Vocal Self-Perception of Singers During COVID-19 Pandemic

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Summary: Objective: to compare the self-perception of vocal fatigue and use of singing voice during the COVID-19 pandemic between professional and amateur singers and to relate this self-perception with vocal use characteristics during this period. Methodology: Participants were 121 singers divided into professional singers group (PSG) (12 men and 20 women) comprising singers who depended exclusively on singing as a profession and an amateur singers group (ASG) (37 men and 52 women) of singers who did not depend exclusively on singing for their livelihood. All answered online questionnaires through Google Forms ®. Sociodemographic and vocal characteristics were investigated before and during the pandemic; symptoms of vocal fatigue were assessed through the vocal fatigue index (VFI); and self-perception of use of singing voice through the evaluation of the ability to sing easily protocol for Brazil (EASE-Br). Results: In the comparison between groups, the PSG presented higher scores of vocal fatigue in fatigue and vocal limitation ($P = 0.045$), vocal restriction ($P = 0.002$), and recovery with vocal rest ($P = 0.008$) domains than did the ASG. There was no difference between the groups regarding the use of singing voice. Based on the relationship between self-perception and vocal use characteristics during the pandemic, it was observed that the presence of vocal complaint was the only factor associated with self-perception of fatigue symptomatology in both groups. Regarding the self-perception of the current status of the singing voice, singing time, the presence of vocal complaints, the need to increase visual concentration, and the perception of vocal worsening during the pandemic were considered predictive for amateur singers. For professional singers, vocal complaints and vocal training were predictors for self-perception of the current status of the singing voice. Conclusion: Professional singers presented with higher scores of vocal fatigue than did amateur singers. The symptomatology of vocal fatigue was associated with the presence of vocal complaints in both groups. However, self-perception of the current status of the singing voice was different between the groups and was associated with vocal training for professional singers and characteristics of vocal demand of singing voice during the pandemic period for amateur singers.

Key Words: Singing−Coronavirus−Voice disorders−Voice.

INTRODUCTION

The new coronavirus, SARS-CoV-2, discovered in late 2019 in China, causes COVID-19 disease. The virus has a high dissemination rate on all continents, which caused the World Health Organization[1] to declare a pandemic state. Several governments implemented preventive and restrictive measures to reduce people's movement and, consequently, the spread and contagion of the virus.[1−3] Therefore, social isolation and prohibitions on gatherings were decreed, with consequent closure of leisure and entertainment venues.

These adopted measures brought consequences for some professionals who had to interrupt or adapt their work. Singers are among the professionals impacted by the pandemic.[4,5]

Singing is one form of artistic expression that conveys emotion through letter, voice, and interpretation. However, it requires great vocal demand and sophisticated neuromuscular adjustments of the vocal tract.[6] Singing can be performed by professional or amateur singers of different musical styles. Professional singers earn their livelihood and recognition through singing, just as amateur singers generally sing for love and pleasure.[7,8] Professional singers commonly undergo vocal training with speech therapists and singing teachers to have a good performance, resistance, and vocal longevity,[9] which is less frequent among amateur singers.[8] Nevertheless, regardless of singing style or ability, both amateur and professional singing have vocal specificities that can bring vocal risk[10−13] and require the adoption of approaches to promote vocal health and prevent vocal disorders.[12]

There is little information about how the virus is transmitted during the singing and how to return to this activity in person safely.[5,14] However, there seems to be a risk of transmitting the SARS-CoV-2 virus through an exhalation act, and that singing, especially singing with increased amplitude, would project more aerosols than other speech events.[15]

Singers have considered the current pandemic moment unfavorable to vocal well-being,[16] since the psychological

Accepted for publication June 30, 2021.

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Journal of Voice, Vol. ■■, No. ■■, pp. ■■−■■
0892-1997

https://doi.org/10.1016/j.jvoice.2021.06.032

stress can negatively affect voice,[17] in addition to the financial impact experienced by the reduction of job opportunities,[5] especially for professional singers. There is evidence that some voice professionals may be more anxious, stressed, and worried about their voice than non-voice professionals during the pandemic.[16]

Brazilian singers of various musical styles are not using the singing voice as often during the pandemic. Most amateur singers have not sung since the pandemic began, and face-to-face musical performances have been canceled. Nevertheless, professional singers have used social media strategies such as transmitting live stream performances on digital platforms.[16] These live stream performances are conducted to provide entertainment for people at home, collect donations for people in vulnerable situations due to the COVID-19 pandemic, and obtain an income for the singer. However, several factors, such as the physical and acoustic characteristics of the environment that is usually the singer's own home, the lack of a band and limited equipment, the absence of an audience on-site, differentiate live stream performances from traditional vocal performances.[18]

Reduced use and vocal training frequency can cause detraining of muscles used for singing activities, decreased resistance, and worsening of vocal performance during singing. This phenomenon is due to the principle of reversibility, that is, if a muscle is not challenged regularly to the same degree (maintenance) or greater degree (overload), then the muscle adaptations induced by training will decrease. An increasing overload is imposed on the muscles during vocal training to prepare for the expected vocal production demand.[19]

It is believed that the possible reduction of vocal and muscle conditioning of singers during the pandemic may result in requiring an increased effort to sing, difficulty in achieving specific notes and adjustments, and symptoms of vocal fatigue after the use of singing voice. Vocal fatigue can be caused by a delay or lack of oxygen supply to the muscle and brain, which can result in the energy demand of tissues for the performance of a given task not being met.[20] This reduction of oxygenation would cause a decrease in the ability to perform a task over time, which can be explained by neuromuscular inefficiency or a recovery deficit. Neuromuscular inefficiency may involve an inadequate phonation muscle pattern, while recovery deficit may be affected by lack of training.[20–23]

Several singers have been verbally describing the difficulties associated with the use of the singing voice during the pandemic. However, although singers have a good vocal self-perception, they attribute different values and importance to their voice, apart from influencing factors such as vocal complaints.[24,25]

Since there is no established timeline of when singers will return to face-to-face singing activities under usual conditions, it is necessary to understand which factors may be related to self-perception of using singing voice and vocal fatigue symptoms during the pandemic. Moreover, it is essential to understand whether these factors differ between professional and amateur singers. It is believed that such data will contribute to the development and implementation of strategies of the orientation and training of singers to maintain vocal conditioning and reduce the risk of developing dysphonia during and after the COVID-19 pandemic.

Thus, this study aimed to compare the self-perception of vocal fatigue and use of singing voice during the COVID-19 pandemic between professional and amateur singers and to relate this self-perception with vocal use characteristics during this period.

MATERIALS AND METHODS

Design

This was an observational, cross-sectional, and analytical study.

Ethical aspects

The Research Ethics Committee of the Universidade Federal de Sergipe approved this study under the number 4,071,175. All participants voluntarily expressed their consent through a digital signature of the free and informed consent form.

Sample

The participants were recruited through the dissemination of the survey via email or social networks in Brazil. For this, a publication was elaborated and shared with a link to the study questionnaire. Through the digital platform Google Forms, the data collection was performed online in July, August, and September 2020, during the COVID-19 pandemic.

The participants were selected based on their answers to a questionnaire prepared by the authors and screening index for voice disorder (SIVD)[26] classification. Brazilian singers of any musical style, aged between 18 years and 49 years, of both sexes, native to Brazil, were invited to participate in this study. We excluded singers who had sung less than a year ago, lived outside Brazil in 2020, and were at risk of developing dysphonia, as per SIVD classification.[26] The singers who went through the selection process answered a questionnaire about sociodemographic data, and the characteristics of the singing voice were divided into two groups: professional singers group (PSG) and amateur singers group (ASG). Professional singers who used their voice as a fundamental tool for their professional activity were included in the PSG, and in the ASG, amateur singers who did not use voice as a fundamental tool for their professional activity, that is, that they did not depend on singing to survive and had another profession, were included.

Sample size calculation was performed using hypothesis testing with an independent t-test. The parameters adopted for the test were α 5%, β 10%, and K 90%. The

variable Evaluation of the Ability to Sing Easily for Brazil (EASE-BR) score was used for the calculation, which presented the highest standard deviation. This variable's following parameters were used: standard deviation of 10 points and minimum difference to be detected from a standard deviation. The sample size calculated was 23 participants per group.

Thus, 121 singers participated in the present study, and the ASG was composed of 89 singers, 37 males and 52 females, with a mean age of 29.62 years. The PSG comprised 32 singers, 12 males and 20 females, with a mean age of 31.91 years.

Outcome

The outcomes analyzed in this study were sociodemographic data, characteristics of the singing voice, and self-perception of vocal fatigue symptoms and use of singing voice during the pandemic.

To analyze the self-perception of vocal fatigue during the COVID-19 pandemic, the participants answered the vocal fatigue index (VFI) questionnaire, translated and validated in Portuguese brazilian.[27] It includes 17 questions answered by selecting an item on a Likert scale, which ranges between never (zero) and always (four). The VFI can be used to assess five factors: tiredness and vocal impairment, avoiding the use of voice, physical discomfort, improvement of vocal symptoms with rest, and total. The calculation of the scores for these factors was performed by simple summation.

To analyze self-perception of the current status of the singing voice, the translated and adapted Portuguese version of the Evaluation of the Ability to Sing Easily for Brazil (EASE-BR)[28] was used. The protocol contains 22 questions answered using a four-degree Likert scale, which represents the frequency of occurrence of each situation between no (zero), a little (one), moderately (two), and a lot (three). For the instrument's calculation, the direct sum of 19 negative questions is performed, with the sum of three positive questions inverted (items 6, 12, and 21). The EASE-Br was developed to evaluate the self-perception of the current status of the singing voice after a presentation, and all questions should be answered based on the state in which voice is at the time of response. In the present study, it was used to assess the self-perception of the current status of the singing voice during the pandemic.

The sociodemographic data and the characteristics of the singing voice during the pandemic in singers were extracted from a questionnaire developed by the authors (Appendix 1). The variables analyzed were as follows: age, gender, schooling, vocal complaints, vocal training, singing class, singing time, weekly workload of singing voice use, singing time per shows/presentations, number of shows/presentations, and number of live stream performances, greater need for visual and auditory concentration during a presentation performed in the pandemic, more tiredness and effort to sing during the pandemic, and vocal worsening during the pandemic.

Data analysis

Data analysis was performed with the Software SPSS 25.0. The data were analyzed descriptively and inferentially.

The variables were described using relative frequency and absolute frequency, measures of variability (standard deviation), central trend (mean and median), and position (minimum, maximum, first quartile, and third quartile).

The outcomes and quantitative characterization variables were subjected to a normality analysis with a Shapiro Wilk test and showed non-normal distribution. Therefore, these variables were compared between the groups with a Mann-Whitney U test. The association between categorical variables of characterization of the sample and the groups was assessed using a Pearson's chi-square test. An independent t-test was used to compare outcomes between the groups if the data presented normal distribution or a Mann-Whitney U test if the data presented non-normal distribution. A significance level of 5% was considered for all inferential analyses.

Inferential analyses were performed using Spearman's correlation test and Mann-Whitney U test to select the variables to compose multiple linear regression analysis models. Significant variables were included in the regression model as independent variables. The categorical variables of multiple categories were transformed into dummy variables. Four models were developed, one for each research group, to predict dependent variables self-perception of vocal fatigue and self-perception of use of singing voice. The test assumptions were tested. A backward model was used to select the variables.

RESULTS

Table 1 shows that the ASG presented a significantly lower weekly workload of singing voice use ($P < 0.001$), singing time per show/presentation ($P < 0.001$), and the number of show/presentation ($P = 0.001$) than the PSG did.

According to Table 2, there is an association between the ASG and not performing vocal training ($p<0.001$) and not participating in singing class ($P = 0.023$).

Compared to the ASG, the PSG presented significantly higher vocal fatigue scores in the domains of tiredness and voice impairment ($P = 0.045$), avoidance of vocal use ($P = 0.002$), and improvement of voice symptoms with rest ($P = 0.008$) (Table 3).

A multiple linear regression analysis was performed to verify whether the vocal variables that worsened during the pandemic, such as singing time (years), vocal training, greater need for visual and auditory concentration during a presentation in the pandemic, vocal complaint, more tiredness, and effort to sing during the pandemic, could predict self-perception of the current status of the singing voice in the ASG. The analysis resulted in a statistically significant model (F [4, 84]=14,269; $P< 0$,001; R2=0.405). The independent variables singing time (years) (β=-0.244; t=-2.871; $P = 0.005$), vocal complaint (β=0.292; t=2.990; $P = 0.004$), greater need for visual and auditory concentration during a

TABLE 1.
Characterization of Groups According to Age, the Singing Time, the Weekly Workload of Singing Voice Use, Singing Time Per Show/Presentation, Number of Show/Presentation, and Number of Live Stream Performances

Variable	Group	Mean	SD	Minimum	Maximum	1Q	Median	3Q	Z	*P*-value
Age	ASG	29.62	9.92	17.00	60.00	22.00	27.00	34.50	-1.580	0.114
	PSG	31.91	9.07	19.00	54.00	24.25	30.00	38.25		
Singing time (years)	ASG	11.09	8.15	1.00	37.00	6.00	10.00	14.50	-1.608	0.108
	PSG	13.00	7.40	2.00	30.00	7.25	12.00	18.00		
Weekly workload of singing voice use (hours/during pandemic)	ASG	4.73	5.88	1.00	40.00	2.00	3.00	5.00	-4.051	<0.001*
	PSG	10.19	8.45	1.00	30.00	3.00	8.00	14.00		
Singing time per shows / presentations (hours/during pandemic)	ASG	2.04	4.39	0.00	40.00	1.00	1.00	2.00	-3.735	<0.001*
	PSG	2.31	0.86	1.00	4.00	2.00	2.00	3.00		
Number of shows / presentations (monthly/during pandemic)	ASG	3.62	4.04	0.00	30.00	1.00	4.00	5.00	-3.478	0.001*
	PSG	6.44	4.39	1.00	15.00	3.00	5.00	9.50		
Number of live stream performances (monthly/during pandemic)	ASG	0.19	0.60	0.00	4.00	0.00	0.00	0.00	-0.886	0.376
	PSG	0.31	0.82	0.00	4.00	0.00	0.00	0.00		

Mann-Whitney U test
Legend: SD, standard deviation; 1Q, first quartile; 3Q, third quartile

presentation in the pandemic (β=0.205; t=2.238; P = 0.028), and vocal worsening during the pandemic (β=0.238; t=2.555; P = 0.012) were predictors of the dependent variable self-perception of the current status of the singing voice for the ASG (Table 4).

A predictive model for self-perception of the current status of the singing voice was obtained for the PSG (F [2, 30] =21.028; P = 0.000; R2=0.584). The independent variables vocal training (β=0.569; t=4.436; P = 0.000) and vocal complaint (β=-0.333; t=-2.600; P = 0.014) were predictors of the dependent variable self-perception of the current status of the singing voice for the PSG (Table 5).

The Table 6 showed that the independent variable vocal complaint (β=0.377; t=3.792; P = 0.000) could predict the dependent variable self-perception of vocal fatigue for the ASG (F [1, 87]=14.381; P = 0.000; R2=0.142).

The analysis of predictive variables of self-perception of vocal fatigue in the PSG resulted in a statistically significant model (F [1, 31]=6.172; P = 0.019; R2=0.166). The independent variable vocal complaint (β=0.407; t=2.484; P= 0.019) was a predictor of the dependent variable self-perception of vocal fatigue symptoms for the PSG (Table 7).

DISCUSSION

The voice can be a means of work and expression for singers. Singers have a sophisticated use of vocal adjustments and are at risk of developing voice disorders, regardless of whether they are professionals or amateurs.[12,13] The COVID-19 pandemic has changed the routine of these singers due to social isolation and reduced singing activities, which may have impacted their lives and voices[15] in the functional, professional, financial, physical, and emotional domains.[5] A study showed that among the aspects most affected by the COVID-19 pandemic, the social bond has a more substantial weight in the perception of loss during routine changes in the COVID-19 pandemic in amateur singers, while professional singers miss physical experiences, physical training, voice training and breathing training.[29] To better understand vocal self-perception and the factors that have influenced it during the COVID-19 pandemic in Brazilian singers, the present study sought to compare the self-perception of vocal fatigue symptoms and the use of singing voice during the COVID-19 pandemic among professional and amateur singers and investigated its association with self-perception with vocal use characteristics during this period.

In the present study, professional singers have a higher weekly workload of singing, sing for longer durations, have a larger number of shows, and more frequently attend singing classes and perform vocal training accompaniment than amateur singers. These data confirm the differences in the characteristics of professional and amateur singers and clarify that the pandemic has not modified them. Professional singers are professionally dedicated to singing, which is their main income source, while amateurs sing for love and pleasure and have another profession as their main source of income.[7] Thus, the difference in workload and frequency of singing voice use was expected. These data corroborate the literature that shows that professional singers present a higher frequency of vocal training and singing classes than amateur singers, in addition to a possible greater knowledge about anatomy physiology and vocal hygiene.[9,30,31]

These results from the study showed that professional singers presented higher self-perception of vocal fatigue symptoms due to high scores of tiredness and voice impairment, avoidance of vocal use factors than amateur singers; however, they also improved voice symptoms with rest than amateur singers. These data corroborate the fact that professional singers present higher vocal demands and high-performance demands concerning the prolonged duration of vocal use and use of voice at high intensity and frequency levels.[32] There is consensus that these high-performance demands can generate overload in the

TABLE 2.
Characterization of Groups According to Gender, Schooling, Vocal Complaints, Vocal Training, Singing Class, Greater Need for Visual and Auditory Concentration During the Presentation in the Pandemic, More Tiredness and Effort to Sing in the Pandemic, and Vocal Worsening During the Pandemic

			Group		*P*-value
			ASG	PSG	
Gender	Male	n	37	12	0.834
		%	41.6%	37.5%	
	Female	n	52	20	
		%	58.4%	62.5%	
Schooling	Elementary School	n	1	0	0.834
		%	1.1%	0.0%	
	High School	n	25	9	
		%	28.1%	28.1%	
	University education	n	63	23	
		%	70.8%	71.9%	
Vocal complaints	No	n	55	21	0.603
		%	61.8%	65.6%	
	Both	n	20	4	
		%	22.5%	12.5%	
	Before pandemic	n	7	3	
		%	7.9%	9.4%	
	During pandemic	n	7	4	
		%	7.9%	12.5%	
Vocal training	No	n	81	18	<0.001*
		%	91.0%	56.3%	
	Both	n	3	6	
		%	3.4%	18.8%	
	Before pandemic	n	3	8	
		%	3.4%	25.0%	
	During pandemic	n	2	0	
		%	2.2%	0.0%	
Singing class	No	n	56	16	0.023*
		%	62.9%	50.0%	
	Both	n	13	12	
		%	14.6%	37.5%	
	Before pandemic	n	12	4	
		%	13.5%	12.5%	
	During pandemic	n	8	0	
		%	9.0%	0.0%	
Greater need for visual and auditory concentration during a presentation performed in the pandemic	No	n	45	13	0.411
		%	50.6%	40.6%	
	Yes	n	44	19	
		%	49.4%	59.4%	
More tiredness and effort to sing during the pandemic	No	n	55	21	0.832
		%	61.8%	65.6%	
	Yes	n	34	11	
		%	38.2%	34.4%	
Vocal worsening during the pandemic	No	n	61	22	1.000
		%	68.5%	68.8%	
	Yes	n	28	10	
		%	31.5%	31.3%	

Pearson's chi-square test
Legend: n, number; %, percent

phonatory apparatus and lead to effort.[33] However, this group also recovered better than the rest. This fact may be associated with constant and regular vocal training performed by professional singers through singing classes and vocal training accompaniment, generating significant muscle and vocal resistance, reducing recovery deficits.

TABLE 3.
Analysis of Self-Perception of the Current Status of the Singing Voice and Symptoms of Vocal Fatigue According to Groups in Singers

Variable	Group	Mean	SD	Minimum	Maximum	1Q	Median	3Q	Z	*P*-value
EASE-Br	ASG	14.61	9.45	0.00	40.00	7.00	13.00	20.50	-0.780	0.436
	PSG	13.50	10.00	1.00	43.00	6.00	11.00	19.00		
VFI Tiredness and voice impairment	ASG	4.67	4.56	0.00	21.00	0.50	4.00	8.00	-2.006	0.045*
	PSG	6.75	5.51	0.00	21.00	2.00	5.50	11.75		
VFI Avoidance of vocal use	ASG	3.25	2.75	0.00	11.00	1.00	3.00	5.00	-3.155	0.002*
	PSG	5.44	3.46	0.00	11.00	2.25	5.50	8.75		
VFI Physical discomfort	ASG	1.04	1.66	0.00	7.00	0.00	0.00	1.00	-1.414	0.157
	PSG	1.50	2.03	0.00	8.00	0.00	1.00	2.00		
VFI Improvement of voice symptoms with rest	ASG	6.20	4.31	0.00	12.00	2.50	6.00	10.00	-2.661	0.008*
	PSG	8.63	3.66	0.00	12.00	7.25	9.00	12.00		
VFI Total	ASG	14.76	6.73	0.00	38.00	11.00	14.00	18.50	-1.425	0.154
	PSG	17.06	8.33	0.00	36.00	11.00	17.00	23.00		

Mann-Whitney U test
Legend: SD, standard deviation; 1Q, first quartile; 3Q, third quartile

TABLE 4.
Predict Analysis of the Self-Perception of the Current Status of the Singing Voice in Singers of the Amateurs Singers Group

	Non-Standard Coefficients		Standardized Coefficients	*t*	*P*-value
	B	Error	Beta		
(Constant)	12.164	1.694		7.182	0.000
Singing time (years)	-0.283	0.098	-0.244	-2.871	0.005
Vocal complaints	5.649	1.889	0.292	2.990	0.004
Greater need for visual and auditory concentration during a presentation performed in the pandemic (during the pandemic)	3.856	1.723	0.205	2.238	0.028
Vocal worsening during the pandemic	4.808	1.882	0.238	2.555	0.012

Multiple linear regression

Vocal training may decrease the time needed for cardiovascular recovery and homeostasis after a period of vocal use.[20] The performance of vocal training, degree of experience, and vocal preparation reduce susceptibility to vocal fatigue in singers, even during the COVID-19 pandemic.[4]

Of note, professional singers have avoided more vocal use, which may point to greater mental fatigue in this population than among amateur singers. The COVID-19 pandemic has been a stressful factor for voice professionals, especially singers, with adverse effects on their well-being and voice.[16] This stress can be aggravated by the lack of guidance on how to deal with the current situation.[34]

Moreover, professional singers commonly have better vocal self-perception than amateur singers, which may have

TABLE 5.
Predict Analysis of the Self-Perception of the Current Status of the Singing Voice in Singers of the Professional Singers Group

	Non-Standard Coefficients		Standardized Coefficients	*t*	*P*-value
	B	Error	Beta		
(Constant)	12.639	2.157		5.860	0.000
Vocal complaints	12.186	2.747	0.569	4.436	0.000
Vocal training	-6.951	2.674	-0.333	-2.600	0.014

Multiple linear regression

TABLE 6.
Predict Analysis of the Vocal Fatigue Symptoms in Singers of the Amateurs Singers Group

	Non-Standard Coefficients		Standardized Coefficients	t	*P*-value
	B	Error	Beta		
(Constant)	12.782	0.846		15.114	0.000
Vocal complaints	5.189	1.368	0.377	3.792	0.000

Multiple linear regression

TABLE 7.
Predict Analysis of the Vocal Fatigue Symptoms in Singers of the Professional Singers Group

	Non-Standard Coefficients		Standardized Coefficients	t	*P*-value
	B	Error	Beta		
(Constant)	14.333	1.679		8.537	0.000
Vocal complaints	6.917	2.784	0.407	2.484	0.019

Multiple linear regression

contributed to greater self-perception of vocal fatigue symptoms in professional singers[24,25] than in amateurs.

In this study, despite the differences between the groups regarding the use of the voice during the pandemic and the vocal fatigue symptoms, in both groups of singers, the only factor associated was the presence of vocal complaints. These results allow us to infer that singers, whether professionals or amateurs, who present vocal complaints, have more vocal fatigue symptoms than those who do not present with vocal complaints. However, the regression models indicate little variability, and, thus, these models were considered weak; therefore, the results should be interpreted with caution. The presence of vocal complaints in singers is common and may be indicative of incorrect vocal use, insufficient vocal training for demand, and the need for adjustments in singing voice.[35] Vocal complaints may have been aggravated by the reversibility[19] of vocal physiology during the pandemic, causing individuals with vocal complaints to have worse scores of vocal fatigue symptoms. Singers relate vocal fatigue to the presence of kinesthetic/proprioceptive and auditory symptoms, with excessive or incorrect voice use and the use of inadequate vocal techniques as the potential causes.[36]

Professional singers can relate vocal fatigue to a reduced ability to project or sustain voice, reduced vocal power, pitch, and loudness, increased hoarseness, increased effort to produce voice, or general vocal constriction.[36] The gradual decrease in task performance in singers with vocal fatigue may be due to neuromuscular inefficiency, which may involve an inadequate phonatory pattern and inefficient muscle recruitment, may increase the energy demand for function performance, and may or may not involve deficit recovery.[20,23] Neuromuscular adjustments used for singing are sophisticated and require a sizeable vocal demand,[6] and any complaint that indicates a possible vocal alteration, mainly behavioral, can compromise the vocal performance and lead to a sensation of vocal effort, possibly due to neuromuscular inefficiency.

In the present study, there was no difference between the amateur and professional singers regarding the self-perception of the current status of the singing voice. Regarding the factors associated with self-perception of the current status of the singing voice, in amateur singers, singing time, presence of vocal complaints, need to increase visual concentration, and perception of vocal worsening during the pandemic were identified as predictive factors. For professional singers, vocal complaints and vocal training were predictors for self-perception of vocal status during singing. Both models were good forecasters. It is believed that professional singers perform vocal training with SLP, which allows better singing performance, better resistance, and, consequently, maintenance of vocal conditioning during the pandemic.[9]

The present study results showed that singers with vocal complaints or possible behavioral alterations showed greater difficulties in performing vocal adjustments of the singing voice and, consequently, worse self-perception of the current status of the singing voice. No studies were found with the EASE-Br. However, other self-perception instruments indicate that singers with vocal complaints have worse vocal self-perception than singers without vocal complaints.[25]

On the other hand, in most amateur singers who do not perform vocal training, variables directly related to the demand, such as singing time and a lower knowledge about vocal anatomy physiology, were higher, indicating the need for greater concentration to perform adequate adjustments. The perception of vocal worsening during the pandemic was predictive of a worse self-perception of the current status of the singing voice. It is believed that they are directly related

to the lack of training, lower vocal resistance,[8] and lower knowledge about the anatomy, physiology, and vocal techniques,[7,8] all of which may have increased the difficulty of amateur singers to adapt to the new conditions of use of singing voice.

One study showed that greater knowledge about singing voice (acting in musical theater or classical singing, having musical training) and a more significant number of singing years training were among the characteristics associated with a better self-perception of the current status of the singing voice.[37] Furthermore, corroborating these findings, a study showed that better EASE-BR scores in theater singers are related to the constant singing practice, greater vocal self-awareness, and better preparation for specific vocal demands, which provides greater resistance and vocal consistency, with a better understanding of the vocal abilities, eventually leading to better vocal conditioning.[38]

Furthermore, it was expected that vocal complaints and possible voice disorders impair singing performance, both of which were associated with worsening self-perception in both groups.

It is impossible to predict the end of the pandemic and withdrawal of social preventive measures in Brazil, which delays singers' return to live entertainment and leisure activities. According to the results, there is a need for measures to promote vocal health and prevent dysphonia, both during the pandemic and after return to the usual vocal demand for singing.[14] Besides, it is emphasized that public health policies should safeguard this class of workers affected by the COVID-19 pandemic; moreover, some consequences may be chronic and not automatically cease with the end of the pandemic.

It is suggested to carry out more studies on the return of singers to their usual singing activities to check how their self-perception will be and the vocal needs of this population.

CONCLUSION

Professional singers have higher symptomatology of vocal fatigue than amateur singers but can recover better after vocal rest. The presence of vocal complaints was associated with higher vocal fatigue scores in both groups of singers. Regarding the self-perception of the current status of the singing voice during the pandemic, the singing time, presence of vocal complaints, need to increase visual concentration, and perception of vocal worsening during the pandemic were predictors of vocal complaints in amateur singers, while the presence of vocal complaints and performance of vocal therapy were predictors in professional singers.

SUPPLEMENTARY DATA

Supplementary data related to this article can be found online at doi:10.1016/j.jvoice.2021.06.032.

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