

Prevalence of Vocal Problems in Portuguese Primary and Secondary School Level Teachers

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Abstract

This study compared the prevalence of vocal problems in two Portuguese groups: 73 teachers that use their voice as professional tool (teachers' group) and 73 non-voice professionals (control group). It also identified the risk factors that contributed to teachers' group voice problems. A questionnaire was applied to both groups in order to obtain information about vocal health, hygiene and behavior, professional activity and general physical health. Statistical results revealed that the teachers' group presented a higher prevalence of vocal problems than the control group: 52% reported hoarseness, 46.6% vocal fatigue and 45.2% vocal discomfort compared with 31.5%, 20.5% and 28.7%, respectively. Environmental factors (e.g., smoke and cold temperatures), vocal abuse and upper respiratory pathologies (e.g., colds, laryngitis and pharyngitis) seemed to increase teachers' voice disorders (p -value < .05). In conclusion, the absence of vocal pedagogy in the curricular plan of teachers' higher education associated to poor working environmental conditions and professional voice demands explained the higher prevalence of vocal problems in teachers' group.

Keywords: prevalence, vocal problems, teachers, portuguese.

Resumo

Este estudo avalia e compara a prevalência dos problemas vocais em dois grupos: 73 professores que usam a sua voz como ferramenta profissional (grupo experimental) e 73 sujeitos que não usam, profissionalmente, a voz (grupo de controlo). Foram também identificados os fatores de risco dos problemas vocais. Foi aplicado um questionário a ambos os grupos no sentido de obter informação sobre comportamento e higiene vocais, atividade profissional e saúde geral. Os resultados estatísticos revelaram que o grupo dos professores apresentou maior prevalência de problemas vocais que o grupo controle: 52% reportaram rouquidão, 46,6% fadiga vocal e 45,2% desconforto vocal, comparados com 31,5%, 20,5% e 28,7%, respectivamente. Fatores ambientais, tais como fumo e frio, abuso vocal e patologias do trato respiratório superior, tais como constipações, laringites ou faringites foram considerados como fatores de risco dos problemas vocais dos professores (p -value < 0.05). Conclui-se que a ausência de técnica vocal

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no plano curricular da formação acadêmica de professores, associada às fracas condições ambientais de trabalho e à exigência vocal da atividade profissional justificam a prevalência das perturbações vocais, entre os professores.

Palavras-chave: prevalência, problemas vocais, professores, portugueses

Resumen

Este estudio evalúa y compara la prevalencia de los problemas vocales en dos grupos: 73 profesores que usan su voz como herramienta profesional (grupo experimental) y 73 sujetos que no usan, profesionalmente, la voz (grupo de control). Han sido también identificados los factores de riesgo de los problemas vocales. Ha sido aplicada una encuesta a ambos grupos para obtener informaciones sobre comportamiento e higiene vocales, actividad profesional y salud general. Los resultados estadísticos han revelado que el grupo de los profesores ha presentado una mayor prevalencia de problemas vocales que el grupo de control: el 52% ha referido ronquera, el 46,6% fatiga vocal y el 45,2% malestar vocal, comparados con el 31,5%, el 20,5% y 28,7%, respectivamente. Factores ambientales, como humo y frío, abuso vocal y patologías del trato respiratorio superior, como constipaciones, laringitis o faringitis han sido considerados como factores de riesgo de los problemas vocales de los profesores ($p\text{-value} < 0.05$). Se concluye que, la ausencia de técnica vocal en el plan curricular de la formación académica de los profesores, asociada a las débiles condiciones ambientales de trabajo y a la exigencia vocal de la actividad profesional, justifican la prevalencia de las perturbaciones vocales, entre los profesores.

Palabras claves: prevalencia, problemas vocales, profesores, portugueses

Introduction

Vocal problems compromise the communicative efficiency of those whose voice is their main professional tool. The biggest voice professional group in this situation is the group of teachers (Brum, 2004; de Jong, 2006; Dragone et al, 1999; Guimarães, 2004; Kooijman et al, 2006; Motta et al, 2004; Roy et al, 2004; Roy, 2005; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006). Teachers use their voice for several hours during their working day. However, the majority of them are not familiar with the phonation mechanisms involved for voice production. Furthermore, teachers are frequently known to have vocal misuse and abuse (ie., they tend to speak with strong intensity in order to be heard over the classroom noise, drink few liquids and have inadequate breathing patterns) and this is reflected on the quality of their communication in the classroom (Brum, 2004; Dragone et al, 1999; Motta et al, 2004).

Hoarseness, vocal fatigue, laryngeal burn and tense articulation are some of the vocal problems referred by teachers (Brum, 2004; de Jong, 2006; Dragone et al, 1999; Guimarães, 2004; Kooijman

et al, 2006; Motta et al, 2004; Roy et al, 2004; Roy, 2005; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006). In the presence of one or several symptoms referred above, the diagnosis of dysphonia is applied. Dysphonia may result from lesions such as nodules (the most common laryngeal growth), polyps and edema of vocal folds (Brum, 2004).

Brazilian Laryngology and Voice Academy revealed that 2% of Brazilian teachers present vocal disturbances, which compel them to take other educational tasks besides lecturing (Brum, 2004). USA studies reported that 43% of teachers reduced their lecturing activity and 18% were absent from work due to vocal problems. 11% of the 3.3 million American teachers referred constant vocal complaints and 58% experienced vocal problems during their career (Roy, 2005). Vocal complaints from American teachers were more than double when compared with other professional groups: 67% versus 33% (Smith et al, 1997). In spite of the research methodology used to study teachers' vocal problems, the literature review reveals that vocal disorders prevail in this professional group (Brum, 2004; de Jong, 2006; Dragone et al, 1999; Guimarães, 2004; Kooijman et al, 2006; Motta et

al, 2004; Roy et al, 2004; Roy, 2005; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006; Smith et al, 1997). From a clinical point of view, teachers were among the top ten professions who most frequently seek solutions for vocal problems (Smith et al, 1997; Cooper, 1977; Herrington-Hall et al, 1988; Fritzell, 1996).

Portuguese comparative studies revealed that teachers' group prevailed as the one who presented the most vocal complaints and was among the top four professions in which presented dysphonia without laryngeal alterations. Questionnaires revealed the percentage of vocal problems as: 1) 20% of 61 teachers (Guimarães, Cruz, 1997), 2) 54% of 48 primary-level school teachers (Ferreira, 2003) and 3) 40% and 47% of 32 fitness teachers (Larcher, 2002).

The present study's main objective was to evaluate and compare the prevalence of vocal problems in two groups: a group of 73 primary and secondary level school teachers and a control group composed of 73 subjects who were not teachers nor used their voice professionally. Secondary objectives were to identify vocal problems in teachers and potential risk factors.

Method

Subjects

146 subjects participated in this study and were divided into two groups: a group of teachers and a control group. Each group had 73 subjects. Teachers' group had 18 males and 55 females, with 52.1% ranging between 30 and 39 years old. Teachers were from 12 different schools and taught at the following levels: 8 (11%) were on primary-school-level; 9 (12.3%) were on secondary-school-level General Certificate of Secondary Education (GCSE) level; 18 (24.7%) were on secondary A-level; 32 (43.8%) were on secondary school GCSE level and on the secondary A-level; and lastly, 6 teachers (8.2%) did not indicate the level, although the courses' designation allowed one to induce that they either taught at Secondary School GCSE level or at the Secondary A-level.

17,8% of teachers had 5 to 9 years of teaching experience and 46,6% had 10 to 14 years. Each teacher taught an average of 4.4 ± 1.05 hours a day.

The control group included 31 males and 42 females, with 38,5% ranging between 30 and 39 years old. Subjects had several different professions

and none of them required voice use as a professional tool. Their jobs were mostly secretaries, administrative assistants and clerks.

Due to cost efficiency and accessibility reasons, 8 Portuguese geographic regions were selected for data collection, for both groups. They were: Aveiro, Castelo de Paiva, Estremoz, Guarda, Lamego, Ovar, Seixal and Vila Nova de Famalicão. Subjects' characteristics were included in Table 1.

Instruments

Two questionnaires were developed, one for the teachers' group and another for the control group. The questionnaires collected data on vocal health, hygiene and behavior, professional activity and general physical health. They specifically included four main sections: 1) socio-professional characterization, 2) vocal symptoms and signs, 3) consequences of the voice disorders and 4) potential risk factors of the voice disorders.

Questionnaires were designed based on Roy's studies (Roy et al, 2004; Roy, 2005). Most questions required a dichotomic yes/no answer, however at the end written remarks could be included. Complementary questions were included for form and content adaptation to the Portuguese reality.

A Likert scale, from 1 to 5, was used to obtain the frequency of vocal symptoms or signs. The scale could be rated as follow: 1) "never", 2) "once", 3) "rarely", 4) "sometimes" and 5) "frequently". The voice signs and symptoms correspond to those referred in the literature (i.e. hoarseness, vocal fatigue, vocal strain, among others) (Brum, 2004; de Jong, 2006; Dragone et al, 1999; Guimarães, 2004; Kooijman et al, 2006; Motta et al, 2004; Roy et al, 2004; Roy, 2005; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006; Roque, 1999; Behlau, 2001; Colton, Casper, 1996). New items were included in order to allow subjects to insert other voice problems or different ways of solving them. Technical and scientific terminologies were avoided to ensure greater success rate.

Control group's questionnaire didn't present questions about teaching but included questions about job's type and description.

Potential risk factors of vocal disorders selected were the most frequently mentioned in the literature (Dragone et al, 1999; Kooijman et al, 2006; Motta et al, 2004; Sliwinska-Kowalska, 2006; Thomas et al, 2006). Other factors were added and related to the working conditions of teacher's and

Table 1 – Sample description

Group Gender	Teachers		Control	
	M	F	M	F
Age				
20-29	1	11	10	17
30-39	10	28	13	15
40-49	5	11	2	4
50-59	1	3	3	6
+ 60	1	2	2	1
Subtotal	18	55	30	43
Subtotal	73		73	
TOTAL			146	
Teaching daily (hours)			Professional Subject	
1	1	0	Commercial	3 4
2	0	2	Students	0 4
3	4	6	Administrative staff	2 12
4	6	12	Tourism and Restaurants	1 3
5	7	23	Health care	4 4
6	0	7		
No answered	0	5	Others	20 16
Subtotal	18	55		30 43
Subtotal	73		73	
Teaching years				
- 4	0	9		
5-9	5	8		
10-14	8	26		
15-19	2	6		
+ 20	3	6		
Subtotal	18	55		
Subtotal	73			

control group. General health questions were added about respiratory system, medication and chronic health problems.

Procedures

146 questionnaires were personally handed out and collected. The return rate of both questionnaires was 100%.

Statistical analysis

Data was analyzed using the *Statistical Package for Social Sciences* (SPSS) – version 11.5. *Boxplots* were used to observe the differences of the vocal symptoms between the two groups. The mode and the median values were found to be the most adequate values to obtain their frequency using a Likert scale. The end points of the *boxplots* went from the highest to the lowest expected value, up to 1.5 of the *boxplot* length. Each *boxplot*, started

from 25 up to 75 percentile with the thickest line indicating the median value according to the scale in use. The isolated values are shown with the symbol (*).

The variables' frequencies were obtained to visualize the most relevant features of the sample. Furthermore, a relationship between the most relevant variables was still established and as well as the statistical values of $p < .05$ to be statistically significant. The mentioned p -values, resulted from the χ^2 Pearson Test application. The answers related to the vocal symptoms or signs were dichotomized in order to satisfy the theoretical assumptions related to the χ^2 Pearson Test application. All answers "never" or "once" regarding one of the vocal symptoms were grouped into one single category, which was categorized as the number 1. All answers "rarely", "sometimes" and "frequently" were also grouped into one category as number 2. The same procedures were done for potential risk factors of

voice disorders, specifically in question 4 of section D (i.e., *Indicate how often you usually have the following health problems: Cold; Laryngitis; Pharyngitis*). The answers were dichotomized in the following way: “never” with number 1, and all the other options (“rarely”, “sometimes”, and “frequently”) were coded with number 2. The questionnaire variables that have not been mentioned in the results section did not achieve statistical significant.

Results

Prevalence of voice problems

The prevalence of voice problems was higher for the teachers’ group than for the control group. The teachers’s group presented a median frequency of 4 (“sometimes”) for voice symptoms as opposed to the control group which presented a median frequency of 3 (“rarely”). Figure 1 shows the voice symptoms frequency for both groups. Some teachers did not fill-in all the listed symptoms,

as a consequence the number of answers varied (i.e., N). For the symptom *dry throat* the teachers’ group registered an isolated value, indicated by (*), revealing an outlier, i.e., subject 42 answered never having felt this symptom - frequency was of level 1 (“never”).

Teachers’ group presented high median frequencies voice symptoms, such as: *hoarseness*, *vocal fatigue* and *vocal discomfort*. 52% of the teachers reported *hoarseness*, 46,6% *vocal fatigue* and 45,2% *vocal discomfort*, comparatively to 31,5%, 20,5% and 28,7% reported by the control group, respectively. *Vocal fatigue* and *vocal discomfort* showed a median frequency always higher or equivalent to 3 (“rarely”) and with reduced variability. *Hoarseness*, *vocal strain*, *voice loss* and *difficulty to project voice* were symptoms that showed higher median frequencies for the teachers’ group. The majority of the teachers referred indexes from 3 to 5 (i.e., from “rarely” to “frequently” respectively).

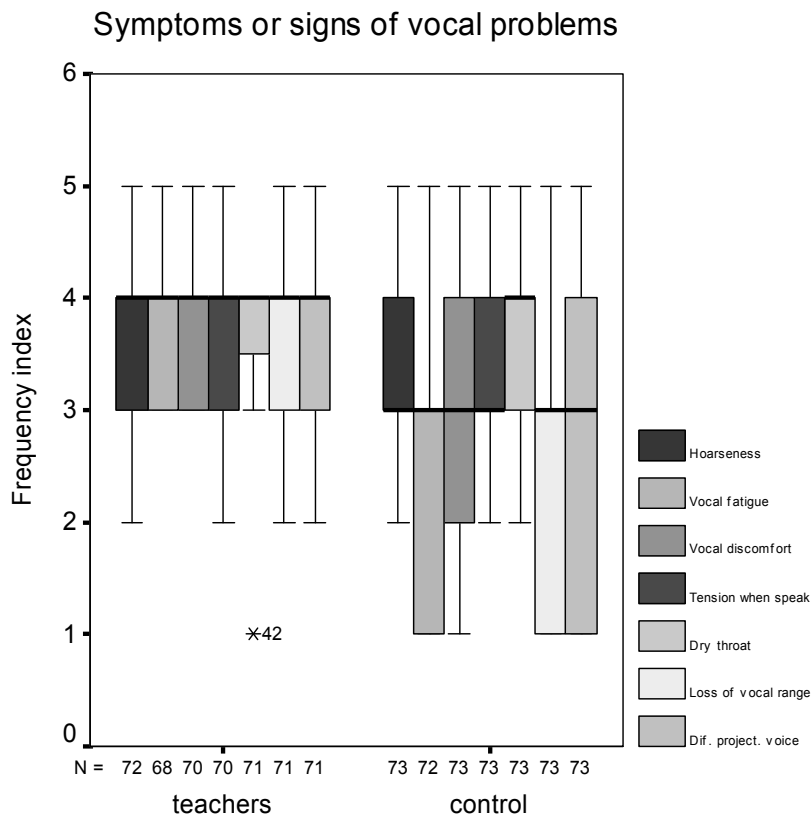


Figure 1 – Frequency of voice symptoms for teachers’ and control groups. The scale was rated as follow: 1) “never”, 2) “once”, 3) “rarely”, 4) “sometimes” and 5) “frequently”

The control group presented a higher variability and asymmetry of values than the teachers' group. Figure 1 presents wider *boxplots* for the control group than for the teachers' group. The median frequency of the voice symptoms was lower when compared with the teachers group, 3 and 4, respectively. The median frequency for all voice symptoms was 3 ("rarely") or lower. For symptoms *vocal fatigue*, *vocal loss* and *difficulty to project the voice*, 75% of the control group showed lower median frequencies (correspondent to level 3 – "rarely" – or less) than the teachers' group. Only the *dry throat* symptom showed the same median frequency for both groups ("frequently").

In order to verify if there was significant association between each vocal symptom and the type of profession the χ^2 Pearson Test was performed. Profession was significantly associated with *hoarseness*, ($\chi^2 = 12, 216; p = 0,016$), with *vocal fatigue*, ($\chi^2 = 36, 471; p = 0,000$), with *vocal discomfort*, ($\chi^2 = 21,613; p = 0,000$), with *throat clear*, ($\chi^2 = 20,261; p = 0,000$), with *vocal loss*, ($\chi^2 = 16, 240, p = 0,003$), and with the *difficulty in projecting voice*, ($\chi^2 = 19,048; p = 0,001$).

Due to the high prevalence of voice symptoms among the teachers' group, when compared with the control group, it was important to identify the causes or the potential risk factors that may induce or perpetuate such symptoms (i.e., vocal behaviors, environmental conditions and general health state).

Potential risk factors of voice problems

Six potential risk factors were significantly different between the two groups ($p < .05$). They were: 1) *environmental noise*, 2) *cold temperatures*, 3) *dust*, 4) *loud talk*, 5) *tea consumption*, and 6) *smoking*. Table 2 shows the statistical results of the potential risk factors. 65.8 % of the teachers' group were exposed to environmental noise compared with 35.6% of the control group, ($\chi^2:1, N = 48; 13.3, p = 0,000$). 56.2% of teachers reported *cold temperatures* in working place, vs. 30.1% of the control group, ($\chi^2:1, N = 41; 10.1, p = 0,001$). 58.9% of teachers reported *dust* in the working place against 37% of the control group, ($\chi^2:1, N = 43; 7.0, p = 0,008$).

Three vocal behaviors were studied as potential risk factors: *fast talk*, *loud talk* and *talk too much*. Only *loud talk* showed a significant difference between the two groups. 72.6% of teachers reported *loud talk*, against 30.1% of the control group ($\chi^2:1, N = 53; 26,3, p = 0,000$).

For the individual intrinsic factors, *tea consumption* presented a significant difference between the two groups, with higher values for teachers' group compared with control group (i.e., 64.4% against 45.2%, respectively), ($\chi^2:1, N = 47; 5.4; p = 0,020$). *Smoking habit* was the only potential risk factor significantly higher for the control group than for the teachers' group (i.e., 35.6% against 16.4%, respectively), ($\chi^2:1, N = 26; 6,9; p = 0,008$).

To investigate other factors that might contribute to the prevalence of voice problems, among the teachers' group, the working environment conditions and the voice symptoms or signs were crossed. The χ^2 Test was run with each working environment conditions and vocal symptoms to see if they were associated for the teachers' group. Considering only the teachers group, the following variables were significantly associated *cold temperatures* and *voice tremor* ($\chi^2 = 4,219; p = 0,040$), *cold temperatures* and *neck pain* ($\chi^2 = 8,213; p = 0,004$), *presence of chemical products at the working place* and *shortage air* ($\chi^2 = 3,896; p = 0,048$), *humidity* and *throat clear* ($\chi^2 = 5,507; p = 0,019$), *smoke* and *excessive throat secretions* ($\chi^2 = 3,924; p = 0,048$), and lastly, *smoke* and *shortage air* ($\chi^2 = 3,917; p = 0,048$).

Clinical history of respiratory pathologies was significantly associated to voice symptoms. Colds, laryngitis and pharyngitis showed significant associations with most voice symptoms, especially for the teachers group. Asthma was significantly associated with the *excessive throat secretions* for the teachers' group, ($\chi^2 = 5,018; p = 0,025$). Table 3 shows the χ^2 Pearson test results. The association between the variables *years of teaching* and *number of daily teaching hours* to each of the voice symptoms did not show a significant statistical result.

Other results

66.7% of the teachers' group revealed changing classroom activities and 38.4 % missed work due to vocal problems. 16.4% of the teachers received specific training on how to use their voice. 4.1%, from these 16.4%, obtained this information during their teaching *curriculum* and all others throughout their continuum education programs.

In order to alleviate the voice problems, 50.7% of the teachers' group reported using *sprays*, *gums* or *drops*, 39.7% searched for a professional health care help (i.e., physician or ENT specialist) and 19,1% reported doing nothing.

Table 2 – Results for potential risk factors among the teacher's group and the control group (c² Pearson's test)

Potential risk factors	Teachers		Control		χ^2	df	p-value
	N	%	N	%			
Respiratory allergies					2,8	1	0,096
Yes	33	47,8	23	33,8			
No	36	52,2	45	66,2			
Asthma					0,1	1	0,717
Yes	7	11,9	9	14,1			
No	52	88,1	55	85,9			
Colds					6,0	3	0,110
Never	0	0	1	1,4			
Rarely	19	16,4	29	39,7			
Sometimes	38	52,8	36	49,3			
Frequently	15	20,8	7	9,6			
Smoking					6,9	1	0,008*
Yes	12	16,4	26	35,6			
No	61	83,6	47	64,4			
Alcohol					3,2	1	0,074
Yes	8	11	16	21,9			
No	65	89	57	78,1			
Drinking coffee					2,7	1	0,097
Yes	48	65,8	57	78,1			
No	25	34,2	16	21,9			
Drinking tea					5,4	1	0,020*
Yes	47	64,4	33	45,2			
No	26	35,6	40	54,8			
Interior noise					13,3	1	0,000*
Yes	48	65,8	26	35,6			
No	25	34,2	47	64,4			
Cold					10,1	1	0,001*
Yes	41	56,2	22	30,1			
No	32	43,8	51	69,9			
Dust					7,0	1	0,008*
Yes	43	58,9	27	37			
No	30	41,1	46	63			
Fast talk					1,0	1	0,307
Yes	31	42,5	25	34,2			
No	42	57,5	48	65,8			
Loud talk					26,3	1	0,000*
Yes	53	72,6	22	30,1			
No	20	27,4	51	69,9			
Talk too much					2,5	1	0,115
Yes	29	39,7	20	27,4			
No	44	60,3	53	72,6			

*p<.05

Table 3 – Results for symptoms/signs of vocal problems and three health problems (c² Pearson's test)

Symptoms Patology	Cold p-value	Laryngitis p-value	Pharyngitis p-value
Hoarseness			
Teachers	0,009*	0,052	0,066
Control group	0,461	0,000*	0,008*
Vocal fatigue			
Teachers	0,049*	0,076	0,358
Control group	0,338	0,074	0,045*
Discomfort related to voice			
Teachers	0,007*	0,016*	0,243
Control group	0,002*	0,053	0,105
Monotonous voice			
Teachers	0,067	0,038*	0,002*
Control group	0,846	0,190	0,812
Speech tension			
Teachers	0,085	0,010*	0,079
Control group	0,734	0,426	0,098
Shortage air			
Teachers	0,044*	0,110	0,014*
Control group	0,209	0,258	0,924
Throat clearing the voice			
Teachers	0,005*	0,028*	0,002*
Control group	0,521	0,151	0,411
Dry throat			
Teachers	0,194	0,017*	0,006*
Control group	0,514	0,964	0,832
Excessive throat secretions			
Teachers	0,519	0,048*	0,001*
Control group	0,010*	0,004*	0,221
Neck pain			
Teachers	0,007*	0,016*	0,062
Control group	0,055	0,207	0,120
Shoulder pain			
Teachers	0,103	0,220	0,356
Control group	0,034*	0,068	0,030*
Trembled voice			
Teachers	0,012*	0,023*	0,053
Control group	0,082	0,061	0,214
Loss of voice reach			
Teachers	0,016*	0,020*	0,013*
Control group	0,096	0,061	0,041*
Difficulty projecting voice			
Teachers	0,010*	0,004*	0,010*
Control group	0,237	0,492	0,812

Discussion

The main objective of this work was to compare the prevalence of voice problems between two Portuguese groups: primary and secondary school level teachers' group and a control group. Results revealed that the teachers' group presented a higher

prevalence of vocal problems than the control group. *Hoarseness*, *vocal fatigue* and *discomfort* were the voice symptoms most frequently referred by the teachers' group: 52%, 46.6% and 45.2%, compared with 31.5%, 20.5% and 28.7% reported by the control group. *Throat clear*, *loss of voice* and *difficulty to project it*, were symptoms significantly

associated with the academic profession. These voice symptoms were also reported by the teachers' group to be a consequence of the intrinsic demands of their profession.

The prevalence of this symptomatology may be associated with voice demands of teachers in order to reach a large group of students. The classroom noise level leads teachers to talk with a strong vocal intensity ranging between 58 and 78 dB (Kooijman et al, 2006; Vilkman, 2000). These factors associated with the absence or incorrect vocal technique, vocal misuse, deficient acoustic and environmental conditions of some schools, justify the higher prevalence of voice problems in the teachers group (Brum, 2004; de Jong, 2006; Dragone et al, 1999; Guimarães, 2004; Kooijman et al, 2006; Motta et al, 2004; Roy et al, 2004; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006; Larcher, 2002; Morton, Watson, 1998).

There are several intrinsic and extrinsic etiological factors that can contribute to the higher prevalence of voice problems in teachers' group. Potential risk factors such as *environmental noise*, *cold temperatures*, *dust*, *tea consumption* and *loud talk* were significantly higher for teachers' group than for the control group. 56.2% and 58.9% of the teachers reported *cold temperatures* and *dusty environments*, respectively. These two factors were significantly different between the two groups ($p = 0,001$ and $0,008$, respectively). The dust from the chalk causes a dry atmosphere and irritability of the vocal folds' mucous membrane (Sliwinska-Kowalska et al, 2006). The teachers should not talk when writing or cleaning the blackboard avoiding dust exposition and also should project the voice towards the students (Brum, 2004). Furthermore, teachers should use a more nasal than oral breathing, in order to filtrate, warm and humidify the inhaled air. This breathing pattern can be used as a defense strategy against *cold temperatures*, *dry and dusty air*, which characterized the working environment conditions of many teachers.

Tea consumption was other potential risk factor significantly higher for the teachers' group ($p = 0,020$). Black tea and coffee have diuretic properties contributing to dehydration and causing *dry mouth*, *throat clearing* and/or *cough* (Guimarães, 2004), vocal behaviors also reported by the teachers' group. In order to keep a healthy voice, one needs to have vocal hygiene habits. Drinking water is the best way to maintain a good general

hydration level including the vocal system. The adult vocal folds' vibration during phonation is 100 to 250 cycles/second, demanding the mucous membrane to be hydrated and reducing attrition. Only 38.4% of the teachers' group reported to have water drinking habits.

Teachers' group reported a daily average of teaching hours of 4 to 5. This variable was significantly associated with vocal symptoms such as *hoarseness*, *vocal fatigue*, and others. The results of this comparative study were in agreement with the previous international investigations (Dragone et al, 1999; Kooijman et al, 2006) and confirmed that the symptom *vocal fatigue* was associated with vocal misuse and not with the number of hours of use. This leads to the importance of the vocal pedagogy for these voice professionals. 83.6% of the teachers' group did not have any education about vocal technique usage, which explained the reported vocal misuse and abuse behaviors: 72.6% *spoke loudly*, 42.5% *spoke fast* and 39.7% *spoke too much*. The generalized absence of vocal pedagogy among teachers was also confirmed in other studies. Arnoux-Sindt et al. (Larcher, 2002) reported that 63.4% of the teachers did not have any information on voice production, basic principles on vocal hygiene, voice problems prevention and vocal quality optimization. Teachers have difficulty in identifying vocal misuse and abuse behaviors and understand the consequences of voice problems. A teacher, who feels pains or throat irritation, tends to adopt strategies that perpetuate the vocal effort, aggravating the existing problems. Therefore, vocal technique knowledge seems to be essential to the teacher's performance in order to prevent voice or other health problems and maximize vocal quality and endurance. These competencies should be taught during the teacher's curricular plan and before the internships.

There were working environmental conditions that were significantly associated with voice symptoms: 1) *cold temperature* and *voice tremor*, 2) *cold temperatures* and *neck pain*, 3) *smoke* and *excessive throat secretions*, 4) *smoke* and *shortage air*, 5) *presence of chemical products* and *shortage air* and 6) *humidity* and *throat clearing*. Some of these conditions were also confirmed by others (Thomas et al, 2006) as favorable to the occurrence of voice problems.

Certain upper respiratory pathologies such as colds, laryngitis and pharyngitis can cause voice

problems. Table 3 shows the association between these respiratory problems and voice symptoms. The teachers' group presented more significantly associated respiratory pathologies with voice symptoms than the control group. These pathologies cause edema of the respiratory and vocal tract mucous membrane leaving the vocal folds more sensitive (Brum, 2004). Arnoux-Sindt et al. (Motta et al, 2004) evaluated laryngoscopically 256 teachers, with voice problems. 34.4% of them presented laryngeal pathology. Le Huchee and Allali (1990) studied 73 cases and revealed that teachers presented a bigger incidence of vocal nodules.

The impact of vocal problems, in the teachers' professional life was absenteeism and limitations of their professional decisions as well as options. According to Sapir, Keidar and Mathers-Schmidt (Morton, Watson, 1998), 9% of the teachers related that voice problems were the reason for stress and frustration; and 21% pointed out that these problems interfere with professional activity. Present study revealed that 66,7% of teachers' group changed their classroom activities and 38,4% missed work due to vocal problems.

This study reveals that Portuguese primary and secondary school level teachers presented a higher prevalence of voice problems than control group. This was the result of a multifactorial analysis, as underlined by several previous international studies on this thematic resulting from the interaction of the working environmental conditions with the vocal misuse and abuse behaviors as well as general physical health. The teachers' voice symptoms can result from a multiplicity of factors and, therefore, the diagnosis of the voice problems implies several factors in order to achieve the best treatment.

Conclusion

The results from this study revealed that the teachers' group presented a higher prevalence of voice symptoms than the control group composed by non-voice professional subjects. All voice symptoms presented a higher frequency in the teachers' group than in the control group.

Cold temperatures, noisy and dusty classrooms were statistically significant working environmental factors that can affect the vocal quality. They can also be potential risk factors of respiratory or laryngeal pathologies, which affect the vocal tract function and ultimately voice production. The

high number of students per classroom increases the environmental noise and the vocal demands as well as vocal effort of the teachers.

In the present study working environmental factors seem to assume a relevant importance in the etiology of voice problems. The percentage of teachers that reported *noise, cold temperature* and *dust* in the classroom (65.8%, 56.2% and 58.9%, respectively) was near the percentage of teachers that reported *hoarseness* (65.7%), *vocal fatigue* (65.8%) and *vocal discomfort* (60.2%). These working environmental conditions precipitate vocal misuse and abuse behaviors. Consequently, they precipitate voice problems and affect the level of the teaching *praxis*. The high percentage of teachers that modified classroom activities and the high absenteeism, caused by the voice problems, are, equally, consequences that help us understand the dimension of this issue.

In conclusion, the prevalence of the voice problems, among teachers, seems to result from a multiplicity of factors. The vocal misuse and abuse (*loud talk, inadequate respiratory patterns*), the working environmental conditions of the school and the general health of the teacher concur to the appearance of voice problems. The environmental conditions precipitate certain behaviors placing vocal health at risk. These factors can also be associated to the emotional factors (Kooijman et al, 2006; Sliwinska-Kowalska et al, 2006; Thomas et al, 2006) (professional instability, indiscipline, the constant curricular and legislative changes at school level).

Future studies should be performed with a bigger sample size, different levels of education and different geographic locations. The improvement of research on teaching practice, on several levels, and the relation between this action and the existence of problems in the voice will allow a more detailed identification of the etiologic factors of the disorders. Therefore, prevention and treatment of voice problems will be increasingly more efficient over time. Thus it is considered pertinent that studies on the voice problems include the intervention of the Ear, Nose and Throat Specialist. The assessment of symptoms shows that voice problems are common. The fact that studies are conducted in the whole country will contribute decisively to the inclusion of voice problems in teachers' professional illnesses.

The work carried out points to the need of prevention programs on voice problems for teachers. At a moment in which the academic training of teachers is being reconsidered under the light of the Bologna process, it is important to consider the existence of a course concerned with vocal pedagogy and technique in initial teacher training curriculum.

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