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Body balance, mobility and respiratory muscle strength in elderly women practitioners of the method pilates

Equilíbrio corporal, mobilidade e força muscular respiratória de idosas praticantes do método pilates

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RESUMO | INTRODUÇÃO: O Método Pilates é baseado em movimentos do corpo inteiro, respiração, concentração, centralização, precisão e ritmo. Não está claro se a prática desta atividade é superior à manutenção de um estilo de vida ativo. **OBJETIVO:** Comparar o equilíbrio corporal, a mobilidade e a força muscular respiratória de mulheres idosas praticantes do Método Pilates e idosas ativas. **MÉTODOS:** Estudo transversal analítico em 22 idosas, sendo 11 praticantes do Método Pilates (PMP) e 11 idosas ativas (IA). As participantes foram classificadas pelo Perfil de Atividade Humana (PAH) e avaliadas por Timed up and Go (TUG), Escala de Equilíbrio de Berg (EEB) e manovacuometria. **RESULTADOS:** A idade da amostra foi de 69,36 ± 9,49 anos. A média no TUG das PMP foi de 8,06 ± 4,29 segundos, e das IA de 8,28 ± 2,82 (p>0,05). Na EEB, a média do escore pelas PMP foi 54,63 ± 1,91 e pelas IA foi 52,90 ± 4,01 (p>0,05). Quanto à avaliação da força muscular respiratória, também não houve diferença significativa entre os grupos, mas houve diferença nas IA ao comparar os valores reais (PiMáx = 59,00 cmH2O e PeMáx = 54,00 cmH2O), com os preditivos (PiMáx = 77,12 cmH2O e PeMáx = 74,18 cmH2O), com p<0,05. **CONCLUSÃO:** Manter-se fisicamente ativa ou praticar o Método Pilates parece ter o mesmo efeito sobre o equilíbrio corporal e a mobilidade de mulheres idosas, principalmente entre os 60 e 65 anos. No entanto, idosas que praticam Pilates parecem manter a força muscular respiratória mais adequada à sua idade.

PALAVRAS-CHAVE: Equilíbrio postural. Musculatura respiratória. Idoso. Exercício.

ABSTRACT | INTRODUCTION: The Pilates Method is based on whole body movements, breathing, concentration, centering, precision and rhythm. It is not clear whether the practice of this activity is superior to maintain an active lifestyle. **OBJECTIVE:** To compare the body balance, mobility and respiratory muscle strength of elderly women practicing the Pilates Method and active elderly women. **METHODS:** An analytical cross-sectional study was carried out on 22 elderly women, including 11 Pilates Method Practitioners (PMP) and 11 Active Elderly (AE) women. Participants were classified by the Human Activity Profile (HAP) and evaluated by Timed up and Go (TUG), Berg Balance Scale (BBS) and manovacuometry. **RESULTS:** The sample was 69.36 ± 9.49 years old. The TUG mean of the PMPs was 8.06 ± 4.29 seconds, and of the AE was 8.28 ± 2.82 (p> 0.05). In BBS, the mean of the PMP score was 54.63 ± 1.91 and the AE was 52.90 ± 4.01 (p> 0.05). Regarding the evaluation of respiratory muscle strength, there was also no significant difference between the groups, but there was a difference in AE when comparing the actual values (PiMax = 59.00 cmH2O and PeMax = 54.00 cmH2O), with the predictive values (PiMax = 77 , 12 cmH 2 O and Pemax = 74.18 cmH 2 O), with p <0.05. **CONCLUSION:** Staying physically active or practicing the Pilates Method seems to have the same effect on the body balance and mobility of older women, especially between 60 and 65 years. However, elderly women who practice Pilates seem to maintain respiratory muscle strength more appropriate to their age.

KEYWORDS: Postural balance. Respiratory muscles. Elderly. Exercise.

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Background

With increasing human life expectancy, healthy ageing has become a growing public health concern, because ageing affects the functional, physical and cognitive capacity, as well as the quality of life[1], which is often related to the loss of muscle mass, decreased aerobic capacity, reduced mobility and other determinants of physical fitness[2].

However, older people who remain physically active have lower rates of morbidity and mortality than their inactive compatriots, because a high level of habitual activity is likely an essential factor in improving or maintaining physical health as physical activity has been associated with physical function. Ikezoe et al. demonstrated that increased standing time during standing or walking improved the muscular strength and balance of sedentary elderly patients[3].

There is an increasing number of studies demonstrating the effectiveness of the Pilates Method in improving muscle strength and balance of healthy elderly women[2,4]. Such a method comprises physical activity that trains the core muscles, an integrated unit of muscles that support the hip-pelvic-lumbar complex. This muscular group ensures adequate balance, stability and increase dynamic postural strength, which is fundamental for the proper postural stabilisation, control of oscillation of the posture) and maintenance of the posture during the performance of a motor skill[5,6].

Despite the growing knowledge about this method, only few studies compare the impacts of this training modality in elderly women who practice the Pilates method[7,8]. Therefore, this study contributes to our understanding of the importance of body balance, mobility and respiratory muscle strength in elderly women who practice the Pilates method and other elderly active individuals who do not participate in structured physical activities. This study aims to compare the body balance, functional mobility and respiratory muscle strength of active elderly women who regularly engage in the Pilates method of physical training.

Methods

The study was characterised as a transversal analytical investigation and was approved by the Research Ethics Committee (approval number 799.252). The study comprised 22 elderly women, 11 from the Pilates group and 11 from the active group. Informed Consent was obtained from all the women who accepted to participate in the study.

The study was conducted in the city of Salvador, between October 2014 and January 2015, and the Pilates group (PG) comprised elderly women practitioners of the Pilates method in the Studio 2 de Pilates; the comparison group, defined as the active group (AG), comprised of elderly women from a community centre. The inclusion criteria were an age of 60 years or older, agreement to the Free and Informed Consent form with signature, and female gender. Women were considered practitioners of the Pilates method if they had practised this method for at least three months, with eight consecutive weeks of assiduity. Active elderly women were those who did not practice a structured exercise training programme, but had scored greater than 53 in the Human Activity Profile (HAP).

We excluded elderly women who presented with neurodegenerative diseases, orthopaedic and/or vestibular disorders that compromised balance, visual or auditory deficits that impeded the physical tests or that depended on gait devices (crutches, cane or walker), smokers, elderly women with chronic lung diseases and infections of the upper and lower airways in the previous year with neuromuscular, orthopedic and thoracic deformities.

The women were evaluated in relation to clinical and sociodemographic aspects including age, income, level of schooling, body mass index, comorbidities, use of medication and the number of falls in the previous six months. For the homogenisation between the groups, the level of physical activity was assessed using HAP and women were considered active if they had an adjusted score of more than 53 points09. The Berg balance scale (BSE) was used to evaluate body balance, timed up and go (TUG) for functional mobility and manovacuometry was used to verify respiratory muscle strength.

The activities that comprised the evaluation were initially demonstrated by the evaluator, and each elderly woman was then submitted to the tests. During the tests, standardised instructions were provided, all applied by a single evaluator to maintain accuracy in the reliability of the obtained data.

The HAP evaluates the functional level and physical activity of any individual. It includes 94 daily activities, which are categorised according to the international classification of functionality. Three responses are possible for each of the activities: 'I still do', 'I stopped doing' or 'I never did'[09].

For HAP analysis, the maximum activity score (MAS) was obtained, which numbers the activity with the highest oxygen demand, which the individual 'still does'. The adjusted activity score was then calculated by subtracting from the MAS the number of items that were 'stopped' before the last 'still does'. The score classifies those assessed as weak or inactive (scores, <53), moderately active (scores, 53–74) or active (scores, >74)[09].

The Berg balance scale comprises 14 tasks, each assigned a value of zero (unable to perform) to four points (performed independently), evaluating both the form and the time to completion. It encompasses everyday movements of daily activities, indicating balance when performing the motor activities, thus predicting the probability of falls. It is widely used in clinical practice, having risk of falls scores below 45 points. The Brazilian version presented high intra- and inter-observer reliability and intraclass correlation coefficients (ICC) 0.99 and 0.98, respectively, thus supporting its usefulness for assessing the balance of elderly Brazilian people[10].

In the realisation of TUG, the time it took for the elderly woman to stand up from a chair, walk a distance of three metres demarcated on the floor, take a 180° turn, and then return to and sit in the same chair was recorded. The timer was started when the participant's spine left the back of the chair and ended when they leaned against it again. This test is widely used for evaluating functional mobility and the risk of falls in the elderly[11]. Each woman performed the test thrice; the lowest value was considered in the analysis.

A TUG value of up to ten seconds was considered normal for healthy, independent adults without a risk of falls; between eleven and twenty seconds denoted those without significant alteration of balance, but presenting some fragility, partial independence and low risk of falls; while a vlauegreater than 20 seconds denoted elderly requiring intervention, high risk of falls and individuals dependent on activities of daily living with altered mobility[12].

The Wika® Manovacuometer was used for the measurement of respiratory pressures with an operating range of ±120 cm H2O. The manoeuvres were performed with guidance of a physiotherapist, using verbal commands for each maximum pressure breath. Each inspiratory or expiratory effort was performed with an interval of 45 seconds while the subject wore a nasal clip and remained in a sitting position[13].

The maximum inspiratory pressure (PiMax) was measured from the residual volume after a maximal expiration, and the maximum expiratory pressure (PeMáx) was measured from the total lung capacity after a maximal inspiration. The participants were instructed to maintain the pressure for at least two seconds, which was considered the highest value for the analysis. Acceptable manoeuvres were considered when there was no air leakage, the pressure was sustained for at least two seconds, and the measurements were reproducible with a variation equal to or less than 10% of the highest value. Each woman was required to perform at least five inspiratory and maximum expiratory efforts for the testing to be considered satisfactory. The highest value obtained from all the manoeuvres performed was the registered value[14].

Data obtained through the application of the evaluation form and the tests were catalogued and recorded in an Excel® spreadsheet for Windows®, version 2003. Descriptive statistics were used for the analysis of demographic and clinical data. The data from continuous variables were analysed with measures of central tendency and dispersion and expressed as means, percentages and standard deviation. Data of dichotomous or categorical variables were analysed with measures of frequency and expressed as percentages. These data were presented with the elaboration of tables and graphs.

The Mann–Whitney U-test was used to compare between-group differences. The differences between changes in mean values were expressed with a 95% confidence interval. Results from the HAP, TUG, BSE and manovacuometer were compared, and the significance level was set at 5%. All statistical analyses were performed using the SPSS (Statistical Package for the Social Sciences) software v20.0.

The data analysed for BSE were divided into groups based on similar functional tasks: transfers (questions 1, 4 and 5), stationary tests (questions 2, 3, 6 and 7), functional reach (question 8), rotational components (questions 9, 10 and 11) and decreased support base (questions 12, 13 and 14)[15,16]. Conversely, the Wilcoxon test was used for the comparative analysis of the predictive values obtained in the measurement of PiMáx and PeMáx. Predictive values were calculated with the following equation: PiMáx = 110.4 + (-0.49 × age) and PeMáx = 115.6 + (-0.61 × age).

Results

Of the 22 women who participated in the study, 11 were from the PG and the other 11 were from the AG. The mean participant age was 69.36 (9.49) years, with a higher concentration in the 60–65 years age group (50%). Physical activity, as assessed through PAH, did not differ across groups ($p < 0.05$), which confirms the homogeneity of the evaluated samples (Table 1).

Table 1. Sociodemographic and clinical characteristics of the elderly women of the Pilates Group and Active Group, Salvador / Bahia, Brazil, 2015.

	PMP n=11	IA n=11
Age (years)	69,54 ±11,03	69,18 ±8,21
Weight (Kg)	64,52 ±8,72	65,09 ±8,08
Height (m)	1,61 ±0,07	1,58 ±0,06
BMI (Kg/m²)	24,78 ±3,33	25,82 ±3,28
Medications (n)	1,81 ±1,4	3,27 ±2,68
Diabetes		
Yes	1	1
No	10	10
Hypertension		
Sim	6	6
No	5	5
Use of corrective eye lenses		
Yes	9	10
No	2	1
HAP		
MAS*	71,18 ±5,34	73,54 ±11,87
AAS*	62,81 ±9,81	62,18 ±17,02

BMI= Body Mass Index, HAP = Human Activity Profile, MAS = Maximum Activity Score, AAS= Adjusted Activity Score, *p (level of significance) ≥ 0,05.

When body balance was evaluated, no statistically significant differences were observed between the Pilates practitioners and AG using total scores (p = 0.401) and BSE domains. Mobility, as assessed by the TUG, did not significantly differ among groups (p = 0.478), and the mean time of the AI test was 8.06 (4.29) seconds and the PMP of 8.28 (2.82) seconds. There were no significant between-group differences in respiratory muscle strength, both for maximal inspiratory (p = 0.478) and expiratory pressure (p = 0.847, Table 2).

Table 2. Comparison of the means of the measured values of BSE, TUG, Real and Predictive PiMax, Real and Predictive PeMáx among the Pilates Practitioners and Active Elderly Women groups.

Variáveis	PMP	IA	p*
BSE – Total Score	54.63 ±1.91	52.90 ±4.01	0.401
BSE – Functional Reach	12	12	1
BSE – Transfers	15.9 ±0.3	15.9 ±0.3	1
BSE - Stationary tests	3.63 ±0.5	3.72 ±0.4	0.748
BSE - Rotational Components	11.81 ±0.4	11.27 ±1.27	0.401
BSE - Support Base	11.27 ±1	9.81 ±2.44	1.193
TUG (seconds)	8.28 ±2.82	8.06 ±4.29	0.478
MIP (cmH_2O)	66.36 ±20.13	59 ±14.45	0.478
MEP (cmH_2O)	64.54 ± 33.27	54 ±14.96	0.847

BSE: Berg Balance Escale; TUG: Timed Up and Go; MIP: Maximum inspiratory pressure; MEP: Maxium Expiratory Pressure; PMP: Pilates Method Practitioners; IA: Elderly Active women.*Level of significance (p <0.05).

Discussion

In the present study, no differences in body balance, mobility and respiratory muscle strength were observed between normally active elderly women and those regularly practising the Pilates method of physical activity. Our results suggest that staying physically active, without the use of structured physical exercise programmes, is just as helpful in maintaining functionality and respiratory muscle strength as compared with those regularly practising the Pilates method.

It is well documented that the Pilates method is safe and efficient in improving balance in elderly women18. However, it is important to note that in both body balance and mobility, both the groups presented satisfactory performance, because it is estimated that women aged over 65 years present with a moderate balance and TUG performance time of approximately 9.08 seconds[19].

The TUG is a short-distance, easy-to-perform test, which allows socially active elderly women involved in usually independent physical activity programmes to maintain satisfactory levels of physical functionality and, therefore, a satisfactory performance in this test[20].

Although elderly people who do not perform regular physical activity are considered to be sedentary, a small level of physical activity in daily activities can contribute to active ageing. Several elderly individuals have a habit of staying in the house for longer periods of time while others are more active and participate in various activities[21]. In our study, although a group of elderly women did not perform systematic physical training, they were still considered to have an active lifestyle according to the assessment of the level of physical activity using HAP.

Regarding respiratory muscle strength, we observed that although there were no differences between inspiratory and expiratory pressure values between Pilates practitioners and active elderly women, the values observed in the active elderly group (Pimax = 59 ± 14.45, Pemax = 54 ± 14.96) were lower

than the predicted values for their characteristics (PiMax = 77.12 ± 3.63, PeMax = 74.18 ± 4.52). Although the values observed in the group of Pilates practitioners (PiMáx = 66.36 ± 20.13, PeMáx = 64.54 ± 33.27) were lower than the predicted values (PiMáx = 76.32 ± 5.4, PeMáx = 73.15 ± 6.72), a more significant increase in strength was observed, indicating that practising the Pilates method may influence the maintenance of adequate respiratory muscle strength in elderly women[22].

While the results of the respiratory muscle strength of the PG should be carefully interpreted, other clinical studies have already shown significant results in this population[23,24]. Despite the results presented herein, there is still no consensus on how the Pilates method is applied to older women. The form and type of exercise, body area focus, number of repetitions and frequency of the sessions can influence the results and should be considered in future research[4].

However, the Pilates method has gained considerable research attention, particularly for its use in the elderly popoulation[2,25]. It has also grown in demand as a method of exercise used by women who wish to improve their physical and psychological health4. Hence, more research is required to assess the effects of this method, and other method(s) of exercise on body balance, functional mobility and respiratory muscle strength in the elderly. Thus, new evidence on the subject can be gathered, contributing to the debate and clinical practice of professionals working with physical exercise interventions in this population.

This study did not evaluate the total time, intensity and type of exercises prioritised in the PG. Although this study included a small sample size, the results are still important because active living seems to offer beneficial results similar to those practising the structured Pilates method of exercise, which is aimed at maintaining body balance and mobility. However, Pilates may be more beneficial for some populations as it appears to influence the maintenance of muscle strength closer to the reference values.

To reinforce the recommendation of using this method as an essential training modality aimed at the prevention of age-associated declines in physical health and the rehabilitation of elderly women, it is necessary to produce well-controlled and randomised clinical trials. Also, it is essential to combine the exercise prescription with the clinical characteristics of the groups of patients studied.

Conclusion

These result of this study suggest that maintaining physical activity levels through unstructured means may have the same effect on the balance and mobility of elderly women (particularly between 60 and 65 years of age) as a structured Pilates regimen. However, elderly women who practice Pilates seem to better maintain respiratory muscle strength as they age compared with those who are active but do not participate in structured exercise.

Authors' contributions

JAR Martinez participated in the stages of the study include the review literature, data collection and writing. LRGC Da Silva has participated bibliographical survey, writing and data analysis. Dd Ferraz, M Gomes Neto and CMS and Silva contributed to the analysis of data, final review of the article and orientation of the study. MB Saquetto held the orientation of the entire study process, data analysis, drafting and final review.

Competing interests

No financial, legal or political competing interests with third parties (government, commercial, private foundation, etc.) were disclosed for any aspect of the submitted work (including but not limited to grants, data monitoring board, study design, manuscript preparation, statistical analysis, etc.).

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