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Subscription Address:
JKDA P.O. Box 20059-00200, Nairobi. Email: journal@kda.cr.ke. Website: www.kda.or.ke

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<td>Kshs 300/=</td>
<td>Kshs 600/=</td>
<td>Kshs 1200/=</td>
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</table>

Other regions US$ 10 per Issue(Excluding shipping)
A cheque or postal order for amount payable to JKDA

Published by:
Kenya Dental Association, Professional Center 1st Floor, Parliament Road, Nairobi,
Kenya
Championing oral health rights in Kenya

Section 43(i) (a) of the New Constitution of Kenya which was promulgated on 27th August, 2010 states: "Every person has a right to the highest attainable standard of health which includes the right to health care services, including reproductive health care". This means that every individual in Kenya has a right to the highest attainable standard of oral health care. What this also means to all health care providers and stakeholders, is that we must go out of our way to participate in those activities which are geared towards ensuring that the people are provided with the best oral health services. It is also for this reason that we must have a vibrant oral health policy which is implemented to the letter and reviewed from time to time, taking into account the current trends in the delivery of oral health care in the global arena. For the aforementioned scenario to evolve and to be seen to be acted upon, it is incumbent upon every oral health care provider in Kenya, to champion the oral health rights of the citizens. Unfortunately, in most dental schools and ours is no exception, dental graduates are not taught how to lobby and negotiate for the improvement of oral health care of their citizenry. The import of this is that the majority of oral health care providers do not have the requisite skills and competencies for lobbying and negotiating. We can only seek recourse in reading the relevant books as well as attending the appropriate courses.

It is with this background information in mind that I encourage all oral health care providers and stakeholders to be seen to be active participants in championing the implementation of our New Constitution to the letter, so that the society can enjoy the highest attainable standard of oral health. Failure to do so will create a scenario where the underprivileged of our society continue to suffer from the ravages of oral diseases. For example, in the current issue of the Journal of the Kenya Dental Association, it is reported that the caries prevalence amongst children with cerebral palsy was high with a mean dmft of 5.49 in deciduous dentition! These children and others such as those who are mentally handicapped, have a right to access quality oral health care like any other Kenyan children. In this same Journal, it is reported that 61% of children in Nairobi West brush their teeth two or more times per day. This means that 39% of our children in urban centres might not be brushing their teeth regularly as expected, with consequent negative effects of poor oral hygiene and higher prevalence of periodontal diseases. Clearly, efforts must be made by all oral health personnel through the promotion and prevention of oral diseases activities such as the dental oral health action month, so as to improve the percentage of children and adults in Kenya who brush their teeth for a minimum of two times a day, as is the practice in most countries which have good oral health.

When Kenya attained independence in 1963, our government undertook to eradicate disease. Obviously oral diseases are not exempted. This can only happen if all oral health care providers and stakeholders make some positive efforts in promoting accessible and affordable oral health care. An example of such an affordable care is the use of Atraumatic Restorative Treatment (ART). Unfortunately, as reported in this journal, a total of 72.9% Of the dentists in Kenya have never placed any art restorations. This is despite the proven advantages of art as a method of caries management that is more comfortable and cheaper for the patient. Therefore, there is need for the Kenyan dental association and the ministry of medical services, to step up their efforts for promoting this method of managing dental caries, a disease which is fairly rampant in Kenya and is one of the major causes of tooth loss. In summary, it is one thing to talk of "responsible corporate citizenship and strong social responsibility," and another, to be seen to be doing it in practice for the sake of improving the oral health care of all Kenyans. Unless and until we make sure that all citizens participate in the implementation of the new constitution, some of the aspirations of our people such as the attainment of the highest standard oral health care and achieving vision 2030, will be a mere mirage.

Prof. J.T Kaimenyi 
Consultant Periodontologist

References

Deciduous canine tooth bud extraction and nutritional status of Maasai children under five years old in Kenya
Kipchumba-Kibet P1, Wanzala P2, Maranga P3, Mpoke S2, and Wasike R1.

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2 Kenya Medical Research Institute
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Abstract

Background: Deciduous Canine Tooth Bud Extraction (DCBE) is a harmful practice prevalent among pastoral communities in Kenya. The communities believe the canine tooth bud causes diarrhea, fevers and growth retardation in children. The practice is carried out mainly by TBAs, who forcefully enucleate the teeth buds using unsterile knives, bicycle wires, razor blades or bare hands. This predisposes the babies to serious complications such as profuse bleeding, HIV infections, swelling and sepsis of the gum wounds that may lead to death. Malnutrition is common among children in the pastoralist communities due to their nomadic way of life. Women and children who depend mainly on livestock for milk, meat and blood as their staple food, are left without food when the livestock move to other areas in search of pasture. The situation result in poor infant feeding practices, predisposing the child to common illnesses such as diarrhea and febrile illnesses. As a remedy, DCBE is performed as a health seeking behavior.

Some aspects of Maasai traditional way of life, cultural practices and beliefs have been changing. However, the enucleation of deciduous canine buds seems to be increasing and this may have influenced oral health and nutritional status especially of children under five years.

Objective: To determine the relationship between prevalence of Deciduous Canine Tooth Bud Extraction (DCBE) and nutritional status of the children under five years in Kajiado district.

Design: A descriptive cross-sectional study.

Setting: Ngong and Magadi Divisions of Kajiado district, Rift Valley Province, Kenya between April and October 2009.

Subjects: A total of 420 Maasai mothers and their children under five years living in manyattas (homesteads) were randomly selected from five (5) sub locations namely Eremit and Oltepesi in Ngong division and Magadi and Oloika and Oldorko in Magadi division. Study also included an average of 8 women, men and children from each sub-location for Focus group discussion, and a total of 8 key informants for in depth interview.

Sampling: Multistage and simple random samplings were used to select manyattas, and mothers with their children respectively. Mothers and key informants were interviewed using structured interview schedule guide.

Child nutritional status was assessed using standard anthropometrics techniques, and the data were entered in a designed nutritional assessment form. Oral examination to determine DCBE was carried out, and data recorded in specially designed oral examination form.

Data analysis: After coding, cleaning and validating data from structured interview questionnaire, it was entered in a computer and analyzed using Statistical Package for Social Science (SPSS) version 14 software. Nutritional data was then transferred from Nutri-Survey, 2007 (ENA, SMART) to SPSS for further analysis. Data from Focus Group Discussions and Key informants was analyzed thematically. Excel program was used to generate figures.

Descriptive statistics were use to analyze continuous and categorical variables and inferential statistics to determine associations between key variables. Chi square tests were used to establish relationships between variables.

Results: The prevalence of DCBE was found to be 24.5%. By division, Ngong had high prevalence (27.8%) compared to Magadi (21.3%). The degree of chronic undernutrition was 15.0% (moderate stunting) and 19.5% (severe stunting). Nutritional status based on Weight- for- Age, showed that moderate underweight was 21.0% while severe underweight was 9.5%. The prevalence of acute undernutrition; the Global Acute Malnutrition (GAM) was 20.7%. Moderate Acute Malnutrition (MAM) was 13.5% and Severe Acute Malnutrition (SAM) was 7.4%.

Conclusion: There was no significant relationship (p>0.05) between the practice of DCBE and nutritional status. However, there was a trend of undernutrition being higher among the DCBE than the non-DCBE. There were also indications that Maasai children are targets for DCBE due to their nutritional status, on the other hand, the complications due to DCBE affects the child nutritional status.
Introduction

Many pastoralists living in the Arid and Semi Arid Areas (ASAL) in the Eastern African region and other isolated parts of Africa are known to practise gouging and mutilation of deciduous canine tooth bud in children with the hope to treat childhood illnesses. Traditional Maasai communities in Kenya remove developing canine in infants in addition to the extraction of mandibular central incisors. It is believed that the practice made its way to Masailand from Sudan, to Tanzania and Uganda. Interviews with some local community members reveal that the DCBE practice was first used to treat sick livestock with diarrhoea related conditions later, the community adopted the practise in the treatment of infants. Apart from other cultural practices such as Female Genital Mutilation (FGM), DCBE is one of the entrenched traditional practices among the Maasai communities in Kenya. The practice also observed among the Teso community in Kenya was dying out. However, studies have shown that the rural Maasai still adhere to this custom, but the practice is less common in children of mixed parents.

In ancient times, extraction of carious teeth was always recommended since this was considered the simplest way to relieve pain. Studies have revealed that Maasai Traditional Birth attendants (TBAs) remove deciduous canine tooth bud due to a belief that it causes infantile illness, diarrhoea and vomiting. Socio-cultural practices in some communities such as the Maasai strongly influence the health status of the children. Several visits to the Maasai Manyattas (Homesteads) by health teams observed prevalent cases of poor health as a result of malnutrition, malaria, pneumonia, poor sanitation, lack of water, HIV/AIDS, Tuberculosis and Upper Respiratory Infections (URTI) among others.

As pastoralists, and due to scarce rainfall received in their region, the Maasai morans move with their cattle to other areas away from their home in search of pasture and water, leaving behind other members of their families, particularly women and children without adequate food. This compromises the health status of the community members, especially that of women and children. Poor infant feeding and weaning practices, food shortages and diet imbalances can lead to such conditions as stunted growth, delayed motor and mental development, immune incompetence, frequent attacks of diarrhoea among others. In addition, macro and micronutrient deficiencies affect full human potential. Good nutrition is essential or promotion of growth and health of the children under five years old. Malnourishment is undisputedly related to greater susceptibility to poor physical growth, high rate of disability and illnesses such as diarrhoea, which are the reasons given for the practice of DCBE, leading to disability and death in children.

The removal of deciduous canine tooth buds and even the permanent teeth from children is done using crude unsterile instruments posing serious dangers to the health of affected children. Complications such as profuse bleeding, inflammation and sepsis due to low immunity of infants could occur; opportunistic infections could also be introduced into the body. In addition, DCBE extraction could lead to the damage of the very delicate permanent teeth growing underneath. This mutilation may also lead to subsequent negative effects like malocclusion and psychological or social embarrassment due to poor aesthetics from remaining maloccluded teeth. Deciduous Canine tooth Bud Extraction (DCBE) should therefore be discouraged to spare children from such unnecessary pain. Certainly, complications resulting from DCBE practice are no doubt harmful to the health and well being of the children and concerted efforts are needed to stop the practice. The Ministry of Health’s strategic plan 1999-2004 aimed at reducing malnutrition among under-five year olds by 30%, to reduce the proportion of under five morbidity and mortality rates attributable to key childhood diseases and malnutrition from 70% to 40%. However, as a strategy to achieve these targets, malnutrition and traditional practices such as DCBE have to be prevented. The aim of this study therefore was to establish the relationship between DCBE and nutritional status in children aged 2-5 years old with a goal to provide data that may be useful in development of oral and nutritional policies and intervention strategies.

Materials and Methods

A descriptive cross sectional study was carried out among the under five year old Maasai children in Ngong and Kajiado divisions of Kajiado district, Rift Valley province, between April and October, 2009. The respondents were defined as all the Maasai children aged 2-5 years and their mothers randomly sampled from 2 and 3 sub-locations of Ngong and Magadi respectively. Selection of children aged between 2-5 years will show the evidence of DCBE in their erupted deciduous teeth than those with non erupted teeth.
Majority of the people who lived in selected areas are the Maasai who speak the Maa language. The Maasai are semi-nomadic people. Majority of the population obtains their livelihood through husbandry of cattle, goat and sheep. As a result of global warming, droughts are becoming severe, forcing the Maasai people to seek alternatives livelihoods. Herds are reducing everyday and most people are now relying on relief food. Food relief programs have been initiated in the two divisions under study.

Multistage cluster sampling was used in this study. To select the respondents, this method was appropriate because the community was large. The method of dividing the population into progressively smaller units can be used to create as many “stages” as desired. In this study, there were five stages. The five stages (stage 1-5) were followed, in selection of divisions, locations, sub-locations, and selection of subjects in the homesteads respectively. In the homesteads, manyattas, systematic sampling was used to select the households. About 30 households were studied per cluster. All mothers with their children less than five years were identified on the doorstep. Subjects for study were selected using simple random sampling. If a mother had more than one child less than 2-5 years of her children was randomly selected and included in the study. A total number of 420 children and their mothers were included in the study, 210 from each division. Equal number of respondents was selected from each sub-location. Ten manyattas with mothers having children less than five years were selected using simple random sampling. From each manyatta, one mother was selected randomly for Focus Group Discussions, a total number of 10 women participated in FGD. In each sub-location, one FGD session was conducted and children who are able to talk were included for FGD. The same number and procedure used for selection of mothers was used to select the men and children. One FGD session for children was held in each sub-location selected.

Hosmer provided a guide on the adequacy of sample size. The sample size of 323 was then determined. In order to increase representation, 420 subjects were studied.

Since the sampled population were mainly the Maasai, all the tools for data collection were translated into Maa language. With the assistance of a translator, one study team member introduced the study to the mothers with their children under five years willing to join the study. The mother was requested to consent only after explanation. The mother signed a written consent but were made to understand that, joining the study and signing the consent was voluntary. Structured questionnaires were administered to them. A moderator and two note takers were involved in FGD. In-depth interviews were conducted with selected male and female (two) informants from each sub location using structured interview guide. Anthropometrics measurements, for stature Age (HFA), underweight, Weight for Age (WFA) and wasting- Weight for Height (WFH) and Oral health examination were taken using WHO guidelines.

Data was cleaned, coded and analyzed using Statistical Package for Social Science (SPSS) version 14. Data was presented in form of tables, charts and graphics. The entered data was stored in flash disks and compact disks (CD). Nutritional data was then transferred from Nutri-Survey, 2007 (ENA, SMART) to SPSS for further analysis. Qualitative data from FGD and Key informants was transcribed, translated and analyzed thematically.

**Results**

**Sample profile**

Table 1 below summarizes demographic characteristics of the children included in the study by sex. The children were drawn from Oltepesi and Eremit sublocations of Ngong division, Oldorok and Oloika sub-

<table>
<thead>
<tr>
<th>Division</th>
<th>Sub-location</th>
<th>Male No</th>
<th>Male %</th>
<th>Female No</th>
<th>Female %</th>
<th>Total No</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magadi</td>
<td>Oldorok 38</td>
<td>55.1</td>
<td>31</td>
<td>44.9</td>
<td>69</td>
<td>16.4</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>Oloika</td>
<td>37</td>
<td>50.7</td>
<td>36</td>
<td>49.3</td>
<td>73</td>
<td>17.4</td>
</tr>
<tr>
<td></td>
<td>Magadi</td>
<td>34</td>
<td>49.3</td>
<td>35</td>
<td>50.7</td>
<td>69</td>
<td>16.4</td>
</tr>
<tr>
<td>Ngong</td>
<td>Eremit</td>
<td>59</td>
<td>55.7</td>
<td>47</td>
<td>44.3</td>
<td>106</td>
<td>25.2</td>
</tr>
<tr>
<td></td>
<td>Oltepesi 52</td>
<td>50.5</td>
<td>51</td>
<td>49.5</td>
<td>103</td>
<td>24.5</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>200</td>
<td>52.4</td>
<td>220</td>
<td>47.6</td>
<td>420</td>
<td>100.0</td>
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</tbody>
</table>
locations of Magadi division. A total of 420 children were recruited into the study and questionnaires administered to their care takers (mothers 388 and fathers 7 and 25 grandmothers). In total 50.2% children were sampled from Magadi (211) while 49.8% (209) from Ngong.

Figure 1 show the age of the index child. The children identified in this study were between 2-5 years. The mean and median age was 3.25 and 3 years respectively.

Care of the children
The care of the children in the study area is the mother. The Majority of the subjects interviewed were mothers (92.4%), the fathers accounted for 1.7% whilst the rest (6.0%) were relatives such as brothers, sisters, aunties and grandmother.

Figure 1: Age group of index children in months

![Figure 1: Age group of index children in months](image1)

Figure 2: Distribution of respondents

![Figure 2: Distribution of respondents](image2)

Figure 3: Educational level of the respondents

![Figure 3: Educational level of the respondents](image3)

Table 2: Area of examination in comparison with the Practice of DCBE

<table>
<thead>
<tr>
<th>Area of study by division</th>
<th>Practice of DCBE</th>
<th>χ²</th>
<th>P- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magadi</td>
<td>No</td>
<td>21.3</td>
<td>2.341</td>
</tr>
<tr>
<td>Ngong</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>58</td>
<td>27.8</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>24.5</td>
<td></td>
</tr>
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Table 3: Practice of DCBE by Sub-locations

<table>
<thead>
<tr>
<th>Sub-locations</th>
<th>DCBE done</th>
<th>( \chi^2 )</th>
<th>P-value</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Yes</td>
<td>No</td>
<td>%</td>
</tr>
<tr>
<td>Oltepesi</td>
<td>43</td>
<td>60</td>
<td>41.7</td>
</tr>
<tr>
<td>Oloika</td>
<td>21</td>
<td>52</td>
<td>28.8</td>
</tr>
<tr>
<td>Magadi</td>
<td>8</td>
<td>61</td>
<td>11.6</td>
</tr>
<tr>
<td>Eremit</td>
<td>15</td>
<td>91</td>
<td>14.2</td>
</tr>
<tr>
<td>Oldorok</td>
<td>16</td>
<td>53</td>
<td>23.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>103</td>
<td>317</td>
<td>24.5</td>
</tr>
</tbody>
</table>

Educational level of the respondents
Figure 3 shows the respondents' educational level.
Majority of the respondents (89.3%) had no formal education; while 8.3% had attended primary school, 1.7% secondary school and a few (0.7%).

Prevalence of DCBE in the Area of Examination
The study found out that out of 420 children who underwent oral examination, 103 (24.5%) had undergone DCBE. By division, 27.8% had undergone the practice of DCBE in Ngong compared to 21.3% in Magadi who had undergone DCBE. However, there was no statistical difference (\( P=0.126 \)) in prevalence of DCBE by divisions (see table 2).

One of the Key Informant had this to say on the prevalence, "...there are many children in our community who have had removal of canine tooth bud, however many of them hide, they will not tell you..."

Prevalence of DCBE by Sub-locations
Prevalence of DCBE distributed significantly (\( P\text{-value} = 0.000 \)) different in various sub locations under study. The prevalence of DCBE was highest in Oltepesi sub-location (41.7%) followed by Oloika sub-locations (28.8%), Oldorok (23.2%), Eremit (14.2%) and Magadi (11.6%). See table 3.

Prevalence of DCBE by sex and age of the index child
Although male had higher prevalence (26.8%) compared to female (22.6%) there was no statistical significant difference in their prevalence (\( P=0.200 \)); Table 4 shows that the practice of DCBE was highest (26.0%) among 5 year old children compared to children aged 4 (22.6%), 3 (25.8%) and 2 (23.9%) years.

Nutritional status of the children aged 2-5 years old
The degree of chronic under nutrition was 15.0% (moderate stunting) and 19.5% (severe stunting). Nutritional status based on Weight- for- Age, the degree of composite (both long term and short term) undernutrition showed that moderate underweight was 21.0% and severe underweight was 9.7%. The prevalence of acute under nutrition; the Global Acute Malnutrition (GAM) was 20.7%, Moderate Acute Malnutrition (MAM) was 13.3% and Severe Acute Malnutrition (SAM) was 7.4%.

Practice of DCBE in children in relation to their nutritional status
There was no significant relationship (\( P>0.05 \)) between the practice of DCBE and nutritional status. However, DCBE was more likely to be practiced in undernourished groups than those not undernourished. The prevalence of severe wasting was two times higher among children who had undergone DCBE (12.6%) than those children who had not undergone DCBE (7.4%). Similarly, moderate stunting was higher among children who had undergone DCBE (20.4%) than those children who had not undergone DCBE (13.2%). At the same time, the percentage of moderate underweight children was higher among

**Table 4: Prevalence of DCBE in relation to sex and age of index child**

<table>
<thead>
<tr>
<th>Sex of index child</th>
<th>freq</th>
<th>Practice of DCBE</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male(n=220)</td>
<td>59</td>
<td>26.8</td>
<td>( \chi^2=1.641, df=1 ), P-value 0.200</td>
</tr>
<tr>
<td>Female(n=200)</td>
<td>44</td>
<td>22.6</td>
<td></td>
</tr>
<tr>
<td>Age of index child</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 years(n=67)</td>
<td>16</td>
<td>23.9</td>
<td>( \chi^2=34621 )</td>
</tr>
<tr>
<td>3 years(n=124)</td>
<td>32</td>
<td>25.8</td>
<td>df=4</td>
</tr>
<tr>
<td>4 years(n=133)</td>
<td>30</td>
<td>22.6</td>
<td>P-value 0.000</td>
</tr>
<tr>
<td>5 years(n=96)</td>
<td>25</td>
<td>26.0</td>
<td></td>
</tr>
</tbody>
</table>
children who had undergone DCBE (20.4%) than those children who had not undergone DCBE (19.6%) as presented in Table 5. Further, the Odds Ratio (OR) of 1.417 indicates that DCBE was more likely in the malnourished group. However, the results (95% CI, OR=1.417 (0.838 - 2.395); χ²=1.355, p=0.244) showed that this association between nutritional status (being malnourished) and the practice of DCBE was not significant.

Table 5: Nutritional status and the practice of DCBE in children 2-5 year old

<table>
<thead>
<tr>
<th>Nutritional status</th>
<th>N=420</th>
<th>DCBE practice</th>
<th>Non DCBE n=317</th>
<th>Total</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>DCBE (n=103)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Underweight</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>26</td>
<td>25.2</td>
<td>62</td>
<td>19.6</td>
<td>88</td>
</tr>
<tr>
<td>Moderate</td>
<td>11</td>
<td>10.7</td>
<td>29</td>
<td>9.1</td>
<td>40</td>
</tr>
<tr>
<td>Moderate</td>
<td>37</td>
<td>35.9</td>
<td>91</td>
<td>28.7</td>
<td>128</td>
</tr>
<tr>
<td>Stunting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>21</td>
<td>20.4</td>
<td>42</td>
<td>13.2</td>
<td>63</td>
</tr>
<tr>
<td>Moderate</td>
<td>17</td>
<td>16.5</td>
<td>65</td>
<td>20.5</td>
<td>82</td>
</tr>
<tr>
<td>Moderate</td>
<td>38</td>
<td>36.9</td>
<td>107</td>
<td>33.8</td>
<td>145</td>
</tr>
<tr>
<td>Wasting</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>13</td>
<td>12.6</td>
<td>43</td>
<td>13.6</td>
<td>56</td>
</tr>
<tr>
<td>Moderate</td>
<td>13</td>
<td>12.6</td>
<td>18</td>
<td>5.7</td>
<td>31</td>
</tr>
<tr>
<td>Moderate</td>
<td>26</td>
<td>25.2</td>
<td>61</td>
<td>19.2</td>
<td>87</td>
</tr>
</tbody>
</table>

Table 6: Perception that wasting leads to DCBE versus the practice of DCBE

<table>
<thead>
<tr>
<th>Does child wasting contribute to DCBE</th>
<th>If DCBE was done</th>
<th>χ²</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>68</td>
<td>28.0</td>
<td>175</td>
</tr>
<tr>
<td>No</td>
<td>35</td>
<td>19.8</td>
<td>142</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>24.5</td>
<td>317</td>
</tr>
</tbody>
</table>

Discussion

In this study, for the first time the relationship between DCBE and nutritional status of the children is examined. When the respondents in this study were asked if there were children in the community who had undergone DCBE, 384 (91.4%) acknowledged that there are many among them are their own children and these findings shows that the practice is common. From oral examination, the prevalence of DCBE observed in this study was 24.5% which was higher than (12.9%) reported for the under one year olds in a study done in some parts of the study area. This suggests that the practice is prevalent in the area of study.

The present study examined children who were between 2-5 years, who had evidence of the tooth removed. Although freshly done DCBE occurred in 3 infants during their study, many cases may not have been reported by the mothers for fear of victimization. This could explain the low prevalence of DCBE. In addition, the present study examined the children who should be having their canine tooth erupted, therefore, it was easy to identify the DCBE cases. Other literature in Kajiado district has indicated that the practice is on the rise. The practice of DCBE is also on the increase in Uganda where gouging of the unerupted deciduous canine teeth occurs in approximately one in three in some areas. Earlier reports in Tanzania also indicated a rising trend. The high prevalence of DCBE in African communities could be due to lack of awareness, or is a cultural practice which should be discouraged.

Significant statistical difference were noted in relation to the prevalence of DCBE in the different
sub locations under study. Out of five sub-locations under the study, Ol tepesi and Oloika sub-locations were leading in the prevalence of DCBE in the study area and could confirm the above recent findings from the same locality. One of the Key Informant, reported that, “kieti nkera kumok tolosho le maa naitayioki ilala lekitishu kake keisudoo nkera kumok nemelimu ajo etiyioki ilala lekitishu. there are many children in our community who have had removal of canine tooth bud, however many of them hide, they will not tell you...” This shows that the practice is common in some parts of the community, and oral examination of the severe gum and missing teeth due to DCBE could only be confirming a few cases yet the practice could be wide spread. The findings of this study further confirm that the practice of DCBE is on the rise rather than decreasing. One child represent a household, this shows that 103 households sampled in the study area are involved in the practice, each having several children, then if all the children were examined, the a large population with DCBE could be observed. The higher prevalence of DCBE in some sub-locations such as Ol tepesi and Oloika implies that children in these areas are at more risks of DCBE than those in other area, therefore intervention programs should be directed first to these areas.

In relation to age, although the practice of DCBE was higher in 4-year old children (28.9%) compared to the 5 year old (27.6%), 3 year olds (23.6%) and 2 year old children (19.8%), there was no significant difference. This confirms earlier findings 4 which noted an increase in DCBE in Maasai children aged 3-5 from 35% in 1883 and 50% in 1988. Pinborg 1 reported a prevalence of 16% in rural northern Uganda, while 22% of urban children in Sudan had DCBE. Findings from a study done in Ethiopia indicated that 70% of the population and 100% among the infants younger than 18 months admitted to hospital in Southern Sudan. 6 The difference in the findings could be attributed to the differences in the ages of the children observed and the time the study was carried out. Although males had higher prevalence of DCBE (26.8%) compared to females (22.0%) there was no statistical significant difference in the prevalence. This shows that the practice of DCBE is done on all the children regardless of their sexual orientation.

Overall nutritional status of children showed that 30.3% were stunted, 36.4% were underweight while 19.5% were wasted. A high prevalence of low Height-for-Age among the one-year-old children indicates current nutrition and health problems in the population, that is, the problems of stunting. In children under five

years, it reflects a past problem in those already stunted but also may indicate that there is active, concurrent stunting among the younger children in the population. Nutritional status based on Weight-for-Age and the degree of composite (both long term and short term) undernutrition showed that chronic malnutrition was also reasonably high (mild underweight was 19.8%; moderate underweight was 14.3% and severe underweight was 16%). Stunting and under weight are common indicators that show chronic malnutrition among the under five-year-old children. Low Weight-for-Age is also the first stage of protein energy malnutrition. It is by far the most important nutrition problem as it affects up to 30% of all children between one and five years. 30 The prevalence of underweight children is one of the indicators being used to track progress toward attaining the MDG target of halving between 1990 and 2015 the proportion of people who suffer from hunger. 17

The prevalence of acute under nutrition was high (moderate and severe) compared with the findings of other communities in Tanzania. 31 where 31.6% were stunted, 14.6% were underweight, and 2.9% were wasted. CBS, MOH and ORC Macro, 32 surveyed other ASAL areas in Kenya (North-Eastern province) and established that the prevalence of wasting in North-Eastern province was extra-ordinary, 27% and severe wasting was very high (11%). Nonetheless, the above findings were based on as small sample size. However, this evidence suggests that some areas, particularly those occupied by the pastoral communities that are harsh and could be experiencing inadequate food supply. Children are affected most in situations of food scarcity. 33, 34

In this study, perceptions of child wasting contributed to DCBE. Statistically significant difference (p-value = 0.05) was noted in relation to perceived wasting and DCBE. This study reveals that causes of childhood illnesses in some communities are a result personal illness control. DCBE is personal illness control practice which is influenced by environment of the people -perceptions, cultural values and beliefs. 36 Maasai people have seen their children suffer greatly and some have lost their children due to undernutrition and other illnesses. Perception of severity of a condition (such as wasting), and believing the consequences of not ‘treating the child’ (by DCBE), could have influenced the practice of DCBE. The perceived benefits of DCBE and the impact of leaving the children to suffer illnesses such as diarrhoea, may have led to their continued practice. UNICEF 37 developed a conceptual framework on the
causes of malnutrition, and classified them as immediate, underlying and basic causes. Immediate causes are lack of food intake and disease; and create a vicious cycle in which disease and malnutrition exacerbate each other. The study revealed that moderate stunting was higher among children who had undergone DCBE than those children who had not undergone the practice. The findings of the study indicate that the burden of undernutrition in the under five year old in Maasai community is high and has a significant influence in the practice of DCBE.

Maasai pastoral lifestyle is also in transition. The Maasai community is responding to challenges that have resulted in increased social and economic stratification, urban migration, and diminished nutrition for women and children. Population growths, loss of livestock due to drought and famine have made many men to seek wage labour leaving their families without food and livestock. The women left to feed the children without any assistance, yet they are not economically empowered. Women status has also been reported to have an effect on child nutrition. Women’s status strongly influence on both long-term and short-term nutritional status of the children, leading to reduction in both stunting and wasting.

Among those who had undergone DCBE, severe wasting was twice compared to those who had not undergone the practice. The respondents strongly believed that malnutrition contributed to DCBE. Their perceptions that children with deciduous canine tooth bud were wasted, was therefore significantly related to the practice of DCBE. The findings of the study however confirmed that, despite DCBE being harmful, the practice does not have long term significant relationship with nutritional status of children under five years old in Kajiado District.

Acknowledgement

We acknowledge all those who contributed to this study in one way or another: The Maasai community in Magadi and Ngong especially their leaders for their cooperation, during data collection. Our colleagues at KMTK and KEMRI for cooperation, Prof. Jameela Hassanali for her moral support. Dr. George Otieno, Dr. Gladys Mengich, Dr. Martin Oganda and Mr. Boruet for their advice and their contribution. Last but not least are Mrs. Alice and Dr. G. Githu for providing tools and facilities for use during the project.

References


Dental caries and periodontal health of children with cerebral palsy in Nairobi, Kenya
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Running Head: Oral health status of children with CP-Kenya
Key words: cerebral palsy, oral health status, dental caries
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Abstract

Objective: To determine the oral health status of children with cerebral palsy (CP) at two centers in Nairobi, Kenya.

Methods: This was a descriptive cross-sectional study carried out on a convenient sample of children aged 3 to 15 years with CP residing in Nairobi attending the annual oral health check-up by Cerebral Palsy Society of Kenya (CPSK) and occupational therapy (OT) clinic at Kenyatta National Hospital (KNH). All children aged 3 to 15 years with CP who reported for the check-up and OT sessions were eligible for recruitment once consent was given by the parent/guardian. Gingival index, plaque index and DMFT/dmft were used to assess the periodontal health and dental caries.

Results: A total of 78 children were recruited, 40 at CPSK and 38 at KNH. The mean age was 5.21 years (SD 2.78, SE 0.32) with an age range of 3-14 years. Caries prevalence was high with a mean dmft of 5.49 in deciduous dentition. Only 5 children were in permanent dentition and the DMFT was 0. The mean plaque score was 1.56 (SD 0.87). Twenty-eight (36.84%) children had poor oral hygiene, 28 (36.84%) fair, 16 (21.05%) good and only 4 children (5.26%) had excellent oral hygiene. The mean gingival index was 1.35 (SD 0.67). Two children (2.60%) had healthy gingivae, 24 (31.17%) mild inflammation, 43 (55.84%) moderate gingivitis and 8 (10.39%) severe gingivitis.

Conclusions: The oral health status of the children with CP examined in this study was poor.

Introduction

Cerebral palsy results in the inability to move and control muscles therefore leading to difficulty in maintaining a good oral hygiene. The exact prevalence of CP in Kenya is not documented. There is paucity of information on the oral health status of children with cerebral palsy in Kenya. However, recent studies indicate that people with CP experience a higher degree of dental caries primarily due to poor oral hygiene which is directly due to the physical inability to cope with brushing. There has been no specific study on cerebral palsy in Kenya. However, a study conducted in 1988 examined 449 handicapped children in Nairobi and found caries prevalence of 44% and DMFT of 0.8. Similar research conducted on 12-14 years old handicapped children in India found the prevalence of caries to be highest in the cerebral palsy group and lowest in the group with visual disibility. In Tanzania found caries experience of 46.7% among children with CP and mental retardation.

All these studies found the decayed component to be predominant in DMFT assessments.

Similar studies conducted in the developed world also demonstrate low restorative indices. The high caries rate has been attributed to the soft and sticky diet given to the children, as well as low birthweight, and problems with saliva amounts, flow and consistency. Other risk factors for caries include dysphagia, mouth breathing, enamel hypoplasia and food pouching.

Barriers to maintenance of good oral hygiene among children with special needs include inadequate access to information, physical limitations and behavioural factors. Oral health education has however been proposed as a factor that may have significant impact on oral hygiene. In Belgium found that 22.1% of mildly mentally challenged children and 20.9% of learning impaired children did not brush daily and that 91.0% and 94.7% respectively did not receive help with tooth brushing from their parents or caregivers.
The prevalence of gingivitis in handicapped children in Kenya reported by Ohito et al.14 was higher than that found in normal children in a previous school based study by Ng'ang'a et al.15. A similar Nigerian study compared the periodontal treatment needs of normal children and those who had mental and multiple handicaps in Lagos, Nigeria and reported that a higher proportion of handicapped children (78.6%) compared with normal children (59.4%) needed professional oral prophylaxis and oral hygiene education. Although both the Kenyan and Nigerian studies were not specific for children with CP, they do indicate unmet treatment needs in handicapped children as a group.

The objective of this study was to determine the oral health status of children with cerebral palsy at two centers in Nairobi, Kenya.

Materials and Methods

The study was done in Nairobi, Kenya; targeting children with CP. This was a descriptive cross-sectional survey carried out on a convenient sample of children attending a dental check-up & occupational therapy clinic. The minimum sample size required was 76. This was based on one sample calculation in small populations. Repeat examinations of every fifth child were done to minimize intraexaminer variability. Kappa score of 0.94 for intraexaminer variability was obtained. Data collection was done at the annual oral health check up of children with CP and on children attending OT at KNH between August and October 2004. Caries assessment was by DMFT index. The oral hygiene was assessed by determining the mean plaque scores using the plaque index while gingival inflammation was by gingival index by Silness and Loe (1964, 1963) respectively. Plaque scores were then rated using a numerical scale with a range from 0 to 3 as follows 0:0.04 excellent; 0.05-0.94 good; 0.95-1.94 fair and 1.95-3 poor (adapted from Peter S).17 For the purposes of a closer comparison, the gingivitis score scale for severity was used as follows 0:0.04 normal; 0.05-1.04 mild; 1.05-2.04 moderate and 2.05-3 severe (adapted from Peter S).17

Data analysis was by SPSS 12.0 for windows computer packages and Intercooled STATA 8. Univariate and bivariate analysis were done and appropriate inferences made ($\chi^2$, OR, t-test and CI constructed). Approval was granted by Kenyatta National Hospital and University of Nairobi research committee and the CPSK. Only participants who gave an informed written consent were recruited into the study.

Confidentiality was maintained and no invasive treatments were offered in the field; however there was appropriate referral of those in need of dental treatment.

Results

Socio-demographic characteristics of the children

The ages of the children examined ranged from 3 to 14 years with a mean of 5.21 years (SD 2.78, SE 0.32) and interquartile range of 4. Males were 42 (53.8%) while 36 (46.2%) were females. The place of delivery (birth) for 3 children from a children’s home was not available. However, only 10 (13.3%) were delivered at home while 65 (86.6%) were born at a health facility. The birth weight ranged between 1.04 and 4.5 kg (n=56) with a mean of 3.0 kg (SD 0.67, SE 0.09) and interquartile range of 1.0. Some of the parents/guardians could not remember the birth weight and did not have the clinic cards for verification. Concerning the birth order of the children examined, 37 (49.3%) were first born, 12 (16%) 2nd born, 18 (24%) 3rd born, 3 (4%) 4th born, 4 (5.3%) 5th born and 1 (1.3%) 7th born. There was no 6th born and the caregivers of 3 children were not sure of their position in the family as they had been adopted by a home.

Dental Caries

A total of 77 children were examined for dental caries. A high number of deciduous teeth were recorded as most of the children were less than 5 years of age. The DMFT in the permanent dentition was zero (n=5), due to the fact that most of these teeth were newly erupted. The mean number of decayed teeth per person was 4.87 (95% CI 3.66 6.08), mean number of missing teeth 0.04 (95% CI 0.04 0.12) and there were no filled teeth. The mean dmft in the present study was 5.49 in the deciduous dentition with an overall caries prevalence of 66.23%. In total therefore, 26 (33.8%) children were caries free. Seventy six (98.70%) had no missing teeth due to caries. Only one child (1.3%) had teeth missing due to caries and none of the children had filled teeth. Caries experience categorized in terms of deciduous, mixed and permanent teeth is summarized in Table 1. Fifteen children in mixed dentition stage had a mean DMFT/dmft of 4.33.

In the maxillary arch of the deciduous dentition, the teeth mostly affected were the deciduous molars followed by the central and lateral incisors (Figure 1). The canines were least affected by dental caries. In the mandibular arch of the deciduous dentition, the teeth
mostly affected by caries were the deciduous molars. The anterior teeth were not severely affected with the canines having the least prevalence (Figure 2).

Table 1: Summary of caries experience

<table>
<thead>
<tr>
<th>Dentition stage</th>
<th>Decayed</th>
<th>Missing</th>
<th>Filled</th>
<th>DMFT/dmft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deciduous</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>310</td>
<td>3</td>
<td>.00</td>
<td>313</td>
</tr>
<tr>
<td>Mean</td>
<td>5.44</td>
<td>.05</td>
<td>.00</td>
<td>5.49</td>
</tr>
<tr>
<td>N</td>
<td>57</td>
<td>57</td>
<td>57</td>
<td>57</td>
</tr>
<tr>
<td>Mixed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>65</td>
<td>.00</td>
<td>.00</td>
<td>65</td>
</tr>
<tr>
<td>Mean</td>
<td>4.33</td>
<td>.00</td>
<td>.00</td>
<td>4.33</td>
</tr>
<tr>
<td>N</td>
<td>15</td>
<td>15</td>
<td>15</td>
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</tr>
<tr>
<td>Permanent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>Mean</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
</tr>
<tr>
<td>N</td>
<td>5</td>
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<td>5</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Sum</td>
<td>375</td>
<td>3</td>
<td>.00</td>
<td>378</td>
</tr>
<tr>
<td>Mean</td>
<td>4.87</td>
<td>.04</td>
<td>.00</td>
<td>4.91</td>
</tr>
<tr>
<td>N</td>
<td>77</td>
<td>77</td>
<td>77</td>
<td>77</td>
</tr>
</tbody>
</table>

Since the decayed component of the DMFT/dmft formed 99.2% of the total caries experience, it was then analysed further to determine whether there was any associations with the sociodemographic variables. There was no significant statistical difference in the mean number of decayed teeth among the children at CPSK and at KNH (t=0.6856(75) p=0.4951). When the association between socio-demographic characteristics and dental caries was tested; the number of decayed teeth was not significantly associated with gender of the child (OR 1.21 p=0.692 CI 0.468-3.14), income of the parent/guardian (OR 3.1 p=0.087 CI 0.848-11.41), occupation of the parent/guardian (OR 1.92 p=0.465 CI 0.33-10.98), and the marital status of the parent/guardian (OR 0.69 p=0.674 CI 0.12-3.87) There was no sufficient statistical evidence against a relationship between decayed teeth and birth order (OR 1.56 p=0.053 CI 0.994-2.48).

Figure 1: Pattern of caries in maxillary deciduous teeth

Figure 2: Pattern of caries in mandibular deciduous teeth


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Oral hygiene
The mean plaque score of the children examined was 1.56 (N=76, SE 0.1 SD 0.87) with a range of between 0 and 3. The majority of the children had fair (36.84%) and poor (36.84%) oral hygiene giving a total of 73.68%. Only 5.26% and 21.05% had excellent and good oral hygiene respectively. Also noted was that the severity of plaque accumulation was not associated with selected socio-economic variables (Gender of the child(Chi(3) 5.27 p=0.153), income of the parent/guardian (Chi(9) 6.99 p=0.638), birth order of the child (Chi(15) 13.06 p=0.597), occupation of the parent/guardian (Chi(12) 6.07 p=0.912), marital status of the parent/guardian (Chi(9) 11.83 p=0.223) and level of education of the parent/guardian (Chi(12) 5.076 p=0.995). The children at CPSK appeared to have a better oral hygiene compared to those at KNH suggesting that the oral hygiene status was associated with the facility where the children were examined (Chi2(3) =9.5714 p = 0.023) (Table 2).

Table 2: Rating of oral hygiene by facility where the children were examined n=76:

<table>
<thead>
<tr>
<th>Facility</th>
<th>Excellent</th>
<th>Good</th>
<th>Fair</th>
<th>Poor</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPSK</td>
<td>0(0%)</td>
<td>10(26.3%)</td>
<td>18(47.4%)</td>
<td>10(26.3%)</td>
<td>38(100%)</td>
</tr>
<tr>
<td>KNH</td>
<td>4(10.5%)</td>
<td>6(15.8%)</td>
<td>10(26.3%)</td>
<td>18(47.4%)</td>
<td>38(100%)</td>
</tr>
<tr>
<td>Total</td>
<td>4(5.3%)</td>
<td>16(21.1%)</td>
<td>28(36.8%)</td>
<td>28(36.8%)</td>
<td>76(100%)</td>
</tr>
</tbody>
</table>

Gingivitis.
The mean gingivitis score of all the 77 children examined was 1.35 (n=77, SE 0.08 SD 0.67) with a range of between 0 and 2.83. Using the gingivitis score scale for severity, majority of the children examined had moderate gingivitis (55.8%). Severe gingivitis was observed in 8 of the children (10.4%), while 2 children (2.6%) and 24 children (31.2%) had normal gingivae and mild gingivitis respectively (Table 3). Severity of gingivitis was not associated with selected socio-economic variables. The variables included; gender of the child (Chi (3) 3.7 p=0.296), income of the parent/guardian (Chi (9) 9.002 p=0.437), birth order of the child (Chi (15) 23.84 p=0.068), occupation of the parent/guardian (Chi (12) 7.10 p=0.851), marital status of the parent/guardian (Chi (12) 6.59 p=0.68) and level of education of the parent/guardian (Chi (12) 16.81 p=0.157).

Discussion

Dental Caries
The prevalence of dental caries among children with CP was relatively high compared to levels reported in previous studies on Kenyan children. The mean dmft in the present study was 5.49 in the deciduous dentition which is much higher than that of 2.95 reported by Ng'ata et al (2001) in deciduous teeth among children aged 3 to 5 years and 0.8 reported by Ohito et al (1993) among handicapped children aged 5 to 15 years in Nairobi. The caries prevalence of 66.23% reported in the current study is also high compared to that of 63.5% and 50% by Ng'ata et al (2001) and Ng'ang'a et al (1991) respectively. The quoted studies did not include children with CP hence the difference in caries experience. The caries pattern in the deciduous dentition was similar to that seen in early nursing caries, with the mandibular molars predominating and the lower incisors being least affected.

There are conflicting reports in the literature regarding prevalence of dental caries in children with CP which was previously reported at lower levels. This may be because earlier studies were based on institutionalized children who consumed controlled diets. Prevalence of dental caries has now been shown to be higher in children with CP compared to those with other disabilities and the general population. Bhavsar (1996) reported a higher prevalence of caries in children with CP compared to a group of children with visual impairment in India. There was no significant difference within gender (p=0.9137). The high caries rate in children with CP is thought to be primarily due to poor oral hygiene accompanied by consumption of cariogenic diet.

Another factor that may further predispose the children with CP to caries is drooling, a common problem in CP, due to problems with swallowing and the musculature. Contrary to the thought that drooling is caused by increased salivation, it is actually characterized by reduced salivary flow and inability to swallow. Drooling results in altered consistency of saliva, inadequate debridement of teeth, and compromised quality of saliva for buffering. The dental caries incidence worsens with the neurological damage in children with CP, and this is due to an increased bite reflex which makes it more difficult to maintain oral hygiene. Other predisposing factors could be dysphagia,
mouth breathing, enamel hypoplasia, food pouching, ruminating, frothing, and more indirectly low birth weight that have been reported in children with CP.

The present study reported low numbers of missing and filled teeth. Pope et al. and Gizami et al. reported that very few handicapped children had restorations. The low number of filled and missing teeth is suggestive of low utilization of oral health services. The low utilization translates to most of the parents not having access to expert advice on how to maintain the children’s oral health status, hence the high caries rate. However, it is also acknowledged that the level of treatment of caries in Kenya is low, and this is manifested by the low number of restorations in the general population.

Oral hygiene status
The oral hygiene status of the children with CP in the present study was poor. The mean plaque score was 1.56 (n=76 SE 0.1 SD 0.87) and only 5.3% and 21.05% had excellent and good oral hygiene status. Fair and poor oral hygiene constituted 73.7%. Ohito et al. in their study on handicapped children also reported poor oral hygiene with plaque on all the sites they examined. However, their study did not rate the severity of plaque accumulation. Several other studies have also reported that handicapped children tend to have poor oral hygiene. Some of the factors that deter adequate plaque control in these children are lack of dexterity and the mechanical difficulty in cleaning. According to several studies including that by Alalussua and Malvimirta, it was concluded that good oral hygiene, particularly tooth brushing with fluoride toothpaste is important for keeping the gingiva healthy and teeth free from caries. Tooth brushing and maintenance of good oral hygiene in children with CP is a challenging task for the parents or caregivers, and dental staff who look after the children.

It was observed that children from CPSK appeared to have a better oral hygiene status than those at KNH (p=0.023). This may be attributed to the oral hygiene instructions that are given at the CPSK during free annual oral health check-ups. This supports the findings by Ohito et al.; who concluded that oral hygiene instructions are an effective means of improving oral hygiene. There were no oral hygiene instructions given at KNH.

Gingivitis
Majority (55.8%) of the children had moderate gingivitis and 10.4% had severe gingivitis and only 2.60% had healthy gingivae. The mean gingivitis score was 1.35 (n=77 SE 0.08 SD 0.67). These results differ slightly from those reported in other studies. Studies by Mc Alister and Bradley in 2003 reported 4.7% of 15 year olds and 8.6% of 12 year old in a special school in Ireland to have healthy gingivae. However, this study did not include children with CP yet oral health status and oral care varies with the various disabling conditions.

Diverse studies have shown that children with CP tend to have higher prevalence of gingivitis than children in the general population or those with other forms of disability, a direct consequence of poor oral hygiene. There was however no difference in severity of gingivitis in the two groups at KNH and CPSK (p=0.111) despite the children at CPSK having better oral hygiene. No gender differences were found in the present study as is usually the case in the general population.

In conclusion therefore, there was very poor oral health status in children with cerebral palsy examined in this study. The slightly better oral health status among the children examined at the dental camp can be attributed to the oral health promotion program by the CPSK. A workable inclusive oral health promotion program aimed at children with special needs by the government is therefore recommended.

Conflict of Interest
The authors have no conflicts of interests to declare.

Ethical Clearance
Kenyatta National Hospital Ethics and Research Committee approval Ref: KNH-ERC/01/2387

Acknowledgements
This study was conducted with the support of the Chairman CPSK, Mr. George Kakala, the Director KNH and the Head of KNH Occupational Therapy Unit. Dr. Sylvia Kasami, Dr. Amritpal Kalsi and Mrs. Rosemary Obillo kindly donated their time and expertise in the annual check-up for children with CP. The authors also thank the Chairman, Department of Community Dentistry and Periodontology, School of Dental Science for providing dental instruments for use in the study, and GlaxoSmithKline (K) Ltd and Colgate-Palmolive Ltd. for generously contributing drugs and tokens for the children.
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Knowledge, perceptions and effect of eating habits on dental caries among urban school adolescents
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Keywords: eating habits, dental caries, DMFT

Abstract

Objective: To determine the knowledge, perceptions and effects of eating habits on dental caries among 11 to 14 year olds in an urban school in Nairobi, Kenya.

Design: This was a descriptive cross sectional study

Setting: The study was conducted at Hospital Hill primary school. It is a co-ed public school run by the Nairobi City Council in Westlands division of Nairobi province.

Materials and methods: A self administered questionnaire was filled by 198 pupils attending Hospital Hill Primary School, and in classes 5-8 and a clinical examination of the first permanent molar in each quadrant using a periodontal probe or explorer was done in a fluorescent lit room. A tooth was noted as carious if it had a color change, wedging and catching of an explorer tip. Proximal surfaces were not examined and no radiographs were taken. Teeth with white spots were not considered as decayed.

Results: The results showed that knowledge of the effect of dietary habits on the incidence of dental caries was high, 99% of the respondents knew that candy, cakes and soft drinks cause tooth decay. Majority (93%) also agreed that the extent of decay was proportional to the amount of candy, cakes and soft drinks taken. There was no statistical significance in the DMFT of those who had knowledge of this relationship compared to those who did not (p=0.896). The source of this knowledge was attributed to the dentist (47%), teachers (32%) and media (9%). Majority of respondents (198) carried snacks to school; 56% because they enjoyed eating them, 19% had their parents pack them to take to school, 10% because they got hungry and 15% carried them for other reasons. The relationship between the dietary habits and the prevalence of dental caries showed no statistical significance between the DMFT of those who ate cariogenic foods more often and those who ate them once in a while (p=0.573). The attitude towards dietary habits and good oral health showed that the 99% respondents who thought healthy teeth were important also tended to brush regularly. In this regard 53% brushed their teeth twice per day, 24% more than twice per day and 21% brushed once per day.

Conclusion: The level of knowledge that candy/sweets, cake and soft drinks are harmful to teeth was high among 9-16 year olds in an urban primary school. A positive attitude towards healthy teeth was shown to have a positive influence on oral hygiene practices. There was however no statistical significance in the first molar DMFT of those who ate cariogenic foods more frequently than in those who rarely ate them.

Introduction

Dental caries is generally accepted as primarily a microbial disease, but few would disagree that dietary habits play a crucial secondary role.1 Dental caries occurs because of demineralization of enamel and dentine by organic acids formed by bacteria in dental plaque through the anaerobic metabolism of sugars derived from the diet.2 These sugars include monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, fruit juices and syrups. The development of caries requires the presence of sugars and bacteria, but is influenced by the susceptibility of the tooth, the bacterial profile, and the quantity and quality of the saliva.

There is a wealth of evidence from many different types of investigations, including human studies, animal experiments and experimental studies in vivo and in vitro to show the role of dietary sugars in the etiology of dental caries. The Vipeholm study, conducted in an adult mental institution in Sweden between 1945 and 1953 showed that the frequency of eating and the nature of the sugar-containing food influenced cariogenicity.3
Frequency of eating was further investigated by Konig in an animal study involving the use of a feeding machine. The results suggested that the caries severity is likely to be more dependent upon frequency of consumption of the cariogenic diet than the total amount consumed.  

Dental caries is one of the most prevalent chronic diseases in children. Hence, the prevention and treatment of dental caries remains an important responsibility of the dental profession. Dental caries among 12 year old pupils has been shown to be directly related to a low frequency of brushing, a higher consumption of sweets and low knowledge levels of dental health. Miyazaki & Morimoto reported a significant correlation ($r=0.91$) between sugar availability in Japan and DMFT at age 12 years between 1957 and 1987.

The amount of dental decay is measured using the DMF index, a count of the number of teeth or surfaces in a person’s mouth that are decayed, missing or filled as a result of caries in the primary dentition or permanent dentition. The present study has investigated DMFT of the first molars due to the following reasons: First, by the age of 12, the first molars would have almost 6 years in the mouth after eruption. Secondly they can be considered as a good basis to study the oral health status of these children. Third, such a study can be used as a powerful aid for planning a proper health care system at early ages. Finally, because of the special morphology of the first molars, they are at greater risk of damage and early loss due to dental caries.

**Materials and Methods**

The study was conducted in Hospital Hill primary school in Westlands division; Nairobi which was chosen by convenient sampling. All pupils in classes 5-8 whose parents gave consent were included in the study.

A self administered questionnaire was filled by the pupils followed by clinical examination of the first permanent molar in each quadrant using a periodontal probe or explorer in a fluorescent lit room. A tooth was considered as decayed when in addition to showing clinical signs such as a color change and wedging there was some degree of resistance to an explorer tip during examination. Proximal surfaces were not examined and no radiographs were taken. Teeth with white spots were not considered as decayed in this study. Approval was obtained in writing from the school to conduct the study as well as consent by proxy from parents for the participation of the children in the study since they were minors. The study was approved by the Kenyatta National Hospital and University of Nairobi ethics and research committee.

**Results**

A total of 198 pupils participated in the study which was 92% of the sample size calculated. There were 90 (46%) boys and 108 (54%) girls all aged between 9 to 16 years of age. The mean age was 12.3 years while the modal age was 13.0 (Fig 1).

![Figure 1: Age distribution of respondents](image)

It was found that all the children carried snacks to school, 147 (74%) of the pupils who carried candy/sweets, cake and soft drinks to school ate them during break, 20 (10%) pupils ate them at lunch time, 17 (9%) ate them after school and 14 (7%) ate them during class.

The relationship between the dietary habits and the prevalence of dental caries showed the highest DMFT of 0.7 among those who ate candy, cakes and soft drinks every day 0.67 for those who consumed them 3-5 times per week and 0.5 among those who eat candy, cakes and soft drinks once per week (Fig 2). The association between the DMFT and frequency of eating snacks was not statistically significant using the t-test ($p=0.573$).
The respondents who took milk, fruits, sugar cane, and whole grain every day had a DMFT of 0.43, those who took them 1-3 times a week had a DMFT of 0.37 and those who never took or took once in a while had a DMFT of 0.48. There was no association between the frequency of eating these foods and DMFT using the t-test (p=0.636).

Majority (99%) of the respondents knew that candy, cakes and soft drinks caused tooth decay. Most (93%) of the respondents also agreed that the amount of candy, cakes and soft drinks taken was proportionate to the extent of tooth decay. There were 94 (47%) respondents who had information that sweets, cakes and soft drinks are harmful to their teeth. The sources of this information were: dentists (47%), school (32%), television (9%), other sources (9%), friends (2%) and parents (1%). The association between pupils who knew that snacks are harmful to their teeth and the DMFT was not statistically significant using the t-test (p=0.896).

Majority of respondents (198) carried snacks to school; 56% because they enjoyed eating them, 19% had their parents pack them to take to school, 10% because they got hungry and 15% carried them for other reasons (Fig 3). The attitude towards dietary habits and good oral health showed that the 99% respondents who thought healthy teeth were important also tended to brush regularly. In this regard 53% brushed their teeth twice per day, 24% more than twice per day and 21% brushed once per day.

Figure 3: Reasons for carrying snacks to school

Most (99%) of respondents thought that healthy teeth were important. Among them the reasons were: for eating (62%), beauty (17%), to prevent bad breath (6%), confidence/self esteem (5%); strong teeth (5%), for healthy gums (3%) and to prevent pain (1%).

Discussion

The children who carried snacks to school once in a while constituted the largest proportion with regard to the frequency per week. A majority of the pupils (74%) ate these snacks during break which is mid morning between 10 and 11am. There was no clear reason as to why this was the time most of them ate snacks because a majority carried them because they enjoy eating snacks (56%). Those who carried snacks because they got hungry at this time of the day were only 10%. This contrasted findings among Welsh adolescents who took mid morning snacks high in sugars mainly because they felt hungry. This difference may be attributed to cultural differences whereby feeding habits and patterns vary from one population to another.

Those who ate snacks every day had the highest proportion of decayed missing and filled teeth compared to those who ate them less frequently but it was not statistically significant. A study in the United Kingdom of children aged 4-18 years showed no significant relationship between caries experience and level of intake of free sugars; in the age group 15-18 years, however, the upper band of free sugars consumers were more likely to have decay than the lower band (70% compared with 52%). The 15-18 year age group is close to the age group under investigation in this study and these observations were similar to those in the current study. When investigating the association between diet and the development of dental caries it is more appropriate to use a longitudinal study design in which sugars consumption habits over time are related to changes in dental caries experience. In a comprehensive study of over 400 children in England aged 11-12 years, a small but significant relationship (r=0.2) using multiple regression was found between intake of total sugars and caries increment over a 2 year period.

In a study conducted among 6-7 year old Namibian children basic oral health knowledge was relatively poor. Approximately 70% of the total group did not know the cause of tooth decay. The 30% who had some knowledge about oral health knew that high consumption of sweets and not brushing your teeth cause "the teeth to become rotten". This may be attributed to the age difference of the respondents with adolescence having had more years in school and more exposure to oral health information.

There was no statistically significant difference in the DMFT of the respondents who agreed that the frequency of eating cariogenic foods has an effect on the incidence of tooth decay when compared to those who disagreed. This differed with findings of a study done by Ernesto Smyth et al that among 12 year olds those subjects with low knowledge of dental health show more caries (POR= 1.32; 95% CI, 1.20-1.61) than
those subjects with higher knowledge. Majority (99%) of the respondents agreed that healthy teeth were important with the main reason being their use in mastication (60%). In light of this, majority (99%) said that it was important to brush their teeth and the main reason given was to prevent caries (66%). Different studies have found that health education could reduce caries affection, concluding that higher knowledge generates more positive attitudes that in turn generate healthier habits.

The mean first permanent molar DMFT of the population was 0.84 which was less than that of an Iranian population of 12-year-old students who scored 1.95 and in both studies there was no statistically significant difference between DMFT of males and females. This is possibly due to the fact that the Iranian children were examined by a specialist on a dental chair as opposed to examination in a fluorescent lit room in the current study.

The mean DMFT of the current study population achieves the WHO goal of not more than 1.0 in 2010 at the age of 12. Noteworthy is that only the first permanent molars were included in the DMF index in the afore-mentioned studies. The World Health Organization has drafted new goals for 2020 entitled “Goals for oral health 2020”. These objectives are intended to act as a framework for the formulation of regional and national oral health goals on the slogan “Think globally, act locally”. Their purpose is to facilitate regional, national and local health policy development and activities leading to more detailed and locally relevant goals. Dental caries is a disease in which cultural and hygienic habits are decisive so prevalence found in different habitats and different moments could be strongly related to these factors.

Conclusion

The level of knowledge that candy/sweets, cake and soft drinks are harmful to teeth was high among 9-16 year olds in an urban primary school. A positive attitude towards healthy teeth was shown to have a positive influence on oral hygiene practices. There was however no statistical significance in the first molar DMFT of those who ate cariogenic foods more frequently than those who rarely ate them.

References


Knowledge, perception and practice of atraumatic restorative treatment among dentists in Nairobi
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Abstract

Aim: To determine the knowledge, perception and practice of atraumatic restorative treatment (ART) approach among dentists in Nairobi.
Design: The study was a descriptive cross-sectional study involving registered and practicing dentists in Nairobi.
Materials and Method: A total of 120 registered dental practitioners based in Nairobi, and who had practiced for more than a year after internship were identified to participate in the study, but only 86 actually did. Information on the knowledge, perception and practice of Atraumatic Restorative Treatment was collected using semi-structured questionnaires. The data gathered was analyzed using SPSS.
Results: Majority of the respondents knew about ART approach (82.6%), considered ART a practical procedure (76.8%), and did not think ART can be an alternative to conventional restorative methods (63.5%). 48.2% thought it can be used for permanent restorations. A total of 72.9% of the dentists had never placed any ART restorations. 60.9% of those who had practiced in ART had placed less than five restorations. However, 82.6% thought the procedures were successful. Among those who had not placed any restorations, 66.7% had never had an opportunity to try and 55% would perform ART on their patients if given the chance. 86.5% of all the dentists were interested in learning more about ART.
Conclusions: It was established that majority of the dentists in Nairobi are knowledgeable about ART, but they have a poor perception of the technique. The study also established that few dentists applied the ART approach in their practices.
Recommendations: There is need to improve the knowledge and perception of ART among the dentists through continuing dental education seminars and workshops, in order to encourage them to use the technique especially in the underprivileged communities without proper dental facilities.

Introduction

Dental caries is an irreversible demineralization process of dental hard tissue by bacterial acids. Dental caries remains a worldwide problem because of availability of sucrose and other forms of sugar in the diet. It is estimated that the entire world’s population has suffered, is suffering or will suffer a carious experience at one time in their life.1,2 Studies have shown that there is an upward trend in prevalence of dental caries in developing countries in contrast to a downward trend in industrialized countries. Downer et al (1990) showed prevalence of less than 50% in industrialized countries, while Akpabio et al (1989) showed a prevalence of dental caries of more than 80% in developing countries.3,4 Dental caries is left virtually untreated in majority of people living in non-industrialized, developing countries of the world. This group of people with no access to proper oral health care constitutes at least two-thirds of the world’s population. In most of these cases, extraction is the commonest form of treatment offered.1

Atraumatic restorative treatment (ART) is a method of caries management using only hand instruments and an adhesive filling material - Glass Ionomer cement (GIC).1,2 ART was pioneered in rural Tanzania in the mid 1980s by Dr. Jo Frencken following a recommendation by WHO to improve oral health status in developing countries using an affordable and practical method.1,3 ART is strongly supported by modern scientific approach to controlling caries, whose key features are maximal prevention, minimal invasiveness and minimal cavity preparation. It has also shown appreciable success and has been accepted
as an appropriate technique in several countries. Recently, improvements in restorative materials, specifically GIC, have given ART a solid practical basis. These improvements include rapid setting reaction, less moisture sensitivity, enhanced wear resistance and a better handling profile. The material, together with the original salient properties of the filling material, namely, chemical bonding to the tooth and fluoride release to the tooth induce remineralization of the restored tooth. Furthermore, conventional considerations in cavity preparation are not necessary, and as a result, there is enhanced conservation of tooth structure because the cavity is not enlarged or "cut" with rotary instruments. The procedure is also more comfortable for the patient because there is less pain.

ART was originally introduced for economically less developed countries in the world. However it has applications in the industrialized, more affluent parts of the world for example, introducing oral health care to very young children who previously exposed to dentistry, patients with extreme fear or anxiety, mentally or physically handicapped patients, home bound elderly and those living in nursing homes, and patients with high caries index who cannot have all the restorative treatment completed immediately, as an intermediate treatment to stabilize conditions. In the past ART has been used for temporary restorations, till the patient could access a dental clinic for the permanent restoration.

Despite the proven advantages of ART as a method of caries management that is also more comfortable and cheaper for the patient, it still has limited use in developing countries. This is probably due to inadequate facilities to implement the program, and lack of well trained personnel that can properly deliver the service. In East Africa, very few studies have been carried out to assess the application of ART. One study by Kemoli et al. (2009) involved an analysis of how the cavity size affected the survival rate of proximal ART restorations in primary molars. It was conducted in Matungulo and Kangundo divisions in Kenya. Another study was conducted by Kikwitu et al. (2009) in Tanzania on barriers to restorative care as perceived by patients attending government hospitals, and ART approach was strongly recommended as a form of treatment.

There appears to be very limited data on ART because it is not being practiced to a large extent in the country. This is probably because of low level of knowledge on ART, a poor attitude or wrong perception among the dentists in Nairobi, and in Kenya as a whole. The aim of this study was to determine the knowledge, perception and practice of ART among dentists in Nairobi. The information will be used for ART development programs, continuous education programs and as a reference for future studies conducted on ART.

Materials and Methods

The study was a descriptive cross-sectional study involving registered and practicing dentists in Nairobi, the administrative and economic capital of Kenya. The study included all the dentists in Nairobi who have finished a year or more since internship, regardless of whether they are based in private practice, public hospitals or teaching institutions, and who consented to participate. Out of 120, only 86 of the dentists filled and returned the questionnaires. Ethical approval was obtained from the Kenyatta National Hospital and University of Nairobi’s Ethics, Standards and Research Committee. Information on the knowledge, perception and practice of Atraumatic Restorative Treatment was collected using semi-structured questionnaires that were designed by the investigator. The questionnaire was distributed by hand to the dentists, who were given a week to fill it before it was collected by the investigator. Data analysis was carried out with SPSS Version 12.0 for Windows.

Results

Knowledge of ART

Where they learnt about ART

Twenty-one (24.7%) of the dentists learnt about ART from conferences, twelve (14.1%) from journals, fifteen (17.6%) from the internet, thirteen (15.3%) from their colleagues, and the remaining twenty-four (28.2%) from lectures given while in school.

What ART involves

Seventy-one (82.6%) of the dentists knew that ART involves management of caries using hand instruments only. Eight (9.3%) thought ART involves management of caries with both hand and rotary instruments, two (2.3%) rotary instruments only, while another four (4.7%) did not know.

Where ART was pioneered

Forty-one (48.2%) of the dentists knew ART was pioneered in East Africa, five (5.9%) in South Africa, three (3.5%) in West Africa, eight (9.4%) in Asia, nine
(10.6%) in Europe, three (3.5%) in America, while sixteen (18.8%) did not know.

The restorative material used in ART
Seventy-one (82.6%) of the dentists knew that the restorative material used in ART is Glass ionomer cement (GIC). Seven (8.1%) thought it is composite material, one (1.2%) thought it is amalgam, while seven (8.1%) did not know.

Potential clients for ART
Thirty-three of the dentists thought the best clients for ART are first time paediatric patients (39.8%), followed by anxious or fearful patients (32.5%), elderly patients (13.3%), difficult patients (6%) and talkative patients (2.4%). Five (6%) did not know.

Perception of ART

Whether they consider ART a practical procedure
Sixty-three of the dentists (76.8%) consider ART a practical procedure. Nineteen (23.2%) did not consider ART practical.

Whether ART can be used for permanent restorations
Forty (48.2%) of the dentists thought ART can be used for permanent restorations while forty-three (51.8%) did not.

Whether ART could be an alternative to conventional cavity preparation with rotary instruments
Fifty-four (63.5%) of the dentists did not think ART can be an alternative to conventional cavity preparation with rotary instruments, while twenty-five (29.4%) thought it could be. Four (4.7%) were not sure.

The future of ART in Kenya
Fifty-three (62.3%) of the dentists thought ART has a bright future, eight (9.4%) very dim, while twenty-three (27.1%) were not sure.

Main advantages of ART
The dentists' perceived advantages were as follows: no need for anaesthesia (32.9%), reduced pain (11.8%), better healing (4.7%), reduced risk of infection through instruments (11.8%), no need for patient follow-up (3.5%), does not require electricity and pressurized water (20%), reduced risk of secondary caries (1.2%), a very affordable procedure (11.8%).

Disadvantages of ART
The dentists’ perceived disadvantages of ART were: risk of infection if cavity toilet is not properly done (31%), limited access in some cavities (16.7%), difficult to conserve tooth substance without rotary instruments (4.8%), risk of residual caries (26.2%), very low longevity (9.5%), not totally atraumatic (10.7%).

Practice of ART

Whether they have ever placed ART restorations or not
Sixty-two of the dentists who participated in the study had never placed any ART restorations (72.9%), while only twenty-three of them had ever done so (27.1%).

Those who had ever placed ART restorations were interviewed further on their practices

Indication for ART as the restorative procedure of choice
Seventeen of the placed ART restorations were minimal to moderately large class I accessible to hand instruments in primary dentition and secondary dentition (73.9%). The remaining six were placed on a large class II, large class I or all cavity sizes and classes (25%).

How many such procedures they have ever done
Fourteen (60.9%) of the dentists had placed less than 5 restorations, six (26.1%) had placed up to 10 restorations, and three (13%) had placed more than 20 restorations.

Whether they considered the procedures successful
Nineteen of the dentists (82.6%) thought the procedures were successful, six did not think they were successful, or were still following the patients (12.9%).

Criteria for successful treatment
Sixteen of the dentists (69.5%) considered absence of post treatment pain and a restoration that lasted more than 5 years to be the main criteria of a successful treatment.

Failed treatment
Nineteen of the dentists (79%) considered failed treatment to be patient complaining of intolerable pain and sensitivity post operatively, and a fractured restoration.

Whether they are interested in learning more about ART
Twenty-one of the dentists (95.5%) were interested in learning more about ART, while only two were not (4.5%).
Those who had not performed any ART were asked the following questions:

**Why they have not performed any ART restorations**

Forty-two of the dentists (66.7%) had never had an opportunity to try, thirteen had inadequate knowledge about it (22.2%), while seven did not think it is practical and would never try it on a patient (11.1%).

**If they would perform ART on their patients if given opportunity to try**

Thirty-three of the dentists (55%) said they would perform ART on their patients if given the chance, while twenty-seven said they would not (45%).

**Whether they have ever observed a demonstration on ART**

Ten of the dentists (16.4%) had observed a demonstration on ART. Fifty-one had not (83.6%).

**Whether they are interested in learning more about ART**

Forty-seven of the dentists (75.8%) were interested in learning more about ART. Fifteen were not (24.2%).

**Discussion**

From this study, it was established that dentists in Nairobi are fairly knowledgeable about ART. Most of them (28.2%) learnt about it from lectures they were given while in school. Most of the dentists (82.6%) are correctly aware that ART involves management of dental caries with hand instruments only, and an adhesive filling material, Glass ionomer cement, as defined by Dr Jo Frencken.1 48.2% of the dentists know that ART was pioneered in East Africa, and that the potential clients include first-time paediatric patients, anxious or fearful patients, and the elderly who cannot easily access dental services.2,5 The dentists are also aware of the main advantages of ART as reduced need for local anaesthetic, reduced pain, reduced risk of infection through instruments, no need for electricity and piped water, reduced risk of secondary caries and a very affordable procedure. These are consistent with those results obtained from studies such as that carried out by Carvalho et al (2003) in sixteen 5 - 7 year olds following ART treatment which showed significant reduction of mutants streptococci levels in saliva one week (95.95%), four weeks (93.27%), and one year (95.56%), after ART as compared to saliva before treatment.6 A study conducted among Finnish elderly persons, mean age 74.5 years showed a promising advantage of patient satisfaction because the patients did not have to go out to visit the dentist, but rather had one come to their homes and this was enabled by the fact that the dentist did not need pressurized water nor electricity in order to treat the patients.11

The disadvantages quoted by the dentists included risk of infection if cavity toilet is not properly done (31%), limited access in some cavities (16.7%), risk of residual caries (26.2%), low chance of survival of the restoration (9.5%), and that the procedure is not totally atraumatic (10.7%). The response to these suggested disadvantages was as variable among the dentists as it is among different researchers. Amerongen et al (1999) considers the choice of ART defensible because the patients experience less discomfort with ART procedure without anaesthesia, and preparations thus made are smaller than those prepared with rotary instruments2, while Anusavice et al (2003) reports that access to the cavity using hatchets to widen entrance or fracture overhanging enamel may cause fragmentation of sound or undermined enamel, and that excavation of carious dentin with hand instruments although less painful than with rotary instruments, is traumatic.9

Another issue that has come up is that regarding residual caries. According to Weerheijm et al (1999), three important measures if considered carefully during the cavity preparation and filling, contribute to caries arrest. However all three need to be combined in order to be effective. These three measures are: isolating the caries process from the oral environment, excavating the carious dentin and using a cariostatic filling material.1,6 Regarding these three measures: In general, isolation leads to a reduction in the number of microorganisms but the sealant or restoration must be very secure and last for a long time; although microorganisms are not always removed during excavation, it remains an important step in arresting the caries process; cariostatic properties are attributed to some filling materials, for example, GIC, dentin conditioner like 37% phosphoric acid, supposedly ensuring reduction of the remaining microorganisms.6,9 How about a place in preservative dentistry? According to Anusavice (1999), retention rates for ART restorations are not impressive, especially for primary teeth. ART technique offers some benefits in restoring function and reducing rate of caries progression but, it is unlikely that current materials will be able to arrest caries progression completely in high risk persons.7 In a typical situation where ART is considered, the option of remineralisation has been lost already and there is a cavitated lesion; preservative dentistry represents an ultra conservative philosophy of delaying placement.
of first restoration or replacement of restorations till there is evidence of cavitations or definite failure is observed or is highly likely.7

However, the present study established that the dentists in Nairobi have a poor perception of ART. Although 76.8% of them consider ART a practical procedure, 51.8% of these do not think ART can be used for permanent restorations. Furthermore, 63.5% do not think ART can be an alternative to conventional cavity preparation with rotary instruments. This is probably because of the dentists' bias against or misinformation concerning the ART approach. These perceptions contrast results of studies done to compare ART with conventional restorations. Monse-Schneider et al assessed whether amalgam restorations would retain successfully in ART repaired cavities and reported a high survival rate (95.1%) of large occlusal restorations.9,16,17 A one year evaluation of ART and MIT in primary dentition of 6 to 9 year old school children using Fuji IX (GIC) and Dypract (composite) materials exhibited an overall 86% success.18 62.1% of the dentists think ART in Kenya has a bright future. This is at per with worldwide studies which have recognized that there is great potential and room to improve ART.17,19

Findings from this study established that there is limited practice of ART among dentists in Nairobi. 72.9% of the participants have never placed ART restorations, and only 10% of these have ever observed a demonstration on ART. This may be due to the fact that they have inadequate knowledge about it, and because most dentists practice in hospital set-ups, with provisions for modern dentistry like piped water and electrically driven dental units, having no need, and therefore no opportunity to place ART restorations. Among the few who have, most of them have placed less than 5 restorations, and the majority considered the restorations successful. Most of these restorations were placed in the field during community outreach programs. All among those who have placed ART restorations, and 75.8% of those who have not were interested in learning more about ART. This may be because they realize the importance of such a convenient and affordable method of caries management in a third world country like Kenya, in which majority of the population has no access to proper dental care.

Conclusion

Dentists in Nairobi were found to be knowledgeable about ART. They are aware that ART involves management of dental caries with hand instruments only, and an adhesive filling material, usually Glass ionomer cement. The dentists also know that the potential clients for ART include first time paediatric patients, fearful or anxious patients, and elderly patients. They consider the main advantages to be reduced need for anaesthesia, no need for electricity and piped water, and that it is a very affordable procedure, and the main disadvantages to be risk of residual caries, very low chance of survival of the restorations, and the fact that it is not totally atraumatic. Dentists in Nairobi have a poor perception of ART. Although most of them consider ART a practical procedure, they do not think it can be used for permanent restorations, nor could it be an alternative to conventional cavity preparation with rotary instruments. However, majority of them think ART in Kenya has a bright future.

Very few dentists in Nairobi practice ART approach in their practice. However, most of them are interested in learning more about ART.

Recommendations

1. The knowledge of ART among dentists in Nairobi should be improved through continuing dental education seminars and workshops.
2. Perception of ART should be improved through education as it appears to have a direct bearing on the practice.
3. Practice of ART should be encouraged among the dentists because in a third world country like Kenya, the population with no access to proper dental care would benefit greatly from the facilities.

References


Antifungal drug susceptibility of *candida* species
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2. Microbiology Research Center, KEMRI

Abstract

**Objective:** To determine the susceptibility of clinical isolates of *Candida* species and to establish the Minimum Inhibitory Concentrations (MIC) to commonly used antifungal drugs.

**Design:** Laboratory Based Experiment.

**Setting:** Mycology Laboratory, Kenya Medical Research Institute, Nairobi, Kenya.

**Subjects:** 150 Candida species isolated from 1997 in Mycology laboratory from blood, stool, urine, CSF and swabs of patients from Cottolengo St Thomas Bernados, Mbagathi District Hospital, Agakhan Hospital and Kenyatta National Hospital.

**Methods:** Susceptibility to Fluconazole, Clotrimazole, Nystatin and Amphotericin B was done using Broth Microdilution Technique with reference to NCCLS document (2002).

**Results:** Among the 130 *Candida albicans* isolates, susceptibility to fluconazole was 70.3%, susceptible dose dependent was 10.5% whereas 10.2% of the isolates were resistant to fluconazole. 90.3% of the isolates had an MIC ≤ 1 μg/ml to amphotericin B. 80.5% of the isolates had an MIC ≤ 4 μg/ml to clotrimazole whereas 90.5% of the isolates had an MIC ≤ 4 μg/ml to Nystatin. The rest (20) non albicans Candida were fairly susceptible to the four antifungal drugs with increased MICs reported at few instances.

**Conclusion:** The study showed increased MICs among some *Candida* species to commonly used antifungals. This therefore calls for further investigations on fungal resistance especially in the context of opportunistic infections of HIV/AIDS.

Introduction

Fungi are opportunistic organisms which are ubiquitous in nature. The last two decades have seen a steady increase in the incidence of systemic fungal infections especially due to opportunistic fungi.¹ Prolonged antimicrobial therapy, invasive procedures, immunosuppressive therapy and acquired Immunodeficiency Syndrome (AIDS) pandemic have contributed to the rise in the systemic fungal infections.² Fungal infections particularly those due to yeasts have significantly increased and species diversity has been modified significantly.³ ⁴ The incidence of invasive fungal infections, particularly those caused by *Candida* species has increased over the past few decades.⁵ ⁷ These infections are major complications in immunocompromised patients and in patients with profound neutropenia due to hematological malignancies or chemotherapy. These infections are usually associated with high mortality.⁸ ⁹ The available treatment for infected patients include azoles (fluconazole, ketoconazole, voriconazole and clotrimazole) and polyene antifungals. During the past decade there has been an emerging resistance among *Candida* species to these antifungals.¹⁰ ¹¹ ¹² This has made it necessary to identify yeasts to species, serotype and to monitor for current levels of antifungal resistance. The present study therefore aimed at determining the current levels of MICs to the four commonly used antifungal drugs. This is necessary for clinicians to make appropriate treatment choices.

Materials and methods

*Candida* species were isolated from different species namely; swabs, sputum, stool, urine, CSF and blood. Preliminary isolation from stock was done using Sabourauds Dextrose Agar (SDA) incorporated with 2% Chloramphenicol. The Germ Tube Test (GTT) was used for presumptive identification of *Candida albicans*. GTT negative yeasts were further identified on slide culture using chlamydospore formation on Corn Meal AGAR incorporated with Tween 80.⁶ Confirmation of the isolates was done using API CAUX 20 and CHROMagar *Candida* (Sanofi Diagnostic Reagent, Paris)⁷
The susceptibility tests and Minimum Inhibitory Concentration (MIC) were done as recommended by NCCLS. The MIC was scored as the lowest concentration that significantly inhibited fungal growth.

Results

The isolates were fairly susceptible to commonly used antifungal drugs. *C. albicans* susceptibility to fluconazole (MIC ≤8 μg/ml) was 97/130 (70.3%), susceptible dose-dependent (MIC 16-32 μg/ml) 19/130 (10.5%) and resistant (MIC ≥64 μg/ml) 16/130 (10.2%). The MIC 50 and MIC 90 to fluconazole were 1 μg/ml and 64 μg/ml respectively. At 1 μg/ml of amphotericin B, most of the isolates were inhibited with only 121/130 (90.3%) with MIC of ≤1 μg/ml. The MIC 50 and MIC 90 to Amphotericin B were 0.25 μg/ml and 1.0 μg/ml respectively. Elevated MIC (≤4 μg/ml) to clotrimazole and nystatin was demonstrated by 120/130 (80.5%) and 124/130 (90.5%) respectively. The MIC50 and MIC90 of clotrimazole and nystatin were 1.0 μg/ml, 0.29 μg/ml and 16 μg/ml, 18.5 μg/ml respectively. The rest (20) non-albicans Candida were fairly susceptible to all the four drugs with resistance reported on very few instances.
Table 1: Susceptibility of clinical isolates of Candida albicans to common Antifungal drugs

<table>
<thead>
<tr>
<th>Antifungal Drug</th>
<th>No. of isolates</th>
<th>No of isolates with MIC≤ 4 µg/ml (%)</th>
<th>No of isolates with MIC≥4 µg/ml (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clotrimazole</td>
<td>130</td>
<td>120 (80.5%)</td>
<td>10 (19.5%)</td>
</tr>
<tr>
<td>Nystatin</td>
<td>130</td>
<td>124 (90.5%)</td>
<td>6 (9.5%)</td>
</tr>
<tr>
<td>Amphotericin B</td>
<td>130</td>
<td>No of isolates</td>
<td>No of isolates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>MIC ≤1 µg/ml121 (90.3%)</td>
<td>MIC ≥1 µg/ml9.7%</td>
</tr>
</tbody>
</table>

Table 2: A table showing distribution of Candida albicans Isolates at different Fluconazole concentration

<table>
<thead>
<tr>
<th>Category</th>
<th>MIC range (µg/ml)</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Susceptible (S)*</td>
<td>≤ 8</td>
<td>95 (70.3)</td>
</tr>
<tr>
<td>Susceptible dose dependant (S-DD)</td>
<td>16-32</td>
<td>19 (10.5)</td>
</tr>
<tr>
<td>Intermediate (I)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Resistant (R)</td>
<td>≥ 64</td>
<td>16 (10.2)</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>130</td>
</tr>
</tbody>
</table>

Discussion

In the recent years the number of serious opportunistic yeast infections, particularly in immunocompromised patients has dramatically increased (Richardson et al., 2003). Among these Candida species accounts for a large number of serious opportunistic yeasts. This study investigated a total of one hundred and fifty Candida isolates from clinical sources in Nairobi. Isolates were recovered from swabs, urine, sputum, aspirates, Cerebral Spinal Fluid (CSF), blood and bile. Majority of the isolates were from swabs including vaginal swabs and throat swabs.

During the last decade, the higher incidence of fungal infections in hospitalized patients has resulted in the use of systemic antifungal agents especially fluconazole, which remains a first line antifungal agent (Redding et al., 1994).

Our study investigated four antifungal drugs against their effects on Candida species. Two polyenes (Amphotericin B and Nystatin) and two azoles (fluconazole and clotrimazole) were used in the study.

Most Candida albicans were susceptible (70.3%) to fluconazole with an MIC ≤ 8µg/ml. However 12.2% were resistant. (Table 3). This is in agreement with previous studies by scientists whereby fluconazole resistant C. albicans accounts for 9-12% of the isolates from HIV-Positive patients (Newman, 1994). Since C. albicans is a natural part of the intestinal and vaginal flora, and thrush is merely its overgrowth, drugs that keep candidiasis at its check may never completely eradicate it. The continued presence of the organism during treatment makes the selection of drug resistant fungal organisms more likely. In fact as prophylactic use of azoles has increased so as the incidence ofazole resistant Candida (Pfaller, 1995).

Azole antifungal agents have therapeutic activity against different Candida species. Among azole drugs, fluconazole shows tolerance and efficiency. However in the recent years increasing resistance with fluconazole has appeared and antifungal drug resistance is quickly becoming a major problem in immunocompromised patients. (Wheat, 1998).

Majority of the non albicans Candida used in our investigation were susceptible to fluconazole. However a marked resistance was observed among Candida glabrata and C. krusei. (Table 4). This is in agreement with past studies by Pfaller et al., 1995 that there has been an emerging resistance to fluconazole among the two.

Clotrimazole is a tritylimidazole derivative [bisphenyl-(2chlorophenyl)-1-imidazolylmethylene]. Initially developed by Bayer in 1968, it was the first commercially available azole antifungal drug (Holt et al., 1972). Released in 1975 as a topical antifungal agent, clotrimazole has been a well-tolerated and frequently administered drug for mucocutaneous candidiasis. Clotrimazole is approved for both treatment and prevention of OPC.

Initial in vitro studies of clotrimazole used various methodologies (Bergen et al., 1983, Hamilton 1972 and Hoeprich et al., 1976). Previous testing of the antifungal activity of clotrimazole disclosed several difficulties. As clotrimazole is highly insoluble in water, the drug must first be dissolved with an organic solvent such as dimethylformamide ethanol (Hoeprich et al., 1976), chloroform, polyethylene glycol (Holt et al., 1972), or DMSO (Hussein et al., 1986). Further
dilution of the drug can be completed by using an aqueous growth medium. Hoeprich and Huston demonstrated that using undefined growth media may affect the MICs of azoles such as clotrimazole and miconazole (Hoeprich et al., 1976). As recommended by NCCLS standard M27-A, the use of a defined growth medium, such as RPMI, could obviate this problem. Inoculum size also was previously reported to influence MICs of clotrimazole (Plemell et al., 1969).

79% of Candida albicans had an MIC of ≤ 1 µg/ml of clotrimazole. However, 12.2% of the isolates had an MIC of ≥ 16 µg/ml which is an indication of resistance to the drug. Clotrimazole has been shown to inhibit all the major fungi causing systemic infection, at a concentration of 1 µg/ml, with efficacy against Candida, Histoplasma and Aspergillus species (Graham Smith and Arsonson, 1992). Although favorable results from systemic treatment of candidiasis and aspergillosis have been described, most C. albicans still show high MICs to clotrimazole. Induction of low blood pressure and toxicity are some of the drawbacks for its systemic use. Despite the high MIC to clotrimazole, the drug is extensively used in Kenya for management vaginal candidiasis and for dermatological conditions. On the other hand, 25% of non albicans Candida had an MIC ≥ 16 µg/ml, which also indicates an emerging resistance to clotrimazole.

At present, there are no established interpretive breakpoint criteria by which to designate a Candida isolate as either susceptible or resistant to clotrimazole. Interpretive breakpoint criteria have been defined for fluconazole and itraconazole against Candida spp. (Rex et al., 1997). Logically, we must label an isolate as resistant to a drug if its MIC exceeds the amount of the drug attainable in the infected tissue of a patient. However, the correlation between the antifungal activity of in vitro levels and levels of the drug in tissue is often variable. Clotrimazole troches, for example, may achieve salivary concentrations of 5.2 to 15 µg/ml for as long as 3 h after dissolution (Shadomy, 1971). Factors such as protein binding, physiologic temperature, and local pH and osmolality may alter the antifungal activity of the same drug concentration in vitro and in vivo. Correlation between in vitro concentrations and clinical response is a key variable in determining breakpoint criteria. In Kenya, a one percent topical cream application for dermatomycoses and a 100 mg pessary for vaginal candidiasis are still widely used.

Majority of the Candida albicans isolates were susceptible to amphotericin B with only 2.3% of the isolates with an MIC ≥ 16 µg/ml. The non albicans Candida were also sensitive to amphotericin B drug which only one non albicans candida was resistant to amphotericin B. Amphotericin B is still widely used as the drug of choice for most patients especially in the developing world. It should also be noted that amphotericin B can only be administered in low doses due to its toxicity.

Most of the Candida albicans and non albicans Candida were susceptible to nystatin with majority of isolates having an MIC range of 0.07-1.15 µg/ml. Nystatin has been considered effective against Candida esophagitis (Nyst et al., 1992). A cure rate of less than 10% has been reported in Zaire (Nyst et al., 1992) and 21.6% in Uganda (Ravera et al., 1999).

The susceptibility pattern revealed that most of the Candida isolates were susceptible to amphotericin B, fluconazole and nystatin. Candida species were most sensitive to amphotericin B. Prevalence of resistance to amphotericin B was lowest followed by nystatin and azoles. Candida has shown reduced susceptibility to clotrimazole. Fungal infections are often challenging to manage; caution has to be exercised in the use of antifungal drugs to arrest any further increase in the resistance.

### Conclusion

The study revealed that most of the Candida species showed increased MICs to commonly used drugs. This calls for further research into the mechanisms of resistance and regular monitoring of susceptibility levels of Candida species to the antifungals. This is important for clinicians to make appropriate treatment choices and for management of Candidiasis which has emerged as a common opportunistic disease especially due to HIV/AIDS.

### References

Dental caries and Oral Health Practices among 12 year old children in Nairobi West and Mathira West Districts, Kenya
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2 Jomo Kenyatta University of Agriculture and Technology
3 Kenya Medical Research Institute

Abstract

Background: Dental caries is a common disease in children which causes pain with resultant effect on various physiological and social functions.
Objective: To determine the dental caries prevalence and the association between dental caries and oral health practices among 12 year old children in Nairobi West and Mathira West districts, Kenya.
Design: Cross-sectional study
Setting: Nairobi West and Mathira West districts, Kenya
Time frame: August 2009-February 2010
Participants: Six hundred and thirty nine children aged 12 years
Results: Nairobi West District had significantly higher caries prevalence of 37.5% than Mathira West District (24%). The mean Decayed, Missing and Filled Index (DMFT) in Nairobi West District was 0.76 ± 1.2, while in Mathira West District it was 0.36 ± 0.7. On multivariate analysis high consumption of soda was found to be a significant risk factor for dental caries in Nairobi West District (Odds Ratio (OR) = 3.0). In Mathira West District having an illiterate mother (OR= 4.3) was a significant risk factor for dental caries.
Conclusions: Countrywide intensive oral health promotion should be carried out especially in urban areas, to reduce the higher prevalence of dental caries. The school health policy should be used to promote oral health by provision of oral health instructions and highlighting harmful dietary practices. Preventive practices such as regular dental checkups should be advocated and promoted in schools.

Introduction

Dental caries is a chronic infectious disease that causes demineralization of teeth. The interaction of four factors allows this to happen: a susceptible tooth surface, specific bacteria in dental plaque (e.g., Streptococcus mutans, lactobacillus), time and a diet rich in fermentable carbohydrates, particularly refined sugars. The impact of dental caries includes oral pain which may affect speech, eating, sleeping, swallowing and breathing. The altered appearance it causes can lead to low self esteem and undermine social acceptance ¹.

The World Health Organization (WHO) recognizes dental caries as a pandemic and reports that the prevalence of dental caries among school aged children is 60% to 90%. ² In several industrialized countries the prevalence and severity of dental caries have declined substantially because of preventive oral health care programmes and changes in living conditions and lifestyles. ³ In developing countries, especially sub-Saharan Africa, the prevalence varies according to country population group and socioeconomic status. ⁴

To date, no national oral survey has been carried out to determine the prevalence of dental caries in Kenya. A study done in 1992 found the prevalence of dental caries to be 40% to 50% among children aged 13-15 ⁵ in Nairobi, while in 2006 Kassim et al. found the prevalence among adults living in a rural arid region, to be 43%. ⁶ Basic oral health education is taught in Kenyan primary schools. Children are instructed to avoid sugary foods because they cause dental caries. They are also taught that they should brush their teeth three times a day. The two messages are important but do not cover the entire aspects of dental caries and its prevention. Another source of dental education is dental clinics, but access to these facilities is limited due to several barriers including poverty. A visit to a public dental clinic will require one to purchase a card the cost of which is prohibitive to many people. Government facilities are also understaffed and are unable to provide dental education to visiting clients as demonstrated by the dentist-population ratio of 1:60,000 of which 80% are situated in the urban areas. ⁷ Dental caries has been shown to affect a significant number of children in our country but there is limited recent information about dental caries proportion
and oral health habits among children in Kenya. We describe the dental caries experience and proportion among 12 year old children in two Kenyan districts and related it to their oral health habits.

Materials and Methods

Study design
We conducted a cross-sectional study on the relationship between dental caries and oral health practices among 12 year old children attending public primary schools in Nairobi West and Mathira West districts, Kenya.

Setting
The study was conducted in two districts. Nairobi West District is located in Nairobi province the capital city of Kenya and is predominantly an urban area. It is a cosmopolitan district. Drinking water is supplied by pipes to homes by the Nairobi Water Company. Mathira West District is located in Central Province and is predominantly a rural area. The main economic activity is farming and the main sources of drinking water are boreholes, rivers and streams.

Study population
The study population consisted of 12 year old children attending public primary schools. Children aged 12 years were used as the study population as this is an index age recommended by WHO. We included children who assented to the study and whose parents/guardians gave written informed consent.

Time frame
The Study was conducted between August 2009 and February 2010.

Sampling
A two stage sampling technique was used. Stratified sampling system was used to sample the primary schools. A total of twelve schools were included, six schools from Nairobi West District and six from Mathira West District were identified. In Nairobi West District two schools were randomly selected from each of the three divisions. In Mathira West District two schools were randomly selected from each of the three locations. To select the children, simple random sampling was used. A register was obtained containing all the 12 year olds. A unique number was assigned to each child and then a list of random numbers was generated using the computer via Microsoft Excel software. A total of sixty children were selected from each school and the refusal rate ranged from 0%-15% in both districts.

Data collection
An interviewer-administered pre-tested questionnaire was used to collect data from the children. Consumption of cariogenic food was classified into three categories: high consumption (consumes at least three times a week), low consumption (consumes two times a week or less) and never consumes.

Clinical examination
Dental caries status was determined by oral screening using the WHO caries diagnostic criteria: Decayed Missing Fillet Teeth DMFT. Dean’s index was used to record the prevalence of dental fluorosis. Results were reported as either sound (score 0) or fluorosed (score 1-4) very mild to severe. Instruments used during the screening included dental mirrors and tongue depressors. The children were examined while seated in an upright chair using natural day light. All examinations were done in the classrooms independently by two examiners. A calibration exercise was conducted to assess the consistency of the two examiners, which revealed agreement between the two examiners for all but 8% of the children. Differences between the two examiners were discussed and a consensus reached upon.

Fluoride content in water
One water sample was collected from each of the six schools in Nairobi West District for analysis of their fluoride content. In Mathira West District six water samples were collected from nearby rivers, water tank and boreholes. The fluoride analysis was done at Kenya Water Institute Laboratory. Fluoride concentration was determined using photometric analysis.

Ethical considerations
Approval to conduct the study was given by The Jomo Kenyatta University of Agriculture and Technology, National Council of Science and Technology and the Nairobi City Council. Written informed consent was obtained from the children’s guardian/parents and assent was sought from the children. All children were interviewed, examined and information obtained treated confidentially. They were consequently given oral health education, advice and referral instructions if indicated.

Data management and analysis
The collected data were entered, cleaned and stored
using Epi info version 3.3.2. Measures of statistical significance were done using T-test, Chi-square and Wilcoxon test. P-value of less than 0.05 was considered significant. Logistic regression was done using the forward method by including variables that had p-values of less than 0.25.

Results

Study Population
A total of 639 children participated in the study. Of these, 347 (54%) were from Nairobi West District while 292 (46%) were from Mathira West District. Females were 57% and 52% in Nairobi West and Mathira West respectively. The mothers of the children in Nairobi West had a higher level of education than compared to Mathira West as 75% had secondary level and above compared to 56% in Mathira West District. Two percent and 3% of mothers in Nairobi West and Mathira West Districts respectively had no formal education.

Dental caries status
The prevalence of dental caries was significantly higher in Nairobi West District (37.5%) than in Mathira West District (24%) (OR= 1.9, CI=1.3-2.7). The major portion of caries experience for both districts was decayed teeth. The mean DMFT was 0.76 in Nairobi West and 0.36 in Mathira West. None of the children in Mathira West District had their teeth filled (Table 1). The mean decayed, missing and DMFT were significantly higher in Nairobi West than Mathira West.

Table 1: Caries experience among 12 year old children in two Kenyan districts, 2009-2010

<table>
<thead>
<tr>
<th></th>
<th>Nairobi West</th>
<th></th>
<th>Mathira West</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of teeth</td>
<td>Index</td>
<td>Number of teeth</td>
<td>Index</td>
</tr>
<tr>
<td>Decayed Teeth</td>
<td>233</td>
<td>0.67*</td>
<td>102</td>
<td>0.35</td>
</tr>
<tr>
<td>Missing Teeth</td>
<td>19</td>
<td>0.05*</td>
<td>3</td>
<td>0.01</td>
</tr>
<tr>
<td>Filled Teeth</td>
<td>13</td>
<td>0.02</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>DMFT</td>
<td>265</td>
<td>0.76*</td>
<td>105</td>
<td>0.36</td>
</tr>
</tbody>
</table>

DMFT: Decayed, missing and filled index, *p<0.05

Sixty-one percent and 54% of the children in Nairobi West and Mathira West districts respectively, brush their teeth two or more times per day as indicated in Table 2. Chewing sticks were reported to have been used by 14% and out of these 1.2% and 30% were from Nairobi West and Mathira West districts respectively. In all, 77% of the children admitted to brushing each of their teeth carefully. Twenty nine percent of children in Nairobi West District had received instructions on tooth brushing while in Mathira West District 40% had received instructions. The proportion of those who had ever visited the dentist was more than twice for Nairobi West District children in comparison to Mathira West District.

Table 2: Oral health practices among 12 year old children in two Kenyan districts, 2009-2010

<table>
<thead>
<tr>
<th></th>
<th>Nairobi West n=347</th>
<th>Mathira West n=292</th>
<th>Total n=639</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of tooth brushing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less often than daily</td>
<td>12 (4.0%)</td>
<td>10 (3.0%)</td>
<td>22 (3.0%)</td>
</tr>
<tr>
<td>Once /day</td>
<td>122 (35.0%)</td>
<td>152 (52.0%)</td>
<td>274 (43.0%)</td>
</tr>
<tr>
<td>Two or more/day</td>
<td>213 (61.0%)</td>
<td>130 (45.0%)</td>
<td>343 (54.0%)</td>
</tr>
<tr>
<td>Tooth cleaning aids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toothbrush and toothpaste</td>
<td>322 (96.0%)</td>
<td>192 (66.0%)</td>
<td>514 (80.0%)</td>
</tr>
<tr>
<td>Chewing stick</td>
<td>4 (1.2%)</td>
<td>88 (30.0%)</td>
<td>92 (14.0%)</td>
</tr>
<tr>
<td>Others**</td>
<td>21 (2.8%)</td>
<td>12 (4.0%)</td>
<td>33 (6.0%)</td>
</tr>
<tr>
<td>Reported brushing every tooth very carefully</td>
<td>320 (93.0%)</td>
<td>168 (58.0%)</td>
<td>488 (77.0%)</td>
</tr>
<tr>
<td>Reported receiving instructions on tooth brushing</td>
<td>100 (29.0%)</td>
<td>116 (40.0%)</td>
<td>216 (34.0%)</td>
</tr>
<tr>
<td>Reported visiting a dentist at least once</td>
<td>132 (38.0%)</td>
<td>51 (18.0%)</td>
<td>183 (2.0%)</td>
</tr>
<tr>
<td>Of those visiting a dentist</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reasons for dental visits</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;For a check up&quot;</td>
<td>22 (17.0%)</td>
<td>6 (12.0%)</td>
<td>28 (15.0%)</td>
</tr>
<tr>
<td>&quot;My gums were bleeding&quot;</td>
<td>8 (6.0%)</td>
<td>3 (6.0%)</td>
<td>11 (6.0%)</td>
</tr>
<tr>
<td>&quot;Teeth were growing badly&quot;</td>
<td>14 (11.0%)</td>
<td>3 (6.0%)</td>
<td>18 (10.0%)</td>
</tr>
<tr>
<td>&quot;My teeth were loose&quot;</td>
<td>6 (4.0%)</td>
<td>2 (4.0%)</td>
<td>8 (4.0%)</td>
</tr>
<tr>
<td>&quot;My tooth was aching&quot;</td>
<td>82 (62.0%)</td>
<td>37 (72.0%)</td>
<td>118 (65.0%)</td>
</tr>
<tr>
<td>Reported visiting a dentist within the past 12 months</td>
<td>70 (20.0%)</td>
<td>34 (12.0%)</td>
<td>104 (16.0%)</td>
</tr>
</tbody>
</table>

**Includes salty water, charcoal and limestone
In Mathira West District having a mother with no formal education was a significant risk factor for dental caries (OR=4.3) as illustrated by table 3. In both districts children who had ever visited a dentist were more likely to have dental caries than those who had never visited a dentist. In Nairobi West district children who ate cakes/biscuits had significantly more caries than those who never ate cakes/biscuits. The risk of dental caries was significantly higher among children who drank sodas at a higher frequency compared to those who did not drink (OR=2.2) in Nairobi West District. There was no significant difference in the distribution of dental caries by sex, frequency of tooth brushing and presence of dental fluorosis.

The mean Fluoride water content for Nairobi West District was 0.59mg/L range 0.35-0.85 while for Mathira West District was 0.77mg/L range 0.4-1.05. The difference between the fluoride content in the two regions was not significant.

Logistic regression analysis revealed that high consumption of soda was a significant risk factor for dental caries in Nairobi West District (OR= 3.2 CI 1.3-8.0). In Mathira West District having an illiterate mother was a significant risk factor for dental caries (OR=4.3, CI 1.1-1.6).

Table 3: Dental caries in relation to sociodemographic characteristics, oral health habits and consumption of cariogenic foods among children in two Kenyan districts

<table>
<thead>
<tr>
<th>Sociodemographic characteristics</th>
<th>Nairobi West</th>
<th>Mathira West</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>Children with caries # (%)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>199</td>
<td>78 (39)</td>
</tr>
<tr>
<td>Male</td>
<td>148</td>
<td>52 (35)</td>
</tr>
<tr>
<td><strong>Mothers education</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No formal education</td>
<td>8</td>
<td>3 (38)</td>
</tr>
<tr>
<td>Primary</td>
<td>49</td>
<td>16 (33)</td>
</tr>
<tr>
<td>Secondary and above</td>
<td>259</td>
<td>103 (40)</td>
</tr>
<tr>
<td><strong>Dental fluorosis present</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>28</td>
<td>11 (40)</td>
</tr>
<tr>
<td>No</td>
<td>319</td>
<td>119 (38)</td>
</tr>
<tr>
<td><strong>Oral health practices</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Frequency of tooth brushing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less often than daily</td>
<td>12</td>
<td>4 (33)</td>
</tr>
<tr>
<td>Once /day</td>
<td>122</td>
<td>51 (31)</td>
</tr>
<tr>
<td>Twice or more/day</td>
<td>213</td>
<td>75 (35)</td>
</tr>
<tr>
<td><strong>Reported receiving instructions on tooth brushing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>100</td>
<td>37 (37)</td>
</tr>
<tr>
<td>No</td>
<td>247</td>
<td>93 (38)</td>
</tr>
<tr>
<td><strong>Reported visiting a dentist at least once</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>132</td>
<td>64 (49)</td>
</tr>
<tr>
<td>No</td>
<td>215</td>
<td>66 (31)</td>
</tr>
<tr>
<td><strong>Reported visiting a dentist within the past 12 months</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>70</td>
<td>40 (57)</td>
</tr>
<tr>
<td>No</td>
<td>177</td>
<td>90 (33)</td>
</tr>
<tr>
<td><strong>Reported cariogenic food consumption</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sweets</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>190</td>
<td>71 (38)</td>
</tr>
<tr>
<td>Low</td>
<td>114</td>
<td>47 (41)</td>
</tr>
<tr>
<td>Never</td>
<td>45</td>
<td>12 (28)</td>
</tr>
<tr>
<td><strong>Cakes/biscuits</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>148</td>
<td>63 (42)</td>
</tr>
<tr>
<td>Low</td>
<td>136</td>
<td>52 (38)</td>
</tr>
<tr>
<td>Never</td>
<td>63</td>
<td>13 (24)</td>
</tr>
<tr>
<td><strong>Soda</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>117</td>
<td>55 (47)</td>
</tr>
<tr>
<td>Low</td>
<td>177</td>
<td>60 (34)</td>
</tr>
<tr>
<td>Never</td>
<td>55</td>
<td>15 (28)</td>
</tr>
</tbody>
</table>

ref = reference group
OR = Odds Ratio
CI = Confidence Interval

*p<0.05
Discussion

We found the prevalence of dental caries to be 37.5% (DMFT 0.76) in Nairobi West and 24% (DMFT 0.36) in Mathira West. This shows a decline in dental caries as compared to previous Kenyan studies that found a prevalence of 50% in 11–13 year olds and 64% in 3-5 year olds. The decrease may be attributed to increased oral health awareness and increase in number of available dental professionals.

The prevalence of dental caries and the DMFT was significantly higher in Nairobi West District than in Mathira West District. Living in urban areas has implications for lifestyle, including dietary patterns and has been shown to be associated with an increased prevalence of dental caries. The prevalence of dental caries found here is slightly lower than other East African countries who have recorded a prevalence of 41% in urban area and 29% in rural areas in Uganda, in Tanzania the prevalence among urban children was 41.5%. Some African countries are also experiencing a similar status of dental caries as seen in a study done in Burkina Faso where the urban area prevalence was 33.8% while the rural area prevalence was 21.2%.

The decayed component of DMFT formed the major component in both districts: Nairobi West District DT 0.67 and Mathira West District DT 0.35. These high numbers of untreated teeth may be a result of a low perception of the need for treatment and the low priority placed on oral health care compared with other needs. None of the children in Mathira West District had any of their teeth filled as opposed to their counterparts in Nairobi West District where 13 fillings were found. This can be explained by the reduced number of dental clinics both private and public in the rural areas and lack of resources in the few clinics that available. A study done in South Africa also indicated that none of the 12 year olds in the rural population had their teeth filled.

Children who had mothers with no formal education had higher caries prevalence than children whose mothers had secondary and above level of education in Mathira West District. Similar findings have been reported in Uganda. Mothers with no formal education may lack access to literature on caries prevention and oral health in general.

Sixty one percent of children in Nairobi West District and 45% of children in Mathira West district brush their teeth at least twice per day. These figures are higher than what has been reported in Sudan where 30% of twelve year old children brush their teeth at least twice a day. In both districts having received instructions on how to correctly brush teeth was found to be protective against dental caries.

Sixty-two percent of the children in Nairobi West District and 82% in Mathira West District had never visited a dentist compared to 76% in Tanzania, 60% in India (16) 34% in Thailand. Although a prior study done in Sudan showed that children who had ever visited a dentist had lower caries prevalence than those who had visited in prior studies, this was not supported here. Our study found that children who had reported visiting a dentist at least once had significantly higher caries prevalence than those who had not in Nairobi West District. The same results applied to those who reported visiting a dentist within the past 12 months though the association was slightly more for both districts. This finding is in agreement with other studies and be explained by the fact that children tended to visit the dentist when there was already a problem instead of going for routine checkups as confirmed by the reasons they gave for visiting the dentist; only 15% had gone for a checkup. Reasons for visiting were curative rather than preventive.

Children who ate cakes/biscuits had significantly higher dental caries prevalence than those who never ate cakes/biscuits. In addition high consumption of sodas was a significant risk factor for dental caries. A study done in Mexico revealed that drinking of sodas particularly between meals was significantly associated with dental caries.

This study has several potential limitations. First, the study uses school children who are twelve years old, thereby missing the small percentage of children not attending school. The children in this study may therefore not representative of the general population. Secondly, we did not have a way to verify the information reported on the questionnaire as we could not assess its validity, therefore there could have been information bias including over-reporting of socially accepted behavior such as tooth brushing and under-reporting for less accepted behavior such as consumption cariogenic food. Nevertheless the self-reported information clearly shows deficits of healthy oral hygiene behavior, and the dental examination documented a high degree of inadequate dental care.

Conclusion

In conclusion we recommend that countrywide intensive oral health promotion should be carried out
especially in urban area, to reduce the high prevalence of dental caries. The school health policy should be used to promote oral health by provision of oral health instructions and education on harmful dietary practices. Preventive practices such as regular dental checkups should be advocated and promoted in schools.

Acknowledgements
We would like to thank the children, their parents and teachers of the twelve schools we visited for their support and co-operation. We are grateful to the Field Epidemiology and Laboratory Training Programme Division in the Ministry of Public Health and Sanitation for financial support.

References
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