Levels of anxiety and impacts on voice: a literature review

Níveis de ansiedade e impactos na voz: uma revisão da literatura

Los niveles de ansiedad y el impacto en la voz: una revisión de literatura

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Abstract

The aim of this article is to perform a systematic review about anxiety and its impacts on voice. The research was conducted in three databases: PubMed, SciELO and LILACS. To this end, we used the descriptors: "Anxiety", "Voice", "Voice Disorders" and "Dysphonia", as well as their equivalents in Portuguese, in the period from January to March 2015. We found 382 articles and only eight met the eligibility criteria. The studies were analyzed in relation to objectives, type of study, methods of evaluation of anxiety, methods of evaluation of voice, statistical analysis of the data, the main results found, association between voice and anxiety, characteristics of the study population, year of publication and country where there was developed the study. The selected studies showed the predominance of cross-sectional study, published in Portuguese and in the year 2007. In accordance with the methods used for evaluation of anxiety and vocals, there were employed nine different types of evaluation for voice and nine for anxiety. Finally, all the articles presented an association between voice and anxiety. It is important to highlight the increased number of researches involving voice and anxiety in scientific productions, especially in Brazil. It was also observed that the high anxiety influences on the vocal characteristics and the quality of life of the population surveyed.

Keywords: *Anxiety; Voice; Research; Dysphonia.*

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Resumo

O objetivo deste artigo é realizar uma revisão da literatura sobre a ansiedade e seus impactos na voz. A pesquisa foi realizada em três bases de dados: PubMed, SciELO e LILACS. Para tanto, foram utilizados os descritores: "Anxiety", "Voice", "VoiceDisorders" e "Dysphonia", bem como os seus correspondentes em português, no período de janeiro a março de 2015. Foi encontrado um total de 382 artigos e apenas oito atenderam aos critérios de elegibilidade. Os estudos foram analisados quanto aos objetivos; tipo de estudo; métodos de avaliação da ansiedade; métodos de avaliação da voz; análise estatística dos dados; principais resultados encontrados; associação entre voz e ansiedade; características da população estudada; ano de publicação e país onde foi desenvolvido o estudo. Os estudos selecionados apresentaram a predominância de tipo transversal, publicados na língua portuguesa e no ano de 2007. De acordo com os métodos utilizados para avaliação de ansiedade e vocal, foram empregados nove tipos de avaliação diferentes para voz e nove para ansiedade. Por fim, todos os artigos apresentaram associação entre voz e ansiedade. É importante destacar o crescente aumento das pesquisas que envolvem voz e ansiedade em produções científicas, sobretudo brasileiras. Observou-se, ainda, que a alta ansiedade influencia as características vocais e a qualidade de vida da população dos indivíduos pesquisados.

Palavras-chave: *Ansiedade; Voz; Pesquisa; Disfonia.*

Resumen

El objetivo de este artículo es realizar una revisión sistemática acerca de la ansiedad y sus efectos en la voz. La investigación se realizó en tres bases de datos: PubMed, LILACS y SciELO. Con este fin, hemos utilizado los descriptores: "Anxiety", "Voice", "VoiceDisorders" y "Dysphonia", así como sus equivalentes en portugués, en el período de enero a marzo de 2015. Encontramos un total de 382 artículos y sólo 8 cumplieron con los criterios de elegibilidad. Los estudios fueron analizados en relación con los objetivos, el tipo de estudio, los métodos de evaluación de la ansiedad, métodos de evaluación de la voz, el análisis estadístico de los datos, los principales resultados encontrados, asociación entre voz y ansiedad, características de la población estudiada, el año de publicación y el país donde se desarrolló el estudio. Los estudios seleccionados mostraron el predominio de estudio transversal, publicado en portugués y en el año 2007. De acuerdo con los métodos utilizados para la evaluación de la ansiedad y las voces fueron empleados nueve tipos de evaluación diferentes para voz y nueve para la ansiedad. Por último, todos los artículos presentan una asociación entre la voz y la ansiedad. Es importante destacar el aumento de la investigación que involucra la voz y la ansiedad en la producción científica, especialmente en Brasil. También se observó que la gran ansiedad influye en las características de voz y la calidad de vida de la población, de los individuos encuestados.

Palabras claves: *Ansiedad; Voz; Investigación; Disfonía.*

Introduction

The production of voice is a multidimensional phenomenon, that is, it is influenced by physiological, acoustic and perceptive-auditory factors and by the individual's perception of its voice. A change in the production and vocal harmony may result in dysphonia[1,2]. Voice is a factor predominantly used in human socialization as a component of oral language and interpersonal relationships[1]. Moreover, the voice reveals physical, behavioral and emotional characteristics of the individual.

Some patients report emotional problems as a cause or a consequence of dysphonia[3,4]. Psychosocial disorders, such as anxiety, may be both primary and secondary to a voice problem, result in or maintain a vocal disorder, or may be the result of a dysphonia, triggering a vicious circle between emotional and vocal symptoms[4,5].

Anxiety is a complete emotion by virtue of its connection with neurological, psychological and physiological responses. It can be classified as a trace, so that anxiety is considered a constant factor and integrates the individual's personality characteristics. On the other hand, the state of

anxiety is transient and follows certain experienced episodes[4,5,6].

This emotion becomes pathological only when the response intensity and/or frequency do not seem to be proportional to the exposed condition[6]. Furthermore, it is characterized as a normal emotional reaction. However, when in excess, it results in many disorders involving emotional and physiological aspects[7]. Thus, vocal tract structures are also affected by such consequences, changing voice emission, which may involve the development of a vocal disorder. It is worth mentioning that individuals subjected daily to critical issues interfering with their emotional state may have their communication impaired[8].

Anxiety-related voice problems may be a higher pitched voice or breaks in frequency, shallow breathing, increased muscle tension, vocabulary restriction, dysfluency, physical discomfort and tremors[9]. On the other hand, vocal problems may cause psycho-emotional stresses, anxiety, depression and frustration, which negatively affects social functioning and causes significant impacts on the quality and the work efficiency of the individual[10].

Given the above, it is believed a literature review is essential to investigate the relation between anxiety and vocal problems. Thus, this research aims to conduct a literature review in order to elucidate the influence of anxiety on the voice.

Methods

This study resulted from a systematic review of the current literature analyzing the relations between "voice and anxiety." Therefore, a survey of articles related to the topic was performed in the digital databases PubMed, SciELO and LILACS. Therefore, the following descriptors were used: "*Anxiety*", "*Voice*", "*Voice Disorders*" and "*Dysphonia*", and their equivalents in Portuguese using the *AND*Boolean operator. This resulted in the following combinations: anxiety and voice, anxiety and voice disorders, anxiety and dysphonia, anxiety and voice, voice disorder and dysphonia. The search period occurred between January and March 2015.

A search was also conducted in the virtual library *"The Cochrane Library"* to verify the existence of a systematic review with descriptors or objectives similar to those proposed in this study. However, no studies with similar characteristics were found.

The eligibility criteria were (a) presence of the descriptors mentioned in titles, abstracts, keywords or text body, (b) clinical studies, (c) population of all ages, (d) scientific papers published in the last ten years (2004-2014), and (e) complete scientific articles available for free in English or Portuguese. It is worth mentioning that repeated articles were considered only once.

During the search in the databases, 382 articles were found. Initially, the titles and abstracts were read in order to verify compliance with the theme. 47 were pre-selected to be read in full and analyzed according to the eligibility criteria. Eight articles were selected, as shown in Figure 1.

The selected articles were analyzed as for objective, type of study, anxiety evaluation methods, methods for assessing voice, statistical analysis, main results, association between voice and anxiety, characteristics of the study population, year of publication and country where the study was conducted.

Results

The selected articles are arranged and shown in Table 1 and Table 2.

Table 1 shows the characterization of the articles as for authorship, proposed objective, type of study, age of the subjects, year of the survey and country where the research was conducted.

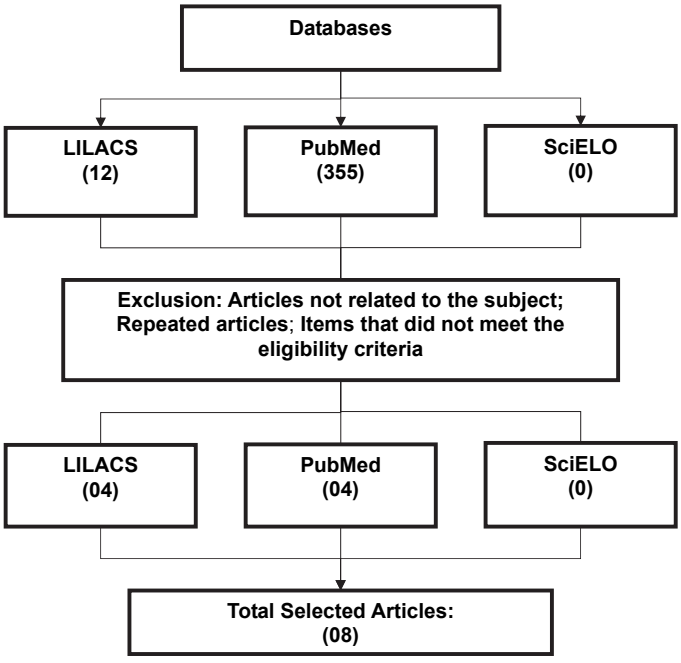

Figure 1. Flowchart of strategies for database search

Table 1. Analysis of the articles selected considering authorship, year of publication, country, objectives, study type and characteristics of the sample

Authors/Year	Objectives	Type of study	Sample	Country
Almeida et al., 2014	Compare vocal and emotional characteristics of teachers and non-teachers with low and high anxiety	Transversal	Men and women/ age: 18-59 years/ 44 teachers and 49 non-teachers	Brazil
Costa et al., 2013	Analyze the interference of risk and emotional factors on the voice of teachers with and without voice complaints	Transversal	Men and women/ age: 18-50 years/ 44 teachers	Brazil
Whiteet al., 2012	Define the correlation between depression and anxiety in people with Spasmodic dysphonia	Transversal	130 patients with spasmodic dysphonia and 157 patients with other voice disorders	USA
Almeida et al., 2011	Investigate the correlation between trait-anxiety, state-anxiety and vocal parameters.	Transversal	Men and women/ age: 19-42 years / 24 adults	Brazil
Cassol et al., 2010	Evaluate the vocal self-image and characterize the acoustic and auditory traits of the voices of individuals with Obsessive Compulsive Disorder (OCD).	Transversal	Men and women/ age: 16-74 years / 17 OCD patients and 18 healthy subjects (control group)	Brazil
Nerrière et al., 2009	Evaluate the prevalence and cofactors of voice disorders among teachers, associating the voice complaint to the psychological state.	Transversal	Men and women/ age: 18-65 years / 10,288 participants	France
Šiupšinskienė et al., 2008	Evaluate the quality of life and voice in patients treated for early laryngeal cancer and healthy individuals as well as the correlations between cancer characteristics and quality of life in the post-treatment of voice.	Longitudinal	Men and women/ Age: 23-83 years / 49 patients with laryngeal cancer and 94 healthy subjects	Lithuania
Ferreira and Benedetti, 2007	Know the conditions of vocal production of teachers of deaf students	Transversal	Women/ 80 teachers of municipal schools	Brazil

As for objectives, it was found that all articles sought to examine relations between emotional aspects, in particular anxiety and vocal problems. As for type of survey, there was a predominance of transversal studies (87.5% - n = 07), and only one article presented a longitudinal or intervention methodology (12.5% - n = 01).

A total of 10,900 individuals, aged 16-74 years, from both genders, were investigated. 50% of the population surveyed were teachers.

As for year of publication, data analysis revealed that such studies began in 2007 and remained constant over the years. The country with the highest number of publications was Brazil (62.5% n = 5), followed by France (n = 1; 12.5%), United States (n = 1; 12.5%) and Lithuania (n = 1; 12.5%).

Table 2 presents the data according to the methods used for emotional and vocal evaluation, tests used for the statistical analysis of each study, main results, and a positive association between voice and anxiety.

Table 2. Voice and anxiety evaluation methods, data analysis and main results of the selected articles for review

Authors	Voice Assessment Methods	Anxiety Assessment Methods	Data analysis	Result	Association between Voice and Anxiety
Almeida et al., 2014	VSSQ, VQLQ, VHI, *APA, *EAV	SRQ-20; STAI	Inferential Statistics, Kruskal Wallis and Mann Whitney Tests	Emotional symptoms (anxiety, stress and depression) may influence proportionally the vocal characteristics and the quality of life of the population of individuals with high anxiety	Yes
Costa et al., 2013	VSSQ, VQLQ, VHI, *APA	SRQ-20; STAI	Inferential Statistics, Mann Whitney Test	Teachers with vocal complaints have a greater emotional and vocal commitment compared to teachers without vocal complaints	Yes
White et al., 2012	Clinical Evaluation of Speech Therapy	Questionnaire aimed to evaluate anxiety (not specified)	T test; Chi-square and Fisher exact tests	Patients with spasmodic dysphonia were not likely to have depression or anxiety as those with other voice disorders	Yes
Almeida et al., 2011	VSSQ, VQLQ, *APA, Acoustic analysis	STAI	Inferential Statistics, Mann Whitney test, Spearman correlation test	This study found that both trait-anxiety and state-anxiety interfered in the expression and the communication of the individual, whether in relation to body, speech and/or voice	Yes
Cassol et al., 2010	Evaluation of Vocal Self Concept	*Y-BOCS Beck Anxiety Inventory (Beck-A) Beck Depression Scale (BDS)	Fischer's exact test, t test and Kolmogorov-Smirnov test	The vocal self-image of individuals with OCD, in general, was positive, except that they considered the voice as "sad" and "bad." There was a change in vocal parameters of patients with OCD	Yes
Nerrière et al., 2009	Questionnaire directed to vocal complaints (not specified)	Questionnaire DSM-IV, SF-36, *MH	Trachoric correlation, Chi square test; Wilcoxon - Mann-Whitney test	Voice disorders were common among French teachers. There were associations with psychiatric disorders and anxiety symptoms.	Yes
Šiupšinskien et al., 2008	VHI	SF-36; *HAD	T test, Mann-Whitney test, Chi-square test	There was a presence of psychiatric disorders and anxiety symptoms in one third of patients with laryngeal cancer	Yes
Ferreira e Benedetti, 2007	CVP-T Questionnaire proposed by Ferreira et al. (2003).	CVP-T Questionnaire proposed by Ferreira et al. (2003).	Spearman correlation test	The conditions of vocal production of the teachers surveyed were similar to those found among teachers of passive students. However, only a third of them mentioned voice changesl	Yes

CAPTION: SRQ-20: Self-Reporting Questionnaire; STAI: State-Trait Anxiety Inventory; Y-BOCS: Yale-Brown Obsessive Compulsive Scale; SF-36: Medical Outcomes Study 36; MH: Mental Health; HADS: Hospital Anxiety and Depression Scale. DSM-IV: Diagnostic and Statistical Manual of Mental Disorders. CVP-T - Conditions of Vocal Production - Teachers

Therefore, it was found that nine different types of evaluations were used. The Vocal Signs and Symptoms Questionnaire (VSSQ) (N = 3; 17.7%), the Voice-Related Quality of Life Questionnaire (VQLQ) (N = 3; 17.7%), the Voice Handicap Index (VHI) (N = 3; 17.7%) and the perceptual-auditory analysis (N = 3; 17.7%) stood out in the research.

Nine different types of anxiety evaluation were employed. The protocol most widely used was the State-Trait Anxiety Inventory (STAI) (n = 3; 25%), followed by*Self-Reporting Questionnaire* (SRQ-20) (n = 2; 16.7%) and *Medical Outcomes Study* 36 (SF-36) (n = 2; 16.7%).

Finally, all articles had associations between vocal symptoms and emotional aspects.

Discussion

Most articles presented in this review analyze anxiety in a determined period and evaluate a possible relation with vocal behavior. However, only one article identifies anxiety in voice at a time of high anxiety (state-anxiety). It is interesting to note that the literature concerning similar evaluations reports the presence of interference in the form of expression and individual communication, whether in relation to body, speech and/or voice[4,5,11].

A study[4] conducted with teachers and non-teachers on vocal and emotional characteristics found that high anxiety groups, especially teachers, showed changes in both vocal and emotional behaviors. In the perceptual-auditory evaluation of voice, all groups showed a slight intensity of vocal deviation in sustained vowels. Non-teachers with high anxiety also showed an average indication of voice alteration. The groups with high anxiety disorder showed, in turn, a predominance of instability and roughness in the voice.

In a research[11] on the risk factors and emotional factors in teacher's voice with and without voice complaints, it was found that teachers with voice complaints reported suffering from more vocal and emotional symptoms, and had a worse self-evaluation compared to teachers without voice complaints. On the other hand, teachers with voice complaints had lower VQLQ scores than teachers without voice complaints, which means a higher interference in the quality of life of individuals. Emotional symptoms were most frequently reported by teachers with voice complaints in the two evaluative questionnaires (SRQ-20 and STAI). In addition, teachers who complained had a higher vocal disadvantage than those who did not complain. In general, the voice of teachers with voice complaints changed more in all parameters when compared to teachers without voice complaints.

Another important aspect is that anxiety was also present in populations with vocal changes, specifically teachers, evidencing an increased number of voice symptoms with the presence of anxiogenic effects associated with psychiatric disorders such as, for example, anxiety and depression[3,12-15].

In another study performed in 2012[12], it was observed that there is a correlation between anxiety and depression regarding the voice of patients with spasmodic dysphonia. It was also verified that patients with dysphonia were no more likely to be diagnosed with depression and/or anxiety than control patients (without dysphonia or any psychiatric disorder). However, when analyzing the duration of the disease, it was observed it was a depression risk factor for both groups (individuals with or without dysphonia).

Such facts corroborate the findings in a research[5] that correlated anxiety to communicative performance. The results evidenced a correlation between trait-anxiety and the data of vocal self-assessment from VQLQ and VSSQ. From the choice of sample at the time of increased anxiety, it was possible to verify the presence of a correlation between trait-anxiety and analysis of perceptual-auditory data covering the vocal tasks of the sustained vowel, connected speech and regular speech. There was also a correlation between state anxiety and the data from perceptual-auditory-visual analysis during an anxiogenic task.

Other research[3]analyzed the vocal characteristics and the psychological aspects of individuals with obsessive-compulsive disorders. Several tests were conducted, reaching the conclusion that, in vocal self-image tests, the types of voice "bad" and "sad" appeared with a greater percentage in individuals with Obsessive Compulsive Disorder (OCD), representing a significant difference. The perceptual-auditory analysis of the voice of individuals with OCD showed the predominance of roughened voice with a small degree of change and, in control cases, obtained a predominance of the adapted voice. It was also found that jitter was the only measurement of disturbances in the short term, with differences between groups.

Other authors[13] contributed to the development of research in order to assess changes in the voice and mental health in teachers. It was found that one in every two female teachers reported voice changes, and one in each four men reported them. The surveyed people that reported vocal disorders showed higher levels of emotional distress. Moreover, co-morbid associations and psycho-pathological disorders, such as anxiety and depression disorders, were also present.

In 2008, a research was conducted[14] in order to assess vocal handicap, stress and anxiety of patients undergoing treatment for laryngeal cancer. Most patients considered their health as regular and 87.8% of them rated their voice as changed by the affirmative mention of VHI. The scores of this protocol also showed that the vocal disadvantage of patients treated for cancer was shown to be worse than that of healthy individuals. They also observed the occurrence of an association of psychiatric co-morbidities in one third of patients, especially anxiety and depression, which in this case may occur differently from other disorders because it is a disease that may lead to death. Thus, it is possible that anxiety be more intense in this situation and permanent and reactive to the patient's condition, that is, it is likely that the vocal diagnosis be the cause of increased anxiety levels.

Finally, it is worth mentioning a study[15] that analyzed the conditions of vocal production of teachers of deaf people. These authors verified that the studied population was composed, in its entirety, of women with an average of 37 years and a high education level. Most considered the working environment as moderate and said that problems such as indiscipline in the classroom, fights and drug problems are the most frequent. Teachers reported they have or had a change in their voice. They mostly reported headaches and anxiety, which may result from situations of violence reported in the school or related to the voice disorder, since most perceived a change in the voice within less than two years, and in an insidious way probably caused by the intensive use of voice or the presence of allergy.

A research[16] affirmed the importance of a literature review as an investigation that provides a summary of evidence indicating specific interventions in related areas. Systematic reviews seem functional to integrate information from a number of studies conducted separately on a particular intervention/therapy, which may present conflicting and/or coincident results. It also identifies issues that need evidencing, pointing to future research.

The reviewed articles had different objectives and scopes regarding the characteristics of the sample. However, they focus on the use of anxiety and voice evaluation methods from the perception of the patient. Voice and anxiety appear as concomitant symptoms. However, their relation must be better understood by conducting studies aiming such a purpose, such as well-structured case-control, cohort or longitudinal studies, for example.

Voice Assessment Methods

The data presented in this review reinforce the importance of vocal self-assessment, mainly using the protocols Voice-Related Quality of Life Questionnaire (VQLQ), Voice Handicap Index (VHI) and Vocal Signs and Symptoms Questionnaire (VSSQ), which were the most used in the selected studies.

Among these, VQLQ is the translated and validated Portuguese version of the *Voice-Related Quality of Life (V-RQOL).* This protocol features 10 items and 2 domains: socio-emotional and physical functioning. Additionally, it provides a total score ranging from 0 to 100. The higher the value of the score, the better the quality of life[18].

The VHI is a translated and validated version of the Voice Handicap Index (VHI) composed of 30 items and 3 domains: functional, organic and emotional. The total score of the VHI is calculated by simple sum and may range from 0 to 120. The higher the final result, the higher the reported voice handicap[19].

The VSSQ aims to determine the occurrence of vocal signs and symptoms. It consists of a list of 14 symptoms contemplating the presence of such symptoms at some point in life, the frequency they appear and the association of the symptom with the work of the subject[20].

Vocal self-assessment data are highly valued in clinical speech therapy and in the literature because they allow observing the patient's perception of the voice problem. For this reason, it has become indispensable for understanding the genesis of dysphonia, for the preparation of the clinical reasoning and consequently for the interventional conduction of vocal disorder cases[21].

Nevertheless, it is known that the voice evaluation, as well as the voice itself, should be multidimensional, using non-instrumental (subjective) and instrumental methods (objectives), complementary and constructive during the evaluation process[22].

This evaluation allows a set of protocols and tests in order to know the nature of vocal changes. In clinical and scientific research, the evaluation of voice implies obtaining information by anamnesis/initial interviews, assessing laryngeal anatomy and physiology (laryngoscopy, endoscopy, stroboscopic, electroglottography), the perception of voice, the functional examination (muscle-skeletal and aerodynamic evaluation). It also allows voice analysis and self-assessment of the psychosocial impacts of the voice[23]. It is extremely important to evaluate the voice in a multidimensional way addressing the clinical and individual point of view[22,23].

It is noted that the studies found generally use only self-assessment, i.e., they assess the vocal characteristics from the patient's perspective, which is insufficient to draw conclusions. Recent studies claim that self-assessment is associated with perceptual voice assessment, which is carried out by experts. It is a more complete assessment of voice capable of basing scientific evidence.

Anxiety Assessment Methods

Studies evidence the importance of measuring the anxiety within a more stable and transient characteristic. State-anxiety refers to a cyclic emotional state characterized by subjective feelings of tension that may vary in intensity over time. Trait-anxiety, in turn, refers to a relatively stable personal predisposition that responds with a higher level of anxiety to stressful situations and that has a tendency to perceive a greater number of situations as threatening[24].

In this review, the most commonly used method for assessing anxiety levels was the State-Trait Anxiety Inventory (STAI). This inventory is a tool that assesses anxiety parameters produced experimentally. It may be applied in a timely moment or may be used to monitor the same person at various times. Initially, the questionnaire was designed[25] and later translated and validated to Portuguese[26]. This instrument has two subscales, STAI S (State) and STAI T (Trace). The first reflects a transient response related to an adverse situation at a specific time. The second refers to a more stable response related to the propensity of the individual to deal with more or less anxiety throughout its life[25,26].

Only 25.0% of the studies (n = 02) evaluated anxiety without validated scales and used a more subjective perspective. The others used at least two validated scales for such measurement. The STAI was selected by 37.5% (n = 03) of the studies as an evaluation method. The SRQ-20 and SF-36 were selected in 25.0% (n = 02) of the articles. The scale for measuring obsessive-compulsive disorder (OCD), Hospital Anxiety and Depression Scale (HADS) and questionnaire of diagnostic classifications of the DSM-IV was selected in 12.5% (n = 01) of the studies.

Type of study, collection, analysis and statistical modeling of data

The studies analyzed in this study were predominately transversal. Cross-sectional studies describe a situation or a phenomenon at a non-defined time represented only by the presence of a disease or disorder. In these studies, the exposure to the factor or cause is present in the effects at the same time or within a defined time range. In longitudinal studies, there is a known temporal sequence between an exposure, the lack thereof or a therapeutic intervention and the presence of pathology. These types of studies are subject to biases arising from extrinsic factors such as the state of the patient on the interview day and the universality of symptoms, or sample decrease in longitudinal studies, which may influence the results[17].

As a result, it is suggested that studies be conducted with a case-control design associated with predictive statistical models to understand the cause and effect relations between anxiety and voice. It is known that this type of study stands out in relation to other types because it includes exposed and non-exposed groups at different times.

The selected studies involved volunteers aged 16-74 years, with a main focus on individuals aged on average 18 and 50 years. Importantly, studies that aim to verify the impact of anxiety on the voice should prioritize adults because they are exempt from the hormonal influences resulting either from vocal changes in adolescents (12-14 years in females, and 13-15 years in males) or the senescence period after menopause or andropause. Such changes have repercussions with a greater or

lesser impact on the voice quality of individuals. It may be considered as a limitation in this research[1].

This literature review found a predominance of Brazilian studies associating voice to emotional aspects. Most of these studies use vocal self-assessment protocols to investigate the association proposed within specific groups, such as professional categories or dysphonic groups with certain installed pathologies.

The statistical analysis of data of a study is a primary tool for validating the resulting information. It provides credibility to the researcher when inferring its findings from populations similar to the studied population. Its conclusions can be used as scientific evidence for the daily praxis[27]. Therefore, the most appropriate statistical methodology should be chosen taking the sample and the research objectives into account.

It was observed that most selected studies aimed to associate vocal characteristics to anxiety and emotional problems. Therefore, selected statistical correlation and/or association tests were consistent with the proposed research, for example, Spearman correlation and Chi-square tests, respectively, which are the most used in research.

The studies are unanimous in describing the association between voice and anxiety. Therefore, the conduction of studies on the cause-effect relations between such factors is suggested, and not only on the relations between them, as reinforced by the findings in the literature described in this review.

Other studies aimed to compare vocal and/or emotional characteristics in specific populations, such as teachers, individuals with cancer or with anxiety disorders, and the general population. To meet this objective - i.e., comparing groups -, parametric and non-parametric tests were used: Student t test, Mann-Whitney test and Kruskal Wallis test. The tests were also applied correctly[27] according to the objectives of the proposed studies.

The methodological choices of statistical analyses were made effectively considering its objectives[28]. It is known, however, that such tests only guarantee the existence or not of a relation between the variables, or they compare different groups. None of the tests showed a cause and effect relation, since the process of inferring causality involves different methods of research from its time classification to the collection of data, variables and data analysis[29].

Conclusion

The findings of this literature review support that high levels of anxiety impact the quality of life and the voice of individuals, causing vocal handicap and increased vocal symptoms. It may also cause changes in vocal parameters. It is noteworthy that, in the studies that specified the assessment of anxiety by STAI, both trait-anxiety and state-anxiety interfered in the manner of expression and communication of the individual.

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