



Misophonia symptoms among Chinese university students: Incidence, associated impairment, and clinical correlates[☆]



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ARTICLE INFO

Keywords:

Misophonia
Chinese adults
Impairment
Phenomenology
Anxiety
Obsessive-compulsive disorder

ABSTRACT

Individuals with misophonia present with sensitivity to selective sounds and, may experience negative psychological and physiological reactions when exposed to triggers. Previous studies have examined the clinical correlates and phenomenology of misophonia; however, further research is warranted to extend findings beyond samples from Western cultures. Accordingly, this study investigated the incidence and phenomenology of misophonia in a sample of Chinese college students ($N = 415$; M age = 19.81; $SD = 1.16$) through the use of self-report measures. Approximately 6% of the sample exhibited clinically significant misophonia symptoms with associated impairment. In addition, misophonia symptoms were associated with impairment across work, school, social, and family domains. Medium to strong relationships were observed with general sensory sensitivities, obsessive-compulsive, anxiety, and depressive symptoms. Anxiety significantly mediated the relationship between misophonia and anger outbursts. This study indicates that symptoms of misophonia are common and directly associated with multiple domains of psychopathology.

Misophonia, characterized by selective sound sensitivity, was first identified by audiologists, and has received growing interest by mental health professionals and researchers (Cavanna, 2014; Schröder, Vulink, & Denys, 2013; Wu, Lewin, Murphy, & Storch, 2014). Misophonia symptoms lead to the avoidance of associated auditory triggers and other distressing behavioral and emotional consequences, often contributing to interference in these individuals' daily activities. However, extant data on the epidemiology, phenomenology, etiology, and treatment of misophonia remain few (Cavanna & Seri, 2015) and limited to people in Western cultures. Although it is difficult to make predictions on cultural variations in the phenomenology of misophonia, based on the limited available data, it is possible that the experience and expression of misophonia differs as a function of Chinese social and cultural norms (Zhou et al., 2011). Chinese culture fosters a strong interdependent self-construal, emphasizing concern about others and maintaining harmony within their relationships (Markus & Kitayama,

1991). Therefore, compared with Euro-heritage in Western society, sufferers from China might be more concerned about symptom display or an overt reaction which could cause harm or discomfort to others. At the same time, sufferers who exhibit distress or anxiety might be more likely to be accommodated by others in Chinese contexts in an attempt to reduce distress. Thus, the purpose of this study is to examine the incidence, phenomenology, and clinical correlates of misophonia in a Chinese college student sample.

Initially termed 'selective sound sensitivity syndrome' (Bernstein, Angell, & Dehle, 2013), misophonia was formally named to recognize the strong negative reaction in response to selective sounds (Jastreboff & Jastreboff, 2002, 2004). Sound triggers are typically trivial noises found in everyday life (e.g., other people eating, breathing, coughing, blinking, pen clicking, trickling water, etc.) (Schwartz, Leyendecker, & Conlon, 2011). In addition to sounds, some people are sensitive to visual motor stimuli that may be associated with sounds

[☆] This study was funded by Shanghai Pujiang Program (14PJJC087) to Xiaolu Zhou.

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(e.g., jaw movement) and repetitive movements (e.g., foot/leg jiggling; Johnson et al., 2013; Schröder et al., 2013). When exposed to triggers, people with misophonia experience strong reactions including autonomic arousal and negative affect (Edelstein, Brang, Rouw, & Ramachandran, 2013; Kumar et al., 2014; Schröder et al., 2013), including anger, anxiety, distress, panic, and/or disgust. Additionally, a visceral reaction often manifests through a range of physical responses, such as tightening of the body and muscle tension (Cavanna & Seri, 2015). Behaviorally, exposure to triggers often motivates the affected individual to avoid or remove themselves from the situation in which the triggers are present or can be anticipated.

Negative reactions to triggers do not necessarily depend on the physical characteristics of sounds (i.e., the spectrum and intensity of the sound), nor are they linked to organic hearing problems (Johnson et al., 2013; Schröder et al., 2013). Instead, a conglomeration of different factors likely contributes to this aversive reaction, including the context of the sound and the individual's previous experiences with the sound (Jastreboff & Jastreboff, 2001). This makes misophonia differs from hyperacusis. The negative reactions of those diagnosed with hyperacusis only related to the physical properties of sounds. With this difference, hyperacusis and misophonia shared similarity in terms of negative reactions to sounds. Hyperacusis and misophonia are regarded as sub-groups of decreased sound tolerance, which broadly refers to an inability to tolerate everyday sounds that do not bother others (Jastreboff & Jastreboff, 2014). While the exact etiology of misophonia is unclear, tinnitus, a conceptually related condition, is associated with heightened neural connections between the auditory, limbic, and autonomic nervous systems (Jastreboff & Hazell, 2004; Jastreboff & Jastreboff, 2013).

Current data on the prevalence of misophonia is unclear. Among clinical samples, the incidence of misophonia is estimated to affect 10–60% of patients with tinnitus — characterized by the perception of sound in the absence of any actual external sound stimuli (Hadjipavlou, Baer, Lau, & Howard, 2008; KochKin, Tyler, & Born, 2011; Sztuka, Pospiech, Gawron, & Dudek, 2010). Additionally, in patients with decreased sound tolerance, 92% of their sample of 201 patients had misophonia (Jastreboff & Jastreboff, 2014). Among non-clinical samples, the prevalence of misophonia is estimated to affect ~3.2% of the general population (Jastreboff & Jastreboff, 2014).

Several studies have examined the phenomenology and clinical correlates of misophonia. Wu and colleagues (2014) studied misophonia in 483 American undergraduate students and found that 19.9% of participants had clinically significant misophonia symptoms defined by a predetermined cutoff threshold (i.e., a score ≥ 7) on the Misophonia Severity Scale of the Misophonia Questionnaire; misophonia symptoms were related to impairment in work/school, social life, and family responsibility. Misophonia demonstrated direct correlations with symptoms of general sensory sensitivities, as well as obsessive-compulsive, anxiety, and depressive symptoms. Wu et al. (2014) also found that anxiety mediated the relationship between misophonia symptoms and externalizing behaviors (i.e., anger outbursts).

Overall, findings have supported associations between misophonia and several psychiatric conditions, including obsessive-compulsive and related disorders (e.g., obsessive-compulsive disorder, Tourette's syndrome), anxiety disorders, and mood disorders (Edelstein et al., 2013; Hadjipavlou et al., 2008; Neal & Cavanna, 2013; Schröder et al., 2013; Schwartz et al., 2011). Misophonia does share phenomenological similarities with obsessive-compulsive disorder and anxiety disorders; they share a similar, significant focus on a selected trigger and both are characterized by resulting anxiety and distress in the presence or anticipation of the trigger. Furthermore, avoidance of the stimulus or engagement in rituals mitigates distress caused by the trigger and alleviates the discomfort. Schröder and colleagues (2013) therefore speculated that misophonia could be categorized as an obsessive-compulsive spectrum disorder, even though the diagnosis does not fully encompass all of the symptoms of misophonia (Schröder et al.,

2013). Others agree with this conceptualization (Johnson et al., 2013; Schneider & Arch, 2015; Webber & Storch, 2015), although more data about phenomenology, the relationship of misophonia to established psychiatric diagnoses, and the underlying mechanisms of misophonia are needed.

Currently, there are no published data on the phenomenon of misophonia in any Chinese samples. Therefore, the present study extends the extant research to a sample of individuals from China and explored the incidence, impairment, and correlates associated with misophonia in a Chinese college sample. Based on clinical observations (e.g., Edelstein et al., 2013; Schröder et al., 2013), our clinical experience, as well as Wu et al. (2014) who found that anxiety mediated the relationship between misophonia symptoms and anger attacks, four hypotheses were formulated: (1) Chinese undergraduates would show comparable rates of clinically significant misophonia symptoms as found in Wu et al. (2014); (2) misophonia symptoms would be positively associated with impairment across domains of work and/or school, social life, and family responsibilities; (3) misophonia symptoms would be positively correlated with other clinical constructs, including sensory sensitivities, obsessive-compulsive, anxiety, and depressive symptoms; and (4) anxiety would mediate the relationship between misophonia symptoms and anger attacks. Specifically, misophonia symptoms would positively predict anxiety, and anxiety in turn would positively predict anger attacks.

1. Methods

1.1. Participants and procedures

Participants were recruited from various classes (e.g., psychology, education, and mechanical engineering) at Shanghai Normal University and mechanical engineering classes at Shanghai Polytechnic University in Shanghai, P.R. China. Ethical approval for the study was obtained from the institutional review board at Shanghai Normal University. Instructors administered the survey in classrooms. All participants provided informed consent to participate; they were paid a small remuneration. Participants completed a paper-and-pencil battery of self-report measures, which took approximately 25 min. All questionnaires that had not been translated previously by other investigators (i.e., Misophonia Questionnaire, Adult Sensory Questionnaire, rage outbursts and anger rating scale) were translated into Chinese (simplified characters) from English. Iterations of translation and back-translation by independent bilinguals were carried out until we obtained satisfactory versions.

The sample comprised of 415 participants (67.2% female), with a mean age of 19.81 years (range = 18–23 years, $SD = 1.16$). The majority of participants were Han (94%); the other participants represented 13 minorities, including Bai, Buyi, Zang, Hui, among others. Regarding psychiatric history, the following percentages reported that they had previously had a diagnosis of or suspected that they had problems with Obsessive-Compulsive Disorder (11.6%), an anxiety disorder (5.1%), depression (2.2%), a substance-related disorder (.5%), Bipolar Disorder (1.9%), eating disorders (4.1%), hair pulling or skin picking (3.4%), body dysmorphic disorder (4.8%), and tic disorder (.7%). Regarding treatment, no participants reported currently taking psychotropic medication or currently participating in psychotherapy.⁴

⁴ In China, university students who take psychotropic medication and/or attend psychotherapy are typically requested by the university to take a medical leave from school to seek care. Thus, our rates of treatment utilization are consistent with university policy.

1.2. Measures

1.2.1. Misophonia Questionnaire

The Misophonia Questionnaire (MQ; Wu et al., 2014) is a measure assessing selective sound sensitivities. Three subscales can be calculated: Misophonia Symptom Scale, Misophonia Emotions and Behaviors Scale, and Misophonia Severity Scale. The Misophonia Symptom Scale is a 7-item measure of the presence of misophonia symptoms (i.e., “people eating”) on a 0 (*not at all true*) to 4 (*always true*) scale. The Misophonia Emotions and Behaviors Scale is a 10-item measure of the resulting emotional and behavioral reactions (i.e., “become angry”) due to misophonia symptoms on a 0 (*not at all true*) to 4 (*always true*) scale. The MQ total score refers to the sum of items from the Misophonia Symptom Scale and Misophonia Emotions and Behaviors Scale. The Misophonia Severity Scale, adapted from the NIMH Global Obsessive-Compulsive Scale (Murphy, Pickar, & Alterman, 1982), is a one-item measure assessing the overall severity of misophonia symptoms on a 1 (minimal) to 15 (very severe) scale. A score of 7 or above corresponds with clinically significant symptoms. For the current study, internal consistency (Cronbach's alpha) was .88 for the Misophonia Symptom Scale, .89 for the Misophonia Emotions and Behaviors Scale, and .90 for the Total score (i.e., the combination of these two parts).

1.2.2. Adult Sensory Questionnaire

Kinnealey and Oliver (2002) ASQ is a 26-item scale that assesses sensory defensiveness. Hypersensitivities and reactions are assessed across visual, tactile, olfactory, and auditory stimuli. Each item is rated on a true or false scale. In the current study, internal consistency (Cronbach's alpha) was .80.

1.2.3. Sheehan Disability Scale - Misophonia

The Sheehan Disability Scale (SDS; Sheehan, 1983) is a 3-item measure designed to assess impairment experienced in work/school, social life, and family responsibilities because of the symptoms of interest. The SDS has demonstrated sound psychometric properties among Chinese adults (Zhu & Zhong, 2010). For the current study, instructions were revised to focus on the impairment specific to misophonia symptoms (SDS-M). Each item is rated on a 10-point scale ranging from 0 (*not at all*) to 10 (*extremely*) interfering. Internal consistency (Cronbach's alpha) for the current study was .89.

1.2.4. Obsessive Compulsive Inventory-Revised

The Obsessive Compulsive Inventory-Revised (OCI-R; Foa et al., 2002) is an 18-item measure of obsessive-compulsive symptom presence and associated distress. Each item is rated on a 5-point scale ranging from 0 (*not at all*) to 4 (*extremely*). There are sound psychometric properties among Chinese college students and patients with OCD (Peng, Yang, Miao, Jing, & Chan, 2011; Tangsu, Wang, Tang, & Zhao, 2011). In the current study, internal consistency (Cronbach's alpha) was .91.

1.2.5. Depression Anxiety Stress Scale-21

The Depression Anxiety Stress Scale-21 (DASS-21; Lovibond & Lovibond, 1995) is a 21-item measure of depressive, anxiety, and stress symptoms. Each item is rated on a 4-point scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much, or most of the time*). Three subscales are generated: anxiety, depression, and stress. Research has established good psychometric properties in Chinese college and community samples (Gong, Xie, Xu, & Luo, 2010; Wen, Wu, & Lu, 2012). Internal consistency (Cronbach's alpha) for the present study was .93.

1.2.6. Rage Outbursts and Anger Rating Scale

The Rage Outbursts and Anger Rating Scale (ROARS; Budman et al., 2008) is a psychometrically sound (Nadeau et al., 2016) 3-item measure of anger attacks in terms of frequency, intensity and duration. Each

Table 1
Individual Symptoms Endorsed on the Misophonia Questionnaire.

MQ Item	Mean	SD	Range	Frequency of endorsement					
				0	1	2	3	4	Missing value
People eating	1.37	1.16	0–4	123	105	118	49	20	0
Repetitive tapping	1.53	1.10	0–4	92	97	155	52	18	1
Rustling	1.23	1.09	0–4	130	122	112	38	13	0
Nasal sounds	1.32	1.15	0–4	126	115	99	58	15	2
Throat sounds	1.31	1.13	0–4	130	100	126	41	16	2
Consonants and/or vowels	0.70	0.92	0–4	221	122	51	12	7	2
Environmental sounds	1.32	1.07	0–4	117	107	141	35	13	2

item is rated on a 4-point scale ranging from 0 to 3. In the current study, internal consistency (Cronbach's alpha) was .82.

2. Results

2.1. Data preparation

Data were cleaned according to Tabachnick and Fidell (2013). Variables more extreme than ± 3.3 standard deviations from the mean were identified as outliers ($n = 9$). All analyses were run with and without the outliers. No significant differences were found. Therefore, the subsequent results were obtained from the dataset excluding the outliers ($N = 415$).

2.2. Descriptive statistics of misophonia symptoms and distress

The means, standard deviations, ranges, and frequencies of individual misophonia symptoms items are shown in Table 1. The means of the rating for each symptom on the MQ Misophonia Symptom Scale ranged between .70 (consonants and/or vowels) and 1.53 (repetitive tapping). On average, 27.6% of the sample reported being “sometimes” sensitive to a certain sound. A total of 23.1% of the sample scored ≥ 14 on the MQ Misophonia Symptom Scale, which corresponds to an average rating of “sometimes” on each misophonia symptom. Additionally, 16.6% of the sample reported their misophonia symptoms to cause clinically significant interference in their daily lives, as indicated by a score of ≥ 7 on the MQ Misophonia Severity Scale. The percentages of the sample endorsing frequencies of being “often” or “always” sensitive to individual sounds were: 16.6% to the sound of people eating (e.g., chewing), 16.9% to the sound of repetitive tapping (e.g., foot on floor), 12.3% to the sound of rustling (e.g., paper), 17.6% to nasal sounds (e.g., sniffing), 13.7% to throat sounds (e.g., throat clearing), 4.6% to the sounds of consonants and/or vowels (e.g., “k” sounds), 11.6% to environment sounds (e.g., refrigerator humming). There was no significant gender differences in the MQ total score, $t_{(133)} = 1.32$, $p = .19$.

The percentage of the sample who reported moderate or higher impairment (i.e., score ≥ 4 on each SDS-M item) were: 25.7% for work/school functioning, 11.0% for social functioning, and 10.4% for family functioning. Six percent of participants ($n = 25$) were identified as exhibiting significant impairment / heightened misophonia symptomology (i.e., score ≥ 7 on the Misophonia Severity Scale and a score ≥ 12 on the SDS-M which corresponds to an average rating of 4 on each SDS-M item).

2.3. Clinical correlates of misophonia symptoms

Pearson correlation coefficients and descriptive statistics for all study variables are in Table 2. Misophonia symptoms as measured by the MS total score were significantly and positively correlated with all

Table 2
Correlation, Means, Standard Deviations, and Ranges for Study Variables.

	1	2	3	4	5	6	7	8	9	10
1. MQ Total Score		.39**	.41**	.37**	.42**	.40**	.44**	.58**	.49**	.45**
2. Severity of Sound Sensitivity			.37**	.65**	.56**	.51**	.63**	.30**	.19**	.06
3. ASQ Total				.30**	.32**	.28**	.33**	.56**	.53**	.38**
4. SDS-M-work and school					.76**	.69**	.91**	.28**	.15**	.03
5. SDS-M-social						.80**	.93**	.35**	.25**	.14**
6. SDS-M-family and home							.89**	.36**	.27**	.16**
7. SDS-M Total								.36**	.24**	.11*
8. OCI-R Total									.65**	.55**
9. Anxiety (DASS–21)										.71**
10. Depressive symptoms (DASS–21)										
Mean	19.58	3.68	8.80	2.21	1.35	1.09	4.69	15.34	8.33	6.51
SD	10.23	3.42	4.73	2.21	1.75	1.70	5.17	10.67	6.77	6.65
Range	1–53	0–15	0–22	0–10	0–8	0–9	0–27	0–48	0–30	0–30

Note. MQ = Misophonia Questionnaire; ASQ = Adult Sensory Questionnaire; SDS-M = Sheehan Disability Scale-Misophonia; OCI-R = Obsessive Compulsive Inventory- Revised; DASS = Depression Anxiety Stress Scale

** $p < .01$.

* $p < .05$.

domains measured, including obsessive-compulsive symptoms, anxiety, depression, misophonia-related impairment, severity of sound sensitivity, and general sensory sensitivities.

2.4. Differences between clinical and subclinical misophonia symptom groups

Participants who reported a ≥ 7 on the MQ Misophonia Severity Scale as well as a score ≥ 12 on the SDS-M total score which corresponds to a moderate or higher level of impairment were regarded as having clinically significant sound sensitivity symptoms. Participants in the subclinical group are inferred to have at least a certain degree of misophonia symptoms and represent a more rigorous test of group differences versus using a nonclinical level group; as such, participants who did not report any sound sensitivities were not included in the subclinical group. This resulted in 25 participants in the clinical group and 283 participants in the subclinical group. Means, standard deviations, independent t -test results, and Cohen's d values are shown in Table 3. Individuals with clinically significant misophonia symptoms reported higher scores than individuals with subclinical sound sensitivities on all variables. Large effect sizes were obtained for all variables.

Table 3
Comparing Clinical and Subclinical Misophonia Symptoms on Study Variables.

	Clinical N = 25		Subclinical N = 283		t	df	Cohen's d
	M	SD	M	SD			
MQ Total	33.11	10.73	18.41	9.72	7.06***	305	1.44
ASQ Total	12.50	3.57	8.96	4.45	3.87***	305	.88
SDS-M-work and school	5.96	1.21	2.16	1.97	14.08***	37.35	2.32
SDS-M-social	4.56	1.33	1.30	1.61	9.81***	290	2.21
SDS-M-family	4.24	1.36	1.01	1.58	9.89***	290	2.19
SDS-M-Total	14.76	2.93	4.49	4.59	15.77***	36.23	2.67
OCI-R Total	26.08	13.47	15.23	9.89	3.93**	26.35	.98
Anxiety (DASS-21)	13.92	6.11	8.34	6.68	3.95***	300	.87
Depressive Symptoms (DASS-21)	11.00	4.79	5.97	6.26	3.84***	299	.90
ROARS-Total	2.13	1.60	.85	1.35	4.38***	294	.86

Note. MQ = Misophonia Questionnaire; ASQ = Adult Sensory Questionnaire; SDS-M = Sheehan Disability Scale-Misophonia; OCI-R = Obsessive Compulsive Inventory- Revised; DASS = Depression Anxiety Stress Scale; ROARS = Rage Outbursts and Anger Rating Scale; Clinical = individuals with clinically significant sound sensitivity symptoms; Subclinical = individuals with at least a certain degree of misophonia symptoms.

Those that endorsed clinically significant misophonia symptoms versus those who did not exhibited significantly greater work/school (100% vs. 22.2%), social (80% vs. 7.1%), and family impairment (68% vs. 7.5%).

2.5. Mediation model

Using the PROCESS macro in SPSS, the bootstrapping technique described by Preacher and Hayes (2008) was conducted to test our hypothesis that anxiety would mediate the effect of misophonia symptoms on anger attacks. Bootstrapping tests the mediation effect through bootstrapped resampling, with better controls for Type I error than traditional approaches (Hayes, 2009; Preacher & Hayes, 2008). Using a simple mediation model, MQ Misophonia Symptom Scale score was entered as the independent variable, ROARS score was entered as the dependent variable, and the number of bootstrap resamples was set at 5000. Significant mediators are identified if the confidence interval (CI) did not include zero. The total effect of misophonia symptoms on anger attacks was significant, point estimate = .04, 95% CI [.01, .06]; the indirect effect of misophonia symptoms on anger attacks through anxiety was significant, point estimate = .02, 95% CI [.01, .03]. However, the direct effect of misophonia symptoms on anger attacks was not significant, point estimate = .01, 95% CI [-.01, .04]. These results suggest that anxiety fully mediated the relationship between misophonia symptoms and anger attacks (see Fig. 1).

3. Discussion

Replicating and extending the work of Wu et al. (2014) to Chinese college students, this study explored the incidence, phenomenology, associated impairment, and clinical correlates of misophonia. Our findings regarding incidence were similar to those reported in Wu

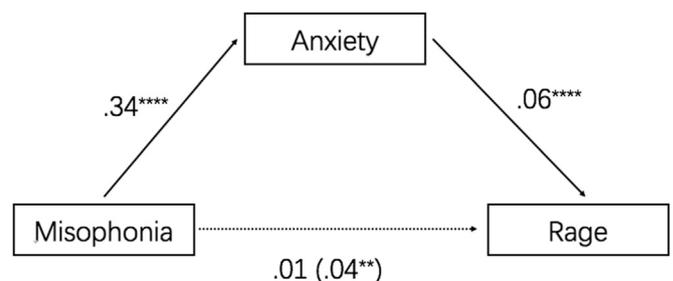


Fig. 1. Mediating effect of anxiety on misophonia symptoms and rage. Note. **** $p < .0001$. ** $p < .01$.

et al. (2014) among American undergraduate students; about a quarter of the participants reported that they were “sometimes” sensitive to certain sounds. The most bothersome stimuli endorsed included people eating, repetitive tapping, and nasal sounds; approximately 20% of participants reported “often” or “always” feeling sensitive to such sound stimuli, which is also consistent with findings from clinical samples of individuals with misophonia (Edelstein et al., 2013; Schröder et al., 2013). However, when we added an impairment criterion, rates of misophonia symptoms associated with ‘moderate’ levels of impairment decreased to 6% of the sample suggesting that while many may experience sound sensitivity, a relatively modest percentage also endure associated impairment.

Minor differences existed between the two samples in terms of the association between misophonia and impairment. Among American college students, strong associations were found between misophonia symptoms and impairment, specifically regarding work/school, social, and overall impairment; a medium association was found for the family and home domain. In contrast, the current Chinese undergraduate sample found medium correlations between misophonia symptoms and impairment. This difference might be attributed to the differences between Chinese and American cultural contexts. In a setting where sensitivity to others is highly valued (Zhou et al., 2011), misophonia may not be as problematic because the symptoms may be accommodated by others. Due to this cultural phenomenon, misophonia symptoms may contribute to greater distress in the individuals themselves. Individuals with clinically significant misophonia symptoms reported higher levels of impairment in all domains, compared to the individuals with subclinical sound sensitivities. The effect sizes for the differences in impairment between the clinical and subclinical groups were similarly high for both the Chinese and American college student samples. This suggests that, regardless of the cultural contexts, impairment may be significant for those with more frequent or severe levels of misophonia.

For both the Chinese and American samples, individuals with clinically significant misophonia symptoms showed more elevated levels of general sensory sensitivities, obsessive-compulsive, anxiety, and depressive symptoms, compared to individuals with subclinical sound sensitivities. As a function of robust associations between misophonia and varied psychological symptoms, we speculate that misophonia may share some features with obsessive-compulsive or anxiety disorders, as well as sensory sensitivities (e.g., see Cavanna and Seri (2015) and Jastreboff and Jastreboff (2015) for reviews). For example, the cognitive-behavioral model of OCD/anxiety suggests that a stimuli elicits distress, which then motivates a response aimed at reducing the anxiogenic trigger; we speculate that this model holds for many with misophonia symptoms although requires validation in experimental paradigms. Indeed, that misophonia was associated with multiple domains of psychopathology may suggest that it is a trans-diagnostic construct or perhaps a phenomenon that is related to an unmeasured variable that is correlated with multiple domains of psychopathology (e.g., emotion regulation deficits). To date, misophonia symptomology does not fit with any DSM/ICD existing diagnoses (Cavanna & Seri, 2015) and its phenomenology should be studied further.

Regarding clinical correlates, significant correlations were obtained between misophonia and varied symptom domains. In both misophonia and obsessive-compulsive symptoms, as noted above, there is a trigger that evokes distress which motivates a behavioral response to reduce these negative emotions. However, it remains unclear if misophonia may fall on obsessive-compulsive spectrum disorders, as advocated by Schröder et al. (2013); also, it remains unclear if similar interventional approaches may be useful (i.e., cognitive behavioral therapy, antidepressant medications), although preliminary data from several case reports suggest that exposure-based cognitive behavioral therapy may be helpful for youth (McGuire, Wu, & Storch, 2015; Reid, Guzik, Gernand, & Olsen, 2016). However, further rigorous evaluation is

warranted before more definitive conclusions can be made.

Current research examining the processes that underlie misophonia symptoms is still limited. The mediation model used in this current study aimed to put forth a partial theory suggested by Wu et al. (2014), namely that misophonia symptoms influence anxiety which then is associated with anger attacks. However, some differences were found in the direct effect of misophonia symptoms on anger attacks. In Wu et al. (2014), misophonia symptoms demonstrated a significant direct effect on anger attacks; no relation was found in the present study. In other words, in the present Chinese undergraduate sample, anxiety may play a more central role and a more powerful mediator when compared to the effects found in Wu et al. (2014). These findings support the theoretical model proposed by Webber and Storch (2015), which is based on the central role of anxiety and distress. According to this model, selective triggers lead to negative emotional reactions (inclusive of anxiety), which is negatively reinforced by behavioral responses. This model is consistent with cognitive-behavioral models of obsessive-compulsive and anxiety disorders, and sheds light on the treatment of misophonia through exposure based therapies, which have demonstrated preliminary effects but require considerable further study.

It is also worth noting that the Chinese version of the Misophonia Questionnaire (Wu et al., 2014) demonstrated high internal consistency. However, psychometric investigation of this measure, as well as misophonia more generally, in clinical samples of Chinese individuals with misophonia is needed.

There are several limitations in the research design of the current study. First, we used only self-report measures which may be influenced by recall bias and contribute to shared method variance. Future research should seek to employ multiple methods, such as physiological readings, qualitative interviews, and clinician-administered measures. Second, our study design was cross-sectional so causal determinations cannot be made especially with regards to our mediation model which was aimed at generating preliminary model hypotheses. Third, our sample only consisted of college students and the sex ratio within our sample was not balanced. In addition, the non-clinical nature, young age, as well as the high level of education of our participants limited the generalizability of our findings. Future studies should explore the incidence and symptoms of misophonia in a broader population, such as a community sample within urban and rural areas and pediatric populations. Fourth, we did not assess other hearing problems (e.g., tinnitus, hyperacusis) in our participants.

4. Conclusion

This study is one of the few empirical studies on the incidence and phenomenology of misophonia. Of the 415 participants, 6% of the study sample reported significantly interfering misophonia symptoms. Misophonia symptoms were associated with significant impairment, as well as general sensory sensitivities, obsessive-compulsive, anxiety, and depressive symptoms. Finally, anxiety significantly mediated the relationship between misophonia symptoms and anger attacks. In sum, our findings from a Chinese undergraduate sample extends upon findings from an American college sample, and provides further support that misophonia is a relatively common phenomenon that is associated with psychological distress and impairment. We highlight the need for future studies to investigate misophonia in samples who are affected with this condition as well as other psychological conditions. With the emergent data, it is hoped that these findings will help inform future studies in developing and evaluating potential treatment approaches.

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