

Self-perceived oral malodour among periodontal patients: prevalence and associated factors

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ABSTRACT

Background: Perceived oral malodour is a common reason for dental consultation implying that vigilant assessment of oral malodour in dentistry will facilitate effective treatment. **Aim:** To determine the prevalence and factors associated with self-perceived oral malodour among periodontal patients. **Methods:** A cross-section of 490 consenting patients attending the Periodontology Clinic of a tertiary healthcare facility in Nigeria between February and June, 2012 were studied. Data analyses in the form of descriptive statistics, chi-square statistics and logistic regression were done and $p < 0.05$ was considered as statistically significant. **Results:** Self-perceived oral malodour was reported by 84 of the 490 studied participants giving a prevalence of 17.1%. Self-perceived oral malodour was significantly associated with gender ($p=0.004$), daily tooth brushing frequency ($p=0.018$) and gingival health perception ($p=0.013$), perceived worsening of oral despite daily tooth brushing ($p=0.001$), and belief that artificial teeth are inevitable in old age ($p=0.001$). Self-perceived oral malodour was significantly higher among participants reported having gingival bleeding on tooth brushing, food packing and tooth mobility, worried about malodour and colour of gingiva and teeth. The determinants of self-perceived oral malodour from logistic regression analysis were gingival bleeding on tooth brushing, worry about oral malodour and belief that artificial teeth are inevitable in old age. **Conclusion:** Data from this study revealed that one out of every six studied periodontal patients had self-perceived oral malodour with the determinants as gingival bleeding on tooth brushing, worry about oral malodour and belief that artificial teeth are inevitable in old age.

Key words: Oral malodour, perception, periodontal disease, oral health

INTRODUCTION

Oral malodour is a common, unpleasant, clinical condition with unpleasant odour emanating from the mouth due to gram-negative anaerobic bacterial putrefaction of sulfur-containing

proteinaceous substrates.^[1-4] Volatile sulfur compounds (VSCs), hydrogen sulfide, methyl mercaptan and dimethyl sulfide, primarily responsible for oral malodour have been implicated in the pathogenesis of periodontal disease due to their toxicity to oral tissues at

extremely low concentration, negative effect on collagen metabolism and protein synthesis of human gingival fibroblasts, induction of deleterious changes in both the extracellular matrix and local immune response of periodontal tissues to plaque antigens.^[5] This implies that many patients with oral malodour as their main presenting complaint will have some level of gingival and periodontal pathology.^[6] Periodontitis patients with oral malodour have been reported to have more severe disease than those without.^[1] The national survey on health and welfare in Japan reported that approximately 15% of individuals who have some dental problem, suffer from oral malodour^[7]

Oral malodour is a major concern to the general population due to its adverse consequences on private and professional life.^[8] It constitutes a significant problem that impairs quality of life and social interactions, leading directly to low self-esteem, depression and other mood disorders.^[9] The negative impact on daily social life and interpersonal communication is rooted on the barrier created between affected individuals and their friends, family and co-workers by the offensive mouth air from affected individuals. It is therefore known that perceived oral malodour, either real or imaginary, triggers behavioural action geared towards restoring fresh breath and consequently facilitating social and psychological well being among affected individuals.^[10] Oral origin of malodour which constitutes more than 80% of cases of malodour emanate from carious lesions, periodontal disease, oral infections, peri-implant disease, pericoronitis, mucosal ulcerations, impacted food debris, tongue coating, dry mouth and improper denture hygiene.^[11] This explains why changes in oral self care behaviour and dentist consultation are the noted behavioural action in malodour. Perceived oral malodour has been cited as one of the most common reasons for dental consultation implying that vigilant assessment of oral malodour in dentistry will facilitate effective treatment with prompt restoration of normalcy and self-confidence boost.^[12] Previous report of improper diagnosis of the aetiology of oral malodour resulted in affected individuals visiting several dentists in Nigeria.^[13]

The paucity of information on oral malodour in Nigeria despite the increasing interest in this area of research in developed countries necessitated this study. Zalewska *et al.*^[9] report on the importance of properly identifying, treating and continuing research on oral malodour is an

additional motivating factor for this study. The objective of the study was to determine the prevalence and associated factors with self-perceived oral malodour among periodontal patients.

METHODOLOGY

This study was conducted among consenting patients attending Periodontology Clinic of the University of Benin Teaching Hospital, Benin City, Nigeria between February and June, 2012. The self-developed, validated questionnaire that assessed self perceived oral malodour, oral self-care, dental visit, perceived periodontal health, periodontal and dental complaints and status was the tool of data collection. This self-administered questionnaire was hand delivered to participants in the clinic wait area and collected before consultation and care in the Periodontology Clinic. Participation was voluntary and did not in any way influence timing and quality of periodontal care receipt among the consenting and non-consenting patients.

Statistical analysis

Data were analyzed by frequency, percentages, cross tabulations, chi-square statistics and binary logistic regression using the statistical package for the social sciences (SPSS) version 17.0 and $P < 0.05$ was considered as statistically significant.

RESULTS

Of the 490 studied participants, 84 of them had self-reported oral malodour giving a prevalence of 17.1%. Gender was significantly associated with self-perceived oral malodour ($p=0.004$) (Table 1). Participants who indulge in more than once-daily tooth brushing using medium strength toothbrush, regular dental floss user, exposed to professional instruction on tooth brushing and dental treatment reported less self-perceived oral malodour. Participants that have ever opened bottled drinks with their teeth and regular chewing stick and mouthwash users reported more self-perceived oral malodour. However, it was once-daily toothbrushing that was significantly associated with self-perceived oral malodour ($p=0.018$) (Table 2). Participants with fair/poor perceived gingival health who perceived that their oral health is worsening despite daily tooth brushing and those that considered artificial teeth inevitable in old age reported significantly more self-perceived oral malodour. Tobacco users

reported less perceived malodour (Table 3). Participants worried about malodour, gingival and teeth colour reported significantly more self-perceived oral malodour. However, participants with satisfaction about dental appearance reported less self-perceived oral malodour (Table 4). Participants with gingival bleeding on tooth brushing, dentinal sensitivity, food packing, tooth mobility and dental caries reported more self-

perceived oral malodour. However it was gingival bleeding, food packing and tooth mobility that were significantly associated (Table 5). In this study, gingival bleeding on tooth brushing, worry about oral malodour and belief that artificial teeth are inevitable in old age, were the determinants of self-perceived oral malodour from logistic regression (Table 6).

Table 1: Demographic characteristics of the participants

Characteristics	Self-perceived oral malodour		P-value
	Yes n (%)	No n (%)	
Age (years)			0.262
≤40	70 (18.1)	316 (81.9)	
>40	14 (13.5)	90 (86.5)	
Gender			0.004
Male	48 (22.9)	162 (77.1)	
Female	36 (12.9)	244 (82.9)	
Education			0.113
Non Tertiary	24 (22.2)	84 (77.8)	
Tertiary	60 (15.7)	322 (84.3)	

Table 2: Oral health behaviour among the participants

Characteristics	Self-perceived oral malodour		P-value
	Yes n (%)	No n (%)	
Strength of tooth brush			0.168
Soft	24 (20.0)	96 (80.0)	
Medium	34 (13.5)	218 (86.5)	
Hard	20 (22.2)	70 (77.8)	
I don't know	6 (21.4)	22 (78.6)	
Daily tooth brushing frequency			0.018
Once	52 (21.1)	194 (78.9)	
>Once	32 (13.1)	212 (86.9)	
Receipt of professional instruction on tooth brushing			0.188
Yes	36 (14.5)	212 (85.5)	
No	48 (19.8)	194 (80.2)	
Regular use of chewing stick			0.098
Yes	8 (28.6)	20 (71.4)	
No	76 (16.1)	386 (83.9)	
Regular use of dental floss			0.062
Yes	6 (9.1)	60 (90.9)	
No	78 (18.4)	346 (81.6)	
Regular use of mouthwash			0.252
Yes	18 (21.4)	66 (78.6)	
No	66 (16.3)	170 (83.7)	
Previous dental visit			0.144
Yes	42 (14.5)	248 (85.5)	
No	42 (21.0)	158 (79.0)	
Tobacco use			0.949
Yes	4 (16.7)	20 (83.3)	
No	80 (17.2)	386 (82.8)	
Ever open bottled drink with teeth			0.381
Yes	60 (18.2)	270 (81.8)	
No	24 (15.0)	136 (85.0)	

Table 3: Perception, beliefs and knowledge regarding gingivodental health

Characteristics	Self-perceived oral malodour		P-value
	Yes	No	
	n (%)	n (%)	
Perceived gingival health			0.013
Excellent/Good	38 (12.7)	262 (87.3)	
Fair/poor	46 (24.2)	144 (75.8)	
Perceived dental health			0.222
Good/Excellent	42 (14.9)	240 (85.1)	
Fair/Poor	42 (20.2)	166 (79.8)	
Perceived worsening of oral health despite daily tooth brushing			0.001
Yes	54 (28.7)	134 (71.3)	
No	30 (9.9)	272 (90.1)	
Belief that periodontal disease can be prevented by tooth brushing alone			0.261
Yes	26 (14.6)	152 (85.4)	
No	58 (18.6)	254 (81.4)	
Belief that artificial teeth are inevitable in old age			0.001
Yes	24 (30.8)	54 (69.2)	
No	60 (14.6)	353 (85.4)	

Table 4: Concerns and satisfaction regarding oral health among the participants

Characteristics	Self-perceived oral malodour		P-value
	Yes	No	
	n (%)	n (%)	
Worry about malodour			0.001
Yes	66 (28.2)	168 (71.8)	
No	18 (7.0)	238 (93.0)	
Worry about gingival colour			0.001
Yes	40 (29.9)	94 (70.1)	
No	44 (12.4)	312 (88.1)	
Worry about colour of teeth			0.001
Yes	60 (22.9)	202 (77.1)	
No	24 (22.9)	204 (89.5)	
Satisfaction about dental appearance			0.470
Yes	32 (15.7)	172 (84.3)	
No	52 (18.2)	234 (81.8)	

Table 5: Self reported oral health problems among the participants

Characteristics	Self-perceived oral malodour		P-value
	Yes	No	
	n (%)	n (%)	
Gingival bleeding			0.001
Yes	54 (38.0)	88 (62.0)	
No	30 (8.6)	318 (91.4)	
Dentinal sensitivity			0.130
Yes	44 (20.0)	176 (80.0)	
No	40 (14.8)	230 (85.2)	
Food packing			0.001
Yes	82 (19.5)	338 (80.5)	
No	2 (2.9)	68 (97.1)	
Tooth mobility			0.002
Yes	22 (29.7)	52 (70.3)	
No	62 (14.9)	354 (85.1)	
Dental caries			0.282
Yes	38 (19.4)	158 (80.6)	
No	46 (15.6)	248 (84.4)	

Table 6: Determinants of perceived oral malodour among the participants

Characteristics	O.D	95.0% C.I.	P-value
Age (years)	3.207	0.93-11.11	0.066
Gender	1.804	0.71-4.59	0.216
Education	2.633	0.92-7.55	0.072
Daily tooth brushing frequency	1.354	0.55-3.34	0.511
Strength of toothbrush texture	1.101	0.66-1.85	0.714
Gingival bleeding on tooth brushing	6.806	2.69-17.21	0.001
Perceived worsening of oral health despite daily tooth brushing	1.791	0.62-5.19	0.283
Receipt of professional instruction on tooth brushing	0.788	0.30-2.10	0.632
Ever open bottled drink with teeth	0.765	0.28-2.13	0.608
Belief that periodontal disease can be prevented by tooth brushing alone	0.753	0.28-2.04	0.576
Perception about gingival health	1.217	0.42-3.54	0.719
Dental sensitivity	1.060	0.43-2.60	0.899
Regular chewing stick use	1.445	0.26-8.01	0.673
Regular dental floss use	0.257	0.04-1.54	0.136
Regular mouthwash use	1.376	0.41-4.67	0.608
Worry about oral malodour	4.403	1.64-11.82	0.003
Worry about colour of gingiva	1.658	0.55-5.04	0.373
Worry about colour of teeth	1.880	0.59-6.02	0.288
Satisfaction about dental appearance	2.590	0.85-7.90	0.094
Tobacco use	0.532	0.07-4.03	0.542
Dental visit	0.765	0.29-2.01	0.586
Perception about dental health	1.410	0.49-4.10	0.528
Tooth mobility	1.585	0.51-4.92	0.426
Belief that artificial teeth are inevitable in old age	3.772	1.11-12.86	0.034
Dental caries	0.806	0.31-2.09	0.657
Food packing	3.849	0.44-33.67	0.223

DISCUSSION

Oral malodour is a frequent and complex problem with a multifactorial etiology which necessitates a multidisciplinary management approach.^[14] However, the majority of oral malodour originates from the oral cavity with 65-85% of the cases having their origin from the periodontium and/or tongue thereby making it, one of major presenting complaints among dental patients.^[15] Correct diagnosis of oral malodour will depend on the analysis of data gathered from the history, oral examination and additional laboratory and diagnostic tests.^[16] The assessment of the origin of the oral malodour and providing appropriate treatment regime, is a task facing the attending dental surgeon.^[14] However, the source of malodour can be deciphered from the oral health behaviours, complaints and concerns of the affected patient.^[17] Of the 490 participants studied, 84 of them reported self-perceived oral malodour giving a prevalence of 17.1%. The reported prevalence of higher oral health impacts with significant differences in the seven domains of oral health related quality of life among individuals experiencing bad breath often qualifies

as a significant oral health issue that deserve urgent attention.^[18] The prevalence of perceived oral malodour in this study was higher than the 14.5% documented among patients attending the Periodontology Clinic of University College Hospital in Nigeria.^[19] However, it is lower than the reported values among teenager in New Zealanders ($\approx 20\%$),^[18] adults attending dental clinics in Italy (19.39%),^[12] Kuwait (23.3%),^[20] Jordan (25%)^[21] and Saudi Arabia (36.8%).^[22] The lower prevalence reported in this study may be due to the variation of factors like the prevalence of oral diseases and dietary variation^[23] among the participants in compared studies.

Younger participants, males and less educated participants reported more self-perceived oral malodour. However it was only gender that was significantly associated with self-perceived oral malodour. These findings contrasted with significant more self-perceived oral malodour among females in both Italy^[12] and Kuwait^[20] and also the non-significant gender association with oral malodour in Nigeria.^[19] The increasing age association with perceived oral malodour in previous reports^[12,19,20] also contrasted with the

finding of this study. The tendencies of younger individuals, males and less educated individuals to neglect or pay less attention to their general body hygiene including oral hygiene in comparison with their counter-parts maybe an obvious explanation. The reported association between oral malodour and social class by Arowojulo and Dosumu^[19] and lower education levels by Al-Ansari *et al.*^[20] and Youngnak-Piboonratanakit and Vachirarojpisan (2010)^[24] may be a contributory explanation.

Oral malodour arises from the microbial metabolism of exogenous and endogenous proteinaceous substrates in the oral cavity and is exacerbated by periodontal disease and poor oral hygiene.^[4] It dominantly originates from dental plaque, bacterial products from deep periodontal pockets and the tongue and has been correlated to oral hygiene in terms of calculus, plaque and irregular dental visits.^[4] In this study, participants that reported receipt of professional instruction on tooth brushing, medium strength toothbrush use, more than once-daily tooth brushing frequency, regular use of dental floss and receipt of dental treatment which are evidences of good oral self care, reported less self-perceived oral malodour. Al-Ansari *et al.*^[20] reported less than once-daily tooth brushing and non dental floss use among the factors significantly associated with self-perceived oral malodour. These are attestations that adequate oral hygiene measures may reduce, treat or protect people from oral malodour.^[25,26] The receipt of professional instruction on tooth brushing on dental consultation may have modeled the participation into optimal plaque control using the recommended tooth brush strength, brushing more than once-daily and indulging in regular dental floss use. This may be based on the fact that reduction of microbial load in the oral cavity due to good oral hygiene practices through tooth brushing and the use of appropriate diets may reduce malodour formation.^[23] Contributory explanation may be related to oral malodour favourable response to improved oral hygiene administered first by a trained professional and followed with adequate home care.^[27]

The use of additional tooth cleaning agents like chewing stick and mouthwash were found more among participants that reported more self-perceived oral malodour. These oral behavioural factors favour the increasing availability of variety of oral healthcare products with claims of success for oral malodour. The less tendencies of affected

individuals to discuss oral malodour even with their most trusted confidants because dominant perception of oral malodour as a cosmetic problem favours the behavioural tendencies towards self medicating health seeking behaviour like indulgence in mints and chewing gum, compulsive tooth cleaning and use of mouthwashes in attempt to restore self to acceptable oral aroma.

The participants, who reported having ever opened bottled drink with their teeth which is a negative oral health behaviour reflecting non-challant attitude to the protection of their teeth, reported more self-perceived oral malodour. This finding reinforces the need for attending dentists to discuss and instruct self-perceived malodour patients on oral hygiene education and proper oral self-care.

Participants with fair/poor perceived gingival health perceived that their oral health is worsening despite daily tooth brushing and believed that artificial teeth are inevitable in old age reported significantly more self-perceived oral malodour. Studies have consistently reported that poor perception of oral health is usually associated with abnormal or disease condition as participants worried about malodour, gingival colour, colour of teeth reported significantly more self-perceived oral malodour.^[28-31] However, participants who expressed satisfaction about dental appearance reported non-significantly less self-perceived oral malodour. Worry is known to elicit anxiety which will invariable result in oral malodour through autonomic and behavioural effects of anxiety on oral structures and function and oral health behaviours respectively.^[12]

Participants with gingival bleeding on tooth brushing, dentinal sensitivity, food packing, tooth mobility and dental caries reported more self-perceived oral malodour. However it was gingival bleeding on tooth brushing, food packing and tooth mobility that were significantly associated (Table 5). Effective therapy might require a combination of periodontal disease treatment, correction of dental restoration-based food traps and a rigorous daily mechanical debridement of the tongue supplemented by the most appropriate mouthwash based on the specific condition of the patient.^[32] The present study documents information on oral health status and the complaint on bad mouth breath which will provide obvious clues to identification, diagnosis and management of perceived oral malodour for

improved social and occupational interaction without embarrassment. In this study, gingival bleeding on tooth brushing, worry about oral malodour and belief that artificial teeth are inevitable in old age were the determinants of self-perceived oral malodour from logistics regression. This reflects periodontal disease, concern about the condition because of its stigmatizing nature and low self-efficacy in maintaining optimal oral health necessary to ultimate preventing diseases that will lead to tooth loss with ageing. Previous reports of association between gingival bleeding and oral malodour^[12,24] which is linked with the putrefaction blood from the gingival bleeding resulting in oral malodour apply here too. This suggests that patients with perceived oral malodour needs not only periodontal and dental therapy but psychological care and counseling to ensure total restoration to of normalcy in mouth air, self confidence and psychological well being.

CONCLUSION

Data from this study revealed that one out every six studied periodontal patients had perceived oral malodour which is associated with gender, daily tooth brushing, belief that artificial teeth are inevitable in old age, perceived worsening of oral health despite daily tooth brushing, periodontal health perception, periodontal complaints (gingival bleeding, tooth mobility and food packing) and worry about oral condition.

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