

DENTAL SURVEY IN NIGERIA PART I. PREVALENCE OF DENTAL CARIES IN NIGERIA

BY

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ABSTRACT

A joint dental epidemiological survey was carried out in 1981 in the ancient city of Ile-Ife and its environs in the Federal Republic of Nigeria. The survey was made with the University of Ife, Ile-Ife, Oyo State, Nigeria, as the base. The occurrence of caries in 898 Nigerian school children of 509 urban and 389 rural children was compared with the occurrence of caries in the Japanese children. The results showed that the incidence of caries in the Nigerian school children was much lower than that of their Japanese counterpart. However, it is projected that with the increase in the consumption of sweet drinks and food in Nigeria, if superimposed on the existing poor oral hygiene, the incidence of caries will increase greatly.

Key words: Dental caries, dental epidemiological survey, Nigerian school children.

INTRODUCTION

There have been several documented reports on dental caries in the Nigerians (Tabrah [5], Akpabio [6], Sheiham [7], Henshaw [8], Enwonwu [9], Henshaw and Adenubi [10], Akpata and Jackson [11], Akpata [12, 13], Hollist and Oyedele [14]). These reports show that the incidence of caries in the Nigerians is considerably less than in both the Euro-

peans and the Japanese. This paper is a result of a joint dental epidemiological survey funded by the grant from the Japanese Ministry of Education, Science and Culture in 1980 and 1981 (Kubota *et al.* [1, 2]) and conducted from the University of Ife, Ile-Ife, Nigeria. This paper presents the incidence of dental caries as observed during the survey in 1981 and will be compared with that in the Japanese children (MHW [3], MHW [17],

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Table 1. Number of School Children Examined in 1981

Age group	Urban		Rural		
	Male	Female	Male	Female	
3-5	30	22	29	35	
6-8	58	67	29	30	
9-11	51	51	28	38	
12-14	79	49	47	34	
15-17	33	44	45	45	
18-	13	12	19	10	
Total	264	245	197	192	898

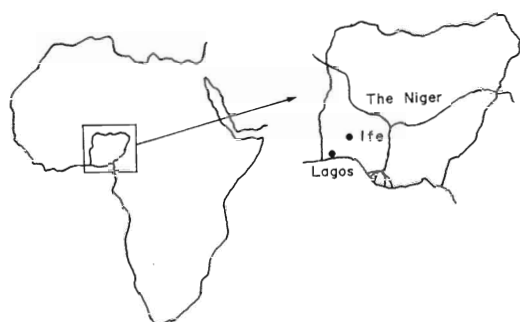


Fig. 1. Map of Surveying Spot in Federal Republic of Nigeria.

Kita [18], Takakuwa [19], Shimono and Sobue [20]).

SUBJECTS (MATERIALS) AND METHODS

1. *Preliminary survey*: The preliminary survey had been performed in November 1980. In the survey, the children of the nursery, primary, junior and senior high schools and adults, totalling in all 159, were examined in Ile-Ife. The results showed that the Nigerian school children have a lower percentage of dental caries than the Japanese children (Kubota *et al.* [1, 2]).

2. *Main survey*: The survey lasted from the 30th of October 1981 to the 9th of December 1981.

3. *Subjects examined*: There were 509

Footnote: *The age range of some of the students from the grammar school is estimated to be between 18-26 years.

Table 2. Number of Adults Examined in 1981

Age group	Rural		
	Male	Female	
18-19	3	0	
20-29	22	0	
30-39	15	1	
40-49	3	1	
50-59	1	0	
60-64	1	0	
Total	45	2	47

children from the nurseries and primary and grammar schools in Ile-Ife. This group represents the urban community. Three hundred and eighty-nine children from similar schools were selected from the rural communities—Ashipa and Origbo villages which are situated about 30 kilometers from Ile-Ife. All the schools were selected by random sampling. Forty-seven adults from the Origbo community were also included in the survey.

Ile-Ife is situated to the northeast of the capital, Lagos (Fig. 1). The breakdown of the number of school children* examined is given in Table 1 and the adults in Table 2.

4. *Dental examination*: The dental examination was conducted by intraoral inspection using a dental mouth mirror and a falciform or sickle-shaped explorer (SS White No. 23). The examination was conducted outside in the open field of

the respective school under the natural light in the morning. Two members of the team conducted the dental inspections, having had calibration experience. Whenever there was a diagnostic doubt by one examiner, both examiners consulted together and made a diagnosis agreed by them.

The following criteria were used:

(i) Present teeth: A tooth with any part of it exposed to the mouth is deemed to be present.

(ii) C1 (Caries grade 1): A tooth that has a detectable incipient carious lesion. When there is a detectable stickiness by the examining explorer in the pits and fissures and/or when roughness is felt by the explorer on the smooth surface. Tooth opacity and coloured surface were not judged as a carious lesion.

(iii) C2 (Caries grade 2): A more advanced stage of caries where the explorer can penetrate the pits and fissures to the depth of 2 mm or where there is a detectable soft dentine or area of decalcification on the smooth surface of the tooth.

(iv) C3 (Caries grade 3): A collapsed tooth with more than one-fifth of its crown lost.

(v) C4 (Caries grade 4): When there is a residual root.

The above criteria were based on the dental epidemiological survey in Japan (MHW [3]), with reference to the dental health survey by WHO [4].

5. *Caries activity test*: A random selection of one-half of the examined subjects in both the rural and urban communities was made. Samples of the plaque from the buccal surface of the maxillary post-canine teeth were obtained with a swab stick. The samples were incubated in a cariostant medium for 48 hours at 37°C.

Table 3. Percentage of Caries Experience in School Children

Age group	Urban		Rural	
	Male %	Female %	Male %	Female %
3-5	20.00	22.72	34.48	17.14
6-8	29.31	37.31	27.59	33.33
9-11	33.33	31.37	21.43	34.21
12-14	26.58	30.61	29.79	41.18
15-17	21.21	27.27	33.33	42.22
18-	23.08	33.33	47.37	50.00
Average	26.89	31.43	31.47	34.90

RESULTS

1. *The percentage of caries experience* is shown in Table 3. This reflects the percentage of those with any dmft* or DMFT* according to the region, sex and age grouping. There is a higher percentage among the females with caries experience in all age groups and regions than among the males except in the age group of 9-11 years in the males in the urban group and the age group of 3-5 years in the rural group.

2. *Average number of carious teeth and carious tooth surface per head*

In Table 4, the dmft index of the deciduous teeth (average number of carious teeth per head) is shown according to the region, sex and age group of the children. The index showed the highest value in the 6 to 8-year age group in the urban areas and in the 3 to 5-year age group in the rural areas but the index decreased in value with age.

Table 5 shows the DMFT index of the permanent dentition according to the region, sex and age group of the school children. There was an increase in the index in both sexes, rising towards the peak in the age group of 12-14 years in

Footnote: *dmft: Decayed, missing and filled deciduous teeth. *DMFT: Decayed, missing and filled permanent teeth.

Table 4. Average Number of Carious Teeth of Deciduous Dentition in School Children (per Head)

Age group	Urban		Rural	
	Male dmft	Female dmft	Male dmft	Female dmft
3-5	0.57	0.64	1.17	0.66
6-8	0.67	1.07	0.55	0.73
9-11	0.51	0.22	0.32	0.39
12-14	0.01	0	0.09	0.06
15-17	0	0.02	0	0
18-	0	0	0	0.30

Carious teeth: Decayed and filled teeth (dmft)

Table 5. Average Number of Carious Teeth of Permanent Dentition in School Children (per Head)

Age group	Urban		Rural	
	Male DMFT	Female DMFT	Male DMFT	Female DMFT
3-5	0	0	0.06	0
6-8	0.09	0.28	0.10	0.07
9-11	0.37	0.51	0.25	0.37
12-14	0.68	0.96	0.51	1.12
15-17	0.58	0.77	0.80	1.07
18-	0.46	0.83	0.95	1.60

Carious teeth: Decayed, missing and filled teeth (DMFT)

the urban school children, whereas there was seen a steady rise of the index in the rural school children as the age increases to 18 years or more.

Table 6 and 7 respectively show the dmfs* and DMFS* indices according to the region, sex and age group of the school children. These indices show the same tendency as the Tables 4 and 5 where the highest peak of the dmfs incidence was noticed in the age group of 6-8 years in the urban areas and the age group of 3-5 years in the rural areas, thus Table 6 is similar to Table 4. The

Footnote: *dmfs: Decayed, missing and filled surface of deciduous teeth, *DMFS: Decayed, missing and filled surface of permanent teeth.

Table 6. Average Number of Carious Surface on Deciduous Teeth in School Children (per Head)

Age group	Urban		Rural	
	Male dmfs	Female dmfs	Male dmfs	Female dmfs
3-5	0.70	0.77	1.38	0.66
6-8	0.76	1.48	0.55	0.83
9-11	0.55	0.24	0.43	0.39
12-14	0.01	0	0.11	0.06
15-17	0	0.09	0	0
18-	0	0	0	0.30

Carious surface: Decayed, missing and filled surface of deciduous teeth (dmfs)

Table 7. Average Number of Carious Surface on Permanent Teeth in School Children (per Head)

Age group	Urban		Rural	
	Male DMFS	Female DMFS	Male DMFS	Female DMFS
3-5	0	0	0.07	0
6-8	0.10	0.28	0.10	0.07
9-11	0.39	0.55	0.29	0.37
12-14	0.84	1.06	0.51	1.12
15-17	0.61	0.82	0.80	1.27
18-	0.46	0.83	1.05	2.00

Carious surface: Decayed, missing and filled surface of permanent teeth (DMFS)

highest peak of the DMFS index (Table 7) was in the age group of 12-14 years in the urban areas but the increase of the DMFS index continued until the last age group in the rural areas as well as in Table 5.

In Table 8, the DMFT index of each molar and the other permanent teeth is shown. The index of the molars only is illustrated by the histogram in Fig. 2. Table 8 reveals the more frequent occurrence of the caries in the permanent molars than in the rest of the dentition. In the urban children the DMFT index of the first permanent molars was the highest in the age group of 9-11 years. The index for their second molars was the highest in the age group of 15-17

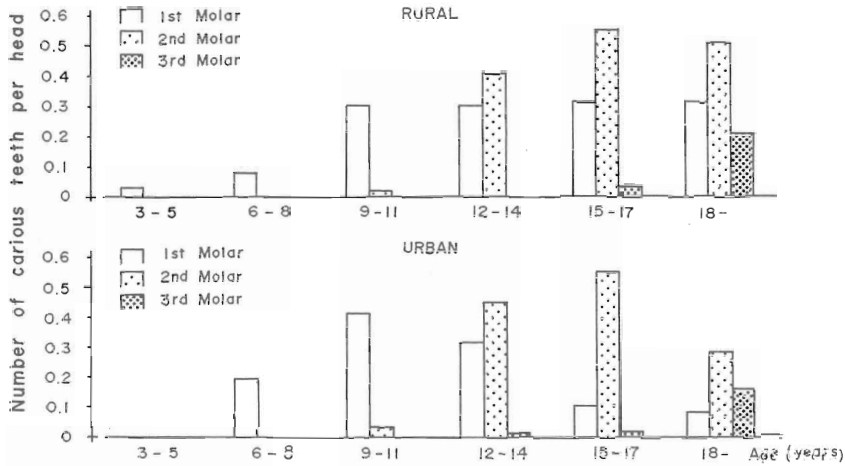


Fig. 2. Average Number of Carious Teeth of Permanent Molars in School Children (Male and Female were mixed together).

Table 8. Average Number of DMF Teeth on Specific Teeth of School Children (Male and Female were mixed together)

Age group	Urban				Rural			
	1st Molar	2nd Molar	3rd Molar	Others	1st Molar	2nd Molar	3rd Molar	Others
	DMFT	DMFT	DMFT	DMFT	DMFT	DMFT	DMFT	DMFT
3-5	0	0	0	0	0.03	0	0	0
6-8	0.19	0	0	0	0.08	0	0	0
9-11	0.41	0.03	0	0	0.30	0.02	0	0
12-14	0.32	0.45	0.01	0.01	0.30	0.41	0	0.06
15-17	0.10	0.55	0.01	0.03	0.31	0.55	0.03	0.03
18-	0.08	0.28	0.16	0.12	0.31	0.52	0.21	0.14

DMFT: Permanent decayed, missing and filled teeth

Table 9. Results of Caries Activity Tests With Cariostat in School Children

Age group	No. of children tested	Reaction (%)								
		Negative (-)		Positive (+)		Positive (++)		Positive (+++)		
		Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	
3-5	20	28	0	0	75.0	78.6	25.0	17.9	0	3.6
6-8	41	37	4.9	10.8	53.7	45.9	41.5	37.8	0	5.4
9-11	30	36	0	16.7	53.3	19.4	46.7	55.6	0	8.3
12-14	49	25	4.1	4.0	51.0	56.0	42.9	32.0	2.0	8.0
15-17	10	19	0	10.5	90.0	47.4	10.0	42.1	0	0
18-	0	3		0		66.7		33.3		0
Total	150	148	2.7	8.8	58.0	48.0	38.7	37.8	0.7	5.4

Table 10. Correlation Between Results of Caries Activity Tests and Number of Carious Teeth (dmf/DMF) in School Children

	No. of children	Urban				No. of children	Rural			
		Reaction					Reaction			
		-	+	++	+++		-	+	++	+++
Subjects tested	150	4	87	58	1	148	13	71	56	8
Percentage (%)		2.7	58.0	38.7	0.7		8.8	48.0	37.8	5.4
Carious teeth (No.)		0	45	58	5		6	34	28	24
Carious teeth/head (No.)		0	0.52	1.00	5.00		0.46	0.47	0.50	3.00
Caries experienced persons (No.)	37	0	16	20	1	43	3	21	14	5
Percentage of caries experienced persons (%)		0	18.4	34.5	100.0		23.0	29.6	25.0	62.5

Table 11. Status of Carious and Missing Teeth in Adults

Percentage of caries experienced persons	40.43%	
Average number of carious teeth	1.21	
(including filled teeth)		
Average number of missing teeth	1.28	
Age	Sex	Number of missing teeth
21	Male	1
23	Male	2
27	Male	1
33	Male	2
35	Male	2
45	Male	32 (full denture)
46	Male	15
52	Male	5

years. However, in the rural children the caries index for the first permanent molars were at the same level as the age group of 9–18 years. The DMFT index for the second permanent molars was the highest in the age group of 15–17 years and did not show a distinct decrease in the higher age group.

3. Caries activity test

The judgement of the caries activity test with a cariostat is shown in Table 9. Although the school children, who had carious teeth, were about 30%, the incidence of the caries activity test judged as positive was 90% or more, the negative cases being few in number. The correlation between the respective judgement of the caries activity test and the number of

dental caries of their present teeth is illustrated in Table 10.

In the urban school children, there was a clear correlation between the judgement of the caries activity test and the percentage of caries experienced persons and the number of carious teeth per head. In the rural school children, however, the correlation was not clear, although the positive three (+++ve) group in the activity test showed a higher percentage of caries experienced persons than did the negative group, and the positive three (+++ve) group had more carious teeth than the negative (-ve) group.

4. Dental health situation of the adults

Table 11 shows the carious and mis-

Table 12. Number of Carious Deciduous Teeth in School Children

Caries grade	Urban				Rural			
	1st deciduous molar	2nd decid. molar	Others	Total (%)	1st decid. molar	2nd decid. molar	Others	Total (%)
C1, C2	62	97	11	170 (93.9)	24	77	22	123 (96.1)
C3, C4	1	4	2	7 (3.9)	2	3	0	5 (3.9)
Missing	0	2	0	2 (1.1)	0	0	0	0
Filled	1	1	0	2 (1.1)	0	0	0	0
Total (%)	64 (25.4)	104 (57.5)	13 (7.2)	181 (100.0)	26 (20.3)	80 (62.5)	22 (17.2)	128 (100.0)

Table 13. Number of Carious Permanent Teeth in School Children

Caries grade	Urban					Rural				
	1st molar	2nd molar	3rd molar	Others	Total (%)	1st molar	2nd molar	3rd molar	Others	Total (%)
C1, C2	100	110	6	5	221 (92.5)	83	97	9	11	200 (96.2)
C3, C4	13	0	0	1	14 (5.9)	3	2	0	1	6 (2.9)
Missing	2	0	0	0	2 (0.8)	1	0	0	0	1 (0.5)
Filled	2	0	0	0	2 (0.8)	1	0	0	0	1 (0.5)
Total (%)	117 (49.0)	110 (46.0)	6 (2.5)	6 (2.5)	239 (100.0)	88 (42.3)	99 (47.6)	9 (4.3)	12 (5.8)	208 (100.0)

sing teeth experience in the 47 adults from the rural area. The number of missing teeth increased sharply at the age of 45 years and over. Unfortunately, it was not known whether these teeth were lost as a consequence of caries or of other causes.

5. Caries incidence, grade of dental caries and dental treatment

The grade of dental caries and the content of the dental treatment are shown according to the regional grouping and dentition in Tables 12 and 13. There was a higher incidence of dental caries of the anterior teeth in the rural subjects than in the urban subjects. How-

ever, there was a much higher incidence of caries of both the deciduous and permanent molars in both groups. In the deciduous molars the second deciduous molars tended to be more susceptible to the caries. These were C1 and C2 in severity. Only two children in the rural group showed caries of the permanent incisors. There were only a few filled or extracted teeth as a result of dental caries. There were two deciduous teeth extracted in the urban children and three permanent teeth extracted in both the urban and rural groups. The number of extracted teeth, as shown in Tables 12 and 13 excluded those lost as a result of

Table 14. Incidence of Proximal Caries of Deciduous and Permanent Teeth in School Children

Community	Deciduous dentition				Permanent dentition				
	1st decid. molar	2nd decid. molar	Others	Total (%)	1st molar	2nd molar	3rd molar	Others	Total (%)
Urban	40/64*	36/104	10/13	86/181 (47.5)	3/117	2/110	0/6	1/6	6/239 (2.5)
Rural	2/26	8/80	11/22	21/128 (16.4)	6/88	2/99	0/9	6/12	14/208 (6.7)

*The number of proximal caries teeth (df or DF)/the number of caries experienced teeth

trauma or periodontal diseases. Table 14 shows the proximal caries experience of both the deciduous and permanent dentition of the two groups. There was a higher incidence of proximal caries in the deciduous dentition than in the permanent. This incidence was higher in the urban children than in their rural counterparts. There were fewer permanent teeth with proximal caries in both groups. Most of the caries were pit and fissure caries on the occlusal surface of the molars.

DISCUSSION

1. Dental caries incidence in the Nigerians

There are a number of available reports on the dental caries incidence in the Nigerians (Tabrah [5], Akpabio [6], Sheiham [7], Henshaw [8], Enwonwu [9], Henshaw and Adenubi [10], Akpata and Jackson [11], Akpata [12]). In these reports, while there are regional variations in the caries experience both in the age of the subjects and in the period of survey, they all showed one thing in common that the caries experience in general is much less among the Nigerians than in the highly industrialised countries. Tabrah [5] surveyed the rural areas and found only one child with caries among the 148 subjects. In a similar survey Sheiham [7] and Enwonwu [9] found over 90% of their respective subjects to be caries-free. However, Sheiham [7], Henshaw [8], Enwonwu [9], Henshaw

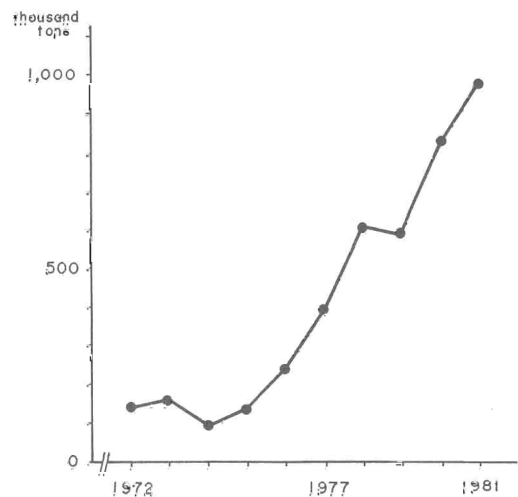


Fig. 3. Annual Change of Sugar Consumption in Federal Republic of Nigeria.

(Sources: Nigerian Sugar Co., Ltd., 1983, and Central Bank of Nigeria, 1983).

and Adenubi [10] also found an increasing trend of dental caries among the urban and wealthy communities. This tendency has been attributed to the greater intake of sweet drinks and food (Henshaw [8], Enwonwu [9], Henshaw and Adenubi [10], Akpata and Jackson [11]).

2. Sugar consumption

Fig. 3 shows the increase in the yearly sugar consumption for the last ten years. In 1980, when the population was quoted at 77,080,000 (HWSA [15]), the average sugar consumption per head was 10 kg per annum. Five years earlier (1975) with a population of 62,930,000 (HWSA [16]) the sugar consumption was

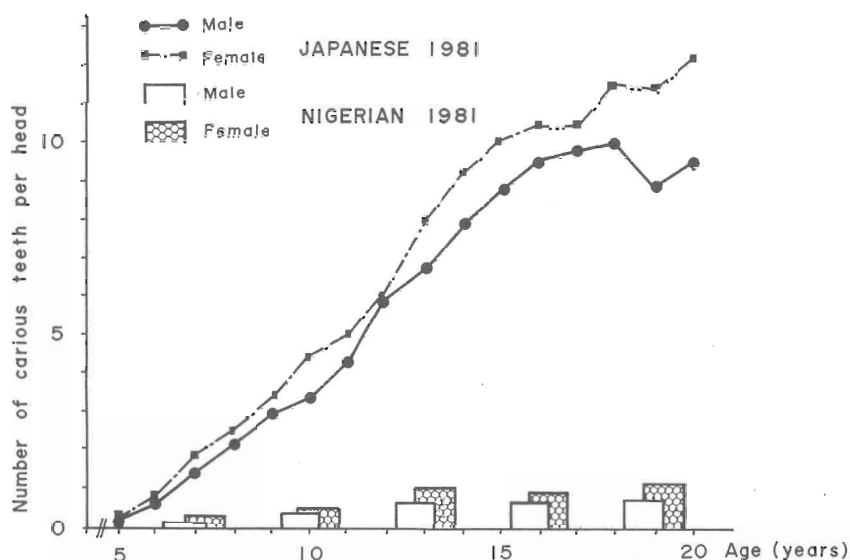


Fig. 4. Comparison of Numerical Change of Carious Teeth per Head in Age Groups between Nigerian and Japanese Children.

2 kg per head per annum. There seems to have been a five-fold increase in the sugar intake per head within the period of 5 years. The rapid economic growth and development in Nigeria, no doubt, has affected the pattern of diet and culture both in the urban area as well as the rural area.

The survey team observed the increase as well as the presence of different types of sweetened refreshing drinks in the local markets in 1981. There was a noticeable absence of these drinks during the first visit of the team in 1980. In view of the hot climate and the infrequent supply of pipe-borne water it will be expected that more sweetened drinks will be consumed by those who can afford it. Once this habit is cultivated it may not be easy to revert, as observed by Henshaw and Adenubi [10]. The prevalence of caries is, therefore, now spreading into every town and village in Nigeria.

In this survey Ife City was presented as an urban community and the surrounding villages as rural. Less incidence of

dental caries in the rural communities was expected. However, there was no significant difference found in the number of the caries experience in both groups. However, the prevalence of dental caries in the children of the age of 12 years and older was shown at a more or less higher level in the rural children than in the urban children (Tables 3, 5 and 7). This phenomenon may be explained by the fact of the easy availability of oral hygiene instruction to the urban children with educated parents. This served to reduce the cariogenic effect of the increase in sugar intake. The home oral hygiene regime is not easily available to the rural school children who also, almost invariably come from uneducated homes and thus could not be instructed by their parents (Hollist and Oyedele [14]).

3. Comparison with caries incidence in Japan

The results of the dental epidemiological survey of the Japanese children conducted by the Japanese Ministry of

Health and Welfare in 1981 [17] and those of the present survey in Ile-Ife (Nigeria) are illustrated in Fig. 4. There was a less gradient in the caries experience of the permanent dentition in the Nigerian children compared with their Japanese counterpart. The lowest score for caries rate in the Japanese children was recorded in 1950, soon after the World War II (Kita [18], Takakuwa [19]). A comparison of the caries incidence per head between the present Nigerian school children and the Japanese children after the end of the War (1950) showed almost the same tendency in the primary school children, that of the Nigerians being a little less than that of the Japanese. However, with the rapid increase in sugar consumption by the Japanese children after 1950 the caries incidence increased. It will, therefore, be very important to investigate whether the same rapid increase in caries experience will be observed in the Nigerian children.

4. Caries experience by age and tooth

The data in Table 8 and Fig. 2 present very interesting aspects. Nearly all the caries occurring in the permanent molars were of the pit and fissure (see Tables 13 and 14). The first permanent molars showed the highest caries incidence in the age range of 9 to 11 years in the urban group and the second permanent molars also had the highest caries incidence in the age range of 15 to 17 years. These high peaks were observed to drop as the subjects got older in age. It is suggested that these molars show the clinical caries in the first 3–4 years after their exposure to the oral cavity and then, owing to the rapid rate of attrition found among the teeth of the Nigerian children, this rapid attrition ground away the slowly forming caries [13]. It is generally recognized that the predomi-

nance of the pit and fissure caries in the permanent molars with little or no caries of the anterior teeth indicates a low caries susceptibility in the individual. There were only two cases of anterior permanent teeth caries in the rural group. This could be due to the comparatively low consumption of the cariogenic food and drinks which might have caused rampant caries.

The deciduous caries index was considerably lower in the Nigerian children than in the Japanese children. The caries pattern distribution in the deciduous dentition was predominantly proximal (see Table 14), a pattern that was not repeated in the permanent dentition. There was a lower incidence of proximal caries in the rural children than in the urban children. This may be due to the consumption of fibrous and coarse food by the rural children. The urban children eat a mixed diet which is soft and sticky and has a higher content of refined carbohydrate.

The number of filled teeth was very low. There were only five filled teeth out of nearly 900 children examined. Out of the five filled teeth one was the Class II type of cavity. There were five teeth extracted as a result of dental caries. The milder types of carious lesion (C1, C2) were found much more than the severer types (C3, C4). It is assumed that since these carious lesions were minute (C1, C2) there was no pain and consequently no great incentive that they had to have the caries treated. Moreover, there was a limited facility for dental restorative treatment in these areas.

5. Caries activity test

Caries activity test is useful in interpreting the approximate caries experience of the individual. Thus, the incubation of the saliva and dental plaque gave the clue to the diagnosis of the oral

environment during the period of the survey.

A comparison between the Nigerian children and the Japanese children revealed that 50% of the Japanese children were judged as either negative (-ve) or a one positive (+ve) (Shimono and Sobue [20]) and 56%–60% of the Nigerian children were classified as either a one negative (-ve) or a one positive (+ve) (see Table 9). At the other end of the scale, 20% of the Japanese children showed more severe degree of three positive (+++ve) compared to 5% of the Nigerian children in the same degree (+++ve). The score showed that the Nigerian children were less susceptible to caries than the Japanese children and that their oral hygiene itself was poor. It is forecasted that with the existing poor oral hygiene status and the trend towards the increasing consumption of cariogenic food and drinks there will be an inevitable rise or explosion in the caries incidence in the immediate future among the Nigerian children.

6. *Dental caries of the adults*

Owing to the small adult sample it was not possible to make a conclusive observation. Eight and one-half percent of the adult sample (4 persons per 47 examinees) had a severe degree of caries classified as C3 or C4. Nevertheless, this figure for the Nigerian adult is considerably lower than that for the Japanese adult.

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