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EVALUATION OF RESPIRATORY PARAMETERS IN ELDERLY PEOPLE SUBMITTED TO PHYSIOTHERAPEUTIC INTERVENTION AND GAMETERAPY

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Abstract: **Introduction:** Aging is characterized as a natural and progressive process, responsible for the appearance of physiological changes in individuals. The respiratory system is the most affected by these modifications as a result of the senescence process, favoring the reduction of the strength of the inspiratory and expiratory muscles promoting changes in maximum inspiratory pressure values (Pimáx) and maximum expiratory pressure (pemáx) and repercussions on pulmonary health. **Objectives**: To evaluate Maximum Respiratory Pressions in Elderly Subjected to Physiotherapeutic Intervention and Game therapy, draw the social and demographic profile of the elderly and analyze the strength of the inspiratory and expiratory muscles of the intervention groups **Method:** Descriptive study with quantitative approach, through a randomized clinical trial, separated in a group Intervention (GI), in which the physiotherapy protocol and Gameterapia group (GG), in which he practiced exercise with virtual games. Maximum respiratory pressures were evaluated before and after the 24 intervention sessions. The sample consisted of active patients who fits the eligibility criteria results the study consisted of a total sample of 13 elderly, being GI = 5 and gg = 8. Both groups showed no statistical difference from each other in relation to the strength gain of respiratory muscles, however there was a considerable increase in the pressure values after the intervention final considerations the analysis of the inspiratory and expiratory muscles' force of GI and GG showed no statistical difference between They, taking into account the proposed exercises. However, there was an increase for both groups after the interventions, the increase in GG.
Keywords: Elderly. Maximum respiratory pressures. Physical exercise.

INTRODUCTION

Aging is defined as a dynamic and progressive process, responsible for the appearance of morphological, physiological and biochemical modifications, which trigger changes in muscle mass, strength and function in many systems, generating greater vulnerability and greater incidence of installation of pathological processes (Buranellolo et al., 2011).

The respiratory system is one of the most affected systems with these modifications as a result of the senescence process, and these changes include increased rigidity of the thoracic box, reduced lung elasticity, change in pulmonary and thoracic compliance and reduced chest mobility, favoring modifications In respiratory mechanics, in addition to reducing the strength of inspiratory and expiratory muscles (PASCOTINI et al., 2016).

According to Castro et al. (2020), the reduction of the strength of the respiratory muscles can be verified by changes in Pimáx and Pemáx values, in which it may result in the appearance of other complications in the respiratory system, such as decreased cough effectiveness and hypoventilation. Thus, the transformations by which the lungs, respiratory muscles and all respiratory mechanics pass, become relevant, considering the consequences in which the deterioration of pulmonary function can cause.

To try to reduce these consequences proper to senescence, exercise are seen as allies to minimize the repercussions of these physiological modifications and the appearance of respiratory dysfunctions. Elderly who do not have an active behavior assume risks that facilitate the loss of muscle strength, given that exercise increases the demand for work of respiratory muscles contributing to the recruitment of this muscle group (RUIVO et al., 2009).

With the modifications observed in the population pyramid, with the increase in the number of elderly and, taking into consideration the physiological changes that affect healthy elderly, such as changes in the strength of respiratory muscles, studies suggest that exercise contributes to invol's of its own repercussions of age. Thus, it is necessary to build more evident research so that these doubts are remedied and understood by the academic community.

Given this, the present study evaluated the maximum inspiratory pressure and maximum expiratory pressure of the elderly submitted to physical therapy intervention and game therapy, traced the social and demographic profile of the elderly analyzed the strength of the inspiratory and expiratory muscles through these findings.

METHODOLOGY

This is a randomized clinical trial (ECR), being started after approval by the CEP (Ethics and Research Committee) (Annex A), held at the Institute of Tisiology and Pulmonology of Campina Grande-PB, Dr Edgley Maciel Lacerda, Physiotherapy service. The population were all the elderly in the city of Campina Grande -PB and the sample consisted of 13 elderly people who participated in the study in a randomized way obeying the eligibility criteria.

Active elderly who do physical activity were included, those over 60 who live in the city of Campina Grande-PB and who had means of movement that would enable their transportation to the collection site and elderly with degenerative chronic diseases under drug control. Regarding the exclusion criteria, elderly people who had disabling pathologies for performing aerobic activities, those with musculoskeletal dysfunctions that disqualified him from participating in the collection and/or those who made use of gear devices and those over 80 years old.

Data collection began with the application of some instruments, first IPAQ (2001) to identify whether the elderly was active or very active. This is divided into four scores (1: very active, 2: active, 3: irregularly active and 4: sedentary), being considered very active one who performs vigorous activity ≥ 5 days/ without and ≥ 30 minutes per session, and considered active when Performs vigorous activity ≥ 3 days/without and ≥ 20 minutes per session + moderate and/or walk ≥ 5 days/ without and ≥ 30 minutes per session, that irregularly active when performing activity with a frequency of 5 days/week, or lasting 150 min / week and sedentary is when you do not perform any physical activity for at least 10 continuous minutes during the week.

Then the second instrument was applied, the Modified Partner Questionnaire (Brazil Old Age Schedule, 1987), modified questionnaire (Appendix B), in order to describe gender, age, marital status and other social and demographic questions. of the sample group. The third instrument applied was the 1RM (maximum repetition) test (appendix C), which evaluated the maximum load raised by the patient in a repetition, being used for the studied muscle groups.

And, as a fourth instrument, the manovacometry test, in order to measure the values of maximum inspiratory pressure (Pimáx) and maximum expiratory pressure (pemáx), was performed with a classic equipment, called Analog +- 150cm H2O Manuvacuometer Murenas. It was a simple, fast, noninvasive, voluntary and effort-dependent test, in which the individual was sitting while the evaluator was positioned in front of him, offering verbal incentive to each suction or blowing maneuver in the cannula, which was measured Pimáx and Pemáx, respectively. 3 acceptable and reproducible repetitions were performed, with a maximum

of 10 % difference between the values. To evaluate the strength of the respiratory muscles it took a chair, a nasal clip, a flat oral, a trachea and the manovacuometer (SILVA, et al. 2018). The scale ranges from zero to 150 cmH2O positive pemáx and from 0 to 150 cmH2O negative for pimax. In performing the maximum expiratory pressure measurement, the patient was requested to inflate the lungs to the total pulmonary capacity and after performing a forced expiration supporting the maximum pressure for approximately 5 seconds. When performing the maximum inspiratory pressure, it was requested to exhale all pulmonary volume to functional residual capacity and then make a maximum inspiratory effort supporting the pressure for approximately 5 seconds (Society, 2002) (Appendix D).

The randomization process was through an external member that organized closed and sealed envelopes with the description of the intervention in the content of its, and identified numbering them in front of the envelope. Once randomized, the sample was allocated in two groups, the Intervention Group (GI) and the Gameterapia Group (GG) of the 13 randomized elderly, 5 (38.4%) were allocated to GI and 8 (62.5%) For GG.

The elderly allocated in the GI were subjected to physical therapy intervention with the protocol (Raimundo et al., 2018), initiated with heating exercises with stretching of muscle groups flexor and forearms of the forearms in the elbows, flexors and legs of the legs in the knees and abductors of the Arms on the 5-minute shoulders, followed by acceleration exercises, consisting of aerobic walking activities on the treadmill for 30 minutes, being monitored by the oximeter to maintain between 50% and 70% of its maximum HR, calculated individually By the Karvonen formula (FCT = FCCREP + (FCMAX-FCREP) x%) (Karvonen (1957), the third stage of the protocol was resistance exercises for flexion and forearm extension in the elbows and legs in the knees and abduction From the arms on the shoulders, for these exercises the tests of 1 RM were calculated, the training was done between 40 % and 60 % of 1RM for 20 minutes, that is, each muscle group was trained in 3 10 repetition series alternately to the right and left sides, and finally the deceleration exercises, with diaphragmatic breathing work in 2 series of 10 repetitions, which was performed in the supine in the last 5 minutes of treatment, totaling 60 minutes Exercise (Raimundo et al., 2018) (Annex e).

The Control Group (GG), performed the intervention by gameterapy, undergoing the practice of exercise with Just Dance 2015 and Kinect Adventures 2015, in which the participant reproduced the movements of the virtual doll and these movements were read through the Kinect sensor (Appendix f). The elderly were subjected to this game for 60 minutes uninterrupted, being monitored to maintain between 50 % and 70 % of the MAX during the execution of the proposed movements. Shortly after the 24 sessions, the sample reevaluation was performed using the same instruments and tests.

The elderly who participated in the research initially signed the Free and Enlightened Consent - TCL (Appendix A), in which they contained research information, including risks and benefits. For the construction of the database, Microsoft Excel 365 was used. And for the comparison of the parameters we used the Mann-Whitney u test of independent samples. The level of significance was $p < 0.05$.

RESULTS

A total of 55 elderly was approached by telephone to participate in the study, among them, 27 (49.1%) were excluded as they did

not meet the requirements regarding the eligible criteria. Therefore, 28 (50.9%) were randomized, being allocated in GI (n = 14) (50%) and gg (n = 14) (50%). However, 9 of GI had the intervention discontinued, leaving 5 (35.7%) elderly for analysis. And, 6 of the GG had the intervention discontinued, leaving only 8 (57.2%) for analysis, therefore remained 13 (23.6%) elderly for final sample analysis, as demonstrated the flowchart of Figure 1.

Based on the data collected through the good-based socio-demographic questionnaire (Brazil Old Age Schedule-1987) described in table 1, the socio-demographic profile of the sample was traced.

As shown in table 1, it is a sample with a female majority, higher average of women with an average of 67.5 years and complete high school, live with a monthly income of a minimum wage, married and reporting some health problem, But this does not disturb everyday, describes a good state of vision and hearing.

Table 2 highlights the total sample values (n = 13) of both groups, both GI and GG, before intervention and after intervention, with maximum inspiratory pressure variables (pimax.) And maximum expiratory pressure (PEMAX.) Exposing the minimum, maximum, average and standard deviation values.

From the values exposed in the table above, it was seen that the variables of Pimáx and Pemáx, after the intervention, presented higher average and higher standard deviation, after the interventions. Pimáx increased by 24 cmh20 and the 15 cmh20 pemax.

Table 3 describes in detail the values of average and standard deviation of the groups in isolation. Thus, the pressure values before the intervention (AI) of the GI group and GG and after intervention (DI) are exposed.

From this, it is notorious how the Gameterapia Group (GG) presented higher averages of all variables compared to the intervention group (GI). In addition, it showed an increase in averages with each other after the intervention, GI showed average increase for Pimáx around 19 cmH20 and for the pemáx around 7 cmH20, compared to the GG that showed average increase to Pimáx in around 28 cmh20 and for the pemáx around 20 cmh20.

With the analysis of the Mann-Whitney U Test of Independent Samples, Pimáx Distribution (DI) was the same among the intervention group categories and Gameterapia Group, with significance level 0.171E and the DI Distribution (DI) was also the same Among the group categories, with significance level 0.127 therefore both removed the null hypothesis for this research.

DISCUSSION

The present study was intended to evaluate the maximum respiratory pressures in elderly people submitted to physical therapy intervention and gameterapy, to draw the socio -profile

Demographic of the patients in question, in which it consisted mostly female (77%) and an average age of 67.5 (± 5.34) years. And also analyze the strength gain of the respiratory muscles in the elderly who underwent the physiotherapeutic protocol and gameterapy through manovacometry. Azevedo et al (2017) highlights the importance of measuring the strength of inspiratory and expiratory muscles and can be defined through static measures through the manovacometry test.

Due to the sampling consisting of elderly patients, there were considerable results related to respiratory muscles, with no significant difference in maximum inspiratory pressure and maximum expiratory pressure after 24 sessions between groups, or in the

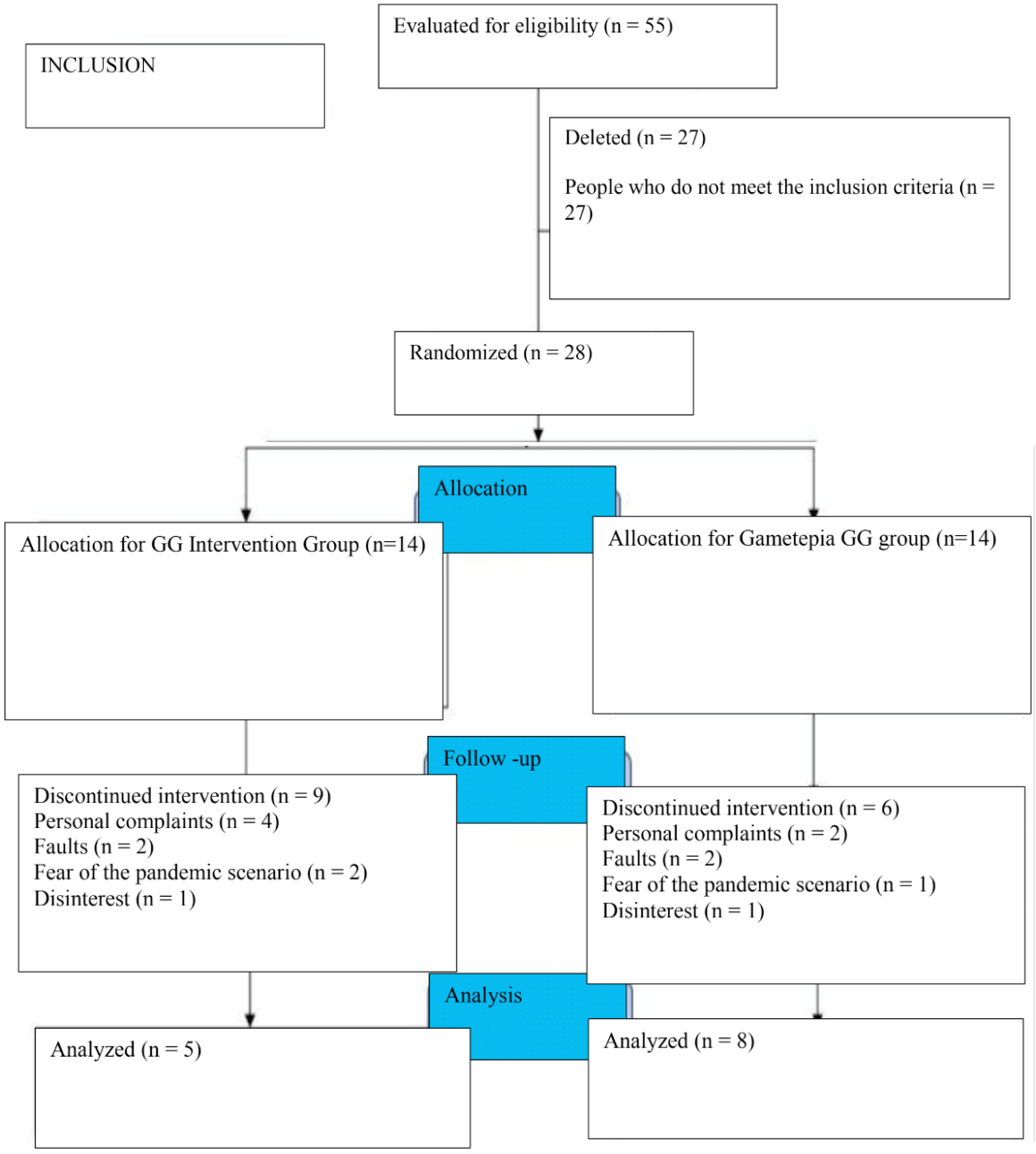

Figure 1. Elderly Selection Flowchart to the Consort (Consort Standards of Reporting Trials), 2010 (Consort), 2010.

Source: Research data (2021).

	GENERAL (n=13) Average ± DP	GG (n=8) Average ± DP	GI (n=5) Average ± DP
Gender			
Female	10 (77%)	6 (83,3%)	5 (83,3%)
Male	3 (23%) ± 0,43	2 (16,7%) ± 0,43	1 (16,6,0%) ± 0,37
Age	67,5 ± 5,34	(64,75) ± 3,77	(72) ± 4,52
Education			
Elementary	2 (15,4%)	1 (12,5%)	1 (20%)
High school	9 (69,2%)	5 (62,5%)	4 (80%)
University level	2 (15,4%) ± 1,03	2 (25%) ± 1,28	0 (0,0%) ± 0,44
Salary			
Up to 1 salary	5 (38,4%)	3 (37,5%)	2 (40%)
Over 1 salary	4 (30,8%)	2 (25%)	2 (40,0%)
Over 2 salaries	4 (30,8%) ± 0,86	3 (37,5%) ± 0,92	1 (20%) ± 0,83
Marital status			
Married/living together	6 (46,1%)	3 (37,5%)	3 (60%)
Widower			
Divorced	1 (7,7%)	1 (12,5%)	0 (0,0%)
The person never get	3 (23,1%)	3 (37,5%)	0 (0,0%)
married	3 (23,1%) ± 1,30	1(12,5%) ± 1,16	2 (40%) ± 1,64
Health Problems			
Yes	11 (84,6%)	7 (87,5%)	4 (80%)
No	2 (15,4%) ± 0,37	1 (12,5%) ± 0,35	1 (20%) ± 0,44
Does this pathology hinder everyday life?			
No	9 (69,2%)	7 (87,5%)	2 (40%)
Yes	4 (30,8%) ± 0,48	1 (12,5%) ± 0,35	3 (60%) ± 0,54
State of vision			
Very bad	3 (23,1%)	1 (12,5%)	2 (40%)
Bad	1 (7,7%)	1 (12,5%)	0 (0,0%)
Good	8 (61,5%)	6 (75%)	2 (40%)
Great	1 (7,7%) ± 0,96	0 (0,0%) ± 0,74	1 (20%) ± 1,34
Hearing state			
Very bad	0 (0,0%)	0 (0,0%)	0 (0,0%)
Bad	1 (7,7%)	0 (0,0%)	1 (20%)
Good	7 (53,8%)	5 (62,5%)	2 (40%)
Great	5 (38,5%) ± 0,63	3 (37,5%) ± 0,51	2 (40%) ± 0,83

Table 1 – Social and demographic characteristics based on the good questionnaire (Brazil Old Age Schedule) - 1987

Source: Research data, 2021.

Variable	Minimum	Maximum	Average ± DP
PI max. (AI)	40	95	62,69 ± 16,555
PE max. (AI)	30	100	57,23 ± 19,900
PI max. (DI)	40	150	86,923 ± 31,085
PE max. (DI)	40	117	72,23 ± 22,558

Note: Pimáx: maximum inspiratory pressure; Pemáx: maximum expiratory pressure; AI: Before the intervention; DI: After the intervention.*p<0,05.

Table 2 – Table with descriptive statistical data of maximum inspiratory pressure and maximum expiratory pressure sample group (n = 13) before and after intervention.

Source: Research data (2021).

Variable	Average ± DPGG (n=8)	Average ± DPGI (n=5)	Level of significance p
PI max. (AI)	70,63 ± 13,999	50 ± 12,329	
PE max. (AI)	59,63 ± 21,993	53,40 ± 17,658	
PI max. (DI)	98,125 ± 32,874	69 ± 18,841	0,171
PE max. (DI)	79,625 ± 23,809	60,40 ± 15,821	0,127

Note: Pimáx: maximum inspiratory pressure; Pemáx: maximum expiratory pressure; AI: Before the intervention; DI: After the intervention.*p<0,05.

Table 3 – Table with descriptive statistical data of GI (n = 5) and gg (n = 8) (before and after intervention).

Source: Research data (2021).

intervention group, which consists of the physiotherapeutic protocol with heating exercise exercise, aerobic, resistance and relaxation, or in the gameterapia group. Thus, it is valid that both groups provided increased maximum respiratory pressures, so no increase was more significant than the other.

The respiratory parameters of the elderly are influenced by the practice of physical exercise and contribute to the involution of repercussions caused by decreased strength of respiratory muscles (CASTRO et al., 2020). Considering that changes that encompass the aging process promote decreased mass and muscle fiber, which influences the efficiency of these muscles that lose their strength, being reflected in the values of maximum respiratory pressures (PASCOTINI et al., 2016).

After the intervention, the average of the variables exposed increased to both groups. Which resembles the study of Agnol et al. (2017), where the values of maximum respiratory pressures were analyzed in a group of active elderly of both genres aged 60 to 78 years, in which it was divided into two group. Solo group that performs resistance exercises for peripheral and trunk muscles and stretching. And, water group that performs resistance exercises for the same GS muscles and aerobic exercise. Thus, the result of this study was increased pressure values for both groups demonstrating that physical activity practice contributes to reducing the loss of respiratory muscle strength.

Compared to the study mentioned above, the study by Albuquerque et al. (2013) conducted a study with a group of active elderly people, aged 60 to 70 years, separating it into two groups, the water aerobics, in which he has heating exercises, aerobic, resistance to peripheral and abdominal muscles and, and, Relaxation exercises in the water and the dance group that performs stretching and dance training. And, the result of that Study showed that the elderly who practiced dance exercises had a greater strength of the inspiratory muscles compared to the group that performed water aerobics.

This resembles the present research, in which there was an increased increase for the intervention group, showing significant increase in Pimáx, in which it presented an average increase in 19 CMH2O after sessions with the physiotherapeutic protocol, which addressed resistance exercises and aerobic, similar to the mentioned study.

The cardiorespiratory and musculoskeletal fitness provided by physical activities can benefit the public to them, in addition to increasing muscle flexibility generated by the heating stage with stretching muscle groups also worked on resistance exercises, which promotes increased considerable force (Alves; Avanzi, 2016). In addition to the relaxation stage that contributes to muscle reeducation, greater thoraco-abdominal mobility, recruiting respiratory muscles, elevation of body awareness, increased concentration, stabilization of the autonomous nervous system and improvement of overall well-being. What possibly justifies the pressure increases of the group submitted to the Physiotherapeutic Protocol, the Intervention Group (Neves Neto, 2011).

Regarding game therapy, it is described as a recent alternative aerobic therapy that helps in physical conditioning, as well as contributing to cognitive and general well-being. Thus, few articles elucidate their effects on respiratory parameters, except for the study by Taslimipour et al. (2021) that does not analyze maximum respiratory pressures, but evaluates other respiratory parameters and demonstrates that dance training with the Xbox 360 kinect was effective in improving forced vital capacity and forced

expiratory volume in young women, even though it was not the parameters In which the present study focuses, the study cited is relevant in the benefits of gameterapy. In addition, the randomized double crossed study of DOURIS et al. (2012) compares the physiological responses to young sedentary who walked in the treadmill for 30 minutes and those who played for 30 minutes at Nintendo. Concluding that the gameterapy used can act as an alternative form to traditional aerobic exercises of moderate intensity.

Training with dance games provided by gameterapy involves large muscle groups favoring an improvement in various aspects for the elderly, such as improving motor coordination and greater movement of joint structures, taking into account the repetition of dance movements, as well as increase of muscle resistance and cardiorespiratory and improvement of muscle strength, in view of the movements of great amplitude. This statement corroborates the finding of the present study, in which it demonstrates a considerable increase in the values of Pimáx and Pemáx after the intervention with gameterapy, demonstrating an increase in the average Pimáx at 28 cmH20 and the pemáx by 20 cmh20, being greater than the increase in the Intervention Group (PEREIRA; VALVERDE; HORIKAWA, 2010).

In contrast to the studies mentioned that show increase for both evaluated groups, the study by Alvarenga et al. (2018) describes the use of PowerBreath as a good ally to promote muscle rebalancing and improvement of respiratory muscle strength, promoting a significant increase in maximum inspiratory pressure and maximum expiratory pressure for the elderly submitted to this intervention, considering that this equipment intended If to the training of the respiratory muscles for the purpose of gaining strength. Thus, this study explains considerable increases for the elderly who associated Pilates with respiratory muscle training using PowerBreath, showing improved respiratory muscle strength. However, it does not corroborate the protocol of the present study, in which it did not use specific equipment for the gain of respiratory muscle strength.

A reduction in blood pressure values related to inspiratory muscles reflects on symptoms related to ventilatory activities, in view of the diaphragm as the main muscle and the largest responsible for respiratory function. And, a reduction in the expiratory muscle pressure values favor symptoms related to non -ventilatory and passive activities such as cough and sneezing (PASCOTINI et al., 2016). Thus, Almeida et al. (2015) reiterates that the reduction of strength of these respiratory muscles resulting from the aging process results in consequences for the pulmonary health of the elderly, increasing the possibility for an ineffective cough and hypoventilation, which facilitates the accumulation of secretion and respiratory infections.

As stated by Garcia et al. (2015), the weakness of this musculature reduces the levels of the individual's functional and pulmonary capacity, and the strength is an important factor in performing everyday activities, with improved physical performance.

Therefore, the benefit of the proposed interventions is associated with the modifications of biological conditions with the improvement of muscle strength, even though it is not a training focused on the gain of strength, and cardiorespiratory conditioning, resulting from

Application of therapeutic proposals, as well as improvement in physical performance, mental health, general well-being, cognitive and activities of daily life (RIBEIRO; NERI,

2012).

Considering that respiratory muscles can improve their functioning and strength in response to proper muscle training, as well as greater thoraco-abdominal mobility and mechanical reorganization of muscles involved in breathing (during et al., 2014). The present study was characterized by the effectiveness of both protocols in the gain of respiratory muscle strength, aiming at a healthy aging.

However, the lack of a difference between the groups relates to the physiological responses generated by the two protocols that assume similar characteristics and purposes. Studies suggest that the aging process becomes a limitation, as this process influences postural deficits, physiological modifications to muscles and joints, and equilibrium changes that favor strength reduction, since the adopted positions decrease expansitivity thoracic and the processes of inspiration and exhalation. Age being a predictor for decreasing respiratory pressures due to physiological modifications of age (Almeida et al., 2015).

Another limiting factor was most of the study to focus on females, which reverberates maximum respiratory pressure differences between the studied group, given that the male audience has a higher percentage of lean mass compared to women, influencing in Strength of the muscles that has intrinsic relationship with muscle mass (LIMA et al., 2012).

CONCLUSION

Based on the findings of the present study and the U-Whitney U Test of independent samples, the analysis of the intervention group's inspiratory and expiratory muscles and the Gameterapy Group showed no statistical difference between them, taking into account the proposed exercises. However, there was an increase for both groups after the interventions, and the increase in the gameterapia group is more significant.

This finding refers to the specific improvement of respiratory muscle performance, in repercussion for the muscle group in training, and can be correlated to both the intervention protocol and gameterapy. Thus, the improvement in the patient's respiratory muscle strength can translate with higher levels of Pimáx and Pemáx and improve physical capacity, as well as reduced symptoms related to ventilatory and non-ventilatory activities and improve overall well-being.

Considering the limitations of the research, such as the reduced number of the sample, as well as the amount of withdrawal of volunteers due to the pandemic scenario that favored the reduction in the sample number, it is suggested to carry out new studies taking into account a larger number of elderly and Distribution of gender variable, so that most public do not focus on a specific genre limiting the interpretation of results for this genre and address physiotherapeutic interventions and their influence on the strength of respiratory muscles, being a factor that directly influences the quality of life of the elderly.

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