
- Reduction in the frequency of sugary foods or drinks and increase in the frequency of natural fruit intake as useful alternatives.
- For the Nigeria Association of Paediatric Dentistry (NAPD) to adopt a modified CRA form to be used in dental clinics

CONFLICT OF INTEREST

None declared

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