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Comparison of the occurrence of signs and symptoms of vocal and change discomfort in the vocal tract in teachers from different levels of education

Comparaç o da ocorr ncia de sinais e sintomas de altera o vocal e de desconforto no trato vocal em professores de diferentes n veis de ensino

Keywords

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ABSTRACT

Purpose: To analyze and compare the occurrence of signs and symptoms of voice and vocal tract discomfort in teachers from different educational levels. **Methods:** There were 112 teachers, of both sexes, of different grade levels, as follows: 38 of kindergarten, 28 of elementary I, 18 elementary school II and 28 high school. Participants self-rated their voices and answered a questionnaire of personal characteristics and work, Signs and Symptoms Vocal Check list, the Vocal Tract Discomfort Scale (frequency scale). The data were statistically analyzed according to the teaching levels using the Kruskal-Wallis test and Pearson's Chi-Square test ($p < 0.05$). **Results:** In high school, the median age and the frequency of male teachers was significantly higher than in other levels of education. There was no difference in the vocal self-assessment, the occurrence of vocal signs and symptoms and frequency of vocal tract discomfort, depending on the level of education of teachers. **Conclusion:** It is concluded that there was no difference in the occurrence of signs and symptoms of voice and vocal tract discomfort in teachers from different educational levels.

RESUMO

Objetivo: Analisar e comparar a ocorr ncia de sinais e sintomas de voz e de desconforto no trato vocal em docentes de diferentes n veis de ensino. **M todo:** Participaram da pesquisa 112 docentes, de ambos os g neros, de diferentes n veis de ensino, sendo: 38 do Ensino Infantil, 28 do Ensino Fundamental I, 18 do Ensino Fundamental II e 28 do Ensino M dio. Os participantes auto avaliaram suas vozes e responderam um question rio de caracteriza o pessoal e do trabalho, a Lista de Sinais e Sintomas Vocais, a Escala do Desconforto do Trato Vocal (somente frequ ncia da sensa o). Os dados obtidos foram analisados estatisticamente em fun o dos n veis de ensino utilizando-se o Teste Kruskal-Wallis e o Teste Qui-quadrado de Pearson ($p < 0,05$). **Resultados:** No ensino m dio, a mediana de idade e a frequ ncia de docentes do g nero masculino foi significativamente maior que nos demais n veis de ensino. N o houve diferen a na autoavalia o vocal, na ocorr ncia de sinais e sintomas vocais e na frequ ncia de desconforto no trato vocal, em fun o do n vel de ensino dos docentes. **Conclus o:** Conclui-se que n o houve diferen a na ocorr ncia de sinais e sintomas de voz e de desconforto no trato vocal em docentes de diferentes n veis de ensino.

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INTRODUCTION

Teachers are widely investigated professionals in the voice field due to their high risk of developing vocal disorders^(1,2). This higher risk can be related to his work characteristics, such as inappropriate vocal behaviors and individual predisposition^(1,3).

The general population presents 6% to 15% of voice disorders, considering teachers, this value is 20% to 50% and may even reach 80%⁽³⁾. A Brazilian study found that 11.6% of teachers have voice disorders, for non-teachers this prevalence was only 7.5%. The same study found that teachers present more voice disorders during their lives, 63% for teachers versus only 35.8% for the general population⁽⁴⁾.

The most frequent symptoms in these professionals are: hoarseness, vocal fatigue, weak voice, voice breaks, discomfort or pain while using voice, throat dryness, throat clearing, coughing habitually and difficulty projecting voice⁽⁵⁾. Brazilian teachers present an average of 3.7 vocal symptoms, while non-teachers present 1.7 symptoms⁽⁴⁾. Also, teachers present higher frequency of vocal tract discomfort symptoms^(6,7). Generally, these symptoms are related to vocal abuse and intensive voice use, which may result in vocal alteration^(5,8), compromising the teachers professional activities⁽⁹⁾.

Commonly, teachers speak loudly, with vocal effort, for long period of time, in a noisy situation with excessive numbers of students per classroom, inappropriate classroom facilities and are expose to chalk powder^(3,5,8,10). These inappropriate working conditions for an appropriate vocal use, added to inappropriate vocal behaviors and individual biological aspects, makes the teachers more vulnerable to several vocal risk situations^(11,12).

It is important to notice that the daily routine of teachers teaching in different educational stages is quite diverse. These differences are related to the duration of a class, the break period, the total numbers of students per class, the type of vocal activities performed (singing or speaking), the environmental noise, among other differences. Although it is a consensus that teachers teaching in different educational stages present peculiarities regarding their voice and communication use⁽¹³⁻¹⁶⁾, no study compared the educational stages among Brazilian teachers. Thus, it was not analyzed if there is an educational stage where teachers present more vocal deviations.

Therefore, there is a need to better understand the vocal signs and symptoms and the vocal tract discomfort of Brazilian teachers working among different educational stages. This understanding will provide scientific evidence that can better assist speech language pathologists during their clinical practice and while giving orientation for this population.

Hence, the objective of the present study was to analyze and to compare the occurrence of vocal signs and symptoms and vocal tract discomfort in teachers teaching among different educational stages.

METHODS

This study has a cross-sectional, observational and quantitative design. It was accepted by the Committee for Ethics in Research under the protocol number 2247819.

All individuals were informed about the study objectives, agreed to participate and signed an informed consent form.

The teachers who participated in this study were personally invited and recruited in public and private schools in the Rio de Janeiro city, Brazil. They answered a questionnaire with questions related to personal and professional information, such as: name, age, date of birth, gender, years in the profession, levels of education they teach and hours lecture. This questionnaire was also used to characterize the study sample.

This study included teachers of both genders who worked giving classes from Preschool to High School. Teachers who were teaching in more than one educational stage were excluded.

A pilot study was performed to calculate the sample size. The estimation method considered the highest standard deviation obtained for each variables of the self-assessment protocols. The highest value found was 3.53 for "lump in the throat" from the Vocal Tract Discomfort Scale. The significance level was set at 5% and the test power at 80% to detect the minimum differences between groups that would be equal to one standard deviation. The required sample size was found to be 17 participants in each study group.

A total of 167 teachers participated in the selection process; 55 were excluded because they were teaching in more than one educational stage. The remaining 112 teachers were included in the study analysis. There was a total of 87 women and 25 men with a mean age of 41.39 ± 12.36 years old. The individuals were divided as following: 38 Preschool teachers(PS); 28 Elementary School teachers(ES); 18 Middle School teachers(MS) and 28 High School teachers(HS).

Data collection was performed using the following procedures: vocal self-assessment, the Signs and Symptoms Vocal Checklist - SSV^(4,17) and the Vocal Tract Discomfort Scale - VTD^(7,18).

Teachers self-rated their voices as excellent, very good, good, reasonable or bad; the answers were analyzed in a five-point Likert scale, where 1 = excellent and 5 = bad.

The Signs and Symptoms Vocal Checklist (SSVC) has 14 vocal signs and symptoms^(4,17) as following: hoarseness; voice tires or changes quality after short use; trouble speaking or singing softly; difficulty projecting voice; loss of singing range; discomfort while using voice; a monotone voice; effort to talk; chronic throat dryness; chronic throat soreness; frequent throat clearing; bitter or acid taste; swallowing difficulties; a wobbly or shaky voice. The professionals should report if they had or not experienced each one of the symptoms and if they did, they should say if it was or not job related.

The Brazilian translation of the Vocal Tract Discomfort Scale (VTD) was also applied and the teachers had to indicate the frequency of occurrence of 8 symptoms: burning, tightness, dryness, aching, tickling, soreness, irritable and lump in the throat^(7,18). The answer was given in a seven-point Likert scale, where 0 = never and 6 = always. Although the VTD has two answering scales, frequency and intensity, only the frequency was used. According to Behlau et al., (2016)⁽¹⁹⁾,

both answering scales have a very high correlation, thus, only one may be investigated.

The data was tabulated and analyzed using Statistica 17.0 software. The significance level was set at 5% ($p < 0.05$) for all analyzes.

Age is a quantitative variable; therefore, the Shapiro-Wilk normality test was used to verify Gaussian distribution and a non-normal distribution was found. Thus, the Kruskal-Wallis test was used to compare age and educational stages (independent groups).

The voice self-assessment and the VTD are ordinal and qualitative variables. The Kruskal-Wallis test was used to compare these both variables with all educational stages (independent groups).

Gender and the SSVC are nominal and qualitative variables, the Pearson Chi-square test was used to associate these variables with the educational stages (independent groups).

RESULTS

Table 1 shows that high school teachers are older than teachers teaching in other educational stages ($p = 0.047$).

Table 2 shows there are more men teachers teaching in high school when compared to the other educational stages ($p < 0.001$).

Table 3 shows there was no difference in the vocal self-evaluation among teachers teaching in education of any level. All teachers self-evaluated their voices as good (mean = 3).

Table 4 shows no difference regarding the vocal tract discomfort frequency, neither for anyone of the eight symptoms nor all of them. The most frequent discomforts were: dryness (PS=2.89; ES=2.54; MS=2.17; HS=2.18) and irritable throat (PS=1.76; ES=2.04; MS=1.50; HS=1.68); aching for the PS (average=1.71) and the MS (average=1.56), soreness for the PS (average=1.55), the ES (average=1.54) and the MS (average=1.56).

Table 5 shows no difference in the vocal signs and symptoms frequency among all teachers. The chronic throat dryness was the most frequent symptom related to the teacher's professional activities (HS=50.00%; MS=44.44%; ES=46.43%; PS=42.11%), followed by hoarseness (PS=31.58%; ES=35.71%; MS=27.78%; HS=46.43%) and voice tires or changes quality after short use (PS=36.84%; ES=32.14%; MS=33.33%; HS=28.57%).

Table 1. Teachers analysis and comparison of age related to the educational stage

| Educational Stage | N | Average | SD | Q1 | Median | Q3 | p-value |
|-------------------|----|---------|-------|------|--------|------|---------|
| PS | 38 | 39.05 | 12.61 | 28 | 39.5 | 49 | 0.047* |
| ES | 28 | 39.32 | 10.78 | 30 | 40 | 49.5 | |
| MS | 18 | 40.44 | 11.36 | 31 | 38.5 | 46 | |
| HS | 28 | 47.25 | 12.85 | 34.5 | 50 | 58 | |

* $p < 0.05$ – Kruskal-Wallis test

Caption: N = Number; SD = Standard Deviation; Q1= First Quartile; Q3 = Third Quartile; PS = Preschool; ES = Elementary School; MS = Middle School; HS = High School

Table 2. Teachers analysis and association of gender related to the educational stages

| Educational Stage | Gender | | | | p-value |
|-------------------|--------|-------|--------|-------|---------|
| | Male | | Female | | |
| | N | % | N | % | |
| PS | 0 | 0 | 38 | 100 | <0.001* |
| ES | 2 | 7.14 | 26 | 92.86 | |
| MS | 6 | 33.33 | 12 | 66.67 | |
| HS | 17 | 60.71 | 11 | 39.29 | |

* $p < 0.05$ – Pearson Chi-square test

Caption: N = Number; % = Percentage; PS = Preschool; ES = Elementary School; MS = Middle School; HS = High School

Table 3. Teachers analysis and comparison of the vocal self-evaluation related to the educational stages

| Educational Stages | Vocal Self-evaluation | | | | | | p-value |
|--------------------|-----------------------|---------|------|-----|--------|----|---------|
| | N | Average | SD | Q1 | Median | Q3 | |
| PS | 38 | 3.05 | 0.96 | 2 | 3 | 3 | 0.904 |
| ES | 28 | 2.86 | 0.65 | 3 | 3 | 3 | |
| MS | 18 | 2.94 | 0.94 | 2 | 3 | 3 | |
| HS | 28 | 3 | 0.94 | 2.5 | 3 | 4 | |

$p < 0.05$ – Kruskal-Wallis test

Caption: N = Number; SD = Standard Deviation; Q1 = First Quartile; Q3 = Third Quartile; PS = Preschool; ES = Elementary School; MS = Middle School; HS = High School

Table 4. Teachers analysis and comparison of the vocal tract discomfort frequency related to the educational stages

| Educational Stages | VTD | | | | | | p-value |
|--------------------|-----|---------|--------------------|------|--------|-------|---------|
| | N | Average | SD | Q1 | Median | Q3 | |
| | | | Burning | | | | |
| PS | 38 | 1.05 | 1.16 | 0 | 2 | 2 | 0.888 |
| ES | 28 | 1.14 | 1.53 | 0 | 0 | 2 | |
| MS | 18 | 1.22 | 1.26 | 0 | 0 | 2 | |
| HS | 28 | 0.96 | 1.2 | 0 | 0 | 2 | |
| | | | Tightness | | | | |
| PS | 38 | 0.66 | 1.07 | 0 | 0 | 2 | 0.857 |
| ES | 28 | 0.79 | 1.4 | 0 | 0 | 1 | |
| MS | 18 | 0.78 | 1.17 | 0 | 1 | 3 | |
| HS | 28 | 0.61 | 1.13 | 0 | 0 | 1 | |
| | | | Dryness | | | | |
| PS | 38 | 2.89 | 1.56 | 1 | 2 | 4 | 0.297 |
| ES | 28 | 2.54 | 1.73 | 1 | 2 | 4 | |
| MS | 18 | 2.17 | 1.34 | 1 | 2 | 3 | |
| HS | 28 | 2.18 | 1.59 | 1 | 2 | 3 | |
| | | | Aching | | | | |
| PS | 38 | 1.71 | 1.47 | 0 | 2 | 3 | 0.827 |
| ES | 28 | 1.46 | 1.62 | 0 | 1 | 2 | |
| MS | 18 | 1.56 | 1.54 | 0 | 1 | 2 | |
| HS | 28 | 1.46 | 1.53 | 0 | 1 | 3 | |
| | | | Tickling | | | | |
| PS | 38 | 1.08 | 1.32 | 0 | 1 | 2 | 0.339 |
| ES | 28 | 1.36 | 1.47 | 0 | 1 | 2 | |
| MS | 18 | 1.39 | 1.42 | 0 | 1 | 2 | |
| HS | 28 | 0.89 | 1.34 | 0 | 0 | 2 | |
| | | | Soreness | | | | |
| PS | 38 | 1.55 | 1.67 | 0 | 0 | 3 | 0.922 |
| ES | 28 | 1.54 | 1.86 | 0 | 1 | 2 | |
| MS | 18 | 1.56 | 1.79 | 0 | 1 | 2 | |
| HS | 28 | 1.21 | 1.42 | 0 | 1 | 2 | |
| | | | Irritable throat | | | | |
| PS | 38 | 1.76 | 1.53 | 0 | 2 | 2 | 0.758 |
| ES | 28 | 2.04 | 2.05 | 0 | 2 | 3.5 | |
| MS | 18 | 1.5 | 1.65 | 0 | 1 | 2 | |
| HS | 28 | 1.68 | 1.74 | 0 | 1 | 3 | |
| | | | Lump in the throat | | | | |
| PS | 38 | 0.78 | 1.4 | 0 | 0 | 2 | 0.293 |
| ES | 28 | 1.29 | 1.78 | 0 | 0 | 2.5 | |
| MS | 18 | 0.59 | 1 | 0 | 0 | 1 | |
| HS | 28 | 0.41 | 0.84 | 0 | 0 | 1 | |
| Total | | | | | | | 0.730 |
| PS | 38 | 10.72 | 7.98 | 5.00 | 8.50 | 15.00 | |
| ES | 28 | 9.39 | 7.22 | 2.50 | 8.00 | 15.50 | |
| MS | 18 | 12.14 | 10.96 | 2.50 | 10.50 | 18.00 | |
| HS | 28 | 11.45 | 7.85 | 4.00 | 11.50 | 16.00 | |

p<0.05 – Kruskal-Wallis test

Caption: N = Number; SD = Standard Deviation; Q1 = First Quartile; Q3 = Third Quartile; PS = Preschool; ES = Elementary School; MS = Middle School; HS = High School; VTD = Vocal Tract Discomfort Scale

Table 5. Teachers analysis and association of the signs and symptoms vocal checklist related to the educational stages

| SSVC | No | | Yes | | Yes | | p-value |
|--|----|-------|------------------|-------|-------------|-------|---------|
| | N | % | Ever experienced | | Job related | | |
| | | | N | % | N | % | |
| Hoarseness | | | | | | | |
| PS | 18 | 47.37 | 8 | 21.05 | 12 | 31.58 | 0.260 |
| ES | 14 | 50 | 4 | 14.29 | 10 | 35.71 | |
| MS | 11 | 61.11 | 2 | 11.11 | 5 | 27,8 | |
| HS | 15 | 53.57 | 0 | 0 | 13 | 46.43 | |
| Voice tires or changes quality after short use | | | | | | | |
| PS | 19 | 50 | 5 | 13.16 | 14 | 36.84 | 0.535 |
| ES | 16 | 57.14 | 3 | 10.71 | 9 | 32.14 | |
| MS | 12 | 66.67 | 0 | 0 | 6 | 33.3 | |
| HS | 19 | 67.86 | 1 | 3.57 | 8 | 28.57 | |
| Trouble speaking or singing softly | | | | | | | |
| PS | 24 | 63.16 | 7 | 18,2 | 7 | 18.42 | 0.378 |
| ES | 14 | 51.85 | 7 | 25.93 | 6 | 22.22 | |
| MS | 12 | 66.67 | 1 | 5.56 | 5 | 27.78 | |
| HS | 21 | 75 | 2 | 7.14 | 5 | 17.86 | |
| Difficulty projecting voice | | | | | | | |
| PS | 26 | 68.42 | 3 | 7.89 | 9 | 23.68 | 0.499 |
| ES | 22 | 78.57 | 4 | 14.29 | 2 | 7.14 | |
| MS | 12 | 66.67 | 2 | 11.11 | 4 | 22.22 | |
| HS | 16 | 57.14 | 5 | 17.86 | 7 | 25 | |
| Loss of singing range | | | | | | | |
| PS | 15 | 40.54 | 13 | 35.14 | 9 | 24.32 | 0.859 |
| ES | 12 | 44.44 | 12 | 44.44 | 3 | 11.11 | |
| MS | 8 | 44.44 | 6 | 33.33 | 4 | 22.22 | |
| HS | 12 | 42.86 | 12 | 42.86 | 4 | 14.29 | |
| Discomfort while using voice | | | | | | | |
| PS | 27 | 72.97 | 2 | 5.41 | 8 | 21.62 | 0.899 |
| ES | 20 | 71.43 | 2 | 7.14 | 6 | 21.43 | |
| MS | 13 | 76.47 | 0 | 0 | 4 | 23.53 | |
| HS | 23 | 82.14 | 1 | 3.57 | 4 | 14,29 | |
| A monotone voice | | | | | | | |
| PS | 34 | 91.89 | 0 | 0 | 3 | 8.11 | 0,68 |
| ES | 24 | 85.71 | 3 | 10.71 | 1 | 3.57 | |
| MS | 17 | 94.44 | 1 | 5.56 | 0 | 0 | |
| HS | 25 | 89.29 | 0 | 0 | 3 | 10.71 | |
| Effort to talk | | | | | | | |
| PS | 28 | 73.68 | 2 | 5.26 | 8 | 21.05 | 0.180 |
| ES | 23 | 82.14 | 3 | 10.71 | 2 | 7.14 | |
| MS | 11 | 61.11 | 1 | 5.56 | 6 | 33.33 | |
| HS | 19 | 67.86 | 0 | 0 | 9 | 32.14 | |
| Chronic throat dryness | | | | | | | |
| PS | 10 | 26.32 | 12 | 31.58 | 16 | 42.11 | 0.255 |
| ES | 9 | 32.14 | 6 | 21.43 | 13 | 46.43 | |
| MS | 8 | 44.44 | 2 | 11.11 | 8 | 44.44 | |
| HS | 12 | 42.86 | 2 | 7.14 | 14 | 50 | |
| Chronic throat soreness | | | | | | | |
| PS | 25 | 65.79 | 6 | 15.79 | 7 | 18.42 | 0.674 |
| ES | 18 | 66.67 | 3 | 11.11 | 6 | 22.22 | |
| MS | 13 | 72.22 | 0 | 0 | 5 | 27.78 | |
| HS | 18 | 64.29 | 2 | 7.14 | 8 | 28.57 | |

p<0.05 – Pearson Chi-square test

Caption: N = Number; % = Percentage; PS = Preschool; ES = Elementary School; MS = Middle School; HS = High School; SSVC = Signs and Symptoms Vocal Checklist

Regarding the vocal signs and symptoms related to the professional activity, chronic throat dryness, hoarseness and voice tires or changes quality after short use were the most frequent ones (Table 4). It is noteworthy that the SSVC does not have an established normal value for Brazilian Portuguese.

Soreness and burning symptoms are related to the inflammatory or tissue alterations in the larynx and hypopharynx⁽²³⁾. The burning sensation may be due to gastrointestinal disorders such as laryngopharyngeal reflux⁽²⁴⁾ or due to excessive vocal use with loud voice⁽²⁵⁾.

Aching and tightness are related to excessive muscular tension in the larynx and hypopharynx region⁽²⁶⁾. These are common symptoms in individuals with voice disorders⁽²⁶⁾. Also, due to the excessive muscular tension used during the work activity, these symptoms are also common in teachers⁽²⁵⁾. Such muscular tension may be the result of inappropriate vocal adjustment used by teachers to increase their vocal loudness⁽²⁵⁾.

Recent research has shown that the frequency of burning, tickling, soreness and irritable throat symptoms increase after class. These symptoms were attributed to muscular tension in the vocal tract and to a higher risk of developing vocal disorders. This was due to vocal abuse and increased vocal loudness, with excessive tension in the vocal tract, and maintenance of these negative adjustments even after giving lectures⁽²⁵⁾.

Considering the SSVC, chronic throat dryness was the most frequent work-related symptom for teachers from all educational stages (Table 5). Dryness was also the most frequent symptom considering the VTD scale. For the ES and PS, the score was above the one found for healthy voices (Table 4). The dry throat symptom is frequent in Brazilian teachers and can occur due to different reasons: vocal tract dryness due to lack of hydration or insufficient hydration during classes; presence of dust or chalk powder; high vocal loudness and high noise level in the classroom^(1,27,28). Dryness was also found to be one of the most frequent symptoms in Brazilian teachers⁽²⁹⁾, as reinforced by the present study.

It seems that dryness is more frequent for the ES and PS groups once these teachers stay a longer period of time in the same classroom and have smaller breaks. If the teacher does not hydrate properly, stays exposed to dust and chalk powder and does not have the necessary vocal resistance, he will most likely get tired and perform compensatory tension to increase his vocal loudness and be heard by the students. These data corroborate to the high frequency of the “voice tires or changes quality after short use” symptom found for all teachers (Table 5).

In addition, there was a high frequency of hoarseness (Table 5). Hoarseness is one of the most frequent symptoms in teachers^(1,30). It is attributed to the lack of vocal hydration, intense vocal use and vocal fatigue that results from the professional activity⁽³⁰⁾. However, hoarseness is also considered to be an indication of voice disorder⁽¹⁾.

Considering the information presented in this paper, teachers have the same frequency of vocal signs and symptoms regardless the educational stage they teach. In general, teachers presented discomforts and symptoms related to the inappropriate and excessive vocal use and to the presence of muscular tension, as well as to the fact of having to teach in an environment with

inadequate conditions, such as presence of dust or chalk powder and in noisy situations.

Some of this research limitations are regarding to the large number of teachers who had to be excluded from the final analysis once they were teaching in more than one educational stage simultaneously. Also, no control was made regarding teachers who had performed voice therapy.

CONCLUSION

No difference was found among teachers teaching among different educational stages regarding the vocal self-assessment, the signs and symptoms vocal checklist and the vocal tract discomfort frequency scale.

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Author contributions

FMHL – Study delimitation, data collection, data analysis, writing of the manuscript; *AEMF* – study delimitation and revision of the manuscript; *FZ* – study delimitation and revision of the manuscript; *MB* – Study delimitation, data analysis, writing and revision of the manuscript.