Comparison of Clinical and Self-Reported Halitosis among Secondary School Adolescents in Maiduguri, Borno State Nigeria.

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ABSTRACT

Background: Halitosis is of extreme relevance in adolescents due to their peculiar predisposition to conditions that affect social relationships.

Objective: To assess the factors associated with halitosis and compare its prevalence using self and clinical reports among secondary school adolescents in Maiduguri, Borno State, Nigeria.

Methods: This was a cross-sectional study carried out among one hundred and fifty 12-18-year-old secondary school students in Maiduguri. The multistage sampling technique was used for the selection of participants and data was collected using an interviewer-administered structured questionnaire on socio-demography, knowledge of the aetiology of halitosis, oral hygiene practices and self-perception of halitosis. A trained and calibrated examiner did clinical halitosis by organoleptic assessment. A chi-square test and logistic regression analysis were done to determine the association between the investigated factors and halitosis. The level of test of significance (p) was set at < 0.05

Results: The prevalence of self-reported halitosis was 17.3 % while using the organoleptic method (clinical halitosis), about 12 (8.0%) had slight to moderate halitosis. There was no statistically significant association between self-reported halitosis and halitosis determined using the organoleptic method. Among the investigated factors, frequency of brushing and gingival bleeding were found to be statistically significantly associated with self-reported halitosis, (aOR 3.64; p=0.032) and (aOR 3.06; p=0.045) respectively.

Conclusion: Adolescents reported halitosis more than was clinically present which may have led to more aggressive oral hygiene practices. There is therefore the need to increase awareness on halitosis and proper oral health behaviour in adolescents in the Northern part of Nigeria.

Keywords: Self-reported halitosis, clinical halitosis, organoleptic halitosis, adolescents

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INTRODUCTION

Halitosis also referred to as bad breath, foetor oris, or oral malodour is described as the presence of an unpleasant breath smell in an individual.[1,2] Halitosis is considered a medical problem that impacts negatively on the emotional and social well-being of the affected individual.[1] Its presence impairs social interaction and has been associated with social and mental conditions such as stigmatization, depression, and reduced oral health-related quality of life.[3] Three major categories of halitosis have been described: genuine halitosis, pseudo-halitosis, and halitophobia.[4] Of these three, the malodour is only clinically detectable in genuine halitosis while the other two can only be perceived by the affected individual. The perception even persists despite treatment for those with halitophobia. Genuine halitosis can be sub-classified into physiological or pathological and can arise from intraoral sources such as coated tongue, poor oral hygiene, dental caries, dry mouth, gingival and periodontal inflammations.[4,5] Extra-oral causes of halitosis include acute tonsillar enlargement, sinusitis, gastrointestinal diseases, metabolic conditions and chronic use of certain medications.[2]

Halitosis is a universal medico-social problem with no gender or age predilection[3,6] although it is particularly of importance in adolescents due to their peculiar predisposition to conditions that affect social relationships.[3] Halitosis can be self-reported or clinically diagnosed using the organoleptic method.[2] The organoleptic method is the oldest method of diagnosis and relies on nasal perception of odour by trained specialist. It is the simplest and cheapest method of diagnosing halitosis. Other clinical methods comprise the volatile sulphur compound (VSC) monitors, Benzoyl-DL-Arginine-a-Naphthylamide (BANA) test and gas chromatography. The VSC monitors measure the amount of volatile sulphur compounds using portable devices at patients' chairside.[2] Based on the method of diagnosis, culture and age of study participants, the prevalence of halitosis varies worldwide. In adolescents and young adults, a prevalence rate of self-reported halitosis ranging between 23.1% and 77.5% was documented in a review by Briceag et al[1,6,7] In Nigerian Adolescents, Alade et al.[3] reported a prevalence of 32.7% which was higher than 14.8%[8] and 13.0%[9] that were previously reported. These values were however based on patients' self-report with only a few studies[10,11] using the clinical diagnostic methods in this environment. Furthermore, the majority of the reports were from the southwestern part of Nigeria with a paucity of data from the northern part of the country. This study therefore aimed to assess the factors associated with halitosis and compare its prevalence using self-reported and clinical reports among secondary school students in Jere Local Government Area, Maiduguri, Borno State, Northeast Nigeria.

MATERIALS AND METHODS

This study is a cross sectional study carried out among 12-18 year old secondary school students in Jere Local Government Area, Maiduguri, Borno state. Sample size was calculated using the Leslie Kish formula where P was 32.7%, prevalence of halitosis obtained from a previous study on self-reported halitosis and oral health related quality of life in adolescent students from a suburban community in Nigeria[3], d was 0.08 and Z was 1.96 considering a 10% non- response rate. This gave an approximate total sample size of 150. A multistage sampling technique was adopted. A list of Local Government Areas (LGAs) in Maiduguri metropolis was drawn and Jere LGA was randomly selected by balloting from the list. A list of wards in Jere Local Government Area was then obtained from the LGA Secretariat in Maiduguri, Borno State. A ward was randomly selected by balloting from the list, after which a list of all the public secondary schools in the randomly selected ward was drawn. One secondary school was randomly selected by balloting. There were four arms in each class of the senior secondary school and in each arm, there were 26 students. Furthermore, adopting the cluster randomized technique; two arms were selected by balloting from each class of the senior secondary classes. Interviewer administered structured questionnaires were used to obtain data on the socio-demography, knowledge of etiology of halitosis, oral hygiene practices and self-perception of halitosis. The socioeconomic status of each participant was derived from an adapted version of an index developed by Olusanya et al.[12–14] The index uses multiple items; the father's occupation and level of education and mother's level of education.

The self-perception of halitosis was considered positive if the participant responded 'Yes' to the question "do you think that you have bad breath: Yes

or No.? Clinical halitosis by organoleptic assessment was done by a trained and calibrated examiner who perceived participant's mouth breath and scored according to Miyazaki et al.[4] standard scoring, which ranges from score 0 to 5. Score 0 represents the absence of malodour; score 1 describes a questionable odour; score 2 is a slightly perceivable odour; score 3 is moderate odour; score 4 is a strong malodour and score 5 indicates severe odour. A score of 2 and above was considered diagnostic of halitosis[10].

Data were entered into and analysed using IBM SPSS version 23.0. The knowledge of aetiology of halitosis score for each participant was obtained by summing responses from five questions on causes of halitosis. Each positive response was assigned a score of 2 with the maximum obtainable score being 10 and minimum obtainable score of 0 which were converted into percentages. Likewise, the oral hygiene practice score was obtained from positive responses to five questions on frequency of brushing the teeth, the tongue, flossing and use of dental services. Each positive response was also assigned a score of 2 and the maximum obtainable score was 10 and minimum obtainable score of 0 converted into percentages. A score of less than 50% was considered poor knowledge and poor practice. The knowledge of aetiology and oral hygiene practice scores were summarised using median and (Inter Quartile Range) IQR as they were not normally distributed. The proportion of study participants with self-perceived halitosis was calculated. The association between the dichotomised oral hygiene practice and self-perceived halitosis was determined using Chi square test. Comparison between self-reported and clinical halitosis was undertaken using the chi square test. Factors found to be statistically significantly associated self-reported halitosis were placed in regression model and their adjusted odds ratio calculated. The level of significance was set at < 0.05.

The study was conducted under the 1964 Helsinki Declaration on health research involving human subjects. Permission was also obtained from the Chairman of Jere LGA. Written informed consent was obtained from the parents of the study participants and assent was obtained from each participant.

RESULTS

Twenty-six (17.3%) of the study participants reported that they had halitosis (self-reported halitosis). Seventeen (65.4%) detected that they perceived the halitosis by breathing into their palm, 6 (17.1%) were informed by others while 2(7.7%) felt that it was just a perception and 1 (3.8) was informed by a Dentist. Using the organoleptic method (clinical halitosis), about 138 (92.0%) of the participants had questionable halitosis while 12 (8.0%) had slight to moderate halitosis. None had severe or strong malodour. Table 1 shows that the majority 113(75.3%) of the participants were aged 15 to 18 years and the mean ±SD age was 15.33±1.30. Females were more than males with a ratio of 3:1. More 61(40.7%) of the participants were in SSS 1. Table 1 also shows that only class of the participants had statistically significant association with self-reported halitosis (p=0.03). Fourteen (53.8%) of the participants in SS 1 reported that they had halitosis while it was reported by 12 (46.2%) of the participants in SS 2 and 3. There was no statistically significant association between sociodemographic characteristics and clinical halitosis (p>0.05).

As regards knowledge of aetiology of halitosis score, the median (minimum, maximum) score was 6.00(0, 4). Table 2 shows that 98(65.3%) of the participants had good knowledge of the aetiology of halitosis. Moreover, more than half 86(57.3%) of the participants brush their teeth only once a day. Twenty-two (84.6%) of the participants who reported halitosis brushed daily while more than once daily tooth brushing was reported by 4 (15.4%) of the participants who reported halitosis (p=0.002). The majority 139(92.7%) of them brush their tongue daily and 71(47.3%) use mouth wash. Thirty-four (22.7%) of the participants use dental floss and 31(20.7%) have visited the dentist.

A median (minimum, maximum) oral hygiene status score of 4.00(0, 2.) were observed among the study participants. A higher percentage 97(64.7%) of the study participants had poor oral hygiene practice compared to those 53(35.3%) who had good oral hygiene practice. Less than a quarter of the participants 21(14%) claimed to experience gingival bleeding. Eight (30.8%) of the study participants that reported that they had halitosis had gingival bleeding when brushing while 13(10.5%) of those who did not report halitosis had gingiva bleeding (p=0.01). On intraoral examination, a median (minimum, maximum) OHI-S score of 2.0 (0, 1) were observed. More than half 85(56.7%) of the participants had good oral hygiene status; 29(19.3%) had tongue coating and 24 (16%) had gingivitis. There was a statistically significant association between tongue coating and self-reported halitosis (p=0.03). Among participants who reported that they had halitosis, 25

(96.2%) of them had no tongue coating while 1 participant who reported that halitosis was present had tongue coating.

Table 3 shows that there was no statistically significant association between knowledge of the aetiology of halitosis, frequency of tooth brushing, tongue brushing, use of mouthwash, use of dental floss, dental visit, oral hygiene status, gingival bleeding, gingivitis and organoleptically determined halitosis (clinical halitosis). Table 4 also shows that there was no statistically significant association between self-reported halitosis and clinical halitosis (p=0.05). However, among those who reported self-halitosis, 5(18.2%) had clinical halitosis while among those who reported no halitosis, 7(5.6%) had clinical halitosis.

Multinominal regression analysis reveals that adolescents who brush once daily were about 4 times more likely to report halitosis than those who brush twice daily (p=0.032; CI 1.12-11.85). Similarly, adolescents with gingival bleeding were about 3 times more likely to report halitosis than those without (p=0.045; CI 0.02-1.63). Table 5.

Table 1: Sociodemographic characteristics of study participants by self-reported and clinical halitosis

		Self-reported halitosis				Clinical halitosis				
Factors	**Total No. (%)**	**Yes No. (%)**	**No No.(%)**	**χ^2**	**p**	**Questionable**	**Slight**	**Moderate**	**χ^2**	**P**
Age (years)										
12-14	37(24.7)	7(26.9)	30 (24.2)	0.09	0.80	34 (24.6)	3(37.5)	-	2.02	0.47*
15-18	113(75.3)	19(73.1)	94 (75.8)			104 (75.4)	5 (62.5)	4 (100.0)		
Mean±SD										
15.33±1.30										
Gender										
Male	38(25.3)	3 (11.5)	35 (28.2)	3.16	0.08	34 (24.6)	3 (37.5)	1 (25.0)	1.04	0.65*
Female	112(74.7)	23(88.5)	89 (71.8)			104 (75.4)	5 (62.5)	3 (75.0)		
Class										
SS 1	61 (40.7)	14(53.8)	47 (37.9)	**6.79**	**0.03***	53 (38.4)	6 (66.7)	2. (50.0)	5.09	0.23*
SS 2	43 (28.7)	2 (7.7)	41 (33.1)			42 (30.4)	-	1 (25.0)		
SS 3	46 (30.6)	10(38.5)	36 (29.0)			43 (31.2)	3 (33.3)	1 (25.0)		
Socioeconomic status										
Upper	140(93.3)	23(88.5)	117(94.4)	3.27	0.17*	128(92.8)	8(100)	4(100)	1.70	1.00*
Middle	7(4.7)	3(11.5)	4 (3.2)			7(5.1)	-	-		
Lower	3 (2.0)	-	3(2.4)			3(2.2)	-	-		

Note: * Fisher's Exact Test

Table 2: Factors associated with self-reported halitosis

		Self- reported halitosis			
Factors	**Total No. (%)**	**Yes No. (%)**	**No No. (%)**	**χ^2**	**p**
KNOWLEDGE OF AETIOLOGY OF HALITOSIS					
Good	98 (65.3)	17 (65.4)	81 (65.3)	0.00	1.00
Poor	52 (34.7)	9 (34.6)	43 (34.7)		
ORAL HYGIENE PRACTICES					
Frequency of brushing					

Once daily	86 (57.3)	22 (84.6)	64 (51.6)	**9.57**	**0.002***
Twice or more	64 (42.7)	4 (15.4)	60(48.4)		
Tongue brushing					
Yes	139 (92.7)	23 (88.5)	116 (93.5)	0.82	0.41*
No	11 (7.3)	3 (11.5)	8 (6.5)		
Use of mouth wash					
Yes	71(47.3)	15 (57.7)	56 (45.2)	1.35	0.25
No	79 (52.7)	11 (42.3)	68 (54.8)		
Use of dental floss					
Yes	34 (22.7)	7 (26.9)	27 (21.8)	0.33	0.57
No	116 (77.3)	19 (73.1)	97 (78.2)		
Dental visit					
Yes	31 (20.7)	5 (19.2)	26 (21.0)	0.04	0.84
No	119(79.3)	21 (80.8)	98 (79.0)		
Oral hygiene practice					
Good	53 (35.3)	8 (30.8)	45 (36.3)	0.29	0.59
Poor	97 (64.7)	18 (69.2)	79 (63.7)		
GINGIVAL BLEEDING WHEN BRUSHING					
Present	21 (14.0)	8 (30.8)	13 (10.5)	**7.35**	**0.01***
Absent	129 (86.0)	18 (69.2)	111 (89.5)		
CLINICAL FACTORS					
Oral hygiene status					
Good	85 (56.7)	15 (57.7)	70 (56.5)	0.33	1.00*
Fair	61 (40.7)	11 (42.3)	50 (40.3)		
Poor	4 (2.6)	-	4 (3.2)		
Tongue coating					
Present	29 (19.3)	1 (3.8)	28 (22.6)	**4.84**	**0.03***
Absent	121 (80.7)	25 (96.2)	96 (77.4)		
Gingivitis					
Present	24 (16.0)	3 (11.5)	21 (16.9)	0.47	0.77*
Absent	126 (84.0)	23(88.5)	103(83.1)		

Note: * Fisher's Exact Test

Table 3: Factors associated with clinical halitosis among study participants

		Clinical halitosis				
Factors	Total No. (%)	Questionable No. (%)	Slight No. (%)	Moderate No. (%)	χ^2	p
KNOWLEDGE OF AETIOLOGY OF HALITOSIS						
Good	98 (65.3)	88 (63.8)	7 (87.5)	3 (75.0)	1.82	0.48*
Poor	52 (34.7)	50 (36.2)	1 (12.5)	1(25.0)		
ORAL HYGIENE PRACTICES						
Frequency of brushing						
Once	86 (57.3)	76 (55.1)	6 (75.0)	4 (100.0)	3.84	0.12*
Twice daily	64 (42.7)	62 (44.9)	2 (25.0)	-		
Tongue brushing						
Yes	139 (92.7)	128 (92.1)	7 (87.5)	4 (100.0)	0.97	0.61*
No	11 (7.3)	10 (7.2)	1 (12.5)	-		
Use of mouth wash						

Yes	71 (47.3)	67 (48.6)	2 (25.0)	2 (50.0)	1.72	0.41*
No	79 (52.7)	71 (51.4)	6 (75.0)	2 (50.0)		
Use of dental floss						
Yes	34 (22.7)	29 (21.0)	4 (50.0)	1 (25.0)	3.68	0.14*
No	116 (77.3)	109 (79.0)	4 (50.0)	3 (75.0)		
Dental visit						
Yes	31 (20.7)	28 (20.3)	2 (25.0)	1 (25.0)	0.66	0.86*
No	119 (79.3)	110 (79.7)	6 (75.0)	3 (75.0)		
Oral hygiene practice						
Good	53 (35.3)	49 (35.5)	3 (37.5)	1 (25.0)	0.29	1.00*
Poor	97 (64.7)	89 (64.5)	5 (62.5)	3 (75.0)		
GINGIVAL BLEEDING WHEN BRUSHING						
Present	21 (14.0)	18 (13.0)	1 (12.5)	2 (50.0)	4.43	0.13*
Absent	129 (86.0)	120 (87.0)	7 (87.5)	2 (50.0)		
CLINICAL FACTORS						
Oral hygiene status						
Good	85 (56.7)	78 (56.5)	5 (62.5)	2 (2.5)	4.44	0.36*
Fair	61 (40.7)	57 (41.3)	2 (25.0)	2 (3.3)		
Poor	4 (2.7)	3 (2.2)	1 (12.5)	-		
Tongue coating						
Present	29 (19.3)	26 (18.8)	2 (25.0)	1 (25.0)	0.87	0.59*
Absent	121 (80.7)	112 (81.2)	6 (75.0)	3 (75.0)		
Gingivitis						
Present	24 (16.0)	22 (15.9)	2 (25.0)	-	1.02	0.66*
Absent	126 (84.0)	116 (84.1)	6 (75.0)	4 (100)		

Note: * Fisher's Exact Test

Table 4: Comparison of self-reported halitosis and clinical halitosis among study participants

		Clinical halitosis				
	Total No. (%)	Questionable No. (%)	Slight No. (%)	Moderate No. (%)	χ^2	p
Self-reported halitosis						
Yes	26 (100.0)	21 (80.8)	3 (11.5)	2 (7.7)	5.64	0.05*
No	124 (100.0)	117 (94.4)	5 (4.0)	2 (1.6)		

Note: * Fisher's Exact Test

Table 5: Logistic regression analysis of factors associated with self-reported halitosis

Factors	aOR	95% CI	p
Class			
1	1.36	(0.50-3.71)	0.551
2	0.33	(0.06-1.78)	0.199
3 (reference)	-	-	-
Frequency of brushing			
Once daily	3.64	(0.12-11.85)	**0.032**
Twice or more daily (reference)	-	-	-
Gingival bleeding while brushing			
Present	3.06	(1.02-9.13)	**0.045**
Absent (reference)	-	-	-

Tongue coating			
Present	0.20	(0.02-1.67)	0.132
Absent (reference)	-	-	-

DISCUSSION

This study assessed the factors associated with self-reported and clinically assessed halitosis among adolescents aged 12-18 years. The prevalence of self-reported halitosis obtained in this study was found to be lower than previous reports[3,15,17,18] probably due to the possibility of under reporting of the condition in this present study. Under reporting of halitosis by individuals has been associated stigma.[19] The prevalence of self-reported halitosis falls within the range of 4.1- 33.0% reported by Faria et al.[19] and these differences may be due to differences in the measures used to assess self-reported halitosis.

As regards factors associated with self-reported halitosis, several studies have documented that factors such as gender, frequency of tooth brushing, dental flossing, use of dental services and habits including alcohol and tobacco chewing were associated with self-reported halitosis.[17,19] This study found the prevalence of self-reported halitosis to be higher in females than in males although this was not found to be statistically significant. This finding agrees with the findings of Alade et al[3] and Milanesi et al.[18] while the opposite was recorded among Korean and Iranian adolescents.[15,17] This pattern may however be attributed to the gender representation within the study population and because females are more responsive to chemo-sensitive stimuli and as such may be more particular about halitosis .[20] In addition, females tend to have better self-perception of their health conditions.[18]The class of the participant was the only sociodemographic factor found to be associated with self-reported halitosis and this was similar to the finding of Milanesi et al.[18] where he reported higher prevalence of self-reported halitosis among participants in early college years.

Concerning oral hygiene practices, the study found halitosis to be more commonly reported among those who brush their teeth once daily and this is similar to previous reports[3,19] but contrary to the report by Lopes et al.[21] Meanwhile, frequency of tooth brushing, in addition to use of dental floss, mouthwash and dental services were found to be significantly associated with self-reported halitosis in an Iranian population.[15] Similar to a previous report[19] this study recorded a statistically significant relationship between gingival bleeding, tongue coating and self-reported halitosis. Gingival bleeding on brushing may be as a result of gingival inflammation or use of vigorous and inappropriate brushing technique. A higher proportion of participants with self-reported halitosis had gingival bleeding on brushing compared to those without the putrefaction of the bleeding could make them have self-perceived halitosis. Likewise, majority of participants with self-reported halitosis did not have tongue coating. This may be because majority of the participants brush their tongue and also those who think they have halitosis may tend to brush their tongue more in an attempt to eliminate the odour. Although in the final regression model, frequency of tooth brushing and gingival bleeding on brushing were the only factors found to be associated with self-reported halitosis. The proportion of adolescents with clinically determined halitosis using the organoleptic method was found to be lower than previous reports of 24.7% [15] and 93.0%[22]. Similar to the findings in self-reported halitosis, majority of the participants with clinically determined halitosis were females and belonged to the upper socioeconomic class although this relationship was not statistically significant. Both findings are contrary to the findings of Ziaei et al.[15] None of the other explored factors was found to be significantly associated with clinical halitosis contrary to previous reports[15,23] and this may be attributed to the low prevalence of clinical halitosis recorded in this study.

Furthermore, this study found no significant association between the self-reported halitosis and clinically determined halitosis as majority of the participants with self-reported halitosis had a score of less than 2 on the organoleptic scale. This agrees with the fact that only about 17.0% of those with self-reported halitosis have ever been informed by others that they had halitosis. This finding is similar to that of Rosenberg et al. [24] and contrary to that of Romano et al.[22] and Pham et al.[23] who documented a strong correlation between self-reported halitosis and slight to moderate halitosis on the organoleptic scale. However, about 70% of their participants were previously informed by others that they had halitosis within the limits of this study which is the first to describe halitosis among adolescents in the northern part of Nigeria. We found that although the majority of the studied adolescents had good knowledge of

the aetiology of halitosis, a large proportion of them had poor oral hygiene practices such as brushing once daily, not flossing and poor dental visits. Furthermore, self-perceived halitosis was associated with the class of the participant, frequency of brushing, gingival bleeding on brushing and tongue coating. Self-assessment of halitosis can be said to be unreliable as the majority of those with self-perceived halitosis can be classified as having physiologic halitosis and/or pseudo-halitosis which was seen as pathologic. There is, therefore, the need to increase awareness of halitosis and proper oral health behaviour in adolescents in the Northern part of Nigeria.

CONCLUSION

Out of all the factors considered, frequency of tooth brushing and gingival bleeding on brushing were the only factors found to be associated with self-reported halitosis while none of the investigated factors was associated with clinical halitosis. The prevalence of self-reported halitosis was higher than clinical halitosis.

LIMITATION AND RECOMMENDATION

Due to the small sample size of this study and its restriction to adolescents, the result may not be generalizable to other age group in the same environment. We, therefore, recommend that further studies be carried out using a larger sample size and considering psychological evaluation of the participants as well as other oral and general clinical conditions associated with halitosis.

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Nil

Conflict of Interest
None declared

References

1. Briceag R, Caraiane A, Raftu G, et al. Emotional and Social Impact of Halitosis on Adolescents and Young Adults: A Systematic Review. Medicina. 2023 [cited 2023 June 16];59:[11 p]. Available from: https://doi.org/10.3390/medicina59030564
2. Aylikci B, Çolak H. Halitosis: From diagnosis to management. J Nat Sci Biol Med. 2013; 4:14–23.
3. Alade O, Ajoloko E, Dedeke A, Uti O, Sofola O. Self-reported halitosis and oral health-related quality of life in adolescent students from a suburban community in Nigeria. Afr Health Sci. 2020; 20:2044–2049.
4. Miyazaki H, Arao M, Okamura K, et al. Tentative classification of halitosis and its treatment needs. Niigata Dent J. 1999; 32:7–11.
5. Guedes CC, Bussadori SK, Weber R, et al. Halitosis: Prevalence and association with oral etiological factors in children and adolescents. J Breath Res. 2019 Mar [cited 2023 June 16];13(2). Available from: http://dx.doi.org/10.1088/1752-7163/aafc6f
6. Mumena CH, Evode U, Muhumuza I et al. Self-perceived halitosis among students of higher learning institutions in Rwanda. Tanzania Dent J. 2015; 19:21–26.
7. Deolia SG, Ali M, Bhatia S, Sen S. Psychosocial effects of halitosis among young adults. Ann Indian Psychiatry. 2018; 2:120–124.
8. Umeizudike KA, Oyetola OE, Ayanbadejo PO, Alade GO, Ameh PO. Prevalence of self-reported halitosis and associated factors among dental patients attending a tertiary hospital in Nigeria. Sahel Med J. 2016;19:150-154
9. Arinola JE, Olukoju OO. Halitosis amongst students in tertiary institutions in Lagos state. Afr Health Sci. 2012; 12:473–478.
10. Oyetola OE, Owotade FJ, Fatusi OA, Olatunji S. Pattern of presentation and outcome of routine dental interventions in patients with halitosis. Niger Postgrad Med J. 2016; 23:215–220.
11. Adedapo AH, Kolude B, Dada-Adegbola HO, Lawoyin JO, Adeola HA. Targeted polymerase chain reaction-based expression of putative halitogenic bacteria and volatile sulphur compound analysis among halitosis patients at a tertiary hospital in Nigeria. Odontology [Internet]. 2019; 108:450–461.
12. Olusanya O, Okpere E, Ezimokhai M. The importance of Social class in Fertility control in a developing Country. Wesr African J Med. 1995; 4:205–212.
13. Folayan MO, Idehen EE, Ufomata D. The effect of sociodemographic factors on dental anxiety in children seen in a suburban Nigerian Hospital. Int J Paediatr Dent. 2003; 13:20–26.
14. Folayan MO, Kolawole KA, Oziegbe EO, et al. Prevalence, and early childhood caries risk indicators in preschool children in suburban Nigeria. BMC Oral Health [Internet]. 2015 [cited 201824];15:1–12. Available from: https://bmcoralhealth.biomedcentral.com/track/pdf/10.1186/s12903-015-0058-y
15. Ziaei N, Hosseinpour S, Nazari H, Rezaei M, Rezaei K. Halitosis and its associated factors

among Kermanshah high school students (2015). Clin Cosmet Investig Dent. 2019; 327–338.
16. Bigler T, Filippi A. Importance of halitosis: A survey of adolescents and young adults. Swiss Dent J. 2016; 126:347–353.
17. Kim SY, Sim S, Kim S gyun, Park B, Choi HG. Prevalence and Associated Factors of Subjective Halitosis in Korean Adolescents. PLoS One. 2015; 10:1–11.
18. Milanesi FC, Kauer B, Wagner TP, Daudt LD, Haas AN. Self-reported halitosis and associated demographic and behavioral factors. Braz Oral Res. 2016;30:1–8.
19. Faria SFS, Costa FO, Silveira JO, Cyrino RM, Cota LOM. Self-reported halitosis in a sample of Brazilians : Prevalence, associated risk predictors and accuracy estimates with clinical diagnosis. J Clin Periodontol. 2020; 47:233–246.
20. Stuck BA, Frey S, Freiburg C et al. Chemosensory event-related potentials in relation to side of stimulation, age, sex, and stimulus concentration. Clin Neurophysiol. 2006; 117:1367–1375.
21. Lopes MHB, Rösing CK, Colussi PRG, Muniz FWMG, Linden MSS. Prevalence of self-reported halitosis and associated factors in adolescents from Southern Brazil. Acta Odontol Latinoam. 2016; 29:93–103.
22. Romano F, Pigella E, Guzzi N, Aimetti M. Patients' self-assessment of oral malodour and its relationship with organoleptic scores and oral conditions. Int J Dent Hyg. 2010; 8:41–46.
23. Pham TAV, Ueno M, Shinada K, Kawaguchi Y. Comparison between self-perceived and clinical oral malodor. Oral Surg Oral Med Oral Pathol Oral Radiol [Internet]. 2012[cited 2023; 113:70–80. Available from: http://dx.doi.org/10.1016/j.tripleo.2011.08.012
24. Rosenberg M, Kozlovskyl A, Gelernter I et al. Self-estimation of Oral Malodor. J Dent Res. 1995; 74:1577–1582.