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INTEGRATIVE REVIEW ARTICLE

RESPIRATORY MUSCLE STRENGTH AND THE IMPACT ON THE HEALTH OF THE ELDERLY: INTEGRATIVE REVIEW

FORÇA MUSCULAR RESPIRATÓRIA E O IMPACTO NA SAÚDE DOS IDOSOS: REVISÃO INTEGRATIVA

LA FUERZA MUSCULAR RESPIRATORIA Y EL IMPACTO EN LA SALUD DE LOS ANCIANOS: REVISIÓN INTEGRADORA

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RESUMO

Objetivo: avaliar as evidências disponíveis na literatura científica sobre a força muscular respiratória em idosos e as repercussões na sua saúde. **Método:** estudo descritivo, revisão integrativa, com vistas a responder a questão << *O que tem sido produzido sobre o impacto da força muscular respiratória na saúde do idoso?* >>. Foram consultadas as bases de dados MEDLINE e LILACS, biblioteca virtual Scielo e o portal de periódicos da Capes. Os Descritores em Ciências da Saúde utilizados foram: idoso, força muscular, músculos respiratórios e atividade motora. **Resultados:** os estudos mostraram aumento da força muscular respiratória em idosos que praticam atividade física, bem como demonstram a correlação positiva entre força de músculos respiratórios com a mobilidade e a autonomia funcional e a correlação negativa com a mortalidade desta população. **Conclusão:** há relação entre a diminuição da força muscular respiratória e impactos negativos na saúde do idoso, bem como a atividade física tem impacto positivo no aumento da força muscular respiratória. **Descritores:** Idosos; Força Muscular; Músculos Respiratórios; Atividade Motora.

ABSTRACT

Objective: to evaluate the available evidence in the scientific literature on respiratory muscle strength in the elderly and the impact on their health. **Method:** a descriptive study, integrative review, in order to answer the question << *What has been produced on the impact of respiratory muscle strength in elderly health?* >>. Databases were searched MEDLINE and LILACS, virtual library SciELO and the CAPES portal. The Health Sciences Descriptors used were old, muscle strength, respiratory muscle and motor activity. **Results:** the study showed increased respiratory muscle strength in the elderly who practice physical activity and demonstrate the positive correlation between respiratory muscle strength with mobility and functional autonomy, and the negative correlation with mortality in this population. **Conclusion:** there is a relation between decreased respiratory muscle strength and negative impacts on health of the elderly, as well as physical activity has a positive impact on the increase in respiratory muscle strength. **Descriptors:** Elderly; Muscle Strength; Respiratory Muscles; Motor Activity.

RESUMEN

Objetivo: evaluar la evidencia disponible en la literatura científica sobre la fuerza muscular respiratoria en los ancianos y el impacto en su salud. **Método:** estudio descriptivo, revisión integradora, con el fin de responder a la pregunta << *¿Qué se ha producido sobre el impacto de la fuerza muscular respiratoria en la salud del anciano?* >>. Se realizaron búsquedas en las bases de datos MEDLINE y LILACS, SciELO biblioteca virtual y la CAPES portal periódica. Los descriptores de Ciencias de la Salud utilizados fueron de edad, la fuerza muscular de los músculos respiratorios y la actividad motora. **Resultados:** el estudio mostraron un aumento de la fuerza muscular respiratoria en las personas mayores que practican actividad física y demostrar la correlación positiva entre la fuerza muscular respiratoria con la movilidad y la autonomía funcional y la correlación negativa con la mortalidad en esta población. **Conclusión:** existe una relación entre la disminución de la fuerza muscular respiratoria y los efectos negativos sobre la salud de las personas mayores, así como la actividad física tiene un impacto positivo en el aumento de la fuerza muscular respiratoria. **Descriptores:** Edad Avanzada; La Fuerza Muscular; Los Músculos Respiratorios; La Actividad Motora.

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INTRODUCTION

The aging affects all individuals slowly and gradually, resulting in biological and environmental changes. The intensity of these changes inherent to the aging process varies from individual to individual.¹

In Brazil, there are about 14 million seniors, and 1,6% of this group is more than 80 years. Thus, it is recognized that a considerable increasing demographic transition with the elderly population, which has brought important implications, especially in health, due to the higher frequency of comorbidity and higher incidence of functional decline.²

Given the remarkable epidemiological transformation that Brazil has suffered in recent times, there is a need for interventions regarding the aging changes and their consequences, in order to provide the elderly a better wellness and a greater functional capacity.³

With the process of aging, there is a reduction of the strength of skeletal muscles, especially after the sixth decade of life. This decrease is similarly observed in the respiratory muscles. Increasing age is a negative predictor of respiratory muscle strength with statistical significance in both men and women.⁴

The respiratory muscle strength can be measured by a manual vacuum gauge. The procedure is non-invasive and simple, resulting in the values of IPmax, which is the measurement of negative pressure through the inspiratory effort from residual volume. And the EPmax, which is the positive pressure generated by the contraction of the expiratory muscles from the total lung capacity.⁵

The study of respiratory muscle strength in the elderly can generate a predictive factor of decline in functional capacity, as well as interventions that minimize the loss of respiratory muscle strength in the elderly can be important to reduce morbidity from respiratory diseases, helping to minimize the loss of functional capacity.

The aim of the current study is to assess the available evidence on respiratory muscle strength in the elderly and the impact on their health.

METHOD

Descriptive study of integrative review type, in order to answer the question << *What has been produced on the impact of respiratory muscle strength in elderly health?* >>. The following steps were completed: establishment of hypothesis and goal of the integrative review, establishment of criteria for inclusion and exclusion of articles (sample selection), defining the information to be extracted from selected articles; analysis and discussion of results.

Selection of items in the period from 2006 to 2014 held an electronic search in databases Medical Literature Analysis and Retrieval System Online (MEDLINE), Latin American Health Sciences - LILACS, virtual library Scientific Electronic Library Online - SCIELO well as through periodic portal of Higher Education Personnel Improvement Coordination - CAPES/MEC.

Inclusion criteria were: articles published in Portuguese, English and Spanish, with abstracts available in selected databases and access to full text, in the period 2006-2014; published articles in which the methodology adopted allowed to obtain strong evidence depicting procedures, procedures or guidelines on respiratory muscle strength in the elderly and their impact on your health. The Health Sciences Descriptors used were old, muscle strength, respiratory muscle and motor activity.

It began the process of finding items after setting the guiding question of the study: What has been produced on the impact of respiratory muscle strength in elderly health?

Six articles were found at the end of the application of the inclusion criteria, three in MEDLINE and two in LILACS. No material found in SCIELO. Periodic CAPES/MEC found three articles being eliminated those already found in previous databases.

RESULTS AND DISCUSSION

For a better analysis of the studies, the results were presented in a figure with the authors name and year of publication, the methodology and results of research. Afterwards, results and discussion.

Author /Year	Methodology	Results
Gonçalves et al. (2006)	136 elderly, divided into two groups: active and sedentary. Evaluation of respiratory muscle strength through the aneroid manual vacuum gauge, to investigate the maximal inspiratory pressure (IPmax) and maximal expiratory pressure (EPmax).	Non-specific physical activity to respiratory muscles resulting in increased respiratory muscle strength, in most elder women.
Fonseca et al. (2006)	Study of 42 elderly, to compare two respiratory muscle training programs, improving functional autonomy of institutionalized elderly. They were divided into three groups, training lasted 10 weeks and the functional autonomy was evaluated by GDLAM.	The group that used Threshold®, partially obtained satisfactory results in functional autonomy.
Freitas et al. (2010)	61 elderly, divided into 2 groups (active and moderately active) and evaluated IPmax, EPmax, peak expiratory flow (PEF), peak cough flow (PCF) and profile of human activity (PAH).	The more active lifestyle can influence positively, relating to greater respiratory muscle strength and values of PFT.
Summerhill et al. (2007)	24 elderly, divided into two active and inactive groups and evaluated IPmax, EPmax and the thickness of the diaphragm through the ultrasound examination.	EPmax, IPmax and thickness of the diaphragm were higher in the active group.
Buchman et al. (2008a)	Data from 960 seniors participating in the Rush Memory and Aging Project associating Respiratory Muscle Strength, pulmonary function and mortality.	The results suggest that the decrease in lung function may partly explain the decreased association of muscle strength and mortality increase.
Buchman et al. (2008b)	Prospective study of 890 elderly outpatients without dementia who underwent annual clinical evaluation, to examine the changes in the rate of mobility over time and correlate it to respiratory muscle strength.	Higher levels of respiratory muscle strength were associated with a slower rate of mobility decline, regardless to less strength in the extremities and physical activity

Figure 1. Articles found by author/year, methodology and results. Teresina (PI), 2014.

Previous works show increased respiratory muscle strength in the elderly who practice physical activity as well as demonstrate a positive correlation between respiratory muscle strength with mobility and functional autonomy and a negative correlation with mortality in this population.

These works divided the elderly sample in two groups: active and inactive, through instruments such as the human activity profile (PAH).^{4,6-7} All patients underwent evaluation of respiratory muscle strength through the manometer to investigate the maximal inspiratory pressure (IPmax) and maximal expiratory pressure (EPmax).

In addition to these variables, was also evaluated the peak expiratory flow (PEF) and peak cough flow (PCF).⁶ Reviewed also the thickness of the diaphragm through the use of ultrasound examination.⁷

Regarding IPmax and EPmax variables, all works have found higher results in respiratory

muscle strength in active individuals. Found a significant increase in IPmax in age groups ranging from 65-69 years ($p = 0,0001$), 70-74 years ($p = 0,0046$) and 75-80 years ($p = 0,0240$) and expiratory pressure maximum in the age groups between 70-74 years ($p = 0,0114$) and 75-80 years ($p = 0,0101$).⁴

In a particular study, 6 active seniors had an average of 13,5 cmH2O more in value of the EPmax ($88 \pm 21,4$ cmH2O) and 16,2 cm H2O in the IPmax ($76 \pm 17,7$ cm H2O), occurring drop in average of 1 cmH2O each year in these variables.

EPmax and IPmax were also higher in the active group (130 ± 44 vs 80 ± 24 cmH2O cmH2O, $p = 0,002$; and 99 ± 32 versus 75 ± 14 cmH2O cm H2O; $p = 0,03$) than in the inactive group at work. The PEF and PFT also higher form in the men ($p < 0,001$ for both) and assets ($p = 0,046$ and $p = 0,004$, respectively), as well as increase in the thickness of the diaphragm higher in the active group ($0,31 \pm$

0,06 cm vs $0,25 \pm 0,04$ cm, $p = 0,011$) in the inactive group, demonstrated in some research.⁶⁻⁷

The aging process is associated with reduced muscle mass the diaphragm and accessory muscles of respiration, as well as the reduction of the workforce for the same neural stimulation.⁸

Inactivity and aging can aggravate the reduction of inspiratory and expiratory muscle strength, resulting in reduction in intrathoracic pressure and expiratory flow during cough.⁹

Study determined the effect of physical activity in respiratory muscle strength and found that plays an important role in maintaining the strength of the inspiratory and expiratory muscles. Thus, regular physical activity could indirectly improve mechanisms to protect the airways, since the strength gain contribute to increasing the effectiveness of cough.¹⁰

The recruitment of the abdominal muscles during the non-respiratory activity may have been the source of strength training stimulus on the diaphragm and expiratory muscles. When performing maneuvers that increase intra-abdominal pressure, the diaphragm is activated to minimize the transmission of high intra-thoracic pressures abdominal. Diaphragm recruitment can be seen during non-respiratory maneuvers involving the upper limbs and trunk, such as lifting or performing crunches. If active seniors are routinely involved in activities that increase intra-abdominal pressure, they would strengthen both the diaphragm and expiratory abdominal muscles.⁷

Seniors who exercise regularly are more self-motivated, have a greater sense of self-efficacy, decrease the likelihood of developing chronic diseases, and improve their fitness levels and general provision. Interventions that minimize the loss of respiratory muscle strength in the elderly may be important to reduce morbidity by common respiratory diseases such as pneumonia and COPD.⁷

It was evaluated the impact of two forms of respiratory muscle training, compared to other control group only with breathing exercises, the functional autonomy of the elderly.¹¹ The training was done for 10 weeks and the control group breathing exercises performed the following exercises: active/resistance exercise horizontal adduction-abduction of the shoulder joint, active exercise/ resistance flexion-extension of the shoulder joint, active exercise/weathered flexion associated with

trunk rotation, active/resistance exercise trunk lateral flexion, active exercise/resistance to lateral rotation of the trunk, active exercise of raising the arms above the head, ultimate relaxation - inspiration and deep expiration without monitoring of other movements.

The other group beyond previous breathing exercises, used the Threshold® IMT, using this for this study was initiated with a workload installed gradually, starting with the value of 50% of MIP each individual, and increased 10% per week, until the fourth week. From the fifth week, they were added 5% to 100% completion in the eighth week or the maximum pressure value of IMT Threshold (41cmH₂O). Since then, this figure has been maintained in the last two weeks. Sessions lasted 20 minutes, with seven strengthening series (two minutes each) and an interval of one minute between the series, for 10 weeks, three times a week. In the other group was performed the same breathing exercises and used the incentive spirometry (EI) with Voldyne® equipment for 20 minutes, or 40 repetitions, totaling two repetitions every minute. Said respiratory muscle training program had a frequency of three times a week.

As result was obtained a significant improvement in Threshold® IMT group in almost all variables of the functional autonomy of the elderly, but compared to the control group was no statistical difference between the groups which underwent respiratory muscle training, resulting in improved functional autonomy elderly. Thus the gain of respiratory muscle strength is reflected in greater autonomy to the elderly and consequently brings benefits to health of the elderly in general.

Data analysis showed that in prospective studies¹¹⁻² gain respiratory muscle strength is positively associated with decreased mortality and increased mobility in the elderly. These data form obtained in a very large group of elderly participants in the Rush Memory and Aging Project, a longitudinal study of clinic pathological research community-based chronic conditions of old age. Participants were recruited from more than 40 residential facilities throughout the metropolitan area of the city of Chicago in the United States and agreed to hold annual detailed clinical evaluations.

In association model used in particular study¹³, it was found that the effect of an increase of one unit of respiratory muscle strength at baseline was associated with a reduced risk of death compared to be about 7

years younger at the start of the study. Demonstrating even respiratory muscle strength and lung function were inversely related to age and positively associated with education, and men performed better than women.

Numerous studies demonstrate that respiratory muscle strength plays a key role in respiratory network, which depends on intact neural circuits that orchestrate interaction between the respiratory muscles and intrinsic pulmonary function to maintain proper ventilation.¹⁴⁻¹⁶ In the absence of activation of muscles respiratory pressure gradients can be developed and the exchange of air with the alveolar surface may not occur. Thus, impaired respiratory muscle strength can lead to lung dysfunction, and even death.

In the association model used in another study¹³, the results showed higher scores indicating better performance. Respiratory muscle strength was inversely related to age ($r = -0,22$, $p < 0,001$), positively associated with education ($r = 0,14$, $p < 0,001$), and the men were stronger than women (unit mean difference = $0,79$, $t = -11,80$, $p < 0,001$). In this model, mobility decreased by about $0,122$ units/year and each one unit increase in respiratory strength at baseline was associated with a slowing decline in mobility $0,043$ units/year. Therefore, respiratory muscle strength is associated with the rate of change of mobility, being positively associated with their values.

Elderly mobility decrease is common and associated with increased dependency, institutionalization and mortality.¹⁷ Factors that predict a change for the worse mobility are important for developing interventions to modify this growing public health problem in our elderly population.

CONCLUSION

These results suggest that interventions focused on promoting physical activity in the elderly and thus improve respiratory muscle strength and lung function may impact the change in mobility, decrease mortality and increase functional autonomy. All this consequently will contribute to maintaining the health of this population in better condition.

So, it also encourages the implementation of further studies to confirm these positive results, as well as adding more benefits to work with the respiratory muscles and better promotion of elderly's health.

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