

East African Medical Journal Vol. 95 No. 5 May 2018

ASSOCIATION OF EARLY CHILDHOOD CARIES EXPERIENCE WITH ORAL HYGIENE STATUS AND ORAL HEALTH PRACTICES OF PRESCHOOL CHILDREN IN TANDALE, TANZANIA

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ABSTRACT

Background: Early Childhood Caries (ECC) has short and long-term effects on children and parents. The short-term effects include higher risk of new lesions, emergency room visits and hospitalization, increased treatment costs and days with restricted activity. The long-term effects are diminished learning ability and delayed physical growth and development.

Objectives: To determine the association of ECC with oral hygiene status and oral health practices among children attending informal preschools in Dar es Salaam, Tanzania.

Materials and methods: A descriptive cross-sectional study among 297 preschool children and their caregivers. Schools were selected using a stratified random sampling technique while children were conveniently selected. A questionnaire to interview parents inquired on socio-demographic characteristics, oral hygiene practices and dietary habits. Clinical examination for children's plaque and dental caries scores was conducted. Data was analyzed using SPSS Version 20. Chi square and logistic regression statistical tests were done to determine the association between variables. The level of significance was set at $p \leq 0.05$

Results: Small proportion of the children brushed their teeth twice per day (24.6%), consumed sugar containing snacks (23.9%) or sugary drinks (20.9%) more than twice per day. Seventy percent had caries with a decayed missing and filled teeth index (dmft) of 4.19(± 4.52 SD). Children brushing less than twice a day ($p=0.021$) and having high plaque scores ($p=0.000$) were more likely to develop dental caries than their counterparts.

Conclusion: Caries experience among preschool children was positively associated with poor oral hygiene status and brushing teeth less than twice per day.

INTRODUCTION

Early Childhood Caries (ECC) is defined as the presence of one or more decayed (non-cavitated or cavitated) lesion, missing (due to caries) or filled tooth surfaces in any primary tooth in a child aged 71 months or younger (1). ECC may have short and long-term effects on children, parents and the population at large (2). Some of the short-term consequences of ECC include higher risk of new lesions in both primary and permanent dentition (2,3), emergency room visits and hospitalization (4,5), increased treatment costs (6) and increased days with restricted activity (7,8). The long-term effects of ECC include diminished learning ability (9) and delayed physical growth and development (10,11). Globally, the prevalence of ECC among preschool children has been reported to range from 15.9% to 56.4% (12-16). Studies conducted in the East African region reported ECC prevalence of 3.7% to 63.6% (17-24).

A number of associated risk factors have been reported globally to contribute to the etiology and development of ECC among children. They include poor dietary habits such as prolonged breastfeeding (beyond 24 months) or increased frequency of consumption of cariogenic snacks and drinks (more than three times a day), oral hygiene practices and oral health seeking behavior (25-27).

In East Africa studies report similar findings among preschool children. A study in Kampala done at Reproductive & Child Health clinics (23) and that in Tanzania among children attending for dental treatment at Muhimbili dental clinic were (28) reported that children with poor oral hygiene had a higher caries experience than those with good oral hygiene. Furthermore, high caries prevalence is frequently reported among

children from low socio-economic families that have low parental education, low family income and poor dietary habits (29).

On the other hand, good oral hygiene practices specifically brushing teeth twice per day and supervision in brushing have lead to the decrease in ECC experience among preschool children (30). A study done in India among 4-48 months preschool children, reported a prevalence of ECC to be 10.9% among children who brushed twice daily and 34.7% among those who brushed once a day (31). A dmft of 2.21 was reported among preschool children who brushed twice a day compared to a dmft of 2.35 among those brushing once a day (32). Similarly, a positive association was seen between ECC experience and frequency of tooth brushing among preschool children with special care needs (HIV infected) attending outpatient clinic at Kenyatta National Hospital. In this study, authors reported a dmft of 1.17 among children who brushed their teeth at least twice a day compared to a dmft of 1.82 in children who brushed less than twice a day (33).

With respect to consumption of cariogenic snacks; a lower dmft score of 0.5 was reported among 3-5 years old preschool children who didn't consume cariogenic snacks as compared to a dmft of 2.36 among their counterparts who consumed cariogenic snacks such as sweets, biscuits, cookies, and chocolates (34). Furthermore, reductions in ECC have been shown to be a result of fluoride use in form of food and water fluoridation in conjunction with the widespread use of fluoridated toothpaste (35).

ECC negatively affect aesthetics especially in its severe form where maxillary deciduous incisors are badly destructed. Severe early childhood caries (SECC) interfere with children's smile and affect the child's social

interactions that are important in building up their interpersonal relationships and self-esteem. Thus, SECC has an impact on the child and parent's oral health related quality of life (36).

The treatment of ECC is costly in terms of finances and time spent both on the parents and practitioners' part. Its treatment is also challenging on the side of the practitioner mainly as a result of children's uncooperative behavior due to dental fear and anxiety (37). In trying to minimize practitioners' challenges; Atraumatic Restorative Procedures using glass ionomer as a material of choice has been shown to be an acceptable approach in treating dental caries among children. This is particularly applicable because caries is removed using hand instruments thus avoiding drilling which often causes pain and fear (38). In extensive carious lesions stainless steel crown can be placed on endodontically treated deciduous molars (38). In case of severe early childhood caries (SECC) aesthetic restoration with composite restorative material can be used after placement of the post to improve retention and stress distribution. This have been shown to improve quality of life of preschool children (39).

Primary prevention of ECC through advocacy for oral hygiene and promotion of healthy diets will help to minimize a need of restorations (cost, fear and anxiety, tension to clinicians) and hence protect children from pain and discomfort. This will allow children to participate fully in school and enjoy their social interactions especially playing activities (40). Despite the importance of preventing ECC no information was retrievable on ECC and the associated factors among Tanzanian children that might help in formulating preventive strategies. Therefore, this study was conducted to find out the current status

of ECC experience and the associated oral health habits among preschool children in Tandale, Dar es Salaam.

MATERIAL AND METHODS

Study Design: Descriptive cross-sectional study that was conducted among preschool children in Tan dale Ward, Dar es Salaam between 26th October 2015 and 8th January 2016.

Study settings: Informal preschools in Tandale Ward, Dar es Salaam.

Study Population inclusion and exclusion criteria: Preschool children aged 36-72 months attending informal schools in Tandale Ward and their caregivers were eligible to take part in the study. A total of 297 children and their caregivers participated after receiving consent from the caregivers. Children with severe illness or mental disabilities that might influence ECC pattern were excluded from the study.

Study sample size sampling procedures: A minimum number of 296 children was estimated to take part in this study based on the prevalence of ECC in a previous study among children aged up to three years. A stratified random sampling technique was used to select the schools in the Ward. At the school, children were conveniently selected and recruited into the study together with their caregivers until a required number was attained.

Data was collected through caregivers' interviews and oral clinical examination of the children. The interview included a pre-tested questionnaire containing both open-ended and closed-ended questions. The data collected included the socio-demographic characteristics of the caregivers, the child's oral hygiene practices weaning foods and the child's current dietary habits. Subsequently,

one researcher (MNG) carried out clinical examination in the classrooms with the child lying in a supine position on the school bench and utilizing a natural light source. Oral hygiene status was first assessed by examining plaque levels among the children

scoring for each individual tooth according to the 1964 Silnes-Löe plaque index (**Box 1**). Thereafter children were examined for dental caries using the dmft index from the 2013 WHO manual for oral health surveys (**Box 2**).

Box 1

1964 Silnes-Löe plaque index

- 0 Absence of microbial plaque
- 1 Thin film of microbial plaque along free gingival margin
- 2 Moderate accumulation with plaque in the sulcus
- 3 Large amount of plaque in sulcus or pocket along free gingival margin

Box 2

dmft index by WHO

0.0-1.1	Very low
1.2-2.6	Low
2.7-4.4	Moderate
4.5-6.5	High
6.6>	Very high

Statistical analysis: The data was entered into a computer and analyzed using SPSS Version 20. Plaque was scored as 0 = Absence of microbial plaque, 1 = Thin film of microbial plaque along free gingival margin, 2 = Moderate accumulation with plaque in the sulcus and 3 = Large amount of plaque in sulcus or pocket along free gingival margin. Mean plaque score of a participant was calculated by summing up the total score divided by the number of teeth examined in an individual. The scores were dichotomized into low (0.00-0.99) and high (1.00-1.99). Dental caries was scored as decayed, missing or filled tooth. The mean dmft of an individual was computed and dichotomized

as low (0-3) and high (4-20). Dichotomization of other variables was done as well. Where children's age was dichotomized into young children (36 to 54 months) and old children (55 to 72 months), age of caregivers into young (20-30 years) and old mothers (>30 years). Caregivers' marital status into living together (married & cohabiting) and living individually (single, divorced, separated and widowed). Their level of education into low (up to primary school education) and high (secondary school education and above), occupation into employed (formal and self-employment) and unemployed (housewife, petty business). Family income was dichotomized into low (TZS 20,000 – TZS

100,000 per month) medium to high (101,000 to 1,000,000 per month). Children's frequency of tooth brushing was dichotomized into brushing less than twice per day and brushing twice or more per day. Frequency of taking cariogenic snacks or drinks was dichotomized into less than twice per day and two or more times per day. Frequency distributions of variables and Chi square test were performed to assess statistical differences in occurrence of ECC with the frequency of tooth brushing, tooth brushing supervision, age at which the child stopped breastfeeding, contents of the feeding bottle and frequency of consumption of cariogenic drinks or snacks. Logistic regression was done to determine associations between early childhood caries and children's oral hygiene status and oral health practices. Frequency of sugary snacks and drinks were included in the logistic regression model regardless of the statistical significance at bivariate analysis because these are known scientific fact of their role in caries etiology. A p-value of ≤ 0.05 was set as a level of significance.

Ethical considerations: Ethical clearance was sought from Muhimbili National Hospital's Institutional Ethical Review Board and Kenyatta National Hospital –University of

Nairobi Ethical and Research Committee. Caregivers were educated on the causes and prevention of ECC and their concerns about children's oral health issues were addressed. Children who were found to have oral health problems were referred to Muhimbili National Hospital for management where treatment cost was waved as per the government policy.

RESULTS

Socio demographic characteristics of participants: The children's ages ranged between 36 and 72 months; about half (49.2%) were aged 36 to 54 months) and a similar proportion (48.5%) were males. The age range of caregivers was between 20 and 60 years, with a mean of 30.41 years (± 6.41 SD). Majority of the caregivers (92.9%) were females, among whom most (86.5%) were biological mothers while, 7.1% were biological fathers. Two hundred and forty six (82.8%) of the caregivers had attained low level of education, majority (74.4%) were unemployed and a bit less than half (42.1%) belonged to low income group. The socio-demographic characteristics of the children and their caregivers are summarized in Table 1.

Table 1
Caregivers' and children's social demographic characteristics

Variable	Frequency	%
Participants' social demographic characteristics		
Age		
36-54 months	146	49.2
55-72 months	151	50.8
Sex		
Male	144	48.5
Female	153	51.5
Caregivers' social demographic characteristics		
Age		
20-30 years	172	57.9
>30 years	125	42.1
Sex		
Male	21	7.1
Female	276	92.9
Marital status		
Living together	242	81.5
Living individual	55	18.5
Education		
Up to Primary school education	246	82.8
Secondary school education and above	51	17.2
Occupation		
Unemployed	221	74.4
Formal employment and Self employment	76	25.6
Monthly income		
Low income	125	42.1
Medium to High income	172	57.9

Children's oral health habits, plaque and dental caries experience: Table 2 presents children's oral health habits, plaque and dental caries experience. All children were reported to brush their teeth. A bit less than one quarter of them (24.6%) brushed their teeth twice per day. Similarly, almost all (96.6%) were reported to consume cariogenic snacks such as biscuits, cakes, and sweets at varying frequencies and 98% to consume cariogenic drinks including juices, soda and lemonade. Small proportions of the children consumed sugar containing snacks (23.9%) or

sugary drinks (20.9%) more than twice per day. Nearly all children (97.3%) had plaque. The highest plaque scores were found in the posterior segments on both the mandibular and maxillary jaws. The overall mean plaque score was 0.50 (± 0.36 SD). Seventy percent of the children had dental caries. The decayed component constituted the greatest proportion of the dmft with a mean dmft of 4.19 (± 4.52 SD). After dichotomizing the plaque and dental caries scores; 86.2% of the children had low plaque score and 56.9% low dmft score (Table 3).

Table 2*Frequency distribution of children's oral health habits, plaque and dental caries experience*

Variable	Frequency	%
Children's habits		
Tooth brushing		
Less than twice per day	224	75.4
Twice or more times per day	73	24.6
Snacking		
Less than twice per day	226	76.1
Twice or more times per day	71	23.9
Consuming sugary drinks		
Less than twice per day	235	79.1
Twice or more times per day	62	20.9
Children's plaque and dental caries		
Children's dental caries experience		
Had caries	208	70
Did not have caries	89	30
Children's plaque score		
Had plaque	289	97.3
Did not have plaque	8	2.7

Table 3*Frequency distribution of children's plaque and dmft score*

Variable	Frequency	%
Plaque score		
Low	256	86.2
High	41	13.8
dmft		
Low	169	56.9
High	128	43.1

Key: Low plaque scores (0.00-0.99), high plaque scores (1.00-1.99).

Low dmft (0-3), high dmft (4-20).

dmft by socio-demographic characteristics: living together (44.2%) had higher dmft compared to their counterparts although, the differences were not significant (Table 4). Slightly more males (47.2%), children whose caregivers had low levels of education (44.3%), were employed (48.7%) and were

Table 4
Children's dmft by socio demographic characteristics

Socio demographic characteristics	Low dmft n (%)	High dmft n (%)	p-value
Participants' socio-demographics			
Age			
3 – 4.6 years	83 (56.8)	63 (43.2)	NS
4.7 – 5.9 years	86 (57)	65 (43)	
Sex			
Male	76 (52.8)	68 (47.2)	NS
Female	93 (60.8)	60 (39.2)	
Parents' socio-demographics			
Age			
Young mothers	98 (57)	74 (43)	NS
Old mothers	71 (56.2)	54 (43.8)	
Level of education			
Up to primary school education	137 (55.7)	109 (44.3)	NS
Secondary school education and above	32 (67.7)	19 (37.3)	
Employment status			
Employed	39 (51.3)	37 (48.7)	NS
Unemployed	130 (58.8)	91 (41.2)	
Income			
Low	68 (54.4)	57 (45.6)	NS
Medium to high	101 (58.7)	71 (41.3)	
Marital status			
Living together	135 (55.8)	107 (44.2)	NS
Living individually	34 (61.8)	21 (38.2)	

dmft by oral health practices and plaque score: A significantly larger proportion of children who brushed less than twice per day (40.9%) $p=0.02$ and those with high plaque score (68.3%) $p=0.001$ had higher dmft scores than their counterparts who were brushing twice or more per day (31.5%) and had low plaque score (39.1%) respectively. Children

brushing less than twice a day were more likely to develop dental caries than those brushing twice or more a day (OR =0.509). Though not significant a smaller proportion of children who were consuming sugar containing snacks less than twice per day had high dmft than those consuming the snacks twice or more times per day, (Table 5).

Table 5
Children's dmft score by oral health practices and plaque score

Practices	Low dmft n (%)	High dmft n (%)	p-value
Oral health practices			
Tooth brushing frequency			
Less than twice per day	119 (53.1)	105 (40.9)	0.02
Twice or more times per day	50 (68.5)	23 (31.5)	
Snacking habits			
Less than twice per day	138 (59.7)	91 (40.3)	NS
Twice or more times per day	34 (47.9)	37 (52.1)	
Consuming sugary drinks			
Less than twice per day	134 (57)	101 (43)	NS
Twice or more times per day	35 (56.5)	27 (43.5)	
Plaque score			
Low	156 (60.9)	100 (39.1)	0.0001
High	13 (31.7)	28 (68.3)	

Key: Low plaque scores (0.00-0.99), high plaque scores (1.00-1.99).
Low dmft (0-3), high dmft (4-20).

DISCUSSION

Tandale is a high-density population area where the inhabitants are mostly engaged in petty trading and informal income generating activities. A substantial proportion of caregivers were from low income families supported by their low level of education where majority had a maximum of primary school education and only a small fraction had formal employment. Most of the caregivers being females reflect the custom of the studied population where mostly mothers are the ones responsible in the care of young children. The participants' equal distribution by age and sex reflects comparable representation at young age.

The overall prevalence of ECC among the children examined is high which might have short and long-term effects on children and parents as well. The prevalence is higher than that reported in other school-based studies carried out in Moshi and Dar es Salaam (22, 24) as well as those done in neighboring

countries of Kenya and Uganda (17-20). The differences could be attributed by the homogeneously low economic status of the caregiver's in the current study. It is evident from the high decay component of the dmft index that the children in the current study suffered from unmet dental care needs.

Although not significant, children in the current study whose caregivers had low levels of education had higher caries experience than their counterparts as has been previously reported. (21, 33, 41). It could be postulated that caregivers with low level of education also have low oral health literacy thus not aware of preventive actions.

A considerable proportion of the children whose caregivers were in employment also demonstrated a higher ECC experience. This suggests that employed caregivers may have capacity to give money out of pocket to their children that may be used to purchase cariogenic snacks and drinks. In addition, there were many kiosks selling snacks in the neighbourhood of the study area which might

contribute to the children's snacking habits. Due to easy availability of cariogenic snacks and caregivers' ability to purchase the snacks their children's daily consumption is likely to increase thus predisposing them to dental caries. Similar findings were reported by Ngatia *et al.* (18) who observed that sweets and other confectionaries were easily accessible to school children from vendors located in the vicinity of the preschools. Use of sugary snacks and drinks did not demonstrate significant relationship with children's dmft scores. This is opposite to what would be expected. However, children's breast feeding, weaning and other nutritional practices were not analyzed they could be confounders and thus mask the association.

Significantly more children who had high plaque scores also had higher dmft. Furthermore, a positive association was seen between caries experience and the frequency of tooth brushing. Children who had a low frequency of tooth brushing had a significantly high caries experience. These observations are in line with known facts explaining the importance of good oral hygiene and use of fluoride tooth paste in the control of dental caries. The current findings are similar to earlier reports (25, 27, 32, 33).

CONCLUSION

Caries experience among preschool children was positively associated with poor oral hygiene status and brushing teeth less than twice per day.

RECOMMENDATIONS

There is a need for the local government to introduce oral health preventive programs which may be school-based, and community

based, preferably for low income communities in Tanzania.

STUDY LIMITATION AND MITIGATION

Reporting of the breastfeeding and weaning practices years after quitting the practices may have introduced recall bias. Pausing of a variety of specific questions helped the mothers to remember the practices.

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