

The prevalence of misophonia in a representative population-based survey in Germany

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Abstract

Purpose

Misophonia is a new disorder, currently defined as significant emotional and physiological distress when exposed to certain sounds. Although there is a growing body of literature on the characteristics of the disorder, the prevalence in the general population is still relatively unknown. This study therefore aims at determining the prevalence and symptom severity of misophonia in a large and representative general population sample in Germany.

Methods

To examine the prevalence of misophonic sounds, misophonic reactions and misophonia severity, a cross-sectional population representative survey in Germany has been conducted. Participants (N = 2.522) were questioned retrospectively about misophonic symptoms using the Amsterdam Misophonie Scale – Revised (AMISOS-R).

Results

Overall 33.3% reported to be sensitive to at least one specific misophonic sound. Within the total sample, subthreshold symptoms were reported by 21.3%, mild symptoms were reported by 9.9%, moderate to severe symptoms were reported by 2.1%, and severe to extreme symptoms were reported in 0.1% of participants.

Conclusion

Based on the diverging presentations and prevalence rates of misophonic sounds, reactions and symptoms according to the severity, it seems worthwhile to conceptualize misophonia as a continuous spectrum disorder (subthreshold, mild, moderate to severe) instead of a categorical diagnosis.

Background

Misophonia is typically described as a distinct clinical syndrome of decreased tolerance for specific auditory stimuli resulting in specific physiological and emotional reactions (e.g. anger, disgust) upon exposure to such sounds. These misophonic sounds (often referred to as “misophonic triggers”) mostly include sounds which are directly or indirectly made by other people (e.g. chewing or scratching). These repeatedly occurring sounds are usually not excessively loud [1] and are especially considered as a trigger, when made by a person one knows well (e.g. a spouse) [2]. Misophonia can result in significant impairment of daily functioning [3] as well as a decrease in quality of life [4].

Misophonia is a relatively new conceptualization of a disorder as research on this phenomenon has been conducted for fewer than 20 years. The disorder has not yet been classified as a mental, neurological or auditory disorder. There is, however, a strong and growing interest in misophonia among psychologists and psychiatrists. Especially due to the high rates of psychiatric comorbidity [5], several researchers have made a case for misophonia to be classified as a mental disorder [6]. Although scholars agree that misophonia has unique clinical characteristics with an underlying neurophysiological mechanism [3], the disorder has been defined by different criteria with heterogeneous methods and assessment tools. The most prominent and often discussed sets of criteria were proposed by two different working groups. The first proposed criteria [2, 7] are mostly based on observations and clinical interviews with large clinical samples in the Netherlands. These criteria are frequently assessed in the literature with the validated assessment tool “Amsterdam Misophonia Scale” (AMISOS-S [7]; revised version: AMISOS-R [8]) which has already been translated into several languages [9]. The second proposed criteria [10] were developed with a small sample of adults with self-identified misophonia who were interviewed via teleconferencing. Commonalities of the proposed criteria are that both groups included angry outbursts or loss of control upon exposure with misophonic triggers, and that patients with misophonia view their symptoms as unreasonable, excessive or unappropriated. However, both common criteria have already been criticized based on clinical observations [11]. In order to bring more cohesion to the growing field of researchers and clinicians who are interested in getting a better understanding of misophonia, a very recent Delphi study, with a systematic literature review and a rigorous consensus-building process, including an expert committee (15 members), ought to synthesize the current findings and compile a definition of the disorder which includes both previous conceptualizations. Their consensus definition includes a general description of the disorder, as well as a description of the specific triggers and reactions to misophonic triggers, the influences on misophonic reactions and the functional impairment due to the disorder. However, this new definition and the Delphi process itself have already been criticized by another scholar in the field [12].

The prevalence rates of misophonia have mostly been described in college student [13] and clinical samples [14] or with online surveys in the general population [15]. Throughout these studies, misophonic triggers and symptoms were assessed inconsistently with different assessment tools, with heterogeneous underlying concepts of the disorder, resulting in very differing prevalence rates [16]. For example, a study in China reported misophonic symptoms in 6% of their college student sample [17], whereas another study in the US reported clinically significant misophonia symptoms in nearly 20% of the students [18], and in a study with undergraduate students in the UK even 49.1% of the participants in their online survey reported misophonic symptoms (AMISO-S questionnaire; [13]) .

To date, little is known about the prevalence of misophonia triggers and symptoms in the general population. To our knowledge, there are only three population based studies on the prevalence of misophonia worldwide, which were conducted in Ankara, Turkey [11], in the UK [19] and in Germany [20]. The authors in the study in Turkey developed a misophonia interview and assessed N = 541 residents as a representative and randomized community sample. The proposed diagnostic criteria diagnosed 12.8% of their participants with misophonia. They found that several variables such as female gender, being

single and being younger were significantly related to misophonia, but only age, a family history of misophonia and past contact with mental health services predicted misophonia. In the study conducted in UK, participants of the third wave (N = 800) were recruited via the platform “prolific.com” and constituted a representative sample of the UK general population. The authors used their own measure based on the misophonia criteria by Schröder et al (2013) [7] and reported a prevalence of 18% of bothersome misophonia in their sample. Lastly, the German study [20], which is also the most recent study (data was collected between December 2020 and March 2021), found a prevalence of participants with clinically relevant scores in the AMISOS-R of 5.9% (caution: the clinical cut-off score was self-developed, there is currently no validated score). Additionally, 2.2% of individuals fulfilled the cut-off points in both their measures. In sum, these first population-based studies report quite diverse prevalence rates, probably due to the different measures and recruitment strategies, which significantly limit their comparability. As a next step in the field, we need to better understand different degrees of symptom severity in the general population, instead of just cut-offs, and conduct replication studies with the measures that had been used so far.

Study Aim

The aim of this study was to determine the prevalence and degrees of severity of misophonia in a large and representative general population sample in Germany, using the most frequently used assessment tool AMISOS-R to allow for comparisons with other population-based studies, as well as with student and convenience samples. Additionally, this study aims at determining prevalence differences of the misophonic symptoms with regard to sociodemographic (e.g. gender, age) and psychosocial (e.g. migration background) variables, and potential differences in symptoms of depression and anxiety regarding misophonia severity in an exploratory manner. Finally, the study will explore potential psychosocial and demographic factors which might influence misophonia severity in an exploratory manner. Hence, with the results of this study, we would like to contribute to our current understanding of misophonia and stimulate more epidemiological research on the distribution of the disorder in the general population.

Methods

Procedure and Sample.

In cooperation with a professional demographics research institute (USUMA) a representative sample of the German population (age 16–96) was collected employing a random route approach. In a first step, 258 German regional areas were predefined using the reference system for representative studies in Germany provided by the “ADM-Sampling- System”. Next, the target households within these regional areas were selected according to a random route procedure. For multi-person households, one person was randomly selected using the Kish selection grid technique. The population-based survey was conducted in the period from 3th March to 26th May 2022. The authors assert that all procedures

contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects/patients were approved by the Ethics Committee of the University of Leipzig (594/21-ek). Written and verbal informed consent was obtained from all respondents, who indicated their willingness to take part in the study. Anonymity in responses was guaranteed by deleting the link between the study code and the name of the participant after data entry. To qualify for inclusion in the survey, participants had to be at least 16 years of age and have sufficient German language skills. Prospective subjects were informed that the study was about psychological health and well-being. Out of the 6192 addresses used, 2522 responded indicating a utilization rate of 41.2%. The final sample consisted of $N = 2522$ respondents (51.4% female) with an average age of $M = 49.42$ years ($SD = 18.89$; range 16–96). A detailed description of the sample with means and standard deviations regarding different sociodemographic factors and misophonia severity can be found in Table 1.

Table 1

Sociodemographic characteristics of the total sample and the comparison of the misophonia subsample severity categories according to the AMISOS-R

	Total Sample (N = 2.522)	Misophonia Subsample (n = 844)			Statistic
		subthreshold Misophonia (n = 537)	mild Misophonia (n = 251)	moderate to extreme Misophonia (n = 56)	
Age	49.42	50.53 (18.63)	47.57 (18.68)	48.71 (17.95)	$F(2, 840) = 2.22, p = 0.109$
<i>Gender</i>					
female	51.4	59.8	62.0	53.6	$\chi^2 (4) = 2.52, p = 0.641$
male	48.4	39.9	38.0	46.1	
divers	0.2	0.4	0	0	
Migration background	13.2	13.2	13.9	14.3	$\chi^2 (2) = 0.11, p = 0.948$
German citizenship	96.3	97.2	98.4	94.6	$\chi^2 (2) = 2.76, p = 0.252$
Living with partner	53.4	55.3	57.1	50.9	$\chi^2 (2) = 0.70, p = 0.703$
Household net-income	2.056,17 (983,86)	2.023,63 (948,18)	1.892,31 (833,79)	1.860,75 (1.049,57)	$F(2, 821) = 2.11, p = 0.122$
<i>Religion</i>					
Protestant	35.8	35.9	36.0	32.7	$\chi^2 (8) = 13.16, p = 0.107$
Catholic	30.6	28.9	27.2	30.9	
Muslim	2.8	1.9	0.8	0.0	
other	1.9	1.1	4.4	0.0	
no confession	28.9	32.1	31.6	36.4	

	Total Sample (N = 2.522)	Misophonia Subsample (n = 844)			Statistic
PHQ-4 Total Score	1.46 (2.15)	1.54 (1.91)	2.80 (2.64)	4.29 (3.55)	$F(2, 838) = 53.67, p < .001$
PHQ-2 Depression Score	0.80 (1.19)	0.82 (1.10)	1.44 (1.46)	2.25 (1.91)	$F(2, 839) = 44.56, p < .001$
GAD-2 Anxiety Score	0.66 (1.10)	0.72 (1.00)	1.35 (1.38)	2.04 (1.76)	$F(2, 838) = 47.49, p < .001$
Note. Values are means (standard deviations) or %, as appropriate.					

Instruments.

Sociodemographic information. Sociodemographic information was collected within an interview format assessing gender, age, migration background (question on whether participants were born in Germany (yes/ no)), living with a partner and household net-income.

AMISOS-R. Misophonia symptoms were measured using the Amsterdam Misophonia Scale-Revised (AMISOS-R: [2]). The first section of the questionnaire assesses specific misophonic triggers (e.g. eating sounds, nasal sounds, throat sounds, etc.) and the emotions which might be evoked when hearing the sounds (irritation, anger, disgust, or other) via two checklists. This part of the questionnaire is an addition to the former AMISO-S [7]. The second section of the AMISOS-R consists of 10 items (assessment period: 3 last 3 days) using a 4-point Likert scale with the anchors: 0 = “not”, 1 = “mild”, 2 = “moderate”, 3 = “severe”, 4 = “extreme” for 8 items. The range of the total scale of the AMISOS-R is 0–40, where higher scores indicate more severe symptoms: 0–10 = “normal to subclinical misophonia”; 11–20 = “mild misophonia”; 21–30 = “moderate to severe misophonia”; 31–40 = “severe to extreme misophonia”. The items in the AMISOS-R have been modified compared to the AMISO-S (total of 6 items) and possible scores in the AMISO-S range from 0 to 24 (with higher scores also indicating more severe misophonia). The reliability of the AMISOS-R in the current sample was good ($\alpha = .89$).

PHQ-4. The Patient Health Questionnaire-4 (PHQ-4), consisting of the subscales PHQ-2 and GAD-2, is a widely used screening instrument for depressive and anxiety symptoms in the last two weeks, and is implemented in clinical settings and in epidemiological studies [21]. THE PHQ-4 consists of 4 items using a 4-point Likert scale with the anchors: 0 = “not at all”, 1 = “several days”, 2 = “more than half the days”, 3 = “nearly every day”. The range of the total scale of the PHQ-4 is 0–12, where higher scores indicate more anxiety and depression symptoms (95%-thresholds at a score of 6–7). The range of the GAD-2 and PHQ-2 is 0–6, with 95%-thresholds at a score of 3–4 respectively [21]. The reliability of the total scale in the current sample was good for the PHQ-4 ($\alpha = .88$), the GAD-2 ($\alpha = .83$) and the PHQ-2 ($\alpha = .79$).

Statistical Analyses.

First, descriptive statistics of the demographic variables, prevalence rates of misophonic sounds, misophonic reactions and misophonia severity were calculated regarding the full sample and the subsample, which reported sensitivity towards sounds. Second, within the misophonia severity categorization of the AMISOS-R, demographic characteristics as well as symptoms of depression and anxiety were inspected and compared. Third, multiple regression analysis was used to examine possible demographic and psychosocial predictors (gender, age, migration background, living with partner and household net-income, religion) of misophonia symptom severity. All analyses were performed using IBM® SPSS® Statistics version 27.

Results

Misophonic sounds. Overall 66.2% (n = 1670) reported to have no particular sensitivity towards sounds in comparison to other people. Among the categories of misophonic sounds, 21.7% (n = 547) of the participants reported to be more sensitive to eating sounds, 13.4% (n = 338) to repeating clicking/ tapping sounds, 9.6% (n = 243) to nasal sounds, 7.0% (n = 175) to ambient sounds; 5.6% (n = 142) rustling sounds; 5.4% (n = 135) to mouth/ throat sounds, and 2.2% (n = 54) to specific sounds.

Misophonic reactions. Among those participants who reported at least one specific misophonic sound (33.5%, n = 844), 74.4% (n = 627) reported irritation, 20.3% (n = 172) reported anger, 29.0% (n = 29.0%) reported disgust as emotional misophonic reactions to the misophonic sounds. Other misophonic reactions were reported by 4.1% (n = 35) and included nervousness, agitation, anxiety, goosebumps, sleeping problems and concentration problems.

Among those participants who reported sensitivity to misophonic sounds, 60.2% (n = 495) reported to not think or be exposed to the misophonic sounds, 31.7% (n = 267) reported to think or be exposed less than one hour per day to the misophonic sounds, 6.2% (n = 52) reported to think or be exposed one to three hours per day to the misophonic sounds, 0.7% (n = 6) reported to think or be exposed three to six hours per day to the misophonic sounds, 0.1% (n = 1) reported to think or be exposed more than eight hours per day to the misophonic sounds. 2.6% (n = 22) of the participants who reported to be sensitive to particular sounds have not answered the question on time being exposed or thinking about the misophonic sounds.

Misophonia symptoms and severity. In the total sample of N = 2522 participants, subthreshold symptoms were reported by 21.3% (n = 537), mild symptoms were reported by 9.9% (n = 251), moderate to severe symptoms were reported by 2.1% (n = 53) and severe to extreme symptoms were reported in 0.1% (n = 3) of participants. Among those participants who reported misophonic sounds (n = 844), this reflected 63.6% with subthreshold symptoms, 29.7% with mild symptoms, 6.2% with moderate to severe symptoms and 0.4% with severe to extreme symptoms. The AMISOS-R mean score in those participants reporting misophonic sounds (n = 844) was M = 9.35 (SD = 6.5; range = 0–34).

Predictors of misophonic symptom severity.

A multiple linear regression model was calculated to predict the misophonia symptom severity (AMISOS-R total score) in the subsample reporting misophonic sounds based on variables gender, age, migration background, living with partner and household net-income. A significant regression equation was found ($F(5,904) = 2.68, p = 0.021$), with a small effect size of R^2 of .016. Only age ($\beta = -.003, p = 0.023$) and household net-income ($\beta = -.0001, p = 0.005$) were significant predictors of misophonia symptom severity in the way that higher age was associated with lower misophonia symptoms and higher household net income was associated with lower misophonia symptoms.

Table 2

Multiple linear regression model with misophonia symptom severity as dependent variable and gender, age, migration background, living with partner and household net-income as independent variables

Predictor	b	SE	CI 95% lower	CI 95% upper	t	p
(Constant)	11.65	1.18	9.32	13.97	9.85	0.000
Gender	0.08	0.46	-0.82	0.99	0.18	0.855
Age	-0.03	0.01	-0,05	-0.00	-2.28	0.023
Migration background	0.53	0.66	-0,76	1.82	0.81	0.419
Living with partner	0.29	0.47	-0,64	1.20	0.62	0.535
Household net income	-0.001	0.000	-0,001	0.000	-2.79	0.005
Note. $R^2 = .016$; SE = Standard Error; CI 95% lower and upper represent the lower-limit and upper-limit of the unstandardized b regression weights.						

Discussion

The aim of this study was to describe misophonia in a large representative population-based sample in Germany to provide the field with new insights on the distribution and phenomenology of misophonia in the general population.

Altogether 34% of the participants reported to be sensitive to any misophonic sound, which is significantly lower compared with the study in Ankara (79% reported at least one misophonic trigger; [11]). This difference can be explained by the vast number of potential misophonic sounds in the Ankara study (51 sounds), compared with only seven categories of sounds in our study. In line with a study by Jager et al. (2020) [2], with subjects with misophonia symptoms who were referred to mental health services, the most frequent misophonic sounds were eating, nasal and repetitive clicking/ tapping sounds. The dominance of these sound categories has also been seen in online surveys with non-clinical samples [10, 15, 22]. The most frequently reported misophonic emotional reaction was irritation and to a lesser extent anger and disgust, which are also specifically named in the misophonia criteria by Jager et al (2020) [2] and the Delphi definition [23].

The mean score in those participants reporting misophonic sounds was three times lower compared to the Dutch clinical sample ($M = 29.78$) which also completed the AMISOS-R [2]. Mean scores in the AMISOS-R in the previous German population-based study, which has used almost the same data collection strategy and a very similar population, were also higher compared with our sample. However, the study by [20] did not report the specific mean score of participants who report misophonic sounds, which makes comparability more difficult.

In the general population, subthreshold misophonia was reported by 21.3%, to a much lesser extent mild (9.9%) or moderate to extreme symptoms (2.3%). This result is similar to the reported prevalence rate of clinically relevant symptoms in the previous German study (5-5.8%) which found significantly lower misophonia rates compared with the studies conducted in Turkey and UK. Although only a very small rate of participants actually report clinically relevant symptoms (2.3%), about every tenth person reports misophonic symptoms. Furthermore, in our subsample with misophonic sounds, prevalence rates on different severity degrees are much higher with 37.3% reporting at least mild symptoms of misophonia. Interestingly, only 39.8% of participants who reported misophonic triggers spend any time thinking or avoiding these sounds, indicating that participants with misophonic triggers who do not avoid the triggers might also not suffer from any impairment during the day. Taken together, the results of this study highlight the need to look at different symptom severity groups more closely, instead of simple cut-off scores, as this might explain the differences in prevalence rates in previous population-based studies. Future research should investigate the different groups more closely regarding potential comorbid psychiatric symptoms or general sociodemographic characteristics to better understand the misophonia symptom profiles and their treatment altogether. Ultimately, this new direction in misophonia research could head towards a more dimensional, instead of a categorical, understanding of the disorder.

Regarding psychiatric comorbidity, we found that participants reporting misophonia symptoms report higher levels of depression and anxiety, which is in line with previous studies on psychiatric comorbidities of misophonia [18, 24], indicating higher vulnerability for psychiatric symptoms in patients with misophonia.

The multiple linear regression model was significant but the sociodemographic and psychosocial factors explained only a very small amount of variance of the misophonia symptom severity in our sample, which is similar to the previous German based study ($R^2 = .18$; [20]). The only significant predictors were age and household net-income, but also with very small effects. Therefore, we conclude that misophonia symptoms show no substantial association with the tested sociodemographic and psychosocial factors and can therefore be seen as a universal phenomenon that permeates all levels of society. This finding also raises the question on whether misophonia might instead have a potential genetic or even epigenetic pathomechanism.

Limitations And Future Research

Firstly, this study assessed misophonia symptoms retrospectively during the last three days only. Since misophonia has been described as a long-lasting disorder [3], future population based studies might consider including a longer time period. Secondly, although the questionnaire assesses the most prominently described misophonic triggers, more elaborate trigger lists [8] might be used in future research to better understand the frequency and combinations of specific sounds, and to help discriminate those sounds with misophonic reactions from those without misophonic reactions. Thirdly, due to the study design and assessment, only participants age 16 and older were included in this study, which is also the case in the study by Jakubovsky et al., 2022 [20]. Especially since the onset of misophonia is most often in childhood/ adolescence [7, 15, 22], and there are only limited studies with children and adolescents on their misophonia symptoms [4], future research needs to include children and adolescents in population based surveys to better describe the phenomenology and clinical correlates of misophonia in children and adolescents. This might be especially important, as there is already some evidence that children with misophonia report poorer well-being and life satisfaction, compared with children without misophonia [4]. Fourthly, when this study was conducted, the Delphi paper has not yet been published so we decided to use the measures AMISOS-R, which is most often used in the current literature to increase comparability with other studies. Future studies might assess misophonia in light of the newly proposed criteria in the Delphi process, though. Future steps after the Delphi process will be to discuss these new criteria within the scientific community and to then develop and validate a measure based on the final criteria. Lastly, since misophonia is a rather new discovered phenomenon, it might be helpful for the field to gather more qualitative data on the patient's experiences and learn from their individual perspective on the symptomatology. Within quantitative research, (semi-structured) interviews might provide the field with a more thorough description of the symptoms, compared with standardized questionnaires [11].

Conclusions

In the absence of a common understanding of the disorder, resulting in different diagnostic criteria and assessment tools, this epidemiological study might shed more light on misophonic sounds and symptoms in the general population and stimulate more population-based surveys in other countries to better understand different cultural and societal influences on the disorder. Based on the diverging prevalence rates of misophonia triggers and symptom severity scores in this study, and the comparably low percentage of people spending time to avoid misophonic triggers at all, it seems worthwhile to consider misophonia as a somewhat dimensional disorder after all, instead of a categorical discrete disorder based on a cut-off score.

Abbreviations

AMISOS-S=Amsterdam Misophonia Scale

AMISOS-R= Amsterdam Misophonia Scale Revised

UK=United Kingdom

USUMA= Unabhängiger Service für Umfragen, Methoden und Analysen (German company name)

PHQ-4= Patient Health Questionnaire-4

GAD-2= Generalized Anxiety Disorder 2-item

Declarations

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The authors have no relevant financial or non-financial interests to disclose.

Competing Interests:

The authors declare that they have no conflict of interest.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Ethics Committee of the University of Leipzig (594/21-ek).

Consent to participate

Written and verbal informed consent was obtained from all respondents, who indicated their willingness to take part in the study.

Availability of Data and Materials

The data is available upon request from the authors.

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