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ORIGINAL ARTICLE

Prevalence of Misophonia in Adolescents and Adults Across the Globe: A Systematic Review

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Abstract
misophonia is a sound tolerance disorder which disturbs the emotions of people when exposed to specific triggers. Studies have shown that visual triggers alone can cause misophonia in affected individuals in the absence of auditory triggers. It is also said to affect people's quality of lives affecting social life, work life and personal relationships. Different studies on misophonia indicate that it is prevalent between 5% and 34.67%. These studies help us understand the existence of misophonia across different parts of the world. Studies report factors like gender, age, socioeconomic status, etc. play significant roles in impacting the prevalence of disorder. This study aims to review 12 such English articles available online, to get a comprehensive set of data to make it easy for readers and researchers. Results of the review indicate that not many countries have their prevalence rates established which could be indicating the lack of awareness. In countries that have carried out the study, clinically significant misophonia exists in many individuals with various degrees with multiple factors affecting it.

Keywords Misophonia · Selective sound sensitivity syndrome · Sound tolerance disorder · Prevalence

Introduction

Misophonia, also known as selective sound sensitivity syndrome, is a condition characterized by a decreased tolerance to specific sounds, leading to a heightened emotional or physiological response whose reaction is attributed to an amplified autonomic nervous system response triggered by certain sounds [1]. Such sounds are called triggers, and triggering stimuli may vary from person to person. The aversive stimuli may include human-generated sounds such as chewing, lip-smacking, breathing, and swallowing, as well as non-body-related sounds like pen clicking, rustling, and typing [2]. Misophonia is found to coexist with other conditions such as Obsessive Compulsive Disorder (OCD), Post Traumatic Stress Disorder (PTSD), eating disorders, tinnitus, phonophobia, hyperacusis (another type of sound tolerance disorder where a person finds it difficult to tolerate the sound when the intensity is high) [1]. The neurophysiological model of misophonia given by Jastreboff suggests that misophonia follows the same pathway as tinnitus, which involves the autonomic nervous and limbic systems [1]. Hence, misophonia can be prevalent in individuals with tinnitus as well.

The specific individual producing the sounds, might be linked to the negative emotional response experienced by someone with misophonia stemming from various triggers [3]. This can influence the interpersonal dynamics within relationships with friends, family, and relatives, thereby influencing the overall quality of life for those with misophonia. The uncertainty of when trigger sounds might occur creates a constant state of anxiety for sufferers. Consequently, they may begin to avoid certain people, locations, and situations that they anticipate will elicit these trigger sounds. Ultimately, the daily physical and emotional discomfort experienced by individuals with misophonia significantly impacts their overall quality of life. Norena [4] suggests that misophonia is prevailing now as a matter of civilization and manners. This concept hints that misophonia could become more prevalent in the coming generations due to social pressure affecting one's functionality, work life, social life, etc.

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Wu et al. (2014) [5] found that, of 483 US undergraduate students, 19.9% had Misophonia. A survey was conducted on 415 Chinese graduates by Zhou et al. (2017) [6], and misophonia was present in 20% of the sample. In India, Aryal & Prabhu (2022) [7] found that 23.28% of participants had clinically significant misophonia. Thus, the literature indicates how it is necessary to carry out a systematic review to compile the existing data for reference. Misophonia is still not considered a condition with significance despite its high prevalence across various countries, ethnic groups, age groups, and gender groups. Thus, compiling the data may help throw more light on misophonia, and it is essential to keep the data handy and presentable within a single form to make it easy for researchers and implementers. A systematic review of the prevalence of misophonia will increase awareness among health professionals and researchers from those countries where no study has been conducted to carry out more research about misophonia in their countries. And in those EN that have produced the data, it will encourage them to develop a test battery to assess and treat misophonia. Hence, this study attempts to determine the prevalence rate of misophonia across countries through a systematic review.

Methods

The systematic review was registered under the PROSPERO International Prospective Register of Systematic Reviews with the ID CRD42024500395. The review was carried out for peer-reviewed articles based on guidelines by the Preferred Reporting Items for Systematic Review and Meta-analyses statement (PRISMA statement) [8].

Databases like Google Scholar, PubMed, CINAHL, J-STAGE, Web of Science, Cochrane Library, and Scopus were systematically searched to extract articles necessary for the review. Citation tracking and reference lists were used to identify other relevant studies to be added. Articles that dealt with the prevalence data of misophonia in normal-hearing adults were considered. Studies involving misophonia coexisting with any other conditions like tinnitus, hyperacusis, OCD, PTSD, multiple sclerosis, etc., were ignored. No criteria on the year of publishing were set. Studies that were published in English were considered for the review. Articles whose full length were accessible were included. Articles with low methodological quality and languages apart from English, case reports, letters to editors, and editorials were not considered for the review. The selection of the articles was done using the keywords, key terms, related search phrases, derivatives, and MeSH words relevant to the study: "prevalence, misophonia," "selective sound sensitivity syndrome," and "sound tolerance disorders." These were combined using Boolean operators like 'OR,' 'AND', and 'NOT.' Keywords were adjusted across different databases to arrive at the required results. The results were taken in .csv format onto an Excel spreadsheet, and duplicates were removed. Mendeley desktop was used as a reference manager for further assistance with data search, title screening and abstract screening for inclusion. The short-listed abstracts were sought for full-length availability, and the available articles were retrieved for review. Data were extracted from the finalized full-length articles under the following headings: author(s), publication year, method, country, objectives, population, study design, tools used, and results of the study. The quality assessment checklist for prevalence studies adapted from Hoy et al. [9] was used.

Results

The entire process of screening the articles has been depicted through the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart (Fig. 1). A total of 280 articles were screened after searching the databases like Google Scholar, PubMed, CINAHL, J-STAGE, Web of Science, Cochrane Library, and Scopus. 32 duplicates were found that demanded their removal, which led to a total of 248 articles. After the title and abstract screening, two hundred and two articles were excluded, which narrowed down the options for 14 articles for a full-length study. 14 full-length articles were assessed for their eligibility for the review. Out of these, 1 study was excluded as having an irrelevant population and 1 was excluded as it was not peer reviewed during the time of writing this article. A detailed PRISMA flow chart for the selection of the study is shown in Fig. 1.

Table 1 summarizes the objectives, study design, specific tools used, place of the survey, and results of each of the studies taken up for the review in the present study. These studies employed self reported questionnaire surveys, online surveys, pen and paper method, household visits, etc.

After a full-length review of these 12 articles, different prevalence rates in different countries were derived with possible factors affecting the prevalence rates. Those factors can be studied under discussion (see Table 2).

9 risks of bias items were analyzed under the risk of bias levels: low risk for the answer 'yes' with 0 points and high risk for the answer 'no' with 1 point. Points from all nine items were added to identify the risk of each study as low risk (0–3), moderate risk (4–6), and high risk (7–9). All the articles are of *low risk* as per the checklist used.

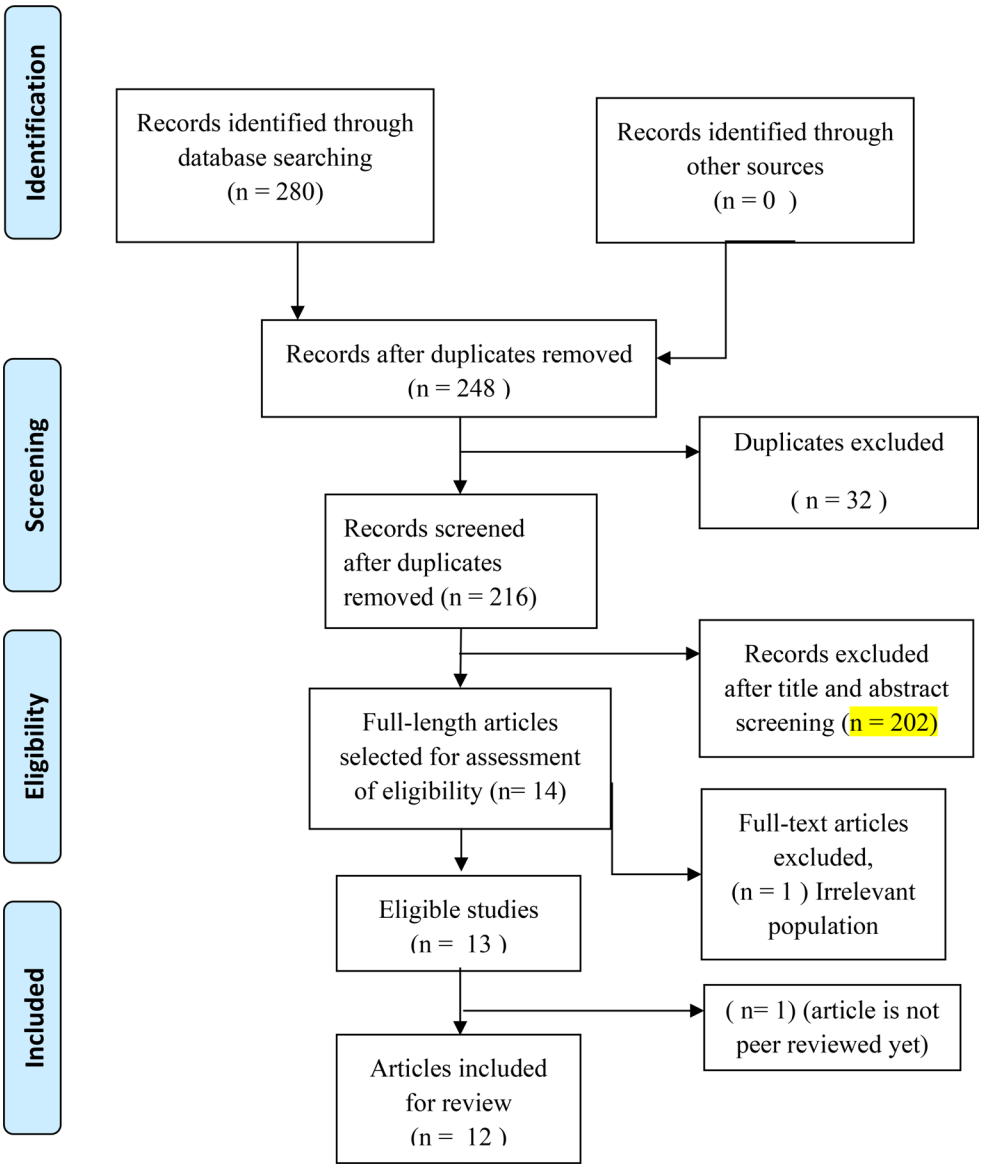

Fig. 1 PRISMA flow chart for the selection process of the article

Discussion

Table 1 is a summary of all the studies reviewed. Misophonia is a condition identified through self-report measures rather than any standardized test battery. Commonly used test materials are The Misophonia Questionnaire (MQ), Misophonia Questionnaire, Adult Sensory Questionnaire, Sheehan Disability Scale – Misophonia, Obsessive Compulsive Inventory-Revised, Amsterdam Misophonia Questionnaire (A-MISO-S), Misophonia Assessment Questionnaire (MAQ), Selective sound sensitivity syndrome scale (S-Five), Misophonia Questionnaire, etc.

One can observe that Zhou et al. (2017) [6], Yektatalab et al. (2022) [10], Vitoratou et al. (2023) [11] have also considered mental health conditions like depression, anxiety, stress, anger, etc. which signifies that misophonia can lead to poor mental health if untreated. Although almost 50% of the sample population had symptoms of misophonia, they did not seem to be affected by the triggers so as to receive professional attention [7]. The severity of misophonia is a hint towards seeking professional help, and people are unaware of the management options available for misophonia. Misophonia is still in its infancy and is not readily accepted as a valid disorder in the scientific community [12]. With such high numbers of prevalence across the globe, misophonia is still not recognized as a distinct illness by either the Diagnostic or Statistical Manual of Mental Disorders, Fifth Edition (DSM-V) or the International Classification of Diseases (ICD-11), Eleventh Edition. Although multiple questionnaires have good reliability and validity, no test materials have been standardized. Aryal & Prabhu (2022) [7] used AMISOS and MAQ on 81 participants who had misophonia

Table 1 Summary of the studies selected for the systematic review

Sl. No.	Author and year	Place/ Country of study	Objectives	Population (*N*)	Design	Tools used	Results
1.	Wu et al. [5]	Florida, US	To explore the occurrence, characteristics, factors related to, and the impairment caused by misophonia symptoms.	*N* = 483 Age > 18 years	Cluster sampling, Online self-administered questionnaire	The Misophonia Questionnaire (MQ)	19.9% reported having clinically significant misophonia symptoms
2.	Zhou et al. [6]	China	The study aims to examine the occurrence and characteristics of misophonia in a sample of Chinese college students by employing self-report measures.	*N* = 415; M age = 19.81;	Questionnaire based study Cluster sampling	Misophonia Questionnaire Adult Sensory Questionnaire Sheehan Disability Scale – Misophonia Obsessive Compulsive Inventory-Revised Depression Anxiety Stress Scale-21 Rage Outbursts and Anger Rating Scale	6% exhibited clinically significant misophonia symptoms
3.	Kılıç et al. [13]	Ankara, Turkey	The current study sought to establish the prevalence of misophonia in a sizable and representative general population sample. This was achieved through the utilization of a comprehensive assessment instrument designed to support clinical diagnosis.	*N* = 541 Age > 15 years	Semi structured interview- survey	Misophonia Interview Schedule = Misophonia Checklist + additional five items for assessing the presence of misophonia diagnosis and 15 items assessing other, misophonia-associated symptoms	12.8% (*n* = 69 of 541)
4.	Naylor et al. [15]	University of Nottingham, England	To determine the prevalence of misophonia among undergraduate medical students enrolled at the University of Nottingham and evaluate the psychometric validity of the Amsterdam Misophonia Scale (A-Miso-S) questionnaire tool within this population.	*N* = 336	Survey	Amsterdam Misophonia Questionnaire (A-MISO-S)	Clinically significant misophonic symptoms appear to be common, effecting 49.1% of the sample population Mild symptoms were seen in 37%, moderate in 12%, severe in 0.3% of participants
5.	Sarigedik & Gulle [16]	Turkey	The study seeks to validate the Amsterdam Misophonia Scale (A-MISO-S) in Turkish and determine its prevalence in the young population.	*N* = 1188 Age > 15 years	Survey, convenient sampling	Socio-demographic Questionniare, Turkish version of Amsterdam Misophonia Scale (A-MISO-S):	Moderate or more severe misophonia symptoms were seen in 13.8% of participants.

Table 1 (continued)

Sl. No.	Author and year	Place/ Country of study	Objectives	Population (*N*)	Design	Tools used	Results
6.	Aryal & Prabhu [7]	India	The objectives of this study are as follows: 1. Finding out the prevalence of misophonia among students at the University of Mysore. 2. Offering detailed information on the symptoms of misophonia, including the frequency and severity of these symptoms. 3. Exploring the co-occurrence of misophonia with other auditory and psychiatric disorders. 4. Describing the impact of misophonia on daily life. 5. Emphasizing the importance of raising awareness about misophonia among the general audience in the discussion.	*N* = 172 Age range: 18–30 years	descriptive cross-sectional study	Amsterdam Misophonia Questionnaire (A-MISO-S) and Misophonia Assessment Questionnaire (MAQ)	1. 48.27% reported misophonia symptoms 23.28% reported clinically significant misophonia. 2. i) According to AMISO-S 33 participants scored between 0 and 4 indicating subclinical misophonia, 38 participants scored between 5 and 9 indicating mild misophonia, 10 participants scored between 10 and 14 indicating moderate misophonia ii) According to Misophonia assessment questionnaire, 65 participants (38.25%)- subclinical misophonia with score 0–11, 10 participants (5.88%) - mild misophonia with score 12–24 4 participants (2.35%)- moderate misophonia with score 25–37 2 participants (1.18%)- severe misophonia with score 38–50 3. 10 of 81 participants who had misophonia reported additional problems such as migraine, headache, asthma and hypothyroidism. 16 participants presented with psychological comorbidities which included depression, anxiety and mood disorders. Balance problems such as giddiness, dizziness, vertigo, motion sickness, were seen in 14 participants. 4. Misophonia has a significant impact on lives of people those with the condition without their knowledge 5. People are unaware of the management options for misophonia due to its hidden nature, hence it is necessary to raise awareness among general public regarding the same.
7.	Jakubovski et al. [14]	Germany	The objective of the study was to carry out the initial extensive epidemiological survey aimed at assessing the prevalence of misophonia symptoms in the adult population of Germany.	*N* = 2519 Age > 16 years	Offline survey	Misophonia Questionnaire (MQ) and the Amsterdam Misophonia Scale-Revised (AMISOS-R).	5% prevalence

Table 1 (continued)

Sl. No.	Author and year	Place/ Country of study	Objectives	Population (*N*)	Design	Tools used	Results
8.	Yektatalab et al. [10]	Iran	The study aimed to ascertain the prevalence of Misophonia and its connection with obsessive-compulsive disorder, anxiety, and depression among undergraduate students at Shiraz University of Medical Sciences.	*N* = 390	analytical descriptive study	Demographic questionnaire, misophonia questionnaire Beck anxiety questionnaire, Beck depression questionnaire, and Maudsley obsessive-compulsive inventory questionnaire	23.8% experienced misophonia.
9.	Vitoratou et al. [11]	The United Kingdom	To evaluate the factor structure and psychometric properties of the S-Five within the specified population.	*N* = 772 Age > 18 years	Stratified sampling, Semi structured interview	Selective sound sensitivity syndrome scale (S-Five), Misophonia Questionnaire [MQ, Amsterdam Misophonia Scale [A-MISO-S; Patient Health Questionnaire-9 [PHQ-9 General Anxiety Disorder-7 questionnaire [GAD-7; preliminary version of the Oxford King's Structured Clinical Interview for Misophonia (Pre-OK-SCIM	18.4% of the UK population experiences misophonia
10.	Sujeeth et al. [19]	India	The research seeks to bridge the gap by examining the prevalence, gender variations, and severity of misophonia among high school students in India.	*N* = 597 M = 328, F = 269 Age range: 14–16 years, mean age: 15.12 years	survey study	The Misophonia Assessment Questionnaire (MAQ)	34.67% of highschool students have misophonia Severity Mild: 52.65% Moderate: 45.41% Severe: 1.93%
11.	Patel et al. [17]	India	The study seeks to determine the prevalence rate and severity of misophonia among college-going students in India, with an additional effort to identify any gender dominance in the phenomenon.	*N* = 328 Undergraduate students	Survey	Amsterdam Misophonia Scale (A-MISO-S), Misophonia Questionnaire	prevalence swas approximately 15.85% with moderate (*N* = 47) to severe degree (*N* = 5) of misophonia
12.	Brennan et al. [18]	University of Illinois at Urbana-Champaign (UIUC)	The study aimed to comprehensively explore misophonia within a diverse and sizable college population, employing an extensive survey test battery that included audiological and psychological questionnaires. The objective was to gain a deeper understanding of the disorder's prevalence and its associations with hearing health.	*N* = 1084 Age range: 18–25 years	Online survey	Misophonia Questionnaire (MQ), Khalfa's Hyperacusis Questionnaire (HQ), Tinnitus and Hearing Survey, and Tinnitus Functional Index (TFI).	Misophonia is prevalent between 8% and 20.02%

Table 2 Quality assessment checklist for prevalence studies adapted from Hoy et al. [9]

Sl. No.	Study Authors	Risk of bias items									Summary on the overall risk of study bias
		Was the study's target population a close representation of the national population in relation to relevant variables, e.g. age, sex, occupation?	Was the sampling frame a true or close representation of the target population?	Was some form of random selection used to select the sample, OR, was a census undertaken?	Was the likelihood of non-response bias minimal?	Were data collected directly from the subjects (as opposed to a proxy)?	Was an acceptable case definition used in the study?	Was the study instrument that measured the parameter of interest (e.g. prevalence of low back pain) shown to have reliability and validity (if necessary)?	Was the same mode of data collection used for all subjects?	Were the numerator(s) and denominator(s) for the parameter of interest appropriate	
1.	Wu et al. [5]	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
2.	Zhou et al. [6]	0	0	0	0	0	0	0	0	0	0
3.	Kılıç et al. [13]	0	0	0	0	0	0	0	1	0	1
4.	Naylor et al. [15]	0	0	0	0	0	0	0	0	0	0
5.	Sarigedik & Gulle [16]	0	0	0	0	0	0	0	0	0	0
6.	Aryal & Prabhu [7]	0	0	0	0	0	0	0	0	0	0
7.	Jakubovski et al. [14]	0	0	0	1	0	0	0	0	0	1
8.	Yektatalab et al. [10]	0	0	0	0	0	0	0	0	0	0
9.	Vitoratou et al. [11]	0	0	0	?	0	0	0	0	0	?
10.	Sujeeth et al. [19]	0	0	0	0	0	0	1	0	0	1
11.	Patel et al. [17]	0	0	0	0	0	0	1	0	0	1
12.	Brennan et al. [18]	0	0	0	0	0	0	0	0	0	0

symptoms and found different severity results accordingly suggesting non uniformity across the questionnaires.

Articles under review incorporated different sampling frames and modes of data collection. Trained interviewers visited households randomly to do one-to-one survey [13, 14]. On the other side, undergraduate and graduate students of various courses which included psychology, mechanical engineering, law, medicine, etc. were sent e-survey forms through convenient sampling methods [5, 7, 10, 15–18]. Zhou et al. (2017) [6] and Sujeeth et al. (2023) [19] visited classrooms and used pen and paper battery on students with self administered questionnaires. The latter authors also had parents assist their children while answering the questionnaires to make the process easier on the subjects as they were highschool students.

Factors affecting the presence of misophonia were studied by various authors. Discussed are the observations recorded from the articles reviewed. While few studies suggested that gender has no role in the prevalence of misophonic symptoms [5–7, 11, 14, 16, 17, 19], few studies contrastingly reported that misophonia is seen more in females than males [13, 18]. It was found that age significantly affects the prevalence of misophonia, with younger individuals being affected more by the condition, and the symptoms deteriorated in older individuals as the age progressed [11, 13]. Paradoxically, according to Wu et al. (2014) [5], age did not have any effects on misophonia. Wu et al. (2014) [5] and Brennan et al. (2023) [18] showed that ethinicty has no effects on the occurence of misophonia in inividuals. Socioeconomic status was proved to not affect misophonia [18]. Kilic et al. (2021) [13] also made few unique notes such as not being married leading to high prevalence of misophonia and also found that misophonics get triggered by visual stimuli as well in the absence of auditory triggers. This suggests that Misophonia requires a standard approach for its assessment and management.

Implications of the Study

Study method is majorly skewed towards online surveys which may have been affected by subjects' bias which could be due to inattentive random answering because of the absence of an interviewer, improper understanding of the questions, etc. The inconsistency observed in various studies underscores the importance of investigating the epidemiology of misophonia using standardized methodological criteria. This research studied a set of such criteria, revealing that a minority of published studies managed to meet the requirements yet it is imperative for forthcoming studies to adhere to a standard methodological criteria to enable a more straightforward comparison of. Prevalence of misophonia and its severity varies depending upon the questions used in the survey. Hence, it is desirable to have a standardized questionnaire with good reliability and validity to achieve consistent results across the globe.

Limitations of the Study

Studies available in English only were considered for the review which led to the ignorance of articles published in native languages. There is a risk of excluding eligible studies. For quality analysis, checklist for prevalence studies by Hoy et al. (2012) [9], was used to analyse the risks of the studies inolved. Although the current results are true and transparent, had there been another checklist to assess the risks of the studies, results of quality analyses would have been different.

Conclusions

Clinically significant misophonia ranges between 5% and 34.67% as found in the 12 studies reviewed. Hence it is necessary not only to accept misophonia as a condition and to come up with management options, but also a well defined approach to ientifying misophonia so that its diagnosis remains universal. Out of 195 countries in the world, misophonia's existence as an independent condition without any comorbidity has been studied in only 7 countries including China, Germany, India, Iran, Turkey, the United States and the United Kingdom. This puts awareness of misophonia in other countries into question and urges researchers to publish their data in English to make it accessible for others. Considering a wider sample from different age groups, ethnicity, profession, etc., for reliable results is emphasized through this review.

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Author Contributions Vidya Gowda was involved in concept development, study design, analysis of the results, interpretation, and writing the manuscript; Prashanth Prabhu was involved in concept development, study design and writing the manuscript.

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Declarations

Ethical Approval In the present study, all the testing procedures were carried out on humans using non-invasive techniques, adhering to the guidelines of the Ethics Approval Committee of the institute.

Conflict of Interest The authors declare no conflicts of interest regarding the publication of this paper.

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