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Dental Caries Experience in 2-15- Year-Olds Living with HIV in Nairobi and Mombasa "Kenya"

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Background: Dental caries affects children both healthy and those living with HIV.

Aims: To determine the dental caries prevalence and association with dental parameters, HIV related oral lesions, oral health practices, immune status and use of ARV's.

Methods: This was a cross sectional descriptive study with a sample size of 237 children aged 2-15 years. A specially structured questionnaire captured demographic data, oral health practices, oral complaints. Plaque scores, gingivitis and dental caries were recorded `in a modified WHO form. Data on ARV use and immune suppression state were obtained from the medical records. Data was analysed using the SPSS software version 17.

Results: 237 children confirmed with HIV aged 2-15 years (mean age=7.5 years) were assessed. The deciduous dentition caries prevalence was 84.4% with a mean dmft of 6.38(± SD5.45). Caries prevalence in the permanent dentition was 78.3% and the mean DMFT score was 3.35 (± SD 3.55).Significant associations were also noted when comparing dental caries with oral hygiene status, gingivitis, presence of HIV oral manifestations, immune suppression state and oral complaints of pain($p<0.05$).

Conclusion: High prevalences of dental caries and dmft/DMFT scores were noted. Reduction in their caries experience is important hence the need for Oral health care to be integrated in their primary care to alleviate their pain, improve their nutritional status and quality of life.

Keywords: *children HIV, caries experience prevalence, dmft, DMFT.*

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I. Introduction

There is minimal literature on the oral health of children with HIV including both dental parameters and oral lesions within the country and our neighbours despite more than 90% of HIV infected children living in Sub Saharan Africa[1,2] . Elsewhere, although there are many studies evaluating oral soft tissue manifestations of HIV/AIDS in children, there are relatively few clinical investigations into the prevalence and incidence of dental caries in the primary and permanent dentitions.[3-5] Some authorities in pediatric HIV/AIDS have indicated that there is no substantial difference between pediatric HIV/AIDS children and the general child population; while others have noted increased caries susceptibility. Among the studies conducted, a wide variation in the prevalence of dental caries has been noted. [6-12]

The high prevalence has been associated with nutritional supplements, Cariogenic medications, xerostomia, presence of painful oral lesions.[6,7]

II. Materials and Methods

The study was conducted in two private homes for children living with HIV (Nyumbani and New life childrens homes) and two referral hospital outpatient comprehensive care centers (Kenyatta National Hospital and Coast Province General hospital) running HIV programmes for children, located in Nairobi and Mombasa respectively. Since this was a descriptive cross sectional study the sample size was determined using the formula: $n = Z^2 XP (1-P)$ with P at 85% as the prevalence of gingivitis in HIV infected children [7]

CI- Confidence Interval 95%; d-absolute precision- 5% [α]; $Z^{1-\infty}$standard error of mean: 1.96

A minimum of 237 children were recruited via convenience sampling technique.

The study was conducted over a period of three months and approved by the joint ethical research committee of KNH and University of Nairobi.

The subjects were categorized into three baseline age groups: 2-5 year olds, 6-11 year olds, and 12-15 year olds based on the dentition primary, mixed and permanent dentition stages respectively.

Plaque scores (WHO Plaque index 1999), Gingival scores (Loe and Sillness 1963), Dental caries status (Klein, Palmer and Knutson 1938) and specific HIV related oral manifestations were recorded in a modified WHO Form[13]

A specially structured questionnaire was used to assess the oral health practices of each child, complaints of oral pain and challenges in feeding and maintaining oral hygiene. Data on ARV'S and the immune suppression state based on the CD4counts/% were obtained from the records. Data was analysed using S.P.S.S version 17.0

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III. Results

Among the 237children, Six (2.5%) were from NewLife childrens home, 77(32.5%) Nyumbani childrens home, 39(16.5%) from the Comprehensive Care Centre at KNH while 115(48.5%) were from the C.C.C at the CPGH. Children from the homes comprised a total of 83(35%) while those from the outpatient centres completed the remaining study population (154, 65%) as depicted (Fig1).

Among the population examined 112 (47.3%) were males and 115(52.7%) females.

The mean and modal ages were 7.5 and 9 years respectively and age cohorts as shown (Table 1).

The mean dmft was 6.38± SD 5.45, 84.4% had caries while only 15.6% were caries free, 2% had fillings and 7.5% of the children had teeth missing due to caries. The mean DMFT was 3.35 ± SD3.55, 78.3% had decayed teeth, 3.9% missing teeth and only 6.2% had fillings (Table 2).

The mean dmft /DMFT of children from the homes (4.77± SD 4.10/ 2.95±SD3.51) was significantly lower than that of the C.C.C outpatient centres (7.39±SD 6.04/ 3.67±SD3.57): Tables 3 and 4.

Males had a dmft of 6.49±SD 5.84 and DMFT of 3.03± SD 3.13 while females had a dmft of 6.55±SD 5.39 and DMFT of 3.65±SD3.89.The gender differences were not statistically significant: Tables 3 and 4.

The mean dmft of children in the 2-5 yrs , 6-11 yrs and 12-15 year age groups were 7.12 ±SD 6.79, 6.57±SD 4.88 and 3.4±1.844 respectively, though not statistically significant.(Table 3).

Differences in the mean DMFT scores in the 6-11 year (2.41±SD2.944) and 12-15 year (4.98±SD3.964) age groups were found to be statistically significant (Table 4).

Children who reported not brushing (32) had mean dmft of 6.66± 6.225,while those who brushed once (90) had a mean dmft score of 7.84±SD 5.98 and those who brushed twice regularly (77) had the lowest mean dmft of 4.92±SD 4.4. (Table 5 and 6).

Children who complained of pain in the mouth had higher dmft and DMFT's (7.90±6.08 and 4.29±4.21) than those who did not (dmft 5.53±5.04 and DMFT 2.97±3.00) Tables 5 and 6.

Higher dmft and DMFT scores (dmft 8.05±SD 6.03, DMFT 4.3±SD4.26) were recorded in children who reported difficulty in maintaining oral hygiene as opposed to those who did not (dmft 5.45± SD5.04, DMFT 2.82±SD2.97); Tables 5 and 6.

A statistically significant difference was also noted in the caries status of children who reported of difficulty in feeding due to pain in the oral soft tissues and the teeth and those who did not. Children who did not complain of feeding difficulties had dmft scores of 5.47± SD5.041and DMFT of 2.94±SD3.099 whereas children who reported feeding difficulty had dmft scores of 8.05± SD6.048 and DMFT 4.13± SD4.182. , Tables 5 and 6.

Chidren who were on ARV therapy (n=109, N=75) had a mean dmft of 7.03± 5.742 and DMFT 3.41± 3.271.Children who were not on ARV's (n=90, N=54) had a dmft of 5.91± 5.4 and DMFT of 3.28± 3.931 respectively. However, statistical tests were not significant as shown below:

DMFT: Mann U, (Z-0.483); p>0.05 (0.629).
dmft: Mann U(Z-1.385);p>0.05(0.166)

Children with no evidence of immune suppression (n=75, N=50) had a dmft of 5.39±SD4.426 and DMFT of 2.22±SD2.179 while the group with moderate immunosuppression (n=55, N=41) had a dmft of 4.84± SD4.574 and DMFT 4.76± SD4.939. Amongst the severely immunosuppressed (n=56, N=30), the mean dmft was 10.04± SD6.734 and mean DMFT was 3.4± SD2.737 respectively. Statistical tests were highly significant as shown:

DMFT: Kruskal-Wallis, X^2=8.505; 2df; p<0.05(0.014)
dmft: Kruskal-Wallis, X^2=22.213; 2df;p<0.05(0.000)

Children with good oral hygiene scores had a lower mean dmft of 4.29±SD 5.22, and highest dmft scores of 9.43± SD 7.32 were seen in patients with poor oral hygiene. (Table 7).

Children with good OH scores had a mean DMFT of 3.38± SD 3.18, those with fair OH scores had a mean DMFT of 3.07± SD 3.29 while those with poor OH scores presented with the highest scores of 4.35± SD4.55.However no significant differences were noted, Kruskal-Wallis test {X^2=0.593;2df;p=0.101}.

Children who were free of gingivitis had mean dmft of 2.46±SD 3.75 and a mean DMFT of 3.42±SD4.36 and those with mild gingivitis presented with a mean dmft of 6.37±SD 4.67 and mean DMFT of 3.36±SD 3.55, while those who had moderate gingivitis presented with a mean dmft of 8.09±SD 6.41 and mean DMFT of 3.33±SD 3.42 respectively.

Kruskal-Wallis test was statistically significant {X^2=24.065; 2df; p<0.05(0.000)} :Table 7, however, it was not statistically significant in comparison for the mean DMFT scores {X^2=0.784;2df;p>0.05(0.676) } .

The mean DMFT of children who did not present with any HIV related oral manifestation (82) was 3.1±SD3.343, while those with one manifestation (38) had a mean DMFT of 4.08±SD4.207, and those with two or more oral lesions (10) had a mean DMFT of 2.7±SD1.889, however these differences were not statistically significant, Kruskal-Wallis {X^2 =2.900; 2df; p>0.05(0.235)}.

The mean dmft in children who did not present with any HIV related oral manifestations (104) was 5.16± SD4.616 and those who showed presence of one manifestation (81) had mean dmft score of 7.33±SD5.922, while those with more than one

manifestation (14) had dmft scores of 11.31± SD6.408. Kruskal- Wallis was significant {X^2 =16.539, 2df; p<0.05(0.000)}.

IV. Discussion

The overall caries experience in both the deciduous and permanent dentitions was high. The mean dmft was 6.38±SD 5.45 and 84.4% of the children while only 2% had fillings indicating most of the caries were untreated. The mean DMFT was 3.35 ± SD 3.55 and 78.3% of the children had caries while only 6.2% had fillings.

Our study reports dmft and DMFT which are 3.5 and 12.4 times respectively higher than those reported for healthy Kenyan children[14].

The caries prevalence is higher than other studies which report prevalences of 60% and 63.8% respectively. [6,7].

The trend toward increased caries susceptibility in HIV infected children noted may be due to several different factors.

Many of the children experience failure to thrive hence more frequent feedings with carbohydrate and sucrose-rich foods may be necessary to maintain body weight.[3-8] It has been shown that increased frequency of carbohydrate intake in HIV infection is associated with increased caries prevalence and cariogenic microbes. In addition to the increased frequency of carbohydrates, many of the medications essential for antiretroviral therapy and prophylaxis against opportunistic infections contain relatively high sweetener levels or are sucrose based for compliance purposes.[3-11] The fact that these medications need to be taken on a frequent basis increases the child's exposure to cariogenic substances[15].

Lack of effective oral hygiene practices and their late commencement, inadequate oral health education, lack of an adequate referral system resulting in poor dental care for these children may also be factors to consider. Ignorance and fear of the sero-status also prevents these children from seeking dental attention in addition to the high cost of dental treatment which inevitably causes the parents/guardians to prioritize other health needs[6,7].

The adolescent group also had high mean DMFT of 4.92±3.95 (p=0.000), a finding close to what Meless et al. reported (294/407) fifteen-year-olds had a DMFT 4.1± 3.0 [16].This may be attributed to the duration of time the permanent teeth were in the oral cavity. During this period the teeth the erupted permanent teeth are exposed to a cariogenic diet, plaque, gingivitis, and microorganisms or cumulative neglected decay.

In the present study, no record was made of the dietary habits of the children and consumption of snacks.

Significant differences were noted in the mean dmft and DMFT scores among children from the homes(p=0.006) and the C.C.C's (p=0.033). This could be attributed to better and supervised oral hygiene practices incorporated in their care .

The mean dmft scores were also lower in children with good and fair oral hygiene (p=0.03) and mild gingivitis (p=0.008); these findings are in agreement with other studies[10-11].

Among the oral health practices, increased frequency of brushing was significantly associated with lower dmft scores (p=0.007) showing that improved oral hygiene could help slow the decay processes, a finding in agreement with other studies [10-11].

Children with positive complaints of pain and difficulty eating presented with higher dmft scores (7.90± SD 6.08) and DMFT scores (4.29± 4.21) as opposed to those with no such complaints (dmft: 5.38± 5.04, DMFT 2.97± 3.00) once again reflecting on the vicious cycle of oral disease- painful oral lesions- pain – dental disease [18] . Painful gums and pain from oral lesions create a vicious circle where a child who does not brush their teeth because they are in pain, results in plaque accumulation, followed by increased severity of gingivitis and then caries experience resulting in more pain[11,21, 22]. During these periods there is deteriorating health along with the influence of increased use of medications most of which are likely to be sucrose based to combat various opportunistic infections [22, 23].

The mean dmft and DMFT did not vary significantly among children who were on ARV's and those who were not on therapy. These findings are in agreement with other studies which have not associated ARV's with increased caries prevalence. However, it is known that frequent use of medications most of which are sucrose based for compliance purposes may be responsible for the high caries prevalence [15].

Further research may be required to establish any association between duration of ARV therapy, the type of medication, its sucrose content and the caries experience.

Both dmft and DMFT scores were notably higher in children with evidence of moderate and severe immunosuppression (p=0.000, 0.014), a finding in agreement with various studies in the literature to assess the relation between caries and CD4 status [11, 19].

The mean dmft scores were lower in children with good and fair oral hygiene (p=0.03) and mild gingivitis (p=0.008), a finding in line with, Hicks et al[11], Riberio et al[12] and Chen et al[20].

High dmft scores were noted among children with HIV related oral manifestations (p=0.000). Reports have cited it as the next common manifestations following candidiasis and concluded an increase in caries prevalence among the pediatric HIV population[2,3,4].

Chen et al reported fungal infections were associated with an increased caries rate.[20]

The high prevalence of dental caries observed in the children in this study may be associated with increased levels of streptococcus mutans in the saliva of children living with HIV[21].

Children suffering from HIV infections have been reported to have xerostomia. Combined with pain, on chewing food salivary flow would be reduced hence the cleansing lubricating effect from the saliva reduces resulting in dryness of the oral cavity leading to increased severity of gingivitis and decay.[21].

Low et al[22] studied the effect of severe caries on the quality of life in children .Tooth-associated pain, difficulty with nutrition, hampered growth as noted by body height and weight, and sleep patterns are adversely altered by severe dental caries in children. HIV infected children do have growth retardation and failure to thrive. This may be further complicated by the presence of severe dental caries.

V. Conclusion

This study had a high prevalence of dental caries in both primary and permanent dentition with high mean dmft /DMFT scores. The oral health of HIV-infected children and a reduction in the caries experience are quite important. In pediatric HIV patients, many factors play a role in caries development and attention should be directed toward establishment of a caries prevention regimen.

It is advisable for oral health care to be integrated in the primary care for these children in order to alleviate their pain and improve their nutritional status and quality of life.

Challenges and limitations of the study

This study was institution based and conducted over a short period. Hence, the results may not be a representative of the caries experience and prevalence of children living with HIV in Kenya as a whole.

Without the aid of radiographs, only 35% of the decay may have been reported.

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This study had Ethical clearance of the Kenyatta National Hospital Ethical Research Committee(Ref no: KNH –ERC/01/2407).

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Table 1: Gender and age distribution of the study population (n=237)

Age Group	Male		Female		TOTAL	
	N	%	N	%	N	%
2-5	36	32	40	32	76	32
6-10	55	49	58	46	113	48
11-15	21	19	27	22	48	20
TOTAL	112	100	125	100	237	100

Table 2: Dental caries experience in the study population

Descriptive	Mean	SD	%
Decayed deciduous	6.38	5.45	84.4%
Missing deciduos	0.15	0.59	7.5%
Filled deciduous	0.05	0.289	2%
Dmft (n=199)	6.38	5.45	
Decayed perm	3.19	3.44	78.3%
Missing perm	0.05	0.29	3.9%
Filled perm	0.16	0.69	6.2%
DMFT (n=130)	3.35	3.55	

Table 3: Caries experience dmft scores in the study population, n=199

Variable	N	dmft	± SD	Statistical test
Study Center				
• Children homes	66	4.77	4.10	Mann U(Z- .761);p=0.006
• Outpatient centre	133	7.39	6.04	
Age				
• 2-5yrs	76	7.12	6.79	Kruskal-Wallis Chi-square
• 6-11yrs	107	6.57	4.88	4.502;2df;p=0.105
• 12-15yrs	15	3.40	1.84	
Gender				
• Male	99	6.49	5.84	
• Female	100	6.55	5.39	Mann U(Z-.394);p=0.693

dmft d-decayed m-missing f-filled in deciduous dentition; ±- plus or minus, SD- standard deviation

Table 4: Caries experience DMFT scores in the study population, n=130

Variable	N	DMFT ± SD	Statistical test
Study Center			
• Children homes	57	2.95 3.51	Mann U (Z-2.132) P=0.033
• Outpatient Centres	73	3.67 3.57	
AGE			
• 6-11YRS	82	2.42 2.96	Kruskal-Wallis Chi-square
• 12-15YRS	48	4.92 3.95	16.89;2df; = 0.000 (P≤0.01)
Gender			
• Male	62	3.03 3.13	Mann U Z-.82 p=0.412 (p≤ 0.05)
• Female	68	3.64 .89	

D- Decayed permanent teeth, M- Missing permanent teeth. F- Filled in permanent dentition, T- Teeth permanent, ±- plus or minus, SD- standard deviation

Table 5: Association between dmft scores and oral complaints, n=199

Variable	N	dmft ± SD	Statistical test
Pain in the Mouth			
• Yes	85	7.9 6.08	Mann U(Z-2.781);p=0.005
• No	114	5.53 5.04	
Challenges in Oral Hygiene			
• Yes	82	8.05 6.03	Mann U(Z- 3.094);p=0.002
• No	117	5.45 5.04	
Difficulties in Feeding			
• Yes	79	8.05 6.05	Mann U(Z-3.060);p=0.002
• No	120	5.47 5.04	

Table 6: Association between DMFT scores and oral complaints, n=130

Variable	N	DMFT ± SD	Statistical test
Pain in the Mouth			
• Yes	48	4.3 4.2	Mann U(Z-2.649);p=0.008
• No	81	2.8 3.0	
Challenges in Oral Hygiene			
• Yes	47	4.30 4.26	
• No	83	2.82 2.97	Mann U(Z-2.490);p=0.013
Difficulties in Feeding			
• Yes	44	4.13 4.2	Mann U(Z-2.092);p=0.036
• No	86	2.94 3.1	

Table 7: Association of dmft scores with oral hygiene and gingivitis

Variable	N	dmft	± SD	Statistical Test
Oral Hygiene				
• Good	24	4.29	5.22	Kruskal-Wallis Chi-square
• Fair	131	5.95	4.60	11.382;2df;P=0.03
• Poor	44	9.43	7.32	
Gingivitis				
• No	30	2.46	3.75	Kruskal-Wallis Chi-square
• Mild	99	6.37	4.67	24.065;2df;P=0.000
• Moderate	77	8.09	6.41	

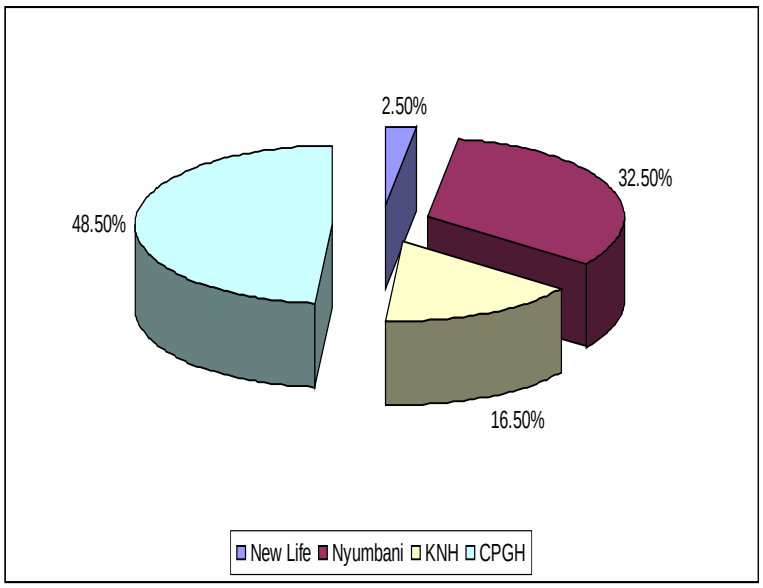

Figure 1: Percent distribution of the children by home and center, n=237