

# Correlation between anxiety and communicative performance

## *Correlação entre ansiedade e performance comunicativa*

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### ABSTRACT

**Purpose:** To investigate the possible existing correlations between trait anxiety, state anxiety, and vocal parameters. **Methods:** Participants were 24 adult subjects, 12 men and 12 women, with ages between 19 and 42 years, with no psychiatric history. The score in the State-Trait Anxiety Inventory (STAI), especially the STAI-Trait, enabled the division of participants into two groups: low anxiety (LA) and high anxiety (HA). Psychological parameters (STAI) and vocal parameters (self-assessment through the vocal signs and symptoms questionnaire and the Voice-Related Quality of Life – V-RQoL protocol; perceptual, auditory and visual assessment of vocal behavior with the description of voice, speech and body parameters; and acoustic analysis). The sustained production of the vowel /a/, counting numbers, and a discourse regarding the subjects' greatest anxiety moments constituted the analyzed material. **Results:** The higher the trait anxiety indicated by STAI, the greater the evidence of anxiety in connected speech and discourse; the higher the vocal pitch, the greater the impairment in speech articulation, coordination between breathing and speech, body movement and facial expression. The higher the state anxiety, the greater the evidence of anxiety in various parameters of the speech, with imbalance in vocal resonance, alterations in the modulation and articulation of speech and in facial expression. **Conclusion:** The trait and state of anxiety differentiated the communicative behavior of individuals, involving changes in the body, speech and voice.

**Keywords:** Behavior; Anxiety/complications; Anxiety/psychology; Communication barriers; Voice

### INTRODUCTION

Anxiety is a normal affective condition that, occurring in excess, may cause humor disturbances as well as alterations in thinking, behavior, and physiological activity<sup>(1)</sup>.

According to the literature, stress and anxiety may be primary or secondary to a voice disorder, generating a vicious circle between emotional and vocal symptoms<sup>(2)</sup>, as observed in some function dysphonia for instance. Many studies reveal that dysphonia diagnostic may be directly related to stress, anxiety, depression, introversion, neuroticism, and social phobia<sup>(2,3-7)</sup>.

Some researches that have pointed out the relationship between vocal problems and emotions were based in reports regarding emotional events throughout lifetime, non-systematic data in medical records, or general questionnaires also addressing the emotional aspect, but few studies have used

psychometric tools, such as questionnaires, inventories, and standardized and valid scales<sup>(3,7-10)</sup>. Currently, it is considered that the mere report of events may not reflect the level of emotion felt<sup>(11)</sup>, which is a limitation to these studies.

Systematic researches including anxiety, stress, and depression should be conducted in order to deepen understanding of its implication on voice and its disorders, and also to be possible to create more appropriated treatment programs, based on its results.

Therefore, the purpose of the present research was to investigate the possible relation between anxiety-trait and anxiety-state according to the vocal parameters.

### METHODS

This research was initially evaluated and approved by the Research Ethics Committee of the Universidade Federal de São Paulo (UNIFESP), under protocol number 0707/05.

### Subjects

Initially it was carried out a pilot study in order to analyze the behavior of study variables. From the obtained results, it was calculated the sample size of 22 participants, based on Cochran (1977)\*.

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\*Cochran WG. Sampling techniques. 3rd ed. New York: John Wiley and Sons, 1977.

Participants were recruited by advertisements on radio, television, and papers promoted by UNIFESP's Press Office. Initially, 103 subjects applied to participate in the research, but only 37 could attend the experiment the way it was designed, and 13 were eliminated due to exclusion criteria or inappropriate image caption for posterior analysis.

Therefore, participants were 24 individuals, 12 female and 12 male, with ages varying from 19 to 42 years, and education level from Elementary School to Graduate education.

The inclusion criteria adopted in this research were: to have age between 18 and 45 years old – minimum age ensuring final process of vocal changes and maximum age, the beginning of structural modifications of the larynx due to the aging process (menopause and andropause), with higher or lower vocal impact –; volunteers without voice complaint and without psychiatric background; and high school as minimum education level, necessary to answer some adopted self-assessment protocols.

After the physician evaluation and answering to a semi-structured interview based on DSM-IV, addressing personal identification, general health, and psychiatric issues, it was verified that all participants had good health, denied psychiatric background, alcohol and drugs abuse, did not use any prescription drugs, and did not report any vocal problems. Chronic smokers, people with palsy or other neurologic disorders involving superior airways, or allergic rhinitis at the moment of the experiment, users of stimulators, psychotropic, herbal, anxiolytic, or anti-depressive drugs, and those who had ingested coffee or alcohol at the day of the experiment were excluded from the sample.

Before the experiment, each volunteer was aware of the purposes of the study and signed the free and informed consent, according to the resolution 196/96 of National Commission of Ethical in Research – CONEP.

## Measurements

### *Psychological*

It was used the State-Trait Anxiety Inventory (STAI) on the valid Brazilian Portuguese (BP) version<sup>(12)</sup>. This tool has two subscales each one with twenty items and four degrees of intensity; one has as purpose to measure the person self-perception about the anxiety-trait (tendency to anxiety characteristic) and the other to anxiety-state (transient emotional state – at the application moment).

### *Vocal*

The vocal parameters were obtained by self-evaluation, auditory-perceptual-visual evaluation, and acoustic evaluation.

To voice self-evaluation it was used the Voice-Related Quality of Life – V-RQOL<sup>(13)</sup>, and the Signs and Symptoms Questionnaire – SSQ<sup>(14)</sup>, translated/adapted to BP<sup>(15)</sup>.

The V-RQOL is a self-evaluation questionnaire to measure the relation of voice and quality of life in aspects related to communication and have ten items and two domains: socio-emotional, expressed in items 4, 5, 8, and 10; and physical, evaluated by the remaining items<sup>(13)</sup>. The SSQ have as purpose to determine the occurrence of voice signs and symptoms; it

has 14 items and contemplates the presence in time, frequency and relation of the symptom with work<sup>(15)</sup>.

Regarding perceptual, auditory and visual analysis, the researchers developed two protocols of auditory-perceptual and visual analysis, based on studies relating voice and emotion<sup>(16,17)</sup>. The first protocol had as purpose to evaluate the anxiety degree observed in the participants during the speech tasks involving sustained vowel and connected speech, measured by an analogue scale. The second one included the vocal parameters evaluation (voice quality, resonance, pitch, loudness, and intonation), speech (articulation, speed, respiration, pneumo-phono-articulatory coordination, and hesitations), and body (movements, facial expression, looking, and gestures).

The analysis material included the sustained vowel emission /a/, counting numbers from 1 to 10, and speech about the moments of major anxiety which the participants had have through life. To auditory-perceptual-visual analysis, a voice specialist was asked to watch the recording video and to identify the anxiety degree of the participant at an analogue scale from 1 to 10 and to point out the voice deviations, speech, and body observed according to the mentioned protocol. It is important to registry that the voice specialist who analyzed the recordings unknown the real degree of participants' anxiety, i.e., it was a blind study by the data evaluator.

To acoustic analysis it was used the software Voxmetria® (CTS Informatics, version 2.5), from which were extracted the following measures: fundamental frequency, minimum fundamental frequency, maximum fundamental frequency, frequency variability, and melodic semitones extension.

## Procedure

After the access to the informed consent and clarification of possible doubts from the volunteer, it was applied the State-Trait Anxiety Inventory – STAI<sup>(12)</sup>, and from the results, the participants were divided into two groups according to the obtained score in the anxiety-trait scale. Participants with scores lower than 40 points were placed in the low anxiety group (LA), and those with scores higher than 41 were placed in the high anxiety group (HA).

Sequentially, the volunteers answered to the V-RQOL and the SSQ, and recordings were made of the sustained vowel /a/, counting numbers, and speech about the “the episodes that caused most anxiety throughout life”. The recordings used a digital video camera, Sony®, model DCR-HC52 MiniDV, fixed at a pedestal at two meters distance from the research volunteer. It was opted to record in a video camera to favor the access to visual resources in body parameters evaluation relevant to communication.

Speech, sustained vowel, and counting numbers were submitted to perceptual, auditory and visual analysis.

## Data analysis

Initially, participants answers in the instruments were scored. To STAI and V-RQOL, validated specific calculus were used to obtain the answers. On the other hand, the responses to the SSQ are calculated by simple addition of

number of vocal signs and symptoms reported by the research participant.

Data were then placed in a digital database and analyzed by descriptive and inferential statistical analysis.

The self-evaluation and auditory-perceptual variables were evaluated by the non-parametric test Mann-Whitney, in order to compare the LA and HA groups. For the variables number of vocal symptoms, anxiety degree by the sustained vowel, and connected speech, the parametric test T-Student was used.

The Spearman Correlation was used to verify the relationship degree between the pairs of variables: STAI x V-RQOL, STAI x SSQ, STAI-T x STAI-T x auditory-perceptive-visual analysis, STAI-T x acoustic analysis, STAI-S x auditory-perceptive-visual analysis, and STAI-S x acoustic analysis.

Differences were considered significant when p-values were lower than 0.05.

## RESULTS

In this topic we present three tables with the results from the measurements taken in the study.

**Table 1.** Psychologic and vocal measures of low and high anxiety group participants

Variable	Group		p-value
	Low anxiety	High anxiety	
STAI-trait	35.2 ± 4.3	55.5 ± 9.1	<0.001*
STAI-state	32 ± 1.3	48.9 ± 2.5	0.006*
Voice self-evalutaion			
Socio-emotional score	97.6 ± 0.7	74.6 ± 7.5	0.17
Physical score	93.4 ± 0.7	63.2 ± 5.6	<0.001*
Total score	95.1 ± 0.6	67.8 ± 6.1	<0.001*
Vocal number of signs and symptoms	2.3 ± 0.4	4.0 ± 0.6	0.03*
Speech tasks			
Sustained vowel	2.3 ± 0.4	4.2 ± 0.6	0.02*
Connected speech	2.5 ± 0.4	4.5 ± 0.6	0.02*

\* Significant values (p<0.05) – Mann Whitney and t Student tests

Table 1 shows the mean and standard deviation from the scores in the STAI, V-RQOL, and SSQ, as well as the degree of deviation found in speech tasks.

Table 2 shows the correlation between anxiety-trait and vocal self-evaluation data from V-RQOL and SSQ. There was correlation among all self-evaluation parameters. The higher the STAI-Trait, the lower the socio-emotional domain (p=0.006), the physical domain (p<0.001), and the total score (p<0.001) in the V-RQOL; the higher the deficit reported in vocal self-evaluation (p=0.03), the higher the number of vocal signs and symptoms (p=0.01), the difficulty to talk down (p=0.04), and the difficulty to project the voice (p=0.01).

Table 3 presents the correlation between the anxiety-trait and the auditory-perceptual-visual analysis involving vocal tasks of sustained vowel, connected speech, and speech. Results showed that the higher the STAI-Trait, the higher the

**Table 2.** Correlation between anxiety trait and voice self-evaluation parameters and quality of life

Variables	Correlation coefficient	p-value
Voice-Related Quality of Life		
Socio-emotional score	-0.542	0.006*
Physical score	-0.882	<0.001*
Total score	-0.853	<0.001*
Voice self-evaluation	0.431	0.03*
Vocal signs and symptoms	0.490	0.01*
Difficulty to talk down	0.422	0.04*
Difficulty to project the voice	0.504	0.01*

\* Significant values (p<0.05) – Spearman Correlation test

**Table 3.** Correlation between anxiety-trait, anxiety-state and auditory-perceptual-visual analysis parameters

Variables	Correlation coefficient	p-value
STAI-T x auditory-perceptual-visual analysis		
Sustained vowel	0.401	0.05
Connected speech	0.480	0.02*
Speech	0.519	0.009*
Body evidence of anxiety	0.609	0.02*
Pitch	0.414	0.04*
Articulation	0.497	0.01*
Pneuno-phono-articulatory coordination	0.454	0.02*
Body movements	0.477	0.02*
Facial expression	0.434	0.03*
STAI-S x auditory-perceptual-visual analysis		
Speech	0.526	0.01*
Resonance	0.510	0.01*
Voice intonation	0.548	0.007*
Speech articulation	0.416	0.04*
Facial expression	0.413	0.04*

\* Significant values (p<0.05) – Spearman Correlation test

evidence of anxiety during the connected speech task (p=0.02), during speech (p=0.009), and higher is the perception of the anxiety degree in the body (p=0.02). Regarding data from the auditory-perceptual-visual analysis approaching voice, speech and body parameters, it was observed that the higher the STAI-Trait, the higher the vocal pitch deficit (p=0.04), the speech articulation deficit (p=0.01), the incoordination between breathing, speaking and articulating (p=0.02), and the facial expression (p=0.03).

Table 3 also shows the correlation between anxiety-state during the anxiogenic task, and data from the auditory-perceptual-visual analysis, involving the vocal tasks of sustained vowel, connected speech, and speech at the anxiety moment. It was possible to observe that the higher the STAI-State, the

higher the evidence of anxiety during speech ( $p=0.01$ ), generating more voice resonance unbalance ( $p=0.01$ ), the higher the voice intonation ( $p=0.007$ ), speech articulation ( $p=0.04$ ), and facial expression ( $p=0.04$ ) deficits.

Regarding the correlation between the anxiety-trait and acoustic analysis parameters, such as: mean fundamental frequency, minimum fundamental frequency, maximum fundamental frequency, frequency variability, and number of semitones, despite showing a tendency of correlation between  $f_0$  and the anxiety trait, there was no correlation for any of the analyzed parameters regarding acoustic analysis. The same occurred in the anxiety-state analysis: there was no correlation for any of the analyzed parameters.

## DISCUSSION

As presented in the results, it is possible to confirm the initial hypothesis that the higher the anxiety-trait and anxiety-state, the higher the deficit in the individual's communication.

The groups LA and HA were different from each other due to the answer to the STAI-Trait: the HA group had higher scores than the other group. Based on this result it was possible to divide the groups to analyze the variables, and it was possible to notice statistical differences between them, as in the results of STAI-State, the vocal self-evaluation (physical and total domains of the V-RQOL, and number of vocal signs and symptoms), and the speech tasks (sustained vowel and connected speech) (Table 1).

The analysis of the V-RQOL results showed that both groups showed different impacts on communication aspects, as the scores of the LA group were higher than the HA group for physical, socio-emotional and total scores, i.e., the LA group had a better quality of life regarding vocal aspects of communication. Moreover, it was verified that the HA group had their voice quality of life more affected in physical and total scores. Comparing the data with the literature<sup>(13,14)</sup>, it was observed that the LA group had similar results to people without dysphonia, and the HA group showed close results to those of people with functional dysphonia.

The HA group had a higher number of vocal signs and symptoms when compared to the LA group. A study carried out with teachers in United States showed that the group of teachers reported, in average, 4.3 vocal signs and symptoms, while non-teachers reported, in average, 3.1<sup>(14)</sup>. In Brazil, teachers reported an average of 3.5 vocal signs and symptoms, and non-teachers, 1.7<sup>(15)</sup>. Thus, it is possible to compare non-teachers with the LA group and teachers with the HA group, due to the high level of stress and anxiety found in this population.

Regarding the correlation between STAI-Trait and vocal self-evaluation (Table 2), the higher the anxiety trait, the lower the socio-emotional and physical domains and the total score of the V-RQOL, and the higher the number of vocal signs and symptoms, especially difficulty to talk down and to project the voice. These data corroborate other pointed out in literature about the relationship between voice and emotional deficits. Stress or the report of stressful events throughout life are more frequent in subjects with voice disorders, or the inverse, subjects with voice disorders report higher emotional issues

when compared to individuals without vocal complaints or disorders<sup>(8-10)</sup>.

Regarding the correlation between STAI-trait and the auditory-perceptual-visual evaluation (Table 2), the higher the anxiety-trait, the higher the evidence of anxiety in connected speech, speech and especially in the body. It is verified a shortage of papers including auditory-perceptual-visual analysis and emotional issues, especially with control of variables related to emotion. Hence, some studies have shown deficits in oral and gestural communication under the influence of emotions, especially anxiety and shyness<sup>(16-21)</sup>.

The correlation between the STAI-trait and the variables assessed during speech (Table 2), the higher the anxiety-trait, the higher the voice pitch, the speech articulation deficit, the pneumophonoarticulatory coordination, of body movements, and facial expression. Besides the correlation between STAI-state and the evidence of anxiety in speech tasks (Table 2), it was verified that the higher the anxiety-state, the higher the evidence of anxiety in speech: the higher the unbalance on voice resonance, the deficit in voice intonation, in speech articulation, and in facial expression.

According to the literature, people under the effect of anxiety may present communication problems, such as: higher pitched voice or frequency breaks, laryngopharyngeal resonance, superficial breathing, increase in muscular tension, vocabulary restriction, disfluency, among others<sup>(16,22)</sup>. Some of these facts may be explained by the activation of the defense cerebral system, causing, among others alterations, the tension of intrinsic muscles of the larynx, as well as body posture<sup>(20,23,24)</sup>.

The correlations between the STAI-trait and acoustic analysis and the STAI-State and acoustic analysis (Table 3) were not significant, however it was possible to identify a tendency towards a positive correlation between mean fundamental frequency and anxiety trait, that is, the higher the anxiety trait, the higher the fundamental frequency. Therefore, it is believed that, with a higher number of participants, these results might be significant.

The literature refers that when people are submitted to fearful or stressful situations, vocal parameters are characterized by the increase in fundamental frequency, and variability of frequency and number of semitones<sup>(16,18)</sup>. Still, it is important to emphasize that, for acoustic analysis, only a few parameters were selected, besides the fact that acoustic analysis is not a specular match of auditory-perceptual analysis, which reinforces the need for an association between both analysis<sup>(25,26)</sup>.

Further researches are recommended to allow the participation of a bigger number of volunteers, as well as the digital recording of voice samples for a more detailed acoustic analysis.

## CONCLUSION

The present study found that both anxiety-trait and anxiety-state interfere in the way of expression and communication of the individual, regarding body, speech and/or voice. The more anxious the subject is, the higher the probability of him/her realizing its anxiety through self-evaluation and of interlocutor to notice the influence of anxiety in his/her communication.

Hence, anxiety trait and state differentiate the communicative behavior of individuals, through body, speech and voice modifications. It is noticed that the higher the degree of anxiety-trait, the higher the deficits in communication and vocal quality of life, and the higher the number of vocal signs and symptoms reported by the individuals.

These findings of this study are important to get to know the vocal limitations triggered by anxiety, which may contribute in the development of rules set to achieve better performance during anxiogenic situations.

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## RESUMO

**Objetivo:** Investigar a correlação entre ansiedade-traço, ansiedade-estado e parâmetros vocais. **Métodos:** Participaram 24 adultos, 12 homens e 12 mulheres, com idades entre 19 e 42 anos e sem antecedentes psiquiátricos. O escore do Inventário de Ansiedade Traço-Estado (IDATE), principalmente o Ansiedade-Traço, possibilitou a divisão dos participantes em dois grupos: baixa ansiedade (BA) e alta ansiedade (AA). Foram avaliados parâmetros psicológicos (IDATE) e vocais (auto-avaliação por questionário de sinais e sintomas vocais, QSSV; protocolo de Qualidade de Vida em Voz – QVV; avaliação perceptivo-auditiva-visual do comportamento vocal com a descrição de parâmetros de voz, fala e corpo; e análise acústica). O material de fala analisado foi a emissão sustentada da vogal /a/, contagem de números e um discurso sobre momentos de maior ansiedade ao longo da vida. **Resultados:** Quanto maior o traço de ansiedade indicado pelo IDATE, maior a evidência de ansiedade na fala encadeada e no discurso; quanto mais agudo o *pitch* da voz, maior o comprometimento da articulação da fala, da coordenação pneumofono-articulatória, da movimentação corporal e da expressão facial. Quanto maior o estado de ansiedade, maior a evidência de ansiedade em diversos parâmetros do discurso, com desequilíbrio na ressonância vocal, comprometimento na modulação, na articulação da fala e na expressão facial. **Conclusão:** O traço e o estado de ansiedade diferenciaram o comportamento comunicativo dos indivíduos, envolvendo modificações no corpo, na fala e na voz.

**Descritores:** Comportamento; Ansiedade/complicações; Ansiedade/psicologia; Barreiras de comunicação; Voz

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