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Knowledge and attitude of medical physicians and dental practitioners towards halitosis in Saudi Arabia

Tariq Wahass[1]✉, **Hazim Alharkan**[1], **Ali Alshamari**[1], **Nader Alamri**[1], **Anmar Alarnous**[1], **Ahmad Assari**[2]

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Author Affiliation:
[1]College of dentistry, Riyadh Elm University, Riyadh, Kingdom of Saudi Arabia
[2]OMFS and Diagnostic Sciences department, Riyadh Elm University, Riyadh, Kingdom of Saudi Arabia

✉**Corresponding author**
College of dentistry, Riyadh Elm University, Riyadh, Kingdom of Saudi Arabia
Email: tariq.h.wahass@student.riyadh.edu.sa

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ABSTRACT

Background: Halitosis is a prevalent condition and causes a lot of embarrassment and psychological distress to individuals. The bad smell mainly arises because of protein degradation by gram-negative anaerobic bacteria which produce volatile Sulphur compounds. The objective of this study was to evaluate the knowledge and attitude of dental practitioners and medical physicians towards halitosis in terms of causes, assessments, and management in Saudi Arabia. *Methodology:* Dentists and Medical physicians of different specializations from Saudi Arabia were invited to participate in this study. A self-administered questionnaire was designed with twenty items related to demographical and halitosis etiology, diagnosis, and therapy. The questionnaire was distributed through Online Platforms and in-person. *Results:* Totally, 191 (50.7%) Dentists and 186 (49.3%) Medical Physicians making it to 377 healthcare professionals participated in this study. Nearly two-thirds of the participants were of Male Gender and the majority of these participants were practicing in the Central Region of Saudi Arabia (80.6%). About 80% and 60% of Dentists and Medical Physicians respectively reported that they don't have any diagnostic protocol for Halitosis. In addition, both Dentists (30%) and Medical physicians (50%) reported that they didn't have adequate teaching/training regarding Halitosis during under graduation. *Conclusion:* We observed inadequate knowledge about Halitosis among both professionals i.e. Dentists and Medical Physicians. However, Medical Physicians had far less knowledge in certain areas. Both professionals require more training on this subject and also better inter-professional coordination and communication.

Keywords: Halitosis; Dentists; Physicians; Knowledge; Attitude; questionnaire

1. INTRODUCTION

Halitosis or oral malodor is an unpleasant breath odor that negatively affects self-confidence and impacts internally the psychological state and externally the social life. Halitosis is a consequence of an array of both extraoral and

intraoral causes (Aimetti et al., 2015, Chen et al., 2016). The Intra-oral causes include thick tongue coating or a change in the bacterial milieu due to periodontitis and gingivitis and the extraoral conditions include systemic insults such as upper respiratory infection, gastrointestinal tract pathologies, otolaryngologic pathologies, and rarely diabetic ketoacidosis (Scully and Greenman, 2012; Struch et al., 2008). Recently it is noticed that patients with confirmed COVID-19 without any relevant medical history experienced the problem of halitosis (Riad et al., 2021). However, volatile Sulphur compounds (VSCs) are the main substance responsible for this oral malodor. These VSCs are produced from protein degradation by gram-negative anaerobic bacteria in the oral cavity (Roth et al., 2014). Halitosis is a prevalent condition affecting 50–65% of the world population (Mento et al., 2021). A recent meta-regression analysis by MF Silva et al 2018 estimated that the prevalence of halitosis was 31.8% (95% CI 24.6–39.0%) in adolescents and adults (Silva et al., 2018). Some studies have observed that the prevalence of halitosis was more among the Male gender and people aged more than 20 Years (Nadanovsky et al., 2007). Studies have also reported that patients with halitosis experience poor oral health-related quality of life (Lu et al., 2017). Most patients with halitosis issues seek treatment because of social and personal embarrassment (Quirynen et al., 2009). The lack of a standardized objective method for the assessment of halitosis poses challenge in recognizing its presence and providing the appropriate treatment. Beholding the complexity of diagnosis and management of the Halitosis and the high prevalence of self-perceived halitosis in residents of Saudi Arabia (AlSadhan, 2016). Moreover, it's multifactorial etiological (both Oral and Systemic Conditions) origin and lack of awareness of this condition among medical physicians and dental practitioners. We thought of assessing and comparing the knowledge and attitude of dental practitioners and medical physicians towards halitosis in terms of causes, assessments, and management in Saudi Arabia.

2. MATERIALS AND METHODS

This descriptive cross-sectional study was carried out among Medical Physicians and Dental Practitioners of Saudi Arabia. We have obtained Ethical Committee approval from the Research Ethics Committee of Riyadh Elm University (registration number FUGRP/2021/222/385) before the commencement of the study. A self-administered questionnaire has been developed. The face validity of the questionnaire was evaluated by distributing among three subject experts and made needful modifications as per the suggestions received. The questionnaire consists of twenty items divided into four main sections: (1) demographical questions; (2) questions related to halitosis etiology; (3) questions related to halitosis diagnosis; (4) questions related to halitosis therapy. Within the questionnaire document, an informed consent form to obtain consent from participants was positioned which explained the purpose, significance, and procedure of the study.

Medical physicians and dentists practicing in Saudi Arabia were invited to participate as the targeted sample. We included medical physicians and dentists practicing in the north-south-east-west regions of Saudi Arabia. The questionnaire has been distributed initially with the help of different social media applications, then in person. We excluded Medical and dental students, Medical and dental interns and Dental hygienists along with non-physician Medical specialists. The study process was conducted in the period from February 2021 until October 2021.

All the Data is transferred to Microsoft Excel sheet and subjected to data analysis using the SPSS software version 19. For the categorical parameters, a cross table with Descriptive statistics (frequencies and percentages) was calculated. The Pearson chi-square test was applied to compare the questionnaire categorical responses between the Medical Physicians and Dental Practitioners. The statistical significance level was set at 0.05 type 1 error probability ($p \leq 0.05$) for all tests.

3. RESULTS

Demographic characteristics of the participants

In this study, about 385 health care professionals participated; from which 8 participants were excluded because they did not meet inclusion criteria. The final sample consists of 377 participants. Among the total, 50.7% were dentists, and the remaining 49.3% were Medical physicians. Around two-thirds of the participants were of Male gender (65%). Most of these participants were practicing in the Central Region of Saudi Arabia (80.6%). The 34.2% of participants were having < 5 years' experience, 26.8% were with 5 to 10 years of experience, and nearly 39% were having > 10 years of clinical experience (Table 1).

Table 1 demographic characteristic of study participants

		N	%
Gender	Female	132	35.0
	Male	245	65.0

Age	Under 30 years	106	28.1
	30-40 years	152	40.3
	41-50 years	67	17.8
	Above 50 years	52	13.8
Specialty	Dental practitioner	191	50.7
	Medical physician	186	49.3
Sub-specialty	ENT specialist	23	6.1
	Family physician	39	10.3
	Internist	33	8.8
	Oral & maxillofacial surgeon	6	1.6
	Dental GP[1]	77	20.4
	Medical GP[1]	28	7.4
	Oral pathologist	3	.8
	Other specialties	140	37.1
	Periodontist	28	7.4
Years of experience	less than 5 years	129	34.2
	5-10 years	101	26.8
	11-19 years	75	19.9
	20+ years	72	19.1
Region of practice in Saudi Arabia	Central region	304	80.6
	Eastern region	22	5.8
	Northern region	15	4.0
	Southern region	10	2.7
	Western region	26	6.9

[1]General Practitioners

General participant's responses to the study questionnaire

Dentists are considered as the most suitable expert for the initial assessment of the halitosis by both the healthcare professionals (67%), (Figure 1). Regarding the origin of halitosis, 41% of them chosen the option of >75% Oral halitosis - <25% Non-oral halitosis and followed by 35.3% are of opinion that the halitosis origin is equally prevalent from both Oral and Non-Oral causes. Among the oral causes, gingival inflammation (72%) and Dry mouth (66%) are reported as most common causes. However, among the medical conditions, GIT conditions (78.5%) and ENT conditions (55.6%) are reported as common causes of Halitosis. The vast majority of clinicians (72%) reported that they don't have diagnostic protocol for halitosis and nearly 43% of them said that they diagnose halitosis with just visual inspection (Table 2). Nearly 47% and 35% of clinicians reported that they will either refer halitosis patient to Dentist and ENT specialist respectively. Forty percent of clinicians agreed that they were not adequately trained about halitosis at their universities as an undergraduate (Table 3).

Table 2 General participant's responses to the questionnaire (Etiology and diagnosis)

	N	%
Choose the correct percentage for halitosis origin		
>75% Oral halitosis - <25% Non-oral halitosis	155	41.1
25< Oral halitosis - >75% Non-oral halitosis.	35	9.3
50% Oral halitosis - 50% Non-oral halitosis	133	35.3
I don't know	53	14.1
Other	1	.3
Which of the following causes is related to oral halitosis?		
Dry Mouth	251	66.6

Dental fillings	143	37.9
Gingival inflammation	271	71.9
Coated tongue	206	54.6
Pericoronitis	182	48.3
I don't know	14	3.7
Which of the below choices could be a contributing factor for Non-oral halitosis?		
ENT Conditions	210	55.7
Heart Condition	23	6.1
Lung condition	86	22.8
GIT Condition	296	78.5
Liver Condition	104	27.6
I don't know	17	4.5
Do you have a diagnostic protocol to diagnose a patient with halitosis?		
No	272	72.1
Yes	105	27.9
What is/are your main method/s to diagnose patient with halitosis?		
Portable Volatile Sulfur Monitor	61	16.2
Organoleptic measurement	23	6.1
Saliva Incubation Test	89	23.6
Visual inspection	163	43.2
Imaging (X-ray - MRI - CT scan - etc..)	52	13.8
Dark-Field or Phase-Contrast Microscopy	10	2.7
I don't know how to diagnose patient with halitosis	132	35.0

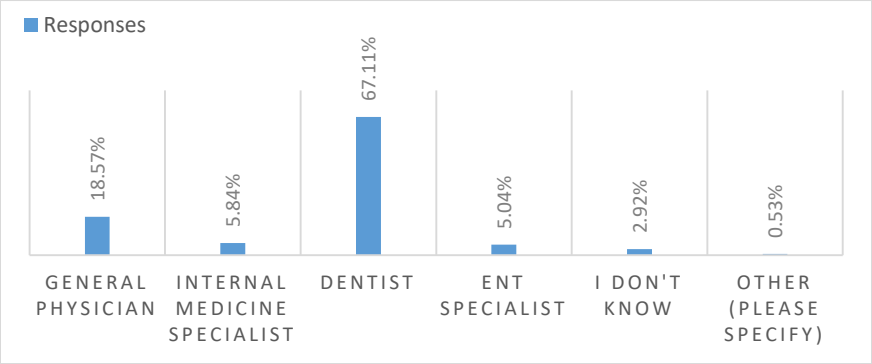

Figure 1 Participant's responses regarding the first suitable specialist for the initial assessment of halitosis

Table 3 General participant's responses to the questionnaire (Management)

What is your treatment option for a patient that is suffering from halitosis?	N	%
Examine the cause and treat or refer according to that	218	57.8
Medications	15	4.0
Mouth wash prescription	95	25.2
Other	2	.5
Refer the patient directly	29	7.7
Tongue scraper	18	4.8

To whom you may refer a patient that has no apparent causes related to your specialty		
Dental practitioner	177	46.9
Emergency department	6	1.6
ENT or Internal medicine specialist	132	35.0
General physician	51	13.5
Other	8	2.1
Psychologist	3	.8
If a patient came to your clinic for a routine check-up, and you recognized that the patient has halitosis. What would you do?		
None of the above	28	7.4
Not to tell him/her, I have no idea how to manage it	11	2.9
Not to tell him/her. It's embarrassing to do so	72	19.1
Tell him/her, that he/she has halitosis and present treatment or refer to another health professional	266	70.6
How was your teaching/training about halitosis at your university as an undergraduate?		
Adequate	150	39.8
Excellent	32	8.5
Inadequate	151	40.1
None	44	11.7
Do you think you are ready to manage (diagnose, treat and/or refer) patients with halitosis?		
No	150	39.8
Yes	227	60.2

Comparison between medical physicians and dental practitioner's responses to the study questionnaires

For the initial assessment of halitosis, 85% of dentists preferred dental professionals while nearly 49% of medical physicians preferred ENT specialists (Table 4). This difference in preferences between Dental and Medical professionals was statistically significant. Statistically significant differences were also observed in regard to the Oral and Non-oral causes of halitosis. Dentists opted more often the Dry mouth, gingival inflammation, and Coated tongue as causes of halitosis than their counterpart Medical Physicians. Medical Physicians picked more often the ENT conditions and Liver conditions as non-oral causes of halitosis than Dentists. About 80% of medical physicians agreed that they don't have any diagnostic protocol for halitosis while only 64% Dentists didn't have it. The treatment protocol for halitosis also significantly differed between the Physicians and Dentists. Nine percent of dentists said they recommend tongue cleaner while only 0.5% physicians recommended it.

In situations where the patient has no apparent causes related to your specialty, about 50% of Dentists and 70% of medical physicians said they will refer the patient to ENT specialist and Dentist respectively (Figures 2 and 3). Nearly 30% of Dentists and 50% of Medical physicians responded that their undergraduate curriculum at university had inadequate teaching/training about halitosis (Table 4).

Table 4 Comparison of responses between the dental practitioners and Medical Physicians

		Specialty				
		Dental practitioner		Medical physician		
		N	%	N	%	P value
In your opinion, which health-care specialist is most suitable for the initial assessment of halitosis?	Dentist	162	84.8%	91	48.9%	0.001*
	ENT specialist	3	1.6%	16	8.6%	
	General physician	11	5.8%	59	31.7%	
	I don't know	5	2.6%	6	3.2%	
	Internal medicine	8	4.2%	14	7.5%	
	Other	2	1.0%	0	0.0%	

Choose the correct percentage for halitosis origin	>75% Oral halitosis - <25% Non-oral halitosis	87	45.5%	68	36.6%	0.186
	25< Oral halitosis - >75% Non-oral halitosis.	18	9.4%	17	9.1%	
	50% Oral halitosis - 50% Non-oral halitosis	57	29.8%	76	40.9%	
	I don't know	28	14.7%	25	13.4%	
	Other	1	0.5%	0	0.0%	
In your opinion, what is the most common source of halitosis?	Blood-borne sources	2	1.0%	0	0.0%	0.041*
	ENT sources	15	7.9%	20	10.8%	
	I don't know	6	3.1%	7	3.8%	
	Oral sources	147	77.0%	152	81.7%	
	Other	8	4.2%	5	2.7%	
	Respiratory sources	13	6.8%	2	1.1%	
Which of the following causes is related to oral halitosis?	Dry mouth	143	74.9%	108	58.1%	0.001*
	Dental fillings	71	37.2%	72	38.7%	0.758
	Gingival inflammation	151	79.1%	120	64.5%	0.002*
	Coated tongue	119	62.3%	87	46.8%	0.002*
	Pericoronitis	98	51.3%	84	45.2%	0.232
	I don't know	4	2.1%	10	5.4%	0.092
Which of the below choices could be a contributing factor for Non-oral halitosis?	ENT conditions	91	47.6%	119	64.0%	0.001*
	Heart conditions	13	6.8%	10	5.4%	0.562
	Lung conditions	39	20.4%	47	25.3%	0.262
	GIT conditions	144	75.4%	152	81.7%	0.135
	Liver conditions	36	18.8%	68	36.6%	0.001*
	I don't know	12	6.3%	5	2.7%	0.093
Do you have a diagnostic protocol to diagnose a patient with halitosis?	No	124	64.9%	148	79.6%	0.002*
	Yes	67	35.1%	38	20.4%	
What is/are your main method/s to diagnose patient with halitosis?	Portable Volatile Sulfur Monitor	47	24.6%	14	7.5%	0.001*
	Organoleptic measurement	15	7.9%	8	4.3%	0.150
	Saliva Incubation Test	60	31.4%	29	15.6%	0.001*
	Visual inspection	79	41.4%	84	45.2%	0.457
	Imaging (X-ray - MRI - CT scan - etc..)	29	15.2%	23	12.4%	0.428
	Dark-Field or Phase-Contrast Microscopy	4	2.1%	6	3.2%	0.494
	I don't know how to diagnose patient with halitosis	57	29.8%	75	40.3%	0.033*
What is your treatment option for a patient that is suffering from halitosis?	Examine the cause and treat or refer according to that	111	58.1%	107	57.5%	0.001*
	Medications	5	2.6%	10	5.4%	
	Mouth wash prescription	50	26.2%	45	24.2%	
	Other	0	0.0%	2	1.1%	
	Refer the patient directly	8	4.2%	21	11.3%	
	Tongue scraper	17	8.9%	1	0.5%	
How many patients came to your clinic with halitosis being the main chief	1-2 patients	70	36.6%	66	35.5%	0.001*
	3-5 patient	44	23.0%	16	8.6%	
	Almost ZERO	52	27.2%	91	48.9%	

complaint in the past month?	More than 5 patient	25	13.1%	13	7.0%	
If a patient came to your clinic for a routine check-up, and you recognized that the patient has halitosis. What would you do?	None of the above	8	4.2%	20	10.8%	0.003*
	Not to tell him/her, I haveno idea how to manage it	2	1.0%	9	4.8%	
	Not to tell him/her, It's embarrassing to do so	32	16.8%	40	21.5%	
	Tell him/her, and present treatment or refer to another health professional	149	78.0%	117	62.9%	
How was your teaching/training about halitosis at your university as an undergraduate?	Adequate	103	53.9%	47	25.3%	0.01*
	Excellent	23	12.0%	9	4.8%	
	Inadequate	57	29.8%	94	50.5%	
	None	8	4.2%	36	19.4%	
Do you think you are ready to manage (diagnose, treat and/or refer) patients with halitosis?	No	61	31.9%	89	47.8%	0.002*
	Yes	130	68.1%	97	52.2%	

*Pearson Chi square test, Statistical significance fixed at p≤0.05

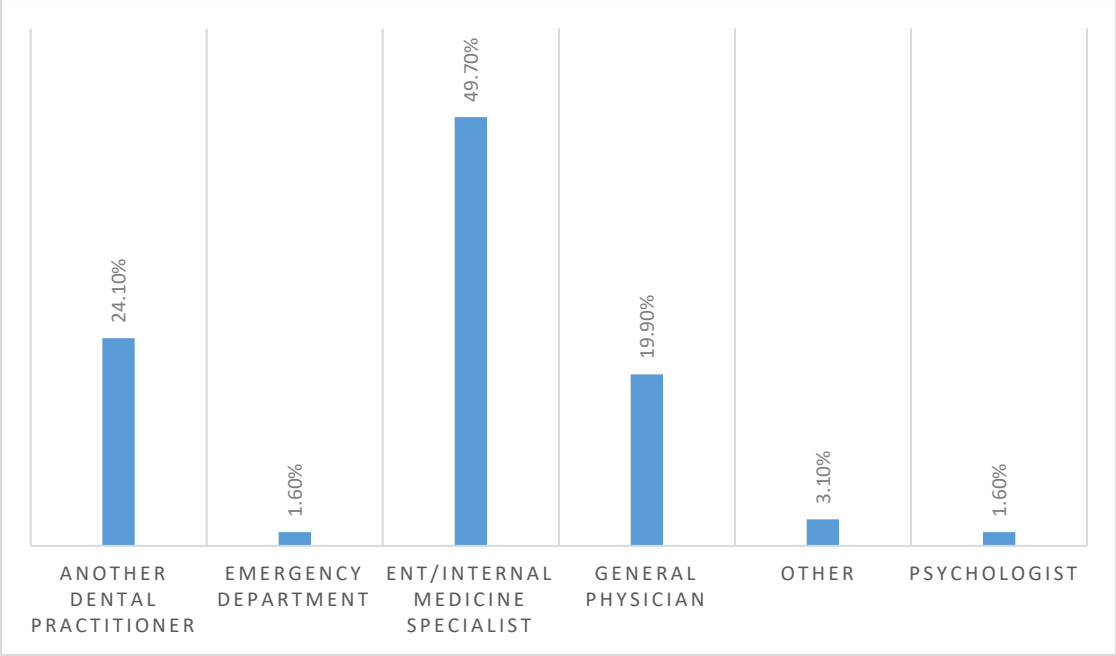

Figure 2 Dental practitioner's responses to whom the patient will be referred in case of undetected causes related to their specialties

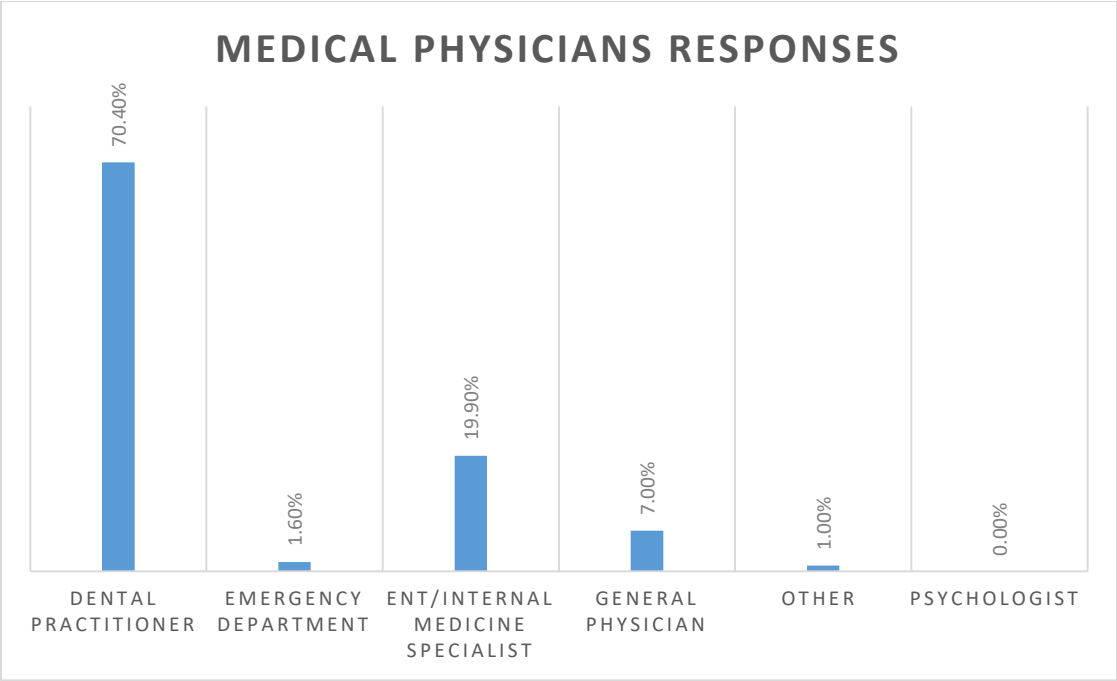

Figure 3 Medical Physicians responses to whom the patient will be referred in case of undetected causes related to their specialties

4. DISCUSSION

Halitosis is an oral disorder that is the most common reason after dental caries and periodontal disease for the patient's visits to the dentist (Rayman and Almas, 2008). Considering the high prevalence of Halitosis and its embarrassing consequences affecting interpersonal social communication, we assessed and compared the knowledge and attitude of Dentists and Medical Physicians of Saudi Arabia. The major proportion of both Dentist and Medical physicians agreed that the most common source of Halitosis is oral cavity. Several studies have confirmed the fact that most of the persistence halitosis originates from the oral cavity mainly through bacterial activity (Allaker, 2010; Eldarrat, 2011). However, more than 50% of medical physicians are of opinion that Medical Professionals of different specializations (Non-Dentist) are the most suitable for the initial assessment of Halitosis. Among the oral sources of halitosis, studies have found that tongue coating is the commonest cause (Porter and Scully, 2006; Renvert et al., 2020; Quirynen et al., 2009). The other predisposing factors include gingivitis, periodontitis, pericoronitis, necrotizing ulcerative gingivitis/periodontitis, dental caries, oral ulceration and oral malignancy, food impaction, and dry socket (Porter and Scully, 2006; De Geest et al., 2016; Scully and Greenman, 2012). In this study, about 62% of Dentists and only 49% of Medical physicians agreed that the tongue coating as intra-oral source of halitosis.

A recent study reported that the metabolic profiles of the tongue coating microbiomes of patients with intra-oral halitosis were significantly different to those of healthy controls (Seerangaiyan et al., 2019). Among the Non-Oral Sources of halitosis, GIT conditions were opted by the majority of Dentists (75%) and Medical Physicians (81%). Gastro-esophageal reflux disease was frequently associated with halitosis (Kinberg et al., 2010; Lee et al., 2007). There are researches that reports that H pylori can produce VSCs and demonstrated that the treatment of H pylori infection has shown significant reduction in Oral malodor (Wright et al., 1998; Kinberg et al., 2010). About 5–10% of all halitosis cases occur because of Extra Oral Causes such as ear/nose/throat (ENT) or respiratory diseases (e.g.: sinusitis, tonsillitis, bronchiectasis, malignancy) and foreign bodies in the airway (Renvert et al., 2020).

Diagnosis of Halitosis is crucial for its appropriate treatment. There are several approaches to identify Halitosis. The first step includes the Visual Examination and this method was practiced by many of Dentists (41%) and Medical Physicians (45%) of Saudi Arabia. Among all the diagnostic approaches of Halitosis, organoleptic method is considered as the gold standard (Renvert et al., 2020). However, in our study, only few Dentists (7.9%) and Medical Physicians (4.3%) employ organoleptic method. However, it is doubtful whether the term 'Organoleptic measurement' has been understood verbatimly or not by the study participants. Moreover, most of the Dentists (64.9%) and Medical Physicians (79.6%) have reported that they don't have a diagnostic protocol to diagnose a patient with halitosis.

With regard to the treatment of Halitosis, nearly an equal proportion of Dentists and Medical Physicians reported that they prescribe mouthwash. However, only 0.5% of medical physicians will prescribe tongue scrappers which is quite less when compared to dentist's prescription (9%). Similar differences among Dental and Medical practitioners were also observed in the

survey in Switzerland(Roth et al., 2014). In comparison to Dentists from Switzerland (92.2%) and Germany (93.3%), very few dentists in Saudi Arabia (9%) are prescribing tongue scrappers (Oppliger et al., 2014). A Cochrane review reported that the use of tongue scrappers has shown small but statistically significant reduction of VSC levels in adults (Outhouse et al., 2006). The cleaning of the tongue with toothbrush/tongue scraper should be performed gently to prevent tissue damage. Tongue scraper is more preferred because of its ability to clean posterior portion of the tongue which harbors the most coating (Clark et al., 1997). Most of the practitioners from both the Medical and Dental reported that they will refer patient to Dental and Medical specialists respectively if the patient has no apparent causes related to their specialty.

Overall It is observed that both the speciality have better understanding about the origin and causes of Halitosis. But the knowledge about diagnosis and treatment is inadequate among both professionals. Specifically, several Medical professionals don't know that the simple tongue cleansers can be effective to control halitosis. Previous research has also reported that Non-Dental health care professionals lack knowledge about halitosis (Afolabi et al., 2009). Our study findings highlight the need of creating awareness among the Dental and Medical practitioners of Saudi Arabia through Continuing Education. It is also necessary to have better collaboration and communication among both professionals, especially when dealing with conditions having both Intra and Extra oral causes.

There are few limitations of our study which need to be considered while generalizing our study findings. Though the decent number of participants from both the fraternity participated but it may not be the representative sample of Saudi Arabia because of sampling method employed in this study. The second limitation is the lack of the previous studies utilizing similar questionnaire which made comparison difficult. Beholding the mentioned limitations and limited research in this field provides a great scope for researchers to take up the research projects in this field with better methodology and different sample of healthcare professionals.

5. CONCLUSION

Our study has demonstrated differences in the level of knowledge among Dental and Medical professionals regarding halitosis. Although both the professionals lack adequate knowledge about diagnosis and treatment of Halitosis, it is more evident among medical professionals. The problem of inadequate knowledge, lack of diagnostic protocol/equipment among the both dental and medical practitioners poses a greater challenge in managing Halitosis among patients. In order to provide a better care for patients with Halitosis, both professionals require training and better interdisciplinary coordination.

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Author Contributions

Tariq Wahass: Conceptualization; Data curation; Investigation; Validation; Writing – original draft; Writing – review & editing
HazimAlharkan: Data curation; Validation; Writing – original draft
Ali Alshamari: Data curation; Validation; Writing – original draft
Nader Alamri**:** Data curation; Validation; Writing – original draft; Writing – review & editing
AnmarAlarnous: Data curation; Validation; Writing – original draft
Ahmad Assari: Data curation; Validation; Writing – original draft; Supervision

Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Institutional Review Board of Riyadh Elm University (IRB approval number "FUGRP/2021/222/385/383).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

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Conflict of interest

The authors declare that there are no conflicts of interest.

Data and materials availability

All data associated with this study are present in the paper.

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