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Prevalence of misophonia and its association with depression and obsessive-compulsive disorder among medical students

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Abstract

Misophonia, a neurobehavioral syndrome, reduces tolerance to specific stimuli and impacts various domains of life. It is also strongly correlated with obsessive-compulsive disorder (OCD) and depression. This study aimed to investigate the prevalence of misophonia among medical students at King Saud University (KSU), Saudi Arabia, identify related sociodemographic factors, and assess misophonia association with OCD and depression. This cross-sectional study included 371 participants. The study tool was distributed electronically between November 19 and December 07, 2023. It consisted of 4 sections: a questionnaire developed by the research team, the Amsterdam Misophonia Scale (A-MISO-S), the Obsessive-Compulsive Inventory-Revised (OCI-R), and the Patient Health Questionnaire-9 (PHQ-9). The results indicated that 42.32% of the participants had previously experienced misophonia, with symptoms developing suddenly in 28.66%. The majority of participants had subclinical misophonia (71.16%) and minimal depression (37.47%), with a significant proportion experiencing mild-to-severe misophonia (28.84%) and varying degrees of depression (33.15%). Approximately 31.00% of the students exhibited likely OCD. The PHQ-9 and A-MISO-S scores showed weak positive correlations, whereas the OCI-R and A-MISO-S scores showed a moderate positive correlation. Furthermore, a moderate positive correlation was observed between the OCI-R and PHQ-9 scores. Multiple logistic regression analysis revealed that sex, family history of misophonia, depression severity, and OCD were significantly associated with clinical misophonia. This study underscores the significance of recognizing misophonia among medical students and its associated factors, such as OCD and depression. Further multicenter studies using more rigorous research methodologies are warranted.

Abbreviations: A-MISO-S = Amsterdam Misophonia Scale, CI = confidence interval, KSU = King Saud University, OCD = obsessive-compulsive disorder, OCI-R = Obsessive-Compulsive Inventory-Revised, OR = odds ratio, PHQ-9 = Patient Health Questionnaire-9, SD = standard deviation

Keywords: depression, King Saud University, medical students, misophonia, obsessive-compulsive disorder, Saudi Arabia

1. Introduction

Misophonia is a neurobehavioral syndrome characterized by reduced tolerance to specific stimuli, resulting in heightened autonomic nervous system arousal.[1] The prevalence of misophonia varies among studies,[2–4] with evidence suggesting a familial tendency.[3,5,6] Symptoms of misophonia often onset during childhood or adolescence.[3,5,7] A study indicated that 75% of the 301 participants experienced misophonic symptom onset during childhood or teenage years, with symptoms intensifying over time.[5] Another study in the United States (US) involving 1061 participants found a correlation between a higher level of misophonia and earlier age of onset.[7]

Misophonic triggers are precise and encompass visual cues, such as pointing fingers, leg jiggling, or hair twisting,[8] and

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

The authors have no conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

The study was approved by the Institutional Review Board of the College of Medicine at King Saud University, Riyadh (Research Project No. E-23-8209).

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auditory cues, such as chewing, low-frequency bass sounds, pen clicking, and typing.[9] While lip-smacking, sniffling, and throat clearing represent the primary organic or biological sounds that serve as misophonic triggers, affected individuals also report distress caused by non-organic sounds, such as electronic noises, keyboard tapping, and animal sounds.[10] Furthermore, a study revealed a significant correlation between misophonic reaction intensity and the volume and duration of the triggering stimuli.[11]

Misophonic phenomena can elicit physiological, emotional, behavioral, and cognitive responses.[1,9,11,12] Emotional responses include annoyance, irritation, anger, and anxiety.[1,9,11] Behavioral responses include avoidance, glaring at, or mimicking the person producing the sound, as well as verbal and physical aggression.[12] Physical manifestations include chest, shoulder, head, or body pressure; elevated body temperature; pain; headache; and breathing difficulties.[9]

Misophonia can negatively affect various life domains, including social interactions, occupational performance, and overall role functioning.[13–15] It also affects an individual's overall quality of life; as misophonia symptoms worsen, their impact on quality of life becomes more pronounced.[7]

Several studies have shown that misophonia is strongly correlated with comorbid obsessive-compulsive disorder (OCD) and depression.[2,16,17] For example, an American study demonstrated a significant increase in the likelihood of clinically significant OCD symptoms among individuals with misophonia. Similarly, research has indicated a significant correlation between misophonia and depression.[2,7,13,17] Furthermore, some studies indicated that the intensity of misophonia tends to decrease when no concurrent psychiatric disorders are present.[5]

Research on misophonia among students has also been conducted. For example, a study in the United Kingdom assessed the prevalence of misophonia among 336 undergraduate medical students. The study revealed that 49.1% of the participants exhibited clinically significant symptoms, 37% displayed mild symptoms, 12% showed moderate symptoms, and 0.3% exhibited severe symptoms.[18]

In Saudi Arabia (SA), very limited research has been conducted concerning misophonia. The present study aimed to estimate the prevalence of misophonia among medical students at King Saud University (KSU), identify associated sociodemographic factors, and assess the association of OCD and depression with misophonia among participants. This study adds to the literature on misophonia in SA and provides valuable insights for stakeholders, including physicians, academicians, and policymakers.

2. Materials and methods

2.1. Study design, setting, and participants

A quantitative cross-sectional study was conducted among the targeted population: all medical students, both male and female, enrolled in the first through fifth years at KSU Medical College in Riyadh, SA. The exclusion criteria encompassed students with any communication barriers and those who were in the preparatory or internship year at the time of the study. The research team distributed the study tool electronically to reduce costs and time among participants between November 19 and December 07, 2023 via social media channels, such as WhatsApp. Concerning the sample size, the number of medical students at KSU Medical College was estimated to be approximately 1494, including both males and females. Using the Raosoft sample size calculator (http://www.raosoft.com/samplesize.html), with a margin of error of 5% and a confidence level of 95%, the estimated sample size was 306 participants. An additional 20% was added to account for nonrespondents (367 students).

2.2. Study instruments

The study instrument consisted of 4 sections: a questionnaire developed by the research team, the Amsterdam Misophonia Scale (A-MISO-S), the Obsessive-Compulsive Inventory-Revised (OCI-R), and the Patient Health Questionnaire-9 (PHQ-9).

The research team developed a questionnaire to assess sociodemographic factors, including age, sex, and current academic year. The questionnaire also evaluated whether the participant had been diagnosed with a mental health condition and if they were currently receiving any psychotropic medication. It further assessed if they had ever experienced misophonic-related symptoms and, if they had, the onset (whether gradual or sudden), and the age of onset. Additionally, the questionnaire inquired about the presence of a family history of misophonia, and if present, the degree of the relationship with this family member.

The A-MISO-S is a self-report scale that measures the presence and severity of symptoms experienced in response to specific auditory stimuli.[19] It comprises 7 questions: 6 are multiple-choice questions and the last is a short-answer question. It is rated on a 5-point ordinal scale ranging from 0 to 4, with a total possible score of 24. The scores are interpreted as follows: 0 to 4 indicate subclinical misophonic symptoms; 5 to 9, mild; 10 to 14, moderate; 15 to 19, severe; and 20 to 24, extreme.[20] Previous studies demonstrated the validity of the scale, with Cronbach's alpha values of 0.838,[19] 0.89,[4] and 0.814.[18] We obtained permission from the authors of the scale for its use in the present study.

The OCI-R is a self-report assessment tool designed to measure the severity of OCD symptoms.[21] It is used in clinical and research settings to assess the presence and intensity of various obsessive thoughts and compulsive behaviors associated with OCD.[21] One study showed that the OCI-R exhibits a sensitivity of 84.4%, specificity of 85.6%, positive predictive value of 85.4%, and negative predictive value of 84.6%.[22] The scale comprises 18 questions, with answers scored from 0 ("not at all") to 4 ("extremely"). The scores are generated by adding each item score.[22] The possible range of total scores is 0 to 72. The recommended cutoff score is 21, with scores at or above this level indicating the likely presence of OCD.[22] The OCI-R is in the public domain, allowing its use free of charge without the need to obtain permission from its authors.[23,24]

The PHQ-9 is a multipurpose instrument for screening, monitoring, and measuring the severity of depression.[25] The internal reliability of the PHQ-9 was found to be excellent, with a Cronbach's α of 0.89 in the PHQ Primary Care Study and 0.86 in the PHQ Ob-Gyn Study.[25,26] The questionnaire comprises 9 multiple-choice questions. The raw score ranges from 0 to 27, with higher scores indicating greater severity of depressive symptoms.[25] A PHQ-9 score > 10 has a sensitivity of 88% and specificity of 88% for major depression.[25] The severity categories are as follows: minimal depression, 0 to 4; mild depression, 5 to 9; moderate depression, 10 to 14; moderately severe depression, 15 to 19; and severe depression, 20 to 27. The PHQ-9 was developed and copyrighted by Drs R.L. Spitzer, J.B. Williams, and K. Kroenke in 1999, funded by an educational grant from Pfizer Inc. While Pfizer holds the copyright to the PHQ-9, it is available for use and replication without needing permission.[25]

2.3. Descriptive statistics

All statistical analyses were performed using SPSS, version 29 (IBM Corp., Armonk). The PHQ-9 scale was used to assess the severity of depression. Misophonia was assessed using the A-MISO-S. The OCI-R was used to assess the presence of OCD. The cutoff points used for the 3 scales were as follows: a score of ≥ 10 for the PHQ-9,[25] ≥ 5 for the A-MISO-S,[20] and ≥ 21 for the OCI-R.[22]

Table 1

Demographic characteristics of the participants (N = 371).

		N	%
Age	Mean (SD)	21.14 (1.59)	
Sex	Male	234	63.07
	Female	137	36.93
Current academic year	First year	58	15.63
	Second year	113	30.46
	Third year	73	19.68
	Fourth year	60	16.17
	Fifth year	67	18.06
Have you been diagnosed with a mental health condition(s)?	No	313	84.37
	Yes	58	15.63
Diagnosed psychiatric condition(s) (multiple answers are allowed, n = 58)	Depression	40	68.97
	Anxiety	18	31.03
	Obsessive-compulsive disorder	10	17.24
	OCPD	3	5.17
	Bipolar disorder	2	3.45
	ADHD	2	3.45
	Depersonalization/derealization disorder	1	1.72
	OCPD traits	1	1.72
Are you currently taking any psychotropic medication(s)?	No	345	92.99
	Yes	26	7.01
Ever experienced misophonia	No	214	57.68
	Yes	157	42.32
Did these miso phonic-related symptoms develop suddenly or gradually? (n = 157)	Suddenly	45	28.66
	Gradually	43	27.39
	I do not remember	69	43.95
How old were you when you started to experience these miso phonic-related symptoms? (n = 152)	Early childhood (4 and below)	7	4.61
	Childhood (5–12)	46	30.26
	Teenage years (13–17)	65	42.76
	Adult (18 and above)	34	22.37
Has anyone in your family ever experienced misophonia?	I do not know	169	45.55
	No	122	32.89
	Yes	80	21.56
Please specify the degree of the relationship with this family member(s) (n = 79)	First-degree relatives (i.e., parents, siblings)	71	89.87
	Second-degree relatives (i.e., grandparent, aunt, uncle, cousin, nephew, niece)	6	7.60
	More distant relatives	2	2.53
Response to misophonic sounds (N = 77)	Inward response	25	32.47
	Outward response	23	29.87
	No true response	15	19.48
	Inward and outward response	8	10.39
	Outward and no true response	2	2.60
	Inward and no true response	3	3.90
	All types of response	1	1.30

ADHD = attention-deficit/hyperactivity disorder, OCPD = obsessive-compulsive personality disorder, SD = standard deviation.

Categorical variables are presented as frequency and percentage (%) and were analyzed using the chi-square test. Numerical data are presented as mean and standard deviation (SD), analyzed using the independent-samples *t* test and one way analysis of variance. Testing for normality of the distribution was done using the Shapiro–Wilk test, and post hoc testing was done using Bonferroni adjustment. Pearson's correlation was used to study the association between different numerical variables. Multiple logistic regression was employed to investigate the factors associated with clinical misophonia (individuals with an A-MISO-S score between 5 and 24). Statistical significance was set at $P \leq .05$.

2.3.1. Ethical consideration. This study received ethical approval from the Institutional Review Board of the College of Medicine at KSU (Research Project No. E-23-8209). Participants were presented with an informed-consent statement, which they read and acknowledged by selecting "Next" to access the study's survey. An explanation of confidentiality and data anonymity was provided to the participants, along with information on the study's scope and the principal investigator's contact information. The right to participate was granted by clicking on the link to provide informed consent.

3. Results

Table 1 presents the demographic characteristics of the participants. A total of 371 individuals participated in the study. The mean age of the participants was 21.14 years, SD = 1.59 years. Of the participants, 234 (63.07 %) were males, and the remaining 137 (36.93%) were females. Most participants, 113 (30.46%), were second-year students. Only 58 (15.63%) participants were diagnosed with mental health conditions: 40 (68.97%) and 18 (31.03%) were diagnosed with depression and anxiety, respectively. Among the participants, 26 (7.01%) were taking psychotropic medications. Of the students, 157 (42.32 %) had experienced misophonia, with 45 (28.66%) and 43 (27.39%) experiencing misophonia-related symptoms that developed suddenly and gradually, respectively. Out of the 152 students who had experienced misophonia, only 7 (4.61%) experienced misophonia during early childhood (age, ≤ 4

Table 2

A-MISO-S, PHQ-9, and OCI-R scores of the participants.

A-MISO-S score	Mean (SD)	3.22 (3.48)
	Median (min, max)	2.0 (0.0, 19.0)
		N (%)
A-MISO-S categories	Subclinical misophonia (score, 0–4)	264 (71.16)
	Mild misophonia (score, 5–9)	83 (22.37)
	Moderate misophonia (score, 10–14)	21 (5.66)
	Severe misophonia (score, 15–19)	3 (0.81)
	Extreme misophonia (score, 20–24)	0 (0.00)
Presence of misophonia	Subclinical misophonia (score, 0–4)	264 (71.16)
	Clinical misophonia (score, 5–24)	107 (28.84)
PHQ-9 score	Mean (SD)	7.39 (5.76)
	Median (min, max)	7.0 (0.0, 24.0)
PHQ-9 categories	Minimal depression (score, 0–4)	139 (37.47)
	Mild depression (score, 5–9)	109 (29.38)
	Moderate depression (score, 10–14)	80 (21.56)
	Moderately severe depression (score, 15–19)	29 (7.82)
	Severe depression (score, 20–27)	14 (3.77)
Presence of depression	No depression (score, 0–9)	248 (66.85)
	Depression (score, 10–27)	123 (33.15)
OCI-R score	Mean (SD)	15.49 (12.51)
	Median (min, max)	13.0 (0.0, 63.0)
Presence of OCD	No OCD (score, 0–20)	256 (69.00)
	Likely OCD (score, ≥21)	115 (31.00)

A-MISO-S = Amsterdam Misophonia Scale, OCD = obsessive-compulsive disorder, OCI-R = Obsessive-Compulsive Inventory-Revised, PHQ-9 = Patient Health Questionnaire-9, SD = standard deviation.

years), 46 (30.26%) during childhood (age, 5–12 years), 65 (42.76%) during teenage years (age, 13–17 years), and 34 (22.37%) during adulthood (age, ≥ 18 years). Eighty (21.56%) participants had family members who previously experienced misophonia. Seventy-nine out of these 80 specified the degree of the relationship with the family member who had previously experienced misophonia, with 71 (89.87%) being first-degree family members. Twenty-five (32.47%) and 23 (29.87%) students responded to misophonic sounds inwardly and outwardly, respectively.

Table 2 presents the A-MISO-S, PHQ-9, and OCI-R scores of the participants. The mean A-MISO-S score of the participants was 3.22, SD = 3.48. Most of the students, 264 (71.16%), had subclinical misophonia. Eighty-three (22.37%), 21 (5.66%), and 3 (0.81%) students experienced mild, moderate, and severe misophonia, respectively. Out of 371 students, 107 (28.84%) had clinical misophonia. The mean PHQ-9 score of the participants was 7.39, SD = 5.76. Among the students, 139 (37.47%) had minimal depression, 109 (29.38%) had mild depression, 80 (21.56%) had moderate depression, 29 (7.82%) had moderately severe depression, and 14 (3.77%) had severe depression. Thus, of the 371 students, 123 (33.15%) were found to have depression. The mean OCI-R score of the participants was 15.49, SD = 12.51. Among the 371 students, 115 (31.00%) had likely OCD.

Table 3 shows the associations between the A-MISO-S, PHQ-9, and OCI-R scores. Pearson's correlation analysis revealed significant associations between these variables. The correlation coefficient (r) between the PHQ-9 and A-MISO-S scores was 0.276 ($P < .001$), indicating a weak positive correlation. Additionally, the correlation coefficient between the OCI-R and A-MISO-S scores was 0.333 ($P < .001$), indicating a moderately positive correlation. Similarly, the correlation coefficient between the OCI-R and PHQ-9 scores was 0.478 ($P < .001$), also indicating a moderately positive correlation.

Table 4 shows the association between the PHQ-9 categories and OCD across misophonia categories. Depression categories showed significant associations: the percentage of students with minimal depression and subclinical misophonia (114, 43.2%) was higher than that of students with minimal depression and mild, moderate, or severe misophonia (23, 27.7%; 2, 9.5%; and 0, 0%, respectively). Furthermore, the percentage of students with mild depression and subclinical misophonia (82, 31.1%) was higher than that of students with mild depression and mild, moderate, or severe misophonia (24, 28.9%; 3, 14.3%; and 0, 0%, respectively). Moreover, the percentage of students with moderate depression and severe misophonia (2, 66.7%) was higher than that of students with moderate depression and subclinical, mild, or moderate misophonia (45, 17%; 24, 28.9%; and 9, 42.9%, respectively). The percentage of students with moderately severe depression and moderate misophonia (7, 33.3%) was higher than that of students with moderately severe depression and subclinical, mild, or severe misophonia (15, 5.7%; 7, 8.5%; and 0, 0%, respectively). In addition, the percentage of students with severe depression and severe misophonia (1, 33.3%) was higher than that of students with severe depression and subclinical, mild, or moderate misophonia (8, 3%; 5, 6%; and 0, 0%, respectively; $P < .001$).

The association with OCD was significant: the percentage of students with likely OCD and moderate misophonia (16, 76.2%) was higher than that of students with likely OCD and subclinical, mild, or severe misophonia (61, 23.1%; 36, 43.4%; and 2, 66.7%, respectively; $P < .001$).

Table 5 shows the associations between participant demographic characteristics and the A-MISO-S, PHQ-9, and OCI-R scores. Age, sex, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed significant associations with the A-MISO-S score. The correlation coefficient between age and the A-MISO-S score was 0.123 ($P = .018$), indicating a weak positive correlation. The mean A-MISO-S score was lower among males (mean = 2.79, SD = 3.21) than among females (mean = 3.96, SD = 3.79) ($P = .003$). The mean A-MISO-S score of participants diagnosed with a mental health condition (mean = 4.29, SD = 4) was higher than that of those not diagnosed with a mental health condition (mean = 3.02, SD = 3.34) ($P = .026$). The mean A-MISO-S score of participants who were taking psychotropic medications (mean = 4.96, SD = 3.85) was higher than that of those who were not taking any psychotropic medications (mean = 3.09, SD = 3.42) ($P = .008$). The mean A-MISO-S score of participants who had previously experienced misophonia (mean = 5.34, SD = 3.51) was higher than that of those who had not experienced misophonia (mean = 1.66, SD = 2.49) ($P < .001$). The mean A-MISO-S score of participants who had a family member with a history of misophonia (mean = 5.13, SD = 3.74) was higher than that of participants who did not have a family member with a history of misophonia (mean = 1.6, SD = 2.33). Participants who indicated that they did not know had a score (mean = 3.49, SD = 3.52) that was higher than that of those who had a family member with a history of misophonia but lower than that of those who had no family members with misophonia ($P < .001$).

Table 3

Association between the A-MISO-S, PHQ-9, and OCI-R scores.

		A-MISO-S score	PHQ-9 score	OCI-R score
PHQ-9 score	Pearson correlation	0.276	--	
	P value	**<.001***		
OCI-R score	Pearson correlation	0.333	0.478	--
	P value	**<.001***	**<.001***	

A-MISO-S = Amsterdam Misophonia Scale, OCI-R = Obsessive-Compulsive Inventory-Revised, PHQ-9 = Patient Health Questionnaire-9.
*Significant at $P \leq .05$.

Table 4

Association of PHQ-9 categories and OCD across misophonia categories.

		Misophonia categories					
		Subclinical N (%)	Mild N (%)	Moderate N (%)	Severe N (%)	χ^2	*P* value
Depression categories	Minimal	114 (43.2)	23 (27.7)	2 (9.5)	0 (0)	**33.53**	**<.001***
	Mild	82 (31.1)	24 (28.9)	3 (14.3)	0 (0)		
	Moderate	45 (17)	24 (28.9)	9 (42.9)	2 (66.7)		
	Moderately severe	15 (5.7)	7 (8.5)	7 (33.3)	0 (0)		
	Severe	8 (3)	5 (6)	0 (0)	1 (33.3)		
OCD	No OCD	203 (76.9)	47 (56.6)	5 (23.8)	1 (33.3)	**31.85**	**<.001***
	Likely OCD	61 (23.1)	36 (43.4)	16 (76.2)	2 (66.7)		

OCD = obsessive-compulsive disorder, PHQ-9 = Patient Health Questionnaire-9.
*Significant at $P \leq .05$.

Table 5

Association between participants' demographic characteristics and A-MISO-S, PHQ-9, and OCI-R scores.

			A-MISO-S score		*P* value	PHQ-9 score		*P* value	OCI-R score		*P* value
Age	Pearson correlation coefficient			0.123	**.018***		0.15	**.004***		0.194	**<.001***
		N	Mean	SD		Mean	SD		Mean	SD	
Sex	Male	234	2.79	3.21	**.003***	6.51	5.8	**<.001***	13.25	11.94	**<.001***
	Female	137	3.96	3.79		8.9	5.38		19.33	12.58	
Academic year	First year	58	3.74	3.79	0.6	8.5	6.03	**<.001***	15.71	10.99	**<.001***
	Second year	113	3.27	3.45		9.04	5.63		19.76	13.24	
	Third year	73	3.26	3.33		7.15	5.5		15.51	12.09	
	Fourth year	60	3.15	3.44		5.18	5.35		11.75	13.48	
	Fifth year	67	2.72	3.47		5.88	5.44		11.45	9.66	
Diagnosed with a mental health condition	No	313	3.02	3.34	**.026***	6.55	5.42	**<.001***	14.67	12.36	**.003***
	Yes	58	4.29	4		11.95	5.42		19.93	12.51	
Currently taking any psychotropic medication	No	345	3.09	3.42	**.008***	6.99	5.64	**<.001***	14.92	12.2	**.001***
	Yes	26	4.96	3.85		12.73	4.57		23.12	14.26	
Ever experienced misophonia	No	214	1.66	2.49	**<.001***	6.55	5.52	**.001***	12.98	11.34	**<.001***
	Yes	157	5.34	3.51		8.54	5.89		18.92	13.24	
Anyone in your family ever experienced misophonia	No	122	1.6	2.33	**<.001***	6	5.65	**.001***	12.13	11.35	**<.001***
	Yes	80	5.13	3.74		8.99	5.7		18.53	13.06	
	I do not know	169	3.49	3.52		7.64	5.66		16.49	12.58	

A-MISO-S = Amsterdam Misophonia Scale, OCI-R = Obsessive-Compulsive Inventory-Revised, PHQ-9 = Patient Health Questionnaire-9, SD = standard deviation.
*Significant at $P \leq 0.05$.

Age, sex, current academic year, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed significant associations with the PHQ-9 score. The correlation coefficient between age and the PHQ-9 score was 0.15 ($P = .004$), indicating a weak positive correlation. The mean PHQ-9 score among males (mean = 6.51, SD = 5.8) was lower than that among females (mean = 8.9, SD = 5.38) ($P < .001$). The mean PHQ-9 score of second-year students (mean = 9.04, SD = 5.63) was higher than that of fourth- (mean = 5.18, SD = 5.35) and fifth-year students (mean = 5.88, SD = 5.44) ($P < .001$). The mean PHQ-9 score of participants diagnosed with a mental health condition (mean = 11.95, SD = 5.42) was higher than that of those not diagnosed with a mental health condition (mean = 6.55, SD = 5.42) ($P < .001$). The mean PHQ-9 score of participants who were taking psychotropic medications (mean = 12.73, SD = 4.57) was higher than that of those who were not taking psychotropic medications (mean = 6.99, SD = 5.64) ($P < .001$). The mean PHQ-9 score of participants who had previously experienced misophonia (mean = 8.54, SD = 5.89) was higher than that of those who had not experienced misophonia (mean = 6.55, SD = 5.52) ($P = .001$). The mean PHQ-9 score of participants who had a family member with a history of misophonia (mean = 8.99,

SD = 5.7) was higher than that of participants who did not have a family member with a history of misophonia (mean = 6, SD = 5.65). Participants who indicated that they did not know had a higher score (mean = 7.64, SD = 5.66) than those who had no family members with misophonia; however, their score was not different from that of those who had family members with misophonia ($P = .001$).

Age, sex, current academic year, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed significant associations with the OCI-R score. The correlation coefficient between age and the OCI-R score was 0.194 ($P < .001$), indicating a weak positive correlation. The mean OCI-R score of males (mean = 13.25, SD = 11.94) was lower than that of females (mean = 19.33, SD = 12.58); ($P < .001$). The mean OCI-R score of second-year students (mean = 19.76, SD = 13.24) was higher than that of fourth- (mean = 11.75, SD = 13.48) and fifth-year students and (mean = 11.45, SD = 9.66) ($P < .001$). The mean OCI-R score of participants diagnosed with a mental health condition (mean = 19.93, SD = 12.51) was higher than that of participants not diagnosed with a mental health condition (mean = 14.67, SD = 12.36) ($P = .003$). The mean OCI-R score of participants who were taking psychotropic medications (mean = 23.12, SD = 14.26) was higher than that of those who were not taking psychotropic medications (mean = 14.92, SD = 12.2) ($P = .001$). The mean OCI-R score of participants who had previously experienced misophonia (mean = 18.92, SD = 13.24) was higher than that of those who had not experienced misophonia (mean = 12.98, SD = 11.34) ($P < .001$). The mean OCI-R score of participants who had a family member with a history of misophonia (mean = 18.53, SD = 13.06) was higher than that of those who did not have a family member with a history of misophonia (mean = 12.13, SD = 11.35). Participants who indicated that they did not know had a higher score (mean = 16.49, SD = 12.59) than those who had no family members with misophonia; however, their score was not different from that of those who had family members with misophonia ($P < .001$).

Table 6 shows the association between the participants' demographic characteristics and misophonia, depression, and OCD. Sex, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed significant associations with the A-MISO-S. The percentage of males with clinical misophonia (51, 21.8%) was lower than that of females with clinical misophonia (56, 40.9%) ($P < .001$). The percentage of participants who were diagnosed with a mental health condition and had clinical misophonia (24, 41.4%) was higher than that of those who were not diagnosed with a mental health condition and had clinical misophonia (83, 26.5%), ($P = .022$). The percentage of participants who were taking psychotropic medications and had clinical misophonia (14, 53.8%) was higher than that of those who were not taking any psychotropic medications and had clinical misophonia (93, 27%) ($P = .004$). The percentage of participants who experienced misophonia and had clinical misophonia (85, 54.1%) was higher than that of those who had not previously experienced misophonia and had clinical misophonia (22, 10.3%) ($P < .001$). The percentage of participants who had a family member who had experienced misophonia and had clinical misophonia (43, 53.8%) was higher than that of those who did not have any family member who had previously experienced misophonia and had clinical misophonia (11, 9%) and those who did not know if a family member had misophonia (53, 31.4%) ($P < .001$).

Age, sex, current academic year, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed a significant association with the PHQ-9. The mean age of participants who had depression (mean = 20.80, SD = 1.55) was lower than that of those who did not have depression (mean = 21.31, SD = 1.58) ($P = .004$). The percentage of males with depression (60, 25.6%) was lower than that of females with depression (63, 46.0%) ($P < .001$). The percentage of second-year students who had depression (51, 45.1%) was higher than that of fourth- (8, 13.3% and fifth-year students (14, 20.9%) ($P < .001$). The percentage of participants who were diagnosed with a mental health condition and had depression (38, 65.5%) was higher than that of those who were not diagnosed with a mental health condition and had depression (85, 27.2%) ($P < .001$). The percentage of participants who were taking psychotropic medications and had depression (19, 73.1%) was higher than that of those who were not taking

Table 6

Association between participants' demographic characteristics and misophonia, depression, and OCD.

		A-MISO-S			PHQ-9			OCD		
		Subclinical misophonia	Clinical misophonia		No depression	Depression		No OCD	Likely OCD	
		N = 264 (%)	N = 107 (%)	*P* value	N = 248 (%)	N = 123 (%)	*P* value	N = 256 (%)	N = 115 (%)	*P* value
Age	Mean ± SD	21.2 ± 1.61	21 ± 1.53	0.27	21.31 ± 1.58	20.80 ± 1.55	**.004***	21.31 ± 1.59	20.77 ± 1.52	**.002***
Sex	Male	183 (78.2)	51 (21.8)	**<.001***	174 (74.4)	60 (25.6)	**<.001***	179 (76.5)	55 (23.5)	**<.001***
	Female	81 (59.1)	56 (40.9)		74 (54.0)	63 (46.0)		77 (56.2)	60 (43.8)	
Current academic year	First year	42 (72.4)	16 (27.6)	0.99	36 (62.1)	22 (37.9)	**<.001***	42 (72.4)	16 (27.6)	<.001*
	Second year	79 (69.9)	34 (30.1)		62 (54.9)	51 (45.1)		60 (53.1)	53 (46.9)	
	Third year	52 (71.2)	21 (28.8)		45 (61.6)	28 (38.4)		50 (68.5)	23 (31.5)	
	Fourth year	42 (70)	18 (30)		52 (86.7)	8 (13.3)		48 (80)	12 (20)	
	Fifth year	49 (73.1)	18 (26.9)		53 (79.1)	14 (20.9)		56 (83.6)	11 (16.4)	
Diagnosed with a mental health condition	No	230 (73.5)	83 (26.5)	**.022***	228 (72.8)	85 (27.2)	**<.001***	226 (72.2)	87 (27.8)	**.002***
	Yes	34 (58.6)	24 (41.4)		20 (34.5)	38 (65.5)		30 (51.7)	28 (48.3)	
Currently taking any psychotropic medication	No	252 (73)	93 (27)	**.004***	241 (40)	104 (60)	**<.001***	245 (71)	100 (29)	**.002***
	Yes	12 (46.2)	14 (53.8)		7 (26.9)	19 (73.1)		11 (42.3)	15 (57.7)	
Ever experienced misophonia	No	192 (89.7)	22 (10.3)	**<.001***	158 (73.8)	56 (26.2)	**.019***	166 (77.6)	48 (22.4)	**<.001***
	Yes	72 (45.9)	85 (54.1)		90 (57.3)	67 (42.7)		90 (57.3)	67 (42.7)	
Anyone in your family ever experienced misophonia	No	111 (91)	11 (9)	**<.001***	111 (65.7)	58 (34.3)	**.002***	98 (80.3)	24 (19.7)	**.004***
	Yes	37 (46.2)	43 (53.8)		95 (77.9)	27 (22.1)		50 (62.5)	30 (37.5)	
	I do not know	116 (68.6)	53 (31.4)		42 (52.5)	38 (47.5)		108 (63.9)	61 (36.1)	

A-MISO-S = Amsterdam Misophonia Scale, OCD = obsessive-compulsive disorder, OCI-R = Obsessive-Compulsive Inventory-Revised, PHQ-9 = Patient Health Questionnaire-9, SD = standard deviation.
*Significant at $P \leq .05$.

Table 7

Multiple logistic regression analysis of factors associated with the presence of clinical misophonia (A-MISO-S score 5–24).

	OR	*P* value	95% CI for OR	
Age	1.03	.764	0.87	1.21
Sex				
Male	**Ref.**			
Female	1.70	**.048***	1.01	2.87
Anyone in the family ever experienced misophonia				
No	**Ref.**			
Yes	9.53	**<.001***	4.32	21.03
I do not know	3.97	**<.001***	1.93	8.18
Depression categories				
Minimal	**Ref.**			
Mild	1.12	.745	0.57	2.18
Moderate	1.58	.219	0.76	3.26
Moderately severe	2.72	**.042***	1.04	7.12
Severe	1.82	.355	0.51	6.47
OCD				
No OCD	**Ref.**			
Likely OCD	2.25	**.005***	1.28	3.94

A-MISO-S = Amsterdam Misophonia Scale, CI = confidence interval, OCD = obsessive-compulsive disorder, OCI-R = Obsessive-Compulsive Inventory-Revised, OR = odds ratio, PHQ-9 = Patient Health Questionnaire-9.

*Significant at $P \leq .05$.

any psychotropic medications and had depression (104, 60%) ($P < .001$). The percentage of participants who had experienced misophonia and depression (67, 42.7%) was higher than that of those who had not experienced misophonia and had depression (56, 26.2%) ($P = .019$). The percentage of participants who had a family member who had experienced misophonia and depression (27, 22.1%) was lower than that of those who did not have any family member who had previously experienced misophonia and had depression 58 (34.3%) and those who did not know if a family member had misophonia (38, 47.5%) ($P = .002$).

Age, sex, current academic year, diagnosis of a mental health condition, current use of psychotropic medication, history of experiencing misophonia, and family history of misophonia showed a significant association with OCD. The mean age of participants who had likely OCD (mean = 20.77, SD = 1.52) was lower than that of those who did not have OCD (mean = 21.31, SD = 1.59) ($P = .002$). The percentage of males who had likely OCD (55, 23.5%) was lower than that of females who had likely OCD (60, 43.8%) ($P < .001$). The percentage of second-year students who had likely OCD (53, 46.9%) was higher than that of fourth- (12, 20%) and fifth-year students who had likely OCD (11, 16.4%) ($P < .001$). The percentage of participants who were diagnosed with a mental health condition and had likely OCD (28, 48.3%) was higher than that of those who were not diagnosed with a mental health condition and had likely OCD (87, 27.8%) ($P = .002$). The percentage of participants who were taking psychotropic medications and had likely OCD (15, 57.7%) was higher than that of those who were not taking any psychotropic medications and had likely OCD (100, 29%) ($P = .002$). The percentage of participants who experienced misophonia and had likely OCD (67, 42.7%) was higher than that of those who had not previously experienced misophonia and had likely OCD (48, 22.4%) ($P < .001$). The percentage of participants who had a family member who had experienced misophonia and had likely OCD (30, 37.5%) and those who did not know if a family member had misophonia (61, 36.1%) was higher than that of those who did not have any family member who had previously experienced misophonia and had likely OCD (24, 19.7%) ($P = .004$).

Table 7 presents the results of a multivariable logistic regression analysis identifying factors associated with the presence of clinical misophonia. The analysis indicated that sex, family history of misophonia, depression severity, and OCD are significantly associated with the presence of clinical misophonia. Sex showed a significant association with the presence of clinical misophonia. Compared with males, females had higher odds of having clinical misophonia (odds ratio (OR) = 1.70, 95% CI: 1.01, 2.87, $P = .048$). A family history of misophonia showed a significant association with the presence of clinical misophonia. Compared with participants without a family history of misophonia, those with a family member who had experienced misophonia and those who could not remember whether they had a family member who had experienced misophonia had higher odds of having clinical misophonia (OR = 9.53, 95% CI: 4.32, 21.03, $P < .001$ and OR = 3.97, 95% CI: 1.93, 8.18, $P < .001$, respectively). Depression severity showed a significant association with the presence of clinical misophonia. Compared with participants who had minimal depression, those who had moderately severe depression had higher odds of having clinical misophonia (OR = 2.72, 95% CI: 1.04, 7.12, $P = .042$). OCD showed a significant association with the presence of clinical misophonia. Compared with participants who had no OCD, participants who had likely OCD had higher odds of having clinical misophonia (OR = 2.25, 95% CI: 1.28, 3.94, $P = .005$).

4. Discussion

In our study, 42.76% of the participants who experienced misophonia reported its onset during their teenage years, whereas 30.26% reported its onset during childhood. A previous study conducted in the Netherlands found that 45% and 30% of participants reported misophonia onset during childhood and teenage years, respectively.[5] Our findings and those of the previous study[5] indicate a common occurrence of misophonia onset during childhood and adolescent years. Therefore, we recommend screening for misophonia in at-risk age groups. Concerning the nature of the response to misophonic sounds in our study, 32.47% of participants displayed inward reactions, whereas 29.87% exhibited outward responses. Another study conducted in the UK explored the nature of responses to misophonic sounds.[18] We propose enhancing the awareness of misophonia and implementing screening strategies to identify individuals who may be affected by this condition. Furthermore, our study found that 27.39% of the participants who experienced misophonia reported gradually developing symptoms. In contrast, a previous study in the Netherlands revealed that most participants (93%) reported a gradual onset of misophonia.[6] The variation between our findings and those of previous

studies[6] could be attributed to methodological differences. Specifically, most (74%) participants in the previous study[6] were already diagnosed with misophonia, whereas our study did not require participants to have a prior diagnosis for participation. Despite the differing percentages, our findings and those of the previous study[6] indicate that misophonia onset may be gradual. Therefore, implementing screening strategies could be beneficial for identifying misophonia at an early stage, enabling early intervention and support. Furthermore, our findings revealed that most participants experienced subclinical misophonia, with approximately one-third of them exhibiting clinical misophonia. Contrary to our findings, a previous study conducted among undergraduate medical students in the UK reported that almost half exhibited clinical misophonia.[18] The variance in percentages between our findings and those of the previous study[18] could be attributed to differences in the demographic composition: most (73%) participants in the previous study[18] were females. Notably, other studies have also shown a higher prevalence of misophonia among females.[3,4] Despite these percentage variations, we recommend increasing awareness of misophonia among medical students. Such awareness initiatives are crucial, as the condition could trigger a spectrum of physiological, emotional, behavioral, and cognitive responses.[1,12]

The present study identified a weak positive correlation between the PHQ-9 and A-MISO-S scores and a moderate positive correlation between the OCI-R and A-MISO-S scores. Our findings align with those of a previous study involving undergraduate medical science students. The previous study also found a significant association between misophonia, depression, and OCD.[2] We recommend that universities establish screening programs to identify students with misophonia, depression, and OCD. Early identification and intervention are crucial as misophonia, depression, and OCD negatively affect individuals' lives.[7,14,27,28] Furthermore, in our study, depression severity showed a significant association with the presence of clinical misophonia, consistent with the findings of another study conducted in Poland[17] using the hospital anxiety and depression scale. The study conducted in Poland[17] showed a moderately positive correlation between the severity of misophonia and depressive symptoms. Similarly, our study revealed a significant association between OCD categories and misophonia. Correlations between misophonia and psychiatric symptoms and illnesses have been reported previously.[16,29] In addition, previous research has found that the intensity of misophonia diminishes in the absence of concurrent psychiatric disorders.[5] Screening for depression and OCD among students with misophonia symptoms, and vice versa, is crucial for early identification and appropriate intervention.

Furthermore, our results indicate a weak positive correlation between age and the A-MISO-S score. Another study conducted in Singapore[30] found that age was not significantly associated with the severity of misophonia symptoms. Our research found a significant association between female sex and misophonia, with the mean A-MISO-S score in males being lower than that in females. This finding is consistent with that of study conducted in Turkey, although the association observed in that study was not statistically significant.[3] However, our findings concerning sex and misophonia were inconsistent with those of studies conducted in the USA[14] and Germany,[4] which found no significant sex differences. Concerning the mental health condition(s) in our research, the mean A-MISO-S score among participants diagnosed with a mental health condition was higher than that among those without such a diagnosis. These results are consistent with those of a study conducted in Turkey involving high school and college students,[19] which showed that the mean A-AMISO-R score was higher among those with a known psychiatric disorder than among those with no psychiatric disorder. Therefore, screening for psychiatric conditions in patients with misophonia is recommended. Furthermore, our results indicated that the use of psychotropic medication was significantly associated with misophonia, a finding that we hypothesize reflects the coexistence of misophonia with other psychiatric conditions. Our hypothesis aligns with a study conducted in China that revealed a medium-to-strong relationship between misophonic symptoms and anxiety, depression, and OCD.[31] This aligns with another study that found that misophonia may be related to multiple forms of psychopathology through either direct or associative relationships.[14] Furthermore, our results suggest that having a family history of misophonia may increase an individual's likelihood of having misophonia, indicating a potential genetic predisposition to the condition. This finding is consistent with those of previous studies.[3,32] Therefore, we recommend screening both individuals experiencing misophonia and their family members for the condition.

Regarding the PHQ-9 score, our study found that females tended to have higher mean PHQ-9 scores than males and that the percentage of females with depression was higher than that of males. These findings are consistent with those of a prior study involving adolescents, which showed that sex was a significant predictor, with male students being less likely to have depression than female students.[33] Furthermore, our findings are consistent with those of another study conducted in SA[34]; however, the results of that study were not statistically significant. Furthermore, our study found that the mean age of participants who had depression was lower than that of participants who did not have depression. This finding is inconsistent with that of a study conducted in India,[35] which found a significant increase in prevalence with age. The variation between our results and those of the Indian study could be attributed to the differences in the sample populations. Our study focused exclusively on medical students, whereas the Indian study incorporated a more diverse sample from various specialties. Furthermore, in our study, we found that the percentage of students with depression in the first 3 years was higher than that in the fourth and fifth years. This result suggests that students in the first 3 years might have difficulties adjusting to medical school, potentially contributing to an increased risk of depression. In another study conducted at the same institution (i.e., KSU),[36] the results showed a similar pattern of decreasing depressive scores in the later years of medical school. Furthermore, our study reported that participants with mental health conditions had higher PHQ-9 scores than those without mental health conditions. Hence, clinicians should recognize the increased risk of depression in individuals with mental health conditions. Furthermore, our data showed that the percentage of participants who experienced misophonia and depression was higher than that of those who had not experienced misophonia and had depression. These findings are consistent with those of a study conducted in Iran,[2] which indicated a significant and direct relationship between misophonia and depression.

Regarding OCD, our results showed that age was significantly associated with OCD, as participants with higher OCI-R scores tended to be slightly younger, suggesting that younger students might be more susceptible to developing OCD. This finding is consistent with that of a study conducted in Iraq,[37] which found that OCD symptoms were significantly related to younger age. Furthermore, our results demonstrated that males had a lower mean OCI-R than females. Additionally, female participants had a significantly higher likelihood of OCD than their male counterparts. These findings are consistent with those of a study conducted in SA,[38] which also reported that women were more prone to higher OCI-R scores. Moreover, our results were consistent with those of a broader meta-analysis,[39] which found that women were 1.6 times more likely to experience OCD than men. Hence, we recommend that clinicians consider sex-related variations when assessing OCD. Furthermore, our findings showed that participants in the first 3 years of college

had a higher mean OCI-R score. These findings align with those of another study, which indicated a significant association between OCD and college years.[37] Our findings also align with those of a study conducted at Taibah University, SA,[40] which found an increase in the probability of OCD in the early academic years. Hence, we advise facilitating access to mental health services for college students, especially those in their first 3 years. Furthermore, in our study, the percentage of participants who were diagnosed with a mental health condition and had likely OCD was higher than that of participants who were not diagnosed with a mental health condition and had likely OCD. This result reflects a possible association between mental health conditions and OCD. This finding aligns with that of a study conducted in the USA,[41] which found that endorsement of one or more obsessive-compulsive symptoms was significantly more frequent in the depressed group than in the non-depressed group. Furthermore, we found that participants taking psychotropic medications had a higher mean OCI-R score than those who were not. Moreover, the percentage of participants who were taking psychotropic medications and had likely OCD was higher than that of those who were not taking any psychotropic medications and had likely OCD. This finding indirectly supports the hypothesis that OCD is comorbid with other mental health conditions. Furthermore, our study showed that participants who had likely OCD had higher odds of having clinical misophonia than those without OCD. This result is consistent with that of a study conducted in Iran,[2] which found a significant relationship between misophonia and OCD. We recommend that clinicians consider assessing for misophonia in individuals diagnosed with OCD. Furthermore, individuals with a family history of misophonia had higher mean OCI-R scores than those who did not. As such, we recommend screening for OCD in patients with a family history of misophonia, and vice versa.

5. Strengths and limitations

This study has several strengths and limitations. In terms of strengths, this study addressed misophonia, which has not been sufficiently studied in SA. In addition, the tool comprises validated scales. Moreover, the sample size was sufficiently large to obtain significant results. Regarding limitations, the study was conducted solely at one location, namely KSU, potentially limiting the generalizability of the results. Future multicenter studies, such as those involving multiple universities, may mitigate this limitation. Another limitation is that convenience sampling was used to recruit participants. A more rigorous sampling method can yield more meaningful results.

6. Conclusions

This study assessed the prevalence of misophonia and its association with depression and OCD. Among other significant findings, we found that close to half (42.32%) of the participants had experienced misophonia, with clinical misophonia being observed more in females than in males. In addition, we found a significant correlation between misophonia, OCD, and depression, suggesting that individuals with misophonia are more susceptible to these mental health conditions, and vice versa. We recommend increasing awareness of misophonia and its manifestations to facilitate early detection and proper management. We also recommend screening for depression and OCD in patients with misophonia.

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