



# Misophonia in children and adolescents: A narrative review

Elisa Pfeiffer  Marc Allroggen and Cedric Sachser

Clinic for Child and Adolescent Psychiatry/Psychotherapy, University of Ulm, Germany

**Summary:** Misophonia describes a phenomenon in which affected children and adolescents show a strong negative physiological and emotional reaction when confronted with specific auditory (misophonic) stimuli (most commonly eating or breathing noises). Individual studies with adults already provide prevalences between 6 and 20% in various (clinical) samples, whereby the representativeness of the samples in most studies was only given to a very limited extent. However, the first manifestation of the symptoms is in more than 80% of cases in childhood and adolescence, which is why this age group should be given special attention. With regard to comorbid disorders, there is also great heterogeneity with estimates of between 28% and 76% for comorbid mental disorders and around 25% for comorbid physical illnesses. The exact etiology has not yet been sufficiently investigated. First neurophysiological explanations and imaging studies point to a specific physiological reaction in misophonia patients. Although there are now a large number of case reports, diagnostic criteria and measuring instruments have been developed and the first cognitive-behavioral treatment approaches have been evaluated, misophonia still does not represent an independent neurological, audiological or psychiatric disorder in the DSM-5 or the ICD-11.

**Key words:** misophonia, review article, children, adolescents, diagnosis and treatment

## Misophonia in Childhood and Adolescence: A Narrative Review

**Abstract:** Misophonia describes a phenomenon in which the affected children and adolescents show a strong negative physiological and emotional reaction when confronted with specific (misophonic) auditory stimuli (most commonly eating or breathing sounds). Several studies with adults yielded prevalence rates between 6% and 20% in various (clinical) samples, but the representativeness of samples was largely limited. More than 80% of the first manifestation of symptoms occurs during childhood and adolescence. Regarding comorbid disorders, studies show great heterogeneity, with estimates ranging from 28–76% of comorbid mental disorders and approximately 25% with comorbid physical disorders. The exact etiology is currently not well studied. Initial neurophysiological explanations and imaging studies point to a specific physiological response in misophonia patients. Although many case reports are now available, and diagnostic criteria and measurement tools have been developed, misophonia currently does not represent a distinct neurological, audiological, or psychiatric disorder in the DSM-5 or ICD-11.

**Keywords:** misophonia, review, children, adolescents, diagnosis and treatment

## background

The term "misophonia" (Greek *misos* = hate, *phone* = noise), literally "hatred of sounds", describes a phenomenon in which those affected show a negative physiological and emotional reaction when confronted with specific auditory stimuli (Brout et al., 2018; Jager, de Koning, Bost, Denys & Vulink, 2020). Although initial studies indicate that the phenomenon of misophonia is quite widespread in the general population, is associated with considerable physical and emotional stress and occurs for most of those affected for the first time in childhood, it has so far received little attention

found in the diagnosis and care of mentally ill children and adolescents (Claiborn, Dozier, Hart & Lee, 2020). The aim of this review article is therefore to create an overview of the symptoms, course and treatment options on the basis of a selective literature search in order to sensitize specialists to the disorder. In addition to the psychiatric perspective, misophonia has received attention in a large number of related interdisciplinary research areas, which has led to an interdisciplinary conceptualization of the disorder in the literature. However, this article focuses on the psychological and psychiatric facets of the disorder.

## Method

The studies for this review were identified through a systematic literature search in the online database *PubMed* using the search terms/keywords “*misophonia*” or “*misophonia*” (title and abstract). The Su. last repeated on October 1st, 2021  
che yielded a hundred relevant studies. The selection of the articles included in this review followed a narrative character, so that the final selection of the articles considered was subjective and unsystematic.

## Description of the disorder

The syndrome misophonia was first conceptualized in the scientific literature (Jastreboff & Jastreboff, 2001) by the Americans Margaret and Pawel Jastreboff, who are known for their research in the field of tinnitus (Jastreboff, 1990). The authors describe neurological similarities to the disorders hyperacusis (extreme sensitivity to loud noises, occurs e.g. in small children) and phonophobia (phobic fear of noises).

The authors noticed that individual hyperacusis patients reacted sensitively to a certain group of sounds, regardless of the loudness or other physical characteristics of the sounds. In contrast to hyperacusis, the triggering sounds were variable in this subgroup of patients.

The stimuli perceived as aversive, which are also called “triggers” or “misophonia sounds”, include eating sounds (e.g. swallowing, chewing, biting into an apple), nasal/breathing sounds, mouth and throat sounds, knocking sounds, rustling, room noises (e.g. telephone ringing) or repetitive movements (e.g. scratching; overview: Jager et al., 2020; Siepsiak & Dragan, 2019). The ensuing automatic emotional response (also called the “misophonia response” or “misophonic response”) can manifest itself in a variety of feelings, such as anger, rage, fear, and disgust, or at the behavioral level, in the form of avoidance and a desire to to escape the situation (*fight-flight response*; Brout et al., 2018; Wu, Lewin, Murphy & Storch, 2014). In a current Dutch study with  $N = 575$  misophonia patients (mixed children, adolescents and adults), the authors were able to show that 93.8% irritability, 89.5% anger, 64% disgust and 13.6% other emotional reactions (e.g. sadness or loss of control) experience (Jager et al., 2020). About

In a survey in the USA, 97.1% also reported physiological reactions in the body and face (e.g. muscle tension) associated with anger and anxiety (86%) and manifested by muscular tension (82.8%) or teeth grinding/clenching (63.9%) (Claiborn et al., 2020). The sound pattern and the triggering reaction are very unpleasant for those affected

different. Initial studies have shown that the context of the sound plays an important role in how aversive that sound is perceived. For example, noises from close people are considered

perceived as more aversive. On the contrary, sounds are perceived as less aversive by young children, adults with intellectual disabilities and elderly people with dementia (Dozier, 2015a). For individuals affected, misophonia can be associated with significant psychoemotional and social stress, a reduction in functional level and quality of life.

Although initial studies have already attempted to characterize the clinical picture of the disorder in terms of diagnostic criteria and the level of suffering of those affected It should be noted that misophonia has not been recognized as a neurological, audiological, or psychiatric disorder to date. In addition, the disorder cannot be classified and diagnosed as an independent disorder using the current classification systems. A detailed overview of the differentiation of psychiatric disorders can be found in Schröder, Vulink and Denys (2013). A working group led by Arjan Schröder published a first proposal for possible diagnostic criteria in 2013 (Schröder et al., 2013), followed by those of Thomas Doziers' working group in 2017 (Dozier & Morrison, 2017; German overview in Spitzczok, by Brinsinski, Semmler, Schüller & Heidenrich, 2019). The criteria according to Schröder were revised by the Jager working group in 2020 on the basis of new findings and are therefore the most up-to-date criteria (see presentation of the criteria in Table 1). All conceptualisations of the diagnostic criteria are largely based on studies with young adults.

With regard to stimuli typical of misophonia, the authors were able to show in a current study that almost all misophonia patients reported eating sounds (96%) and nasal or breathing sounds (85%) as misophonic stimuli, which is why these special sounds were included in the criteria. In their sample, 78% of patients also reported nonauditory stimuli as misophonic triggers, but auditory stimuli are categorized as primary triggers.

Early studies of the phenomenology of the disorder included only case studies or case series from Awake Those who reported sensitivity to a variety of sounds (made by people or objects) (e.g.,

Johnson et al., 2013; Kluckow, Telfer & Abraham, 2014). Studies that differentiated the symptoms from other disorders, such as eating disorders (Kluckow et al., 2014), autism (Williams, He, Cascio & Woynaroski, 2021) or tic disorders (Cavanna & Seri, 2015). In children and adolescents there are already individual (therapeutic) case reports on patients with misophonic symptoms (Kamody & Del Conte, 2017; McGuire, Wu & Storch, 2015; Sarigedik & Yurteri, 2021; Spitzczok von Brisinski et al., 2019). In his guide, Thomas Dozier (2016) describes two types of children with misophonia based on surveys in social media and personal experiences with those affected: Type 1 are sensitive and empathetic children, Type 2 are headstrong and impulsive children. In his experience, type 1 and type 2 children develop initial symptoms as a result of a conditioned response to stressful social situations. He

emphasizes the exclusion from the peer group through tantrums in misophonia triggers and increased conflicts within the family due to misophonic reactions as the psychosocial consequences of misophonia.

comorbidity

The study situation on mental and physical comorbid disorders is very heterogeneous (Siepsiak & Dragan, 2019) and is briefly presented below. In a first study on the differential diagnosis of misophonic symptoms, a Dutch working group

PE show that in a sample of 42 adults who reported misophonic symptoms, 52.4% met criteria for anankastic personality disorder, 7.1% mood disorder, 4.8% (attention-deficit/hyperactivity disorder (ADHD), 2.4% panic disorder and 2.4% had OCD (Schröder et al., 2013) Other common comorbid diagnoses include post-traumatic stress disorder (PTSD; 15.4%) and autism and anorexia nervosa (9.61%; Erfanian, Kartsonaki & Keshavarz, 2019; Green & Ben-Sasson, 2010; Rouw & Erfanian, 2018) In a study of N = 1061 people who completed an online social media survey and self-attributed misophonia to themselves, 76.2% of study participants reported at least one other psychiatric condition diagnosis (diagnosed disorder or own assessment; Claiborn et al., 2020).

The most common comorbid disorders were mood disorders (48.4%), anxiety disorders (43.6%) and obsessive-compulsive disorders (20.8%). A total of 18.5% stated that they suffered from tinnitus. On the contrary, 72% of the patients in the utilization population reported by the Dutch working group led by Jager et al. were examined, apart from the misophonia diagnosis, no other axis I disorder according to DSM-IV criteria (Diagnostic and Statistical Manual of Mental Disorders; American Psychiatric Association, 1994; Jager et al., 2020). Only about 28% met the criteria of a comorbid psychiatric diagnosis, of which the most common diagnoses were in the area of mood disorders (10.1%), anxiety disorders (9%) and ADHD (5.4%). However, a total of 27.1% of the patients were conspicuous in the area of personality s

Table 1. Proposed diagnostic criteria for misophonia according to Jager et al., 2020 (translated and slightly modified from English to German)

Revised criteria for misophonia (Amsterdam UMC 2020)
AR. Preoccupation with a specific auditory, visual, or sensory stimulus that is predominantly performed by another person. Requires oral or nasal sounds to be a trigger.
BR. The stimuli evoke intense feelings of irritation, anger, and/or disgust that the person recognizes as excessive, inappropriate, or disproportionate to the circumstances.
CR. As emotions trigger an impulsive, aversive physical response, the person experiences a deep sense of loss of self-control with infrequent but potentially aggressive outbursts.
DR. The person actively avoids situations in which triggers occur, or endures triggers with intense discomfort, irritation, anger, or revulsion.
HE. The irritation, anger, disgust, or avoidance causes significant distress and/or disruption to the person's daily life. For example, it is impossible to eat together, to work in an open-plan office, or to live together.
FR. The irritation, anger, disgust, and avoidance are not better accounted for by another disorder, such as an autism spectrum disorder (e.g., general hypersensitivity or over-excitement to all sensory stimuli) or an attention-deficit/hyperactivity disorder (e.g., attention problems with high distractibility in general).

realm of the compulsive personality. A total of 24% of the patients reported a physical illness (20% a disorder). The most common physical diagnoses were migraines, irritable bowel syndrome, asthma and back pain. In the field of audiological disorders, four patients had a diagnosis of hyperacusis, ten patients had tinnitus, one patient had both clinical pictures and 21 patients reported hearing loss or other hearing problems.

Another study from the USA with adults examined the connection between misophonia, psychopathology and personality disorders using semi-structured clinical interviews (Cassello-Robbins et al., 2021). They were able to show that misophonia symptoms were only associated with an increase in personality disorders and not with psychopathology in general. This association was also partially mediated by anxiety symptoms.

A study with students in the USA was able to

Positive correlations of misophonia symptoms with anxiety, depression and obsessive-compulsive symptoms also show that the symptoms are associated with a reduction in the level of functioning in everyday life and increased sensory defensiveness (Wu et al., 2014). In a large online survey with  $N = 628$  participants ( $n = 121$  with misophonia symptoms), the authors were able to inside show that there was a large heterogeneity of comorbid symptoms and that no typical pattern of psychological abnormalities was found in people with misophonia. A large number of studies have come to the conclusion that misophonia is not associated with a specific mental disorder per se, but in principle with increased psychological abnormalities, a restricted level of functioning (Brout et al., 2018; McKay, Kim, Mancusi, Storch & Spankovich, 2018) and reduced quality of life (Jager et al., 2020). Although a large number of the studies described above

and adolescents and pointed out that this population is particularly affected, no study has so far examined comorbidity exclusively in children and adolescents. However, since many mental disorders in childhood and adolescence occur more frequently (e.g. ADHD) and sometimes less frequently (e.g.

schizophrenia) than in adulthood, the comorbidity of misophonia in this particularly vulnerable population must be examined more closely in the future. In addition to recording the comorbid psychiatric diagnoses per se, the question arises, particularly with regard to the treatment of children and adolescents with misophonia, as to whether the comorbid disorders in the context of a disorder development and maintenance model also determine the misophonic symptoms and possibly even cause them for misophonia (e.g. trauma

noises associated with it that can trigger PTSD symptoms) or are also a consequence of misophonia (e.g. depressive mood due to withdrawal and rejection by others). A case study with tic patients in childhood and adolescence who describe symptoms of misophonia ( $N = 12$ ) already provides the first indications that the disorders may be closely linked (both as a trigger and as a reaction; Robinson, Hedderly, Conte, Malik & Cardona, 2018). There are similar findings in children and adolescents in the area of obsessive-compulsive disorders (Webber, Johnson & Storc, 2014), whereby the patient described in this publication had a tic disorder in addition to an obsessive-compulsive disorder, which is why no concrete statements on the connection have yet been made for children. OCD and misophonia symptoms can be affected independently of other disorders.

## Epidemiology and course

The onset of the disease is usually in childhood and adolescence (Claiborn et al., 2020; Dozier, 2015a; Gemstone, Brang, Rouw & Ramachandran, 2013; Jager et al., 2020; Schröder, Vulink, van Loon & Denys, 2017). A recent study of people who self-reported having the disease misophonia reported a mean age of onset of 12.61 years ( $SD = 7.46$ , range 0–15; Claiborn et al., 2020). About 80% of the study participants stated that symptoms started before the age of 15. Age and gender of the patients had no influence on the age of onset (Claiborn et al., 2020; Jager et al., 2020), but earlier onset of symptoms was permanently associated with stronger symptoms (Claiborn et al., 2020). A recent study (Jager et al., 2020) on a clinical utilization population who presented with their misophonia symptoms ( $n=575$  of the  $N=779$  patients met the authors' misophonia criteria, 69% female,  $Mean = 13.17$  years), was able to show that most patients reported a gradual onset of symptoms and a chronic course. However, there are still no concrete studies on long-term courses (e.g.

increase or decrease in misophonic response). However, Thomas Dozier describes in his publication that the symptoms often become more severe during puberty (Dozier, 2016). So far, there are no indications of gender differences in the symptoms described.

There are currently only a few representative studies on the Prevalence of misophonia in the general population or specifically in children and adolescents (Siepsiak & Dra-



gan, 2019). Previous studies, most of which were carried out with university students or tinnitus patients, report very different prevalence rates and only allow a few conclusions to be drawn about the general population. For example, a study with  $N = 438$  students (16% male) in the USA reported clinically significant symptoms of misophonia in 20% of the study participants (Wu et al., 2014). Another study with students in Great Britain found

a significantly higher prevalence: A total of 49.1% reported misophonic symptoms (37% mild symptoms, 12% moderate symptoms, 0.3% severe symptoms;  $N = 336$  participants; Naylor, Caimino, Scutt, Hoare & Baguley, 2021). In a study of students in China using the same instrument as the US study, 6% were clinically abnormal ( $N = 415$ ).

There are studies among patients with tinnitus that assume a prevalence of misophonia of 10 to 60% (Hadjipavlou, Baer, Lau & Howard, 2008; Sztuka, Pospiech, Gawron & Dudek, 2010). Both the Wu et al. (2014) and the study by Zhou, Wu, & Storch (2017) showed that anxiety symptoms mediated the relationship between misophonia and outbursts of anger.

Of particular note is a representative study on a household sample in Turkey, in which  $N = 541$  people older than 15 years were interviewed about misophonia symptoms (Kiliç, Öz, Avanoğlu & Aksoy, 2021). A total of  $n = 69$  (12.8%) met the diagnostic criteria used by the authors and  $n = 427$  (78.9%) reported that at least one of the listed tones was associated with stress for them.

## pathomechanism/etiology

The exact etiology of misophonia has not yet been sufficiently studied (Siepsiak & Dragan, 2019).

Jastreboff and Jastreboff, on the one hand, started from a dysfunction in the central auditory neuronal pathway

On the other hand, they assumed a conditioned reflex, in the sense of classical conditioning according to Pavlov, in which a misophonic noise (conditioned stimulus) causes a conditioned reaction (extreme emotion and "fight-flight" reaction as a physiological reaction). ) triggers (Jastreboff & Jastreboff, 2014). Dozier (2015b), on the other hand, proposes a two-stage model in which the triggering stimulus leads to an (unconditioned) muscle reflex, which in turn evokes an emotional response and thus to conditioning th reaction. In the second stage, additional triggering stimuli are created by previous As

associations of this stimulus with the stimulus-response in the sense of a generalization.

Individual studies indicate a familial accumulation of misophonia. Two studies, one from the Netherlands (33%; Jager et al., 2020) and one from the USA (55%; Rouw & Erfanian, 2018), report a family history of misophonia in at least one in three sufferers. A possible genetic component or intra-familial model learning as a cause of

misophonia should be examined more closely in the future in order to better understand the overall etiology of the disorder to understand.

## Neurophysiological explanations

So far, there are only a few studies that have dealt with possible neurophysiological correlates and causes of misophonia (Brout et al., 2018).

The studies available to date must also be interpreted with caution, since in some cases different diagnostic criteria for misophonia were used, e.g. In some cases, the study populations were very different and only very small numbers of cases were considered (Palumbo, Alsaman, De Ridder, Song & Vanneste, 2018).

Studies measuring skin conductance during the presentation of misophonic triggers have shown a specific stress response to misophonic triggers in patients with misophonia but not in healthy controls (Edelstein et al., 2013; Kumar et al., 2017). In addition, a study showed that people with misophonia showed a reduction in the N1 wave when recording event-related potentials compared to healthy controls with circumscribed auditory signals (Schröder et al., 2014).

Likewise, impairments of executive functions under the presentation of misophonic stimuli in those affected could be demonstrated in the Stroop interference test (Daniels, Rodriguez & Zabelina, 2020) as well as a tendency towards more controlled behavior in a stop signal test (Eijsker, Schröder, Smit, van Wingen & Denys, 2019). Even if these findings do not allow any conclusions to be drawn about the underlying pathomechanisms, they do point to a specific physiological reaction in misophonia patients.

In recent years, some functional imaging studies have also been conducted with misophonia patients (Giorgi, 2015; Kumar et al., 2017; Schröder, San Giorgi, van Wingen, Vulink & Denys, 2015; Schröder et al., 2019). When misophonic stimuli are presented, the findings predominantly show an increased activation in the auditory cortex as well as the amygdala and other

range of the limbic system (Eijsker, Schröder, Smit, van Wingen & Denys, 2021; Giorgi, 2015; Schröder et al., 2015; Schröder et al., 2019). The investigation of Kumar et al. (2017) also found increased activation in the area of the anterior insular cortex (AIC), an area associated with directed attention to stimuli (salience), when misophonic triggers were presented. In addition, there was impaired connectivity of the AIC with medial frontal, medial parietal and temporal regions.

Based on these findings, it is speculated that the stress response associated with the perception of misophonic stimuli is based less on increased perception of the stimulus itself, as in hyperacusis, and more on impaired affective evaluation and salience to the specific stimulus (Palumbo et al., 2018). However, a recent study did not find any differences in the activation of the auditory cortex in misophonia patients compared to healthy controls, but rather a stronger activation in areas associated with orofacial movements. These findings are linked to previous clinical findings showing that the noise of eating in particular is perceived as unpleasant, so that it is discussed whether increased activation of motor neurons could play a role in the development of misophonia (Kumar et al., 2021). Findings on structural changes in the white matter also indicate that the impaired visual perception of facial expressions could have a possible role in the development of misophonia symptoms (Eijsker, Schröder, Liebrand, Smit, van Wingen & Denys, 2021).

## Diagnostics

In the following, all currently available instruments for assessing misophonia in children and adults are presented (see Table 2). The sub-item "Target group" shows whether the inventory can also be used with children and young people. There is currently no instrument specifically designed for children and young people.

## treatment

According to the study by Claiborn et al. (2020), only 24.7% of those affected report having sought treatment because of their symptoms. A big

part reports little or no improvement in symptoms as a result of treatment. Counseling or talk therapy was used most frequently (13.7%), followed by treatment through cognitive behavioral therapy (8.2%). However, the treatment spectrum covered a very wide range from hypnosis (2.9%) to pharmacotherapy (2.8%). Talk therapy was associated negatively ( $b = 0.93$ ;  $p < .001$ ) and psychopharmacotherapy positively ( $b = -1.39$ ;  $p < .001$ ) with symptom reduction. Outside of regular treatment, the most common coping strategies used by patients with misophonic symptoms include listening to music (99%), avoiding/

Leaving the situation (99%) or making noises (86–77%; Jager et al., 2020).

Current studies on the treatment of misophonia mostly only include uncontrolled case studies/case series (Bernstein, Angell & Dehle, 2013; Dozier, 2015a; Haq, Al resheed & Tu, 2020; McGuire et al., 2015; Potgieter et al., 2019; Reid, Guzik, Gernand & Olsen, 2016), which is why no specific treatment recommendations can yet be made. The treatment approaches known to date are briefly presented below.

## Cognitive Behavioral Therapy

First studies on confrontation therapies with misophonia patients were able to show that exposure to misophonia noises did not lead to direct habituation (Frank & McKay, 2019), which is why the authors adapted their treatment model and included an inhibitory learning model in the treatment. After further individual case studies in which cognitive behavioral therapy appeared to be promising (Bernstein et al., 2013; Dozier, 2015a, 2015b; McGuire et al., 2015; Reid et al., 2016), a first uncontrolled quasi-experimental study on the effectiveness of cognitive behavioral therapy (eight 2-week sessions with concentration exercises, counterconditioning, stimulus manipulation, relaxation exercises) with  $N = 90$  patients (28% male,  $Mage = 35.8$ ;  $SD = 12.2$ ) first evidence of a symptom reduction through the treatment was found (Schröder et al., 2017). A first randomized controlled study on behavioral therapy for misophonia was carried out in Amsterdam in an outpatient setting with  $N = 71$  adult patients (70.4% female,  $Mage = 33.06$ ;  $SD = 14.13$ ) (Jager, Vulink, Bergfeld, van Loon & Denys, 2021). Participants were assigned to either a 3-month weekly behavioral therapy regimen or a wait-list condition. The treatment condition was

**Table 2.** Diagnostic tools

Name des Instruments	Quality criteria, norm sample description	remark
Amsterdam Misophonia Scale (A-MISO-S; Schröder et al., 2013; German Version: Schwemmler & Arens, 2021)	<p><b>Reliability:</b></p> <p>– <math>\bar{y} = .81</math> (Naylor et al., 2021)</p> <p><b>Validity:</b></p> <p>– <math>r_{\bar{y}} = .87</math>, <math>p &lt; .01</math></p> <p><b>Sample:</b></p> <p>– N = 54 (70.4% female, <math>Mage = 33.06</math>, <math>SD = 14.13</math>)</p>	<p>– Detects severity of misophonia symptoms in the past week</p> <p>– Modified version of the Yale Brown Obsessive Compulsive Scale (YBOCS; Goodman et al., 1989)</p> <p>– self-judgment</p> <p>– 6 items with a 5-point Likert scale</p> <p>– 1 open item</p> <p>– Total score is divided into subclinical (0-4), mild (5-9), moderate (10-14), severe (15-19), extreme (20-24)</p> <p>– Questions at time caused by symptomatology is ingested, impairment of social functioning, level of anger, resistance to the impulse, control over your own thoughts and anger, Avoidance of misophonic situations</p> <p>– Target group: adults (validation sample 18 years and older)</p>
Amsterdam Misophonia Scale- $\bar{y}$ Revised (AMISO-S-R; Schröder & Spape, 2014)	<p><b>Reliability:</b></p> <p>– <math>\bar{y} = .84</math></p> <p><b>Validity:</b></p> <p>– <math>r_{\bar{y}} = .87</math>, <math>p &lt; .01</math></p> <p><b>Sample:</b></p> <p>– N = 54 (70.4% female, <math>Mage = 33.06</math>, <math>SD = 14.13</math>)</p>	<p>– self-judgment</p> <p>– 10 items, 5-point Likert scale</p> <p>– Values from 0-40 possible: normal to subclinical (0-10), mild (11-20), moderate to severe (21-30), severe to extreme (31-40)</p> <p>– Target group: adults (validation sample 18 years and older)</p>
Duke Misophonia Questionnaire (DMQ; Rosenthal et al., 2021)	<p><b>Convergent Validity:</b></p> <p>– High correlations (<math>r = .721-.806</math>) with MAQ, MER, MCR and A-MISO-S</p> <p><b>Sample:</b></p> <p>– N = 424 (54.4% male, <math>Mage = 37.7</math>, <math>SD = 11.1</math>) (Rosenthal et al., 2021)</p>	<p>– self-judgment</p> <p>– 86 items, 9 Subscales</p> <p>– Response format: 5-point Likert scale, yes-no for specific triggers</p> <p>– Target group: adults (validation sample 18 years and older)</p>
Misophonia Activation Scale (MAS-1; Fitzmaurice, 2010, Kluckow et al., 2014, Dozier, 2015b)	– Not yet validated	<p>– Records severity of reaction to Misophonic triggers, focus on emotional responses</p> <p>– self-judgment</p> <p>– Level 0-10, high values correspond to stronger misophonic response</p> <p>– Target group: adults</p>
Misophonia Assessment Questionnaire (MAQ; Johnson et al., 2013)	<p><b>Reliability:</b></p> <p>– <math>\bar{y} = .96</math></p> <p><b>Sample:</b></p> <p>– N = 424 (54.4% male, <math>Mage = 37.7</math>, <math>SD = 11.1</math>) (Rosenthal et al., 2021)</p>	<p>– Self-judgment, foreign judgment for children</p> <p>– 21 items, 4-point Likert scale</p> <p>– Assesses symptom severity: mild (1-21), moderate (22-42), severe (43-63)</p> <p>– Target group: adults, young people, children</p>
Misophonia Coping Responses (Misophonia Coping Responses, 2013)	<p><b>Reliability:</b></p> <p>– <math>\bar{y} = .89</math></p> <p><b>Sample:</b></p> <p>– N = 424 (54.4% male, <math>Mage = 37.7</math>, <math>SD = 11.1</math>) (Rosenthal et al., 2021)</p>	<p>– Records how affected with Bypass trigger noise</p> <p>– self-judgment</p> <p>– 21 items, 4-point Likert scale</p> <p>– Target group: adults (validation sample 18 years and older)</p>

Table 2. Continued

Name des Instruments	Quality criteria, norm sample description	remark
Misophonia Emotional Response Scale (MERS; Dozier, 2015b)	<p><i>Reliability:</i> <math>\bar{y} = .94</math></p> <p><i>Sample:</i></p> <ul style="list-style-type: none"> <li>– N=424 (54.4% male, <i>Age</i> =37.7, <i>SD</i>=11.1) (Rosenthal et al., 2021)</li> </ul>	<ul style="list-style-type: none"> <li>– Captures frequency of emotional response to triggers</li> <li>– self-judgment</li> <li>– 26 items, 4-point Likert scale</li> <li>– Target group: adults (validation sample 18 years and older)</li> </ul> <p>– Freely available: <a href="https://misophoniatreatment.com/wp-content/uploads/2014/06/MER-2.pdf">https://misophoniatreatment.com/wp-content/uploads/2014/06/MER-2.pdf</a></p>
Misophonia Physical Response Scale (MPRS; Bauman, 2015)	<ul style="list-style-type: none"> <li>– Not yet validated</li> </ul>	<ul style="list-style-type: none"> <li>– Indication of the physical response associated with misophonic triggers</li> <li>– self-judgment</li> <li>– Level 0-10, high values correspond to stronger misophonic response</li> <li>– Level 11 for additional information</li> <li>– Target group: adults</li> </ul> <p>– Freely available: <a href="https://misophoniatreatment.com/wp-content/uploads/2014/06/MPRS.pdf">https://misophoniatreatment.com/wp-content/uploads/2014/06/MPRS.pdf</a></p>
MisoQuest (Siepsiak, Źliwierski & Dragan, 2020)	<p><i>Reliability:</i></p> <ul style="list-style-type: none"> <li>– <math>\bar{y} = .955</math></li> <li>– Retest reliability: <math>r = .84</math></li> </ul> <p><i>Sample:</i></p> <ul style="list-style-type: none"> <li>– N = 705 (<i>Age</i> = 32.09, <i>SD</i>=<math>\bar{y}</math>8.58, Range: 18–68)</li> </ul>	<ul style="list-style-type: none"> <li>– self-judgment</li> <li>– Based on diagnostic criteria from Schröder et al. (2013)</li> <li>– 14 items, can be divided into 7 categories will</li> <li>– 5-point Likert scale</li> <li>– Target group: adults (validation sample 18 years and older)</li> </ul> <p>– Not freely available</p>
Misophonia Questionnaire (MQ; Wu et al., 2014)	<p><i>Reliability:</i></p> <ul style="list-style-type: none"> <li>– <math>\bar{y} = .86</math> for subscales, <math>\bar{y} = .89</math> for the entire questionnaire</li> </ul> <p><i>Convergent validity:</i> – <math>r = .50</math> with Adult Sensory Questionnaire (ASQ; Kinnealey &amp; Oliver, 2002)</p> <p><i>Discriminant Validity:</i></p> <ul style="list-style-type: none"> <li>– <math>r = .33</math> (<math>p &lt; .001</math>) for ASQ visual, <math>r = .28</math> (<math>p &lt; .001</math>) for ASQ olfactory and <math>r = .34</math> (<math>p &lt; .001</math>) for ASQ tactile sensitivity</li> </ul> <p><i>Sample:</i></p> <ul style="list-style-type: none"> <li>– N = 483 (83.6% female, 18-54 years, <i>Age</i> = 21.43, <i>SD</i> = 4.52)</li> </ul>	<ul style="list-style-type: none"> <li>– Assesses misophonic triggers, emotional and behavioral consequences of symptoms, severity of noise sensitivity</li> <li>– 3-part self-assessment</li> <li>– The first two parts consist of 7 and 10 items, 5-point Likert scale, Total values from 0-68 are possible</li> <li>– The third part is based on the National Institute of Mental Health Global Obsessive Compulsive Scale (NIMH-GOCS; Murphy, Pickar &amp; Alterman, 1982), range from 1 to 5 (minimal to very strong noise sensitivity), from a value of 7 clinically significant</li> <li>– Target group: adults (validation sample 18 years and older)</li> </ul> <p>– Not freely available</p>
Misophonia Screening List (Schröder & Spape, 2014)	<ul style="list-style-type: none"> <li>– Not yet validated</li> </ul>	<ul style="list-style-type: none"> <li>– self-judgment</li> <li>– 14 items, 5-point Likert scale</li> <li>– Values from 0-56, values above 20 mean Misophonia</li> <li>– Target group: adults</li> </ul> <p>Freely available: <a href="https://doi.org/10.1371/journal.pone.0231390.s005">https://doi.org/10.1371/journal.pone.0231390.s005</a></p>
Misophonia Sound List (Schröder, 2014)	<ul style="list-style-type: none"> <li>– Not yet validated</li> </ul>	<ul style="list-style-type: none"> <li>– Five categories of sounds</li> <li>– Indication of the emotional reaction on a 5-point Likert scale</li> <li>– self-judgment</li> <li>– Target group: adults</li> </ul> <p>Freely available: <a href="https://doi.org/10.1371/journal.pone.0231390.s006">https://doi.org/10.1371/journal.pone.0231390.s006</a></p>
Selective Sound Sensitivity Syndrome Scale (S-Five; Vitoratou, Hayes, Uglik-Marucha & Gregory, 2020)	<ul style="list-style-type: none"> <li>– Not yet validated</li> </ul>	<ul style="list-style-type: none"> <li>– self-judgment</li> <li>– 25 items, 5 factors: internalizing Judgment, externalizing judgment, perceived threat and avoidance behavior, outbursts of anger, functional impairment</li> <li>– Assessment of the items on the levels 0–10</li> <li>– Target group: adults</li> </ul> <p>Available upon request from authors</p>



Table significantly superior in terms of misophonia symptom reduction, both short-term and long-term (1-year follow-up). In the treatment group, 37% reported a clinically significant reduction in symptoms, compared to 0% in the waiting condition. The standardized effect size of the behavioral therapy was  $d = 1.92$ . Other therapeutic interventions that have been described in case reports or case series include transdiagnostic cognitive-behavioural therapy approaches (Lewin et al., 2021), exposure therapy (Rabasco & McKay, 2021), EMDR (Eye Movement Desensitization and Reprocessing; Jager, Vulink, de Roos & Denys, 2021) and dialectical behavioral therapy (Kamody & Del Conte, 2017).

## Alternative treatment models

In addition to cognitive behavioral therapy, there is initial evidence of the effectiveness of the “tinnitus retraining therapy” originally developed by Jastreboff and Jastreboff for tinnitus patients for misophonia as well (Jastreboff & Jastreboff, 2013, 2014). So far there are only single case studies on the pharmacological treatment of misophonia, e.g. B. with antidepressants (Sarigedik & Yurteri, 2021). Based on the current interdisciplinary understanding of the disorder, Brout et al. (2018) in their review a multidisciplinary individual treatment model, in which not only psychiatrists but also departments such as neurology, audiology, occupational therapy, neuropsychology and clinical psychology are included. The book “Misophonia: Lisa’s anger and the noises” (Seebeck & Homrighausen, 2020) was published especially for children and adolescents and can be a helpful tool for psychoeducation with affected children and adolescents.

## conclusion

At the current time, it is still questionable whether misophonia should be understood as a symptom manifestation of other underlying or comorbid diagnoses or should be considered as an independent diagnosis in the classification systems of psychiatric disorders.

Other possible underlying pathomechanisms (e.g. pathophysiological processes, the influence of life events, the frequency and intensity of exposure to trigger noises) as well as protective and risk factors for the (individual) course of the disorder must be examined more closely in order to be able to determine a better (different

To be able to develop (cial) diagnostics on the one hand and a better understanding of therapeutic approaches on the other. Especially in children and adolescents there is little valid knowledge about epidemiology, symptom criteria and pathomechanism as well as treatment, but misophonia should be considered as a possible cause of stress reactions, especially in social

tuations as well as with the described noise sensitivity are taken into account.

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## ORCID

Elisa Pfeiffer

 <https://orcid.org/0000-0002-9742-3004>

## Dr. A.S. Cedric Sachser

Clinic for child and adolescent psychiatry/psychotherapy

Senior Psychologist

University Hospital Ulm

Steinhövelstr. 1

89075 Ulm

Germany

[cedric.sachser@uniklinik-ulm.de](mailto:cedric.sachser@uniklinik-ulm.de)