

EFFECT OF TIME UNDER PHYSICAL EXERCISE PRACTICE ON THE PHYSICAL FITNESS RELATED TO HEALTH IN ELDERLY WOMEN

Efeito do tempo de prática de exercício físico na aptidão física relacionada à saúde em mulheres idosas

Efecto del tiempo de práctica de actividad física en la aptitud física relacionada a la salud de mujeres mayores

Original Article

ABSTRACT

Objective: To analyze the effect of time under physical exercise practice on the physical fitness related to health in elderly women. **Methods:** Cross-sectional quantitative research, with participation of 61 women, divided into two groups, being Group A (n=34), formed by veterans in the practice of physical exercise (for at least six months) and Group B (n=27), composed by beginners in the physical exercise practice (for less than six months), all of them participants in an exercise program promoted by the *Education Program through Work for Health (PET-Saúde)* at the University of Fortaleza (UNIFOR). The anthropometric parameters (body mass, height, and body mass index - BMI) and the physical fitness tests related to health (flexibility, balance, upper and lower limbs strength and aerobic endurance) were evaluated. **Results:** Group A presented better results compared to Group B in flexibility, balance and upper limb strength tests. However, in other elements of physical fitness no difference was observed, between the groups. **Conclusion:** The physical exercise provided beneficial effects to the physical fitness related to health in elderly women with longer period of practice.

Descriptors: Exercise; Physical Fitness; Health Promotion.

RESUMO

Objetivo: Analisar o efeito do tempo de prática de exercício físico na aptidão física relacionada à saúde em mulheres idosas. **Métodos:** Pesquisa quantitativa do tipo transversal, na qual participaram 61 mulheres, divididas em dois grupos, Grupo A (n=34), formado por mulheres praticantes veteranas de exercício físico (no mínimo seis meses) e Grupo B (n=27), composto por mulheres iniciantes na prática de exercício físico (menos de seis meses), todas integrantes de um programa de exercícios promovido pelo Programa de Educação do Trabalho para Saúde (PET-Saúde) da Universidade de Fortaleza (UNIFOR). Avaliaram-se parâmetros antropométricos (massa corporal, estatura e índice de massa corporal) e os testes de aptidão física relacionados à saúde (flexibilidade, equilíbrio, força de membros superiores e inferiores e resistência aeróbia). **Resultados:** O Grupo A apresentou melhores resultados do que o Grupo B nos testes de flexibilidade, equilíbrio e força de membros superiores. Entretanto, nos outros elementos da aptidão física não se observou diferença entre os grupos. **Conclusão:** O exercício físico proporcionou efeitos benéficos na aptidão física relacionada à saúde em mulheres idosas com mais tempo de prática.

Descritores: Exercício Físico; Aptidão Física; Promoção da Saúde.

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RESUMEN

Objetivo: Analizar el efecto del tiempo de práctica de actividad física en la aptitud física relacionada a la salud de mujeres mayores. **Métodos:** Investigación cuantitativa del tipo transversal en la cual han participado 61 mujeres divididas en dos grupos, el Grupo A (n=34) con mujeres que ya practican actividad física (un mínimo de seis meses) y el Grupo B (n=27) constituido de principiantes en la actividad física (menos de seis meses), todas participantes de un programa de ejercicios promocionado por el Programa de Educación del Trabajo para la Salud (PET-Salud) de la Universidad de Fortaleza (UNIFOR). Se evaluó los parámetros antropométricos (masa corporal, estatura e índice de masa corporal) y los testes de aptitud física relacionados a la salud (flexibilidad, equilibrio, fuerza de miembros superiores e inferiores y resistencia aeróbica). **Resultados:** El Grupo A presentó resultados mejores que el Grupo B en los testes de flexibilidad, equilibrio y fuerza de miembros superiores. Sin embargo, en los demás elementos de la aptitud física no se observó diferencia entre grupos. **Conclusión:** La actividad física ha producido efectos benéficos en la aptitud física relacionada a la salud de mujeres mayores con más tiempo de práctica.

Descriptor: Ejercicio, Aptitud física, Promoción de la Salud.

INTRODUCTION

The epidemiological changes that are occurring globally, as regards the demographic phenomenon of the XXI century, have been modifying and redirecting services, actions and activities developed in the Basic Health Unit to meet the demands of this audience, represented by people over 60 years, called elderly. This new demographic rearrangement is called population aging⁽¹⁾.

Data of the *Instituto Brasileiro de Geografia e Estatística - IBGE* (Brazilian Institute of Geography and Statistics) indicates that the representativeness of the Brazilian population's age groups in 2010, over 25 years, has increased in the last decade. For this reason, there is an extension on top of the age pyramid related to greater relative participation of individuals aged 65 years or more. The prevalence of elderly individuals in 1991 was 4.8%, and 5.9% in 2000, reaching 7.4% in 2010, with the South and Southeast regions with the highest proportion of this group⁽²⁾.

The aging process is characterized by a period of losses, in which there is an increase in body weight; loss of height; increased body fat; decrease in the number and size of muscle fibers, causing muscle strength loss, and thus lower motor performance, decreased agility, coordination, balance, flexibility and aerobic power⁽³⁾.

The aggravating factor for the overall situation is the reduction of physical activity and the prevalence of physical inactivity, which is the challenge for public health worldwide. These are the major responsible features for the development of non-transmittable chronic diseases and the so-called hypokinetic diseases. One of the strategies that can be used to modify this framework is the deployment of physical exercise practice as a means of health promotion⁽⁴⁾.

The shift and the practice of a more active life also provides physical and mental health as well as the individual's autonomy to perform the activities of daily living (ADL), family and social integration, and economic independence⁽⁵⁾.

Nevertheless, for the results of the physical activity implementation to be satisfactory to health, the U.S. Centers for Disease Control and Prevention says that one must achieve significant levels of physical fitness related to health, being necessary to target the goals of the exercise at the components related to health, and not at athletic ability⁽⁶⁾.

The practice of physical exercise, focused on physical fitness related to health, has significant importance in the incorporation of a physically active lifestyle, thus decreasing the risk of developing hypokinetic diseases. For this it is necessary to include, in the training program, exercises that reduce the amount of body fat; increase lean body mass, flexibility, balance, muscular strength, muscular endurance and cardiorespiratory fitness⁽⁶⁾. Moreover, regular physical exercise is considered an excellent tool in reducing the aging impact on functional autonomy and quality of life. Such statement was proven when evaluating the relationship between the regular exercise practice, and the autonomy and independence levels in the elderly⁽⁷⁾.

In this background several projects are designed, aimed at working the physical exercise in order to provide its benefits, increase the physical activity level, and combat sedentary lifestyle. For this, the Ministry of Health makes use of the *Programa de Educação pelo Trabalho para a Saúde - PET-Saúde* (Education Program through Work for Health), which aims to promote the improvement and specialization in services for health professionals and, for students in the health area, work initiation and internships oriented according to the needs of the *Sistema Único de Saúde - SUS* (Unified Health System). The students enrolled in this program undertake teaching, research and extension activities in basic health units with the purpose of integrating bonds between academy-service-community and develop healthcare practices, aiming at their improvement through work initiation in SUS⁽⁸⁾.

The objective of this study was to analyse the effect of time under physical practice on physical fitness related to health in elderly women.

METHODS

This study was characterized as a quantitative research of controlled cross-sectional type⁽⁹⁾, developed in 2010, in which took part 61 women of middle age and elderly, residing in the Tancredo Neves community in Fortaleza, CE, and participants in an exercise program sponsored by *PET-Saúde* (Education Program through Work for Health) of the University of Fortaleza (UNIFOR).

The women were distributed into two groups, Group A (n=34), comprising the veterans, practitioners of physical exercise for at least six months; and Group B (n=27), composed of the beginners, in physical activity practice for less than six months.

Were adopted as inclusion criteria middle-aged women and elderly, veterans and beginners, members of the intervention program and willing to participate, and signing the Free Informed Consent Form. Pacemaker carriers were excluded.

The exercise program developed by *PET-Saúde* has as its target audience middle-aged and elderly individuals assisted by the *Centro de Saúde da Família Maria de Lourdes Jereissati - CSF* (Maria de Lourdes Jereissati Center for Family Health), enrolled population and attendees of the spot called *Viva a vida* (Live the life), where the study took place. Most project participants live at social risk, have low socioeconomic conditions and are affected by major disturbances resulting from chronic diseases such as diabetes, hypertension, obesity, osteoporosis, cardiovascular disease and dyslipidemia.

This *PET-Saúde* program was held twice a week, lasting 60 minutes each meeting, when aerobic activities, exercises for strength, flexibility, balance, and body awareness were performed. Simultaneously with this intervention, lectures included the theoretical approach on various topics such as: benefits of physical activity on the cardiorespiratory system; components of the cardiovascular and respiratory system; effects of exercise on the myocardium, blood pressure and heart rate (HR); self-control of HR at rest and during exercise; body image; self-esteem and well-being improvement; and active lifestyle.

Anthropometric parameters for body weight, height and Body Mass Index (BMI) were analysed to characterize the sample, and the elements of health-related physical fitness: flexibility, balance, upper and lower limbs strength, and aerobic endurance.

For the measurement of body mass, a digital scale (brand Plena) was used, with a capacity of 150 kg and

accuracy of 100 grams. For height, a tape graduated in inches and tenths of inches was used fixed to the wall, and a cursor, on which the evaluated were positioned barefoot, in the orthostatic position, with feet together, in contact with the measuring instrument. The measurement was performed with the assessed in inspiratory apnea and the head parallel to the ground. BMI was calculated by dividing body weight (in kg) by height (in squared meters)⁽⁶⁾.

The flexibility was evaluated by the sit-and-reach test, using the Wells and Dillon bench⁽¹⁰⁾. This test consists of placing the assessed sitting with legs extended forward, flexing the trunk forward with overlapping hands and arms outstretched. The maximum point that one can reach with the middle fingers is then recorded, with feet flat on the wooden bench, legs fully extended and in contact with the ground, being barefoot. The evaluated women performed a brief heating, consisting of four to six stretching exercises before beginning the test. The result was expressed in centimeters, according to the best of three trials correctly performed⁽¹⁰⁾.

The balance test was applied, requesting the assessed to stay standing with hands on hips looking at a fixed point, 2-meter distant, and at the signal, bend one knee upward, trying to keep this position for at least 30 seconds. The result was expressed by the average of three attempts that assessed the total time of position maintenance, rated up to 30 seconds⁽¹¹⁾.

To evaluate the strength of the upper members, the elbow flexion test at 30 seconds⁽¹²⁾ was used, where the result is an indirect measure. Testing used a stopwatch (Casio HS3) a straight-backed chair (without arms) and 2-kilogram dumbbells for women. The evaluated were positioned sitting in a chair with their feet flat on the floor, with the dominant side of the body near the side edge of the chair, holding the dumbbell aside with dominant hand closed, elbow extended aside from the chair, perpendicular to the ground. At the signal, the assessed positioned palm up, flexing the elbow, having to fully complement the angle of the movement before returning to the initial position, with the elbow fully extended. It was recommended that the upper part of the arm remained stable during the test. The largest number of elbow bends within 30 seconds were thus counted⁽¹²⁾.

The sit-to-stand test in 30 seconds was used to indirectly measure the strength of the lower limbs. For this, a stopwatch (Casio HS3) and a chair with a straight back (no arms) were needed, the chair with a height of approximately 43 cm, supported against the wall, so that it did not move during the test. The assessed initiated the test sitting in the middle of the chair, with feet flat on the floor and arms crossed against their chest, being instructed to, at the signal, rise to an upright position and then sit totally back, repeating this

movement as many times as possible within 30 seconds. The total number of complete movements performed correctly in 30 seconds were counted⁽¹²⁾.

For aerobic endurance testing, the 2-minute stationary march was performed, needed for that a stopwatch (Casio HS3), measuring tape (Sanny), and masking tape. At the signal, the evaluated simulated the movement of marching, without running, without leaving the place, starting with the right leg. Proper knee height to perform gait is the midpoint between the patella and the iliac crest level. For monitoring of the correct knee height, a rope was placed fixed to wooden rods, attached to a wooden base, the rope being ahead of the subject. The number of steps performed within 2 minutes were counted, only validated when the knee reached the established height. Before the test itself, the evaluated familiarized themselves with the movements for 30 seconds. The total number of times the right knee reached the prescribed height was thus verified⁽¹²⁾.

The study used also the health parameters referenced as criteria established by the Canadian Standardized Test of Fitness (CSTF) Operating Manual, also called Fitness Canada⁽¹³⁾, for the flexibility test. The results of balance and lower limb strength tests were analysed by Matsudo classification⁽¹⁴⁾, and the results of upper limb strength tests and stationary march were confronted to health parameters established in the literature⁽¹⁵⁾.

The data was submitted to statistical analysis using the Statistical Package for Social Sciences (SPSS) 16.0 for Windows, whether descriptive (mean and standard deviation) and inferential type (Independent-sample T test and One-sample T test), because of the normal distribution identified by the Kolmogorov-Smirnov Test. The level of significance in all cases was set at $p < 0.05$.

Table I - Influence of time under physical exercise practice on the flexibility variable (cm); comparison between groups and health parameters. Fortaleza, CE, 2010.

	N	Mean	SD	p^a	Flex. $\geq 26^b$
Group A	34	27.48*	4.21	0.001	0.05
Group B	27	24.30	8.31		0.30

SD: Standard Deviation; Flex.: Flexibility; ^a: T Test for independent samples; ^b: T Test for one sample, comparison with health parameters; * $p < 0.05$

Regarding the upper limb test, it was observed that there was significant difference between the groups, with women in Group A showing better results compared to Group B. As for the normative standards, women in Group A had good results, being in P75 (17 to 19 repetitions), while the test results of the women in group B were in P25 (11 to 13 repetitions).

The study followed the ethical and scientific standards established by Resolution No. 196/96, National Board of Health/Ministry of Health on research involving human subjects and was approved by the Ethics Committee of the University of Fortaleza, under Opinion No. 284/2010.

RESULTS

Using descriptive statistics, the homogeneity of the groups was observed in the variables age and BMI, thus enabling the comparison. Regarding age, Group A had a mean of 60.5 ± 10.00 years and group B was 59.9 ± 15.00 years. With respect to BMI, women in Group A presented mean value of 28.02 ± 4.01 kg/m² and Group B had 27.51 ± 4.18 kg/m².

According to Table 1, one can see that there was a significant difference in the flexibility test between the studied groups, with women in Group A reaching better results compared to Group B. When compared to health standards, only Group A, formed by veteran practitioners, showed values significantly higher than the health parameters.

The result of the balance test showed significant difference between the groups, indicating improvement in balance in women of group A (veteran practitioners). Moreover, according to the analysis of these results in relation to the normative parameters, expressed by the percentile (P), the women of Group A obtained test result in P50, while Group B obtained results below P25. This comparison confirms satisfactory results in health, in the balance test, among the elderly women in Group A compared to Group B (Table II).

As regards to the variable lower limb strength, no significant difference was found between the groups. On the other hand, for the health parameters, the group of women veterans presented results in P25 (16 repetitions) and the group of women beginners obtained results lower than P25, i.e., much below 75% of the population of the same gender and age group.

Table II - Influence of time under physical exercise practice on balance, upper and lower limbs strength, and aerobic endurance variables; comparison between groups. Fortaleza, CE, 2010.

Variables		Group A	Group B	<i>p</i>
Balance (sec.)	Mean	25.29*	9,6	0.001
	SD	2.612	5,731	
Strength of MMSS (rep. in 30 sec.)	Mean	17.29*	13,63	0.002
	SD	1.488	2,989	
Strength of MMSS (rep. in 30 sec.)	Mean	16.66	12,37	0.983
	SD	3.339	3,421	
Aerobic endurance (rep. in 2 min.)	Mean	92.62	88,07	0.853
	SD	20.184	18,62	

MMSS: upper limbs; MMII: lower limbs; SD: Standard Deviation; * $p < 0.05$. T Test for independent samples.

In the stationary gait test, no difference was observed between the groups. However, when the results were analysed facing the normative standards, it was found that women in Group A were in P50 (91 to 106), that is, the test result represents the average values of the same gender and age group population; for Group B, the test result was in P25 (75 to 90), thus being ranked below 75% of the population.

DISCUSSION

Several factors are associated with increased population life expectancy; however, the individuals' longevity is associated with increased morbidity from non-transmittable chronic diseases, physical inactivity, inactive lifestyle, dependence, and costs to the family and the government⁽¹⁶⁾. Furthermore, it is inevitable to mention the physiological decline that directly affects the elderly's functional components, which has close intimacy with the low level of physical activity and decrease in the physical fitness elements⁽³⁾.

Among these, flexibility is a component that undergoes a reduction with the aging process, due to the deficiency of collagen, causing changes in the elasticity of tendons, ligaments, and joint capsule. These changes threaten the independence, because the individual will have difficulties performing activities of daily living such as climbing stairs, combing hair and dressing⁽¹⁷⁾. Therefore, a significant difference was found in this study between groups of women veterans and beginners regarding the health parameters. Women in Group A were above the referenced values and those in Group B were below the parameters. In relation to this variable, the literature findings were similar to this study, in which the authors found positive performance in the flexibility test in women who participated in a

hydrogymnastics program for three months, with 45-minute sessions carried out twice a week⁽¹⁸⁾.

Stretching exercises provide injury prevention and are important in the treatment of low-back pain; improve posture, personal appearance and self-image; and contribute to the reduction of tension and stress. Flexibility is, therefore, a component of health-related physical fitness of utmost importance in order to ensure welfare in the activities of social and professional life⁽¹⁹⁾.

On the balance variable, the present investigation observed a significant difference between the groups, and that women of Group A were on average facing the referenced criteria; those of Group B, however, were much below the average. Similar results were found in the literature⁽²⁰⁾; that author submitted the studied sample to a 20-session hydrogymnastics program, and conducted pre-test and post-test, in which a significant increase was obtained in the static balance test.

Given all the morphological, functional and biochemical transformations generated by the aging process, postural instability and loss of balance, falls are characterized as a public health problem, due to its high incidence⁽²¹⁾. In addition to this factor, it is noteworthy that the reduction in muscle mass also increases the predisposition to falls⁽²²⁾.

In the upper limb strength component, a significant difference between groups was observed in the present study, where women veterans showed good results, while the beginners had below-average results. In a published study⁽²³⁾, there was also a significant improvement in that parameter between active and sedentary elderly women.

In the variable lower limb strength, evaluated by the sit-to-stand physical fitness test, the present study did not find significant difference between the groups; however, women veterans had below-average results, and the beginners were

much evidently below average, showing better performance of Group A, which had been under physical activity practice for longer. Findings in the literature have obtained similar results concerning the number of repetitions per minute, and still found a positive correlation between the number of repetitions achieved in the sit-to-stand test and the time under physical activity, indicating that those physically active have better fitness aptitude than non-practitioners⁽²³⁾.

The component of cardiorespiratory fitness is related to the maximal oxygen consumption that the individual is able to capture in order to use in their aerobic metabolism. This begins to decrease after 20 years of age⁽²⁴⁾ and, with the advancing of age, there is a reduction in the values of cardiac output, decrease in myocardial contractility, limitation of the alveolar lung function decline⁽²⁵⁾, increase in the vascular peripheral resistance, and hence the elevation of blood pressure⁽²⁶⁾.

In the stationary gait test performed in this study, no significant difference was found between women veterans and beginners; however, the veterans' results were considered close to the mean values (P50), while the beginners' were below 75% of the population (P25). One study found a significant difference between pre- and post-testing of women undergoing a training program, which consisted of gymnastics, weightlifting and swimming, with an average frequency of twice per week for each modality⁽²⁵⁾.

Muscular strength and endurance undergo significant changes with the aging process, beginning at 25 years of age, and escalating at 50 years. The decrease in strength and endurance refers to muscle mass loss, due to the atrophy and reduction in the number of muscle fibers, more severe in the lower limbs than in the upper⁽²⁶⁾. As a result of these transformations, the elderly's functional capacity becomes limited, they feel difficulty in performing activities of daily living, for presenting greater fatigability. These individuals become more susceptible to falls, and gait biomechanics becomes impaired.

Moderate levels of strength and endurance are thus necessary for carrying weights, climbing stairs, getting up from chairs, sweeping and mopping⁽²⁷⁾; therefore, the adoption of physical activity practice in a systematic and regular way provides improvement to the functional capacity, in the performance of daily living activities, and reduces the effects of aging process that characterise this period^(28,29).

CONCLUSION

In the present study, it was observed that the practice of physical exercise in women with time under physical activity longer than 6 months provided satisfactory and

significant results in comparison with women beginners, in flexibility, balance and upper limb strength tests.

For the other elements of physical fitness, despite there was no statistical significance, women with longer time under physical activity practice had superior results compared to the group of beginners. With respect to health parameters, Group A achieved positive results for most testings, except in the lower limbs strength test. On the other hand, in Group B positive results related to health were not observed in any of the tests.

Therefore, the physical exercise performed in a systematic manner, with at least 6 months of practice time, provides beneficial effects to the elements of physical fitness related to health, generating relevant physiological and mechanical adaptations in functional actions, and it may improve the activities of daily living in elderly women participating in this group.

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REFERENCES

1. Santos MAB, Mattos IE. Condições de vida e saúde da população idosa do Município de Guaramiranga-CE. *Epidemiol Ser Saúde*. 2011;20(2):193-201.
2. Instituto Brasileiro de Geografia e Estatística - IBGE. Primeiros resultados definitivos do Censo 2010 [acesso em 2012 Abr 24]. Brasília: IBGE; c2011. Disponível em: http://www.ibge.gov.br/home/presidencia/noticias/noticia_visualiza.php?id_noticia=1866&id_pagina=1.
3. Penha JCL, Piçarro IC, Barros Neto TL. Evolução da aptidão física e capacidade funcional de mulheres ativas acima de 50 anos de idade de acordo com a idade cronológica, na cidade de Santos. *Ciênc Saúde Coletiva*. 2012;17(1):245-53.
4. Glaner MF. Importância da aptidão física relacionada à saúde. *Rev Bras Cineantropom Desempenho Hum*. 2003;5(2):75-85.
5. Silva RS, Silva I, Silva RAS, Souza L, Tomasi E. Atividade física e qualidade de vida. *Ciênc Saúde Coletiva*. 2010;15(1):115-20.
6. American College of Sports Medicine. Manual do ACMS para avaliação da aptidão física relacionada à saúde. Rio de Janeiro: Guanabara Koogan; 2006.

7. Borges MRD, Moreira AK. Influências da prática de atividades físicas na terceira idade: estudo comparativo dos níveis de autonomia para o desempenho nas AVDs e AIVDs entre idosos ativos fisicamente e idosos sedentários. *Motriz Rev Educ Fís.* 2009;15(3):562-73.
8. Ministério da Saúde (BR). Portaria Interministerial nº 421, de 3 de março de 2010. Institui o PET-Saúde, para a formação de grupos de aprendizagem tutorial em áreas estratégicas para o SUS. *Diário Oficial da União, Brasília, 5 mar. 2010.*
9. Thurber J. Outros métodos de pesquisa descritiva. In: Thomas JR, Nelson JK, Silverman SJ. *Métodos de pesquisa em atividade física.* Porto Alegre: Artmed; 2012. p. 249-59.
10. Marins JCB, Giannichi, RS. Medidas motoras e físicas. In: Marins JCB, Giannichi RS. *Avaliação e prescrição de atividade física: guia prático.* 3ª ed. Rio de Janeiro: Shape; 2003. p. 61-112.
11. Matsudo SMM. Avaliação da aptidão física e da capacidade funcional. In: Matsudo SMM. *Avaliação do idoso: física e funcional.* São Caetano do Sul: CELAFISCS; 2010. p. 45-99.
12. Rikli RE, Jones CJ. Aplicação do teste. In: Rikli RE, Jones CJ. *Teste de aptidão física para idosos.* São Paulo: Manole; 2008. p. 66-98.
13. Fitness Canada. *Canadian Standardized Test of Fitness (CSTF) Operations Manual.* Ottawa: Fitness and Amateur Sport; 1986.
14. Morrow JR, James R. Avaliação da atividade física e da aptidão física em adultos. In: Morrow JR, James R. *Medidas e avaliação do desempenho humano.* Porto Alegre: Artmed; 2003. p. 176-213.
15. Morrow JR, James R. Avaliação da atividade física e da aptidão física em adultos. In: Morrow JR, James R. *Medidas e avaliação do desempenho humano.* Porto Alegre: Artmed; 2003. p. 176-213.
16. Guedes DP. Programa academia da saúde: ação para incrementar a prática de atividade física na população brasileira. *Rev Bras Ativ Fís Saúde.* 2011;16(11):184-5.
17. Shephard RJ. Aging and exercise [acesso em 2010 Set 10]. In: *Encyclopedia of Sports Medicine and Science.* Internet Society for Sport Science 1998. Disponível em: <http://sportsoci.org>.
18. Alves RV, Mota J, Costa MC, Alves JGB. Aptidão física relacionada à saúde de idosos: influência da hidroginástica. *Rev Bras Med Esporte.* 2004;10(1):31-7.
19. Moura MS, Pedrosa MAC, Costa EL, Bastos Filho PSC, Sayão LB, Sousa TS. Efeitos de exercícios resistidos, de equilíbrio e alongamentos sobre a mobilidade funcional de idosos com baixa massa óssea. *Rev Bras Ativ Fís Saúde.* 2012;17(6):474-84.
20. Echepare LS, Pereira EF, Graup S, Zinn JL. Terceira idade: aptidão física de praticantes de hidroginástica. *Revista Digital [periódico na internet] 2003 [acesso em 2010 Set 10]; 9(65).* Disponível em: <http://www.efdeportes.com/efd65/hidrog.htm>.
21. Cruz DT, Ribeiro LC, Vieira MT, Teixeira MTB, Bastos RR, Leite ICG. Prevalência de quedas e fatores associados em idosos. *Rev Saúde Pública.* 2012;46(1): 138-46.
22. Pedrinelli A, Garcez-Leme LE, Nobre RSA. O efeito da atividade física no aparelho locomotor do idoso. *Rev Bras Ortop.* 2009;44(2):96-101.
23. Berlezi EM, Rosa PV da, Souza ACA de, Scheneider RH. Comparação antropométrica e do nível de aptidão física de mulheres acima de 60 anos praticantes de atividade física regular e não praticantes. *Rev Bras Geriatr Gerontol.* 2006;9(3):49-66.
24. Mcardle WD, Katch FI, Katch VL. Atividade física, saúde e envelhecimento. In: Mcardle WD, Katch FI, Katch VL. *Fundamentos de fisiologia do exercício.* Rio de Janeiro: Guanabara Koogan; 2002. p. 885-927.
25. Botelho RMM. Efeitos da prática da actividade física sobre a aptidão física de adultos idosos [dissertação; acesso em 2010 Set 10]. Porto: Faculdade de Ciências do Desporto e de Educação Física; 2002. Disponível em: <http://hdl.handle.net/10216/10649>.
26. Hughes VA, Frontera WR, Wood M, Evans WJ, Dallal GE, Roubenoff R, et al. Longitudinal muscle strength changes in older adults: influence of muscle mass, physical activity, and health. *J Gerontol Ser A Biol Sci Med Sci.* 2001;56(5):209-17.
27. Carvalho J, Soares JMC. Envelhecimento e força muscular: breve revisão. *Rev Port Ciênc Desporto.* 2004;4(3):79-93.
28. Penha JCL, Piçarro IC, Barros Neto TL. Evolução da aptidão física e capacidade funcional de mulheres ativas acima de 50 anos de idade de acordo com a idade cronológica, na cidade de Santos. *Ciênc Saúde Coletiva.* 2012;17(1):245-53.

29. Lustosa LP, Silva JP, Coelho FM, Pereira DS, Parentoni AN, Pereira LSM. Efeito de um programa de resistência muscular na capacidade funcional e na força muscular dos extensores do joelho em idosas pré-frágeis da comunidade: ensaio clínico aleatorizado do tipo crossover. Rev Bras Fisioter. 2011;15(4):318-24.

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