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## EARLY CHILDHOOD CARIES IN MOSHI, TANZANIA

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D.S. RWAKATEMA and P.M. NG'ANG'A

### ABSTRACT

**Objective:** To determine the prevalence, severity and pattern of early childhood caries (ECC) in Moshi Municipality, Tanzania.

**Design:** Cross-sectional study.

**Setting:** Moshi Municipality, Kilimanjaro region, Tanzania.

**Subjects:** Three hundred and seventy two randomly selected children aged three to five years (157 males and 215 females) in 2008.

**Results:** Overall caries prevalence was 30.1% with no significant gender difference ( $p > 0.05$ ). The severe form of ECC that attacks primary maxillary incisors occurred in 21.2% of the children. The mean dmft score was 0.95 (SD  $\pm$  1.81). The decay component was 0.87 (SD  $\pm$  1.71), whereas the missing component was 0.08 (SD  $\pm$  0.41). There was no significant gender difference in the mean dmft scores ( $p > 0.05$ ). Among the posterior teeth, mandibular last molars had the highest caries prevalence (12.4%) and for the anterior teeth, the maxillary central incisors had the highest caries prevalence (21%). Majority of the affected children had three or less teeth affected. The sample mean plaque score was 0.57 (SD  $\pm$  0.46) with no statistical gender difference ( $p > 0.05$ ). A total of 174 (46.8%) parents/guardians responded to the questionnaire. Caries risk and experience was significantly higher in children with guardians and in children with history of falling asleep with the breast in the mouth respectively ( $p < 0.05$ ).

**Conclusion:** Most of the affected children had ECC in the anterior and posterior segments. In the anterior segments, the maxillary teeth were affected more frequently than the mandibular teeth, while in the posterior segments the mandibular teeth were more frequently involved than the maxillary teeth. Significantly higher caries prevalence was found in children under the care of the guardians, children who had slept with breast in the mouth and those with higher sugar moments as the result of snacking.

### INTRODUCTION

Early childhood caries (ECC) and periodontal diseases are the common enemies of children's oral health. ECC is described as an experience of dental caries on at least one primary tooth in a child under six years of age (1). ECC is considered a major personal and public health problem in the developing countries and among certain minority groups in the developed countries (2-3). Pain and suffering due to caries experienced at this age-group may bring a negative impact on the general growth of the child (4-5). There may also be many man-hours and school-hours lost while seeking treatment for these minors since they have to be accompanied by an adult. In places where there are limited paediatric oral healthcare services, carious lesions in these children may remain

unattended to. This may compromise the developing occlusion because the deciduous dentition is the base for future permanent occlusion. Indeed the sequelae of the severe form of ECC described by Druryl *et al* (6) that attack primary maxillary incisors are far reaching in terms of child suffering and treatment modalities.

Prolonged bottle feeding, at will breastfeeding, frequent use of medicinal syrup containing sucrose and sucrose-dipped pacifiers have been reported to predispose to ECC (5, 7). ECC has also been reported to be related to feeding practices, snacking habits, oral health practices and pattern of dental services utilisation as well as socio-economic backgrounds (7-8). Prevalence of caries in pre-school children is reported to be lower in developed countries (9). Literature indicates that the highest caries prevalence

in young children is in Africa and South-East Asia (3). Based on a few community studies, prevalence of ECC has been reported to range from 6.8- 63.5% among East African countries ( 10-13).

Studies done in Tanzania in regard to ECC and associated factors such as plaque levels are scanty and inconclusive. They report high plaque levels (13) and prevalences of ECC ranging from 2-26.4% (10, 13-14). The aim of this study was to determine the prevalence, severity and pattern of early childhood caries in Moshi, Tanzania.

## MATERIALS AND METHODS

This was a cross sectional study conducted in urban areas of Moshi in 3-5 year-old pre-school children in 2008. The study evaluated the oral health knowledge, attitudes and practices of parents/guardians of children in Moshi, ECC, plaque levels as well as morphological and functional traits of malocclusion in the children. Ethical clearance was sought from Kilimanjaro Christian Medical Centre Ethical Committee. A written informed consent was obtained from each of the parent/guardian of the children who were examined. The subjects were randomly selected from all 57 pre-primary nursery schools in Moshi municipality to increase chances of sample representativeness. Moshi municipality had about 10,000 children aged 3-5 years (15). In each pre-primary nursery school subjects aged 3-5 years were identified through a register and each assigned a number for random selection of ten children per school. A total of 372 children selected agreed to participate for clinical examination. Based on a previous report of ECC in a Tanzanian population (10), this number constituted a representative sample. This sample constituted about 4% of all 3-5 year-olds in Moshi municipality.

The present paper reports on ECC and plaque whereas the other issues evaluated on the children are reported elsewhere (16, 17). Data were collected in two parts, first, by the clinical determination of plaque levels and ECC and secondly by self-administered questionnaire to the parents/guardians of the examined children. Children were examined for ECC based on the World Health Organization (18) recommended method and the oral hygiene by using the simplified Oral Hygiene Index of Green and Vermillion (19). A questionnaire probing the feeding factors related to ECC was posted to each parent of the examined child through the heads of the schools.

At the time of data collection all clinical examinations were carried out under natural daylight

by one paediatric dentist (DSR). Data were entered in a pre-prepared form by an assistant. Data were fed in the computer for processing and analysis using Statistical Package for Social Sciences (SPSS) version 12.1 (20) and Epidemiology Information package (Epi Info) (21). The Kappa test was used to evaluate intra-examiner reproducibility of the qualitative variables (22). On each day, every tenth subject was re-examined. A total of 44 subjects were re-examined by the end of data collection.

Chi-square test was used to evaluate for differences between male and female on the prevalence of ECC and between levels of caries due to feeding behaviour. Analysis of variance (ANOVA) was used to determine the differences in mean dmft scores between male and female, mean plaque scores between male and female and between levels of socio-demographic characteristics. A p-value <0.05 was considered significant.

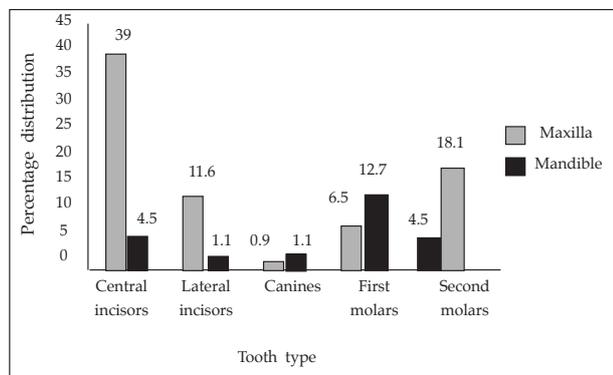
## RESULTS

A total of 372 pre-school children, 157 (42.2%) male and 215 (57.8%) female were examined. None of the children had missing anterior teeth due to exfoliation. The mean age of the children was 4.1 (SD  $\pm$  0.7) years (range: 3-5 years). The intra-examiner reproducibility test for qualitative variables produced a Kappa score of 0.9 indicating high reproducibility.

The mean plaque score was 0.57 (SD  $\pm$  0.47). There was no significant gender difference ( $p > 0.05$ ) (Table 1). The overall caries prevalence among the sample was 30.1% with no significant gender difference ( $p > 0.05$ ) (Table 1). Among 112 children who had caries experience, 33 (29.5%) had caries in both posterior and anterior segments, 29 (25.9%) only in the posterior segments and 50 (44.6%) only in the anterior segments. The prevalence of the severe form of ECC that attacks primary maxillary incisors was found in 79 (21.2%) children and there was no significant gender difference ( $p > 0.05$ ). Figure 1 shows the distribution of 354 carious teeth by tooth type. Most of the affected teeth were the maxillary central incisors 138 (39%). Majority of the affected children had dmft scores between one to three (Figure 2). The mean dmft scores in the age groups of three point four and five years were 0.43 (SD  $\pm$  1.34), 1.01 (SD  $\pm$  1.93) and 1.23 (SD  $\pm$  1.87) respectively (Table 2). The overall mean dmft of the sample was 0.95 (SD  $\pm$  1.81) with a decay component of 0.87 (SD  $\pm$  1.71) and a missing component of 0.08 (SD  $\pm$  0.41). No filled teeth were encountered (Table 2). Decay was the major component of the mean dmft scores (91.3%).

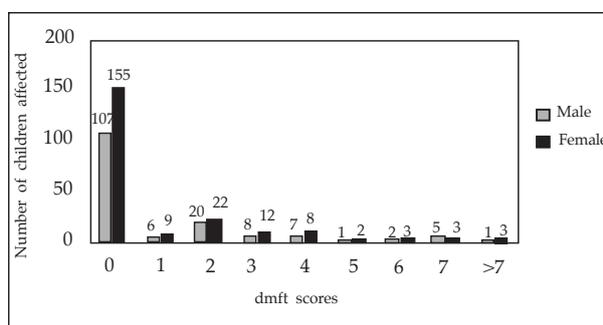
**Figure 1**

Percentage distribution of the 354 carious teeth according to tooth type in 112 out of 372 affected children aged 3-5 years



**Figure 2**

Distribution of dmft scores in 372 children aged 3-5 years



**Table 1**

The mean plaque score and caries experience by gender in 3-5-year-olds (n=372)

|                   | Gender |      |        |      | Total | P-value |
|-------------------|--------|------|--------|------|-------|---------|
|                   | Male   |      | Female |      |       |         |
|                   | No.    | (%)  | SD     | No.  | (%)   | SD      |
| Mean plaque score | 0.59   |      | 0.46   | 0.55 |       | 0.46    |
| Caries positive   | 50     | 13.4 |        | 62   | 16.7  |         |
| Caries free       | 107    | 28.8 |        | 153  | 41.1  |         |

**Table 2**

The mean decayed (d), missing (m), filled (f) teeth and dmft in different age groups in 372 children aged 3-5 years in

| Age in years | Number of children | Decayed(d) | Missing (m) | Filled (f) | dmft | SD   |
|--------------|--------------------|------------|-------------|------------|------|------|
| 3            | 82                 | 0.34       | 0.09        | 0.0        | 0.43 | 1.34 |
| 4            | 169                | 0.94       | 0.07        | 0.0        | 1.01 | 1.93 |
| 5            | 121                | 1.14       | 0.09        | 0.0        | 1.23 | 1.87 |
| Total        | 372                | 0.87       | 0.08        | 0.0        | 0.95 | 1.81 |

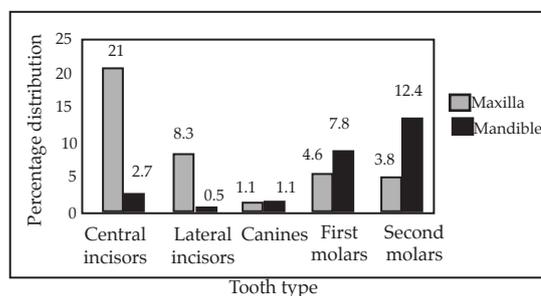
The males had a mean dmft score of 1.01 (SD ± 1.85) and females 0.91 (SD ± 1.85). The differences were not statistically significant (p>0.05).

The overall caries prevalence by tooth type in maxilla and mandible is presented in Figure 3. Among the posterior teeth, mandibular second molars had the highest caries prevalence 46 (12.4%) followed by the mandibular first molars 29 (7.8%) and the maxillary first molars 17 (4.6%). Among the anterior teeth, the maxillary central incisors had the highest caries prevalence 78 (21%) followed by maxillary lateral incisors 31 (8.3%) and mandibular central incisors ten (2.7%).

Only 174 (46.7%) parents / guardians of 372 examined children responded to the questionnaire. These were 156 (41.9%) parents and 18 (4.8%) guardians. Hence in relating the caries experience and caries risks of the children to the socio-demographic characteristics of parents and guardians only the data from 174 children of the 174 respondents to the questionnaire were used. Questions used to probe feeding habits are presented in Table 3. The question "was your child used to falling asleep with the breast in the mouth?" was one of the specific questions used to probe for caries risk in children.

Caries experience was higher in children whose parents/guardians responded positively to this question than in those who responded negatively ( $p < 0.05$ ) (Table 3). The question “how many times per day are you giving your child sugary snacks?” was also used to probe for frequency of sugary food snacking in children. Majority of the parents/guardians 159 (91.4%) responses showed lower sugar moments snacking in their children (Table 3). Caries experience was higher in children whose parents/guardians provided sugary snacks more frequently than in those whose parents/guardians provided sugary snacks less frequently ( $p < 0.05$ ) (Table 3).

**Figure 3**  
Overall prevalence of caries according to tooth type in maxilla and mandible in 372 children aged 3-5 years in Moshi, Tanzania



**Table 3**

Distribution of parents/guardians' response alternatives ( $n = 174$ ) to questions used to probe for caries risk due to feeding habit in pre-primary school children

| Question  | Dichotomous responses  | Caries experience |         | P-value |
|---|--|-------------------|---------|---------|
|   |  | Present           | Absent  |         |
|   |  | No. (%)           | No. (%) |         |
| 1. Was your child used to falling asleep with the breast in the mouth?          | Caries risk response   | 36 20.7           | 16 44.4 | • 0.00  |
|   | Non caries risk response   | 138 79.3          | 29 21.0 |         |
| 2. If your child had naptime bottle what did you put in the bottle?             | Caries risk contents   | 18 10.3           | 7 38.9  | * 0.25  |
|   | Non caries risk contents   | 156 89.7          | 11 61.1 |         |
| 3. Did your child fall asleep/ is falling asleep with baby bottle in the mouth? | Caries risk response   | 3 1.7             | 1 33.3  | * 1.00  |
|   | Non caries risk response   | 171 98.3          | 2 66.7  |         |
| 4. What type of snack do you give to your child?                                | Caries risk snacks   | 110 63.2          | 28 25.5 | * 0.93  |
|   | Non caries risk snacks   | 64 36.8           | 82 74.5 |         |
| 5. How many time per day are you giving your child sugary snacks                | More frequent sugar moments snacking (three times or more per a day)       | 15 8.6            | 7 46.7  | ■ 0.00  |
|   | Less frequent sugar moments snacking (none or less than three times a day) | 159 91.4          | 8 53.3  |         |

• =  $p < 0.05$  (parents/guardians with caries risk responses had children with more caries experience than in those with non caries risk responses); ■ = Caries experience is higher in children whose parents/guardians provided sugary snacks more frequently than in those whose parents/guardians provided sugary snacks less frequently \* =  $p > 0.05$  (no significant difference); statistics: Chi-square test

The socio-demographic characteristics of the parents/guardians are presented in Table 4. There were no significant socio-demographic differences in parents/guardians in relation to mean plaque scores of their children. However, a considerable number of children with older parents/guardians

had a considerable caries experience 39 (29.3%) but their caries risk due to feeding habits was low 128 (73.6%) (Table 4). Parental status (biological parent or guardian) was found to be a significant predictor of caries risk. Caries risk in children with guardians as care givers was significantly higher than in those

with biological parents ( $p < 0.05$ ) (Table 4). Parental educational level and the type of occupation were not associated with caries experience and caries risk due to feeding habits in children (Table 4).

integrated community oral health care in pre-school children in this community.

The plaque levels in this sample were relatively low. This low level of plaque may probably partially account for the relatively low overall prevalence of ECC. It is also noteworthy that some parents/

**Table 4**

*Distribution of socio-demographic characteristics of parents/guardians (n= 174) by levels of mean plaque scores, caries experience and caries risk due to feeding habit in their pre-school children*

| Socio-demographics of parents/guardians      | Group plaque score |      | Variables assessed in children |            |                                   |         |     |      | Total number of respondents |      |     |      |
|--|--------------------|------|--------------------------------|------------|-----------------------------------|---------|-----|------|-----------------------------|------|-----|------|
|  | Mean               | (SD) | Caries experience              |            | Caries risk due to feeding habits |         |     |      | No.                         | (%)  |     |      |
|  |                    |      | Present No.                    | Absent (%) | High No.                          | Low (%) | No. | (%)  |                             |      |     |      |
| Younger (20-30 years)                        | 0.50               | 0.43 | 6                              | 14.6       | 35                                | 85.4    | 2   | 4.9  | 39                          | 95.1 | 41  | 23.6 |
| Older (over 30 years)                        | 0.59               | 0.44 | 39                             | 29.3       | 94                                | 70.7    | 5   | 2.8  | 128                         | 73.6 | 133 | 76.4 |
| p-value                                      | *0.67              |      | *0.06                          |            | *0.67                             |         |     |      |                             |      |     |      |
| Married parents                              | 0.57               | 0.46 | 38                             | 27.3       | 101                               | 72.7    | 4   | 2.9  | 135                         | 97.1 | 139 | 79.9 |
| Single parents                               | 0.58               | 0.39 | 4                              | 23.5       | 13                                | 76.5    | 0   |      | 17                          | 100  | 17  | 9.8  |
| Guardian                                     | 0.56               | 0.33 | 3                              | 16.7       | 15                                | 83.3    | 3   | 16.7 | 15                          | 83.3 | 18  | 10.3 |
| p-value                                      | *0.99              |      | *0.61                          |            | *0.01                             |         |     |      |                             |      |     |      |
| Primary education                            | 0.57               | 0.42 | 32                             | 29.1       | 78                                | 70.9    | 5   | 4.5  | 105                         | 95.5 | 110 | 63.2 |
| Secondary education                          | 0.55               | 0.47 | 13                             | 20.3       | 51                                | 79.7    | 2   | 3.1  | 62                          | 96.9 | 64  | 36.8 |
| p-value                                      | 0.78               |      | *0.2                           |            | *1.0                              |         |     |      |                             |      |     |      |
| Labourer                                     | 0.61               | 0.46 | 7                              | 20.0       | 28                                | 80.0    | 1   | 2.9  | 34                          | 97.1 | 35  | 20.1 |
| Professional farmer business or skilled work | *0.56              | 0.44 | 38                             | 27.3       | 104                               | 74.8    | 6   | 4.3  | 133                         | 95.7 | 139 | 79.9 |
| p-value                                      | *0.54              |      | *0.73                          |            | *1.0                              |         |     |      |                             |      |     |      |

• =  $p < 0.05$  (caries risk due to feeding behaviour of children is more in guardians than in married parents); \*  $p > 0.05$  (no significant difference); statistics: Chi-square test

## DISCUSSION

Moshi Municipality has both urban and peri-urban communities. The nursery schools from which the sample was drawn were selected from both communities. The overall caries prevalence in this population was 30.1% which was in the range of recent findings conducted elsewhere in Tanzania (10, 13-14). The findings for ECC in this population were however, lower compared to studies done among pre-school children in Kenya and Uganda (11-12).

The mean dmft score was lower than in most of the previous studies in Tanzanian. Majority of the affected children had three or less affected teeth (Figure 2). The dmft levels increased with age. This can be attributed mainly to cumulative increase in the caries incidence over time. This trend has been observed elsewhere in East Africans (11). The high decay component of the dmft scores without any filled component indicated a low uptake of dental treatment which most likely reflects absence of

guardians of the children reported that they supervised their children during tooth brushing (17). Generally, the upper incisors and lower molars were more frequently found to be carious as compared to upper molars and lower incisors. This difference may be due to the closer proximity of the upper molars to the parotid salivary gland duct and the lower incisors to the sublingual salivary gland ducts. The copious salivary flow from these salivary glands tends to dilute the acid from bacterial plaque leading to increase of pH around these teeth. Increased pH promotes remineralisation of teeth if they are in a carious process (23).

The maxillary central incisors showed the highest caries prevalence 78 (21%). This may be attributed to the lower salivary flow around these teeth compared to other areas in the oral cavity. This would result in the maxillary incisors "bathing" directly in the stagnant milk of suckling infants. Stagnant human milk in the oral cavity has been reported to be associated with ECC (24). Among the parents/guardians who

responded to the questionnaire, 36 (20.7%) admitted that their children used to sleep with the breast in the mouth at some point. This behaviour is known to predispose to higher caries risk. The present results showed a higher caries experience in children of parents/guardians with a positive response to this question ( $p < 0.05$ ) (Table 3).

The prevalence of ECC in the first mandibular molars was lower than in the second molars. This was in agreement with the expected pattern reported in the literature (25). Anatomical differences between the first and second molars may account for differences in caries susceptibility because the occlusal surfaces of the first primary molars are less pitted and fissured than the second primary molars hence probably leading to less plaque retention in the first molar.

Although the parents' / guardians' responses on snacking showed consumption of high caries risk snacks in their children this was not statistically associated with caries experience. Probably this may be explained by the fact that majority of the parents/ guardians 159 (91.4%) (Table 3) exposed their children to sugary snacks less frequently. However, caries experience in children of parents/guardians who exposed their children to sugary snacks more frequently was significantly higher than in those children who were exposed to sugary snacks less frequently by their parents/ guardians ( $p < 0.05$ ) (Table 3). The caries risk was found to be significantly higher in children with guardians than in single or married parents. It may be argued that children with guardians are likely to be exposed more frequently to cariogenic items as a means of psychological compensation for their absent parents. They are also likely to be under less stringent oral hygiene supervision (brushing) than those under the direct care of parents. It is usual in this community to find older grandparents taking care of their grandchildren and doing the best in their ability to give cariogenic snacks to the children as a means of showing affection. In this sample, the desire to show affection is probably another reason for the higher caries experience in the older children who could be left under the care of guardians more conveniently. The parents/guardians age, level of education or type of occupation were not found to significantly influence either the caries risk or caries experience of the children.

The presence of caries in the primary dentition has been shown to be the strongest predictor of caries in permanent dentition (26). Therefore, the results of this study give a useful insight into the caries problem that would need to be addressed through oral health education as well as curative efforts in this community.

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