REVISTA CEFAC
SPEECH, LANGUAGE, HEARING SCIENCES AND EDUCATION JOURNAL
Rev. CEFAC. 2016 Maio-Jun; 18(3):635-648 doi: 10.1590/1982-021620161838515

Original articles

Occupational, general health and vocal profile of teachers of Santa Maria city

Perfil vocal, ocupacional e de saúde geral de docentes de Santa Maria/RS

Carla Aparecida Cielo[1]
Caroline Rodrigues Portalete[2]
Vanessa Veis Ribeiro[3]
Gabriele Rodrigues Bastilha[1]

[1] Departamento de Fonoaudiologia e Programa de Pós-Graduação em Distúrbios da Comunicação Humana da Universidade Federal de Santa Maria – PPGDCH/UFSM – Santa Maria (RS), Brasil.
[2] Departamento de Fonoaudiologia da Universidade Federal de Santa Maria –UFSM – Santa Maria (RS), Brasil.
[3] Universidade de São Paulo - FOB/USP – Bauru (SP), Brasil.

Source of aid: CAPES, CNPq

Conflict of interest: non-existent

Received on: June 16, 2015
Accepted on: July 20, 2015

Mailing address:
Gabriele Rodrigues Bastilha
UFSM – Av. Roraima nº 1000
Cidade Universitária - Bairro Camobi
Prédio 26 – 4º andar
Departamento de Fonoaudiologia
Santa Maria – RS – Brasil
CEP: 97105-900
E-mail: fonogabriele@gmail.com

ABSTRACT

Purpose: to characterize and relate the vocal, occupational and general health profile of elementary school teachers from Santa Maria/RS.

Methods: observational analytical cross-sectional study of quantitative character. The sample consisted by 127 teachers (average age of 38.25 years-old) who responded to a questionnaire and underwent hearing screening, perceptual voice assessment and acoustic analysis.

Results: average of 7,03h/day of teaching; work as a teacher for 13,13 years on average; high occurrence of vocal complaints and there was no reports of respiratory disorders, alcoholism and smoking habits; most showed no disorders in the auditory perceptual parameters; the acoustic analysis presented disorders in measures of disturbance frequency, the amplitude and noise; the teachers who have submitted complaints vocals had daily workload higher than those that did not show; teachers with vocal complaints presented significant changes in measurement of the fundamental frequency variation (jitter); and it was found a statistically significant relationship between respiratory disorders and the measurement of the relative average frequency disturbance (jitter).

Conclusion: there is high occurrence of vocal complaints among elementary school teachers, and these were related with the high workload and acoustic measures of jitter, which also presented relation to the related respiratory disorders.

Keywords: Epidemiology; Dysphonia; Occupational Health; Voice

RESUMO

Objetivo: caracterizar e relacionar o perfil vocal, ocupacional e de saúde geral de professores do ensino fundamental de Santa Maria/RS.

Métodos: estudo transversal observacional analítico de caráter quantitativo. A amostra constituiu-se de 127 professores (média de idade de 38,25 anos), que responderam a um questionário e foram submetidos à triagem auditiva, avaliação vocal perceptivoauditiva e avaliação acústica.

Resultados: média de 7,03h/dia de docência; trabalho como docente há 13,13 anos em média; elevada ocorrência de queixas vocais e ausência de relato de distúrbios respiratórios e hábitos de etilismo e tabagismo; a maioria não apresentou alterações nos parâmetros perceptivoauditivos, e na análise acústica, apresentou alterações nas medidas de perturbação de frequência e amplitude e de ruído; os professores que apresentaram queixas vocais tinham carga horária diária superior aos que não apresentaram; os professores com queixas vocais apresentaram alterações significantes na medida variação da frequência fundamental (*jitter*); e verificou-se relação estatisticamente significante entre distúrbios respiratórios e a medida da média relativa da perturbação de frequência (*jitter*).

Conclusão: há elevada ocorrência de queixas vocais entre professores do ensino fundamental e essas se relacionam com a carga horária elevada e com medidas acústicas de *jitter* que também apresentam relação com o relato da presença de distúrbios respiratórios.

Descritores: Epidemiologia; Disfonia; Saúde do Trabalhador; Voz

INTRODUCTION

One of the biggest interests on voice researches is the teacher's vocal health, interest that keeps rising since the last decade[1-12] as a result of the importance of the craft the teacher exert before the society[8].

Since 1997, the Speech Federal Council understands that most voice disturbs must be classified as "occupational diseases"[13]. An American research pointed that the vocal symptoms are more frequent on teachers than on the population in general, also showing that, as a result of these vocal changes, the teachers miss work a lot[14, 15]. In Brazil, the reality is similar, considering the unfavorable work conditions to the correct usage of the voice and the massive number of teachers in the country, besides the women's histological and anatomical conditions, most in teaching, that predispose them to dysphonia[5-7].

Surveys point that the vocal symptoms most found on teachers are: vocal fatigue, loss of voice, pain on the throat area, hoarseness, hem, persistent cough and sensation of grip and heaviness on the throat[3,16,17]. However, besides these symptoms being many times frequent and intense, a study shows that the teachers only search for professional support when there are other health disorders associated[9]. Those data were confirmed by a held investigation with kindergarten and elementary school teachers of Santa Maria/RS, showing that less than 50% of the teachers that presented aphonia looked for specialized medical help.

Study that sought the reason for the late search for health attendance and for the big occurrence of vocal disturb evidenced that the teachers use to work without proper vocal preparation, many times with no knowledge of vocal health questions and making inappropriate use of the voice[18]. The incorrect vocal uses, when constantly and long-term used, can put in risk the teacher's voice[18] and, considering that it is indispensable for the exertion of their profession, it can bring consequences for their career, causing prejudice for the school and the society[12].

On the national literature, many works aim to use strict criteria for the composition of study groups, excluding questions of general health, what makes that, many times, the researches not picture the real conditions of teachers that are at work in the country. It's believed that an analysis together of the characteristics of general, vocal and occupational health be of great worth for the design of actions of teacher's vocal health promotionseeing that, on this group of voice professionals, it is used as a mediator on the relationship with the student and on the teach-learning process[19], also exerting a social and economic importance.

Thus, the objective of this study is to characterize and lost the vocal profile, occupational and of general health of elementary school teachers from Santa Maria/RS.

METHODS

The research was characterized by being of the analytical observational cross kind of quantitative character, performed according to recommendations of the 466/12 norm of the National Commissionof Ethics in Research, and approved by the Ethics Committee of the home institution (protocol no. 23081.016945/2010-76). The responsible ones for the educational institutions received the necessary clarifications and were invited to sign the Institutional Authorization Term (IAT). The volunteers of the authorized schools were clarified about the survey and invited to sign the Free and Clarified Agreement Term (FCAT).

The study had as target population elementary school teachers of the urban area of the city of Santa Maria (RS), of the private, state and municipal networks.

For the sample constitution, were stablished the following criteria of inclusion: teachers of elementary schools (1st to 9thgrade) of state, municipal and private networks, just from the urban area of the city of Santa Maria (RS); both genders; age above 19 and under 65 years; adhesion to the FCAT.

The stablished excluding criteria were: flunk on the hearing screening; report of allergic, respiratory or gastric crisis or hormonal dysfunction due to pregnancy or pre-menstrual or menstrual periods on the evaluation days; incomplete data on the screening protocols.

A data collection of the municipal schools, just of the urban network, from all regions of Santa Maria, resulting on 36 private schools and 68 public schools (44 municipal and 24 state). Based on these data, three lists were made for each region, being the order of the schools drawn randomly, of what were excluded one school to each present one, remaining 27 private schools, 31 municipal and 19 state that were invited to participate in the study. 15 schools adhered to the IAT and all teachers were invited to participate the sampling process, wherein 219 teachers adhered the FCAT.

To select the sample, the subjects were submitted to hearing screening and answered in writing to a questionnaire composed by questions referring to occupational, general and vocal health data. The hearing screening was held with the audiometer

Amplivox, model A260, 2011, by scanning of pure tones on the frequencies of 500Hz to 4kHz in 25dB, only through air means. For the execution of the procedure, a silent room given in by the school with noise-level under 50dB, verified by the sound pressure measurer *Instrutherm*, model Dec-480. The subjects that didn't respond to the pure tone in 25dB were retested and the cases that flunked the retesting were excluded from the survey and sent for complete hearing evaluation.

Of the 219 volunteer teachers, 14 were excluded on the hearing screening and 78 by presenting incomplete data on the questionnaire. This way, the sample is constituted of 127 teachers, being 117 women and ten men, of ages between 20 and 64 years old (average age of 38,25 years), of those 53,54% pertained to the private education network (n=68), 19,92% to the state (n=38) and 16,53% to the municipal (n=21). For the gathering, an auditory perceptual vocal evaluation and an acoustic analysis of the voice were held.

The samples were collected by the sustained utterance of the vowel "a", spontaneous speech by the question "Tell me about the importance of the voice in your profession", and the sentences proposed by the CAPE-V protocol[20]. On the vocal utterance, the individuals were oriented to perform in a sustained manner in habitual *pitch* and *loudness*, after deep breath, in a maximum phonation time, without using the expiratory reservation. Each sample was collected three times, being considered the longest one. On the utterance of the proposed sentences by the CAPE-V protocol and of the spontaneous speech, the subjects were oriented to utter, in speed of speech, habitual *pitch* and *loudness*. The record time of each speech situation was not controlled, letting each individual free to perform them according to their capacity. The utterances were collected by a digital professional recorder of the brand *Zoom*, model *H4n*, with quantization rate of 96 kHz and 16*bits*, with recording in 50% of the entry level. The recorder was attached to a pedestal 90°-angled of the subject's mouth, with linked *BehringerECM 8000* professional omnidirectional microphone, with capitation range of frequencies between 15 and 20kHz. The individuals kept distance of four centimeters between the microphone and the mouth for the vowels' utterance and ten centimeters for the sentences' and spontaneous speech utterance.

The protocol CAPE-V was used for the auditory perceptual analysis. Were used the sustained utterance of the vowel "a" without edition, the spontaneous speech and the sentences proposed by the protocol. The voices were recorded in *Digital Versatile Disc* (DVD) 52x, 7GB, with PCM audio format; 96kHz; 16*bits*; mono, converted into the extension *wave form*. After that, were disposed on the DVD folders with the three samples, without the participant's identification, randomly, with repetition of approximately 20% (for the evaluators' reliability analysis) and were sent to five speech therapists with at least a 5-year experience on the area and not authors of the study. The judges were blinded about the survey's objectives, the sex, the replication of the utterances and the evaluations left by the other speech therapists, being told just about the subjects' general age group and oriented to hear the voices as much times as necessary in a silent environment and with computer configurations of: 16*bits*, 96kHz. They were also oriented to make the analysis according to the parameters of the CAPE-V protocol (dysphonia, breathiness, roughness and tension general degrees). CAPE-V is a visual analog protocol, composed by a linear analog scale that goes from zero to 100mm, being able to be analyzed quantitatively[20]. The *pitch* and *loudness* parameters that depend, respectively, on the comparison with pairs of same sex and age and on the communicational context to be judged, also integrate the CAPE-V protocol, nonetheless, as the judges were blinded about the sex and didn't make the present evaluation with the participants, these both aspects were not considered on this research.

After the voices evaluation by the judges, a statistic analysis was held, in order to verify the intra and inter evaluatorreliability by means of the *Kappa* coefficient, being selected the evaluations from the three speech therapists with higher inter evaluator reliability, and based on these three analysis, an average was made for each parameter of the CAPE-V scale. For the deviation degree classification, the Brazilian pattern was used, whereby the scores between zero and 35,5% are considered normal; between 35,6% and 50,5% a light deviation; from 50,6% to 90,5% moderate deviation and above 90,6% the deviation is considered intense[21].

For the acoustic analysis from glottal source was used the *Multi Dimensional Voice Program Advanced* da *Kay Pentax®software*, with sampling rate of 44kHz and 16*bits*, analyzing the sustained utterances of the vowel "a", with the vocal attack and the end of the utterance eliminated in order to prevent the influence of natural periods of voice instability. The shortest edited time among all the participants was pf four seconds, which is standardized for the acoustic analysis. Were grouped and analyzed the measures the following

way: (1) frequency measures: f0; f0 maximum (fhi); f0 minimum (flo); standard-deviation of f0 (STD); (2) frequency disturbance measures or *jitter*: disturbance relative average (RAP); *jitter* percentage (*Jitt*); absolute *jitter* (*Jita*); disturbance quotient of the softened *pitch* (sPPQ); *pitch* disturbance quotient(PPQ); variation coefficient of the f0 (vf0); (3) amplitude disturbance measures or *shimmer*: *shimmer* in dB (ShdB); *shimmer* percentage (Shim); amplitude variation coefficient (vAm); amplitude disturbance quotient(APQ); softened amplitude disturbance quotient (sAPQ); (4) noise measures: noise harmonicproportion(NHR); soft phonationindex (SPI); voice turbulence index (VTI); (5) voice breaks measures: numberof voice breaks (NVB); degreeof voice breaks (DVB); (6) deaf of unvocalized segments measures: degree of unvocalized segments(DUV); number of unvocalized segments (NUV); (7) sub-harmonic segments measures: numberof sub-harmonic segments (NSH); degreeof sub-harmonic components (DSH). It's believed that the measures' group analysis provides higher reliability for the data analysis, since that still there isn't in the literature an exact correspondence between each of the acoustic measures and the adjacent phenomenon. Were considered the normality parameters by sex proposed by the program.

The analyzed data referring to general health, vocal and occupational complaints were removed from the questionnaire filled in by the teachers.

The data were statistically analyzed through ANOVA and Chi-Square test of Pearson non-parametric tests, adopting the significance level of 5%.

RESULTS

In the present study, the group of researched teachers functioned an average of 7,03h/day and worked as a teacher about 13,13 years; 53,54% of the teachers pertained to the private education network (n=68), 19,92% to the state (n=38) and 16,53% to the municipal (n=21).

In the table 1, the descriptive results about the aspects of vocal complaint, general health, acoustic analysis of glottal and auditory perceptual sources of the voice are observed.

It's seen, in the table 2, the relation of vocal complaint with the results of the acoustic and auditory perceptual analysis of the voice.

The relation of smoking report with the results of the acoustic and auditory perceptual analysis of the voice can be seen in the table 3.

In the table 4, it's verified the relation of the respiratory disorder report with the results of the acoustic and auditory perceptual analysis of the voice.

The table 5 shows the analysis of the variables vocal complaint, smoking report and respiratory disorder report according to the period of use of the professional voice, daily function and age.

Table 1. Descriptive results about the aspects of vocal complaint, general health, acoustic analysis of glottal and auditory perceptual sources of the voice

Measures			Normality	n	%
MDVPA	Frequency	f0 (HZ)	NOR	124	97,63
			CHA	3	2,36
		fhi (Hz)	NOR	120	94,48
			CHA	7	5,51
		flo (Hz)	NOR	125	98,42
			CHA	2	1,57
		STD (Hz)	NOR	66	51,92
			CHA	61	48,03
	Frequency disturbance	Jita (Ms)	NOR	21	16,53
			CHA	106	83,46
		Jitt (%)	NOR	33	25,98
			CHA	94	74,01
		RAP (%)	NOR	33	25,98
			CHA	94	74,01
		PPQ (%)	NOR	32	25,19
			CHA	95	74,80
		sPPQ (%)	NOR	29	22,83
			CHA	98	77,16
		vf0 (%)	NOR	40	31,49
			CHA	87	68,50
	Amplitude disturbance	ShdB (dB)	NOR	6	4,72
			CHA	121	95,28
		Shim (%)	NOR	6	4,72
			CHA	121	95,28
		APQ (%)	NOR	3	2,36
			CHA	124	97,64
		sAPQ (%)	NOR	2	98,42
			CHA	125	1,58
		vAm (%)	NOR	24	18,90
			CHA	103	81,10
	Noise	NHR	NOR	10	7,87
			CHA	117	92,13
		VTI	NOR	65	51,18
			CHA	62	48,82
		SPI	NOR	60	47,24
			CHA	67	52,76
	Voice break	DVB (%)	NOR	122	96,06
			CHA	5	3,94
		NVB	NOR	122	96,06
			CHA	5	3,93
	Subharmonics egments	DSH (%)	NOR	70	55,11
			CHA	56	44,09
		NSH	NOR	70	55,11
			CHA	57	44,88
	Deaf or unvocalized segments	DUV (%)	NOR	97	76,38
			CHA	30	23,62
		NUV	NOR	93	73,23
			CHA	34	26,77

	Measures	Normality	n	%
CAPE-V	General Degree	NOR	118	92,91
		SLI	6	4,73
		MOD	3	2,36
		SEV	0	0,0
	Roughness	NOR	118	92,91
		LEV	7	5,51
		MOD	2	1,58
		SEV	0	0,0
	Breathiness	NOR	122	96,06
		LEV	4	3,15
		MOD	1	0,79
		SEV	0	0,0
	Tension	NOR	127	100
		LEV	0	0,0
		MOD	0	0,0
		SEV	0	0,0
		NOR	127	100
General Health	Vocal complaints	YES	87	68,50
		NO	40	31,50
	Smoking	YES	5	3,94
		NO	122	96,06
	Alcoholism	YES	0	0
		NO	127	100
	Respiratory Disturbs	YES	29	22,83
		NO	98	77,16

Descriptive analysis of occurence frequency.
Legend: n=number of subjects; %=percentage of subjects; NOR=normal; CHA=changed; SLI=slight; MOD=moderate; SEV=severe.

Table 2. Relation of vocal complaint with the results of the acoustic and auditory perceptual analysis of the voice

Measures			Normality	Presence of complaints		Absence of complaints		Value of p
				n	%	n	%	
MDVPA	Frequency	f0 (HZ)	NOR	85	66,93	39	30,71	0,944
			CHA	2	1,57	1	0,79	
		fhi (Hz)	NOR	82	64,57	38	29,92	0,863
			CHA	5	3,94	2	1,57	
		flo (Hz)	NOR	86	67,72	39	30,71	0,570
			CHA	1	0,79	1	0,79	
		STD (Hz)	NOR	40	31,50	26	20,47	0,046*
			CHA	47	37,01	14	11,02	
	Frequency disturbance	Jita (Ms)	NOR	11	8,66	10	7,87	0,081
			CHA	76	59,84	30	23,62	
		Jitt (%)	NOR	18	14,17	15	11,81	0,044*
			CHA	69	54,33	25	19,69	
		RAP (%)	NOR	18	14,17	15	11,81	0,044*
			CHA	69	54,33	25	19,69	
		PPQ (%)	NOR	18	14,17	14	11,02	0,084
			CHA	69	54,33	26	20,47	
		sPPQ (%)	NOR	15	11,81	14	11,02	0,026*
			CHA	72	56,69	26	20,47	
		vf0 (%)	NOR	19	14,96	21	16,54	>0,001*
			CHA	68	53,43	19	14,96	

Measures			Normality	Presence of complaints		Absence of complaints		Value of p
				n	%	n	%	
	Amplitude disturbance	ShdB (dB)	NOR	4	3,15	2	1,57	0,920
			CHA	83	65,35	38	29,92	
		Shim (%)	NOR	4	3,15	2	1,57	0,920
			CHA	83	65,35	38	29,92	
		APQ (%)	NOR	3	2,36	0	0,0	0,234
			CHA	84	66,14	40	31,50	
		sAPQ (%)	NOR	1	0,79	1	0,79	0,570
			CHA	86	67,72	39	30,71	
		vAm (%)	NOR	16	12,60	8	6,30	0,829
			CHA	71	55,91	32	25,20	
	Noise	NHR	NOR	7	5,51	3	2,36	0,915
			CHA	80	62,99	37	29,13	
		VTI	NOR	45	35,43	20	15,75	0,853
			CHA	42	33,07	20	15,75	
		SPI	NOR	37	29,13	23	18,11	0,116
			CHA	50	39,37	17	13,39	
	Voice break	DVB (%)	NOR	85	66,93	37	29,13	0,161
			CHA	2	1,57	3	2,36	
		NVB	NOR	85	66,93	37	29,13	0,161
			CHA	2	1,57	3	2,36	
	Subharmonicssegments	DSH (%)	NOR	48	38,10	22	17,46	0,897
			CHA	39	30,95	17	13,49	
		NSH	NOR	48	37,80	22	17,32	0,985
			CHA	39	30,71	18	14,17	
	Deaf or unvocalized segments	DUV (%)	NOR	65	51,18	32	25,20	0,514
			CHA	22	17,32	8	6,30	
		NUV	NOR	61	48,03	32	25,20	0,242
			CHA	26	20,47	8	6,30	
CAPE-V	General Degree		NOR	79	62,20	39	30,71	0,235
			SLI	6	4,72	0	0,0	
			MOD	2	1,57	1	0,79	
			SEV	0	0,0	0	0,0	
	Roughness		NOR	79	62,20	39	30,71	0,365
			SLI	6	4,72	1	0,79	
			MOD	2	1,57	0	0,0	
			SEV	0	0,0	0	0,0	
	Breathiness		NOR	83	65,35	39	30,71	0,133
			SLI	4	3,15	0	0,0	
			MOD	0	0,0	1	0,79	
			SEV	0	0,0	0	0,0	
	Tension		NOR	0	0,0	0	0,0	1,000
			SLI	0	0,0	0	0,0	
			MOD	0	0,0	0	0,0	
			SEV	0	0,0	0	0,0	
			SLI	0	0,0	0	0,0	
			MOD	0	0,0	0	0,0	
			SEV	0	0,0	0	0,0	

*p<0,005 – Chi-Square test of Pearson
Legend: n=number of subjects; %=percentage of subjects; NOR=normal; CHA=changed; SLI=slight; MOD=moderate; SEV=severe.

Table 3. Relation of smoking report with the results of the acoustic and auditory perceptual analysis of the voice

Measures				Smokers		Non-smokers		Value of p
				n	%	n	%	
MDVPA	Frequency	f0 (HZ)	NOR	5	3,94	119	93,70	0,722
			CHA	0	0,0	3	2,36	
		fhi (Hz)	NOR	5	3,94	115	90,55	0,581
			CHA	0	0,0	7	5,51	
		flo (Hz)	NOR	5	3,94	120	94,49	0,772
			CHA	0	0,0	2	1,57	
		STD (Hz)	NOR	3	2,36	63	49,61	0,713
			CHA	2	1,57	59	46,46	
	Frequency disturbance	Jita (Ms)	NOR	3	2,36	18	14,17	0,007*
			CHA	2	1,57	104	81,89	
		Jitt (%)	NOR	3	2,36	30	23,62	0,076
			CHA	2	1,57	92	72,44	
		RAP (%)	NOR	3	2,36	30	23,62	0,076
			CHA	2	1,57	92	72,44	
		PPQ (%)	NOR	3	2,36	29	22,83	0,067
			CHA	2	1,57	93	73,23	
		sPPQ (%)	NOR	2	1,57	27	21,26	0,350
			CHA	3	2,36	95	74,80	
		vf0 (%)	NOR	2	1,57	38	29,92	0,676
			CHA	3	2,36	84	66,14	
	Amplitude disturbance	ShdB (dB)	NOR	0	0,0	6	4,72	0,611
			CHA	5	3,94	116	91,34	
		Shim (%)	NOR	0	0,0	6	4,72	0,611
			CHA	5	3,94	116	91,34	
		APQ (%)	NOR	0	0,0	3	2,36	0,722
			CHA	5	3,94	119	93,70	
		sAPQ (%)	NOR	0	0,0	2	1,57	0,772
			CHA	5	3,94	120	94,49	
		vAm (%)	NOR	1	0,79	23	18,11	0,948
			CHA	4	3,15	99	77,95	
	Noise	NHR	NOR	0	0,0	10	7,87	0,504
			CHA	5	3,94	112	88,19	
		VTI	NOR	5	3,94	60	47,24	0,025*
			CHA	0	0,0	62	48,82	
		SPI	NOR	4	3,15	56	44,09	0,134
			CHA	1	0,79	66	51,97	
	Voice break	DVB (%)	NOR	4	3,15	118	92,91	0,059
			CHA	1	0,79	4	3,15	
		NVB	NOR	4	3,15	118	92,91	0,059
			CHA	1	0,79	4	3,15	
	Subharmonics segments	DSH (%)	NOR	3	2,38	67	53,17	0,838
			CHA	2	1,59	54	42,86	
		NSH	NOR	3	4,29	67	52,76	0,822
			CHA	2	1,57	55	43,31	
	Deaf or unvocalized segments	DUV (%)	NOR	3	2,36	94	74,02	0,379
			CHA	2	1,57	28	22,05	
		NUV	NOR	3	2,36	90	70,87	0,495
			CHA	2	1,57	32	25,20	

Measures			Smokers		Non-smokers		Value of p
			n	%	n	%	
CAPE-V	General Degree	NOR	5	3,94	113	88,98	0,819
		SLI	0	0,0	6	4,72	
		MOD	0	0,0	3	2,36	
		SEV	0	0,0	0	0,0	
	Roughness	NOR	5	4,24	113	88,98	0,819
		SLI	0	0,0	7	5,51	
		MOD	0	0,0	2	1,57	
		SEV	0	0,0	0	0,0	
	Breathiness	NOR	5	3,94	117	92,13	0,898
		SLI	0	0,0	4	3,15	
		MOD	0	0,0	1	0,79	
		SEV	0	0,0	0	0,0	
	Tension	NOR	0	0,0	0	0,0	1,000
		SLI	0	0,0	0	0,0	
		MOD	0	0,0	0	0,0	
		SEV	0	0,0	0	0,0	

*p<0,005 – Chi-Square test of Pearson
Legend: n=number of subjects; %=percentage of subjects; NOR=normal; CHA=changed; SLI=slight; MOD=moderate; SEV=severe.

Table 4. Relation of the respiratory disorder report with the results of the acoustic and auditory perceptual analysis of the voice

Measures				Present Respiratory Disturbs		Absent Respiratory Disturbs		Value of p
				n	%	n	%	
MDVPA	Frequency	f0 (HZ)	NOR	28	22,05	96	75,59	0,661
			CHA	1	0,79	2	1,57	
		fhi (Hz)	NOR	28	22,05	92	72,44	0,579
			CHA	1	0,79	6	4,72	
		flo (Hz)	NOR	28	22,05	97	76,38	0,356
			CHA	1	0,79	1	0,79	
		STD (Hz)	NOR	12	9,45	54	42,52	0,193
			CHA	17	13,39	44	34,65	
	Frequency disturbance	Jita (Ms)	NOR	3	2,36	18	14,17	0,306
			CHA	26	20,47	80	62,99	
		Jitt (%)	NOR	4	3,15	29	22,83	0,088
			CHA	25	19,69	69	54,33	
		RAP (%)	NOR	3	2,36	30	23,62	0,028*
			CHA	26	20,47	68	53,54	
		PPQ (%)	NOR	4	3,15	28	22,05	0,107
			CHA	25	19,69	70	55,12	
		sPPQ (%)	NOR	4	3,15	25	19,69	0,186
			CHA	25	19,69	73	57,48	
		vf0 (%)	NOR	7	5,51	33	25,98	0,331
			CHA	22	17,32	65	51,18	

Measures				Present Respiratory Disturbs		Absent Respiratory Disturbs		Value of p
				n	%	n	%	
CAPE-V	Amplitude disturbance	ShdB (dB)	NOR	2	1,57	4	3,15	0,530
			CHA	27	21,26	94	74,02	
		Shim (%)	NOR	2	1,57	4	3,15	0,530
			CHA	27	21,26	94	74,02	
		APQ (%)	NOR	1	0,79	2	1,57	0,661
			CHA	28	22,05	96	75,59	
		sAPQ (%)	NOR	1	0,79	1	0,79	0,356
			CHA	28	22,05	97	76,38	
		vAm (%)	NOR	8	6,30	16	12,60	0,173
			CHA	21	16,54	82	64,57	
	Noise	NHR	NOR	2	1,57	8	6,30	0,823
			CHA	27	21,26	90	70,87	
		VTI	NOR	15	11,81	50	39,37	0,946
			CHA	14	11,02	48	37,80	
		SPI	NOR	12	9,45	48	37,80	0,471
			CHA	17	13,39	50	39,37	
	Voice break	DVB (%)	NOR	29	22,83	93	73,23	0,214
			CHA	0	0,0	5	3,94	
		NVB	NOR	29	22,83	93	73,23	0,214
			CHA	0	0,0	5	3,94	
	Subharmonic segments	DSH (%)	NOR	17	13,49	53	42,09	0,533
			CHA	11	8,73	45	35,71	
		NSH	NOR	17	13,39	53	41,73	0,665
			CHA	12	9,45	45	35,43	
	Deaf or unvocalized segments	DUV (%)	NOR	22	17,32	75	59,06	0,940
			CHA	7	5,51	23	18,11	
		NUV	NOR	21	16,54	72	56,69	0,910
			CHA	8	6,30	26	20,47	
	General Degree		NOR	25	19,69	93	73,23	0,147
			SLI	2	1,57	4	3,15	
			MOD	2	1,57	1	0,79	
			SEV	0	0,0	0	0,0	
	Roughness		NOR	25	19,69	93	73,23	0,270
			SLI	3	2,36	4	3,15	
			MOD	1	0,79	1	0,79	
			SEV	0	0,0	0	0,0	
	Breathiness		NOR	26	20,47	96	75,59	0,073
			SLI	2	1,57	2	1,57	
			MOD	1	0,79	0	0,0	
			SEV	0	0,0	0	0,0	
	Tension		NOR	0	0,0	0	0,0	1,000
			SLI	0	0,0	0	0,0	
			MOD	0	0,0	0	0,0	
			SEV	0	0,0	0	0,0	

*p<0,005 – Chi-Square test of Pearson
Legend: n=number of subjects; %=percentage of subjects; NOR=normal; CHA=changed; SLI=slight; MOD=moderate; SEV=severe.

Table 5. Analysis of the variables vocal complaint, smoking report and respiratory disorder report according to the period of use of the professional voice, daily function and age

Period of professional voice use (years)		Average	SD	value of p
Vocal complaint	Yes	13,34	0,99	0,697
	No	12,65	1,47	
Smoking	Yes	11,20	4,16	0,638
	No	13,20	0,84	
Respiratory disturb	Yes	13,13	1,73	0,993
	No	13,12	0,94	
Daily Funtion (hours)				
Vocal complaint	Yes	7,44	0,32	0,002*
	No	6,15	0,47	
Smoking	Yes	7,02	0,27	0,788
	No	7,40	1,36	
Respiratory disturb	Yes	6,93	0,30	0,496
	No	7,37	0,56	
Age				
Vocal complaint	Yes	39,10	1,09	0,169
	No	36,40	1,61	
Smoking	Yes	38,29	0,93	0,816
	No	37,20	4,61	
Respiratory disturb	Yes	38,47	1,04	0,648
	No	37,48	1,91	

*p<0,05 – ANOVA test.
Legend: SD = Standard-Deviation

DISCUSSION

The group of teachers of the present study were mostly womankind, functioning an average of 7,03h/day and has worked as a teacher for about 13,13 years. Study held with 476 teachers of elementary and high school showed similar data, wherein the teachers worked 7,64 hours daily and have acted for 11,5 years[4]. In another research which participated 37 teachers of primary and elementary school, it was found that 62,6% have worked on this profession for over ten years and presented daily time of permanence with students of 7,56 hours[11].

For this group of professionals, a harmonious voice is needed, with vocal quality, adequate*pitch* and *loudness*for the function, for the public and for the place, therefore, in a group of teachers, all and any difficulty or change on the vocal utterance that interfere in the natural production of the voice can also interfere on the professional performance, what makes the dysphonia a occupational disturb[22]. The dysphonia can affect the life quality both on personal aspects and on professional and social aspects[23].

The class of teachers, that make use of the voice as a work tool, is one of the most affected by dysphonias, existing recent studies that show the presence of vocal changes up to 78,7% of the teachers[10-12].

It was observed in this research, that the teachers that presented vocal complaints had superior workload than the ones who didn't (Table 5). Each teacher owns a particular vocal demand, some believe that the voice becomes overloaded not by the explained contents in class, but by the need of controlling the scholar environment. Therefore, the period of voice use in class can be considered predisposing factor to the dysphonia, especially when added to external and internal environmental noise and numerous classes of students[10,16].

Research held with teachers of the city of Porto Alegre/RS verified that 48,6% of the teachers identified the noise as a possible trigger factor of vocal disturbs, which comes from the classroom. For 32,4% of the interviewed, this makes the teachers to exert vocal effort to be audible for the students, wherein that effort and vocal fatigue possibly have their increase proportional to the increase of hours front of the student[11].

Besides being related between themselves, the vocal complaints and exerted workload by this population related also to the frequency disturb measures (*jitter*) and to the STD, showing that the

teachers with vocal complaints presented significant changes on the frequency disturb measures (Table 2). Such acoustic measures show how much the period of glottal vibration differs from what succeeds it, being able to acoustically reveal the instability of the analyzed signal, so, decrease of the phonation system's control with presence of aperiodicity[24,25].

Furthermore, the major part of the teachers presented, in the acoustic analysis, changes on the noise and frequency and amplitude disturbance measures (Table 1). These modifications that arise at different moments show that the vocal production is not totally periodic and is independent just by the individual's attention to perform the utterance. Sometimes, the aperiodicity and instability accrue from alterations on the vibration of the vocal chords, where different forces and configurations of the laryngeal musculature or of the vocal chords' mucus are created, causing vibratory asymmetry, just like can accrue from glottal adduction insufficiency and, even, of alterations in the sound's articulation, caused by the variations on the source-filter relation[26]. According to the literature[24-26], as certain levels of aperiodicity and instability are considered normal, high levels of alteration in the acoustic measures can suggest presence of laryngeal injuries.

The majority of the teachers didn't present alterations on the auditory perceptual parameters of the voice, according to some studies[10,12]. Research held verified that only one third of the analyzed teachers presented vocal disturb found by the auditory perceptual evaluation of the voice, and the majority of a low degree[10]. Such result resembles to the one of the present study, although with higher number of subjects with auditory perceptual alterations, what suggests that the acoustic analysis showed itself more sensitive and, in this case, can be signaling a vocal disturb that, although presented complaints, didn't expressed itself in the vocal quality yet.

As to the general health, the major part of the teachers didn't present respiratory disturbance reports and didn't have alcoholism or smoking habits, but presented vocal complaints (Table 1), which meets a work that found a high number of teachers with vocal complaints, although not smokers or alcoholic[17].

In the present study, the alterations of *jitta* and VTI measures have been related to the smoking report (Table 3). The *jitter* measure rise can signal difficulties of control in phonation or respiratory level since they provide evidences of the irregularity of the vibration of the vocal chords' mucus, like mass, tension and mucus distribution variation, as well as the relation between the biomechanics characteristics and the neuromuscular control, making the *jitter* be an evidence of an oscillatory instability of the vocal chords and characterizing itself by a hoarse vocal quality[24]. On the other hand, the VTI corresponds to the voice turbulence index and presents greater relation to the air turbulence components that correspond to modifications in the glottal adduction[24].

Despite studies allege that this relation is not direct[27,28], once the other factors can influence the occurrence of dysphonia by smoking, like the kind and amount of cigarettes smoked daily and the period the habit have been installed[29], it's known that the smoking can generate edema on vocal chords region that difficult the mucus' mobilization, what justifies the phonation instability and the noise found in the acoustic analysis.

Furthermore, the teachers analyzed in this study showed a statistically significant relation between respiratory disturb reports and RAP measure (Table 4). It can be justified the relation of respiratory disturb and *jitter* measures once it's necessary that the pulmonary aerodynamic forces be balanced to the myoelastic forces of the larynx so that the utterance be stable[12,30].

Therefore, it's indispensable to highlight the importance of improvements in the work conditions an of the investment on the worker's general health, mainly regarding to prevention. At this rate, it's noticed the oversight with the vocal health in the teachers' life, which the voice is the basis of their occupation.

CONCLUSION

There is high occurrence of vocal complaints between teachers of the elementary school and these are related to the larger daily workload and to acoustic measures of *jitter*. The *jitter* measures also present relation to the report of presence of respiratory disturbs. It's concluded that on the studied elementary school teachers of Santa Maria/RS, there was relation between the vocal, occupational and general health profile, thus paying attention to the importance of improvements on the work conditions and to the investment in prevention programs related to the teachers' general health, including the voice.

REFERENCES

1. Servilha EAM, Costa ATF. Conhecimento vocal e a importância da voz como recurso pedagógico na perspectiva de professores universitários. Rev CEFAC. 2015;17(1):13-26.
2. Anhaia TC, Klahr OS, Cassol M. Associação entre o tempo de magistério e a autoavaliação vocal em professores universitários: estudo observacional transversal. Rev CEFAC. 2015;17(1):52-7.
3. Behlau M, Zambon F, Guerrieri AC, Roy N. Epidemiology of voice disorders in teachers and non teachers in Brazil: prevalence and adverse effects. J Voice. 2012;26(5):665-9.
4. Ceballos AGC, Carvalho FM, Araújo TM, Reis EJFB. Avaliação perceptivo-auditiva e fatores associados à alteração vocal em professores. Rev Bras Epidemiol. 2011;14(2):285-95.
5. Ziegler A, Gillespie AI, Abbott KV. Behavioral treatment of voice disorders in teachers. Folia Phoniatr Logop. 2010;62(1):09-23.
6. Musial PL, Dassie-Leite AP, Zaboroski AP, Casagrande RC. Interferência dos sintomas vocais na atuação profissional de professores. Distúrb Comun. 2011;23(3):335-41.
7. Giannini SPP, Latorre RMDO, Ferreira LP. Distúrbio de voz e estresse no trabalho docente: um estudo caso-controle. Cad Saúde Pública. 2012;28(11):2115-24.
8. Luchesi KF, Mourão LF, Kitamura S. Ações de promoção e prevenção à saúde vocal de professores: uma questão de saúde coletiva. Rev CEFAC. 2010;12(6):945-53.
9. Medeiros AM, Assunção AA, Barreto SM. Alterações vocais e cuidados de saúde em professores. Rev CEFAC. 2012;14(4):697-704.
10. Servilha EAM, Correia JM. Correlações entre condições do ambiente, organização do trabalho, sintomas vocais autorreferidos por professores universitários e avaliação fonoaudiológica. Disturb Comun. 2014;26(3):452-62.
11. Cezar Vaz MR, Severo LO, Borges AM, Bonow AC, Rocha PL, Almeida MCV. Voice disorders in teachers. Implications for occupational health nursing care. Investigación y Educación en Enfermería. 2013;31(2):252-60.
12. Ribeiro VV, Cielo CA. Vocal acoustic and auditory-perceptual measures, vocal complaints and professional characteristics of teachers from the city of Santa Maria (Rio Grande do Sul), Brazil. Audiol Commun Res. 2014;19(4):387-98.
13. Ferreira L, Zenari M, Latorre M, Giannini S. Distúrbio de voz relacionado ao trabalho: proposta de um instrumento para avaliação de professores. Disturb Comun. 2007;19(1):127-36.
14. Roy N, Merrill RM, Thibeaults S, Gray SD, Smith EM. Voice disorders in teachers and the general population: effects on work performance, attendance, and future career choices. J Speech Lang Hear Res. 2004;47(3): 542-52.
15. Roy N, Merrill RM, Thibeaults S, Parsa R, Gray SD, Smith EM. Prevalence of voice disorders in teachers en the general population. J Speech Lang Hear Res. 2004;47(2):281-93.
16. Tomazzetti, CT. A voz do professor: instrumento de trabalho ou problema no trabalho? [dissertação]. Santa Maria (RS): Universidade Federal de Santa Maria. Programa de Pós-Graduação em Educação; 2003.
17. Choi-Cardim K, Behlau M, Zambon F. Sintomas vocais e perfil de professores em um programa de saúde vocal. Rev CEFAC. 2010;12(5):811-9.
18. Guerrieri AP, Zambom F, Behlau M, Roy NGVP. Panorama epidemiológico sobre a voz do professor no Brasil. In: Congresso Brasileiro de Fonoaudiologia; Anais do 18º Congresso Brasileiro de Fonoaudiologia; 2009 Oct 21-24.Salvador: Sociedade Brasileira de Fonoaudiologia; 2009. p.1-6.
19. Miranda DR, Azevedo MS, Freire NRH, Oliveira MP. O professor como comunicador e mediador do processo ensino e aprendizagem: implicações ambientais e organizacionais em seu desempenho. Anuário. 2012;1(1):564-77.
20. ASHA - American Speech-Language-Hearing Association. Consensus auditory-perceptual evaluation of voice (CAPE-V), United States of America, 2002. Disponível em: <http://www.asha.org>. Acesso em: maio de 2014.
21. Yamasaki R, Leão SHS, Madazio G, Padovani M, Azevedo R. Correspondência entre escala analógico-visual e a escala numérica na avaliação perceptivo-auditiva de vozes. In: Congresso Brasileiro de Fonoaudiologia; Anais do 16º Congresso Brasileiro de Fonoaudiologia; 2007 Sep 24-27; Auditório Claudio Santoro. Campos do Jordão: Sociedade Brasileira de Fonoaudiologia; 2008. p.1-5.
22. Alves LA, Robazzi MLCC, Marziale MHP, Felippe ACN, Romano CC. Alterações da saúde e a voz do

professor, uma questão de saúde do trabalhador. Rev Latino-Am Enfermagem. 2009;17(4):66-72.
23. Ricarte A, Oliveira G, Behlau M. Validação brasileira do VAPP. CoDAS 2013;25(3):242-9.
24. Barros APB, Carrara-de Angelis E. Análise acústica da voz. In: Dedivitis RA, Barros APB (Org.). Métodos de avaliação e diagnóstico da laringe e voz. São Paulo: Lovise, 2002. p. 185-221.
25. Beber BC, Cielo CA. Medidas acústicas de fonte glótica de vozes masculinas normais. Pró-Fono R Atual Cient. 2010;22(3):299-304.
26. Gama ACC, Behlau MS. Estudo da constância de medidas acústicas. Rev Soc Bras Fonoaudiol. 2009;14(1):8-14.
27. Fuess VLR, Lorenz MC. Problemas vocais no jardim de infância e professores do ensino primário: prevalência e fatores de risco. Rev Bras Otorrinolaringol. 2003;69(6):807-12.
28. Cielo CA, Finger LS, Roman-Niehues G, Deuschle VP, Siqueira MA. Hábitos de tabagismo e etilismo em disfonias. R Ci Med Biol. 2010;9(2):119-25.
29. Ribeiro V, Ribeiro VV, Dassie-Leite AP. Queixa vocal e qualidade de vida em voz de mulheres tabagistas. R Bras Qual Vida. 2014;6(3):192-8.
30. Behlau M. Voz: o livro do especialista. 1st ed. São Paulo: Revinter. 2001.