Relation Between Musculoskeletal Pain and Voice Self-Assessment in Tele-Operators

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Summary: Objectives. To investigate musculoskeletal pain, vocal fatigue, and voice-related quality of life of tele-operators and compare these aspects with nonvoice-related professionals; and verify if there is a relationship between musculoskeletal pain and vocal fatigue and voice-related quality of life (V-RQOL) of tele-operators and nonvoice-related professionals.

Methods. Thirty-five tele-operators (SG) and 35 nonvoice-related professionals with no vocal complaints (control group) participated in the study. All of them answered investigating questionnaires of musculoskeletal pain, vocal fatigue index, and V-RQOL. The data were statistically analyzed in aim to compare the groups and the association between variables.

Results. Women from SG presented higher pain frequency in their upper back than women from control group ($P = 0.039$). Different correlations were observed between musculoskeletal pain and vocal fatigue, just as between musculoskeletal pain and V-RQOLindex, for men and women in both groups. However, men presented a higher number or correlations between the protocols than women from both groups.

Conclusion. Female tele-operators presented higher pain frequency on their upper back when compared to nonvoice-related professional women. Musculoskeletal pain has a negative impact on voice-related quality of life and on the increase of vocal fatigue during oral communication, regardless of the professional use of the voice.

Key Words: Voice−Telecommunication−Protocols−Fatigue−Quality of life−Musculoskeletal pain.

INTRODUCTION

Telemarketing is a type of work that involves using telecommunications technology and marketing data to provide customer service, and it is also an employment generator.[1,2] Tele-operators mainly need their voices, not necessarily their bodies, gestures, or facial expressions, to persuade or convince the customer. This work structure, associated with the structural organization and functionality of the occupation, also contributes to emergencies of vocal and laryngeal symptoms, vocal changes, musculoskeletal pain, and posture alterations caused by repetitive strain,[3-7] which can damage the communication of the tele-operator during his or her activities. Studies show that the vocal and laryngeal symptoms that appear most in tele-operators are: hoarseness, voice failures, and losses, feeling of worsening of vocal quality by the end of the day, body pain, tiredness, and effort when speaking, phlegm, dry throat, and others.[7-11]

Regarding pain, literature[12-14] has reported that a lot of voice professionals present musculoskeletal pain. Authors[7] have verified the relationship between the use of the voice and the type of body pain in tele-operators and concluded that they present more distal pain closer to the larynx, especially in the shoulder and neck area, than the overall population. Authors have also observed that tele-operators associate their pain with vocal problems and need distance from work to treat voice alterations. Other authors[15] have noticed in their studies that dysphonic individuals tend to have more pain closer to the larynx than nondysphonic individuals, with resulting worsening of life quality. However, a study revealed that tele-operators refer to a small effect of vocal difficulty in life quality and that there is an association between limitation and participation in laboral activity and worse professional performance.[10]

Considering that musculoskeletal pain may be present in tele-operators due to their work style, such as inappropriate vocal habits that cause vocal and laryngeal symptoms, describing vocal fatigue, it is of utmost importance to verify if these aspects negatively impact the voice-related life quality of this population and their work performance.

Knowledge of these variables may provide more effective vocal actions in clinical practice with voice professionals by means of specific strategies aimed at improving vocal function with lower energy expenditure, work performance, and quality of life. Studies that considered the relationship between musculoskeletal pain and vocal fatigue were not found, just as with the quality of life in tele-operators. Therefore, this study was intended to investigate musculoskeletal pain, vocal fatigue, and voice-related quality of life in tele-operators; compare these aspects with nonvoice-related professionals and verify if there is a relationship between musculoskeletal pain and vocal fatigue and voice-related quality of life in tele-operators and nonvoice-related professionals.

METHODOLOGY

Study design

This is an observational, analytical, and transversal study.

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TABLE 1.
Distribution of Study and Control Groups According to Sociodemographic Characteristics and Working Time

Sociodemographic Characteristics and Working Time		SG		CG	
		n	%	*n*	%
Scholarity	Incomplete elementary school	1	2.86	3	8.58
	Complete high school	25	71.43	16	37.15
	Incomplete high school	0	0	2	5.72
	Complete Undergraduate education	1	2.86	6	17.15
	Incomplete Undergraduate	8	22.86	6	17.15
Profession	Tele-operator	35	100	0	0
	Administrative Assistant / Accountant	0	0	4	11.43
	Educational coordinator	0	0	1	2.86
	Pharmacy attendant	0	0	2	5.72
	Freelancer / Trader	0	0	4	11.43
	Housewife	0	0	6	17.15
	Student	0	0	2	5.72
	General service assistant	0	0	3	8.58
	Cooking	0	0	1	2.86
	Civil engineer	0	0	1	2.86
	Industrial mechanic	0	0	4	11.43
	Technical / Forestry Engineer/Environmental	0	0	3	8.58
	Waiter/driver	0	0	4	11.43
Working time	6–11 months	9	25.72	6	17.15
	1–5 years	18	51.43	18	51.43
	6–10 years	8	22.86	9	25,72
	11–15 years	0	0	2	5.72

Sample

This study was approved by the Ethics in Research Committee of the Institution (protocol: 2.147.873). All the participants signed the informed consent form after being informed about the research.

Self-reported healthy male and female tele-operators of a company from the state of Paraná/Brazil were invited to participate. All of them had worked with the call center for at least the previous six months in active (tele-operators seeking out customers) or passive style (tele-operators sought out by customers), composing a study group (SG). A control group (CG) formed with self-reported healthy individuals and nonvoice-related professionals was created, paired with SG according to age and gender.

The exclusion criteria for both groups were: individuals treated for previous voice complaints, hormonal changes, heart and lung problems, self-reported hearing loss, neurological or psychiatric changes, and/or history of head and neck surgeries. Smoking individuals and alcoholic individuals did not participate in the study. For the CG, voice-related professionals were also excluded.

Therefore, the research included 35 individuals in the SG and 35 in the CG, with 18 males and 17 females in each group. The ages varied between 20 and 39 years for women (an average of 29.12) and 20 and 42 years for men (an average of 28.5). The average operating time for the tele-operators was 3.84 years, 8 hours a day.

Table 1 shows the sociodemographic characteristics of the participants of both groups.

Procedures

The participants answered self-assessment protocols about frequency investigation and musculoskeletal pain intensity, vocal fatigue investigation, and voice-related quality of life. In the telemarketing companies that participated in the research, the assessments were administered at the beginning of the work shift.

Musculoskeletal pain investigation

In order to investigate musculoskeletal pain, the "Musculoskeletal Pain Questionnarie"[16] was applied. The body parts investigated in this study were: anterior and posterior neck areas, shoulders, upper and lower back areas, temporal region, masseter muscles, submandibular regions, and larynx. To investigate pain frequency, the participants had to indicate in which part the pain had persisted over the previous 12 months using a numeral scale from 0 to 3, whereby 0 = never, 1 = sometimes, 2 = usually, and 3 = always. To investigate pain intensity, for each area, a 100 mm long visual analog scale was used. For every point of pain indicated, the individuals had to mark a vertical line on the scale at the exact point according to the pain intensity, increasing

from left to right. Afterward, the scale was measured with a ruler, millimeter by millimeter, to conduct static analysis.

Vocal fatigue investigation

The participants answered the protocol "vocal fatigue index – VFI," which consists of 19 vocal fatigue-related questions.[17] This protocol is divided into three parts: voice fatigue and limitation (11 questions), voice-related physical discomfort (5 questions), and improvement of symptoms due to rest (3 questions).[18] For this protocol, the participants answered using a 5-point Likert scale, whereby 0 means "never," 1 "hardly ever," 2 "sometimes," 3 "almost always," and 4 "always." Aspects such as vocal fatigue and voice limitation, voice-related physical discomfort, and improvement of symptoms due to vocal rest were investigated. The calculation of each part was done through simple summation. Questions with high values on parts 1 and 2 indicate a worse vocal fatigue level, and low values on part 3 also indicate worse vocal fatigue.

Voice-related quality of life

The voice-related quality of life evaluation was conducted using the voice-related quality of life—VRQOL[19] protocol, verified in Brazil.[20] It provides a series of information based on individual self-assessment. This protocol involves 10 questions, consisting of three parts: total, physical, and socioemotional. All of them enable dysphonia evaluation of an individual's life.

The protocol calculation was done according to the author's proposal[19,20] for each part: physical score, socioemotional score, and total score. The protocol result may vary from zero to 100 percent; the maximum score indicates better quality of life, and the minimum score indicates worse quality of life, for the physical and socioemotional parts as well as for total score.

Vocal self-assessment

The participants were also questioned about their self-perception of voice quality, on a scale from 1 to 5, with "1" being excellent voice self-perception, "2" a very good voice, "3" a good voice, "4" a fair voice, and "5" a poor voice.

Analysis of data

For group pairing, a *t* test was also used. The data relating to the answers to the three protocols were esthetically analyzed using the Mann-Whitney test to compare protocol results from both groups with asymmetrical distribution. The Spearman correlation test was applied to the correlation between protocol data of pain with vocal fatigue results and voice-related quality of life for both genders. The correlation strength was analyzed following Dancey and Reidy,[21] who consider values of correlation coefficient (*r*) between 0.10 and 0.39 to be poor; between 0.40 and 0.69 to be moderate; and between 0.70 and 1.00 to be high.

TABLE 2.
Comparison Between Musculoskeletal Pain Frequency and Intensity Between the Study Group (RG) and Control Group (CG), Separated by Gender

	Pain Frequency					Pain Intensity				
	SG		CG			SG		CG		
Corporal Regions	Mean	SD	Mean	SD	*P* value	Mean	SD	Mean	SD	*P* value
Women										
Upper neck	1.18	0.73	0.94	0.75	0.243	10.71	15.75	18.53	28.73	0.757
Shoulders	1.35	0.86	1.29	0.85	0.683	12.47	20.22	14.82	27.55	0.865
Upper back	**1.41**	**0.80**	**0.88**	**0.78**	**0.039***	18.82	26.27	14.59	24.60	0.283
Lower back	1.06	0.83	1.35	1.11	0.450	16.47	27.93	14.82	26.88	0.630
Temporal	0.88	0.86	1.12	0.93	0.511	12.29	26.61	13.06	27.05	0.643
Masseter	0.35	0.49	0.65	0.86	0.361	1.12	2.98	4.82	12.74	0.564
Submandibular	0.41	0.51	0.12	0.33	0.056	0.82	1.74	0.41	1.46	0.392
Larynx	0.59	0.62	0.53	0.62	0.756	6.24	19.07	0.88	2.47	0.564
Anterior neck	0.71	0.69	0.47	0.80	0.189	7.82	20.39	0.71	2.17	0.464
Men										
Posterior neck	0.94	0.80	0.56	0.62	0.136	18.56	26.45	9.00	18.19	0.305
Shoulders	1.06	0.87	0.72	0.83	0.244	19.39	23.37	12.83	24.22	0.179
Upper back	0.78	0.88	0.94	0.94	0.600	12.89	15.31	13.44	21.28	0.436
Lower back	0.61	0.85	0.94	0.80	0.189	13.11	22.01	14.72	20.75	0.935
Temporal	0.78	0.73	0.67	0.91	0.470	9.61	15.72	7.94	19.13	0.482
Masseter	0.22	0.55	0.28	0.57	0.696	1.28	4.25	3.89	11.07	0.434
Submandibular	0.22	0.55	0.11	0.32	0.598	2.89	7.64	2.00	4.51	0.575
Larynx	0.28	0.57	0.11	0.32	0.353	1.56	4.38	1.61	4.34	0.983
Anterior neck	0.39	0.61	0.28	0.57	0.492	4.56	14.40	5.78	17.49	0.857

Mann-whitney test ($P < 0.05$) Caption: Sd: standard deviation.

TABLE 3.
Comparison of Domains Scores From Protocol VFI Between Study Group (SG) and Control Group (CG). Separated by Gender

	SG		CG		
Domains	Mean	SD	Mean	SD	*P* value
Women					
Vocal fatigue and limitations	6.71	6.80	8.12	7.51	0.690
Voice-related physic discomfort	2.41	2.72	1.53	1.70	0.423
Recovery with vocal rest	3.76	4.09	4.65	4.42	0.620
Total	12.71	12.55	14.29	10.91	0.628
Men					
Vocal fatigue and limitations	5.89	8.20	3.22	5.16	0.189
Voice-related physic discomfort	1.39	3.22	0.44	0.92	0.546
Recovery with vocal rest	3.67	3.69	2.67	3.90	0.353
Total	10.94	13.19	6.33	8.83	0.287

Mann-whitney test ($P < 0.05$) Caption: Sd: standard deviation.

TABLE 4.
Comparison of Domains Scores From Protocol VRQL and Vocal Self-Assessment Between Study Group (SG) and Control Group (CG). Separated by Gender

	SG		CG		
Domains	Mean	SD	Mean	SD	*P* value
Women					
Socioemotional	97.80	7.62	90.81	19.67	0.105
Physic	92.40	10.22	88.98	15.57	0.857
Total	94.56	8.26	89.41	15.82	0.257
Vocal Self-Assessment	3.06	0.43	3.06	1.20	0.508
Men					
Socioemotional	96.53	13.24	97.92	5.24	0.655
Physic	90.51	13.46	89.82	14.02	0.960
Total	92.92	12.52	93.06	10.27	0.974
Vocal Self-Assessment	3.06	0.90	2.72	0.83	0.278

Mann-whitney test ($P < 0.05$) Caption: Sd: standard deviation.

For all the completed tests, a significance level of 95% was used ($P < 0.05$).

RESULTS

There was not a significant difference in ages in the groups, for both women ($P = 0.927$) and men ($P = 0.954$).

Tables 2–4 show value comparisons of musculoskeletal pain frequency and intensity, VFI, and voice-related quality of life (V-RQOL) for men and women in both groups (SG and CG). It is observed from Table 1 that women from the SG presented higher frequency of pain in the upper back area than women from the CG. There were no differences between the groups in terms of the other variables studied.

Tables 5–8 show statistically significant correlations of musculoskeletal pain frequency and intensity with vocal fatigue and voice-related quality of life. All significant correlations that were found among the study variables are considered moderate.[21]

Table 5 indicates a positive correlation of pain frequency between the "submandibular" and "larynx" areas and the domains of "vocal fatigue and limitation," "voice-related physical discomfort," and VFI "total" for women in the SG. On the other hand, for men in the SG, a lot of positive correlations can be observed between the pain frequency and VFI domains. In the CG, a positive correlation was found between "masseter" pain frequency and the field "vocal fatigue and limitation"; "larynx" and "anterior neck area"; and the fields "vocal fatigue and limitation" and "total".

Table 6 shows correlations between pain intensity and VFI domains. A positive correlation between pain intensity in the "submandibular" area and the VFI domain "voice-related physical discomfort" was observed for women in the SG. In the CG, there was a positive correlation between pain intensity in the "upper back" area and the fields "recovery with vocal resting" and "total" in the VFI protocol.

Regarding men, in the SG, a lot of positive correlations of pain intensity between the "posterior neck," "upper and lower back," and "temporal" areas and VFI domains were observed. In the CG, there was a positive correlation only between the "masseter" area and all domains from the VFI protocol.

Table 7 shows the correlation between musculoskeletal pain frequency and life quality of women and men from both groups. A negative correlation between "larynx" pain frequency and the domains physical and total from the V-RQOL protocol was observed from the SG. In the CG, there were negative correlations between "shoulder" pain and all fields in the V-RQOL protocol.

Table 8 shows the correlations between musculoskeletal pain intensity with V-RQOL protocol and vocal self-assessment of women and men from both groups. Correlations between pain intensity and voice-related quality of life to women and men from the SG were not found. In contrast, women and men from the CG presented a negative correlation between pain intensity in the "upper neck," "shoulders," and "temporal" area and V-RQOL. In addition, positive correlations between vocal self-assessment and pain intensity were found.

TABLE 5.
Statistically Significant Correlation Between Musculoskeletal Pain Frequency and Protocol VFI Domains for Men and Women From Both Groups.

		SG				CG			
		Vocal Fatigue and Limitation	Voice-related Physical Discomfort	Recovery with Vocal Rest	Total	Vocal Fatigue and Limitation	Voice-related Physical Discomfort	Recovery with Vocal Rest	Total
Women									
Shoulders	*r*	−0.075	0.172	0.081	0.042	0.566	0.412	0.270	**0.567**
	P	0.774	0.510	0.756	0.874	**0.018***	0.100	0.295	**0.018***
Submandibular	***r***	**0.532**	**0.651**	0.188	0.465	0.282	0.019	0.459	0.336
	P	**0.028***	**0.005***	0.469	0.060	0.274	0.941	0.064	0.187
Larynx	***r***	**0.565**	**0.626**	0.368	0.528	0.290	**0.538**	0.148	0.344
	P	**0.018***	**0.007***	0.147	**0.029***	0.259	**0.026***	0.572	0.176
Men									
Posterior neck	*r*	**0.510**	0.342	0.338	**0.548**	0.358	0.386	0.243	0.315
	P	**0.031***	0.165	0.171	**0.019***	0.144	0.114	0.332	0.203
Shoulders	*r*	0.346	0.413	0.466	**0.516**	**0.494**	**0.528**	0.189	0.332
	P	0.159	0.089	0.051	**0.028***	**0.037***	**0.024***	0.452	0.179
Upper back	*r*	**0.628**	**0.529**	**0.608**	**0.485**	0.243	0.254	0.230	0.253
	P	**0.005***	**0.024***	**0.007***	**0.042***	0.331	0.309	0.358	0.311
Lower back	*r*	0.419	0.440	0.368	**0.565**	0.404	0.407	0.121	0.260
	P	0.083	0.067	0.133	**0.015***	0.097	0.094	0.631	0.297
Temporal	*r*	**0.721**	**0.777**	**0.567**	**0.547**	0.329	0.327	0.012	0.155
	P	**0.001***	**0.000***	**0.014***	**0.019***	0.182	0.186	0.963	0.539
Masseter	*r*	0.455	**0.572**	0.467	0.300	**0.505**	0.367	0.339	0.431
	P	0.058	**0.013***	0.051	0.227	**0.032***	0.135	0.168	0.074
Submandibular	*r*	0.437	0.442	**0.736**	**0.629**	0.073	−0.187	0.000	0.000
	P	0.070	0.067	**0.000***	**0.005***	0.774	0.457	1.000	1.000
Larynx	*r*	0.318	0.346	**0.597**	**0.587**	**0.547**	0.304	0.366	**0.492**
	P	0.199	0.160	**0.009***	**0.010***	**0.019***	0.219	0.135	**0.038***
Previous neck	*r*	**0.514**	**0.530**	0.416	**0.686**	**0.511**	0.437	0.352	0.443
	P	**0.029***	**0.024***	0.086	**0.002***	**0.030***	0.070	0.152	0.066

* Sperman correlation ($P < 0.05$) Caption: *r*: correlation coefficient.

TABLE 6.
Statistically Significant Correlation Between Musculoskeletal Pain Intensity and Protocol VFI Domains for Men and Women From Both Groups

		SG				CG			
		Vocal Fatigue and Limitation	Voice-related Physical Discomfort	Recovery with Vocal Rest	Total	Vocal Fatigue and Limitation	Voice-related Physical Discomfort	Recovery with Vocal Rest	Total
Women									
Upper back	*r*	−0.019	0.000	0.445	0.187	0.476	−0.126	**0.507**	**0.493**
	P	0.942	1.000	0.074	0.472	0.053	0.629	**0.038***	**0.044***
Submandibular	***r***	0.237	**0.487**	0.281	0.389	0.048	0.043	0.254	0.105
	P	0.359	**0.047***	0.275	0.123	0.853	0.868	0.326	0.687
Men									
Posterior neck	*r*	0.421	**0.546**	**0.485**	**0.527**	0.288	0.179	0.124	0.242
	P	0.082	**0.019***	**0.042***	**0.025***	0.247	0.477	0.625	0.333
Shoulders	*r*	0.257	0.317	0.576	0.462	**0.497**	0.334	0.173	0.361
	P	0.303	0.199	0.012*	0.054	**0.036***	0.176	0.493	0.141
Upper back	*r*	**0.539**	**0.516**	**0.580**	**0.660**	0.281	0.311	0.209	0.283
	P	**0.021***	**0.029***	**0.012***	**0.003***	0.259	0.210	0.406	0.256
Lower back	*r*	**0.655**	**0.510**	0.345	**0.616**	0.295	0.167	0.046	0.180
	P	**0.003***	**0.031***	0.160	**0.006***	0.235	0.508	0.857	0.474
Temporal	*r*	**0.473**	0.251	**0.570**	0.459	0.339	0.423	0.243	0.269
	P	**0.047***	0.315	**0.014***	0.055	0.168	0.080	0.331	0.281
Masseter	*r*	0.101	0.030	−0.162	−0.047	**0.594**	**0.538**	**0.476**	**0.540**
	P	0.691	0.905	0.520	0.854	**0.009***	**0.021***	**0.046***	**0.021***
Submandibular	*r*	0.421	**0.546**	**0.485**	**0.527**	0.288	0.179	0.124	0.242

* Sperman correlation ($P < 0.05$) Caption: *r*: correlation coefficient.

TABLE 7.
Statistically Significant Correlation Between Musculoskeletal Pain Frequency and Protocol V-RQOL Domain Scores and Vocal Self-Assessment of Women and Men From Both Groups

		SG				CG			
		Socioemotional	Physical	Total	Vocal Self-Assessment	Socioemotional	Physical	Total	Vocal Self-Assessment
WOMEN									
Shoulders	*r*	0.409	0.153	0.163	−0.093	**−0.513**	**−0.656**	**−0.656**	0.288
	P	0.103	0.558	0.532	0.723	**0.029***	**0.003***	**0.003***	0.247
Larynx	*r*	0.061	**−0.562**	**−0.539**	0.372	−0.155	0.029	−0.113	−0.284
	P	0.815	**0.019***	**0.026***	0.142	0.551	0.911	0.666	0.269
MEN									
Posterior neck	*r*	0.012	−0.317	−0.302	0.014	**−0.547**	−0.352	−0.352	**0.535**
	P	0.399	0.200	0.223	0.958	**0.019***	0.152	0.152	**0.022***
Shoulders	*r*	0.041	−0.295	−0.295	−0.024	**−0.513**	−0.656	−0.656	0.288
	P	0.871	0.234	0.235	0.927	**0.029***	0.003	0.003	0.247
Lower back	*r*	−0.114	−0.157	−0.183	−0.204	−0.430	−0.398	−0.398	**0.480**
	P	0.653	0.534	0.468	0.432	0.075	0.102	0.102	**0.044***
Temporal	*r*	−0.361	**−0.642**	**−0.650**	0.335	−0.299	−0.226	−0.226	0.285
	P	0.141	**0.004**	**0.004**	0.189	0.229	0.367	0.367	0.253
Masseter	*r*	0.157	**−0.483**	**−0.482**	−0.053	**−0.550**	−0.438	−0.438	**0.577**
	P	0.533	**0.043***	**0.043***	0.840	**0.018***	0.069	0.069	**0.012***
Submandibular	*r*	0.157	**−0.490**	**−0.489**	0.163	−0.315	−0.089	−0.089	0.370
	P	0.533	**0.039***	**0.039***	0.532	0.203	0.724	0.724	0.131
Larynx	*r*	0.189	−0.462	**−0.486**	0.130	−0.315	−0.429	−0.429	0.370
	P	0.453	0.054	**0.041***	0.619	0.203	0.076	0.076	0.131
Anterior neck	*r*	−0.452	**−0.501**	**−0.523**	0.152	−0.558	−0.444	−0.444	**0.577**
	P	0.059	**0.034***	**0.026***	0.559	**0.016***	0.065	0.065	**0.012***

* Sperman correlation ($P < 0.05$) Caption: *r*: correlation coefficient.

TABLE 8.
Statistically Significant Correlation Between Musculoskeletal Pain Intensity and Protocol V-RQOL Domain Scores and Vocal Self-Assessment of Women and Men From Both Groups

		SG				CG			
		Socioemotional	Physical	Total	Vocal Self-Assessment	Socioemotional	Physical	Total	Vocal Self-Assessment
WOMEN									
Posterior neck	*r*	0.354	0.070	0.070	−0.359	−0.101	**−0.686**	**−0.578**	**0.313**
	P	0.164	0.791	0.791	0.157	0.698	**0.002***	**0.015***	**0.022***
Shoulders	*r*	0.323	0.072	0.072	−0.061	−0.226	−0.446	**−0.484**	0.344
	P	0.207	0.783	0.783	0.816	0.382	0.073	**0.049***	0.177
Temporal	*r*	0.292	−0.017	−0.017	−0.250	−0.117	**−0.691**	**−0.621**	**0.508**
	P	0.256	0.948	0.948	0.333	0.654	**0.002***	**0.008***	**0.037***
MEN									
Posterior neck	*r*	0.327	−0.152	−0.125	0.133	**−0.641**	−0.427	−0.427	**0.489**
	P	0.185	0.547	0.621	0.612	**0.004***	0.077	0.077	**0.039***
Shoulders	*r*	0.171	−0.207	−0.192	0.165	**−0.714**	−0.728	−0.728	0.342
	P	0.497	0.409	0.445	0.527	**0.001***	0.001	0.001	0.165
Upper back	*r*	0.072	−0.425	−0.426	0.089	−0.431	**−0.481**	**−0.481**	0.339
	P	0.776	0.079	0.078	0.735	0.074	**0.043***	**0.043***	0.169
Temporal	*r*	0.003	−0.157	−0.145	0.346	−0.308	−0.483	−0.483	0.312
	P	0.990	0.533	0.567	0.174	0.213	**0.042***	**0.042***	0.208
Masseter	*r*	0.157	−0.060	−0.060	−0.061	−0.408	**−0.695**	**−0.695**	0.362
	P	0.534	0.813	0.813	0.816	0.093	**0.001***	**0.001***	0.139
Submandibular	*r*	0.187	−0.259	−0.259	−0.044	−0.418	−0.544	−0.544	0.386
	P	0.458	0.299	0.300	0.866	0.084	**0.020***	**0.020***	0.114
Larynx	*r*	0.187	−0.295	−0.295	−0.041	**−0.537**	**−0.646**	**−0.646**	0.349
	P	0.458	0.235	0.235	0.877	**0.022***	**0.004***	**0.004***	0.156

* Sperman correlation ($P < 0.05$) caption: *r*: correlation coefficient.

DISCUSSION

According to the *International Association for Study of Pain,* the definition of pain is: a sensitive and emotional unpleasant experience, associated or related to an actual injury or potential of the tissues, or described in terms of the injuries.[22] The literature[4,12,14,23,24] suggests that musculoskeletal pain is a factor found in voice-related professionals' lives and may cause limitations in their professional activities as much as in their quality of life.[10,15] Furthermore, inappropriate vocal use for a long period of time may lead to the development of larynx lesions,[24,25] causing pain or discomfort during phonation.[26] Because of that, authors[16] recommend that pain must be a factor of investigation during vocal evaluation because it may be an aggravating symptom leading to compensatory adjustments related to posture and undesirable tensions, resulting in functional dysphonia.

In this study, it was observed that only women from the SG presented higher pain frequency in the upper back area than women from the CG, with no difference in other variables (Table 2). Occupational factors such as stressful laboratory activity, noisy environments, constant sitting posture, continuous use of computer, and overly speaking with repetitive vocal tension and effort may explain the appearance of pain on this area in tele-operators.[7] A study with tele-operators[7] verified that these professionals pointed out higher pain occurrence in the shoulders and neck area when compared to the general population. However, unlike in the current study, pain in other corporal regions, such as the head, arms, hands, and ears, was also significantly referred to by tele-operators. It is worth mentioning that 235 tele-operators participated in the research mentioned, which may mean that more information was gathered about the pain.

It was expected that the SG would present higher pain frequency and intensity when compared to the CG, as was shown in other studies,[7,13,16] but that did not happen. Tele-operators have an exhaustive working day, performing repetitive movements and intensive vocal use.[7] Another possibility for the difference in results is that because of their age, they reported lower pain frequency and intensity. A study involving tele-operators stated that there was no association between the presence of musculoskeletal pain and length of professional performance and amount of working hours.[7] However, the authors justified that the studied group had little time to act. Therefore, it is suggested that future studies check if there are associations between these variables.

Vocal fatigue is a symptom that must be studied to better investigate its relationship with other vocal disorders.[27,28] Considering that and the large variety of symptoms and manifestations of vocal fatigue, a self-assessment protocol was created so that individuals could report their symptoms and the related limitations. The VFI[17] provides information to identify individuals with or without vocal fatigue.

In this study, when the VFI protocol scores were compared, significant differences between the SG and CG for both men and women were not observed (Table 3), which can be explained by the small sample. It should be noted that 20% of the individuals from the SG mentioned hoarseness as a voice complaint, 12% of women and 8% of men. On the other hand, according to the resultant average values obtained in the process of VFI,[17] for individuals that are vocally healthy at work, the SG reported lower values in the three domains of the mechanism—vocal fatigue and limitation (5.16), voice-related physical discomfort (1.44), and recovery with vocal rest (5.8)—indicating that they do not realize vocal fatigue-related symptoms, a characteristic that can appear in voice-related professionals.

A positive correlation was observed between pain frequency in the submandibular and laryngeal areas and the fields of vocal fatigue and voice-related physical discomfort in tele-operators. Women from the CG presented a positive correlation between pain frequency in the "shoulder" area and vocal fatigue and limitations (Table 5). Therefore, it is noted that with a higher occurrence of pain in these areas, there will be a higher occurrence of vocal fatigue and discomfort, regardless of the professional use of the voice. However, in the current study, it was verified that an intense use of the voice causes vocal fatigue and discomfort in tele-operators, and as a consequence, there is a higher level of pain in muscle regions close to vocal apparatus (larynx and submandibular regions), unlike in nonvoice-related professional women, for whom physical tiredness and postural alteration[15] reflect corporal unsuitability and vocal adjustments that may impact speech.

Muscle tension associated with dysphonia, often characterized by pain, tingling, and discomfort, may occur due to inadequate vocal behaviors and relate to vocal fatigue symptoms such as dry throat, breaking voice, discomfort when speaking, breathlessness, effort when speaking, rough voice, itching throat, and other symptoms.[29] These symptoms may modify quality of voice and vocal dynamics, such as mechanisms surrounding phonation.[27] Authors[8,30] have reported that physical, psychological, organizational, environmental, and other factors may result in the appearance of vocal symptoms in voice-related professionals. These symptoms, associated with a long period of voice usage, can lead to vocal fatigue, vocal and corporal discomfort, and musculoskeletal pain.

In terms of men, both tele-operators and nonvoice-related professionals, a lot of positive correlations were observed between pain frequency in proximal and distal areas with the phonation and VFI protocol domains (Table 5). However, it should be highlighted that men from the SG had a higher number of correlations between pain and VFI fields. Only this group presented a positive correlation between larynx, submandibular, and temporal pain and the field of "recovery with vocal rest," indicating the possibility that men can recover after vocal rest, unlike women. These data may suggest that the tele-operator profession causes corporal discomfort and muscular tension that will lead to development of other vocal and larynx symptoms, resulting in vocal fatigue.

It is noted that men from the SG had more correlations between pain (distal and proximal corporal areas in relation to phonation) and VFI protocol domains when compared to the CG and women from both groups (Table 6). These

differences between genders must be investigated in more detail in further studies in order to comprehend which factors are causing this association between pain (frequency and intensity) and vocal fatigue in men.

According to the data obtained in this study, male tele-operators presented a higher impact on vocal production in the working environment. The working conditions of tele-operators have been well studied. Meanwhile, studied samples were composed mostly of women,[5,7,30] just as studies that investigated pain impact on dysphonia focused on women.[12,16] This emphasizes once again that the current study shows the necessity for further studies that better investigate the pain in men and its influence on the working environment, especially in tele-operators.

While there are studies that approached the relationship between voice-related quality of life and musculoskeletal pain[15] or vocal discomfort,[31] studies that investigated the impact of these factors on tele-operators' quality of life were not found. In the current study, it was observed that the higher pain frequency in the larynx area resulted in worse voice-related quality of life in female tele-operators (Table 7), which was not the case for women in the CG. The men's group presented correlations between three body areas, one of them being the larynx, and the physical and total V-RQOL fields, while the CG presented more correlations between frequency of pain and the fields from the V-RQOL, especially the socioemotional field.

The results corresponding to individuals from the SG indicated that the activity as a tele-operator, with intense voice usage, may result in more pain in the larynx, causing a negative impact on voice-related quality of life. However, the results corresponding to individuals from the CG, especially men, showed that the communication-related pain in the cervical and facial areas negatively impact quality of life, regardless of the professional use of the voice. In a study that investigated the relationship between pain and life quality,[15] the authors observed that in individuals with no vocal alterations, there was a negative correlation between pain intensity in the regions of the neck, upper back, and temporal areas and the physical and total V-RQOL fields. In another study,[31] it was determined that individuals with cervical complaints presented negative correlations between discomfort in the vocal tract and voice-related quality of life. In other words, the more vocal discomfort, the worse the voice-related quality of life.

Regarding the pain intensity, no correlations with voice-related quality of life were found for women or men in the SG (Table 8). In contrast, women and men in the CG presented positive correlations between pain intensity in the cervical and temporal regions and the fields from the V-RQOL protocol and vocal self-assessment. These results reveal that pain intensity is not correlated with working activities but probably with regular daily activities. It is worth mentioning that no participant in the CG uses his or her voice professionally.

This study reported limitations related to the small sample size, something that may have prevented finding differences between voice-related professionals and nonvoice-related professionals in terms of the studied variables. Another aspect that possibly contributed to the results is the fact that the data collection took place in the working environment of the participants, which could have inhibited them from answering the protocols. Additionally, the use of nonvalidated protocols may be considered a limitation to this study. It is suggested that in further studies, a larger number of tele-operators should be evaluated and lengthwise supervised, including vocal evaluations (perceptive-auditory and acoustics) in order to obtain wider knowledge of the relationship between vocal fatigue and musculoskeletal pain in tele-operators' voice quality. We also emphasize that this study did not investigate the level of physical activity of the participants, which could help in the interpretation of the results in relation to their regular lifestyle, a limitation that can be overcome in future studies.

In general, when compared, no differences were observed between tele-operators and vocally healthy individuals in relation to pain, vocal fatigue, and voice-related quality of life, aside from the pain frequency in the upper back, which was higher in women in the SG. However, the correlation of these factors was different between voice-related professionals and nonvoice related professionals, just as between men and women. This result should be taken into consideration in speech interventions with this population in order to obtain better vocal conditions during working activities, with no damage to their health, communication, and quality of life.

FINAL CONSIDERATION

Under the conditions in which the study was conducted, it was observed that female tele-operators present a higher frequency of pain in the upper back area when compared to nonvoice-related professional women. It can also be concluded that musculoskeletal pain negatively impacts voice-related quality of life and the increase of vocal fatigue during oral communication, regardless of the professional voice usage. Larynx pain has more of an impact on tele-operators' lives, while pain in the cervical and facial areas has more of an impact on nonvoice-related professionals.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at doi:10.1016/j.jvoice.2018.07.006.

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