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Original articles

Correlation between slow vital capacity and the maximum phonation time in elderly

Correlação entre a capacidade vital lenta e o tempo máximo de fonação em idosos

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ABSTRACT

Purposes: to verify the existing relationship between the slow vital capacity and maximum phonation time in the elderly.

Methods: the study was analytical and observational, cross-sectional, conducted at the Open University Senior Citizens at the origin institution, in the period from June to October 2014, with 61 elderly female, nonsmokers. We excluded patients with chronic obstructive pulmonary disease and / or respiratory diseases, individuals with neurological or hearing problems and voice professionals. All participants were assessed for slow vital capacity and maximum phonation time. The following data were also collected: gender, weight, height, age and body mass index.

Results: the results showed that the values of slow vital capacity and maximum phonation time are reduced in the elderly. In addition, there is a positive correlation between the slow vital capacity and maximum phonation time of / s / and / z /.

Conclusion: with aging, breathing and voice measures may be reduced. In addition, there is an association between the slow vital capacity and maximum phonation time in older women, suggesting the influence that breathing exercises over phonation in this specific population.

Keywords: Vital Capacity; Elderly; Voice

RESUMO

Objetivos: verificar a relação existente entre a capacidade vital lenta e o tempo máximo de fonação em idosos.

Métodos: o estudo foi do tipo analítico e observacional, de corte transversal, realizado na Universidade aberta a Terceira Idade na instituição de origem, no período de junho a outubro de 2014. Participaram 61 idosos do sexo feminino, não tabagistas. Foram excluídos portadores de Doença Pulmonar Obstrutiva Crônica e/ou doenças respiratórias, indivíduos com problemas neurológicos ou de audição e profissionais da voz. Todos os participantes foram avaliados quanto à capacidade vital lenta e tempo máximo de fonação. Foram coletados ainda os seguintes dados: sexo, peso, estatura, idade e índice de massa corpórea.

Resultados: os dados demonstram que os valores de capacidade vital lenta e tempo máximo de fonação estão reduzidos na terceira idade. Além disso, existe uma correlação positiva entre a capacidade vital lenta e o tempo máximo de fonação do /s/ e /z/ no sexo feminino.

Conclusões: com o envelhecimento, medidas de respiração e voz podem estar reduzidas. Além disso, existe uma associação entre a capacidade vital lenta e o tempo máximo de fonação em mulheres idosas, sugerindo a influência que a respiração exerce sobre a fonação nesta população específica.

Descritores: Capacidade Vital; Idoso; Voz

INTRODUCTION

Population aging is a major impact theme worldwide nowadays and it has been the subject of numerous studies, including Brazil. It is estimated that the elderly population will reach 23.6% by 2050[1-3]. Despite being a natural process, aging causes the individual a number of physiological changes[2,3].

The respiratory system undergoes progressive changes due to age[4-6]. With aging, the vital capacity (VC) is one of the respiratory variables that can be modified, with a reduction of 40% on average from 20 to 80 years old[4,5]. Vital Capacity is the most commonly respiratory measure used in clinical practice and it is characterized as the maximum volume exhaled from the lungs after a maximal inhalation and can be measured slowly, slow vital capacity (SVC) or forcefully, forced vital capacity (FVC) [7].

The heterogeneity of aging is also reflected in voice conditions of the elderly. And for the vocal production, an interaction among breathing, phonation and articulation is necessary[8-10]. To generate and sustain a normal phonation, it is necessary that the aerodynamic forces are in equilibrium with the forces of the laryngeal muscles[11,12], leading to the necessary vibration of the vocal folds[9].

A simple and practical measure to achieve integration among the components of vocal conditions and breathing is the measurement of maximum phonation time (MPT)[13], which is the maximum time that an individual can sustain the emission of a sound[6,14]. The MPT provides great value in the characterization of vocal behavior related to breathing, as during connected speech air refills are carried out each third of the MPT.

Elderly individuals may have the MPT changed, as well as reducing the amount of air available[11,15,16], impairing the aerodynamic forces required for speech. Thus, it is assumed that there is an association between the two measures. In healthy adults[17] as well as children with asthma[18], it has already been possible to establish the relationship between the two variables, but in the elderly population, in which a reduction in the values of VC and MPT is expected, it is not yet established.

If there is a direct relationship between MPT and VC in the elderly, it is possible to propose alternative treatment to the voice of the elderly with focus on the relation voice-breathing. That way, it will be possible to improve these individuals' communication and consequently their quality of life.

In the face of what was listed, the aim of this study was to analyze the relationship between the SVC and the MPT in the elderly.

METHODS

The study was approved by the Ethics and Human Research Committee of the Federal University of *Pernambuco*, under the CAAE number: 26206113.8.0000.5208. All participants were informed about the research content and invited to take part in it, since they have signed the Informed Consent (IC).

This is a quantitative, analytical, observational and cross-sectional study, which was held at the Open University for Senior Citizens and aims to promote actions to improve the quality of life of older people through courses and other activities to facilitate the knowledge update and integration into society.

61 elderly female participated in the study, considering as an elderly person each and every citizen aged 60 years old or over, according to the Statute of the Elderly (2003)[19]. Participants were linked to the program in the first half of 2014. The study excluded smokers, people with COPD (chronic obstructive pulmonary disease) and / or other respiratory diseases, who presented neurological or hearing problems and who were or had been voice professionals.

Data were collected, as BMI (body mass index), weight, height, age, sex, SVC, MPT. BMI was calculated from the anthropometric measures and calculated according to the standard formula[20] to homogenize the sample on the biotype. The SVC was measured by the analog spirometer Wright Mark 8, graduated in milliliters (ml). Vital capacity is the maximum volume exhaled, leaving the maximum inspiratory capacity. Three measurements were made and the best of them was used, considering the two minute interval between measurements. The elderly was sitting with his feet flat on the floor and the back straight. Occlusion of the nostrils was performed with a nose clip and a deep breath outside the nozzle was requested until the lungs were full of air. Then a slow exhalation into the nozzle until the lungs were empty. All values were registered.

To measure MPT, the elderly was requested to perform a deep breath in and then sustain for as long as possible the vowels / a /, / i /, / u / and the fricatives / s / and / z /. Their values were measured using a chronometer of the brand Cronobio model - SW2018.

The test was performed in the same sitting position and the best value from two measurements was used,

considering the interval of two minutes of rest between them.

Statistical Analysis

Statistical analysis was performed using SPSS 19.0 (Statistical Package for Social Science). For all tests, a 5% significance level was considered. To check the normality of the data the Kolmogorov-Smirnov test was used. Subsequently, mean equality tests t Student were performed (for variables with normal distribution) or Mann-Whitney (for variables with non-normal distribution). In addition, the Pearson correlation test (for variables with normal distribution) or Spearman (for variables with non-normal distribution) was used to verify possible associations between respiratory and vocal variables.

RESULTS

It can be noticed in Tables 1 and 2 the distribution of the variables weight, height, BMI, SVC and MPT (/ a /, / i /, / u /, / s /, / z /), and the values of mean and standard deviation were presented. The values of weight, height and BMI showed that there was homogeneity in the sample.

Table 1. Variables distribution age. weight. height. body mass index and Slow Vital Capacity with mean and standard deviation

	Variables Distribution		P-value
	n = 61		
	Mean	Standard Deviation	
Age	70	6	0.2275**
Weight Kg	63.2	10.0	0.3173**
Height_cm	1.57	.06	0.0132**
BMI	25.6957	3.5418	0.7953**
SVCmL	1977	454	0.0078*

(*) Mann-Whitney: P<0.05
(**) t Student: P<0.05
Note: BMI (body mass index); SVCmL (Slow Vital Capacity in mL).

Table 2. Distribution of / a /, / i /, / u /, / s / and / z / Maximum Phonation Time with their mean and standard deviation

	Variables Distribution		P-value
	n = 61		
	Mean (seconds)	Standard Deviation	
MPT /a/	11	4	0.0606*
MPT /i/	12	5	0.1356*
MPT /u/	12	5	0.3737*
MPT /s/	8	3	0.9561*
MPT /z/	8	4	0.0991*

(*) Mann-Whitney: P<0.05
(**) t Student: P<0.05
Note: MPT /a/ (Maximum phonation time of vowel /a/); MPT /i/ (Maximum phonation time of vowel /i/); MPT /u/ (Maximum phonation time of vowel /u/); MPT /s/ (Maximum phonation time of fricative /s/); MPT /z/ (Maximum phonation time of fricative /z/).

For MPT values / a, / i /, / u /, / s / and / z /, the mean obtained was 11 ± 4, 12 ± 5, 12 ± 5, 8 ± 3 and 8 ± 4 seconds, respectively.

In Table 3, it can be observed the correlation between the SVC and the maximum phonation time, and it is possible to verify the positive correlation between the SVC and the MPT of / s / and / z /.

Table 3. Correlation between Slow Vital Capacity x Maximum Phonation Time

	n = 61	P-value
	r- Pearson correlation	
MPT /a/	0.147	0.258
MPT /i/	0.072	0.583
MPT /u/	0.243	0.059
MPT /s/	0.373	0.003
MPT /z/	0.310	0.015

Note: MPT /a/ (Maximum phonation time of vowel /a/); MPT /i/ (Maximum phonation time of vowel /i/); MPT /u/ (Maximum phonation time of vowel /u/); MPT /s/ (Maximum phonation time of fricative /s/); MPT /z/ (Maximum phonation time of fricative /z/).

DISCUSSION

Breathing and voice are closely related and, with aging, it is known that these functions can be impaired[21,22]. Some studies indicate that the decrease of lung capacity, between 20 and 80 years old, is around 40%; which may explain the drop in respiratory support for speech, leading to restriction of loudness and especially the reduction of maximum phonation times[14,22]. This study was to analyze the relationship between vital capacity in the SVC form and the maximum phonation time in elderly women.

On the measures of MPT, it can be verified that the values are lowered according to age. Similar findings were found by Paes *et al.*[23], that compared the vocal characteristics, aging proprioception, complaints and vocal health of 94 elderly women. The study of Siqueira[24] examines the impact of respiratory and vocal aspects in the quality of life in 56 elderly of both sexes and also finds reduced values of MPT in the female group and greater impact on quality of life in this group's voice.

Fabron *et al.*[25], while studying respiratory measurements in a group of 41 elderly male or female, also found similar results, with MPT means for women around 13s and men around 17s, showing that these values tend to decline with aging.

Regarding the mean of the consonants / s / and / z / MPT, the results are below the values found in some studies that indicate a mean from 15s to 25s in adults[26]. In the elderly, these values are particularly decreased and they are from 10s to 20s[15,16]. In the current study, however, the means were below expectations even for the elderly.

As for the VC values, this study recorded reduced values in the population of elderly women. Ruivo *et al.*[11], when comparing respiratory function in young and old adults, have identified a reduction in chest expansion and VC 28.41% in females and 18.09% in males, for the elderly. VC is an index that evaluates the distension capacity of the thorax and lungs system and, with aging, there may be reduction of this mobility, being reflected in the volumes and lung capacity values[25,26]. For Ruivo *et al.*[11], the reduction in the values found between the sexes can be attributed to the biotype difference between men and women and even to the values of abdominal circumference which, in their study, was greater in elderly female group.

Ide[5] defended that women of all ages have vital capacity values reduced with aging. However, Ruivo *et al.*[11] verified these lower values only in the elderly group.

Regarding the correlation analysis, similarity between / s / and / z / MPT measurements and SVC was found, suggesting that with aging, the decrease in maximum phonation time values is related to the maximum volume of exhaled air. So, it is shown that the glottal efficiency will depend largely on the respiratory air support of the elderly. These results corroborate those obtained in the study of Rossi *et al.*[18], who analyzed the relation between expiratory flow peak and the maximum phonation time in asthmatics. The authors defend that one of the reasons to believe that respiratory variables can influence the MPT is that

the larynx is mechanically attached to the respiratory tract, allowing it to suffer direct force from breath. During inhale, the glottis tends to widen by the removal of arytenoid cartilages due to the tracheal traction resulting from lung expansion[27].

CONCLUSION

There is an association between the SVC and the MPT in elderly women, suggesting that there is influence of breathing exercises over phonation in this specific population. These results may contribute to the development of specific intervention programs, with emphasis on the relationship voice-breathing.

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