ORIGINAL ARTICLE

EGS Mumghamba KP Manji J Michael Oral hygiene practices, periodontal conditions, dentition status and self-reported bad mouth breath among young mothers, Tanzania

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Abstract: Objectives: To determine the oral hygiene practices, periodontal conditions, dentition status and selfreported bad mouth breath (S-BMB) among young mothers. Study participants and methods: This was a crosssectional descriptive study conducted at Muhimbili National Hospital, Dar es Salaam, Tanzania. A total of 302 postpartum mothers, aged 14-44 years, were interviewed on oral hygiene practices and S-BMB using structured questionnaire. Oral hygiene, dentition and periodontal status were assessed using the Community Periodontal Index probe and gingival recessions (GR) using Williams Periodontal probe. Results: Tooth brushing practice was 99%; tongue brushing (95%), plastic toothbrush users (96%), chewing stick (1%), wooden toothpicks (76%), dental floss (<1%); and toothpaste (93%). The prevalence of plaque and gingival bleeding on probing was 100%, gum bleeding during tooth brushing (33%), calculus (99%), probing periodontal pocket depth (PPD) 4-5 mm (27%), PPD 6+ mm (3%), GR 1+ mm (27%) and tooth decay (55%). The prevalence of S-BMB was 14%; the S-BMB had higher mean number of sites with plaque compared to the no S-BMB group (P = 0.04). Factors associated with S-BMB were gum bleeding on tooth brushing (OR = 2.4) and PPD 6+ mm (OR = 5.4). Conclusion: Self-reported bad mouth breath is a cause of concern among young mothers, and associated significant factors were gum bleeding on tooth brushing and deep periodontal pockets of 6+ mm. Further research involving clinical diagnosis of bad mouth breath and intervention through oral health promotion and periodontal therapy are recommended. *Clinical relevance:* This study provides baseline information on oral health status and the

complaint on bad mouth breath which necessitates in the future need for objective assessment, diagnosis and management of bad mouth breath for enhanced social and professional interaction without embarrassments.

Key words: bad mouth breath; carious lesions; gingival bleeding; oral hygiene; periodontal pockets

Introduction

Oral health status of an individual, special groups and general population depends on nutritional status, oral hygiene practices and general health status, whereby the presence of systemic diseases may show some oral manifestation. Important oral hygiene practices include daily and effective tooth brushing, proper use of dental floss and toothpicks whenever indicated (1). Poor oral hygiene practices may lead to accumulation of microbial plaque and hard deposits on tooth surfaces, either supra- or subgingivally (2). Microbial plaque accumulation among other factors, may in turn lead to gingivitis, periodontitis and dental caries (2, 3). The women's health issues and their relationship to periodontitis have emerged recently as an important sex-specific field of study (4). In some populations, women's awareness and knowledge on oral health has been reported to be poor (5). Furthermore, pregnancy has been found to affect gingival health (6). On the other hand, it has been reported that, maternal poor oral health status may have an ill effect to the childbirth outcome such as restricted fetal growth, prematurity and low birth weight thus necessitating women to be considered as among special groups that need attention of the oral health professionals (7–9).

Poor oral hygiene in the general adult population aged 15 years or above in Tanzania is very common (65–99.6%), and prevalence of gingivitis is very high ranging from 79% to 93.8% (10, 11). The prevalence of periodontal diseases using the presence of periodontal pockets criterion is low (8–11.7%) (12–14). For adult population aged 40 years or above in the rural areas, a higher prevalence of about 82% for mild periodontal disease and 44% for severe periodontal disease, using periodontal pocket depth (PPD) of 4–5 mm and 6+ mm criterion, respectively, has been reported (15).

The prevalence of dental caries in adolescents and adults in Tanzania ranges from 30% to 80%, and that the mean number of decayed teeth (DT) increased significantly with age (16). The decayed, missing and filled teeth (DMFT) in adults has been reported to range from 1.15 to 2.25 and that it is higher in females than in males (17). Also without any sex predilection, a higher DMFT of 3.5 has been reported for sugar estate workers in Tanzania (18).

Bad mouth breath (BMB), which is also described as oral malodour, halitosis or foetor ex ore, is multifactorial in origin (oral, non-oral and psychosomatic). The BMB is a cause of concern, social embarrassment and frustration on the part of general public; whereas at an individual level can lead to social isolation, personal discomfort, divorce proceedings, depression and even contemplation of suicide (19). Genuine BMB is tainted with volatile sulphur compounds (VSC) such as hydrogen sulphide, methyl mercaptan and organic acids caused by dental plaque, bacterial products from deep periodontal pocket, tongue, tonsils and pharynx and rarely originates from gastrointestinal tract (20). Non-oral causes for genuine BMB include renal failure, cirrhosis of the liver, diabetes mellitus and other metabolic conditions that can lead to systemic production of volatile malodours that manifest themselves as halitosis (21). Psychosomatic or pseudo-halitosis is that 'self-perceived BMB' which does not exist in actual fact but the patient believes that he or she has bad mouth breath (22, 23). Methods of analysing BMB are several, but the major ones mostly used are organoleptic measurement (judges for BMB), gas chromatography (gold standard) and sulphide monitors, e.g. halimeter, zincoxide thin film semiconductor sensor (21, 22, 24). In addition to these methods, clinical application of a questionnaire for diagnosis and treatment of BMB has been developed (25).

In Tanzania, BMB in relation to oral hygiene practices and oral health status is not known. Therefore, the aim of the present study was to determine the level of oral hygiene, dentition and periodontal status in relation to self-reported bad mouth breath among young mothers. This situation analysis would provide baseline information for the planning of interventional oral health programmes, accordingly.

Study participants and methods

Study participants

This study was conducted at the Maternity Block, Muhimbili National Hospital in Dar es Salaam, Tanzania. All postpartum mothers who had their neonates hospitalized for various medical problems were visited and informed of the study Mumghamba et al. Oral hygiene practices, dental status and self-reported BMB

Variable	Number of sites or teeth*	κ -value	SE	<i>P</i> -value	95% CI
Periodontal pockets Gingival recessions (1+ mm) Dentition status (caries)	6912 sites 6912 sites 1152 teeth	0.924 0.784 0.885	0.007 0.011 0.024	<0.001 <0.001 <0.001	0.910–0.938 0.762–0.806 0.837–0.934

Table 1. Intraexaminer reproducibility of the periodontal and dentition status parameters

*A total of 36 study participants were examined for the reproducibility exercise.

Table 2. Age distribution of the study participants

	Study participants				
Age group (years)	n	%			
14–19	81	26.8			
20–24	113	37.4			
25–29	74	24.5			
30–34	23	7.6			
35–44	11	3.6			
Total	302	100.0			

objectives, thereafter requested to participate in the study whereby those willing had to sign the consent form. One calibrated dental practitioner did clinical assessment and the reproducibility ranged from good to very good (Table 1). A total of 302 postpartum mothers aged 14–44 years (mean \pm SD 23.2 \pm 5.3 years, median, 22 years and mode, 20 years) were recruited (Table 2). Married participants were 62.3% and 37.7% were not married; and the majority had primary school education (66.9%), few had secondary school education (10.6%), very few had post-secondary college or university education (3.3%) and the rest (19.2%) had no formal education.

Methods

This was a hospital-based cross-sectional descriptive study, whereby the study participants were interviewed on oral hygiene practices, gum bleeding on tooth brushing, presence of unpleasant or bad mouth breath, number of pregnancies and number of children. Assessments on birth weight of the newborn and maternal blood pressure (mmHg) were recorded from patients' medical records. Oral hygiene practices included tooth brushing, frequency and specific time of brushing in relation to meals; interdental cleaning using toothpicks and or dental floss; tongue brushing; types of tooth-cleaning devices [local chewing stick ('miswaki'), plastic tooth brush or both types]; dentifrices (Colgate fluoride tooth pastes, local brands 'Whitedent' and others).

For clinical examination, participants were seated on a portable dental chair with artificial light. Dichotomous (present or absent) scoring was applied for periodontal conditions: plaque, calculus and gingival bleeding on gentle probing (BOP) on six sites of all teeth including third molars. During examination, the readings or scores were read loudly to a person doing the recording in a special clinical form. Other clinical parameters assessed were probing PPD on six tooth sites and dental caries using the Community Periodontal Index (CPI) clinical C probe with a ball tip of 0.5 mm in diameter, with a black band between 3.5 and 5.5 mm and rings at markings at 8.5 and 11.5 mm from the ball tip (26). Gingival recessions were assessed using the Williams periodontal probe with 1, 2, 3, 5, 7, 8, 9 and 10 mm markings (27).

The data were entered into a personal computer and analysed using the Statistical Package for Social Sciences (SPSS) 12.0 for Windows (SPSS Inc., Chicago, IL, USA). The intraexaminer reproducibility for the duplicate examinations is presented as kappa values with significance levels and the 95% confidence interval (CI). Data analysis included generation of frequencies for all variables and later on data transformations were done: recode for example to generate age groups; counts, to generate total number of affected teeth or periodontal sites. Cross-tabulations were generated for maternal status/demographic information, periodontal conditions and dentition status by self-reported bad mouth breath variable; whereby Pearson chisquared and Student's t-tests were applied to test the difference between groups for the categorical and continuous variables respectively. For all statistical tests, two-sided type 1 error probability <0.05 was considered as the level of significance. The results are presented as prevalence for categorical variables together with chi-squared test, odds ratio (OR) and the 95% CI; whereas for continuous variables, the mean values, t-test, mean difference and the 95% CI are presented accordingly.

Results

Oral hygiene practices

Tooth brushing practice was as high as 98.7%; whereby frequency of brushing was once per day (38.7%), twice per day (48.7%) and three times or more per day (11.3%). However, four participants (1.3%) reported not to be brushing but used

to rinse the mouth with water as the only means of keeping their teeth clean. Tooth brushing before breakfast was very common (98.3%), only 0.3% did brush after breakfast and 44.0% brushed before going to bed. Most of the participants used plastic toothbrush (96.3%) and very few used chewing stick (0.7%), both types of toothbrush (1.7%). Tooth brushing technique was mainly horizontal to-and-fro movements (75.2%) followed by a combination of horizontal and circular (22.8%) and the least practiced technique was the vertical (up and down movements) alone or in combination with rotary movements (0.6%). Tooth-cleaning adjuvant included toothpaste (93.4%), charcoal/ash (0.7%), salt (0.3%) and those who used toothbrush alone without adjuvant, were 5.6%. Of 282 study participants who used toothpaste during tooth brushing practice, commonly used brands were Whitedent - local brand (53.9%) and Colgate (39.7%), followed by Chemident - local brand (2.5%), Close-up (1.8%), ABC (1.4%) and Aqua-fresh (0.7%). Tongue brushing was practiced by 95% and the experience of gum bleeding during tooth brushing was reported by 32.5% of the study participants. Interdental cleaning with wooden toothpicks was found to be a common practice (75.8%) but use of dental floss was very rare (0.3%). Of all the study participants, only four (1.3%) were cigarette smokers.

Periodontal conditions

The occurrence of plaque and gingival bleeding on gentle probing was 100%, while calculus was 99%. PPD of 4–5 mm was prevalent in 26.8%, PPD 6+ mm in 3.0% and gingival recessions 1+ mm in 27.2% of the participants. The mean number of periodontal or tooth sites covered by microbial plaque was very high (129.83 \pm 28.99), BOP was moderate to low

Table 3. Prevalence and mean number of sites affected by periodontal conditions as well as mean number of teeth with open carious lesions

 (65.79 ± 30.68) , PPD 4–5 mm and PPD 6+ mm were very low $(0.65 \pm 1.81 \text{ and } 0.11 \pm 0.90 \text{ respectively})$ (Table 3).

Dentition status

Tooth decay was prevalent in 54.6%, whereby 21.9% of all the study participants had signs and symptoms of pulp involvement. The prevalence for missing teeth was 57.3% and filled teeth component was 2.0%. The mean number of decayed teeth was 1.08 ± 1.85 (Table 3), missing teeth 0.92 ± 1.56 , filled teeth 0.05 ± 0.44 and the mean DMFT was 2.05 ± 2.84 .

Self-reported bad mouth breath

Among all the study participants, 42 participants (13.9%) selfreported to have experienced a problem of bad mouth breath. Individual efforts taken to alleviate the condition included reinforced tooth brushing (76.2%), use of chewing gums (11.9%), unspecified other means (7.1%) and 'wait and see' group who did nothing (4.8%).

Maternal factors

Maternal factors in particular the mean number of pregnancies, number of deliveries, infant birth weight and blood pressure are shown in Table 5.

Self-reported bad mouth breath in relation to oral hygiene practices, periodontal conditions, dentition status and maternal factors

In this study population, the prevalence of S-BMB in relation to teeth with open carious lesions (Tables 4 & 5), time of

	Partici (n = 3	pants 102)	Periodontal/tooth sites affected			
Periodontal conditions and teeth with open carious lesions	n	%	All sites	Mean no. of sites*	SD	
Plaque	302	100.0	39 210	129.83	28.99	
Calculus	299	99.0	12 357	40.92	30.31	
Gingival bleeding	302	100.0	19 868	65.79	30.68	
Periodontal pockets (0-3 mm)	302	100.0	50 856	168.40	10.89	
Periodontal pockets (4–5 mm)	81	26.8	196	0.65	1.81	
Periodontal pockets (6+ mm)	9	3.0	32	0.11	0.90	
Gingival recessions (1+ mm)	82	27.2	374	1.24	3.39	
Open carious lesions	165	54.6	325†	1.08†	1.85†	

*Mean number of periodontal/tooth sites present (based on six sites/tooth and total number of teeth present in the mouth) was 181.0.

†The unit is teeth and not sites.

	Self-reported	d bad mouth brea	0			
Mothers' demographic information, periodontal conditions and dentition status	+ve	-ve	Total	χ [∠] test: <i>P</i> -value	Odds ratio	95% CI
Married						
+ve	28 (66.7)	100 (38.5)	114 (37.7)	0.525	0.8	0.40-1.59
-ve	14 (33.3)	160 (61.5)	188 (62.3)			
Education: primary education or above (≥1)						
+ve	32 (76.2)	212 (81.5	244 (80.8)	0.414	1.4	0.64-2.30
-ve	10 (23.8)	48 (18.5)	58 (19.2)			
Gum bleeding during tooth brushing						
+Ve	21 (50.0)	77 (29.6)	98 (32.5)	0.009	2.4	1.22-4.60
-ve	21 (50.0)	183 (70.4)	204 (67.5)			
Periodontal pockets 6+ mm						
+ve	4 (9.5)	5 (1.9)	9 (3.0)	0.007	5.4	1.38–20.88
-ve	38 (90.5)	255 (98.1)	293 (97.0)			
Open carious lesions						
+ve	24 (57.1)	141 (54.2)	165 (54.6)	0.725	1.13	0.58–2.17
-ve	18 (42.9)	119 (45.8)	137 (45.4)			

Table 4.	Self-reported	bad mouth	breath in	relation to	o social	status	(marital	and	education)	, occurrence	of gum	bleeding,	periodontal
pockets	6+ mm and op	pen carious	lesions										

tooth brushing (before or after meals), frequency and method of tooth brushing; tongue brushing, brands of toothpaste used, level of education, age, marital status, calculus, gingival bleeding on gentle probing and probing periodontal pockets of 4 mm or more showed no significant differences when compared with the none-S-BMB individuals. Factors significantly associated with S-BMB were gum bleeding during tooth brushing (OR = 2.16, P = 0.02, 95% CI 1.12-4.19) and PPD 6+ mm (OR = 5.37, P = 0.007, 95% CI 1.38–20.88) (Table 4). Also, the S-BMB group had significantly higher mean number of tooth sites with plaque $[138.36 \pm 25.99 \text{ (SD)}]$ than those without S-BMB [128.46 \pm 29.25 (SD), P = 0.04] (Table 5). Although not statistically significant, the mean number of sites with calculus, gingival bleeding and maternal factors; number of pregnancies, number of deliveries, infant birth weight and diastolic blood pressure were consistently higher in S-BMB group when compared with the none-S-BMB individuals (Table 5).

Discussion

In this study, oral hygiene practices, in particular, the daily tooth brushing and toothpicks were high. This shows that, the study participants were aware of the necessity for the good oral hygiene, and the findings are in agreement with other reports in the country (11, 15). Most of the study participants reported to be brushing on daily basis before breakfast, few brushed before going to bed and very few brushed after meals. This practice, in a way defeats the whole purpose of tooth brushing as most of the time the teeth were left unclean, and this may be one of the explanations for high prevalence of poor oral hygiene as depicted by the presence of plaque, calculus and gingival bleeding in this study population.

The type of toothbrush mostly being used was the industrial plastic manual toothbrush and very few used the traditional chewing stick. The factors that could have possibly contributed to this trend might be the urban residency and modernization. However, both types of toothbrushes when used properly have been shown to be equally effective in plaque removal (28). The use of worn plastic toothbrushes was not within the scope of the present study. Given the low socioeconomic status of most Tanzanians, it is anticipated that most of the study participants could have been using worn toothbrushes. Worn toothbrush is known to be less effective in plaque removal and control of gingivitis (29). On the contrary, there are reports showing that wear status of a toothbrush may not be critical in ensuring plaque control (30, 31). Although there is no brushing technique that is superior to others in plaque removal, the horizontal technique that is commonly practiced in this study population, together with the dentifrices claimed to enhance plaque removal (due to presence of abrasive particles), could have resulted into a better oral hygiene standards, but unfortunately this was not the case. The possible explanation for this paradox, among other factors, might be the difficulties in understanding and attaining objectively effective tooth brushing practice, irrespective of the method used.

Despite poor oral hygiene, the prevalence of periodontal diseases among the study participants was low. Similar findings have been reported from pregnant and postpartum mothers as well as from the general adult population in Tanzania and Kenya (12, 13, 32, 33). The genetic and host risk factors may be one of the possible explanations for the low prevalence of

Table 5. Self-reported bad mouth breath (BMB) in relation to maternal variables, mean number of sites affected by periodontal conditions and open carious lesions

	Occurrenc mouth (n = 302)	e of bad breath			
Periodontal conditions, carious teeth and maternal status	Mean	SD	<i>t</i> -test: <i>P</i> -value	Mean difference	95% CI
Plaque					
+Ve	138.36	25.99	0.04	9.90	0.46 to 19.33
-ve	128.46	29.25			
Calculus					
+ve	46.24	32.33	0.22	6.18	-3.73 to 16.09
-ve	40.06	29.95			
Gingival bleeding					
+ve	72.10	30.28	0.15	7.33	-2.70 to 17.35
-ve	64.77	30.68			
Periodontal pockets (0–3 mm)					
+ve	170.00	7.87	0.31	1.86	-1.70 to 5.43
-ve	168.14	11.29			
Periodontal pockets (4–5 mm)					
+ve	1.02	2.03	0.15	0.44	-0.15 to 1.03
-ve	0.59	1.77			
Periodontal pockets (6+ mm)					
+Ve	0.21	0.75	0.40	0.13	-0.17 to 0.42
-ve	0.09	0.92			
Gingival recessions (1+ mm)					
+Ve	1.24	2.39	0.99	-0.00	-1.11 to 1.11
-ve	1.24	3.53			
Teeth with open carious lesions					
+Ve	1.12	1.85	0.871	0.05	-0.56 to 0.65
-ve	1.07	1.85			
No. of pregnancies					
+Ve	2.26	1.43	0.212	0.28	-0.16 to 0.72
-ve	1.98	1.34			
No. of deliveries					
+ve	1.88	1.37	0.404	0.16	-0.21 to 0.53
-ve	1.72	1.09			
Infant birth weight (g)					
+ve	2531.00	826.00	0.547	80.63	-182.67 to 343.92
-ve	2450.00	801.00			
BP-systolic (mmHg)					
+Ve	112.62	14.99	0.915	-0.27	-5.33 to 4.78
-ve	112.89	15.51			
BP-diastolic (mmHg)					
+Ve	72.86	9.44	0.602	-0.95	-4.53 to 2.63
-ve	73.81	11.1/			

periodontal diseases in this study population (34). As the prevalence of periodontal diseases increases with age, the relatively young age group (14–44 years) of the women studied might have affected the results, as for older age group (40 years and above), a higher prevalence has been reported from one of the rural population in Tanzania (15).

The prevalence of dental caries and the mean DMFT among the study participants was found to be within the previously reported range of 30–80% and DMFT 1.15–2.25 in some adult populations in the country (16, 17). The decay component was reported to be very high while filled teeth component was very low. The possible explanation for this

imbalance might be attributed to the difficulties in the availability and affordability of biomaterials for restorative dental procedures in the country (35). The missing component was equally high due to the fact that, tooth extraction was the most readily available type of dental treatment (13, 36–38).

The prevalence of self-reported S-BMB is substantial and need professional attention. The method chosen to study 'bad mouth breath' in this population was among the simplest and acceptable, as other methods needed training and calibration as a 'malodour judge' or to acquire equipment for assessment that was not readily available in the country (22, 24, 25). As the S-BMB was not verified clinically, the interpretation of these preliminary findings should be done with caution, as it is possible that some of the S-BMB individuals may fall into a category 'psychosomatic bad mouth breath' (23, 39). On the other hand, those not having bad mouth smell based on selfassessment, might be found to have the problem if other test methods would have been used.

Most of the participants reported to be brushing their teeth, tongue and also cleaning interdentally with toothpicks. Contrary to the expectation for such reported practices, the oral hygiene standard of the participants was very poor. However, there were no significant differences on S-BMB as compared to none-S-BMB group in relation to the presence of calculus and open carious teeth, as well as the level of education, age and marital status. Poor oral hygiene, calculus deposits, gingival bleeding and periodontal diseases have been reported to be strongly associated with bad mouth breath (20, 40). As a matter of caution, the difference in the methodology used might have contributed to the discrepancy observed in these findings.

The prevalence of S-BMB was low and similar findings have been reported among females in Saudi Arabia (41). Tongue brushing in the present study population was very high and is essentially known to reduce the microbial plaque coating on the tongue. Tongue coating plays a major role in aetiology of bad mouth breath regardless of periodontal status (40, 42-44). Among the actions taken by the participants to control the S-BMB were reinforced tooth brushing practice, increased use of toothpaste and to a lesser extent use of chewing gum. The uses of these adjuvant agents (dentifrices) and proper tooth brushing have been reported to have a beneficial effect in controlling the bad mouth breath problem (44-46). However, it has also been reported that some designs of manual toothbrush are better off than others in reducing the bacteria and gases responsible for bad mouth breath (47, 48). Furthermore, tongue scrapers have been found to be more effective than softbristle toothbrushes in reducing the gases responsible for bad mouth breath (49). All these factors underscore the necessity for having proper selection of the tooth cleaning aid.

In this study population, the factors significantly associated with S-BMB were gum bleeding provoked by tooth brushing and probing periodontal pocket depths, 6 mm or more; and the findings are in agreement with what has been reported elsewhere (42). The limitation of this study was that, bad mouth breath was neither assessed organoleptically nor by using specialized diagnostic equipment. Therefore, it is very much possible that some of the participants in the none-S-BMB group were missed and also those in the S-BMB group might have psychosomatic malodour only. In conclusion, findings from the present study are that selfreported bad mouth breath is a cause of concern among young mothers and that the significantly associated factors includes gum bleeding on tooth brushing and probing PPD 6 mm or more. There were no significant differences on self-reported bad mouth breath as related to level of education, marital status, plaque accumulation, calculus and carious teeth. Future studies should include organoleptic and other clinical methods to assess oral malodour objectively, together with intervention through oral health promotion and periodontal therapy, accordingly.

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