Oral Malodor: An Indicator of Oral Neglect and Poor Self-Esteem Among Slum Dwelling Children in Nigeria

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Key words: halitosis, oral malodor, oral health, self-esteem, quality of life.

ABSTRACT

Objective: Oral malodor, an inadequately studied disease in children, is the third most prevalent reason for dental consultations, with negative impacts on psychosocial health. This study assessed self-rated and normatively assessed oral malodor and its impact on quality of life among a cohort of slum dwelling children in Lagos, Nigeria.

Materials and Methods: This descriptive survey was conducted among children living in slums in Lagos State, Nigeria. A multi-stage sampling method was utilized to select participants for the study. The Organoleptic test was utilized by two calibrated dentists to assess oral malodor. The Self-Reported Scale for Oral Health (SOHO) and the Rosenberg Self-Esteem Scale (RSE) were used to assess quality of life and self-esteem. Regression analysis was done using sociodemographic, clinical, self-esteem and QOL variables as the predictor variables to identify their strength of association with oral malodour. The probability level of $p<0.05$ was considered significant.

Results: Majority of the 427 respondents were aged between 10-14 years of age (67%), and were females (54.4%). Thirty four percent of the respondents self-rated themselves as having oral malodor; normatively, 22.6% of the respondents had oral malodor. There was a significant association between OHRQOL (aOR: 2.724; CI: 1.563-4.932), gingival inflammation (aOR: 2.402; CI: 1.417-4.078), self-esteem (aOR: 2.546; CI :2.015-5.246), self-rated oral malodor (aOR: 3.846; CI: 2.118-8.571), parental education (aOR: 1.483; CI: 1.034-1.940), history of dental visit (aOR: 8.375; CI: 2.435-28.810), reason for dental visit (aOR: 2.224; CI: 0.932-5.310), and number of children in the family (aOR: 1.106; CI: 1.010-1.212), with oral malodor.

Conclusion: Oral malodor was significantly associated with low self-esteem, poor OHRQOL poor oral health, and dental attendance pattern. The oral health of children living in slums needs to be seen by policymakers as an important predictor of their mental health and wellbeing.

INTRODUCTION

In addition to dental caries and periodontal disease, oral malodor, the third most prevalent reason for dental consultations, is an indicator of poor oral health, with negative impacts on psychosocial health.[1] Oral malodor is a multifactorial condition that results from the interplay between oral, systemic, and psychosomatic factors.[2] It is often characterized by a noticeably unpleasant breath which can predispose a child to bullying and victimization.[3] About 80–85% of cases are associated with intraoral causes, while the rest are caused by extraoral factors such as upper respiratory tract infections.[4] Methyl

mercaptan and hydrogen sulphide, which are volatile sulphur compounds, are principally responsible for the odor associated with intra-oral halitosis.[6,7] The prevalence of oral malodour in children in different regions of the world ranges between 8% and 45% depending on the assessment technique utilized. [7-9]

Although oral malodor is not associated with pain and physical distress as seen in dental caries, it has negative psychological and social effects, impacting self-confidence, self-esteem, and interpersonal communication, and often leads to internalizing disorders such as withdrawal, anxiety and depression.[10] Oral malodor often interferes with self-confidence during communication, hampering the professional and social life of sufferers because of the negative feedback they receive as a result of their offensive breath.[11] This negative effect on interpersonal relationships can predispose individuals to low self-esteem and even progress to suicidal ideation and intent.[12] Oral malodor also has a negative impact on Oral Health Related Quality of life (OHRQOL) within the context of cultural and societal value systems and expectations. A study investigating this impact observed poorer OHRQOL in patients with oral malodor, dysgeusia, and burning sensations on the tongue.[13] Individuals who live in slums, who are often marginalized, have been observed to have higher impacts on their OHRQOL.[14]

Due to exposure to environmental risk factors from poor sanitation, poor access to medical services, limited educational opportunities and poor attention to their health by relevant authorities, children who live in slums tend to have poorer health outcomes. They are also susceptible to diseases that result from poor nutrition as well as some non-communicable diseases. They are predisposed to diarrhea which is associated with high mortality and morbidity rates.[15] These diarrheal episodes can result in gut enteropathy and nutritional deficiencies, which can further impact their systemic health and halitosis.[16] These children are also more vulnerable to acute respiratory infections (ARIs).[17] Studies have shown a higher prevalence of ARIs among children who live in slums compared to children who do not.[17] Amidst other possible aetiopathologies, respiratory infections, which are prevalent in children, predispose to mouth breathing, which can contribute to dry mouth and the development of oral malodor.[18]

Traditionally, research and clinical care on halitosis and oral malodor have almost entirely focused on adults. Moreover, there is a possibility that factors predisposing to oral malodor could be addressed early in childhood before they become intractable. Adolescence is a transition period associated with introspection and significant physical, emotional, and social changes.[19] Moreover, adolescence is a period in which behaviors and attitudes formed about health and self-care can be long-lasting. [20] To date, there is a scarcity of data on the prevalence of oral malodour among slum-dwelling children in Nigeria as well as its impact on their self-esteem and quality of life. Therefore, this study assessed the prevalence of self-rated and normatively assessed oral malodor and its impact on quality of life in a cohort of children and adolescents in Lagos, Nigeria.

MATERIALS AND METHODS

Ethical approval and informed consent: Ethical approval for the study was obtained from the Health Research and Ethics Committee of Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria. Adequate consideration was given to protect the identity of study participants, and the confidentiality of the information given was guaranteed. Assent was obtained from pupils aged 7-17 years, while consent was obtained from students aged 18 years and older. All participants also provided parental consent, and the confidentiality of the information was assured.

Study design and study setting: This descriptive survey was conducted among school children aged 10-19 years, schooling in Ikorodu and Ikeja Local Government areas in Lagos state, in the Southwest geopolitical zone of Nigeria. Lagos is the commercial nerve center and a cultural melting pot for a diverse population of Nigerians of different cultures and backgrounds, making studies conducted in it more representative than in other regions of the country. Ikeja is the capital of the state and its economic hub, which includes all socioeconomic classes represented in the local government area. Ikorodu is the second largest LGA in Nigeria and mainly comprises manufacturing, farming, and trading activities.

Sample Size: Using the sample size formula for descriptive studies: $n= Z^2pq/d^2$; making a provision of 20% for incomplete responses, a minimum sample size of 400 children was required to achieve a 5% level of precision, using a standard normal deviate of 1.96 and a prevalence of oral malodor of 32.7% from a reference study[21] for the calculation.

Sampling method: In the multistage sampling method utilized, Ikorodu and Ikeja LGAs were firstly selected, using the balloting method. At the second stage, delineation of slum dwelling areas in the two LGAs and random selection of two slums in each LGA was done. Two clusters were selected in the slum regions in the final stage and enlistment of eligible children in each cluster was done proportionally.

Inclusion and exclusion criteria: Subjects aged 10–19 years of both sexes whose parents agreed to participate in the study and gave informed consent and assent where appropriate were included. Subjects with physical or mental disability, those with conditions and had difficulty in managing routine oral hygiene measures, those with any developmental dental anomaly, and those with ongoing dental treatment were excluded. Any subject with a condition deemed to be a dental emergency, those with a recent tooth extraction, those who fasted from the previous day before the evaluation, and those who refused to provide consent and/or assent were excluded.

Study procedure/study instrument: Each selected cluster was given a specific date for data collection after permission was obtained from the opinion leaders of the community. An interviewer-administered questionnaire was used for data collection. The data collection tool contained questions that elicited information on the socio-demographic profile of the subject (age of the study participants at the last birthday, sex, parents' level of education, tribe, and location of school); data on oral health-related behaviors related to dietary habits, oral hygiene practices, and past dental visits were obtained.

Oral Examination/Organoleptic Test: Two calibrated dentists who had an inter-examiner reliability using kappa was 0.86 and intra-examiner reliability of 0.89 and 0.84, respectively, performed the intraoral examination and organoleptic test. The magnitude of the odor was graded on a scale of 0 to 5 (0, no odor; 1, barely noticeable; 2, slight but noticeable; 3, moderate; 4, strong; and 5, extremely strong). Subjects with an organoleptic test score ≥2 were considered to have oral halitosis.222,23 The organoleptic test was performed two hours after breakfast to avoid false results caused by fasting and certain diets that alter the odor of the oral cavity. There was a five-minute break between each examination to standardize the clinical examination and avoid adaptation. Subjects were deemed to have reported halitosis if they answered "Yes" to the question, "Do you suffer from bad breath?"

The Self-rated Scale for Oral Health (SOHO) was used to assess quality of life while the Rosenberg Self-Esteem Scale (RSE), a 10 item Guttman scale, was used to assesses self-esteem based on a score of 1 = strongly agree, 2 = agree, 3 = disagree, 4 = strongly disagree. The scale was scored by adding the individual 4-point items after reverse-scoring the negatively worded items in the scale.

Data analysis: The data generated from this study was subjected to analysis using SPSS version 26.0 (Armonk, NY: IBM Corp). Univariate data were presented as means and percentages while bivariate data were presented as proportions and means with standard deviation. Regression analysis was done with sociodemographic, clinical, self-esteem, and QOL as predictor variables to determine the strength of their association with oral malodor. Statistical significance was determined at p values <0.05.

RESULTS

Majority of the respondents were aged between 10–14 years of age (67%) and were female (54.4%). The highest proportion of fathers had no educational qualification (48.5%). The majority of children were from families with three or fewer children (41.5%). Thirty-four percent of the respondents self-rated themselves as having oral malodor, and the majority (41.8%) stated that the odor was first perceived 4 years ago. The prevalence of malocclusion was 39.1%, and 21.1% of the patients had at least one carious lesion. Forty-six (10.8%) respondents had poor oral hygiene (Table 1).

Table 1: Sociodemographic and clinical

characteristics of respondents.

		Frequency	Percent
Age Categories (years)	6-9	14	3.3
	10-14	289	67.2
	15-19	124	28.8
	Total	427	99.3
Gender	Male	195	45.6
	Female	232	54.4
Paternal level of Education	None	207	48.5
	Primary	55	12.9
	Secondary	107	25.0
	Tertiary	58	13.6
Number of children in family	1-3	177	41.5
	4-6	153	35.8
	≥7	97	22.7
Self-perceived mouth odour	Yes	146	34.0
	No	281	66.0
First time malodour was perceived (n=146)	<1 year	3	2.1
	1 year	10	6.8
	2 years	49	33.6
	3 years	19	13.0
	4 years	61	41.8
	5 years	4	2.7
Malocclusion	present	168	39.1
	absent	259	60.9
DMFT	0	337	78.9
	1	44	10.3
	2	3	0.7
	3	34	7.9
	4	3	0.7
	5	6	1.5
Oral Hygiene (OHIS-S)	Good	200	46.8
	Fair	181	42.4
	Poor	46	10.8
Gingivitis (GI)	Mild	403	94.4
	Moderate	24	5.6
	Severe	0	0.0
		427	**100.0**

Using the Rosenberg Self-Esteem Scale, a high proportion of the respondents strongly disagreed with being satisfied with themselves (37.9%), that they felt that they were persons of worth, at least on an equal plane with others (43.8%), and that they had a positive attitude towards themselves (37.9%). On the whole, majority of the respondents had more negative responses on the self-esteem (Table 2).

Table 2: ROSENBERG SELF-ESTEEM SCALE

	Strongly Agree	Agree	Disagree	Strongly Disagree
On the whole, I am satisfied with myself	53 (12.4)	166 (38.9)	46 (10.8)	162 (37.9)
At times I think I am no good at all.	19 (4.4)	104 (24.4)	142 (33.3)	162 (37.9)
I feel that I have a number of good qualities	44 (10.4)	172 (40.4)	56 (13.1)	137 (32.1)
I am able to do things as well almost other people.	50 (11.7)	161 (37.7)	56 (13.1)	160 (37.5)
I feel I do not have much to be proud of	14 (3.3)	87 (20.4)	155 (36.3)	171 (40.0)
I certainly feel useless at times	3 (0.7)	92 (21.5)	130 (30.4)	202 (47.3)
I feel that I'm a person of worth, at least on an equal plane with others	26 (6.1)	164 (38.4)	50 (11.7)	187 (43.8)
I wish I could have more respect for myself	48 (11.2)	208 (48.7)	13 (3.1)	158 (37.0)
All in all, I am inclined to feel that I am a failure	3 (0.7)	84 (19.7)	163 (38.1)	177 (41.5)
I take a positive attitude toward myself	48 (11.3)	165 (38.6)	52 (12.2)	162 (37.9)

On the self-reported scale of oral health, a quarter of the respondents stated that their self-confidence/self-esteem had been moderately affected because of oral malodor or "the state of your mouth", while 6.3% stated that it is affected a lot (Table 3).

Table 3: Self-reported scale of oral health (SOHO-5)

Has your self-confidence/self-esteem ever been affected because of oral malodour or the state of your mouth	Frequency	Percentage
no (0)	254	59.5
a little (1)	33	7.7
moderate (2)	107	25.0
a lot (3)	27	6.3
a great deal (4)	6	1.5
Total	**427**	**100.0**

For the Oral Malodor Score measured using the organoleptic score based on the Rosenberg scale of 0-5, slight malodor was observed among 19.2% of the respondents, while moderate odor or a score of 3 was observed among 2.5% of the children. 0.9% of the respondents had strong Malodour, while severe malodor was observed among none of the respondents. -Table 4

Table 4: Oral Malodor Score measured by using organoleptic score based on the Rosenberg scale of 0-5.

	Frequency	Percentage
0= absence of odor	182	42.6
1= barely noticeable odor	148	34.8
2=slight malodor	82	19.2
3= moderate odor	11	2.5
4= strong malodor	4	0.9
5= severe malodour	0	0.0
Total	427	100.0

Table 5 presents the bivariate association between the Rosenberg Malodour Scale scores of the respondents and self-rated malodors. There was a significant association between self-rated and normatively assessed malodors (p<0.05).

Table 5: Bivariate association between the Rosenberg Malodour scale scores of the respondents and self-rated malodour.

	Rosenberg Malodour scale of 0-5					
	0	**1**	**2**	**3**	**4**	**5**
Self Rated						
Present	34 (7.9)	68 (15.9)	22 (5.2)	7 (1.6)	4 (0.9)	0 (0.0)
Absent	148 (34.6)	80 (18.7)	60 (14.1)	4 (0.9)	0 (0.0)	0 (0.0)
	182 (42.6)	148 (34.8)	82 (19.2)	11 (2.5)	4 (0.9)	0(0.0)
				Chi^2 =37.47	P=0.000	

There was a significant association between OHRQOL (aOR:2.724; CI:1.563-4.932), gingival inflammation (aOR:2.402; CI:1.417-4.078), self-rated oral malodor (aOR:3.846; CI:2.118-8.571), parental education (aOR:1.483; CI:1.034-1.940), history of dental visit (aOR:8.375; CI:2.435-28.810), reason for dental visits (aOR:2.224; CI:0.932-5.310), number of children in the family (aOR:1.106; CI:1.010-1.212), and oral malodor. The predictors of oral malodor among the study participants are displayed in (Table 6).

Table 6: Regression analysis displaying the predictors of oral malodour.

.	OR	aOR	95% C.I.		P value
			Lower	Upper	
Self Esteem	1.063	1.939	0.827	2.066	0.328
Oral health Practice	1.014	1.120	0.789	1.592	0.525
Age	0.366	0.693	0.445	1.081	0.106
SOHO OHRQOL	1.323	2.724	1.563	4.932	**0.012**
Self esteem	1.734	2.546	2.015	5.246	**0.004**
Malocclusion	0.628	0.972	0.675	1.400	0.879
DMFT	0.922	1.025	0.804	1.307	0.840
Gingival Inflammation	1.877	2.404	1.417	4.078	**0.001**
Self-Rated Oral malodour	1.348	3.846	2.118	8.571	**0.001**
Parental Education	1.394	1.483	1.134	1.940	**0.004**
Prior dental visit	2.125	8.375	2.435	28.810	**0.001**
Reason for dental visit	1.799	2.224	0.932	5.310	**0.002**
No of children in family	1.101	1.106	1.010	1.212	**0.030**

DISCUSSION

After dental caries and periodontal disease, oral malodor is the third most frequent cause of dental visits. It has a societal influence on persons who experience it, disrupting communication and other regular everyday tasks like social and professional connections. Additionally, it has an impact on a person's self-confidence, self-worth, employment, and general quality of life.[24] In the current study, 34.4% of the participants self-reported having oral malodor, and majority said the odor was first noticed four years ago. However, normative assessments revealed that malodor was found in 22.6% of the children, indicating that almost twice the number of those with malodor self-rated themselves as having oral malodor, possibly showing a heightened perception of the condition in this population. This prevalence of oral malodor was slightly lower than that in a systematic review and meta-analysis that reported an estimated prevalence of 31.8%, with high heterogeneity among the studies.[25] Another systematic review and meta-regression analysis by Silva also reported a prevalence of 31.8% with a confidence interval of 24.6% to 39.0%.[26] Another review reported a wide range for its

prevalence, which ranged from 2.4% for severe halitosis to 42% for subjectively reported halitosis.[27] Among school children, a previous study reported a high prevalence of oral malodor, detecting oral malodor in 39.6% of senior high school children.[28] The wide range in the prevalence obtained in the studies could be due to differences in sampling methodology, diagnostic criteria and the populations studied. However, most of these values were obtained in adults and epidemiologic data on oral malodour in children are currently limited.

Some studies have also highlighted the pervasiveness of oral malodor in slum-dwelling children,[29,30] where significantly elevated levels of Prevotella oralis and P. melaninogenicus were measured in their saliva, compared to controls.[29] A high occurrence of oral malodor among children in these slum areas may be attributed to various factors. Poor oral hygiene practices, lack of awareness of oral health, and limited access to dental services may contribute to this high prevalence.[31] In a study conducted in Ahmedabad, poor oral hygiene practices were significantly prevalent among slum dwelling children.[31] Similarly, a study conducted in Bangladesh reported a remarkably high prevalence of gingivitis and plaque accumulation among slum dwelling children.[32] These findings highlight the need for improved oral hygiene practices and access to oral care for these children. Furthermore, living conditions in slum areas can contribute to the prevalence of oral malodor. Slum-dwelling children are more vulnerable to respiratory infections such as acute respiratory infections (ARIs), which can affect oral health.[17] A higher prevalence of ARIs has also been observed among slum-dwelling children than non-slum-dwelling children.[17] Respiratory infections can lead to mouth breathing, which can contribute to dry mouth and the development of oral malodor.[29]

A high proportion of the respondents had negative impacts on their self-esteem from oral malodor while 31.3% of the respondents had moderate to severe impacts on their QOL from halitosis. According to a self-reported scale of oral health, 25% of respondents stated that their quality of life had been moderately affected by oral malodor or the state of their mouth, while 6.3% stated that it was significantly affected. Unpleasant breath can negatively impact human relations and the overall quality of life.[33] Individuals with oral malodor often experience negative impacts on their mental and social well-being as well as their oral health-related quality of life. Oral malodor may also play an important role in social communication.[34] Participants with oral malodor have been found to be more anxious and to experience stress and depression more frequently.[35] According to the American Dental Association, 50% of adults have experienced occasional or chronic oral malodor disorders, with 25% having a persistent problem. As a result, dental consultations and commercial business interests in products that eliminate the factors causing halitosis has been increasing.[35] Thus, dental practitioners should consider patients' OHRQoL when planning treatment for oral malodor, and the OHIP-14 appears to be an appropriate tool for screening in the dental clinic to screen for the impact of oral malodour on patients' functional and psychosocial well-being.

Children aged between 7–12 years, females, those who did not use toothbrush and toothpaste, those who had no preventive dental visits, and those with low self-esteem had a higher prevalence of oral malodor. There was a strong association between oral malodor and oral health-related quality of life, gingival inflammation, self-rated oral malodor, parental education, history of dental visit, reason for dental visit, and number of children in the family.

CONCLUSION

Oral malodor was significantly associated with low self-esteem, poor OHRQOL poor oral health and dental attendance pattern. The oral health of children who live in slums needs to be seen by policymakers as an important predictor of their mental health and wellbeing.

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