

# Correlation between two physical activity programs in the gait of sedentary elderly subjects

Correlação entre dois programas de atividade física na marcha de idosos sedentários

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## ABSTRACT

**Objectives:** To assess the effect of exercise on gait using two different programs: a group of aerobic exercises (Group A, n = 18) and a group of flexibility and balance exercises (Group B, n = 19). **Methods:** A casualized controlled study, in which each sample controlled itself, was undertaken. The sample comprised 37 male and female subjects, aged from 60 to 90 years, from the outpatient clinic of the Geriatrics Unit of Hospital das Clínicas of Faculdade de Medicina of Universidade de São Paulo; the patients were sedentary and had not exercised regularly during the past six months. **Results:** Improvement of gait was seen mainly in the group that did specific exercises. **Conclusion:** The results of this study underline the importance of physical exercises in sedentary elderly subjects, but show the need for programming the exercises towards specific goals, which can optimize the results of this tool of health promotion for the elderly.

**Keywords:** Motor activity; Sedentary lifestyle; Exercise; Pliability; Postural balance; Physical fitness; Gait

## RESUMO

**Objetivos:** Avaliar o efeito dos exercícios na marcha por meio de dois diferentes programas: o grupo dos exercícios aeróbios (Grupo A, n = 18) e o grupo que realizou exercícios de flexibilidade e equilíbrio (Grupo B, n = 19). **Métodos:** Este foi um estudo casualizado, ensaio controlado, no qual cada amostra foi controle dela mesma. Foram sujeitos desta pesquisa 37 idosos, com idade entre 60-90 anos, de ambos os sexos, encaminhados dos ambulatórios do serviço de Geriatria do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo, sedentários e que não tinham praticado atividade física por, pelo menos, seis meses. **Resultados:** Observou-se que a melhora do padrão da marcha dos idosos foi obtida, principalmente, no grupo que realizou exercícios específicos. **Conclusão:** Os resultados desta investigação reforçam a relevância da prática de exercícios físicos pelos idosos sedentários, mas demonstra a necessidade de dirigir a programação para objetivos definidos, o que pode otimizar os resultados deste instrumento de promoção de saúde do idoso.

**Descritores:** Atividade motora; Estilo de vida sedentário; Exercício; Maleabilidade; Equilíbrio postural; Aptidão física; Marcha

## INTRODUCTION

Aging is no longer a privilege of a few individuals. A significant increase in life expectancy and, consequently, the corresponding growth in the number of people living beyond 60 years has been recognized worldwide<sup>(1)</sup>.

These changes have taken place at a fast and radical rate in Brazil. The number of elderly persons has gone from 3 million, in 1960, to 7 million, in 1975, and to 20 million in 2008. It is also important to note that the fastest growth has been observed among the “very elderly” population – those aged 80 years or more<sup>(2,3)</sup>.

People wish to retain their health as they age to continue involved in social life<sup>(4)</sup>.

The natural biological aging process alters motor control<sup>(5)</sup>. A widened base of support, decreased step length and foot clearance, decreased velocity, a smaller knee and hip extension, and altered flexibility and balance manifest as abnormal gait – a change in a fundamental act for locomotion. These manifestations limit activity and raise the rate of sedentarism among the aging population<sup>(6-8)</sup>.

Current evidence suggests that physical exercise brings positive results for the health of elderly persons. It is also certain that the lack of exercise results in unsatisfactory function in the elderly<sup>(9)</sup>.

Regular and systematic physical exercise has been shown to be useful in the context of aging; it mitigates changes resulting from decreased muscle strength, balance, flexibility, and aerobic capacity<sup>(10)</sup>.

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Some studies showed that *Tai Chi Chuan* increases balance and flexibility in elderly subjects<sup>(11)</sup>. Other studies reported that physical exercises increase movement amplitude, spatial orientation, visual and auditory stimulation, flexibility, and balance<sup>(12)</sup>.

Several studies stated that regular aerobic activities significantly increase physical fitness<sup>(13)</sup>. Exercising with weight training, running, and walking help delay loss of bone mass, which is directly associated with the aging process<sup>(14-16)</sup>.

Thus, strategies to maintain gait in the elderly are needed.

## OBJECTIVES

To analyse gait in the elderly and to correlate the effects of two specific physical exercise programs in sedentary elderly subjects.

## METHODS

An interventional controlled randomized study of correlated samples, in which each group was its own control, was undertaken. The study period was February 2002 to February 2003. The Institution Review Board of Hospital das Clínicas da Faculdade de Medicina of Universidade de São Paulo (FMUSP) approved the study.

The sample comprised 40 sedentary male and female elderly subjects, aged from 60 to 90 years, who had not exercised within the past six months, and who were referred from the Geriatrics Unit of Hospital das Clínicas of FMUSP. One subject declined to participate and two others left because of surgery; the final sample comprised 37 elderly subjects.

Subjects were randomized and allocated to two groups according to the exercise program:

- aerobic exercises (Group A): monitored walking on an athletic field (400 m);
- flexibility and balance exercises (Group B): active stretching exercises of the upper and lower limbs (stretching the brachial biceps, brachial triceps, pectoralis major, quadriceps, sural triceps, ischiotibialis, and gluteus maximus), and exercises involving progressive changes in the base of support and the visual status (tiptoeing over a wider and narrower base of support, lateral movement of the trunk, squatting over a wider and narrower base, and exercises with eyes closed).

Activities were undertaken at the Associação Atlética Acadêmica Oswaldo Cruz (AAAOC) of FMUSP, lasting 50 minutes per session, during 12 months.

All subjects signed an informed consent form, written by Hospital das Clínicas of FMUSP and authorized by

the Ethical Committee for Research Projects Analysis (CAPPesq).

A questionnaire that included questions about age, sex, marital status, the presence of age-related diseases, use of medication, and the reason for practising exercises was applied for data gathering purposes.

The Tinetti gait test<sup>(17)</sup> was applied before starting the exercises and after three months for comparison purposes. The test variables were gait initiation, step length, foot clearance, step symmetry and continuity, deviation from a straight line, trunk, and the base of support.

Subjects were asked to walk naturally on a regular surface<sup>(17)</sup>.

The Sigma Stat 3.0 for Windows® software was used for the statistical analysis; the intergroup analysis consisted of a one-factor univariate analysis (ANOVA 1 factor). Significant results were those with  $p < 0.001$ .

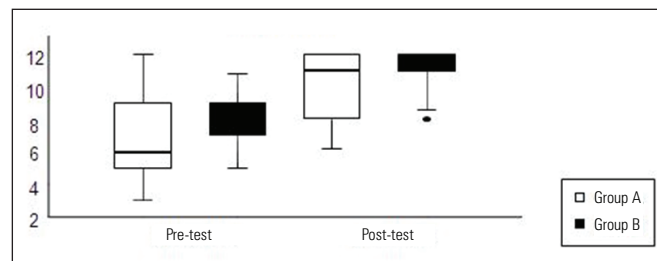
## RESULTS

Table 1 shows the demographic data of the 37 elderly subjects who participated in the study. Values are shown as mean  $\pm$  standard deviation.

**Table 1.** Demographic data

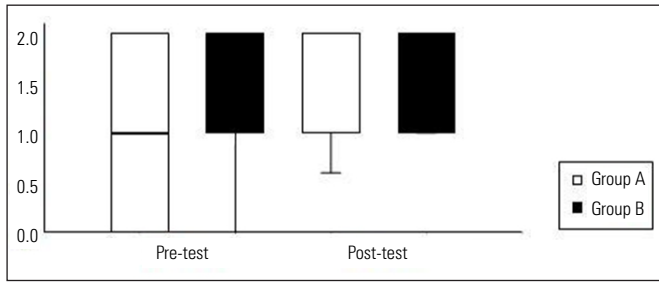
Data	Group A	Group B	p value
Subjects (37)	n = 18	n = 19	
Age (years)	69.8 $\pm$ 3.4	73.8 $\pm$ 3.5	0.003
Minimum-maximum (years)	62 - 75	69 - 78	
Sex: M/F	2/16	2/17	0.98

We observed in the gait analysis, on univariate analysis, significant difference for parameters in Group A ( $p = 0.035$ ) as well as in Group B ( $p \leq 0.001$ ). There were no significant parameter differences in the intergroup analysis (pre-test,  $p = 0.919$  and post-test,  $p = 0.878$ ) (Figure 1).



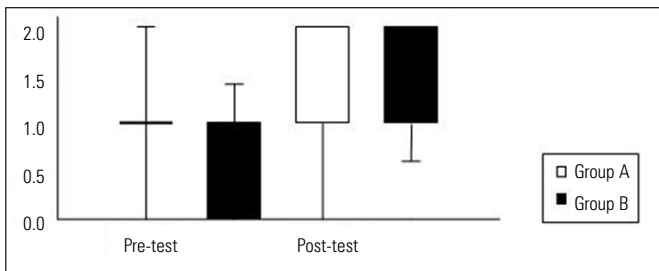
**Figure 1.** Gait test.

The deviation of straight line verified at two moments of the study in both groups, over univariate analysis, that only Group B had a significant improvement ( $p = 0.009$ ). There were no significant parameter differences in the intergroup analysis (pre-test,  $p = 0.710$  and post-test,  $p = 0.622$ ) (Figure 2).



**Figure 2.** Path (deviation from a line). Box plot showing deviation from a straight line at two moments of the study for both groups

Trunk positioning during gait on univariate analysis revealed a significant improvement only in group B ( $p = 0.037$ ). There were no significant parameter increases in the intergroup analysis (pre-test,  $p = 0.570$  and post-test,  $p = 0.678$ ) (Figure 3).



**Figure 3.** Trunk positioning during gait. Box plot showing trunk positioning during gait at two moments of the study for both groups

## DISCUSSION

Preserving gait is essential for elderly persons, because it is a necessary element for daily activities<sup>(18,19)</sup>.

The present study showed that specific flexibility and balance exercises improved postural stability in elderly subjects. This may imply in a significant decrease of falls in this population. These findings were not seen in Group A, which performed only walking exercises.

Several studies applied indirect metrics, such as walking, dancing, aerobic exercises, or exercises associated with stretching for obtaining effects on flexibility. For some authors, flexibility training increases velocity, amplitude and cadence of gait<sup>(20,21)</sup>. Another study<sup>(22)</sup> showed that there was a significant improvement in gait velocity in elderly subjects following a training that consisted of balance, strength and flexibility exercises during 22 weeks.

Gait initiation parameters improved significantly in both groups at the two moments of the study.

Plain physical activity, such as walking, improves the physical status of elderly persons and results in interesting increases in foot and lower limb muscle strength<sup>(12)</sup>. From a population standpoint, walking daily for 40 to 60 minutes is a simple and low cost exercise that can be easily incorporated into daily routine<sup>(23)</sup>.

Walking alone does not improve the gait conditions of sedentary elderly persons compared to those that did specific flexibility and balance exercises, as found in this study.

Flexibility and balance training (Group B) resulted in significant gains in path, trunk positioning, and step continuity, resulting in improved postural control during gait in this group.

The base of support, step length, and foot clearance were increased in Group A, which may have been influenced by walking on open and irregular surfaces.

Increased joint mobility makes possible to carry out daily activities that are generally impossible for sedentary elderly persons. Exercise programs involving physical activities or flexibility exercises with postural changes are beneficial and able to increase their balance, flexibility, postural control, muscle strength, and aerobic capacity<sup>(24-26)</sup>.

Our study revealed that the determinants of gait improved in both groups, but group B, which performed specific exercises, had significant improvements in all components; furthermore, the association and execution of both types of activities could be beneficial for the elderly.

## CONCLUSION

Plain and easily performed exercises carried out under specific guidance result in significant gait improvements in sedentary elderly subjects.

Walking in open environments over irregular surfaces improves gait quality but is not fully effective.

Gait was predominantly improved in Group B (specific exercises), in which all components of gait were reinforced.

This study therefore brings attention to a greater encouragement of specific physical exercises for sedentary elderly persons.

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