

Diagnosis, management and knowledge of halitosis among Polish and Lebanese dentists: Questionnaire-based survey

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Abstract

Background. Halitosis (fedor ex ore, malodor, bad breath) is defined as an unpleasant odor coming from the oral cavity, regardless of the cause: local or systemic. It affects 22–50% of the population worldwide, leading to a significant decrease in the overall quality of life, and can have oral and extra-oral etiologies. There is an increased interest in the management of halitosis.

Objectives. This study aims to evaluate the patient–dentist communication on halitosis, the dentists' knowledge about the management and etiology of halitosis, and the treatment options used by dentists who practice in Poland and Lebanon.

Materials and methods. An online questionnaire was sent to both Lebanese and Polish dentists using Google Forms (Google LLC, Mountain View, USA). In total, 205 dentists completed the questionnaire, of which 100 practiced in Poland (group P) and 105 practiced in Lebanon (group L). A multivariate analysis was conducted to determine differences between both groups and to identify parameters that could influence a dentist's management of halitosis.

Results. According to the questionnaire, 86% of group P members and 65.7% of group L members reported communicating with patients about halitosis. Regarding the knowledge of halitosis, 78% of dentists in group P and 85.7% of dentists in group L reported that there is a classification for halitosis. A significant majority of dentists in both groups revealed not having any tool to measure halitosis (67.6% and 68% from group P and group L, respectively).

Conclusions. This study confirms the need for improved communication skills in Polish and Lebanese dentists, as well as for education on the subject among dentists in both countries, and for standardization in diagnosis, treatment modalities and management of halitosis.

Key words: questionnaire, laser, fetor ex ore, malodor, oral bad breath

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Background

Halitosis, or bad breath, is a common condition affecting 22–50% of the population worldwide, leading to a significant decrease in the overall quality of life. It can have oral and extra-oral etiologies. Halitosis (fedor ex ore, malodor, bad breath) is defined as an unpleasant odor coming from the oral cavity, regardless of the cause (local or systemic). This malodor is essentially due to the presence of chemical compounds in the exhaled air, mainly volatile sulfur compounds (VSCs) in oral pathologies and volatile organic compounds (VOCs) in the majority of extraoral causes.¹

In the literature, reported prevalence of halitosis varies largely from study to study. This variation is due to many factors, such as its perception, definition, classification, and lack of a standard assessment method and diagnosis. For instance, the American Dental Association reports that 25% of the US population suffers from halitosis. Bornstein et al. stated that in Switzerland, 32% of the examined population suffers from halitosis, while in Japan, it is estimated to affect 23% of the population.² Conversely, Seemann et al. found that only 2.4% of Finnish population suffers from halitosis.³ As for the classification, halitosis can be classified as 1) genuine halitosis, including pathological halitosis and physiological halitosis; and 2) psychological halitosis. Physiological halitosis occurs when the odor has a physiological origin and not pathological (from a putrefactive process), and is caused by a disease. Pathological halitosis presents as a pathological etiology that can be oral (such as periodontal diseases, tongue coating, bad oral hygiene, and dental caries) or extraoral (such as pneumonic disease, uncontrolled diabetes and others). Another classification based on the etiology of halitosis has also been proposed. This classification divides halitosis into physiological halitosis (type 0) and pathological halitosis (types 1–4). Type 1 has an oral etiology, type 2 – airway-related etiology, type 3 – gastroesophageal etiology, and type 4 – hematogenous etiology. According to this classification, type 5 includes subjective halitosis.^{4–6}

Studies suggest that in 70% of cases, genuine halitosis originates from the oral cavity.^{1,7} The most common reason is tongue coating (around 43% of all cases).^{7–9} In addition, it was shown that when VSCs are accompanied by VOCs, the origin of the halitosis will most likely be extraoral (10–20% of cases). Among extraoral causes, chronic sinusitis, purulent tonsillitis, deviated septum, neoplastic changes, esophageal diverticula, severe gastroesophageal reflux disease, *Helicobacter pylori* infections, bronchitis, bronchiectasis, lung cancer, diabetic ketoacidosis, and uremia are well documented.^{4,7–10}

There has always been a high demand internationally for the proper management of halitosis, and since 70% of halitosis cases originate from the oral cavity, the role of oral and dental healthcare providers seems to be intuitive.¹¹ However, halitosis-related education is limited among the dental community. Harmouche et al. established that

halitosis-related knowledge is insufficient in the French and Lebanese dentist populations and highlighted the need for professional education in both countries, targeting proper diagnosis and treatment strategies for halitosis.¹²

Objectives

This study aimed to assess halitosis-related knowledge among dentists in Poland and Lebanon to determine the need for halitosis-related professional education.

Materials and methods

Study sample

An online questionnaire was sent to Polish (group P) practicing dentists and Lebanese (group L) practicing dentists via WhatsApp and e-mail using a sheet from Google Forms (Google LLC, Mountain View, USA). The questionnaire sent to group P was in Polish, while group L received an English translation. The contacted dentists were informed regarding the scope and content of the study. The e-mail addresses and WhatsApp numbers were obtained from the Lebanese Dental Association and Polish Dental Association. One hundred and thirty dentists from each group were chosen arbitrarily from the master list of dentists, and the survey was sent to them with an explanation of the type and aim of the study. This study was conducted from September 2021 to September 2022. The questionnaire is the first part of our research on the treatment of halitosis with lasers. This study was approved by the local Medical Chamber (approval No. 12/148/2021).

Questionnaire design

This study was carried out using self-administered, structured questionnaires. The questionnaire used in this study was based on a previous study that evaluated French and Lebanese dentists regarding their knowledge and management of halitosis.¹² However, some modifications were made in our questionnaire.

Statistical analyses

For statistical analysis purposes, the data collected in the study were recorded, processed and analyzed using Statistica v. 13.3 (TIBCO Software Inc., Palo Alto, USA). All statistical tests were two-sided. A p-value of less than 0.05 was considered statistically significant. Categorical variables are presented in the contingency tables as percentages. Comparisons of the proportions of the Polish and Lebanese groups were made using the Pearson's χ^2 test.

Fisher's exact test was used due to a low expected frequency in the contingency table. Fisher's exact test was used

to determine if there is a significant difference between the responses of the two groups. To conduct Fisher's exact test, survey responses from the two groups were obtained and sorted into different categories. A contingency table was then created to display the frequencies of each category for both groups. Next, Fisher's exact test was applied to calculate the probability of obtaining the observed frequencies under the null hypothesis that there is no difference between the two groups. If the p-value obtained from the test is less than the predetermined significance level, it suggests that there is a significant difference between the two groups, which would allow to draw conclusions about the potential reasons for these differences.

Results

Demographic characteristics of the populations

A total of 205 participants were enrolled in our study (100 Polish and 105 Lebanese dentists), including 60% of women (71 Polish and 52 Lebanese female dentists). The mean value of age was 40 years old for group P and 49 years old for group L dentists, with an average professional experience of more than 20 years for Polish

and <5 years for Lebanese respondents. The demographic characteristics of the 2 groups were significantly different in terms of age ($p < 0.001$), professional experience ($p < 0.001$), type of practice ($p < 0.01$), and specialization ($p < 0.01$) (Table 1).

Diagnosis and communication with patients

Concerning the diagnosis of halitosis, no significant difference was observed between both groups. A total of 32.7% of dentists, of which 31% were from Poland and 34.3% from Lebanon, received more than 10 patients per year seeking treatment for halitosis. According to 58% of dentists in group P and 50.5% of dentists in group L, less than 10 patients per year sought care for halitosis. Additionally, 11% of group P and 15.2% of group L members reported not receiving any patients per year complaining of halitosis (Table 2). Multivariate analysis showed that members of group P were more prone to inform patients about halitosis if they detected it during a check-up (odds ratio (OR) = 3.47, $p < 0.01$). However, interestingly, 68% of the Polish and 67.6% of the Lebanese dentists revealed not having any instrument for the diagnosis of halitosis (Table 3).

Table 1. Demographic characteristics of the studied population

Variable	Detailed information	Poland n (%)	Lebanon n (%)	χ^2/df	p-value
Gender	male	29 (29.0)	51 (50.5)	9.54/2	0.008 ^a
	female	71 (71.0)	53 (49.5)		
	prefer not to say	0 (0.0)	1 (1.0)		
Age [years]	<30	12 (12.0)	84 (80.0)	97.4/4	<0.001 ^a
	30–39	31 (31.0)	10 (9.5)		
	40–49	34 (34.0)	7 (6.7)		
	50–59	20 (20.0)	2 (1.9)		
	>59	3 (3.0)	2 (1.9)		
Professional experience [years]	<5	16 (16.0)	71 (67.6)	72.2/3	<0.001 ^a
	5–10	14 (14.0)	20 (19.0)		
	11–20	34 (34.0)	5 (4.8)		
	>20	36 (36.0)	9 (8.6)		
Type of practice	private practice	96 (96.0)	76 (72.4)	–	<0.001 ^b
	dental hospital	6 (6.0)	6 (5.7)	–	1.000 ^b
	academics	32 (32.0)	50 (47.6)	5.21/1	0.022 ^a
Dental specialization	general practice	43 (43.0)	76 (74.2)	18.2/1	<0.001 ^a
	specialized in periodontology	9 (9.0)	5 (4.8)	–	0.275 ^b
	specialized in oral surgery	13 (13.0)	4 (3.8)	–	0.022 ^b
	specialized in endodontics	10 (10.0)	6 (5.7)	–	0.303 ^b
	specialized in orthodontics	7 (7.0)	2 (1.9)	–	0.095 ^b
	specialized in pediatric dentistry	6 (6.0)	3 (2.9)	–	0.323 ^b
	specialized in prosthodontics	12 (12.0)	7 (6.7)	1.73/1	0.188 ^a

^a – Pearson's χ^2 test; ^b – Fisher's exact test; df – degrees of freedom.

Table 2. Results of the diagnosis and communication with patients among the population

Question	Answer	Group P n (%)	Group L n (%)	χ^2/df	p-value
Did you come across people with bad breath at your daily practice?	Yes, frequently	46 (46.0)	79 (75.2)	18.7/2	<0.001 ^a
	Yes, rarely	53 (53.0)	25 (23.8)		
	No, never	1 (1.0)	1 (1.0)		
Do you receive patients that are aware of their bad breath and want to treat it?	Yes, more than 10 per year	31 (31.0)	36 (34.3)	1.40/2	0.496 ^a
	Yes, but less than 10 per year	58 (58.0)	53 (50.5)		
	No	11 (11.0)	16 (15.2)		
Do you receive patients seeking advice for someone else's bad breath (wife/husband, friend, family member...)?	More often patients	85 (85.0)	84 (80.0)	0.38/1	0.538 ^a
	More often doctors	15 (15.0)	20 (19)		
Do you diagnose or comfort your patients about their bad breath in your daily practice?	Yes	57 (57.0)	43 (41.0)	6.88/2	0.032 ^a
	Only if patient brings the subject up	37 (37.0)	58 (55.2)		
	No	6 (6.0)	4 (3.8)		
If you detect a patient's halitosis, do you inform them about it?	Yes	86 (86.0)	69 (65.7)	10.4/1	0.001 ^a
	No	14 (14.0)	36 (34.3)		
Do you try to educate your patients about halitosis?	Yes	76 (76.0)	91 (86.7)	3.18/1	0.074 ^a
	No	24 (24.0)	14 (13.3)		
Do you feel uncomfortable when talking about halitosis with a patient?	Yes, often	23 (23.0)	26 (24.8)	0.09/2	0.957 ^a
	Yes, rarely	31 (31.0)	32 (30.5)		
	No, never	46 (46.0)	47 (44.8)		

^a – Pearson's χ^2 test; df – degrees of freedom.

Knowledge among dentists

In group P, 78% of dentists responded that there is a classification for halitosis, 69% stated that they do not know the classification, and 22% claimed there is no classification for halitosis. In addition, 1% of group P members claimed that halitosis was made up by pharmaceutical companies, and 61% had not heard of pseudo-halitosis.

As for group L, 85.7% of dentists responded that there is a classification for halitosis, 50.5% stated that they do not know the classification, and 14.3% claimed there is no classification for halitosis. In addition, 18.1% of group L members claimed that halitosis was made up by pharmaceutical companies and 44.8% have not heard of pseudo-halitosis. Moreover, the majority of participants reported halitosis to have an oral etiology (84% in group P and 86.7% in group L) (Fig. 1, Table 3).

Skills for halitosis management

Most of the surveyed dentists revealed that they do not frequently treat halitosis in their clinical practice (87% for group P and 89.6% for group L), while only 13% of respondents in group P and 10.4% in group L reported treating halitosis frequently. Specific toothpastes, mouthwashes and tongue scrapers were prescribed, but infrequently. In addition, the use of lasers for the management of halitosis was not a known treatment for the majority of dentists (81% in group P and 85.7% in group L) (Fig. 2). Overall,

Answer on the question: do you try to find the origin connected with halitosis?

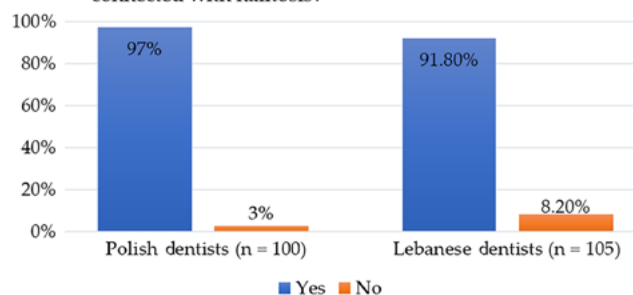


Fig. 1. Distribution of answers to the question: "Do you try to find the origin connected with halitosis?" in both groups

respondents reveal that halitosis treatments can be successful, and 57% of dentists in group P and 58.1% in group L considered the treatment they applied effective. The need for professional education focusing on halitosis appears to be of importance for dentists in both Poland and Lebanon. No significant differences in terms of treatment modalities were observed between group P and group L ($p > 0.05$) (Table 4).

Discussion

In this study, the level of knowledge about halitosis and competence in the diagnosis and management of halitosis among Polish and Lebanese dentists (a total of 205 respondents) was evaluated using self-administered questionnaires.

Table 3. Knowledge of halitosis among dentists

Question	Answer	Group P n (%)	Group L n (%)	χ^2/df	p-value
Do you think that there is a classification of halitosis?	Yes	78 (78.0)	90 (85.7)	1.57/1	0.210 ^a
	No	22 (22.0)	15 (14.3)		
Do you know any classification of halitosis?	Yes	31 (31.0)	52 (49.5)	6.54/1	0.011 ^a
	No	69 (69.0)	53 (50.5)		
Do you think that halitosis was made up by pharmaceutical concerns?	Yes	1 (1.0)	19 (18.1)	74.5/3	<0.001 ^a
	No	83 (83.0)	31 (29.5)		
	Maybe	0 (0.0)	34 (32.4)		
	I don't have an opinion	16 (16.0)	21 (20.0)		
Have you heard about pseudo-halitosis?	Yes	39 (39.0)	58 (55.2)	4.79/1	0.029 ^a
	No	61 (61.0)	47 (44.8)		
Have you heard about halitophobia?	Yes	39 (39.0)	76 (72.4)	21.8/1	<0.001 ^a
	No	61 (61.0)	29 (27.6)		
Do you have any instruments to help you diagnose halitosis? If yes, what? (e.g., Halimeter, oral chroma)	Only my own senses	31 (31.0)	33 (31.4)	0.01/2	0.997 ^a
	No	68 (68.0)	71 (67.6)		
	Halimeter	1 (1.0)	1 (1.0)		
What do you think is the main etiology of halitosis?	Gastro-intestinal conditions	59 (59.0)	15 (14.3)	42.4/1	<0.001 ^a
	Oral hygiene	82 (82.0)	74 (70.5)	3.12/1	0.077 ^a
	Systematic diseases	82 (82.0)	14 (13.3)	94.4/1	<0.001 ^a
	Others	57 (57.0)	2 (1.9)	–	<0.001 ^b

^a – Pearson’s χ^2 test; ^b – Fisher’s exact test; df – degrees of freedom.

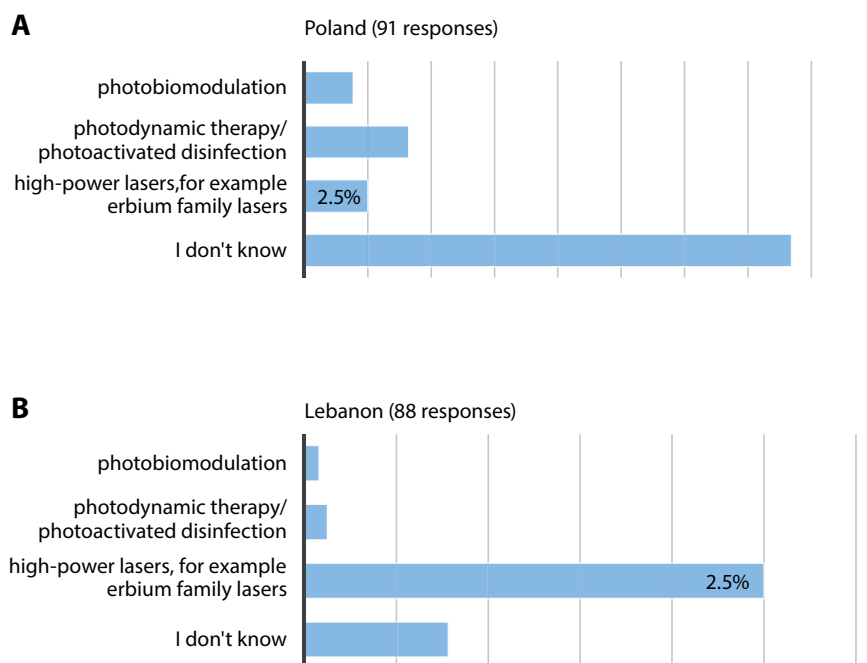


Fig. 2. Laser treatment modalities for the management of halitosis as reported by dentists practicing in Poland (n = 19) and in Lebanon (n = 15). Please note that the participants could choose only 1 answer from a given list

To the best of our knowledge, this was the first questionnaire-based study on halitosis among dentists practicing in Poland, but not in Lebanon. The diagnosis and management of halitosis are of great importance in regard to the social and health impact as well as negative influence of this symptom on a patient’s quality of life. Yet, it was demonstrated in this survey that it is still uncomfortable for patients and

healthcare providers to discuss the problem openly. In this study, dentists admitted to having a relatively insufficient level of knowledge about halitosis. In fact, 84% of respondents (n = 84) in group P and 65.7% (n = 69) in group L reported a lack of knowledge about halitosis. Harmouche et al. showed that only 36.5% of French dentists are aware of physiological halitosis, and 61% of them overestimated

Table 4. Results of the skills for halitosis management

Question	Answer	Group P n (%)	Group L n (%)	χ^2/df	p-value
How many patients have you treated in the last 6 months for halitosis?	None	59 (59.0)	43 (41.0)	9.21/3	0.026 ^a
	<5	28 (28.0)	51 (48.6)		
	5–15	11 (11.0)	9 (8.6)		
	>15	2 (2.0)	2 (1.9)		
Do you think that halitosis treatments are successful?	Yes	57 (57.0)	61 (58.1)	1.86/2	0.394 ^a
	No	1 (1.0)	4 (3.8)		
	Maybe	42 (42.0)	40 (38.1)		
In your opinion, is it necessary to repeat the treatment?	Yes	69 (69.0)	70 (66.7)	2.96/2	0.228 ^a
	No	3 (3.0)	9 (8.6)		
	I don't have an opinion	28 (28.0)	26 (24.8)		
Do you have any instruments for halitosis treatment?	Yes	30 (30.0)	20 (19.0)	2.76/1	0.096 ^a
	No	70 (70.0)	85 (81.0)		
Do you recommend mouthwashes to patients with halitosis?	Yes	74 (74.0)	95 (90.5)	8.50/1	0.004 ^a
	No	26 (26.0)	10 (9.5)		
Do you recommend dedicated toothpastes to patients with halitosis?	Yes	61 (61.0)	58 (55.2)	0.48/1	0.488 ^a
	No	39 (39.0)	47 (44.8)		
Do you recommend tongue scrapers to patients with halitosis?	Yes, more than 3 times a week	34 (34.0)	33 (31.4)	5.65/2	0.056 ^a
	Yes, 1–3 times a week	37 (37.0)	54 (51.4)		
	No	29 (29.0)	18 (17.1)		
Have you heard about using lasers to treat halitosis?	Yes	19 (19.0)	15 (14.3)	0.52/1	0.472 ^a
	No	81 (81.0)	90 (85.7)		

^a – Pearson's χ^2 test; df – degrees of freedom.

the involvement of extraoral causes.¹² It was clearly stated in the results that regardless of age, experience or country, dentists have a massive problem discussing and analyzing malodor during dental appointments. Therefore, respondents did not present appropriate knowledge and methodical preparation (in total, 72%). It is worth emphasizing that dental offices are the best places to gain information and receive proper treatment. Moreover, this study revealed that 67.6% and 68% of interviewees from group P and group L, respectively, admitted not using any tools or instruments to diagnose halitosis. The findings are again in accordance with the study by Harmouche et al., who stated that only a very limited number of dentists use any tools to monitor VSCs or use the organoleptic method to manage halitosis.¹² In addition, the majority of the studied population revealed that when halitosis is detected or diagnosed during routine treatment, dentists do not discuss it with patients (57% in group P and 41% in group L). Moreover, the respondents showed poor knowledge about psychosomatic and real halitosis, including the classification and treatment options. For instance, to properly examine halitosis, dental surgeons should have at least an organoleptic measurement (sensory test), chromatography with a flame photometric detector for VSCs in the breath, or apparatus for sulfide monitoring (like a Halimeter) available.

On the other hand, it can also be concluded that in both countries, the undergraduate curriculums do not cover

properly the subjects related to halitosis diagnosis, management and etiology. In fact, the Internet is the main source of knowledge about halitosis in 57% of dentists in group P and 51.4% in group L dentists. Books or scientific papers were pointed out as knowledge sources by 58% of respondents in group P and 44.8% in group L. While 54% of dentists in group P and 45.7% in group L reported that the knowledge about halitosis provided during their studies was insufficient, 33% of group P members and 2.9% of group L members answered they did not receive any instruction at the university/medical school about halitosis. Interestingly, despite insufficient knowledge about halitosis, dentists are generally not seeking any extra courses to deepen their knowledge (94% and 73.3% of respondents in group P and group L, respectively).

The mean values of age were 40 years for group P and 49 years for group L, revealing that there is no significant difference between both groups. Our study highlights that regardless of age and/or professional experience, the quality of halitosis knowledge acquired at universities/medical schools has not changed much over the past 20 years. Combining the outcomes, more than 67% of respondents are dissatisfied with the level of teaching about halitosis at their universities/medical schools. This can be considered a relatively powerful information showing how an undergraduate student's curriculum could be improved.

The management of halitosis should be assigned regarding the origin of the disease. Patients with oral halitosis should be treated by dentists, while extraoral halitosis should be treated by general medical practitioners with the help of appropriate specialists. On the other hand, patients with halitophobia must be referred and encouraged to consult a psychologist and/or psychiatrist.¹³ The gold standard treatment for halitosis remains a detailed interview with the patient to exclude any extraoral sources, like diet and chronic infection of the liver or respiratory tract. If these causes are eliminated, the next step is to exclude intraoral sources, and educate and instruct the patient about proper oral hygiene. Harmouche et al. claimed that despite the uncomplicated procedures of dealing with halitosis, the overall satisfaction with treatment outcomes was very low, as only 39.7% of those interviewed in France and 28% in Lebanon thought their treatment was effective.¹² Our survey found that 59% and 41% of Lebanese and Polish interviewees, respectively, declared that in the last 6 months, they did not treat any patients for halitosis, and 28% and 48%, respectively, treated halitosis in less than 5 patients in the last 6 months. Hence, this questionnaire confirmed a poor level of awareness about laser therapy – 81% of group P and 85.7% of group L dentists have not heard about using lasers to treat halitosis. Additionally, 76.9% of group P and 78.4% of group L did not know the protocol for the use of lasers in the treatment of oral malodor.

A study by AlSadhan showed that in Riyadh, 46.6% of interviewees claimed that halitosis affects their social life, mostly (over half of the answers) by alienation.¹⁴ In a 2010 study by Settineri et al.,¹⁵ 19.39% of examined Italians had self-reported halitosis, and 22.8% of students from Saudi Arabia had self-perceived halitosis.¹⁶ These numbers may increase due to the use of face masks as protection from COVID-19 infections. This is a factor contributing to oral malodor.¹⁷

The diagnosis and management of halitosis should be systematically performed by dentists in their routine practice. The diagnosis, discussion with patients, patient education, and treatment of halitosis should be included in the standard care provided by oral health practitioners.^{5,6,18} In this context, the use of lasers for the management of halitosis proved to be an interesting and promising approach.^{19–26} For instance, lasers can effectively eliminate microorganisms found in the deep periodontal pockets,²⁶ tongue, uvula, and tonsils which produce VSCs. For instance, the literature contains a relatively large number of studies showing a significant reduction in the bacteria involved in halitosis when lasers were used in photodynamic therapy, also referred to as photoactivated disinfection (the use of a photosensitizer with a low power laser). More specifically, the populations of *Fusobacterium nucleatum*, *Capnocytophaga gingivalis*, *Solobacterium moorei*, *Treponema denticola*, *Prevotella intermedia*, *Prevotella veroralis*, *Peptostreptococcus*

micros, *Veillonella parvula*, *Treponema denticola*, and *Porphyromonas gingivalis* have been reported to be significantly reduced in examined patients after treatment.^{19–25} In 2008, Kara et al. investigated the success rate of oral malodor treatments in 60 patients with periodontitis using Nd:YAG laser treatment in a randomized controlled clinical study. They noted that the treatment of the periodontal pocket with 5–7 mm can significantly decrease the rate of VSCs measured using a Halimeter ($p < 0.05$).¹⁹ Moreover, neodymium lasers have been used to reduce the microbial population during periodontal pocket treatment by numerous researchers.^{22,24–28} Therefore, it seems reasonable to include the use of lasers for the management of halitosis associated with periodontitis into the general treatment protocol. Krespi et al. reported in a randomized controlled prospective study that using a single 10-minute Er,Cr:YSGG laser treatment on the dorsum of the tongue with a power of 4 W, a frequency of 40 Hz and a non-contact swiping motion lead to a significant reduction of VSCs measured using a Halimeter, when compared to tongue scraping alone.²⁵ Moreover, diode lasers and antibacterial photodynamic therapy (aPDT) are also effective and promising approaches to reducing microorganisms. The aPDT can be defined as the therapeutic use of light to stimulate a photo-activated agent that has a bactericidal effect. This therapeutic modality proved to be safe and predictable,^{23–29} and a promising treatment for halitosis. Studies evaluated the effects of aPDT on halitosis in older adults with complete dentures and demonstrated elimination of halitosis for longer than 1 month in comparison to mouth disinfection using tongue scraping.^{30–33} For example, Patil et al. treated severe malodor patients with a single dorsal tongue session involving aPDT and methylene blue (6 points for 90 s each). Using real-time polymerase chain reaction (PCR) analysis, Patil et al. reported that such protocol resulted in a significant reduction in Halimeter scores on the 3rd and 7th day, and that the populations of *P. gingivalis* and *F. nucleatum* bacteria significantly decreased.³²

Although the sample size in this study was enough to compare 2 groups and perform statistical analysis, we invite researchers to use the suggested questionnaire on a larger sample size and different dentists in different countries. This will reflect a more accurate account of the general halitosis-related knowledge among dentists worldwide.

Compared to the conventional treatment of halitosis, laser therapy is considered a minimally invasive and promising approach. The present survey confirms that there is a lack of standardization of procedures related to the treatment of halitosis, and the knowledge of dentists should be broadened, as should be the availability of information about treatment and diagnosis options. Furthermore, studies should be conducted to examine the best procedure to manage halitosis and reduce VSCs.

Limitations of the study


This study was made on a relatively small sample population and in only 2 countries.


Conclusions

The treatment of halitosis is still considered challenging for Polish and Lebanese practicing dentists. Moreover, there is still a lack of professional knowledge and training about halitosis among this population. Hence, there is a need for further education and training about halitosis.

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