26 - RESPIRATORY MUSCLE STRENGTH BEHAVIOR IN ACTIVE AND SEDENTARY ELDERLY

CAROLINE BOTTLENDER MACHADO[1]
ÉBONI MARÍLIA REUTER[1]
ROSÂNGELA HINTERHOLZ[1]
ISABELLA MARTINS DE ALBUQUERQUE[1]
DULCIANE NUNES PAIVA[1]
1. UNISC - Universidade de Santa Cruz do Sul, Santa Cruz do Sul, Rio Grande do Sul, Brasil.

INTRODUCTION

The population aging is a Brazilian and worldwide reality, such process causes an increase of diseases and organic disorders incidence (BRITTO et al., 2005). The structural and functional changes that happen, cause the decline in muscle strength and functional capacity (GURJÃO et al., 2010; ZAZÁ et al., 2010). There are evidences that regular practice of physical activity can bring cardiorespiratory benefits for the elderly and those who maintain a constant level of such activity can minimize the losses resulting from the aging process (FERREIRA et al., 2005; CIPRIANI et al., 2010). Aging reduces breathing capacity due to the loss of muscle mass and the changes in quantity and composition of connective tissue that reduces the elastic pressure of the lung recoil (BRITTO et al., 2005; SIMÕES et al., 2007).

The evaluation of the respiratory muscle strength (RMS) is performed checking the maximum inspiratory pressure (MIP) and maximal expiratory pressure (MEP). Body weight, gender, height and genetic factors influence the RMS, and that can also be reduced in cases of pulmonary or neuromuscular diseases (AMERICAN THORACIC SOCIETY, 2002; BRUNETTO; ALVES, 2003). In face of the changes in lung function with aging and the benefits of physical activity, the objective of this paper was to evaluate the extent to which regular physical activity interferes in RMS (MIP and MEP) of elderly individuals.

MATERIALS E METHODS

The initial sample of this paper was with 74 elderly woman in the city of Santa Cruz do Sul – RS, 08 members were excluded for not fitting in the inclusion criteria. The final sample consisted of 66 elderly aged between 66 and 81 years old. They were placed in active group (n = 36) (regular physical activity at least three times a week) and sedentary group (n = 30). For data analysis, the elderly were allocated into two age groups: 60 to 69 years old and 70 to 81 years old. Non-smoking elderly were included, without evidence of acute or chronic respiratory disease and with BMI < 40 kg/m2. All participants signed a clear consent form.

To attest to normal lung volume it was performed spirometry (EasyOne®, Modl 2001), with values predicted by Pereira et al. (1992). For the evaluation of MIP and MEP it was used digital manometer (MVD MDI® model 300). The MIP was obtained from inspiratory effort at the level of residual volume (RV) and MEP in expiratory effort at total lung capacity. There were performed the total of 05 tests with the supported time of 02 seconds. For data analysis, it was considered the greatest amount of MIP and MEP that did not differ by more than 10% of the second highest amount in a descending order (Neder et al., 1999).

For statistical analysis we used SPSS (version 14.0). The Student t test for two independent samples observed differences between Active and Sedentary groups in the age groups of 60-69 years old and 70-81 years old. The Pearson's correlation coefficient evaluated the degree of correlation between the anthropometric variables and RMS. For statistical purposes significance it was considered $p < 0.05$.

DISCUSSION AND RESULTS

In the table 1 it can be observed the variables of anthropometric characterization of the analyzed sample.

Table 1. Anthropometric characterization of the analyzed groups.

Variables	Active Group		Sedentary Group	
	60-69 of age (n=19) $\bar{x}$ ±SD	70-81 of age (n=17) $\bar{x}$ ±SD	60-69 of age (n=12) $\bar{x}$ ±SD	70-81 of age (n=18) $\bar{x}$ ±SD
Age (years)	65,78 ± 3,02	73,88 ± 3,82	64,91 ± 3,42	76,11 ± 4,65
Weight (kg)	67,47 ± 11,05	63,74 ± 7,80	65,75 ± 10,15	69,44 ± 11,13
Height (cm)	162,05 ± 5,74	160,35 ± 6,00	160,66 ± 7,80	162,64 ± 6,40
BMI (Kg/m²)	25,58 ± 3,59	26,57 ± 7,54	25,71 ± 5,46	26,27 ± 5,03

BMI = Body Mass Index; $\bar{x}$±SD = average + standard deviation.

According to Ferreira et al. (2005), with age advancing there is increased risk of respiratory diseases however, in this paper, the lung function of active and sedentary elderly were within a regular standard.

According to Monteiro (2003), which held measure of RMS in broad aging groups, height had no significant association with RMS. In our research, elderly aged between 70 to 81 years old, had a negative correlation between age and MIP, according to Whitelaw e Evans (2009) it is likely to be that the relationship between MIP and age is not linear, with greater negative slope in the age of 60 years old. In the Active Group (70 and 81 years old), there was a negative correlation between BMI and MIP (Table 2). As Matsudo et al (2000) and Narciso et al. (2010), weight gain and body fat accumulation result from age advancing, genetic pattern, diet and physical activity level.

Table 2. Correlation between age, height, BMI and maximal respiratory pressures of the elderly evaluated.

Respiratory muscle strength / Groups	Height (cm)	BMI (Kg/m²)	Age (years)
MIP / Sedentary (60-69 of age)	p= 0,374 r= -0,282	p= 0,484 r= 0,237	p= 0,265 r= 0,350
MEP / Sedentary (60-69 of age)	p= 0,201 r= -0,408	p= 0,054 r= 0,594	p= 0,793 r= 0,085
MIP/ Active (60-69 of age)	p= 0,106 r= 0,665	p= 0,071 r= 0,773	p= 0,080 r=0,411

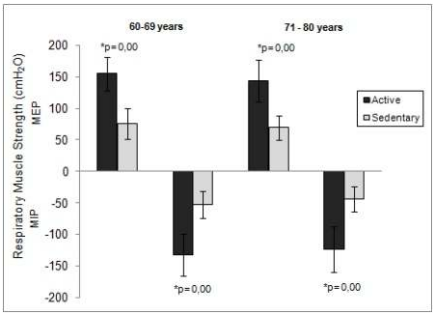
MEP / Active	p= 0,536	p= 0,428	p= 0,442
(60-69 of age)	r= -0,151	r= 0,193	r= 0,188
MIP / Sedentary	p= 0,732	p= 0,139	p= 0,002*
(70-81 of age)	r= -0,090	r= 0,386	r= -0,685*
MEP / Sedentary	p= 0,637	p= 0,304	p= 0,313
(70-81 of age)	r= -0,124	r= 0,274	r= -0,252
MIP / Active	p= 0,880	p= 0,034*	p= 0,951
(70-81 of age)	r= -0,040	r= -0,517*	r= 0,016
MEP / Active	p= 0,900	p= 0,185	p= 0,640
(70-81 of age)	r= -0,033	r= -0,337	r= 0,122

*Statistical significance (p<0.05); *r= Correlation of Pearson; BMI= Body Mass Index; MEP = maximal expiratory pressure; MIP = maximal inspiratory pressure.

The body fat increasing impairs the respiratory muscle activity, because visceral fat interferes in the contractility of these muscles (MATSUDO et al., 2000). Simões et al. (2010) evaluated sedentary individuals (20 to 89 years old) showing significant correlations of RMS with age, weight and height. There was a negative correlation between age and RMS and a positive correlation between MIP and height.

In Figure 1, it was observed that the RMS was higher in the Active Group than in the Sedentary Group in the analyzed age groups. Corroborating with these data, Simões et al. (2007) evaluated sedentary individuals (40 to 89 years old) and he found out reduced MIP and MEP in each advancing decade, allowing to conclude that advancing age affects the RMS. Sarcopenia, which occurs with advancing age is another factor that justifies the reduction in MIP and MEP. According to Neder et al. (1999), the elderly have regression of respiratory muscle mass, as well, lower response of these muscles to a same level of neural stimulus.

Figure 1. Comparative analysis of respiratory muscle strength between the active and sedentary groups within the same age group.



* Statistical significance (p<0.05).

When comparing the group of sedentary vs. active elderly (60 to 69 years old), there was significant variation in the MIP (52,91 + 21,31 cm H2O → 132,84 + 32,83 cm H2O) (p= 0,00) and MEP (76,25 + 24,51 cm H2O → 155 + 26,48 cm H2O) (p= 0,00). From 70 to 81 years old, there was variation in MIP (44,11 + 19,58 cm H2O → 124,05 + 36,25 cm H2O) (p= 0,00) and MEP (69,38 + 19,32 cm H2O → 143,76 + 33,12 cm H2O) (p= 0,00). There was thus a reduction of RMS in the sedentary group, within the same age group. Gonçalves et al. (2006), investigated the influence of physical activity on the increase of RMS in women (65 to 80 years old), comparing groups of active and sedentary elderly. It was found an increase in MIP in all age groups and MEP in the age group of 70-80 years old in the active group.

The table 3 shows that the MIP and MEP in the active group are higher than in the sedentary group, which they are over the amounts predicted by Neder et al. (1999). Such finding may be due to the methodological differences of studies and geographic variations of population.

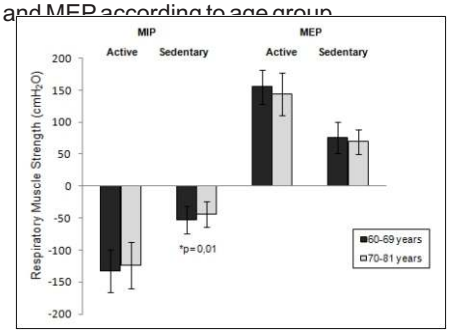
Table 3. Comparison of MIP and MEP among active and sedentary groups and their standard values.

Age Group	Neder et al.		Active		Sedentary	
	MIP $\bar{x}$ ±SD	MEP $\bar{x}$ ±SD	MIP $\bar{x}$ ±SD	MEP $\bar{x}$ ±SD	MIP $\bar{x}$ ±SD	MEP $\bar{x}$ ±SD
60-69	85,3 ± 5,5	75,6 ± 10,7	132,8 ± 32,8*	155 ± 26,4 *	52,9 ± 21,3 *	76,2 ± 24,5
70-81	72,7 ± 3,9	69,6 ± 6,7	124 ± 36,2	143,7 ± 33,1	44,1 ± 19,5 *	69,3 ± 19,3

MEP = maximal expiratory pressure; MIP = maximal inspiratory pressure; *Statistical significance (p<0.05); $\bar{x}$±SD = average + standard deviation.Source: Neder et al. (1999).

Our results showed that aging produces a decrease of RMS, and there was a significant reduction in MIP of the Sedentary Group among the two analyzed age groups (Figure 2).

Figure 2. Behavior of the MIP and MEP according to age group.



* Statistical significance (p<0.05).

Black and Hyatt (1969) made one of the first studies of RMS in 60 men (20 to 80 years old) and 60 women (20 to 86 years old), noting that the RMS showed variability in their normality range. Neder et al. (1999) measured the RMS in people (20 to 80 years old), divided into age groups with an interval of 10 years, showing that the predicted values for MIP were higher than those predicted by Black and Hyatt. This variation can be attributed to factors such as the degree of understanding of the exercises and lung volume used. One of the limitations of our study was the sample size and one of the factors that contributed to reducing the sample was the absence of male gender.

According to Gonçalves et al. (2006), regular physical activity is a relevant factor in healthy aging, promoting longevity, improved cardiorespiratory fitness and weight control as well as increased muscle strength. The results of this study showed that the group of elderly who practices sports presented values of RMS reported to be increased compared to sedentary which allows us to infer that the physical activity, even if the non-specific respiratory muscle training also helps in strengthening the muscles breathing.

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CORRESPONDING AUTHOR: DULCIANE NUNES PAIVA
Address Avenida Independência, 2293
Bairro Universitário – Zipcode: 96.815-900
Santa Cruz do Sul – RS
UNISC, Physiotherapy, block 34, room 3430
dulciane@unisc.br
Phone (51) 3717-7387

RESPIRATORY MUSCLE STRENGTH BEHAVIOR IN ACTIVE AND SEDENTARY ELDERLY

ABSTRACT

Aging brings changes in cardiorespiratory system, like the reduction in respiratory muscle strength (RMS). The aim of this study was to evaluate the respiratory muscle strength in healthy elderly active and sedentary people. It was evaluated 66 old females, 36 of those make exercises regularly (at least 3 times a week) and 30 are sedentary, all of them between 60-81 years. It was used a spirometry test to demonstrate the well function of the lung. The RMS was evaluated by the maximal lung pressures with a digital manovacuometry. The student t test to comparison between groups and Pearson correlation test were used ($p<0.05$). The maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) were significantly higher in the active group in all age groups evaluated: 60-69 years [active group versus sedentary: MIP = 132,84 + 32,83 →52,91 + 21,31 cm H2O; MEP = 155 + 26,48 →76,25 + 24,51 cm H2O]; 70-81 years [active group versus sedentary: MIP = 124,05 + 36,25 →44,11 + 19,58 cm H2O; MEP = 143,76 + 33,12 → 69,38 + 19,32 cm H2O] p=0,00. The respiratory muscle strength (MIP and MEP) obtained in the active group was higher than that reported by Neder et al. (1999). The practice of regular exercise resulted in a higher RMS in people above 60 years old in relation to sedentary people with the same age group.

KEY WORDS: Respiratory Muscle, Ageing, Physical Activity, Sedentary

COMPORTEMENT DE LA FORCE MUSCULAIRE RESPIRATOIRE CHEZ LES PERSONNES ÂGÉES ACTIFS ET SÉDENTAIRES

SOMMAIRE

La vieillesse apporte des changements dans le système cardiorespiratoire comme une réduction de la force des muscles respiratoires (FMR). L'objectif de cet étude était d'évaluer le FMR chez les personnes âgées de bonne santé actifs et sédentaires. Nous avons évalué 66 personnes âgées dont 36 étaient actifs (activité physique régulière par 03 fois / semaine) et 30 étaient sédentaires, tous âgés de 60 à 81 ans. La spirométrie a été réalisée pour attester de la fonction pulmonaire normale. La FMR a été évaluée en mesurant la pression maximale des voies respiratoires à l'aide du manomètre numérique digital. Utilisé le test t de Student et le test de Corrélation de Pearson a été considéré pour l'analyse des données, p <0,05. La pression inspiratoire maximale (MIP) et la pression expiratoire maximale (MEP) étaient significativement plus élevés dans le groupe actif dans toutes les tranches d'âge: 60-69 ans (du groupe actifs versus sédentaires: MIP = 132,84 + 32,83 →52,91 + 21,31 cm H2O; MEP: 155 + 26,48 →76.25+24,51 cm H2O, 70-81 ans [le groupe actif versus sédentaires: MIP 124,05 + 36,25 →44,11+ 19, 58 cm H2O]; →MEP 143,76 + 33,12 -- 69,38 +19,32 cm H2O] (p = 0,00) . La force musculaire respiratoire (MIP et MEP) obtenu dans le groupe actif était supérieur à la valeur prédite par l'âge rapporté par Neder et al. (1999). Une pratique d' exercices réguliers a favorisé une plus grande FMR chez les patients de plus de soixante ans, par rapport aux personnes sédentaires du même âge.

MOTS-CLÉS: La Force Musculaire, Le Vieillissement, Les Activités Physiques et Sédentaires

COMPORTAMIENTO DE LA FUERZA MUSCULAR RESPIRATORIA EN ANCIANAS ACTIVAS Y SEDENTARIAS

RESUMEN

El envejecer trae consigo alteraciones en el sistema cardiorrespiratorio tales como la reducción de la fuerza muscular respiratoria (FMR). El objetivo de ese estudio fue evaluar la FMR en ancianas hígidas activas y sedentarias. Han sido evaluadas 66 ancianas, de las cuales, 36 eran activas (actividad física regular, tres veces a la semana) y 30 eran sedentarias, todas tenían la edad entre 60 y 81 años. Se realizó la espirometría para atestar la normalidad de la función pulmonar. La FMR ha sido evaluada a través de las medidas de las presiones respiratorias máximas utilizando la manovacuometría digital. Utilizando el test t de Student y el test de Correlación de Pearson siendo considerado para análisis de los datos, o sea, p <0,05. La presión inspiratoria máxima (PIMAX) y la presión expiatoria máxima (PEMAX) han sido significativamente más grandes en el grupo activo en todas las edades evaluadas: 60-69 años (grupo activo versus sedentario: (PIMAX) = 132,84 ± 32,83 →52,91 ± 21,31 cm H2O; (PEMAX): 155 ± 26,48 → 76,25 ± 24,51 cm H2O); 70-81 años [grupo activo versus sedentario: (PIMAX) 124,05 + 36,25 → 44,11 + 19,58 cm H2O; (PEMAX) 143,76 + 33,12 → 69,38 + 19,32 cm H2O] (p=0,00). La fuerza muscular respiratoria PIMAX y PEMAX, obtenidas en el grupo activo fue más grande que los valores predichos por faja etaria hallados por Neder et al. (1999). La práctica regular del ejercicio ha promovido una mayor FMR en los individuos que tenían más de 60 años, cuando fueron comparados con los individuos sedentarios de la misma faja etaria.

PALABRAS CLAVE: Fuerza Muscular, Envejecimiento, Actividad Física, Sedentarismo

COMPORTAMENTO DA FORÇA MUSCULAR RESPIRATÓRIA EM IDOSAS ATIVAS E SEDENTÁRIAS

RESUMO

O envelhecer traz consigo alterações no sistema cardiorrespiratório tais como a redução da força muscular respiratória (FMR). O objetivo desse estudo foi avaliar a FMR em idosas hígidas ativas e sedentárias. Foram avaliadas 66 idosas das quais 36 eram ativas (atividade física regular por 03 vezes/semana) e 30 eram sedentárias, todas na faixa etária de 60-81 anos. Realizou-se a espirometria para atestar a normalidade da função pulmonar. A FMR foi avaliada através das medidas das pressões respiratórias máximas utilizando a manovacuometria digital. Utilizado o teste t de Student e o teste de Correlação de Pearson sendo considerado para análise dos dados, p<0,05. A pressão inspiratória máxima (PImax) e a pressão expiratória máxima (PEmax) foram significativamente maiores no grupo ativo em todas as faixas etárias avaliadas: 60-69 anos [grupo ativo versus sedentário: PImax = 132,84 + 32,83 →52,91 + 21,31 cm H2O; PEmax = 155 + 26,48 →76,25 + 24,51 cm H2O]; 70-81 anos [grupo ativo versus sedentário: PImax = 124,05 + 36,25 →44,11 + 19,58 cm H2O; PEmax = 143,76 + 33,12 →69,38 + 19,32 cm H2O] (p=0,00). A força muscular respiratória (PImax e PEmax) obtida no grupo ativo foi maior que os valores preditos por faixa etária encontrados por Neder et al. (1999). A prática regular de exercício promoveu maior FMR nos indivíduos acima de sessenta anos, quando comparados aos indivíduos sedentários de mesma faixa etária.

PALAVRAS–CHAVE: Força Muscular, Envelhecimento, Atividade Física, Sedentarismo