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Group speech-language pathology intervention in popular singers: prospective controlled study

Intervenção fonoaudiológica em grupo a cantores populares: estudo prospectivo controlado

ABSTRACT

Purpose: To assess the benefits of a group vocal improvement program to popular singers without voice disorders. **Methods:** This is a quasi-experimental intervention study, carried out with 37 popular singers of both genders, with ages between 18 and 40 years and adapted vocal quality. Participants were divided into two groups: Intervention (IG) and Control (CG). The IG included 21 subjects who participated in seven weekly lectures regarding anatomy and physiology of the vocal tract, vocal hygiene care, and vocal exercises for voice improvement. The CG included 16 participants, who maintained their normal activities during this period, and did not receive any orientations regarding vocal improvement. In pre- and post-intervention, all participants answered a questionnaire about habits and demands related to the voice, and were evaluated regarding resonance, speech articulation, voice projection, pitch, loudness, maximum phonation time, and s/z ratio. **Results:** The vocal training was positive in the perception of the singers, who reported improvement in their voices. The assessment of maximum phonation time and s/z ratio did not present differences between groups ($p=0.57$). No modifications of behaviors potentially harmful to the vocal health were observed within 60 days after the intervention ($p=0.24$). There was also no considerable decrease of voice complaints ($p=0.1$), although the decrease percentage of complaints in the IG (22.2%) was higher than that of the CG (11.1%). **Conclusion:** Group vocal training intervention in popular singers is positive regarding the perception of the individual about his/her voice production, even though they presented adapted voice from the beginning of the process.

RESUMO

Objetivo: Verificar os benefícios de um programa de aperfeiçoamento vocal em grupo a cantores populares. **Métodos:** Trata-se de estudo de intervenção, quase experimental, realizado com 37 cantores populares de ambos os gêneros, com idades entre 18 e 40 anos e qualidade vocal adaptada. Os participantes foram divididos em dois grupos: Intervenção (GI) e Controle (GC). O GI contou com 21 indivíduos que receberam orientações sobre anátomo-fisiologia do aparelho fonador, cuidados de higiene vocal e realização de exercícios vocais, em um total de sete encontros. O GC contou com 16 participantes, que mantiveram suas atividades normais durante o período de realização da pesquisa e não receberam as orientações sobre o aperfeiçoamento vocal. Nos períodos pré e pós-intervenção todos os participantes responderam a um questionário sobre hábitos e demandas relacionadas à voz e foram avaliados em relação a: ressonância, articulação, projeção, *pitch*, *loudness*, tempo máximo de fonação e relação s/z. **Resultados:** O trabalho de aperfeiçoamento vocal mostrou-se positivo na percepção dos cantores, que referiram melhora em suas vozes. Os tempos máximos de fonação e a relação s/z não apresentaram diferença entre os grupos ($p=0,57$). Não houve modificação dos comportamentos potencialmente nocivos à saúde vocal ($p=0,24$) em até 60 dias após a intervenção. Não foi observada diminuição considerável das queixas vocais ($p=0,1$), ainda que a porcentagem de redução de queixas do GI (22,2%) tenha sido maior que a do GC (11,1%). **Conclusão:** A intervenção fonoaudiológica em grupo a cantores populares é positiva no que se refere à percepção do indivíduo sobre sua produção vocal, ainda que estes apresentem voz adaptada desde o início do processo.

Study conducted at Universidade Feevale – Novo Hamburgo (RS), Brazil, in partnership with Universidade Federal do Rio Grande do Sul – UFRGS – Porto Alegre (RS), Brazil, and Universidade Federal de São Paulo – UNIFESP – São Paulo (SP), Brazil.

Conflict of interests: None

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INTRODUCTION

Singers are people who accompany music melodies with harmony using the voice, emitting musical notes with precision. In order to realize this process, the demands to the vocal tract are big and, therefore, it is said that a singer is “the athlete of voice”. For singing, speech organs have specific adjustments that depend on the requirements of each musical style and type^(1,2).

For the singer, a professional whose voice is an indispensable working tool, alterations in the vocal quality may have an enormous impact on the quality of life, which may result in withdrawal from work activities. In addition, some professionals live daily with the vocal effort and tiredness, what result in an even bigger wear and tear. Among the most prevalent complaints it is possible to highlight the sensation of voice breaks, loss of intensity, burning, raspiness and tiredness when speaking⁽³⁾.

Considering that singers use to have similar complaints, a work in group may be advantageous. This work may promote rationalization of costs related to vocal improvement, possibility to count on a speech therapy treatment in their rehearsal places and exchanges of knowledge and experiences with other singers^(4,5).

In this way, we present an intervention study which objective is to investigate the impact of a program for the promotion of vocal health in a group of singers without vocal alteration⁽⁶⁻⁹⁾. The proposal presented provides orientations related to anatomy and physiology of the voice tract, basic care of vocal hygiene and exercises for improving the use of voice, including notions of vocal warming up and warming down. The objective was the modification of potentially harmful habits to vocal health, as well as the prevention of future problems related to vocal bad use and abuse.

METHODS

The research was approved by the Research Ethics Committee of the Universidade Feevale, under protocol number

4.07.03.08.995. All participants of the study signed a free and informed consent form.

It is an intervention study realized with 37 popular singers with ages between 18 and 40, of both genders, and with adapted vocal quality. Exclusion factor were considered: smoking, previous treatment with speech therapist for voice disorders and occurrence of perceptible vocal alteration at the time of the study.

The participants were divided in two groups: Intervention (IG) and Control (CG). The IG included 21 singers who received orientation about basic knowledge on anatomy and physiology of the voice tract, care of vocal hygiene and realization of vocal exercises, in a total of seven meetings, with approximate duration of one hour each. The process had the objective of improving the voice (Chart 1).

The CG included 16 participants, who did not receive speech therapy orientations during the period of the study. In addition, they continued their normal activities during the process.

In the pre- (t_0) and post-intervention (t_1) periods, all participants filled a protocol (Appendix 1) based on publications of references in this area^(7,10-13,22) about habits potentially related to voice and vocal health, vocal requirements at work and leisure, as well as aspects related to self-perception of demands and fragilities related to the use of the voice, especially for popular songs. In addition, a perceptive-hearing evaluation took place comparing the two periods, to verify if there had been any improvement on vocal quality as a whole, indirectly considering parameters such as:

- a) types of voice: adapted, hoarse, breathy or rough (the last ones considered as exclusion factors at the beginning of the study)
- b) resonance: oral, hyponasal/denasal, hypernasal or balanced
- c) vocal register: modal, basal or falsetto
- d) vocal attack: isochronic, abrupt or aspirated
- e) articulation: adequate, inadequate
- f) speed of speech and singing: adapted or not adapted
- g) pitch: low, normal or high
- h) loudness: weak, medium, strong

Chart 1. Activities realized during the meetings of intervention group (IG)

Meeting	Activities*
Meeting 1	Orientation on physiology of voice tract and vocal hygiene care.
Meeting 2	Relaxing exercises of head, neck and shoulders. Start work on awareness for respiratory type and mode.
Meeting 3	Relaxing activities of head, neck and shoulders. Training costal-diaphragmatic breathing and nasal sound prolonging associated vowels.
Meeting 4	Relaxing exercises, costal-diaphragmatic breathing, nasal ad vibrant tongue sound (modal and scales).
Meeting 5	Relaxing exercises, costal-diaphragmatic breathing, nasal and vibrant tongue sound (modal and scales). Inclusion of exercise for easy articulation.
Meeting 6	Relaxing exercises, costal-diaphragmatic breathing, nasal and vibrant tongue sound (modal and scales), exercise for easy articulation.
Meeting 7	Relaxing exercises, costal-diaphragmatic breathing, nasal and vibrant tongue sound (modal and scales), exercise for easy articulation. Return to orientations previously developed to be applied in the singers' routine. Systematization of vocal warming up and warming down plan for systematic use.

* Proposed activities were based on: Boone and McFarlane⁽⁶⁾; Colton and Casper⁽⁷⁾; Oliveira⁽⁸⁾; Estienne-Dejong (p. 148-166)⁽⁹⁾

- i) respiratory type: superior, inferior, mixed
- j) respiratory mode: oral, nasal or mixed

The parameters were evaluated by means of sustained emissions, speech chain. The analysis was done using the same evaluator, and the vocal quality classified as adapted or not adapted. It was considered adapted voice when vocal parameters were within normality, following the vocal demand of individuals and not adapted when at least one of the vocal parameters was negatively interfering in the execution of evaluated sound producing activities.

Vocal samples comprised: sustained emission of vowel /a/ and fricatives /s/ and /z/, speech chain, counting numbers 1 to 10 and months of the year, singing "Happy Birthday to You", and a free choice song from the singer, part of his/her repertoire. It was used a recorder Panasonic® RR-US450 and edited using the program Voice Editing 2.0. The measurement of maximum phonation times was realized taking the average of three emissions of vowel /a/ and sustained fricatives /s/ and /z/.

Vocal samples were analyzed by a speech therapist with two and a half-year experience in the area of evaluation and improvement of the singing voice, blind for the data in intervention and control groups. Voice samples of each singer were evaluated without identification and randomly distributed, independently of the group (intervention and control). Perceptive-hearing analysis was requested to the same evaluator, blind for times of each vocal sample, asking to classify pairs of voices in terms of being equal or different, identifying as the case might be, in which sample the evaluated parameter was better.

The average of the three emissions of maximum phonation times and the s/z ratio were compared, looking to identify the variations in t_0 and after seven weeks (t_1), considering a significant statistical index of 5%.

Data collected at the beginning and at the end of the study through a data protocol (Speech Therapy intervention in group for singers – IFC) were compared, considering the perception of singers on the impact of speech therapy regarding vocal quality, vocal complaints, habits and vocal hygiene care, among others. (Appendix 1).

The frequency of the research variables and associations were charted, when relevant, as well as the average and standard deviation, using Fisher exact test or chi-square test, as the case might be. For both, significance level of 5% was used.

Initially, 48 volunteered to participate in this study. Of these, 46 singers were eligible and 37 effectively participated in the study, nine singers gave up because they could not be present in all stages of the study. Ages varied from 18 and 40 years, of these, 26 (56.5%) were females. The average age of the singers was 26.3 years (SD=6.1).

Regarding their main occupation (besides singing), 25 (54.3%) of those interviewed reported the use of voice as their main working tool, 12 (26.1%) as secondary tool in activities (not essential) and nine (19.6%) did not use the voice as a tool of their professional activity.

The period acting as singer in the IG varied between 0.3 and 30 years, with a mean of 8 years (SD=7.8; median=5). The period acting as singer in the CG varied between 1 and 23 years, with a mean of 9.7 years (SD=5.9; median=10).

IG singers sang in average 4.9 hours per week (SD=3.3; median=4). CG singers, an average of 3.9 hours per week (SD=3.7; median=3).

In the IG, 16 (76.2%) singers had taken vocal technique classes and 13 (81.2%) singers in the CG. In the IG, ten (47.6%) had classes for less than six months, three (14.3%) from seven months to one year, two (9.5%) from one year and one month to three years, and one (4.8%) for three years and one month or more. In the CG, six (37.5%) singers had classes for less than six months, three (18.8%) from seven months to one year, two (12.5%) from one year and one month to three years, and two (12.5%) for three years and one month or more.

From the participants, nine (19.6%) had already had speech therapy treatment. In the IG, three (14.3%) singers had had treatment for vocal improvement, one (4.8%) to solve vocal pathologies, and two (9.5%) to solve issues related to the voice. In the CG, no singer had had speech therapy treatment.

Regarding the type of music sang, most participants, both in the IG (33.3%, n=7) and CG (43.8%, n=7), reported to sing gospel music. Other styles mentioned were MPB (Brazilian Popular Music), rock and pop rock (8.1%, n=3).

The results show characteristics related to the history of symptoms and injuries related to respiratory, digestive and hormonal systems, for both control and intervention groups (Table 1).

RESULTS

The results show aspects related to habits of vocal health, in both groups, during the pre- and post-intervention periods (Table 2).

Regarding the use of drugs none of the participants in this research reported to use substances during the collection for exams. In the IG, two singers (9.5%) were taking medicine, and eight (50%) in the CG during the pre-intervention period. After this period, four (19%) singers in the IG and seven (43.8%) in the CG were taking medicine. Significant change was observed ($p=0.008$) towards the increase in the use of medicine with medical orientation.

Eating habits of those participating in the study were also obtained (Table 3).

Knowledge regarding the vocal tract

Many singers did not know how the vocal production process took place. Among those who answered the question, most of them reported the voice as being produced by means of vibration of vocal folds. Few singers considered breathing in the process to produce voice. Also it was small the number of participants who referred to the process of amplifying the voice and articulation of sounds.

Asked about the structures involved in the production of voice, some singers answered they did not know. Among those who answered the question, practically all of them mentioned vocal folds and/or larynx. After that, diaphragm and respiratory system were mentioned, respectively. The mouth, pharynx, teeth, tongue, trachea, palate, resonance boxes, nose, were

Table 1. Distribution of injuries related to respiratory, digestive and hormonal systems, for control and intervention groups

Injuries	Intervention group		Control group		Total	
	n	%	n	%	n	%
Respiratory system						
No complaints	9	42.9	7	43.8	16	43.2
Rhinitis	4	19.0	3	18.8	7	18.9
Sinusitis	3	14.3	2	12.5	5	13.5
Rhinitis and Sinusitis	2	9.5	2	12.5	4	10.8
Bronchitis	0	0	1	6.3	1	2.7
Rhinitis, Sinusitis and Bronchitis	0	0.0	0	0	0	0.0
Rhinitis, Sinusitis and others	3	14.3	1	6.3	4	10.8
Allergies						
No complaints	10	47.6	6	37.5	16	43.2
Dust/powder	4	19.0	5	31.3	9	24.3
Pollen	0	0.0	0	0.0	0	0.0
Dust/powder and pollen	0	0.0	1	6.3	1	2.7
Dust/powder and animal hair	1	4.8	2	12.5	3	8.1
Dust/powder, pollen, animal hair and others	3	14.3	0	0.0	3	8.1
Others	3	14.3	2	12.5	5	13.5
Digestive system						
No complaints	17	81.0	11	68.8	28	75.7
Gastro esophageal reflux	0	0.0	2	12.5	2	4.3
Heartburn	1	4.8	1	6.3	2	4.3
Poor digestion	0	0.0	0	0.0	0	0.0
Gastro esophageal reflux and poor digestion	0	0.0	1	6.3	1	2.2
Others	1	4.8	1	6.3	2	4.3
Hormonal disorders						
No	21	100.0	13	81.2	34	93.5
Yes	0	0.0	3	18.8	3	6.5

also mentioned by some singers. One singer reported believing that the stomach also was involved in the production of voice.

Vocal complaints related to singing

Vocal complaints were gathered related to singing, in both groups (Table 4).

Vocal evaluation

The mean maximum phonation times during the pre-intervention period of singers in the IG varied between 5.6 and 13.3 (mean 10.19; SD=2.44) for women; and 11.3 and 21 (mean 14.75; SD=4.33) for men. In post-intervention period the mean varied between 5.6 and 15.6 (mean 11.88; SD=2.86) for women; and 8.3 and 23.6 (mean 13.5; SD=4.98) for men. The s/z ratio varied from 0.7 to 2.33. In the initial evaluation of the CG the mean maximum phonation time was 13.91 seconds (SD=4.1) and, in the final evaluation, the mean was 15.94 seconds (SD=5.5). In general, an improvement was observed only in the vocal quality parameter, and still in both groups (Table 5).

Perception of singers regarding the results of the voice improvement program

In general, IG singers reported to having observed improvement regarding the production of voice. They felt their voices

cleaner, clearer, more firm, secure, open, balanced, looser, velvety, soft, coming out more naturally. Singers said to have observed a difference in vocal production by having learned costal-diaphragmatic-abdominal breathing. Singers observed that they did not use a good portion of their breathing capacity.

Participants reported further the difficulty of automation in the new phonatory adjustment, even when noticing that emission was looser and easier. Singers in the intervention group pointed out that the emission of long vowels was easier, and they felt more safe to emit higher sounds. They said that the voice was “more towards the outside”, with more projection and using the body more. In CG, only one singer said to have noticed the improvement of his/her voice since the first recording.

DISCUSSION

The results of this research show the number of female participants was higher than men. This aspect is also observed in studies with specific populations that have the voice as an important working tool^(3,10,14-16).

Few subjects participating in the study reported not using their voices in their main professional activity, besides singing. Most of them reported that his/her profession totally involved using the voice. This data calls the attention to some issues. First of all their even bigger demand on the use of the voice. A recent study shows that the occurrence of dysphonia is proportional to the number of hours in the week using the

Table 2. Distribution of habits and care potentially related to vocal health pre- and post-intervention

Habits	Intervention group				Control group				p-value
	Week 0 (t ₀)		Week 7 (t ₁)		Week 0 (t ₀)		Week 7 (t ₁)		
	n	%	n	%	n	%	n	%	
Sleeping hours									
8-10 hours	7	33.3	7	33.3	8	50	8	50	0.3
5-7 hours	13	61.9	13	61.9	8	50	8	50	
4 hours or less	1	4.8	1	4.8	0	0	0	0	
Ingestion of water (ml/day)*									
Average		1200		1700		1250		1450	0.01*
Median		1250		1250		-		1250	
SD		675		1150		575		725	
Preventive food and alcohol restriction (before the use of voice for singing)									
No	21	100.0	21	100.0	16	100.0	16	100.0	-
Yes	0	0.0	0	0.0	0	0.0	0	0.0	
Speech in the presence of competitive noise (tension increase to phonation)									
No	12	57.1	11	52.4	5	31.3	4	25.0	0.14
Yes, in noisy environment	7	33.3	9	42.9	10	62.5	10	62.5	
Yes, always	2	9.5	1	4.8	1	6.3	2	12.5	
Frequent exposition to air conditioning									
No	16	76.2	16	76.2	12	75.0	11	68.8	-
Yes	5	23.8	5	23.8	4	25.0	5	31.3	
Self-medication									
Never	7	33.3	3	14.3	6	37.5	4	25.0	0.03*
Sometimes	5	23.8	5	23.8	2	12.5	2	12.5	
Frequently	9	42.9	13	61.9	8	50.0	10	62.5	
Cigarette consumption									
No	19	90.5	19	90.5	16	100.0	16	100.0	-
Yes	0	0.0	0	0.0	0	0.0	0	0.0	
Sometimes	2	9.5	2	9.5	0	0.0	0	0.0	
Alcoholic beverages consumption									
Never	11	52.4	11	52.4	8	50.0	7	43.8	0.27
Sometimes	10	47.6	10	47.6	7	43.8	7	43.8	
Weekly	0	0.0	0	0.0	1	6.3	2	12.5	

* Significant values (p<0.05) – Chi-square Test, indicating significant modification when compared to pre- and post-intervention data

Note: SD = standard deviation

Table 3. Eating habits reported before the use of voice for singing

Hábito alimentar	Intervention group				Control group				p-value
	Week 0 (t ₀)		Week 7 (t ₁)		Week 0 (t ₀)		Week 7 (t ₁)		
	n	%	n	%	n	%	n	%	
Fatty or highly spicy food									
No	15	71.4	15	71.4	10	62.5	9	56.3	0.24
Yes	6	28.6	6	28.6	6	37.5	7	43.7	
Chocolate and/or dairy products									
No	18	85.7	20	95.2	13	81.3	13	81.3	0.002*
Yes	3	14.3	1	4.8	3	18.7	3	18.7	
Stimulating beverages (tea, coffee, energetic drink)									
No	18	85.7	18	85.7	11	68.8	13	81.3	0.08
Yes	3	14.3	3	14.3	5	31.2	3	18.7	
Ingestion of cold beverages									
No	12	57.1	12	57.1	6	37.5	6	37.5	0.14
Yes	9	42.9	9	42.9	10	62.5	10	62.5	

* Significant values (p<0.05) – Fischer Exact Test

Table 4. Vocal complaints related to singing self-reported pre- and post-intervention, in both groups

Vocal complaint	Pre-intervention period (t ₀)				Post-intervention period (t ₁)				p-value
	No complaints		With complaints		No complaints		With complaints		
	n	%	n	%	n	%	n	%	
Intervention group									
Sore throat	10	47.6	11	52.4	10	47.6	11	52.4	0.11
Itchy throat	14	66.7	7	33.3	16	76.2	5	23.8	0.04*
Tingly throat	12	57.1	9	42.9	10	47.6	11	52.4	0.09
Dry throat	5	23.8	16	76.2	3	14.3	18	85.7	0.13
Burning throat	18	85.7	3	14.3	13	61.9	8	38.1	0.08
Throat tightness	15	71.4	6	28.6	14	66.7	7	33.3	0.29
Sensation of ball in throat	18	85.7	3	14.3	15	71.4	6	28.6	0.07
Tired voice	7	33.3	14	66.6	5	23.8	16	76.2	0.16
Raspiness	9	42.9	12	57.1	11	52.4	10	47.6	0.03*
Control group									
Sore throat	5	31.3	11	68.7	4	25	12	75	0.51
Itchy throat	9	56.3	7	43.7	7	43.8	9	56.3	0.23
Tingly throat	11	68.8	5	31.2	9	56.3	7	43.7	0.12
Dry throat	1	6.3	15	93.7	3	18.8	13	81.2	0.03*
Burning throat	14	87.5	2	12.5	12	75	4	25	0.08
Throat tightness	14	87.5	2	12.5	10	62.5	6	37.5	0.07
Sensation of ball in throat	14	87.5	2	12.5	13	81.2	3	18.8	0.12
Tired voice	3	18.8	13	81.2	2	12.5	14	87.5	0.21
Raspiness	8	50	8	50	8	50	8	50	0.11

* Significant values (p<0.05) – Chi-square test

voice⁽¹⁵⁾. Nevertheless, this data is not reported in the literature unanimously, with a study that mentions there is not a necessary relationship in this sense⁽¹⁶⁾. Considering the hypothesis of the first author⁽¹⁵⁾, singers, even amateurs, had intense vocal demand when added the number of hours of professional use of the voice to the use of voice when singing. This high demand would increase the risk of the appearance of vocal alterations. In addition, the impact of a vocal alteration in a singer could be even bigger, interfering in his/her professional life, even if not related to music and singing. The literature mentions that voice professionals in general are more concerned with alterations in their voices⁽¹⁷⁾.

More than half of the participants in the study reported complaints regarding the respiratory system, especially rhinitis and other allergies related to dust, animal hair and pollen, according to the literature, that highlights allergic rhinitis as an important factor to be considered in the treatment and prognosis of vocal rehabilitation^(11,15,18,19). Complaints related to the gastric system were less frequent, although it has been mainly reported gastro esophageal reflux, another aspect indicated in the literature associated with the increase of symptoms potentially associated to dysphonia and/or phonic inadequacies⁽¹⁵⁾.

The prevalence of hormonal alterations in the present study was relatively low. All singers who presented such alterations were treated immediately, what may possibly have prevented the co-participation of these factors for the occurrence of vocal complaints.

Another relevant aspect is the restricted knowledge of the singers about the necessary care for the maintenance of vocal health. In addition, the perception of the subjects studied about the difficulties and potentialities for the use of voice for singing

need more attention in order to improve its self-perception. These factors may contribute for the overload on the phonetic system, and, as a consequence, for the vocal wear and tear that may be potentially prevented^(8,20). Numerous homemade recipes and beliefs that are followed in an attempt to improve voice quality were also observed in the studied population, especially in an attempt to correct problems and/or reduce disagreeable sensations connected with the use of the voice for singing^(1,10,12,20-24).

Potentially harmful aspects for a healthy vocal production were recurrent in the subjects studied, such as reduced sleeping hours, some eating habits in the period previous to the use of the voice for singing, the low consumption of water, self-medication and bad use of the voice. Such aspects did not suffer significant alterations after the intervention program. This finding agrees with the previous study that mentions that orientations regarding vocal hygiene does not result necessarily in reduction of behaviors of bad vocal use, and does not also interfere positively in the increase of hydration or in the practice of exercises for vocal warming up⁽¹⁰⁾.

Almost all singers studied presented episodes of hoarseness or intense dysphonia, especially associated to flu and cold or the intensive use of the voice, for singing or speech, as it is also reported in the literature^(11,24). The latter may be related to intense and constant noise in places where vocal demand is increased⁽²⁵⁾.

It was observed that most of the singers participating in the study had already taken vocal technique classes. However, among them the highest number was those who took it for less than six months or for six months and one day to a year. Such aspect had no relationship with the knowledge of singers

Table 5. Maximum phonation time and s/z ratio and post speech therapy intervention

Subject	Gender	Maximum phonation times average (MPT)			s/z ratio		Vocal quality of second sample compared to first
		Pre-intervention	Post-intervention	Diff.*	Pre-intervention	Post-intervention	
Intervention group							
001	F	7	5.6	-1.4	0.88	1.25	Better
002	F	8	9.6	1.6	1.3	1	Equal
003	M	21	9.3	-11.7	0.88	1	Better
005	M	20	19.6	-0.4	0.7	1.26	Better
006	M	12	8.7	-2.3	1.16	2	Equal
007	M	14.3	13.6	-1	1.25	1.09	Better
008	M	13.3	15.6	2.3	1.57	1.56	Worse
009	M	11.3	13.3	2	0.8	0.94	Better
010	F	13.3	13.3	0	1.13	1.31	Equal
011	F	12.3	13	0.7	1.1	1.22	Better
012	M	12	10	-2	1.63	2.33	Better
013	M	13.6	13	-0.6	1.8	1.2	Better
014	F	10	15.6	5.6	2.18	1.5	Better
016	F	11	11	0	1.43	1.4	Better
017	M	9	8.3	-0.7	1.35	1.2	Equal
027	F	11	15	4	1.2	1	Better
028	F	12.3	11	-1.3	1.17	1.4	Better
030	F	5.6	11	5.4	1	1.18	Better
031	F	9.6	11	1.4	1.5	1.13	Equal
032	M	21	23.6	2.6	1.06	1.26	Better
034	F	12	14.6	2.6	1.5	1.2	Better
Control group							
023	M	13	13.6	0.6	1.45	1.66	Equal
024	F	13	14	1	1.9	1.08	Better
025	M	10.3	13.3	3	1.14	0.88	Equal
026	F	16.6	21.6	5	1.08	0.83	Better
035	F	10	13	3	1.15	1.07	Better
036	M	5	4.6	-0.4	1.16	1.63	Equal
037	F	9.3	12.6	3.3	1.33	1.2	Better
038	M	16.6	18.6	2	1.12	1.08	Better
039	F	18.33	24.6	5.3	0.9	1.05	Equal
040	F	14	14.3	0.3	0.95	0.8	Better
041	M	19.3	22.3	3	0.96	1.15	Better
042	F	9.3	10.3	1	1	0.7	Equal
043	F	15	15.6	0.6	1.57	1.9	Better
044	M	24	24	0	1.5	0.8	Better
045	F	11.3	12.3	1	1.05	0.7	Better
046	M	17.6	20.3	2.7	1.08	0.85	Better

* Difference in seconds between average of maximum phonation time pre- and post-intervention

Note: M = male; F = female

about how the sound producing system functions, much less the necessary habits to maintain vocal health.

The main complaints and symptoms related to the use of the voice were widely present in both groups and are according to the data found in the literature^(11,12,26). For both groups (IG and CG) the most frequent complaint was dry throat after the use of the voice for singing in the pre- and post-intervention periods.

IG singers in general, observed an improvement in their voices after intervention. However, some vocal complaints had increased. This fact may be related to the increase in the singer's perception about his/her vocal potential and subjective

sensations following the systematization of information contained in the pre-intervention. The evaluation on sensations related to the use of the voice in the first moment of the study helped them to recognize these perceptions and sensations in the second phase. Thus, it is possible to infer that exposing the singer to the list of symptoms and sensations associated to singing, negative or positive, is already capable of sensitizing him/her to recognize the potential and limitations when using the voice for singing, according to descriptions in other studies^(26,27).

About the objective measures of vocal evaluation, it is important to point out that in general the singers of both groups

had maximum phonation times below normal, analyzing by sex or general analysis of both groups studied, (intervention and control)⁽²⁸⁾, although it was observed vocal quality adapted at the pre-intervention moment. There was no significant modification in measurements of maximum phonation time in both groups at the end of the process, when the analysis was done by sex, even if in the general pre- and post-intervention analysis statistically significant modifications had been found. It was not found in the literature studies that compared the average of maximum phonation time before and after the work to improve the voice. The studies in general demonstrate the result following the perception of the participants regarding the improvement or worsening of the voice.

Most of the subjects with s/z ratio outside the limits of normality presented aerodynamic prevalence during phonation (n=10, 48%), aspect that was not subject to significant modification with the proposed vocal training. The s/z ratio also did not show significant change at the time of vocal reevaluation in IG. This aspect may lead to the assumption that a longer period of intervention time may be necessary so that modifications in the objective evaluations may be observed, according to evidence presented in previous studies related to the theme⁽²⁷⁻³⁰⁾.

Some data stood up in the sample, such as important alterations in the values of the maximum phonatory time and s/z ratio, including the important worsening in some cases. These data, in fact, do not agree with the perceptive-hearing evaluation of voice quality. Such fact may be associated to several factors such as the difficulty in understanding the proposed task at the time of evaluation and the tension caused by the situation evaluation (mainly in the second phase of the study). In addition, it is important to consider the climate in the region in which the study took place (south of Brazil), because of environmental aspects. In that region, there is more occurrence of respiratory and allergic problems, even though not diagnosed or even without perceptible relevance by the subject at first, but that could be an influence in the values of parameters evaluated^(29,30).

Even if care was taken such as repetition of measurements of parameters for all subjects evaluated in each phase of the study, we believe that the variables related to the phonation times should be aspects better studied and evaluated in specific populations. Thus, it will be possible to determine possible variables codependent to them, such as stature, history of regular physical activity practice, respiratory diseases and seasonality, among others.

Even if it is possible to consider that the parameters for phonation times had limitations for the group studied, the improvement in the perception of singers regarding their voices after vocal training proved to be positive for IG. One must consider that the improvement in the self-perception is a potentially relevant aspect for the promotion and maintenance of vocal health.

In general, singers reported improvement related to vocal production, clearly specifying their positive subjective sensations after the vocal intervention program. These results are similar to others obtained in studies with professionals using their voice^(27,29,30), especially for the prevention of vocal disorders, in an attempt to reduce vocal bad use and abuse

and, consequently, to reduce the risk of developing laryngeal pathologies, arising from functional alterations.

CONCLUSION

Data in this study denote the predominance of lack of knowledge from the singers regarding the mechanism for the production of voice and care for the maintenance of vocal health. In addition, the singers do not put this care into practice. In general, even after receiving orientations about vocal hygiene, there are no modifications related to their behavior in terms of vocal health. The results reinforce the fact that isolated vocal hygiene programs do not produce modifications related to vocal quality or modifications of habits.

Vocal training in singers with adapted voice focused as a priority in vocal exercises and orientations for the maintenance of vocal health was not sufficient, at short term, to point to significant modifications in complaints related to vocal symptoms during their singing, even if a small reduction was evident in the group submitted to intervention.

Speech therapy intervention in the group of popular singers is positive regarding the perception of the individual about his/her vocal production. However, this type of intervention, with the duration of seven meetings and focused on orientations about the production of voice, vocal hygiene care and realization of exercises, do not promote modifications in terms of maximum phonation time, s/z ratio and data on the voice perceptive-hearing evaluation.

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Appendix 1. Protocol of vocal evaluation

1. Identification data

ID number in research: _____

A - Sex: (1) Male (2) Female

B - Age: _____ years

C - Residence city

(1) Caxias do Sul (2) Farroupilha (3) Flores da Cunha (4) Bento Gonçalves (5) Others _____.

D - Work city

(1) Caxias do Sul (2) Farroupilha (3) Flores da Cunha (4) Bento Gonçalves (5) Others _____.

E - Highest education level: _____ full years of study

F - Occupation: _____

G - Regarding this occupation:

(1) Without professional use of the voice (2) With professional use of the voice (3) With partial professional use of the voice

H - Regarding the respiratory system:

(1) No complaints (2) Rhinitis (3) Sinusitis (4) Bronchitis (5) Others. Describe. _____

I - Regarding gastric system:

(1) No complaints (2) Reflux (3) Heartburn (4) Poor digestion (5) Others. Describe. _____

J - Regarding allergies:

(1) No complaints (2) To dust (3) To pollen (4) To animal hair (5) Other. Describe. _____

K - Any episode of hormonal alteration?

(1) No (2) Yes. Which? _____ Was it treated? _____

2. Data pre-speech therapy intervention

2.1 Vocal hygiene

In general do you sleep:

(1) 4 hours or less (2) 5 to 7 hours (3) 8 to 10 (4) More than 11 hours

How many glasses of water do you use to drink daily? _____ glasses per day

Do you smoke?

(1) No (2) Yes (3) Sometimes

Do you drink alcoholic beverages?

(1) No. Never (2) Sometimes (3) Weekly (1 or twice) (4) 3 or more times per week

Regarding cocaine use:

(1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Regarding marijuana use:

(1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Regarding ecstasy use:

(1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Do you use any medicine?

(1) No (2) Yes. Which? _____

Do you use to take medicine on your own, without medical indication?

(1) No (2) Yes (3) Sometimes

Do you stay in air conditioning places?

(1) No (2) Yes, during work; (3) Yes, at home; (4) Yes, practically everywhere (home, work and whenever possible)

Do you consider the air in your city polluted?

(1) No (2) Yes

Do you need to strain to be heard?

(1) No (2) Yes, in noisy places (3) Yes, always; (4) Others. Describe. _____

Do you use to drink alcoholic beverages before singing?

(1) No (2) Yes

Do you use any homemade recipe before singing?

(1) No (2) Yes. Specify. _____

Do you use to eat fatty or highly spicy food?

(1) No (2) Yes

Do you use to take chocolate or dairy products before singing?

(1) No (2) Yes

Do you use to drink beverages with caffeine (coffee, tea) before singing?

(1) No (2) Yes

Do you use to drink cold beverages?

(1) No (2) Yes

Do you become hoarse and/or without voice sometimes?

(1) No. Never (2) Only when I have flue or cold (3) Yes, in the morning (4) Yes, at the end of the day (5) Yes, after singing and/or use the voice a lot (6) Others. Describe _____

2.2 Knowledge about the voice tract

How is voice produced?

Which structures do you believe are involved in the production of voice?

2.3 Vocal care related to singing

How long have you sung? _____ months/years

How many hours do you sing per week? _____ hours

Do you now or have you taken vocal technique lessons?

(1) No. Never (2) Yes, for at least 6 months (3) Yes, from 7 months to 1 years (4) Yes, from 1 year and 1 month to 3 years (5) Yes, 3 years and 1 month or more

What type of music do you sing?

(1) MPB (2) Rock (3) Pop-rock (4) Reggae (5) Funk (6) Pagode (7) Sertanejo (8) Other. Describe _____

Describe how the stage is organized where you sing.

2.4 Vocal complaints related to singing

Classify: 0 – never 1 – rarely 2 – sometimes 3 – almost always 4 – always

After singing do you have a sore throat? 0 1 2 3 4

After singing does your throat itch? 0 1 2 3 4

After singing does your throat tingle? 0 1 2 3 4

After singing do you feel your throat dry? 0 1 2 3 4

After singing do you feel your throat burning? 0 1 2 3 4

After singing do you feel tightness in the throat? 0 1 2 3 4

After singing do you have the sensation of a ball in your throat? 0 1 2 3 4

After singing do you feel your voice tired? 0 1 2 3 4

After singing do you have raspiness more than normal? 0 1 2 3 4

2.5 Vocal evaluation

Maximum times of phonation: /a/ _____ then /a/ _____ then /a/ _____ then /s/ _____ then /z/ _____ then

Relationship s/z: _____

Vocal quality: _____

3. Data post- speech therapy intervention

3.1 Vocal hygiene

In general do you sleep:

- (1) 4 hours or less (2) 5 to 7 hours (3) 8 to 10 (4) more than 11 hours.

Do you usually drink how many glasses of water daily? _____ glasses per day

Do you smoke?

- (1) No (2) Yes (3) Sometimes

Do you drink alcoholic beverages?

- (1) No. Never (2) Sometimes (3) Weekly (1 or twice) (4) 3 or more times per week

Regarding cocaine use:

- (1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Regarding marijuana use:

- (1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Regarding ecstasy use:

- (1) Never used (2) Does not use (3) Uses sometimes (4) Daily

Do you take any medicine?

- (1) No (2) Yes. Which? _____

Do you use to take medicine on your own, without medical indication?

- (1) No (2) Yes (3) Sometimes

Do you stay in an air conditioned room?

- (1) No (2) Yes, during the work; (3) Yes, at home (4) Yes, practically everywhere (home, work and whenever possible)

Do you consider the air in your city poluted?

- (1) No (2) Yes

Do you need to strain to be heard?

- (1) No (2) Yes, in noisy places; (3) Yes, always; (4) Others. Describe _____

Do you use to drink alcoholic beverages before singing?

- (1) No (2) Yes

Do you use any homemade recipes before singing?

- (1) No (2) Yes. Specify _____

Do you use to eat fatty or highly spicy food?

- (1) No (2) Yes

Do you use to eat chocolate or dairy products before singing?

- (1) No (2) Yes

Do you use to drink beverages with caffeine (coffee, tea) before singing?

- (1) No (2) Yes

Do you drink cold beverages?

- (1) No (2) Yes

Do you get hoarse and/or without voice at some time?

- (1) No . Never (2) Only when have a flu or cold (3) Yes, in the morning (4) Yes, at the end of the day (5) Yes, after singing and/or using much your voice (6) Others. Describe _____

3.2 Knowledge about how the vocal tract functions

How is voice produced?

Which structures do you believe are involved in the production of voice?

3.3 Vocal care related to singing

How long have you been singing? _____ months/years

How many hours per week do you sing? _____ hours

Do you now you have you taken classes on vocal techniques?

- (1) No. Never (2) Yes, for at least 6 months(3) Yes, from 7 months to 1 year (4) Yes, from 1 year and 1 month to 3 years (5) Yes, 3 years and 1 month or more

What type of music do you sing?

- (1) MPB (2) Rock (3) Pop-rock (4) Reggae (5) Funk (6) Pagode (7) Sertanejo (8) Other. Describe _____

Describe how the stage where you sing is organized.

3.4 Vocal complaints related to singing

Classify: 0 – never 1 – rarely 2 – sometimes 3 – almost always 4 - always

After singing do you have a sore throat? 0 1 2 3 4

After singing do you feel your throat itch? 0 1 2 3 4

After singing do you feel your throat tingle? 0 1 2 3 4

After singing do you feel the throat dry? 0 1 2 3 4

After singing do you feel your throat burning? 0 1 2 3 4

After singing do you feel tightness in your throat? 0 1 2 3 4

After singing do you have the sensation of a ball in your throat? 0 1 2 3 4

After singing do you feel your voice tired? 0 1 2 3 4

After singing do you have raspiness more than normal? 0 1 2 3 4

3.5 Vocal evaluation

Maximum times of phonation: /a/ _____ then /a/ _____ then /a/ _____ then /s/ _____ then /z/ _____ then

Relationship s/z: _____

Vocal quality: _____

Based on:

Behlau M, Pontes P. Higiene vocal: cuidando da voz. Rio de Janeiro: Revinter; 2001⁽¹¹⁾.

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