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Evaluation of Quality of School Children's Lunch Meal in Relation to Caries Experience

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Abstract

Objective: To assess the relationship between school feeding practice and prevalence of dental caries in Nigerian school children.

Methods: A cross-sectional study was conducted among Primary school children using a structured interviewer administered questionnaire. Information collected include: socio-demographic variables, oral hygiene measures and meals consumed during lunch break. The contents of lunch boxes were categorized as balanced (cooked meals with vegetables or fruits), overloaded (one cooked meal and a snack) and unbalanced &over loaded (no lunchbox, or greater than one snacks). Also, intra oral examination was carried out to assess the caries status of the dentition using the Decayed, Missing, Filled Teeth (DMFT) index. The data was analyzed using IBM SPSS version 22. Chi Square statistical tests were done as appropriate and the level of significance was set at ≤ 0.05.

Results: There were 194 children comprising 90(46.4%) males and 104(53.6%) females with a mean age of 11.3($\pm$1.5) years. Seventy-four pupils (38.1%) brushed twice a day and 144(74.2%) rinsed after meals. Almost all (99.5%) participants used fluoridated tooth paste. Fifty-two (26.8%) had lunch boxes and there were statistically significant differences (p=0.01) between males and females. Only 8(4.1%) had balanced meals in their lunch boxes. The prevalence of dental caries was 8.8% and the mean DMFT index was 0.14($\pm$0.59). Those with dental caries had either overloaded 7(47.1%) or unbalanced-overloaded meals 9(52.9%). There were no statistically significant differences between the meal categories and dental caries.

Conclusion: Though most of the participants consumed refined carbohydrates, the mean DMFT index, 0.14($\pm$0.59) was very low. This may be related to the good oral hygiene practices.

Keywords: Lunchbox, dental caries, children, DMFT, oral hygiene behaviour

Introduction

Dental caries is a common chronic dental infection in children. It is a process of progressive demineralisation of hard tooth tissue and prevails when demineralisation offset the protective processes of remineralisation. It occurs as a result of imbalance between exposure to risk factors and protective factors resulting in demineralisation of tooth substance by organic acids produced in bacterial plaque in the presence of dietary sugars. [1-4] The aetiology of dental caries is multifactorial [2]; these factors include the diet, oral microflora, susceptible tooth surface and time. Other identifiable predisposing factors in children are poor oral hygiene habit (i.e. poor plaque control and late commencement of tooth brushing), low parental educational level, living condition, family structure, age, sex and number of siblings of the child. Factors such as quantity and quality of saliva, fluoride exposure and presence of buffers [1,5,6] could mitigate the occurrence of dental caries.

Presumably, the easiest to control of the major contributory risk factors is diet. Dietary sugar provides favourable substrate for oral microbiota to produce organic acid which perpetrate the progressive tooth destruction in dental caries.

The characteristics of the dietary sugars such as the form, period of exposure to the teeth and frequency /sequence of consumption determine whether dental caries will be initiated or not.

High molecular weight carbohydrates like starch are low in cariogenicity. Staple starchy foods, vegetables, fruits and foods like peanuts, cheese and whole grain that stimulate salivary flow have been reported to have low risk of causing dental caries. [3,5-8] Likewise, cow's milk which has been said to be rich in calcium, phosphorus and casein is believed to inhibit dental caries and plaque. [3,9-11] However, low molecular weight carbohydrates taken in excess of 15kg/year/person may lead to an increase in dental caries. [7] These low molecular weight cariogenic carbohydrates are typically found in confectioneries, which are common content of children's lunch boxes in most Nigerian schools.

Whereas many studies [12-24] on School Health Services in Nigeria have been reported, still, there is paucity of study related to feeding in particular reference to oral health considerations. This gap requires to be bridged. Considering that dental caries is a major oral health challenge among School age children, intervening at the level of dietary control via education could be advantageous. Since, the school environment offers a suitable platform where feeding and nutrition pattern of children could be positively influenced for health promotion purposes [12], this study was initiated to assess the relationship between school feeding practice and prevalence of dental caries in Nigerian school children. The assumption is that the nature of children's lunch box content can tell by inference, the tendencies of parents to expose their children to cariogenic diets.

Materials and Methods

Ethical consideration

Prior to data collection, Ethical clearance was obtained from the Ethics Board in University of Port Harcourt Teaching Hospital and permission was sought and obtained from the School Management Board. Permission and consent were sought from the head teachers and parents.

Public schools in Obio/Akpor local government area listed on the State Ministry of Education school registration list were considered eligible for inclusion in the study. Three public schools were selected by simple random sampling. Two hundred and ten children were selected from the schools. The research tool for this study was a structured anonymous questionnaire which was interviewer administered to the pupils of these schools. The information elicited included
(i) Socio-demographics; age as at last birthday, sex, number of siblings, parents occupation
(ii) Oral health practices such as frequency of tooth brushing, timing of tooth brushing or cleaning, use of fluoride tooth paste and past dental visits (type- routine or symptom-related). The study was non-invasive, and the names of the schools/pupils were excluded from the study. The researchers went to the schools on three different visits.

Inclusion criteria
1. School children that consistently brought same type of meals/quality of meal or snacks in the three visits
2. School children that consistently did not bring lunch boxes in the three visits

Calibration of researchers
Prior to the visits, research assistants (dentists) were trained on the parameters that would be entered on the survey form.

Assessment of the content of the lunch box

The presence and contents of the lunch boxes were assessed. Also, the food and beverages purchased from food vendors by the children within and outside the school premises were assessed using a checklist.The reasons for the choice of foods purchased were also elicited.

The meals were then categorized [25] as:
1. Balanced- i. Home cooked food with vegetables, fruits
   ii. Sandwich vegetables, fruits
2. Overloaded- i. Home cooked food with more than one extra food (snacks)
3. Unbalanced &over loaded –when there is no lunchbox, or greater than one extra food (snacks)

The drinks were categorized into water, milk, and extra drinks. [25] The sugar containing drinks such as fizzy drinks, sodas, sweetened yoghurts, fruit drinks were the extra drinks.

Assessment of the dentition status

The intra oral examination was carried out under natural light in an upright chair. Using the World Health Organization's (WHO) criteria, [26] the diagnosis of dental caries was made as follows;
'D' was noted if there was any decayed, filled tooth with recurrent caries; retained root; and temporary filling or filled tooth surface with other decayed tooth surface.
'M' if a tooth was missing as a result of extraction due to caries.
'F' when there was a restored tooth.
The DMFT index values were assessed as follows [26]: i. Very low: 0.0–1.1 ii. Low: 1.1–2.6 iii. Moderate: 2.7–4.4 iv. High: 4.5–6.5 v. Very high: >6.5

Data analysis

The information collected was entered into data spreadsheet and analysed using the SPSS version 22 (IBM corp. Chicago, United States of America). Descriptive summary statistics was obtained for demographic variables, lunch box and the contents of the meals ingested in schools. The mean DMFT index was calculated, T test and Pearson's chi square was used to test for significance and these were set at $p \leq 0.05$.

Results

One hundred and ninety-four (92.4%) of the 210 questionnaires distributed were returned with complete information. There were 90 (46.4%) males and 104 (53.6%) females and they had a mean age of 11.3 (±1.5) years and median of 11 years.

Oral hygiene behaviour

The past dental visit and oral hygiene behaviours are shown in Table 1. Almost all the participants (99.5%) used fluoridated tooth paste with tooth brushes to clean their teeth regularly. One hundred and fifteen (59.3%) pupils brushed once a day, 82 (42.3%) brushed their teeth after meals, 89 (45.9%) brush last thing at night before going to bed and 144 (74.2%) rinsed after meals. There were statistically significant differences between males and females in the frequency of tooth brushing (p=0.05), brushing after [confectioneries] meals (p=0.01) and last thing before going to bed (p=0.01). Twenty seven (13.9%) had been to dental clinic for either routine or symptom related visits.

School feeding practice
Relationship between subjects' gender and their having a lunch box and its contents

Only 52 (26.8%) brought lunch boxes to school and there were statistically significant differences (p=0.01) between females and males. Forty- two (82.7%) had cooked food and 11 (21.2 %) confectioneries and there were no significant differences between the males and females in the content of their lunch boxes and types of meals consumed in school. (Table 2) Nine year old pupils brought the most lunch boxes to school and the proportion of those that brought lunch boxes decreased as the age increased. (Depicted in Figure 1)

It was observed that only 8 (4.1%) came to school with a balanced meal [this was 15.4% {8/52} of those that brought meals to school], i.e. cooked meals with vegetables or fruits while 144 (74.2%) took unbalanced-overloaded meals i.e. there was no lunchbox, or greater than one extra food [snack] and 21.6% had overloaded meals. Also, 57.4%, 38.9% and 3.7%subjects took water, extra drinks (fizzy/fruit drinks) and milk, respectively as the beverage/ drink during lunch break.

One hundred and thirty- one (67.5%) bought snacks within and outside the premises whether they brought food from home or not.

Table 1: Relationship between subjects' gender and their oral hygiene behaviour

Oral hygiene	Males	Females	Total	p value
Use of fluoride toothpaste				
Yes	89 (98.9)	104 (100)	193 (99.5)	
No	1 (1.1)	0	1 (0.5)	0.28
Frequency of tooth cleaning/day				
Once	59 (65.6)	56 (53.8)	**115** (59.3)	
Twice	31 (34.4)	43 (41.3)	74 (38.1)	
Thrice	0	5 (4.8)	5 (2.6)	0.05*
Tooth brushing after meals/snacks				
Yes	29 (32.2)	53 (51.0)	82 (42.3)	
No	61 (67.8)	51 (49.0)	**112 (57.7)**	0.01*
Rinsing of the oral cavity after meals/snacks				
Yes	62 (68.9)	82 (78.8)	**144 (74.2)**	
No	28 (31.1)	22 (21.2)	50 (25.8)	0.11
Tooth brushing last thing at night				
Yes	32 (35.6)	57 (54.8)	89 (45.9)	
No	68 (64.4)	47 (45.2)	**115 (59.3)**	0.01*
Past dental visits				
Yes	11 (12.2)	16 (15.4)	**27 (13.9)**	
No	79 (87.8)	88 (84.6)	164 (86.1)	0.53

*p statistically significant ≤0.05

Table 2: Relationship between subjects' gender and the content of their lunch boxes

Lunch box and its content	Males	Females	Total	p value
Do you bring lunch box to school				
Yes	16 (17.8)	36 (34.6)	52 (26.8)	
No	74 (82.2)	68 (65.4)	142(73.2)	
				0.01*
†Content of lunch box				
Cooked food	12 (70.6)	31 (83.8)	43 (84.3)	
Confectioneries	5 (29.4)	6(16.2)	11 (21.6)	
				0.26
Drink in lunch box				
Water	10 (58.8)	21 (56.8)	31 (60.8)	
Milk	0	2 (5.4)	2 (3.9)	
Juices/fizzy /soda	7 (41.2)	14 (37.8)	21 (41.2)	
				0.62
Category of meal				
Balanced	1 (1.1)	7 (6.7)	8 (4.1)	
Under loaded	72 (80.0)	72 (69.2)	144 (74.2)	
Over loaded	17 (18.9)	25 (24.1)	42 (21.6)	
				0.08

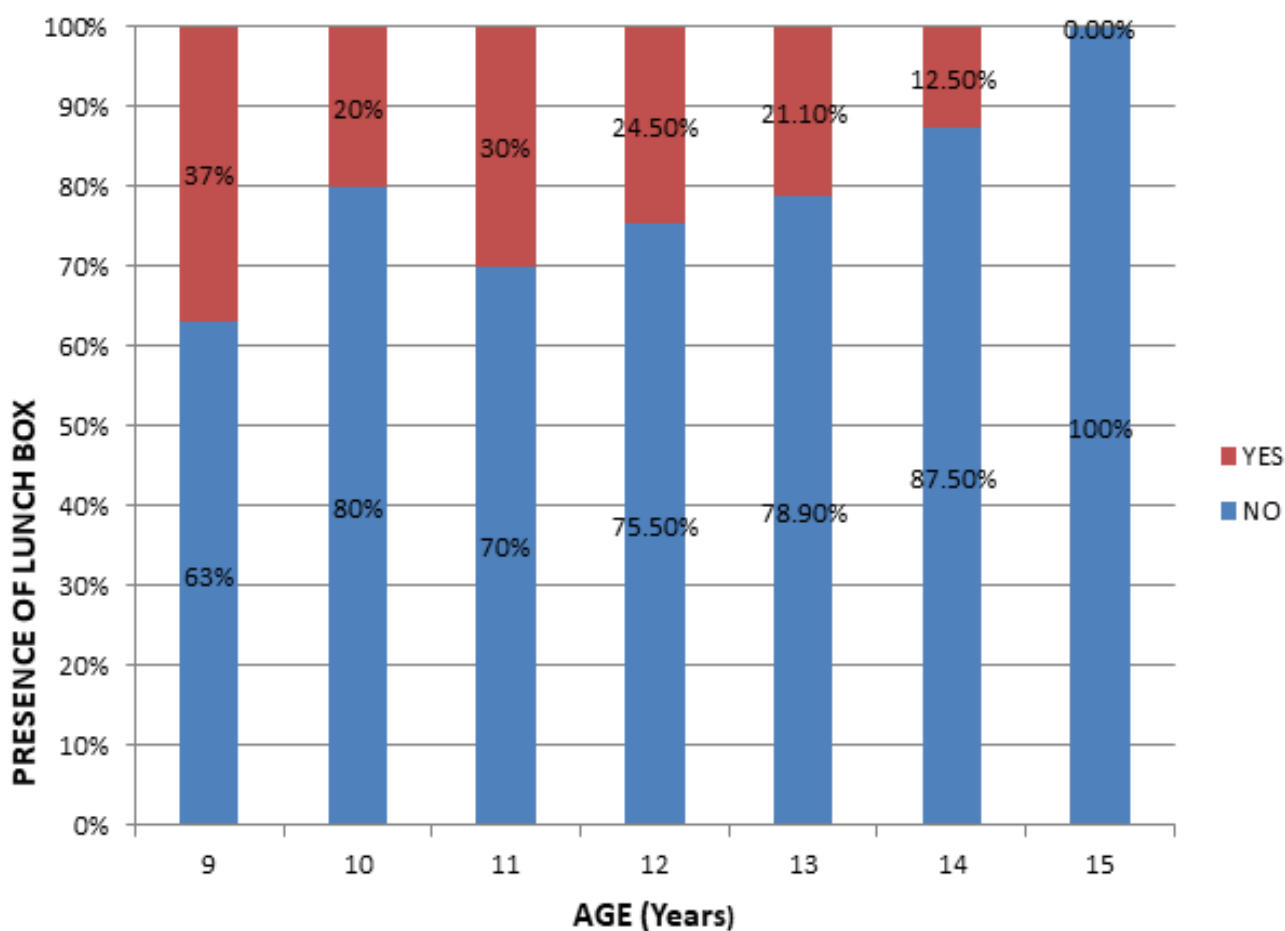*p statistically significant ≤0.05; † two had both types of meals in lunchbox

Figure 1: Presence of Lunch boxes according to age.

Caries experience of the primary school pupils

Seventeen (8.8%) had dental caries, 14 (82.4%) of which were females. The mean DMFT index was 0.14 (±0.59); mean for males was 0.09 (± 0.65) and mean for females was 0.19 (±0.52). The decayed component was 16 (94.1%) and missing was1 (5.9%) but there was no filled tooth on the tooth surface. All those that had dental caries had either overloaded meals 7(47.1%) or unbalanced-overloaded meals 9 (52.9%).A third (35.3%) of those that brought meals from homes had dental caries; however these meals were not balanced.

Table 3 shows the relationship between caries experience /DMFT index and the lunch consumed (presence of lunch box and the content). There were no statistically significant differences between the meal categories and caries experience, also no differences between caries experience and presence or absence of lunch box.

Discussion

In the present study, it was observed that the oral health behaviour was not optimal as depicted by the pattern of the pupils' oral hygiene measures and past dental visits. This observation was observed in previous studies in Nigeria, where poor utilisation of dental services was reported among children. [27,28] Though they all brushed everyday, most brushed once a day, this finding corroborates previous studies, [29] twice a day tooth brushing is recommended and brushing last thing before going to bed is necessary to remove food substances that would have been left after meals. When these are fermentable dietary sugars they can act as substrates for cariogenic bacteria in the oral cavity. [1-4]

It was observed that the school feeding service according to the National School Health policy [12] was yet to be implemented in schools in the Local Government Area however the children were allowed to bring their food from home or buy within the school premises. About a quarter of the subjects took lunch boxes to school and this was less than those of the children reported among other Nigerians.[20,24] Eight (15.4%) had bal-

Table 3: Relationship between subjects' dental caries status and the content of their lunch boxes

Lunch boxes	DMFT index				Total	p value
	0	1	2	6		
Presence of lunch box						
Yes	46 (88.5)	3 (5.8)	2 (3.8)	1 (1.9)	52 (26.8)	0.40
No	131 (92.3)	7 (4.9)	4 (2.8)	0	142 (73.2)	
Content of lunch box						
Balanced meals	8 (100)	0	0	0	0	
Unbalanced-overloaded	134 (83.5)	5 (3.5)	5 (3.5)	0	7 (41.2)	0.16
Overloaded meals	35 (83.3)	5 (11.9)	1 (2.4)	1 (2.4)	10 (58.8)	

*p statistically significant ≤0.05; † two had both types of meals in lunchbox

anced meals ,and this low proportion of balanced meal was also reported in the abovementioned studies.[20,24] Majority don't take lunch boxes to school; and of those that took lunch boxes most took high molecular weight, starchy non-cariogenic carbohydrate[7]More females (34.6%) brought lunch boxes to school than males (17.8%) and this difference was statistically significant. This trend has also been reported in Brazilians [30] and English children.[31]This could be that the males prefer buying their meals than carrying extra bags (lunch boxes) to school.

This study corroborates the report that the older children tend not to take lunch bag to school. [30]They took more of confectioneries than cooked food during lunch breaks as previously reported that older children appeared to prefer tasty(sweetened) cariogenic meals to high calorie dense meals.[7,20,24,30] It was observed that confectioneries were what majority of the pupils bought in the school premises and consumed irrespective of whether they brought lunch boxes or not. This further lends credence to previous findings in this regard. [20, 24]

Among those that brought lunch boxes, the females had healthier meals than the males and this pattern has also been reported in other studies. [30,31] It has been stated that milk and milk products are not only important for nutritional values in children, but also caries prevention purposes. [10,11] However, in this study only 3.7%had milk as part of their lunch, [7] and 4.1% had fruits and vegetables in their lunch meals. This corroborates previous studies done in Nigeria, Brazil and Bulgaria, [7, 20, 30] but contrary to that reported in Australians, [32] where fruit intake was very high. The drink taken with meals was mostly water, this was also reported among Australians. [32] Water aside its function as an essential nutrient, would cleanse the mouth of food substances and may reduce the risk of dental caries when fluoridated. [6]

Although the pupils were exposed to refined sugars in confectioneries on a daily basis, the caries experience was very low as portrayed in the prevalence and DMFT index. A similar study in Bulgarians [7] revealed that 54% of the children had a high DMFT index score. It is worth mentioning that all those that had caries were all exposed to dietary sugars (overloaded and unbalanced &overloaded) meals. This was also reported by Bamba et al.[11] The fact that three quarter of the children rinse their oral cavities with water after ingestion of confectioneries and quite a number drank water instead of other beverages with their meals might have contributed to the observed low caries experience. In addition, the exposure to fluoride in toothpaste and water would have further reduced the risks of dental caries or encouraged remineralisation of teeth. [6,33]

There were more females than males with dental caries and this corroborates the previous study done in Port Harcourt, Nigeria. [34]The untreated caries was 94.1% which was higher than the 84.2%reported in the previous study carried out in Port Harcourt, Nigeria. This finding supports previous reports on poor awareness and motivation in utilizing dental facilities. [27,28, 34]

However, the limitation of DMFT index for determining caries index must be underscored. The use of ICDAS would be a more sensitive method to determine the incidence of caries especially for its ability to detect incipient lesions. However, the use of ICDAS is associated with logistic challenge for field studies such as this. The use of an effective airjet is mandatory but this was not achievable in this study. More so, most similar studies previously published have employed the DMFT index probably for similar reasons. The ease of comparison with previous reports is another reason for adopting DMFT index in this study. However, future studies using ICDAS is very much desirable.

Conclusion

Though most of the participants consumed refined carbohydrates, the mean DMFT index, 0.14($\pm$0.59) was very low. This may be related to the good oral hygiene practices.

Recommendation

Efforts should be made to ensure that all pupils enjoy at least one balanced meal a day in their schools. They would benefit from school feeding service in schools since at least a balanced meal will be provided a day. Furthermore, such studies using ICDAS should be done for more authentic report of caries prevalence among the study subjects.

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