

# GENERAL EXERCISES VS. WALKING TRAINING IN THE MOTOR SKILL OF HEALTHFUL ELDERLY PERSONS

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## ABSTRACT

The objective of this study was to assess and compare the effects of two programs of physical activities (general exercises and walking training) in manual motor skill of healthful sedentary elderly persons. Thirty elderly persons were recruited (12 men, 18 women), average age of 68.6 years old, sedentary, non-institutionalized. They had their motor skill assessed through a graphic test. The subjects were randomly assigned into 3 groups of 10 each: GA carried out a general exercising program. GB took part in a walking training program. GC acted as the control. GA and GB exercised for four months, twice a week, within a one-hour session, presenting maximum heart rate between 40-70%. The graphic test was applied again and the number of lines and the percentage of correct lines were extracted from it. This datum was later compared to the results obtained in the baseline test of the individual and between the groups through Wilcoxon Signed-Ranks Test. Kruskal-Wallis test was used to compare the groups. As a result, both tasks improved significantly in GA. In GB, only the percentage of correct lines improved significantly. The effects of the general exercises in the motor skill performance are known. GB's motor skill changes can be related to general physical improvement of the subjects in this group. General exercises and walking training improve manual motor skill in healthful sedentary elderly persons.

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General physical exercises provide more quantitative and qualitative improvement compared to walking training.

**Key words:** Elderly persons. Physical exercise. Walking. Motor skill. Psychomotor performance.

## INTRODUCTION

Aging is a set of structural and functional changes in the human body. These changes are progressive, due to age (TIMO-IARIA, 1996). Aging is related to losses in all the body structures. The size of the brain decreases 10-20 % and the nerve conduction speed decreases around 0.4% a year, from 20 years old on. Aging also decreases the nervous conduction and magnitude and amplitude of the reflex reply. The age diminished the size of the brain structures related to motor skill (lateral prefrontal cortex and cerebellar hemispheres) (KENNEDY; RATZ, 2005). These changes can lead to slowness in the achievement of motor tasks (PAYTON; POLAND, 1983; RODRIGUE et al., 2005). Smith et al (2005) found that motor learning was significantly slower in adults over 62 years old. The most common damages of motor functions in elderly persons are the decrease of movements, muscle strength, maximum strength and motor skill (THOMPSON, 1994).

Physical exercises are related to the preservation or partial recovery of body functions affected by aging. They lead to biological adaptations, which improve the functioning of several organs and systems and the performance of motor skills. They also aid in illness prevention, normalize the emotional state and facilitate socialization (ASTRAND; RODAHL, 1980; BALADY et al, 1994). Regular exercising decreases all-case mortality (BRENNAN, 2002). On the other hand, sedentary habits lead to losses in most of the body systems, affect motor skills, spoil health (O'BRIEN, 1994; MILLS, 1994) and are related to the increase in morbidity and mortality due to chronic illness (BLAIR; CONELLY, 1996).

The practice of physical exercises is related to primary prevention in elderly persons (MURPHY; CICILLINE, 2001). Important health-related agencies indicate regular and continuous exercise practice in order to protect the quality of life, socialization and autonomy of elderly persons (DIPIETRO; DZIURA, 2000). Preventive physical exercises aim to keep elderly persons' independence and maximize functional performance (ROSEMOND; MERCER, 2002), as well as

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to keep cardiopulmonary, muscle-skeletal and neuromotor functions (MEREDITH, 1989; MCARDLE et al., 1991).

Neurological assessment in healthful elderly persons must emphasize motor skill of global and fine movements, beyond static and dynamic balance (TINETTI, 1986). Motor skill performance is frequently studied by direct observation (BASSEY; HARRIES, 1993). Manual tasks, as writing, can also be used to assess motor skill. But this way of assessment is complex and difficult to be analyzed. The use of graphic tests, in which reproduction of simple geometric figures are asked, can be useful (CAROMANO, 1989). The use of video recording, instead of direct observation, facilitates attainment of information and makes it possible to analyze the joints and body segment movements repeatedly during different physical activities (JOHNSON; BOLSTAD, 1973; CAROMANO, 1989).

Motor skill is essential to the independence of the elderly person. It was not found studies those analyses the effects of general exercises and walking in this parameter. If one of the proposed programs were able to improve motor skill, it could be employed with success to keep or partially recover the motor skill of the subjects.

This study aims to assess the effects of two programs of physical activities (general exercises and walking training) in manual motor skill of healthful elderly persons.

## METHODS

### Participants

Thirty volunteers were recruited, 18 women and 12 men, average age of  $68.7 \pm 3.5$  years old. To be included, subjects could not have been smokers, couldn't have practiced any physical exercise or walked more than 1 kilometer per week in the last five years, to be socially active in the community, not to present muscle-skeletal, neuromotor or cardiovascular illness that could prevent them from performing physical activities. Time availability, access to means of transportation, acceptance of training routine (foreseeing a maximum of absence, with justification and replacement of the session), intention to complete training and signing of the informed consent form were also considered. It was still necessary that subjects randomized to control group should not do physical exercises for four months. All participants were assessed by clinical and physical therapy examination. The Ethics Committee of the involved University approved this study.

## Procedures

The subjects' motor skill was assessed through graphic test (baseline-test). In this test, volunteers were sitting on a chair, with a standard table and received a pen, a square-lined sheet of paper and information about the text. Those who used eyeglasses for reading and writing were guided to wear them. In the test, the subject received a geometric figure, which he should copy in the square-lined paper. Each participant should copy the figure repeatedly (how many times he could), with the same size, as similar and fast as possible, for three minutes.

A simple figure model was used to a training session and the figure model used in the baseline was modified in the post-test. The post-test model was more difficult than the first one, to eliminate learning factor (CAROMANO, 1989). All the models can be observed in Figure 1.

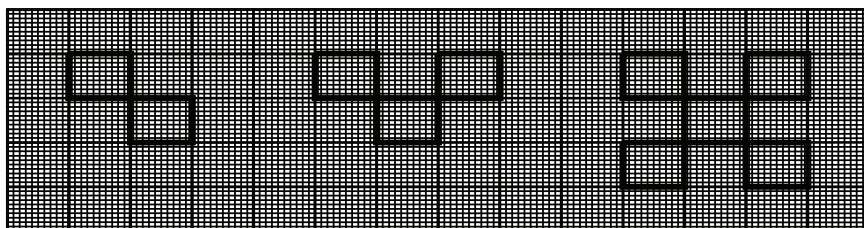


Figure 1 – Graphic models: training, baseline and post-test, respectively

The number of lines drawn in three minutes was counted. The quality of the lines drawn was also assessed, through analysis of the percentage of correct lines, defined as those lines that do not exceed its limits and within proposed time.

After the baseline test, participants were stratified by sex and randomly assigned to general exercises (GA), walking exercises (GB) and control group (GC), with four men and six women each group.

GA was prescribed a program of physical exercises. GB attended a walking exercise program. GC did not receive interventions. GA and GB were prescribed exercises for four months, twice a week, 1 hour each session, with intensities set from low to moderate, obtaining 40-70 % of maximum heart rate.

The aim of general exercises was to improve general motion amplitude, cardiocirculatory and respiratory function, muscle stretch, muscle strength and balance, besides reeducating the movements of the upper and lower limbs. The program of general exercises included breathing, stretch, posture, motor skill, muscle strength and cardiovascular resistance training. The order of exercise training respected its level of difficulty, from the easiest to the most complex one.

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The walking exercises were performed in a plain and covered place. The 1st month of training was developed in three stages: the first 15 minutes in normal speed (neither too slow, nor too fast), associated with respiratory exercises. The next 30 minutes, five minutes of fast speed and five minutes of normal speed were intercalated, until the end of 30 minutes. In the last 15 minutes, the walking exercise was performed with normal speed. In the last three months of walking training, the level of difficulty was increased. In the last weeks of program, subjects walked normally during the 1st and the last five minutes and walked fast during the other 50 minutes. If necessary, subjects could intercalate short periods of deceleration during these 50 minutes of fast walking.

Post-test assessment was performed at the end of the intervention.

## Statistical Analysis

Statistical analysis was performed using Stata, version 9.0. An “intent-to-treat” analysis was also considered. Statistical significance for all analyses was set at  $p < .05$ . Because most of the data followed non-normal distribution, non-parametric tests were used in all statistical analyses.

To confirm the initial homogeneity between the groups, the three groups had their age, height and weight compared through Kruskal-Wallis test. Baseline and post-test results in the groups were analyzed through Wilcoxon Signed-Ranks Test. Kruskal-Wallis test was also used to compare the groups.

Data collected in baseline and post-test were still analyzed according to criteria of Table 1, which classified subjects’ performance in improvement, worsening and maintenance. Based on the analysis of subjects’ average performance in each group, the performance of the groups was prescribed.

Table 1 – Criteria for the study of evolution of manual motor performance

Motor Skill	Lines Number	Percentage of correct lines
Improvement	Increase $\geq 10$	Increase $\geq 5\%$
Worsening	Decrease $\geq 10$	Decrease $\geq 5\%$
Maintenance	Increase or decrease of 1 to 9	Increase or decrease of 1 to 4%

Two independent observers analyzed graphic data. Scores were submitted to the analysis of agreement between observers. For agreement calculation, Johnson formula was used  $(A/A + D) \times 100$ , where A is the number of agreements (the two observers registered the same behavior, index or value) and D is the number of disagree-

ments. It was considered an adequate agreement level those that vary from 90 % to 100 % (JOHNSON; BOLSTAD, 1973).

## RESULTS

The initial homogeneity between the groups was confirmed through Kruskal-Wallis test. Results are presented in Table 2.

Table 2 – Sample characteristics and baseline motor skill

	Baseline comparisons among the groups **	Baseline mean		
		GA	GB	GC
Subjects	Men	4	4	4
	Women	6	6	6
Age (years)	0.91*	68.4	68.8	68.8
Height (cm)	0.76*	171.4	169.2	169.7
Weight (Kg)	0.82*	69.7	65.8	68.0
Lines number	0.84*	229.2	238.5	224.9
Percentage of correct lines	0.86*	73.5	78.3	75.8

\* No significant difference

\*\* Kruskal-Wallis test

Table 3 presents the effects of training in motor skill, in the three groups. The two tasks, number of lines and percentage of correct lines, improved significantly in GA. In GB, only the percentage of correct lines showed significant improvement. It was not observed any difference in GC.

Table 3 – Effects of training in motor skill, by groups

			GA	GB	GC
Lines number	Improvement		6	---	---
	Worsening		---	---	---
	Maintenance		4	10	10
	Mean	Baseline	229.2 (39.8)	238.5 (44.1)	224.9 (36.3)
	(SD)	Post-test	242.9 (42.7)	240.5 (43.7)	226.3 (35.7)
	Wilcoxon				
	Signed-Ranks		p = .005*	p = .126	p = .173
Percentage of correct lines	Test				
	Improvement		10	5	1
	Worsening		---	---	---
	Maintenance		---	5	9
	Mean	Baseline	73.5 (8.4)	78.3 (5.7)	75.8 (7.2)
	(SD)	Post-test	89.7 (7.3)	89.1 (5.5)	77.6 (7.0)
	Wilcoxon				
	Signed-Ranks		p = .005*	p = .005*	p = .169
	Test				

\* Significant difference between the groups at different times

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## DISCUSSION

The two exercise programs (physical and walking exercises) improved the number of lines performed by the subjects. The percentage of correct lines improved only in GA. Significant changes in GC was not found.

The motor skill performance was different when comparing GA and GB. The performance speed (number of lines in three minutes) increased only in GA. The quality (percentage of correct lines) improved in all the subjects of GA and in only five of GB. It proves that physical exercises lead to higher quantitative and qualitative improvement in motor skill compared to the walking program. GB's motor skill changes can be related to general physical improvement of the subjects in this group.

There are few researches about the effects of physical exercise on motor skill. All of them showed positive effects of the exercises in motor skill, in agreement with this study. Only four studies with elderly persons were found. Shoy and Roth (1992) performed a transversal study to assess the relation between prolonged exercise and neurocognitive performance in 105 men, in three age intervals: 18 to 28, 35 to 45 and 60 to 73 years old. Authors suggested that physical activity aids the maintenance of cognitive function that normally decreases with age. However, it has to be considered that those data were obtained in a cross-sectional study, that do not consider the normal aging process of the subjects. It has been found differences in the motor skill assessed by longitudinal and cross-sectional studies (RODRIGUE et al., 2005). These benefits are more evident in situations when the vision and space processing is required, with effects on manual motor skill. Improvement was found in motor tasks – like combing the hair, dressing or holding small objects – after exercise practicing, suggesting positive relation between exercise and motor task performance (BASSEY; HARRIES, 1993).

Connelly et al (2000) studied the effects of isokinetic training of ankle dorsiflexors in elderly persons' motor performance. Twenty-eight subjects went through a 2-week, 3-day/week strength training program. Authors found motor skill improvement and neural adaptation to concentric and eccentric muscle contraction.

Stevens e Hall (1998) studied the relation between motor skill learning and low back pain rehabilitation exercises. Authors described several strategies for motor skill acquisition: transfer-appropriate processing, contextual interference effect and repetitive self-assessment. Authors recommended these methods in rehabilitation programs to improve the subjects' cognitive aspect, helping them to get skills more quickly and retain them longer.

Ourania et al (2003) assessed the effects of a 12-week exercise program on physical abilities of 55 sedentary women, aging from 60 to 75 years old. This exercise program was performed for 1 hour, once, twice, and 3-time/week, in the three experimental groups. Authors found improvement in the dynamic balance, muscle endurance, sitting and reach-flexibility and motor skill. The improvement was proportional to the exercise training frequency.

Researches about the effects of walking training in motor skill were not found.

Physical exercises and walking training improve manual motor skill in healthful elderly persons. Physical exercises lead to more quantitative and qualitative improvement in motor skill compared to walking training. Those exercises can be used to improve and keep motor skill in elderly persons.

## REFERENCES

ASTRAND, P. O.; RODAHL, K. Tratado de fisiologia do exercício. São Paulo: Interamericana, 1980.

BALADY, G. J. et al. Cardiac rehabilitation – American Heart Association. Circulation, v. 90, n. 3, p. 1602-1610, 1994.

BASSEY, E. J.; HARRIES, A. Normal values for handgrip strength in 920 men and women aged over 65 years, and longitudinal changes over 4 years in 620 survivors. Clinical Science, La Jolla, CA, v. 84, n. 3, p. 331-337, 1993.

BLAIR, S.N.; CONELLY, A. How much physical therapy should we do? The case of moderate amounts and intensities of physical activities. Research Quarterly for Exercise & Sport, v. 67, n. 2, p. 93-205, 1996.

BRENNAN, F. H. Exercise prescription for active seniors: a team approach for maximizing adherence. Phys Sportsmed, v. 30, 2002.

CAROMANO, F. A. Análise funcional das posturas induzidas por dois sistemas cadeira-mesa significativamente diferentes e o grau de desempenho na realização de atividades gráficas e testes de função respiratória. 1989. (Dissertation) –Universidade Federal de São Carlos, São Carlos.

CONELLY, D. M.; CARNAHAN, H.; VANDERVOORT, A. A. Motor skill learning of concentric and eccentric isokinetic movements in older adults. Experimental Aging Research, Kentucky, v. 26, n. 3, p. 209-228, 2000.

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persons. *Salusvita*,  
Bauru, v. 27, n. 1,  
p. 19-28, 2008.

DIPIETRO, L.; DZIURA, J. Exercise: a prescription to delay the effects of aging. *Phys Sportsmed*, v. 28, p. 77-78, 2000.

JOHNSON, S. M.; BOLSTAD, O. D. Methodological issues in naturalistic observation: some problems and solutions for field research. In: HAMERLINCK, L. A.; HANDY, L. C.; MARCH, E. J. Behavior change – methodologic concepts and practice. New York: Research Press, 1973.

KENNEDY, K. M.; RAZ, N. Age, sex and regional brain volumes predict perceptual-motor skill acquisition. *Cortex*, v. 41, n. 4, p. 560-569, 2005.

MCARDLE, W. D.; KATCH, F. I.; KATCH, V. L. Exercise physiology energy: nutrition and human performance. New York: Lea & Febiger, 1991.

MEREDITH, C. N. Peripheral effects of endurance training in young and old subjects. *Journal of Applied Physiology*, v. 66, p. 2844, 1989.

MILLS, E. M. The effect of low intensity aerobic exercise on muscle strength, flexibility and balance among sedentary elderly persons. *Nursing Research*, v. 43, n. 4, p. 207-211, 1994.

MURPHY, J. B.; CICILLINE, M. Medidas preventivas para os idosos. In: GALLO, J. J. et al. Aspectos clínicos do envelhecimento. Rio de Janeiro: Guanabara Koogan, 2001.

O'BRIEN, K. Getting around: a simple office workout to assess patient function. *Geriatrics*, v. 49, n. 7, p. 38-42, 1994.

OURANIA, M. et al. Effects of a physical activity program: the study of selected physical abilities among elderly women. *Journal of Gerontological Nursing*, v. 29, n. 7, p. 50-55, 2003.

PAYTON, O. D.; POLAND, J. L. Aging process: implications for clinical practice. *Physical Therapy*, v. 63, n. 1, p. 41-48, 1983.

RODRIGUES, K. M.; KENNEDY, K. M.; RAY, N. Aging and longitudinal change in perceptual-motor skill acquisition in healthy adults. *Journal of Gerontology, Part B: Psychological Sciences*, v. 60, n. 4, p. 174-181, 2005.

ROSEMOND, C.; MERCER, V. S. Educational programs to maximize function and mobility in long term care. *Topics in Geriatric Rehabilitation*, v. 17, p. 42-52, 2002.

SHOY, K. A.; ROTH, D. L. Association between aerobic fitness and visuospatial performance in health older adults. *Psychology and Aging*, v. 7, n. 1, p. 15-24, 1992.

SMITH, C. D. et al. Memories that last in old age: motor skill learning and memory preservation. *Neurobiology of Aging*, v. 26, n. 6, p. 883-890, 2005.

STEVANS, J.; HALL, K. G. Motor skill acquisition strategies for rehabilitation of low back pain. *Journal of Orthopaedic & Sports Physical Therapy*, v. 28, n. 3, p. 165-167, 1998.

THOMPSON, L. V. Effects of age and training on skeletal muscle physiology and performance. *Physical Therapy*, v. 71, p. 71-77, 1994.

TIMO-IARIA, C. Envelhecimento. In: JACOB-FILHO, W. Envelhecimento do sistema nervoso e a dor no idoso. São Paulo: Faculdade de Medicina da USP, 1996.

TINETTI, M. E. Performance oriented assessment of mobility problems in elderly patients. *Journal of the American Geriatrics Society*, v. 34, p. 119-126, 1986.

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