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Adolescents: a cross-sectional study comparison between the absence and presence of halitosis and quality of life

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ABSTRACT

Introduction: Adolescence is a development period between childhood and adulthood. the halitosis can interfere significantly in the full development of this young person, showing how necessary it is to carry out studies on the subject, especially regarding the impact of this disease on this population's quality of life. **Objective:** The purpose of this study was to compare absence versus presence halitosis with quality of life of adolescents. **Methods:** This is a quantitative, observational, cross-sectional study composed of a randomized sample conducted in public schools in Parelheiros district, São Paulo, Brazil. The sample consisted of 238 adolescents aged 15-19 years. The evaluation was performed through a questionnaire with questions about health, OHIP-14 (Oral Health Impact Profile) quality of life questionnaire, through a simple clinical examination with rating VPI (Visible Plaque Index) and DMFT (Decayed, Missing and Filled Teeth) and also with the BreathAlert^{TM} halitosis sulfide monitor values ≥2 were considered positive for halitosis. **Results:** The results showed a prevalence of 3.4% for halitosis in adolescents and a tendency to impact on their quality of life. No relationship was found between halitosis, economic level, VPI and DMFT in the population evaluated. **Conclusion:** Although the prevalence of halitosis has been low, it was possible to observe that adolescents with bad mouth odor tended to have worse quality of life in relation to their oral health.

Keywords: adolescent; halitosis; adolescent health; Quality of life.

INTRODUCTION

Halitosis, also known as foul breath, bad mouth odor, bad oral odor, is defined as an unpleasant change in breath originating in the mouth, nostrils and/or pharynx that may or may not be pathological[1-3]. It is classified as genuine, when bad breath is diagnosed through organoleptic or physicochemical tests; or in "pseudo-halitosis", when the patient does not show a bad oral odor, but believes he/she has it[2,3]. Genuine halitosis, when diagnosed by a trained professional as physiological or transitory halitosis, this type being treated by means of adequate oral hygiene and pathological, when it is due to alterations in the oral cavity, diseases of the respiratory tract or digestive system or systemic disorders[3-5].

The term genuine halitosis can be used for physiological halitosis, which occurs when you wake up, and pathological halitosis, which is related to halitosis caused by problems in the oral cavity (dental caries, periodontal disease, tongue coating, exposed dental pulp, healing wounds, ill-fitting dentures, restorations and lesions in the oral cavity, among others), which account for 90% of cases[2-5], and halitosis caused by extra-oral pathologies (Otorhinolaryngologic diseases or respiratory diseases; diseases of the digestive system; renal failure and diabetes mellitus), account for the other10.0%[2,3,6].

Halitosis affects one in four adults in world[7,8]. A literature review by Akaji et al.[8] showed bad breath rates ranging from 22.0% to 50.0% in the adult world population. In Brazil it is estimated that 15.0% of adults have persistent bad oral odor[9]. Publications on the topic are scarce in the adolescent population, especially in Brazil. A paper published in 2019 found that 29.7% of Iranian adolescents aged 14 to 18 years had this condition[10]. It is estimated that a large part of the adult population that has problematic oral breath suffers some kind of social embarrassment because of this

problem[11,12]. Halitosis causes negative social impact, reflecting on professional and family life and on people's quality of life[2,8,13].

Adolescence is a stage in human growth and development marked by physical, psychological, and social transformations. It is a time of discovery, referring to the development period between childhood and adulthood, chronologically defined by the World Health Organization (WHO), as the age range from 10 to 19 years old[14]. It is during this time of life that individuals seek their identity, tend to live in groups, present evolution of their sexuality, and progressively separate from their parents in order to become full and autonomous subjects[14,15]. Any situation that can disadvantage them in becoming part of a group, such as halitosis, for example, can interfere significantly in the full development of this young person, showing how necessary it is to carry out studies on the subject, especially regarding the impact of this disease on this population's quality of life.

The objective of this study was to compare absence versus presence halitosis with quality of life of adolescents**.**

METHODS

This is a quantitative, observational, analytical, cross-sectional study consisting of a randomized, probabilistic, conglomerate sample conducted in public schools in the district of Parelheiros, in the city of São Paulo, Brazil. The sample calculation was applied in order to estimate the occurrence of halitosis among students aged 14 to 19 years, students of schools in this region. Considering 95.0% confidence, sampling error (margin of error) of 5.0%, minimum occurrence of halitosis in the adult population of 20.0% (the prevalence of halitosis in adults ranges from 22.0% to 50.0% and adults tend

to have more halitosis than adolescents, for this reason the minimum expected prevalence in this population was used)[8] and knowing that the total number of students enrolled in the Parelheiros public school network in the year 2018 was 6829, it was necessary to select 238 students. The calculation was performed using the Dimam Version 1 program (Guanabara Koogan, Barueri, Brazil).

The 18 schools in the Parelheiros district were mapped using the zip code of each school unit. These were then separated into three clusters by proximity. One school from each conglomerate was drawn and invited to participate. In cases of refusal of the invitation to participate, another school from the same conglomerate was drawn and invited to participate in the study. The inclusion criteria used was being between 14 and 19 years old, being enrolled in one of the public schools in the Parelheiros region between 2018/2019 and being in class at the time of data collection. Exclusion criteria were: being a smoker (regular cigarette, cigars, pipes, narghile), drug user, people with alcoholic beverage intake of more than three times per week, people with excessive garlic and/or onion salad consumption, individuals with excessive coffee intake, and people who had sinusitis tonsillitis, pharyngitis, esophagitis, gastroesophageal reflux, renal failure, diabetes or neurological disorders, psychiatric disorders, and those who were taking some type of medication such as antibiotics and anti-inflammatory drugs.

Students were instructed not to consume spiced or flavored foods 24 hours before their first appointment, to have a meal three hours before the evaluation, and then to proceed with oral hygiene as usual, without the use of mouthwash, candy, chewing gum, and disinfection pastilles. At first, the students were interviewed individually and general information were collected, such as gender, age, frequency of tooth brushing, use of dental floss and/or mouthwash, presence of bleeding gums, last visit to the

dentist, use of braces. They were also asked about the presence of respiratory diseases, esophagitis, gastroesophageal reflux, renal failure, diabetes, neurological and/or psychiatric diseases.

In this first meeting, the following health questionnaire on alcohol consumption, smoking, foods that alter breath (coffee, onions, garlic), medications in use, systemic diseases and oral hygiene practices (frequency of oral hygiene, tongue, use of mouthwashes and orthodontic appliances and last visit to the dentist) and the following instruments were applied:

1) Oral Health Impact Profile (OHIP- 14) - instrument used to verify the impacts of oral health problems on the quality of life of individuals, and the OHIP-14 is the reduced version[16]. This questionnaire classifies the impact on the quality of life of individuals into seven categories: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and disadvantage[16]. It was originally developed and validated for use in elderly populations; however, several studies have successfully used this questionnaire to verify the impact on quality of life in adolescents[13,17,18]. It was translated and validated to Brazilian Portuguese[19].

2) Socioeconomic Level Questionnaire - to define the socioeconomic level, the classification questionnaire model of the Brazilian Association of Research Companies *Associação Brasileira de Empresas de Pesquisa*, (ABEP) was used, reformulated in 2018[20]. The basic concept of this classification is to discriminate people socioeconomically, based on information about their schooling and the possession of certain "comfort items", such as automobiles, refrigerator, microcomputer, housekeepers, dishwasher, clothes dryer, among others[20]. The number of units owned is

taken into consideration, item by item. The sum of the points obtained includes the respondent in classes A, B1, B2, C1, C2, D and E.

In the second step, the adolescents who fulfilled the inclusion criteria for the research were individually tested with the BreathAlert™ device (Tanita Corporation, Japan), which is used to monitor the amount of sulfides in breath, according to the manufacturer's recommendations. The instrument was agitated 4 to 5 times in the air before use, then the patient blew the frontal entrance. The result appeared in a few seconds, with scores between 0 and 5. Values ≥2 were considered positive for halitosis. In this same visit, a simple clinical evaluation was a wooden toothpick and a flashlight performed to verify the evaluate of Decayed, Missing and Filled Teeth (DMFT index).

This index is used by the WHO[21] to assess the prevalence of dental caries; the acronym DMFT comes from the words "decayed", "missing" and "filled", and the D indicates that the unit of measurement is the tooth[22]. The WHO recommends as ideal an average DMFT value of less than 1.1 at 12 years of age, which corresponds to a very low prevalence of caries, as shown in table 1. A clinical analysis was also performed to verify the presence or absence of plaque and, from this evaluation, the Visible Plaque Index (VPI) was calculated, which consists of the sum of the number of surfaces with visible plaque divided by the total number of surfaces evaluated[22]. The VPI value was obtained in decimal places and multiplied by 100. The clinical examinations were performed by the researcher responsible for the project, under natural light, at the school's facilities. After the evaluation, all adolescents received orientation about oral hygiene and halitosis and halitosis through an interactive presentation and handing out of oral hygiene kits.

The descriptive statistical analysis of all information collected in this research was done by average, median, minimum and maximum values, standard deviation, absolute and relative frequencies (percentage). For the inferential analyses the Fisher's Exact test or its extension and the Mann-Whitney test were used with the purpose of confirming or refuting evidence found in the descriptive analysis. In all the conclusions obtained from the inferential analyses, the alpha significance level equal to 5.0% was used. Data were entered and analysed in the IBM Statistical Program for Social Science, version 19 (SPSS for Windows, SPSS, Inc., Chicago, Illinois, United States). As it is a study with several variables, we initially opted for logistic regression, as it allows for the possibility of estimating the occurrence of halitosis associated with all study variables, but the "N" of students with halitosis obtained at the end of the study made this type impossible of analysis.

This study is in accordance with Resolution 466/12 of the National Health Council of the Ministry of Health, Brazil, which regulates research involving human beings, and was approved by the Research Ethics Committee of the Universidade Federal de São Paulo (UNIFESP)/Hospital São Paulo (HSP), under report number 3,098,407 and CAEE: 93661218.5.0000.5505.

RESULTS

Among the 238 adolescents evaluated, 162 (68.0%) were female; had an average age of 16.1 years, ranging from 14 to 19 years; and socioeconomic level predominantly in classes B2 (34.6%) and C1 (24.8%).

Through the questionnaire ABEP, it was possible to verify that 91,7% of those evaluated had treated water service in their homes, 80.8% lived on a paved street and

the financial heads of the house had the following levels of education: 14.1% illiterate, 19.6% elementary school I, 17.6% elementary school II, 27.6% high school and 21.1% higher education.

The average DMFT values obtained in the population was 1.9±2.4 (0–12.0). Eight (3.4% – p=0.713) adolescents presented halitosis according to the BreathAlert™ test.

Tables 1 and 2 correspond to the information obtained from the health questionnaire and oral hygiene practices filled in by the students before the assessments and the halimeter test. The characterization of the sample according to gender, age, socioeconomic level, and presence or absence of halitosis is shown in table 1. Table 2 shows the presence or absence of halitosis according to the oral evaluation, meaning the frequency of daily brushing, use of dental floss, use of orthodontic appliance, tongue hygiene, use of mouthwash, presence of gingival bleeding, and last visit to the dentist using the questionnaire oral hygiene practices.

When evaluating the results obtained in the Oral Health Impact Profile - OHIP-14 instrument, higher scores were observed among the adolescents with halitosis (p=0.091), showing a tendency for adolescents with bad breath to have worse quality of life regarding to oral health, especially in issues related to physical and psychological disabilities, as shown in table 3.

DISCUSSION

The district of Parelheiros is located 40 km from downtown São Paulo and is characterized for being a dormitory district with a large population growth, having approximately 25.0% of the population composed of children and adolescents up to 15

years of age[23]. There is a great lack of public facilities in the area, and the few that currently exist cannot adequately meet the demand of the population that lives there[23]. Schools face problems such as violence, lack of equipment and staff, safety, access difficulties and structural problems[23]. The conduction of this research in this location was justified by the fact that this particular area shelters a large part of Sao Paulo City's young population.

The evaluation of halitosis can be done by subjective or objective tests. The organoleptic test considered the "gold standard" consists of an evaluation in which the examiner stands at a distance of approximately 10 cm from the patient and rates the exhaled air on a scale of 0 to 5 (0= absence of odor; 1= almost undetectable odor, 2= mild odor, 3= moderate odor, 4= strong odor, and 5= extremely strong odor). This type of evaluation may suffer alterations since it depends on the examiner's sense of smell, which can be distorted due to weather conditions and respiratory diseases[1,24-26].

The objective tests are conducted using devices called halimeters that perform a quantitative assessment of volatile sulfur compounds (VSCs), through measurement of the main gaseous compounds present in the exhaled air[2]. Falcão et al.[25] argued that the Breath Alert™ instrument has low accuracy compared to the organoleptic test in adults who do not report halitosis. Guedes used the BreathAlert™ halimeter - the same device used in this paper - to compare the subjective (organoleptic) test with the objective test and concluded that this halimeter is effective and has high sensitivity and specificity for the detection of halitosis in children[26].

Portable sulphide monitors for checking halitosis also have the advantage of easy transportation, a low cost and ease of use, but have limitations such as not detecting all CSVs and not detecting the origin of the gases. They can be used for a first

diagnosis, but for a more specific diagnosis, the gas chromatography method should be used, which is a more precise device for detecting the origin of the gases, but has the disadvantage of not being portable, having a high cost, and requiring specialized people to operate[2,25].

The prevalence of halitosis in the studied population was 3.4% and this result was not related to gender, age, socioeconomic level, DMFT, VPI, frequency of tooth brushing, use of dental floss and/or mouthwash, gingival bleeding, last visit to the dentist, use of orthodontic appliance. Ziaei et al.[10] found much higher prevalence (29.8%) when evaluating adolescents aged 14–18 years in Kermanshah, Iran, using organoleptic testing. The same was observed in the work of Guedes who, when evaluating children between 6 and 12 years of age, found a prevalence of 17.3% of halitosis; and in that of Motta et al., who found altered breath in 63.0% of children between 3 and 14 years[27,28]. The prevalence of halitosis in the present study cannot be compared to those found in the papers published by Guedes et al.[27] and Motta et al.[28], as they were developed with children who attended pediatric dentistry services and presented oral diseases such as caries with great coronary destruction, which may have increased the prevalence of halitosis. The study published by Ziaei et al.[10], in addition to using a subjective method to diagnose halitosis, also intended to relate it to respiratory and gastrointestinal diseases; therefore, adolescents affected by these diseases were not excluded from the research, differently from what happened in the present study, which may have consequently led to a different prevalence from the one found in this research.

It is also noted that Motta et al.[28], when evaluating children and adolescents between 3 and 14 years old, found no difference between genders[2]. Despite the differences in terms of age and population studied, in relation to the study conducted

here, no difference was found in the prevalence of halitosis between genders. Regarding adult age, some studies point out a higher prevalence in males[9,10]. It was not possible to observe a relationship between halitosis and socioeconomic status. López and Baelum conducted a study with Chilean adolescents between 15 and 21 years old, in which they also did not find this relationship[17].

Most teenagers don't floss daily and no relationship was observed between not flossing and halitosis. However, the lack of daily flossing is considered a risk factor for the development of periodontal disease and gingival bleeding[2] and may be the cause of halitosis in older people. According to Porter and Scully[29], the most probable cause of long-standing bad breath is inflammation of the gum tissues caused by the accumulation of food residue and plaque on the teeth and tongue due to poor oral hygiene.

The low prevalence of halitosis found in this study may be related to the fact that very few adolescents are affected by periodontal disease[30]. The normal microbiota of the oral cavity consists of cocci and bacilli (Gram-positive and Gram-negative) and, due to periodontal disease, individuals with halitosis have a predominantly anaerobic proteolytic microbiota composed of the Gram-negative bacteria *Fusobacterium nucleatum, Selenomonas, Treponema denticola, Prevotella intermedia, Tannerellaforsythensis, Porphyromonasgingivalis and Bacteroides forsythusand*[2,3].

These bacteria break down amino acids, producing VSCs, diamines, and short-chain fatty acids that are responsible for bad oral odor[1-4]. According to the Brazilian Oral Health Survey 2010, developed by the National Ministry of Health, periodontal disease is not very prevalent in adolescents between 15 and 19 years old (0.8%), being more common in adults between 35 and 44 years old (6.9%)[30].

The presence of carious lesions and halitosis is also cited in some papers, which was not observed in this research[10,12,14,27,30]. It should not be forgotten that the City of São Paulo, where this study was conducted, started water fluoridation in October 1985, and the effectiveness of this measure in reducing the DMFT indices has been well documented[31]. This study obtained a mean DMFT index of 1.9, which is considered low for the prevalence of caries and, consequently, for bad oral odor, according to the WHO[21,30,31].

In 2016, the prevalence of smoking among adolescents in Brazil[32] was 18.5%. Smoking adolescents were excluded from this particular study because tobacco is known to predispose to periodontal disease, cause hyposalivation, and tobacco smoke has VSCs that lead to bad oral odor[6]. This may have been another reason found for the low prevalence of halitosis present in the adolescents who were part of the research.

Relevant information about adolescents behavior, habits and oral health was obtained. It was observed that seven (87.5%) of the eight adolescents who tested positive for halitosis answered that they believed they did not have bad breath at the time of the examination. Lopes et al.[13], contrary to what was found, determined a high prevalence of self-reported halitosis among adolescents aged 15 to 19 years, in a research conducted by filling out a questionnaire, with no clinical evaluation to confirm or not the existence of bad breath[2,3]. It was observed that most of the adolescents in this study did not use dental floss daily, but no relationship between not using dental loss and halitosis was observed, although the lack of daily use is considered a risk factor for the development of periodontal diseases, therefore in older age groups halitosis may appear[2]. It is interesting to note that most adolescents (96.6%) who participated in this research brushed their teeth two to four times or more a day,

cleaned their tongues (89.8%), and had visited the dentist in the last year (65.7%), which may indicate satisfactory oral hygiene habits, consistent with a low prevalence of periodontal disease and, consequently, halitosis.

According to the results obtained through the OHIP-14 quality of life questionnaire, adolescents with bad mouth odor tended to have worse quality of life in relation to their oral health. This relationship appeared in the questions related to physical ($p=0.039$) and psychological ($p=0.023$) disabilities, showing how important it is to offer oral health care services to the adolescent population, so that those with halitosis or other related morbidities are adequately treated and followed up, so that these disorders do not compromise the full social development of these individuals. Until this moment, there are no studies that relate halitosis to quality of life in adolescents.

Given that the results obtained in this sample have internal and external validity, due to the study design and the sampling technique, it may be confirmed that the entire population behaves in a similar way, and the results can be extrapolated to the population of students in the Parelheiros public schools. This study has the differential by performing the objective evaluation for halitosis in adolescents from a very poor region with little access to oral health services. But, despite the existing deficiencies, the low prevalence of halitosis and the oral hygiene habits found, it can be inferred that, in some way, the adolescents in this region are being assisted by dental professionals, that they are receiving orientation and that these orientations are being followed. Most likely, the existing public health programs in the region, such as, for example, the Oral Health Program, which establishes the Guidelines for Oral Health Care in the city of São Paulo, providing access to dental services to the population through the Unified

Health System; or the School Health Program which disseminates practices, through the training of professionals, for the promotion, prevention, and care of health in public schools in Brazil, have their merits, seem to be effective, and should be continued, stimulated, and expanded[33].

In this study, a sample calculation was performed, however, it was not possible to perform logistic regression due to the small number of individuals with halitosis and this was a limitation of the study. However, it was possible to work with other variables and relate them to the risk of halitosis. We, therefore, suggest new studies in which sample region is expanded and, with this, there is a greater probability of allowing the performance of the regression analysis[34,35].

A limitation of this study was not examine tongue coating index[36], because of the limited time available to carry out the student evaluations, as tongue coating is related to the causes of halitosis.

One of the main discoveries of this study was the tendency for halitosis to have an impact on adolescents' social lives. Adolescence is a stage of life in which social relationships are extremely important for their development. The objective halitosis analysis and the adolescent public are what differentiate this study, as subjective assessments have more bias and there are few studies relating the prevalence of halitosis and quality of life in this age group[36]. The development of public policies that promote oral health and hygiene in this age group could indirectly prevent halitosis and have a positive impact on the quality of life of this population.

It would be interesting to carry out a study evaluating the prevalence of halitosis in adolescents using tongue coating and oral hygiene index with biofilm evidencer, which are more objective indicators than the visible plaque index used in this study.

Conclusion

The prevalence of halitosis among adolescents was low and there was no relationship between halitosis, economic level, VPI and DMFT. However, halitosis tends to have an impact on social life.

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Table1: Characterization of the sample of adolescents according to halitosis (presence/absence) and sex, age (years), economic level (ABEP), DMFT, IPV. Sample size - n and percent%

		Halitosis				Total		P
		Presence		Absence				
		n	%	n	%	N	%	
Sex	Female	5	3.1	157	96.9	162	100.0	0.713[a]
	Male	3	3.9	73	96.1	76	100.0	
	Total	**8**	**3.4**	**230**	**96.6**	**238**	**100.0**	
Age (years)	N	8.0		229.0		237.0		0.448[b]
	Mean	15.9		16.1		16.1		
	Median	16.0		16.0		16.0		
	minimum and maximum	15.0–18.0		14.0–19.0		14.0–19.0		
	standard-deviation	1.0		1.1		1.1		
ABEP	A	-	-	24	100.0	24	100.0	0.612[a]
	B1	3	7.5	37	92.5	40	100.0	
	B2	3	3.7	78	96.3	81	100.0	
	C1	1	1.7	57	98.3	58	100.0	
	C2	1	4.8	20	95.2	21	100.0	
	D-E	-	-	10	100.0	10	100.0	
	Total	**8**	**3.4**	**226**	**96.6**	**234**	**100.0**	
DMFT	N	8		230		238		0.559[b]
	Mean	2.6		1.9		1.9		
	Median	1.5		1.0		1.0		
	minimum and maximum	0.0-12.0		0.0-11.0		0.0-12.0		
	standard-deviation	3.9		2.4		2.4		
IPV	N	8		230		238		0.193[b]
	Mean	0.41		0.73		0.72		
	Median	0.01		0.43		0.43		
	minimum and maximum	0.00-1.71		0.00-4.16		0.00-4.16		
	standard-deviation	0.68		0.82		0.82		

[a]Fisher's exact or its extension, [b]Mann-Whitney. ABEP = Associação Brasileira de Empresas de Pesquisas.

Table 2: Halitosis assessment (presence/absence) related to oral assessment. Sample size(n) and percentage (%)

Oral assessment		Halitosis				Total		P
		Presence		Absence				
		n	%	n	%	n	%	
Daily brushing	Once	-	-	8	100.0	8	100.0	0.672[a]
	Twice	4	3.9	98	96.1	102	100.0	
	three times	4	4.4	86	95.6	90	100.0	
	4 or more	-	-	37	100.0	37	100.0	
	Total	8	3.4	229	96.6	237	100.0	
To floss	No	7	3.4	198	96.6	205	100.0	>0.999[a]
	Yes	1	3.0	32	97.0	33	100.0	
	Total	**8**	**3.4**	**230**	**96.6**	**238**	**100.0**	
Use orthodontic appliance	No	7	3.6	186	96.4	193	100.0	>0.999[a]
	Yes	1	2.3	43	97.7	44	100.0	
	Total	**8**	**3.4**	**229**	**96.6**	**237**	**100.0**	
Tongue hygiene	No	-	-	24	100.0	24	100.0	>0.999[a]
	Yes	8	3.8	205	96.2	213	100.0	
	Total	**8**	**3.4**	**229**	**96.6**	**237**	**100.0**	
bleeding gums	No	5	3.4	140	96.6	145	100.0	>0.999[a]
	Yes	3	3.2	90	96.8	93	100.0	
	Total	8	3.4	230	96.6	238	100.0	
Mouthwash	No	4	3.5	109	96.5	113	100.0	>0.999[a]
	Yes	4	3.2	121	96.8	125	100.0	
	Total	**8**	**3.4**	**230**	**96.6**	**238**	**100.0**	
last visit to the dentist	Never	-	-	1	100.0	1	100.0	0.840[a]
	<1 month	3	5.9	48	94.1	51	100.0	
	1A3	1	4.0	24	96.0	25	100.0	
	3A6	1	3.0	32	97.0	33	100.0	
	6A1A	1	2.2	45	97.8	46	100.0	
	1OU+	2	2.5	78	97.5	80	100.0	
	Total	**8**	**3.4**	**228**	**96.6**	**236**	**100.0**	

[a]Fisher's exac tor its extension, [b]Mann-Whitney.

Table 3: Characterization of the sample according to halitosis (presence/absence) and the OHIP-14 Quality of Life questionnaire

		Halitosis			
		Presence (n=08)	**Absence (n=230)**	**Total (n=238)**	**P**
OHIP	Mean	8.33	5.95	6.03	0.091[a]
	Median	8.95	4.81	4.97	
	minimum and maximum	0.91–14.72	0.00–24.19	0.00–24.19	
	standard-deviation	4.41	4.86	4.86	
OHIP functional limitation[1]	Mean	0.82	0.62	0.62	0.246[a]
	Median	1.00	0.51	0.51	
	minimum and maximum	0.00–1.49	0.00–3.02	0.00–3.02	
	standard-deviation	0.46	0.62	0.61	
OHIP physical pain[2]	Mean	1.25	1.15	1.16	0.762[a]
	Median	1.17	1.00	1.00	
	minimum and maximum	0.00–3.00	0.00–4.00	0.00–4.00	
	standard-deviation	1.03	0.96	0.96	
OHIP physichological discomfort[3]	Mean	2.11	1.40	1.43	0.105[a]
	Median	2.28	1.10	1.10	
	minimum and maximum	0.00–4.00	0.00–4.00	0.00–4.00	
	standard-deviation	1.24	1.26	1.26	
OHIP physical disability[4]	Mean	0.94	0.47	0.48	0.039[a]
	Median	0.74	0.00	0.00	
	minimum and maximum	0.00–2.48	0.00–4.00	0.00–4.00	
	standard-deviation	0.90	0.77	0.78	
OHIP physichological disability[5]	Mean	1.65	0.92	0.94	0.023[a]
	Median	1.70	0.60	0.60	
	minimum and maximum	0.40–2.80	0.00–4.00	0.00–4.00	
	standard-deviation	0.88	1.00	1.00	
OHIP social disability[6]	Mean	2.04	1.81	1.82	0.482[a]
	Median	1.62	1.45	1.52	
	minimum and maximum	0.38–3.86	0.00–7.62	0.00–7.62	
	standard-deviation	1.27	1.61	1.59	
OHIP Handicap[7]	Mean	0.52	0.48	0.48	0.465[a]
	Median	0.30	0.00	0.00	
	minimum and maximum	0.00–2.00	0.00–4.00	0.00–4.00	
	standard-deviation	0.71	0.88	0.87	

[a]Mann-Whitney ,[1]functional limitation; [2]physical pain; [3]physichological discomfort, [4]physical disability; [5]physichological disability; [6]social disability; [7]Handicap.

OHIP-14: Oral Health Impact Profile.