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## Prevalence of early childhood caries among 2-6 years old underprivileged and privileged children in Dar es Salaam

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### Abstract

**Aim:** To determine the differences in prevalence of early childhood caries among underprivileged and privileged children aged 2 to 6 years at different institutions in Dar es Salaam. **Design:** A cross sectional study. **Study participants and methods:** Intra oral examination was done to assess the children's caries status scored according to WHO criteria. **Results:** A total of 333 children comprising 51% boys and 49% girls were examined. About 52% were underprivileged children. Nearly half of the children (49.6%) had caries in their primary dentition, the mean decayed teeth (dt) was 2.4, which was 1.3 among underprivileged and 2.8 among the privileged children. The lower posterior teeth were the most affected by caries and the lower anterior incisors were the least affected. Caries occurrence increased with age from 12.5% at 2 years, to 59% at 5 years, then dropped to 50.6% at six years. Caries was more prevalent among males (55.9% versus 44.8%) ( $p = 0.049$ ); among the older group children (55.7% versus 40.2%) ( $p = 0.008$ ); and among the privileged children (59.1% versus 42.5%) ( $p = 0.003$ ). **Conclusions:** Nearly half of the examined children had ECC. The occurrence increased with age. Privileged children were more affected by caries than the underprivileged. The mandibular posterior teeth were the most affected and mandibular anterior teeth the least affected.

**Key words:** Early childhood caries, privileged, underprivileged, children

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### Introduction

Early childhood caries (ECC) also known as baby bottle tooth decay (BBTD), rampant caries, nursing caries, labial caries or maxillary anterior caries, is a form of tooth decay affecting teeth of young children especially infants and toddlers. (1). A severe pattern of ECC that attacks the maxillary deciduous incisors in particular is termed as severe early childhood caries, SECC (2).

ECC can develop soon after the first tooth erupts (3-4). Usually it starts as a whitish lesion on the smooth surfaces of the front teeth towards the lips and cheeks and it is often covered by thick plaque. The lesion quickly develops into caries. Initially, an ECC lesion is brown in colour, later it becomes dark brown. The condition is more likely to occur in infants or toddlers who suck a bottle filled with a sugar-containing liquid or a dummy dipped in a sweetener, or who have a prolonged (over one year) on-demand breast feeding habit (5). Studies show that there is significant association of high caries rates with

cariogenic diet, and frequency of sugary meals per day (6). All of these habits are particularly damaging to the teeth while a child is sleeping. Because saliva which has an important role in washing away the harmful acids that cause tooth decay is less produced during sleep, (7).

ECC is a multifactorial disease in nature. Like other dental caries, ECC is a disease resulting in destruction of tooth structure by acid-forming bacteria found in dental plaque, in the presence of sugar (8). The micro-flora, substrate, saliva and host are key factors involved in the pathogenesis, together with the immature host defence system. Immature enamel surfaces and developmental defects of enamel are as well considered in the aetiology (8).

Studies among children at the age of 5 years and below have shown that ECC (ECC and SECC) increases with age (6, 9-11). Furthermore, Carino et al (12) reported a prevalence of ECC to range from 59% in children aged 2 years, to 94% in children aged 5 years and a slight drop to 92%

among children aged 6 years. In another study it was noted that the prevalence of ECC increased with the number of sugary snacks between meals and a cariogenic diet (6).

The most prevalent caries patterns in the 3-year-old children are the fissure (62%) patterns. Further, the prevalence of the fissure pattern of ECC increases successively with age groups, however the maxillary anterior patterns have no significant change with age (11). Groups at high risk of dental caries were reported by Jose et al. (13) to be first those with poor oral hygiene status, secondly those who consume snacks and are given sweets as rewards and third are those belonging to a lower socioeconomic class. Other studies report an association of ECC and being underprivileged (14-15). In a similar manner, Ferro et al. (9), reported ECC to be higher among the immigrant children than among the Italian native-born children. He further reported the prevalence of ECC to be three times and that of S-ECC six times more frequent in this group than in native born. Other studies show that prevalence, severity and distribution of the caries varies greatly with age but not sex (11, 16).

In Tanzania, Matee et al (16) reported the overall prevalence of ECC to be 6.8%. Rugarabamu (10) reported a 40% prevalence of caries among three year olds where as Mosha et al (17-18) reported a prevalence of 24% and 25% among 5-6 year old Tanzanian children. Recently, Mziray and Kahabuka (19), reported an ECC prevalence of 26.4% among 6-36 months old children attending a reproductive and child health clinic at Mnazi Mmoja Dispensary in Dar es Salaam.

ECC is further reported to be a big challenge to the dental profession throughout the developing and developed world as well. For instance in Saudi Arabia, dentists working with children have expressed their concerns about the seriousness of the nursing caries problem (20). Studies report that socially disadvantaged children experience higher mean dmft levels than their similarly aged children (14, 21). In Tanzania, socially disadvantaged children include street children, orphans, refugees and those living in remote areas. These children may have no access to oral health services including oral health education and thus they may have higher levels of dmft than their similarly aged children. Whereas information on ECC among Tanzanian school children is available, the information among underprivileged Tanzanian

children is lacking. Therefore, the aim of this study was to determine the differences in prevalence of early childhood caries among underprivileged and privileged children aged 2 to 6 years at different institutions in Dar es Salaam.

### Study participants and methods

This was a cross sectional study conducted among 2-6 year old underprivileged children living at special institutions and privileged counterparts attending nursery schools in Dar es Salaam. Underprivileged children refer to children who were living at institutions for underprivileged children either because they were orphans or were formerly street children. A minimum sample of 298 children was required for the study. Fourteen institutions were conveniently sampled and visited, 12 for the underprivileged and 2 for the privileged children. Only 10 institutions (8 underprivileged and 2 privileged schools) had children eligible for the study. A convenient sampling technique was used to obtain the children for the study in the institutions for underprivileged children whereas a random sampling method was used to select children attending the nursery schools by picking every second child from the list of students in a school registry.

Informed consent was obtained from the authorities in the particular institutions and from parents on behalf of the children. Intraoral examination was conducted under natural daylight in classrooms with the child seated on an office chair. Examination was in form of inspection aided by mouth mirrors whenever necessary. Caries was scored according to the WHO criteria of 1997, (22). Children who were found with oral health problems following examination were recorded and authorities responsible for the children were advised to seek medical or dental attention. Children were instructed on oral hygiene to enhance their hygiene practices.

SPSS version 11.5 computer program was used for data analysis. Chi square tests was used to test differences in caries occurrence between sex, age and privileged or underprivileged groups. P-value of < 0.5 was chosen as a level of significance.

### Results

A total of 333 children were examined, 170 (51.1%) boys and 163 (48.9%) girls. The underprivileged group of children were 52.2% and privileged group 48%. About 41% of the children were five years old with older (5 and 6

years) children constituting 66.4 % and the younger (2 to 4 years) children constituting 33.6%. With the exception of the 3 and 6 year olds there were more males than females, (Table 1).

**Table 1: Distribution of the study population by age and sex**

| Age (years) | Male |      | Female |      | Total |      |
|-------------|------|------|--------|------|-------|------|
|             | n    | %    | N      | %    | n     | %    |
| 2           | 5    | 2.9  | 3      | 1.8  | 8     | 2.4  |
| 3           | 9    | 5.3  | 16     | 9.8  | 25    | 7.5  |
| 4           | 43   | 25.3 | 36     | 22.1 | 79    | 23.8 |
| 5           | 75   | 44.1 | 59     | 36.2 | 134   | 40.2 |
| 6           | 38   | 22.4 | 49     | 30.1 | 87    | 26.1 |
| Total       | 170  | 100  | 163    | 100  | 333   | 100  |

Table 2 shows the distribution of participants by number of decayed teeth. About half of the children (49.6%) were caries free. Among those who had caries, majority (27%) had one to three decayed teeth. Whereas the least proportion of children (8.1%) had seven to 13 decayed teeth. The overall mean decayed teeth (dt) was 2.4, privileged school children had a higher mean caries score (dt = 2.8) than underprivileged children (dt 1.3). This difference was statistically significant ( $p < 0.001$ ).

Caries status for specific tooth types showed that a larger proportion of the children (32.7%) had dental caries on mandibular first molars and the lowest (1.2 to 1.8%) presented with dental caries on the mandibular incisors, (Table 3).

**Table 2: Distribution of children by number of decayed deciduous teeth**

| Caries score | Number of children |      |                   |      |
|--------------|--------------------|------|-------------------|------|
|              | Underprivileged    |      | Privileged school |      |
|              | n                  | %    | n                 | %    |
| 0            | 100                | 57.5 | 65                | 40.9 |
| 1-3          | 46                 | 26.4 | 44                | 27.7 |
| 4-6          | 22                 | 12.6 | 29                | 18.2 |
| 7-13         | 6                  | 3.4  | 21                | 13.2 |
| Total        | 174                | 100  | 159               | 100  |

For both groups of children (underprivileged and privileged) caries occurrence increased with age. Generally, the frequency of children with caries increased almost five times from 12.5% at the age of 2 years to 59% at the age of five years. The proportion of study participants aged two to three years who were caries free (59.8 %) was significantly higher than 44.3% of those aged 5 and 6 years ( $p < 0.001$ ). Fewer children were affected by caries among the underprivileged than among the privileged groups of children (42.5% and 59.1%, respectively). This difference was statistically significant ( $p < 0.001$ ), (Table 4).

**Table 3: Distribution of children with caries lesion according to tooth type**

| Tooth type       | Children with caries on maxillary teeth |      | Children with caries on mandibular teeth |      |
|------------------|---|------|--|------|
|                  | n                                       | %    | n  | %    |
| Second molars    | 43                                      | 12.9 | 95                                       | 28.5 |
| First molars     | 71                                      | 21.3 | 109                                      | 32.7 |
| Canines          | 8                                       | 2.4  | 9  | 2.7  |
| Lateral incisors | 37                                      | 11.1 | 4  | 1.2  |
| Central incisors | 49                                      | 14.7 | 6  | 1.8  |

**Table 4: Caries status among the privileged and underprivileged children according to age**

| Age (years) | Privileged children |      |             |      | Underprivileged children |      |             |      | Privileged and underprivileged combined |      |             |      |
|-------------|---------------------|------|-------------|------|--------------------------|------|-------------|------|---|------|-------------|------|
|             | Caries free         |      | Have caries |      | Caries free              |      | Have caries |      | Caries free                             |      | Have caries |      |
|             | n                   | %    | n           | %    | n                        | %    | N           | %    | n                                       | %    | n           | %    |
| 2           | 2                   | 66.7 | 1           | 33.3 | 5                        | 100  | 0           | 0.0  | 7                                       | 87.5 | 1           | 12.5 |
| 3           | 8                   | 66.7 | 4           | 33.3 | 12                       | 92.3 | 1           | 7.7  | 20                                      | 80   | 5           | 20   |
| 4           | 19                  | 40.4 | 28          | 59.6 | 21                       | 65.6 | 11          | 34.4 | 20                                      | 80   | 39          | 49.4 |
| 5           | 28                  | 37.3 | 47          | 62.7 | 27                       | 45.8 | 32          | 54.2 | 55                                      | 41   | 79          | 59   |
| 6           | 8                   | 36.4 | 14          | 63.6 | 35                       | 53.8 | 30          | 46.2 | 43                                      | 49.4 | 44          | 50.6 |
| Total       | 65                  | 40.9 | 94          | 59.1 | 100                      | 57.5 | 74          | 42.5 | 165                                     | 49   | 168         | 50.5 |

Caries affected more males (55.9%) than females (44.8%) and the difference was statistically significant ( $p < 0.05$ ).

### Discussion

A substantial number of the children enrolled in the study were picked from streets to be raised at institutions thus their age was estimated based on their appearance or information from unreliable sources. Therefore, interpretation of the relationship of caries with age should be done cautiously.

The number of children at the institutions increased roughly with age, both for the underprivileged and privileged groups. The small number of the younger children found in the institutions could be explained by the fact that the younger children are usually taken care at institutions specialized in raising the younger children and which were not included in this study. Regarding the children at nursery schools, in Tanzania few parents enroll their children to schools at early ages. Therefore, only few young children were already in schools at the time of study. Similarly there was a slight difference in the distribution of the population by sex. There were more males than females. The difference in sex distribution of the studied population may have influenced the difference in the prevalence of ECC among males and females.

The prevalence of deciduous teeth caries in this study group (50.5%) was higher than that reported previously by Rugarabamu (10), Matee et al. (16), Mosha et al (17-18) as well as Mziray and Kahabuka (19). The difference between the findings of the current study and the previous ones could be due to differences in the age groups of the study participants. In the younger age groups, the prevalence is lower than in the older age groups.

The mean dt among the privileged was higher than among the underprivileged children. The dissimilarity between the two groups can be explained by possible differences in exposures to cariogenic foods. The underprivileged children may not have had as much access to sugary snacks/ foods at the institutions compared to the privileged ones who live at their homes as a significant association between high caries rate and consumption of sugary foods is known (6). Additionally, it is also possible that the underprivileged children were not breastfed at will and for prolonged periods of time beyond one year of age. Breast feeding at will is considered to be a causal factor of ECC in

Tanzanian children as was reported to be the case in Southeast Asian population (23). When the mother's nipple is used to induce sleep or if the child is allowed to breast feed at night in the event the mother shares a bed with the child, residual milk is left in the child's mouth as the child sleeps. The residual milk provides substrate to the bacteria that ferment the carbohydrates in milk to produce acids. Because the substrate is available constantly, demineralization of the enamel continues without an opportunity for remineralization and therefore an aggressive form of ECC called rampant caries occurs.

The lower anterior teeth were the least affected teeth, compared to the lower posterior teeth which were highly affected. This could be explained by the fact that the lower anterior teeth are protected by the tongue from residual milk (24) and they have an advantage of a self-cleansing effect of saliva as well as the likely and easy accessibility of these teeth for cleaning. On the other hand, mandibular molars were more affected by caries due to what has been said to be a direct result of the structural irregularities associated with occlusal pits and fissures of these teeth which is more likely to retain food remnants and plaque hence a higher risk to develop caries (25).

Contrary to the findings by Ramalingam and Messer (8), Jamieson et al (14), and Albert et al (25) who reported prevalence of ECC to be extremely high in children from poor backgrounds, in this study the proportion of children with caries among the underprivileged group appeared to be significantly less than that among the privileged ones. Probably in the present study children living in underprivileged institutions did not have access to sugary snacks unlike the privileged children. This scenario was earlier on reported by Kahabuka and Mbawala (27), that underprivileged children living at institutions are less likely to access sugary snack and drinks. The other feasible explanation could be that the underprivileged children, who mostly were initially street children, may have not had the privilege of breast feeding at will beyond one year of age, therefore had less risk to caries development. Breast feeding at will is likely to have been done to children of the privileged group and is the most probable causal factor of ECC in Tanzanian children as reported elsewhere (23). Moreover, the definition of privileged and underprivileged children in these studies is not the same as the one used in the present study. This dissimilarity in defining the two groups may have some influence on the

findings.

On the other hand, Livny et al (28) reported a prevalence of ECC among underprivileged Bedouin community to be 17.6% which is much lower than 42.5% observed among the underprivileged group in the current study.

Caries prevalence increased roughly with age in both the two groups of children. Similar trend was reported by Carino et al (12) who observed the prevalence of ECC to range from 59% in children aged 2 years, to 94% in children aged 5 years and a slight drop to 92% among children aged 6 years. In the similar way, the study agrees with the report by Ferro et al. (9), Rugarabamu (10), Rosenblatt & Zarzar (6), and Douglass et al (11), who also reported caries prevalence to have the tendency of increasing with age. The early rise in caries occurrence with age may be a result of increase in exposure to cariogenic foods with age as well as due to time factor, that is, longer exposures which is necessary for caries development. The possible reason for the drop could be the natural exfoliation and /or tooth extraction(s) that are likely to have taken place by this age.

According to the results of this study, more boys than girls were affected by caries. This is contrary to reports by Matee et al (16) and Douglass et al (11) who reported the prevalence, severity and distribution of caries to vary greatly with age but not sex. Since deciduous teeth emergence time among Tanzanian children does not differ significantly among sexes (personal communication), the difference in caries occurrence between sexes suggests that the two sexes encountered dissimilar exposures to cariogenic foods and should not imply caries to be sex determined. However, the results may have been influenced by the difference in the number of males versus females who participated in the study especially among the five year olds who were the most affected of the age groups.

#### **Conclusion:**

The prevalence of caries was high, (50.5%) and the privileged children were slightly more affected by caries than the underprivileged children living at institutions. Occurrence of caries increased with age. Mandibular posterior teeth were the most affected teeth whereas mandibular anterior teeth were the least affected. Males were more affected by caries than females.

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on another computer.

A travel agent offered me a 21-day special. He told me I would fly from New York to London. Then from Tokyo back to New York. I asked him ....how am I supposed to get from London to Tokyo? ....He told me.... That is why we give you 21 days.