

Misophonia – a review of research results and theoretical concepts

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Summary

Misophonia is a new and relatively under-explored condition characterized by experiencing strong emotions (mainly anger and disgust) and a physical response (such as muscle constriction, increased heart rate) when exposed to specific sounds. Among the most frequent aversive triggers are the sounds of eating, breathing, or typing. The experience of misophonia is associated with suffering and a significant decrease in quality of life. The phenomenon was first described in 2002. Since then, numerous case studies and data from psychophysiological and neurological and survey research on this phenomenon have been published. These data indicate that misophonia is a consistent phenomenon and preliminary identification is possible. The most recent results show that misophonia occurs independent of other disorders. There are still, however, many questions regarding the definition and diagnostic criteria to be answered. The most important diagnostic issues that are faced during clinical work with people with misophonia are described in this article. Furthermore, the main theoretical concepts and research on misophonia are reviewed and analyzed.

Key words: misophonia, decreased sound tolerance

Introduction

Misophonia (from the Greek *misos* – ‘hate’, *phonia* – ‘sound’) is a form of decreased sound tolerance [1, 2]. Its literal translation is misleading, because the essence of the condition is selective sound aversion, not a hypersensitivity to all kinds of sounds. Some authors [3] include reactions evoked by visual triggers in misophonia. However, because of the predominance of data on sound triggers and sparse evidence for other triggers, this article will be consistent with the main subject literature and assume that misophonic reactions are related to sounds.

Misophonia was first described in 2002 by Paweł Jastreboff, who, when working with patients with tinnitus, noticed a group of people displaying a set of symptoms

that did not fit any previously described disorders [2]. In 1990, Marsha Johnson, an audiologist, observed the same specific intolerance for certain sounds during her clinical work, calling it 4 S – Selective Sound Sensitivity Syndrome [4]. Both terms for this condition are present in the literature, however, ‘misophonia’ is more common.

In recent years, a growing interest in this condition among researchers has contributed to new knowledge and awareness of this extremely disruptive affliction. The scientific work performed to date has identified new areas for future research and provided clinicians with the fundamentals to take into consideration this currently marginalized phenomenon. Though the problem of misophonia has already been addressed by Polish authors [5, 6], there has been no systematic theoretical review on this phenomenon in the Polish language.

Misophonia – general characteristics

Misophonia is a set of symptoms which some people experience when exposed to certain sounds. Strong emotions such as anger, irritation, disgust, or anxiety are evoked immediately when people with misophonia hear particular sounds [7–11]. Somatic responses are also present – pressure in the chest, arms, head, or the whole body, as well as increased heart rate, increased body temperature, physical pain, or difficulties with breathing [8]. Dozier [3, 12], based on research conducted by his group, postulates the inclusion of muscle constriction (varying between individuals) as one of the main symptoms of misophonia, in addition to unpleasant emotional reactions. Sufferers consider these difficult emotions to be unwanted, uncontrolled, and excessive [10]. These feelings are often accompanied by a desire to violate the ‘source’ of the sound and various thoughts such as “I hate this person” [8]. Sometimes, a strong uncontrolled emotional experience leads to verbal and physically aggressive outbursts [8, 10]. These are, however, rare cases. Jastreboff and Jastreboff [7] claim that the reaction is influenced by one’s history, subjective assessment of the sound, beliefs about possible danger, psychological profile, and the context in which the sound appears. This opinion is consistent with the results of Edelstein et al. [8] which found that the majority of subjects said that their reactions tend to be limited to members of their family or coworkers, and that they do not experience misophonic reactions if the sound is made by a child or an animal.

It is not known what fraction of the population suffers from misophonia (all the more so, given that there is no agreement on what misophonia really is), but it is possible to infer that the number is significant. An estimate based on data gathered by the Emory Tinnitus and Hyperacusis Center shows that around 3% can have misophonia [2]. It is possible, however, that the numbers are even higher. The data on decreased sound tolerance (including misophonia) shows a prevalence of up to 15% [13]. Additionally, according to Jastreboff and Jastreboff [2], 92% of people with decreased sound tolerance have misophonia. The suggestion that there is a large number of people with misophonia is supported by data from research on

this phenomenon. Over the course of 5 years, almost 500 people with misophonia contacted a clinic in Amsterdam [9]. Almost 20% of 483 American students of psychology [14] and 17% of 415 Chinese students [15] declared they suffered negative consequences from misophonic symptoms in their daily lives (the questionnaire used in this research is described below). Therefore, it seems that misophonia might be a significant social problem.

Differential diagnosis and comorbidity with other disorders

Despite the disagreements among researchers about the specifics of misophonia, preliminary identification is possible in both research as well as in clinical practice as the differences in the proposed diagnostic criteria are not very significant. Misophonia is not included in any diagnostic classification and in spite of growing knowledge on this phenomenon it is still not defined enough to include it soon in any of them. In 2013, based on the available research data, Schröder et al. [10] defined misophonia as follows:

- A. The presence or anticipation of a specific sound, produced by a human being (e.g., eating sounds, breathing sounds) provokes an impulsive aversive physical reaction which starts with irritation or disgust that instantaneously becomes anger.
- B. This anger initiates a profound sense of loss of self-control with rare but potentially aggressive outbursts.
- C. The person recognizes that the anger or disgust is excessive, unreasonable, or out of proportion to the circumstances or the provoking stressor.
- D. The individual tends to avoid the misophonic situation, or if he/she does not avoid it, endures encounters with the misophonic sound situation with intense discomfort, anger or disgust.
- E. The individual's anger, disgust or avoidance causes significant distress (i.e., it bothers the person that he or she has the anger or disgust) or significant interference in the person's day-to-day life. For example, the anger or disgust may make it difficult for the person to perform important tasks at work, meet new friends, attend classes, or interact with others.
- F. The person's anger, disgust, and avoidance are not better explained by another disorder, such as obsessive-compulsive disorder (e.g., disgust in someone with an obsession about contamination) or post-traumatic stress disorder (e.g., avoidance of stimuli associated with a trauma related to threatened death, serious injury or threat to the physical integrity of self or others).

In 2017, Dozier et al. [12] proposed another set of criteria for misophonia:

- A. The presence or anticipation of a specific sensory experience such as a sound, sight, or other stimulus (e.g., eating sounds, breathing sounds, machine sounds, leg movement, vibration), provokes an impulsive, aversive physical

- and emotional response which typically begins with irritation or disgust that quickly becomes anger.
- B. The stimulus elicits an immediate physical reflex response (skeletal or internal muscle action, sexual response, warmth, pain, or other physical sensation). Note the physical response cannot always be identified, but the presence of an immediate physical response may be used to more clearly identify the condition as misophonia.
 - C. A moderate duration of the stimulus (e.g., 15 s) elicits general physiological arousal (e.g., sweating, increased heart rate, muscle tension).
 - D. Dysregulation of thoughts and emotions with rare but potentially aggressive outbursts. Aggressive outbursts may be frequent in children.
 - E. The negative emotional experience is later recognized as excessive, unreasonable, or disproportionate to the circumstances or the provoking stressor.
 - F. The individual tends to avoid the misophonic situation, or if he/she does not avoid it, endures the misophonic stimulus situation with discomfort or distress.
 - G. The individual's emotional and physical experience, avoidance, and efforts to avoid cause significant distress or significant interference in the person's life. For example, it is difficult for the person to perform tasks at work, attend classes, participate in routine activities, or interact with specific individuals.

Although both suggested criteria were based on research results and case studies of people with misophonia, neither was entirely verified empirically. The criteria proposed by Dozier undoubtedly indicate a new perspective in misophonia research. Dozier emphasizes that misophonia should be seen as a multi-sensory phenomenon, as the trigger stimuli are not necessarily sounds but can also be, for example, another person's movement or a vibration. However, because of limited data, these suggestions should be treated as a hypothesis to verify.

There are currently no published, validated questionnaires for detecting misophonia based on the proposed criteria. There are, however, some other unvalidated scales and questionnaires for assessing it.

Schröder's research group [10] created a scale to measure the intensity of misophonia, the *Amsterdam Misophonia Scale* (A-MISO-S), which was adapted from the obsessive-compulsive disorders assessment scale (*Yale-Brown Obsessive-Compulsive Scale* – Y-BOCS). It consists of 6 questions related to time taken up by misophonia during the day, influence on social functioning, anger intensity, efforts to inhibit the impulse, control over the anger, as well as thoughts and time spent on avoiding misophonia-related situations. There are 5 levels of misophonia intensity, based on score.

Another questionnaire (*Misophonia Questionnaire* – MQ) for identifying misophonia and assessing its intensity was created by Wu et al. [14]. It consists of 3 scales:

- 1) the *Misophonia Symptom Scale*, which includes sounds made by people, sounds from one's surroundings as well as repetitive and once-off sounds;

- 2) *the Misophonia Emotions and Behaviors Scale*;
- 3) *the Misophonia Severity Scale*, adapted from a questionnaire that assesses the intensity of obsessive-compulsive disorder (*the National Institute of Mental Health Global Obsessive-Compulsive Scale* – NIMH-GOCS).

As in the NIMH-GOCS, the cut-off point for clinical symptoms was defined as at least 7 points (out of 15) on the MQ. Psychometric analysis showed that the tool has high internal consistency. The questionnaire has some limitations. The authors assessed its psychometric properties on the research group and the external validity was correlated with questionnaires that assess general sensory sensitivity (including sound sensitivity), but not misophonia. However, better assessment of the external validity was not possible as the study had been performed before the first paper with criteria for misophonia was published. Moreover, among the sounds classified as misophonic were repetitive sounds (repeated many times over a longer period of time), which are not included in either criteria proposed by Schröder et al. [10] or Dozier et al. [12] (the misophonic reaction should be immediate, impulsive, and not evoked only if the sound does not fade). The analysis also included sounds made by things (non-human sounds), which are still a controversial issue. Additionally, some people with hyperacusis might be misclassified as having misophonia.

Misophonic reaction is selective and is not related to hearing impairment [7]. It should be differentiated from hyperacusis, however, those two condition can exist together. People with hyperacusis exhibit aversive reactions towards sounds characterized by certain physical properties, such as volume or frequencies, and their emotional responses are consistent, not dependant on social situations. Audiological assessment shows that these patients usually have a lower loudness discomfort level (LDD) [16]. In misophonia, there is an unnaturally strong, negative emotional reaction to specific sounds, unique to each individual. The acoustic features of the triggers may vary, but they tend to be rather soft and low [7]. Therefore misophonia is not an intolerance of loud sounds or noise. It is critical to assess what kind of sounds are aversive to the individual and what kind of sounds are tolerated. Importantly, misophonia and hyperacusis can be present together [2, 7]. Jastreboff and Jastreboff [2] claim that the emotions which are experienced by individuals when exposed to aversive triggers are identical in both misophonia and hyperacusis. However, this has not yet been confirmed empirically.

Since research began on misophonia, one of the main areas of interest has been its comorbidity with other disorders. In 2013, Schröder et al. [10] suggested that misophonia could be included in the obsessive-compulsive disorder spectrum because of the characteristic obsessionality, impulsivity and compulsivity associated with misophonia. Some comorbid disorders were identified among the patients examined by Schröder – obsessive-compulsive personality (over 50%), mood disorders, Tourette syndrome, ADHD, trichotillomania, obsessive-compulsive disorder, and hypochondria. One objection against the data gathered by Schröder is the recruitment of an unrepresentative group of patients with psychiatric disorders [2]. In 2014, Wu [14] assessed 483 students

of psychology using the MQ described above, of whom almost 20% showed clinical symptoms of misophonia. Analysis of the data showed moderate, significant correlation of the intensity of misophonia with OCD and depression. Interestingly, anxiety (assessed with *the Depression Anxiety Stress Scale-21* – DASS-21) was a mediator between misophonia (measured with *the Misophonia Symptom Scale*) and aggressive outbursts (assessed with *the Rage Outbursts and Anger Rating Scale* – ROARS) evoked by exposure to aversive triggers.

A recent study by Rouw and Erfanian [18], on the other hand, did not show an increased occurrence of any particular disorder among people with misophonia. Instead, a higher intensity of symptoms of misophonia in people with post-traumatic stress disorder was found in comparison to people with other disorders. McKay et al. [19] assessed a non-clinical group with a battery of many tests to measure various psychological disorders and traits potentially related to misophonia. They found three distinct profiles, of which only one differentiated between people with and without misophonia (barely accounting for 11% of the total variance). The profile was related to lower results on the scales of neutralizing, washing, and general symptoms of OCD (*the Obsessive Compulsive Inventory-Revised* was used [20]) as well as higher results on ordering and harm avoidance scales (*the Obsessive-Compulsive Trait Core Dimensions Questionnaire* was used [21]). The authors came to the conclusion that in spite of the previously mentioned relations with OCD, 70% of the variance in the model was explained by two profiles that did not differentiate between people with and without misophonia; therefore it is reasonable to claim that misophonia is not unambiguously bound to any other pathology, but is rather a unique set of symptoms.

It is characteristic for people with misophonia to experience sudden, uncontrollable, strong emotions together with a tendency to avoidance. Therefore, it could be misdiagnosed with a specific phobia. Nevertheless, the reaction cannot be classified as a phobia because the dominant emotion in misophonia is anger, rather than fear [10]. The term ‘phonophobia’ describes the condition where one is afraid of certain sounds [17]. However, this phenomenon is not well documented yet. Symptoms of people with misophonia may also be similar to symptoms of social phobia. However, the reason for avoiding other people by people with misophonia is not fear of judgment, but the desire to protect themselves from the sounds that they make. It is important to take into account the fact that no particular cognitive issues are reported among people with misophonia, which differentiates it from dissociative and somatomorphic disorders. People with misophonia are aware of the fact that their reactions are exaggerated [10]. Research shows [26] that people with misophonia process aversive sounds differently in their neurological connections. Despite the fact that it is not known whether this is a cause or consequence of misophonia, for the purposes of research we can discuss it as a neurological correlates of the specific emotional reaction in people with misophonia. However, as already said, it is not unusual for misophonia to be present with other disorders [10, 14, 19]. It is worth mentioning that the literature also contains case studies of people with misophonia and eating disorders [22].

The lack of diagnostic criteria for misophonia and validated questionnaires to detect and measure its intensity makes it difficult to compare the results from the various research groups and make diagnoses in clinical work. The participants who took part in published studies were recruited according to different theoretical approaches, and mostly did not go through a full psychiatric and audiological assessment. In many works only the self-report of the symptoms was used, therefore the conclusions drawn from this data might have limited credibility and the results cannot be generalized to the whole population of people with a potential diagnosis of misophonia [23, 24].

Dispute about the nature of the aversive sounds

In the literature, there is disagreement over what kind of sounds should be categorized as misophonic, a point which can impact the validity of a diagnosis and lead to different diagnoses being made by different specialists. Some authors [7, 25] claim that any sound can be misophonic, regardless of its source – therefore including sounds made by people, such as eating sounds, breathing, or snoring, and other sounds, for example, a clock ticking, a toilet flushing, a vacuum cleaner working, a school bell ringing, a pen tapping, or typing on a keyboard, etc. Other researchers consider only sounds made by people to be misophonic.

In an experiment conducted by Edelstein et al. [8] that measured skin galvanic reaction, among other things, the most aversive sounds were found to be those made by people, e.g., eating and crunching sounds as well as snoring (11 people). Only 2 people indicated that the sounds they found most aversive were a pen clicking and a clock ticking. Among the other subjects, the most common (but less unpleasant) aversive sounds were pen clicking, the sound of steps, typing, the sound of plastic bags, and repetitive dog barking. For 6 people, the ‘s’ sound was unpleasant.

The results of Kumar’s work [26] also indicate that the strongest negative reactions are evoked by specific soft sounds made by humans. The analysis showed statistically significant differences in emotional arousal (measured with a galvanometer) and in heart rate (HR) between the following conditions: sounds of breathing and eating, a woman screaming and a baby crying, and sounds made by non-humans – raining and a kettle whistling. The most aversive triggers were the sounds of breathing and eating. The analysis of functional Magnetic Resonance Imaging (fMRI) data showed that the sounds of eating and breathing greatly activated the anterior insular cortex, which is related to emotional regulation and the detection of signals that are important for the individual from the surroundings.

Describing the characteristics of misophonic sounds seems to be crucial to understanding the mechanism of misophonia, the data is increasingly showing that misophonic trigger sounds are very individualized and dependent on personal history and social context.

Determinants of misophonia

The mechanisms underlying misophonia are still unknown [27]. That there is a greater prevalence of decreased sound tolerance among people with genetic disorders suggests the possibility of it having a genetic basis. In the study of Levitin et al. [28], including 118 people with Williams syndrome, 90.6% showed increased sensitivity to certain sounds, of which 14% were aversive towards the sounds made by people or animals. The same kind of sound intolerance was present in 27% of people with autism, 7% of people with Down syndrome, and 2% of people in the control group. The authors, in order to distinguish aversiveness towards particular, selective sounds from the category of general sensitivity to sounds, created a category that they called 'auditory allodynia'. It was not named misophonia, maybe because at this time the term 'misophonia' was not yet widely used, and apart from theoretical papers (e.g., Jastreboff and Jastreboff [1]), no empirical studies on misophonia existed. The existence of decreased sound tolerance in the population of people with Williams syndrome is indicated, for example, by the results of the study conducted by Bloomberg et al. [29]. To date, no genetic analyses concerning decreased sound tolerance have been conducted on a population of people without additional disorders and illnesses.

Jastreboff and Jastreboff [7] claim that misophonia is related to a dysfunction of the central auditory pathways. According to these authors, people with misophonia have enhanced neural connections between the auditory and limbic systems for certain sounds. The previously mentioned research by Kumar et al. [26], published in 2017, seems to confirm the theory postulated by Jastreboff and Jastreboff [7]. It showed a difference in the processing of certain aversive sounds in functional neural connections between the anterior insular cortex and the regions related to emotional regulation as well as greater myelination in the prefrontal cortex among people with misophonia. Earlier, Schröder et al. [30] published a study where they were the first to show the neurobiological mechanisms of misophonia. Using the event-related potential (ERP) in the oddball paradigm, they showed a difference in N1 mean peak amplitude, a bioelectrical brain response related to early processing. People with misophonia had a lower average mean peak than people from the control group.

Edelstein et al. [8] notice a similarity between misophonia and synesthesia. They postulate that in the same way that sound can be associated with color, in misophonia, certain sounds could be associated with a certain emotional reaction. Dozier instead proposed a theory saying that misophonia is formed by a process of classical conditioning [25], suggesting in the case studies that this reflex reaction might have been created, for example, by a quarrel while eating, or issues with sleeplessness which were accompanied by a breathing sound. However, this has yet to be demonstrated. The data on the causes of misophonia are still insufficient to determine whether it is innate or acquired and the role of neurobiological and cognitive factors.

Social functioning, mental hygiene, and misophonia

According to the current state of knowledge on misophonia, its intensity can vary from symptoms causing discomfort or irritation with some influence on social life to extreme cases where the individual can experience decreased mood or even have suicidal thoughts [2, 8]. Comments on misophonia-related websites and forums indicate that misophonia often leads to social isolation, family conflicts, absconding from family meals and interactions with friends, or even separations and divorces. One of the most frequently mentioned problems on internet forums is the lack of support among those closest to the person suffering from misophonia – their parents or partner. People with misophonia describe experiencing psychological abuse from family members – being called ‘mentally ill’, ‘crazy’, accusations of manipulation and ‘making up’ problems in order to attract attention or to distress other family members. Some people with misophonia also mention a fear of having children (they are afraid that their child might make aversive sounds). The experience of misophonia is linked to suffering and a significant decrease in quality of life [8, 10, 12]. It is also known that the phenomenon is not a particularly rare problem [2, 14, 15]. Therefore, it seems that the issue of exploration of misophonia by both researchers and practitioners is a big challenge for contemporary psychology, psychiatry, audiology, and other disciplines.

Directions for further research

Misophonia has become a more active area of research in recent years. However, this phenomenon is still little known in the Polish scientific literature. Taylor [31] prioritizes the analysis of misophonia in the context of other sensory sensitivities, not only auditory ones. Further exploration of its comorbidity with other disorders seems to be important as well. Rare reactions to trigger sounds, such as the experience of warmth, pain, and sexual arousal [12], are another interesting avenue of investigation. One of the lesser known, but more controversial, aspects are the mechanisms underlying misophonia. Brout et al. [27] suggest avoiding preliminary classification of misophonia as a phenomenon dependent on genetics vs. a conditioned one. According to them, this attitude can have a negative impact on the diagnosis and therapy of misophonia. It seems important that tools for the diagnosis and measurement of the severity of misophonia be developed and validated. Detailed multidisciplinary diagnoses of research participants and the use of objective measurement tools (in contrast to self-descriptive questionnaires) in our opinion is crucial for further research on misophonia. Only this will allow the comparison of analyses from different research groups.

Conclusions

In spite of the lack of official diagnostic criteria for misophonia and the contention around its definition, in light of the discussed research results it is reasonable to

agree on the existence of a specific, uniform construct. Misophonia is related to many aspects of functioning – hearing, emotions, physiology, and social functioning. Therefore, diagnosis of misophonia should involve various specialists such as psychiatrists, audiologists, and psychologists. Because there is no evidence of the effectiveness of any therapy for misophonia, apart from limited data from research [9, 32, 33] and clinical work [2], patients should be informed about the current, not definite state of knowledge concerning their condition.

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