

Evaluation of the balance of elderly practitioners of different sports modalities

Avaliação do equilíbrio de idosas praticantes de diferentes modalidades esportivas

Karen Rodrigues Euzébio¹, Jefferson Carlos Araujo Silva², Tamara Augusta Ferreira de Paiva³, Fernando Barcellar Biângulo⁴, Liana Mayara Queiroz Caland⁵, Lídia Mara de Aguiar Bezerra⁶

¹Euro American University Center. Brasília, Distrito Federal, Brazil. ORCID: 0000-0003-4599-8970. h2karen.edu.fisica@gmail.com

²Corresponding author. Brasília University. Brasília, Distrito Federal, Brazil. ORCID: 0000-0001-9131-4360. jeffcasilva@gmail.com

³Brasília University. Brasília, Distrito Federal, Brazil. ORCID: 0000-0002-2941-0199. tamisdpa@gmail.com

⁴Brasília University. Brasília, Distrito Federal, Brazil. ORCID: 0000-0001-8329-4224. fernandobarcellar@gmail.com

⁵Brasília University. Brasília, Distrito Federal, Brazil. ORCID: 0000-0001-7752-9357. ft.liana@gmail.com

⁶Brasília University. Brasília, Distrito Federal, Brazil. ORCID: 0000-0003-0661-6298. lidia.bezerra@gmail.com

RESUMO | INTRODUÇÃO: O processo natural de envelhecimento leva os sistemas do corpo humano ao declínio de suas funções. É consenso na literatura que a atividade física direcionada para idosos promove efeitos positivos na manutenção da saúde destes, promovendo redução da perda de massa muscular, ganho de flexibilidade e aumento da resistência cardiorrespiratória. **OBJETIVO:** Avaliar o equilíbrio de idosas praticantes de diferentes modalidades esportivas. **MÉTODOS:** A amostra de idosas integrantes de diferentes grupos de atividades esportivas, e idosas residentes em uma instituição de longa permanência. Todos os grupos possuíam 15 voluntárias, a saber: capoterapia (GCa), hidroginástica (GH), ginástica (GG), treinamento de força (GTF) e grupo controle (GC). As participantes tiveram sua massa corporal, estatura, circunferência da cintura e quadril avaliados. A avaliação do equilíbrio das voluntárias foi realizada através do teste de equilíbrio unipodal com e sem restrição visual, nesta ordem. As diferenças entre os grupos foram verificadas através da análise de variância ANOVA One Way, $p < 0,05$. **RESULTADOS:** As atividades de treinamento de força surtiram efeito positivo no equilíbrio sem restrição visual, enquanto que as voluntárias da capoterapia demonstraram melhor desempenho no equilíbrio com restrição visual. **CONCLUSÃO:** Atividades que englobem diversas modalidades parecem ser mais eficientes para manter um adequado equilíbrio de idosas.

PALAVRAS-CHAVE: Idoso. Equilíbrio. Atividade física.

ABSTRACT | INTRODUCTION: The natural process of aging leads the systems of the human body to decline in function. There is a consensus in the literature that physical activity directed at the elderly promotes positive effects on maintaining their health, promoting reduction of muscle mass loss, flexibility gain and increased cardiorespiratory resistance. **OBJECTIVE:** To evaluate the balance of elderly women practicing different sports. **METHODS:** A sample of elderly women from different groups of sports activities, and elderly residents in a long-term institution. All groups had 15 volunteers, namely: capotherapy (GCa), water aerobics (GWA), gymnastics (GG), strength training (GST) and control group (GC). The volunteers had their body mass, height, waist circumference and hip evaluated. The balance evaluation of the volunteers was performed through the unipodal balance test with and without visual restriction, in this order. Differences between groups were verified by one way ANOVA, $p < 0,05$. **RESULTS:** The strength training activities had a positive effect on balance without visual restriction, while capotherapy volunteers showed better performance on balance with visual restriction. **CONCLUSION:** Activities that encompass several modalities seem to be more efficient to maintain an adequate balance of the elderly.

KEYWORDS: Elderly. Balance. Physical activity.

Introduction

The natural process of aging, typical to humans, is characterised by its progressive character and gradual and leads to lose of functional abilities of the body, with psychological alterations and motor¹. In Brazil and in the world has been noting an increase of elderly individuals, by the Census of 2010 Brazil had a total of 20,590,599 elderly, which corresponded to 10% of the total population. Currently, it is estimated that the elderly population is 26 million².

The natural aging process takes the systems of the human body to the decline of its functions. The musculoskeletal system has reduced strength and muscle mass (sarcopenia), while the cardiovascular system evolves with a reduction in the capacity of contraction and adaptation to different degrees of effort, the nervous system, that suffers with atrophy and reduction in the volume of the cortex, reduction in the number of neurons and neurotransmitters. The latter features intimate relationship with the decrease of the adaptive responses of balance^{3,4}.

Such changes caused by aging directly influence the quality of life of the elderly, due to the limitation that imposes, thus putting your health at greater vulnerability. The reduction of the functional capacity of the systems directly implies the independence of the elderly, making it more susceptible to adverse events, such as the emergence of chronic non-communicable diseases (CNCD)⁵. The combination of deficits of the body during the natural process of aging has direct consequences on the balance of elderly individuals, in most cases providing harmful effects⁶.

Between the consequences which arise with deficits in balance, the fall event deserves to be highlighted. The fall stems from an accidental event where the subject changes position, going to a lower level in comparison to the actual position⁷. The fall may represent failure, loss of function, and lead to a syndrome of immobility, moreover, causes physical and psychological damage, caused by the reduction in autonomy and independence. The fall can be responsible for fractures, as well as those of hip, and by a large number of hospitalization in the elderly⁸.

It is a consensus in the literature that physical activity directed to the elderly promotes positive effects in the maintenance of health, promoting reduction of loss of muscle mass, gain flexibility and increase cardiorespiratory endurance⁹. Physical activity may improve and/or maintain the functional capacity of the elderly, impacting positively on control and/or prevention of CNCD associated to sedentary lifestyle, such as coronary artery disease, Diabetes Mellitus (DM), hypercholesterolemia, Systemic Arterial Hypertension (SAH); in addition to improve the balance and coordination¹⁰.

The physical exercises cooperate to postpone and minimise the effects that the natural process of aging affects the elderly population. In this way the regular practice of physical activity is an ally to reduce susceptibility to the event fall in the elderly, through an increase that promotes the balance of these individuals^{11,12}, however, studies do not specify which type of physical activity is the most appropriate to reduce balance deficits in the elderly. With this in view the present article aimed to evaluate the balance of elderly practitioners of different sports.

Methods

This is a cross-sectional study, quantitative, descriptive and observational study, conducted with the elderly members of different groups of sports activities, and elderly residents of a rest home institution. The inclusion criteria adopted for the research were: elderly individuals (≥ 60 years), practitioners of a sport in a regular way, with physical and functional autonomy, with medical release to perform certain modality and who do not make use of medications that can interfere in the postural balance. Individuals that presented with cognitive and motor disorder, or diseases that could influence directly the balance were considered in the exclusion criteria.

The elderly practitioners of physical activities were recruited in two centers (Sesc Ceilândia and Vila Olímpica Parque da Vaquejada) which provides activities for the elderly, among which were included in the study, capotherapy (GCa, n = 15), water aerobics

(GWA, n = 15), Gymnastics (GG, n = 15) and strength training (GST, n = 15). And the elderly who were part of the control group (GC, n = 15) were recruited from São Vicente de Paula Institution. Both centers are located at the Federal District.

The study was guided by Resolution 466/2012 of the National Health Council (NHC) which regulates the studies with humans, all procedures related to data collection and analysis took place after approval by the Committee for Ethics in Research of the Catholic University of Brasília, under protocol nº 014/2007. The volunteers confirmed their participation in the study by signing the Informed Consent Form (ICF).

The data collection was divided into two stages, the first consisted in an interview where data were collected regarding the anthropometric characterization and circumference waist and hip circumference, this in order to calculate the waist-hip ratio (WHR). The classification of the WHR divides the subjects at low risk (WHR <0.76), moderate (WHR between 0.76 to 0.84) and high risk (WHR between 0.85 to 0.90)¹³. The second stage was the evaluation of the balance of the volunteers through Unipedal balance test with and without visual restriction, in this order¹⁴.

The data were presented in the form of descriptive statistics, using the procedures of average and standard deviations. And in order to observe differences between groups analysis of variance ANOVA One Way was calculated with a significance level of p<0.05. All data were calculated using the program SPSS version 17.0.

Results

The data regarding the average age, body mass, height, body mass index (BMI), circumference and WHR of all five groups are described in table nº 01.

Table 1. Averages of age, body mass, height and circumference and elderly classifications of two centers of the Federal District, 2010

Variáveis	GC (n = 15) X ± SD	GG (n = 15) X ± SD	GWA (n = 15) X ± SD	GST (n = 15) X ± SD	GCa (n = 15) X ± SD
Average (years)	70.93 ± 5.6*	66.0 ± 7.0	67.4 ± 4.7	65.1 ± 4.8	62.9 ± 2.8 *
Body mass (kg)	60.6 ± 10.2	71.6 ± 13.2	60.0 ± 9.8	64.9 ± 8.3	72.1 ± 10.9
Height (meters)	1.48 ± 0.05 †	1.55 ± 0.5	1.50 ± 0.5	1.56 ± 0.03 †	1.54 ± 0.6
BMI (kg/m ²)	27.3 ± 4.8	30.2 ± 6.0	26.5 ± 3.8	26.5 ± 3.4	30.1 ± 4.0
Class.BMI	1.7 ± 0.8	2.4 ± 1.0	1.6 ± 0.7	1.69 ± 0.63	2.3 ± 0.8
Waist	90.1 ± 8.2	92.4 ± 9.3	86.0 ± 7.4	86.3 ± 6.7	91.9 ± 7.4
Hip	100 ± 8.8	107.2 ± 11.2	99.2 ± 9.4	99.7 ± 8.3	104.2 ± 5.7
WHR	0.91 ± 0.08	0.85 ± 0.05	0.87 ± 0.05	0.86 ± 0.05	0.87 ± 0.04
Class. WHR	High	High	High	High	High

BMI – Body Mass Index

WHR – waist-hip ratio e Class. WHR – cardiac risk classification by waist-to-hip ratio

*1 - Significant difference control group vs. capotherapy group

†2- Significant difference control group vs. strength training group

After the analysis of variance (One Way) it was observed that the variable balance without visual restriction, the GC reached lower value when compared with the GST. It was also shown lower value of the same variable in the GCa when compared with the GST. As for the variable balance with visual restriction the GC had a time less when compared with the GST and the same also showed a significant disadvantage when compared with the GCa.

Table 2. Balance evaluation of elderly women practicing different sports through the one-legged test, Federal District, 2010

Variables	GC (n = 15) X ± SD	GG (n = 15) X ± SD	GWA (n=15) X ± SD	GST (n = 15) X ± SD	GCa (n = 15) X ± SD
Balance Without V.R. (seg)	6.3±4.7 †	09.07±13.4	6.5±8.6 ‡	18.5±10.0 †§	6.7±10.79 ‡§
Balance With V.R. (seg)	2.4±2.3 †	6.5±3.9	6.3±3.9	3.67±3.08 †§	10.3±4.0 §

Balance Without V.R. – balance without visual restriction and Balance With V.R. – balance with visual restriction

§- Significant difference strength training group vs. capotherapy group

* - Significant difference control group vs. capotherapy group

† - Significant difference control group vs. strength training

‡- Significant difference water aerobics group vs. capotherapy

Discussion

This article aimed to evaluate the balance, with and without visual restriction, of elderly women practitioners of different sports modalities. The changes that result from the natural aging process directly influence the balance of these individuals, a set of morphological, functional, biochemical and psychological changes are involved in decreasing the functional performance of the elderly⁵. This fact influences the postural balance of the elderly, where structural alterations combined with functional losses of the sensory and motor systems are responsible for causing deficits in the balance maintaining system¹⁵.

In the present study, the mean age of the GC was superior comparing to other groups, and presenting even smaller stature and increased cardiac risk classification by the WHR. The volunteers from the GC did not practice physical activities and were residents of a rest home institution. A study¹⁶ conducted in São Caetano do Sul-SP evaluated the association between the gear and the functional capacity and physical fitness in institutionalized elderly, 69 volunteers of both genders were evaluated through the tests of normal speed of cycling, maximum speed of cycling, cadence of steps, unipodal test of 30 seconds and Timed Up and Go (TUG). The authors showed that the greater the age the lower is the length of the last step and, on the other hand the greater the time of static equilibrium, the higher the amplitude of the gear. In the present study the GC presented lower average balance in two ways, with and without visual restriction, it is suggested that not performing physical activity on a regular basis may have contributed to such findings.

The evaluation of the WHR demonstrated that all volunteers of the groups had shown values considered high risk. A survey¹⁷ held in MG evaluated the WHR of 8 elderly participants in a group of gymnastics, the group had gymnastics classes 2 times a week, with a duration of 60 minutes each, the volunteers had their body mass and height measured for the calculation of the BMI, and circumference waist and hip circumference for the calculation of WHR. The authors identified three volunteers with moderate WHR, four with high WHR and an elderly with WHR

too high. Although in both studies the volunteers are practitioners of physical activity, except for the control group in the present study, the presence of high WHR draws attention to the risks of cardiovascular events to which they are exposed, the elderly, and the incentives the practice of physical activity on a regular basis must be laid to minimise such effects¹⁸.

In the evaluation of the balance without visual restriction the GG presented higher average to GC, GWA, and GCa, however, has not exceeded the GST. In the evaluation of the balance with visual restriction the GG presented higher average in the GC, GWA, and GST, however, the mean of the GCa was higher in this question. The gymnastics is an activity that improves the flexibility of individuals and provides a maintenance of range of motion (ROM), agility, balance and coordination, important in the joints of the lower limbs for realization of gait¹⁹.

A clinical trial²⁰ had for objective to evaluate the effects of the training of balance and motor coordination, systemized and supervised, that would reduce the propensity to falls in the elderly. All volunteers have already performed cardiopulmonary rehabilitation protocol and to individuals in the experimental group were added to the training of balance and motor coordination, the exercises were performed three times per week, during 12 weeks. The authors were able to conclude that the protocol of balance and motor coordination has had a positive effect on the improvement of static and dynamic balance and coordination, decreasing the propensity to falls of volunteers who participated in the experimental group. In the present study, all participants except the GC showed satisfactory performance in the balance assessment tests, reflecting the protective effect that regular physical activity promotes, minimizing the balance deficits that the natural aging process causes, thus making the elderly less susceptible to the fall event^{15,21}.

The elderly population showed a reduction of the regular practice of physical activity, it directly influences the emergence of CNCD and the reduction of functional capacity, its practice must be encouraged because associates directly to an improvement

in quality of life and independence to carry out its activities²². The GWA showed lower BMI groups GC, GG and GCa, but the result was very similar to the GST, in the classification of the BMI, the GWA showed a lower classification to other groups, a fact which must have been influenced by the average height of the group.

A study²³ conducted a comparison of three protocols of exercises, exercises on the ground, exercises in the water and control group, 132 volunteers had their flexibility, abdominal and lower limb strength and balance assessed before and at the end of eight weeks of training. The results showed that the end of the protocol the volunteers showed improvement in muscle strength, balance and flexibility, however, for the group that performed exercises in the water, were observed improvements in measures of abdominal muscle strength and balance. Our results showed that GWA presented superior results only when compared to GC, when the balance without visual restriction was evaluated, in the assessment of balance with visual restriction GWA showed means ahead of the GST and GC. These results may be influenced by the physical principles of water which hydrotherapy practitioners are exposed²⁴.

The elderly have reduction of muscle mass, sarcopenia, gradually, being observed structural changes and remodeling of motor units⁵. Resistance training directed to the elderly can slow this loss of muscle mass, influencing on body balance and reducing the risk of falls, providing greater independence. When evaluated the balance without visual restriction in the present study, the GST showed better results when compared to the others, the assessment with visual restriction the GCa presented higher average. A research²¹ developed with older people from Porto Alegre-RS compared two types of training, muscle strength and flexibility, and its influence on the balance, both training protocols possessed 11 weeks in duration twice a week, to assess the balance used to Balance Scale Berg (BSB). The authors observed that both groups showed a significant increase in body balance after application of the protocol, leading to an effective functional independence and lower risk of falls.

The capotherapy is an activity based on caponier to the elderly public, includes stretching exercises and muscle strengthening, promoting benefits, such as improved motor coordination, cognitive function and socialization²⁵. Due to this fact, GCa volunteers presented better results in the assessment of balance with visual restriction. Utilizing an integration of coordinated motion in association with music, capotherapy, in addition to a practice that uses movements of caponier, stimulates the joke, the playful, fun, the well-being index, among other benefits. These are important things to be integrated in the activities for the elderly, because the process of aging is associated with depressive symptoms, which contributes to social isolation and reduction of functional independence measure²⁶.

The study presented as limitations of the research the unknown time of practicing of each activity. More research is needed by evaluating the combination of modalities and noting the frequency of each type of training to generate positive effects on body balance of elderly and minimize the chances of falling in these individuals.

Conclusion

The assessment of the balance of elderly women who practice different sports with and without visual restriction, showed that the activities related to the strength training possessed best answers in balance without visual restriction, while the volunteers who performed activities of capotherapy showed better balance front evaluation with the visual restriction. All volunteers in the study presented WHR considered high, demonstrating the propensity to cardiovascular risks to which they are exposed, despite the practice of physical activity, except for the GC.

A combination of activities involving the most varied sports seems to be the most appropriate to minimize the deficits which the natural aging process causes the body balance of individuals.

Author contributions

Euzébio KR participated in the conception, design, data collection, search and statistical analysis of research data, interpretation of results, writing of the scientific article. Silva JCA, Paiva TAF and Biulo FB participated in the writing of the scientific article. Caland LMQ participated in the critical review of the article. Bezerra LMA participated in the conception, design, search and statistical analysis of the research data, as well as in the interpretation of the results.

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.).

References

1. Ministério da Saúde. Envelhecimento e saúde da pessoa idosa. Série A. Normas e Manuais Técnicos. Caderno de Atenção Básica. Brasília: Ministério da Saúde; 2006.
2. DATASUS. Indicadores demográficos. Proporção de idosos na população. [Internet]. [acesso em 22 de dez de 2017]. Disponível em: <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?ldb2011/a14.def>
3. Martins JAO, Miranda DG, Malaman TAB, Leite SN. Efeitos de um programa de exercícios de fortalecimento muscular na prevenção de quedas em idosos da comunidade. *Revista Inspirar: Movimento & Saúde*. 2014; 6(1):18-21.
4. Marin L, Lima S, Giacomini L. Avaliação da qualidade de vida de idosos com e sem correção de valvulopatia cardíaca: relatos de casos. *FisiSenectus*, 2014; 2(1): 43-50. doi: [10.22298/rfs.2014.v2.n1.2896](https://doi.org/10.22298/rfs.2014.v2.n1.2896)
5. Fong JH, Feng J. Comparing the loss of functional independence of olders adults in the U.S. and China. *Archives of Gerontology and Geriatrics*, 2018; 74: 123-127. doi: [10.1016/j.archger.2017.10.020](https://doi.org/10.1016/j.archger.2017.10.020)
6. Almeida ST, Soldera CLC, Carli GA, Gomes I, Resende TL. Análise de fatores extrínsecos e intrínsecos que predispõem a quedas em idosos. *Rev Assoc Med Bras*, 2012; 58(4):427-433. doi: [10.1590/S0104-42302012000400012](https://doi.org/10.1590/S0104-42302012000400012)

7. Prata HL, Junior EDA, Paula FL, Ferreira SM. Envelhecimento, depressão e quedas: um estudo com os participantes do Projeto Prev-Quedas. *Fisioter Mov*, 2011;24(3):437-43. doi: [10.1590/S0103-51502011000300008](https://doi.org/10.1590/S0103-51502011000300008)
8. Alves RLT, Silva CFM, Pimentel LN, Souza ACS, Coelho LAF, Costa IA. Avaliação dos fatores de risco que contribuem para queda em idosos. *Rev Bras Geriatr Gerontol*, 2017; 20(1): 59-69. doi: [10.1590/1981-22562017020.160022](https://doi.org/10.1590/1981-22562017020.160022)
9. Gillespie LD, Robertson MC, Gillespie WJ, Lamb SE, Gates S, Cumming RG et al. Interventions for preventing falls in older people living in the community. *Cochrane Database of Systematic Reviews* 2009; (9):CD007146. doi: [10.1002/14651858.CD007146.pub3](https://doi.org/10.1002/14651858.CD007146.pub3)
10. Kendrick D, Kumar A, Carpenter H, Zijlstra GAR, Skelton DA, Cook JR et al. Exercise for reducing fear of falling in older people living in the community. *Cochrane Database of Systematic Reviews* 2014; (11):CD009848. doi: [10.1002/14651858.CD009848.pub2](https://doi.org/10.1002/14651858.CD009848.pub2)
11. Silva PCR, Oliveira VH, Neto ECA, Azevedo KPM, Rebouças GM, Knackfuss MI. Impacto do agachamento em superfície estável e instável sobre o equilíbrio estático e dinâmico de idosos. *Rev Andal Med Deporte*, 2017; 10(4):176-180. doi: [10.1016/j.ramd.2015.09.004](https://doi.org/10.1016/j.ramd.2015.09.004)
12. Carvalho DA, Brito AF, Santos MAP, Nogueira FRS, Sá GGM, Neto JO et al. Prevalência da prática de exercícios físicos em idosos e sua relação com as dificuldades e a falta de aconselhamento profissional específico. *R. bras. Ci. e Mov.* 2017;25(1):29-40. doi: [10.18511/rbcm.v25i1.6467](https://doi.org/10.18511/rbcm.v25i1.6467)
13. Lohman TG, Roche AF, Martorell R. Anthropometrics and standardization reference manual. Illinois: Human Kinetics Book; 1988.
14. Alfieri FM, Riberto M, Gatz LS, Ribeiro CPC, Battistella LR. Uso de testes clínicos para verificação do controle postural em idosos submetidos a programas de exercícios físicos. *Acta Fisiatr*, 2010; 17(4): 153-158.
15. Woellner SS, Araujo AGS, Martins JS. Protocolos de equilíbrio e quedas em idosos. *Neurociências*, 2014;10(2): 104-117.
16. Beltran DCG, Junior JPS, Mancini RB, Araújo TL, Matsudo SMM. Relação do padrão de marcha associado com a aptidão física e a capacidade funcional de residentes de instituições de longa permanência. *Estud. Intediscipl. Envelhec*, 2017; 22(2): 43-55.
17. Soares PG, Pádua TV. Relação entre cintura-quadril e imagem corporal em mulheres de meia idade e idosas ativas fisicamente. *Revista Kairós Gerontologia*, 2014;17(1): 283-295.
18. Pereira MWM, Arruda AL, Lima MS, Martins KMS, Damacena KG, Alves GSA et al. Indicadores antropométricos associados a fatores de risco cardiovasculares em idosos. *Rev Eletrônica Gestão & Saúde. Saúde do Idoso*, 2014;5(5): 3115-31.
19. Ribeiro DP, Mazo GZ, Brust C, Cardoso AS, Silva AH, Benedetti TRB. Programa de ginástica para idosos nos centros de saúde: avaliação da aptidão funcional. *Fisioterapia e Movimento*, 2009; 22(3): 407-417.
20. Ferreira JP, Cruz VL, Cardoso RA, Leite FNTS, Duarte CMG, Gouveia VM. Efeitos do treinamento de equilíbrio e coordenação motora em idosos: ensaio clínico randomizado. *Geriatria & Gerontologia*, 2012; 6(2): 183-191.
21. Albino ILR, Freitas CR, Teixeira AR, Gonçalves AK, Santos AMPV, Bós AJG. Influência do treinamento de força muscular e de flexibilidade articular sobre o equilíbrio corporal em idosos. *Rev Bras Geriatr Gerontol*, 2012;15(1):17-25. doi: [10.1590/S1809-98232012000100003](https://doi.org/10.1590/S1809-98232012000100003)
22. Vagetti GC, Oliveira V, Silva MP, Pacífico AB, Costa TRA, Campos W. Associação do índice de massa corporal com aptidão funcional de idosos participantes de um programa de atividade física. *Rev Bras Geriatr Gerontol*, 2017;20(2):216-227. doi: [10.1590/1981-22562017020.160160](https://doi.org/10.1590/1981-22562017020.160160)
23. Padua E, Campoli F, Manzi V, Panzarino M, Lombardo M, Melchiorri G et al. Water versus land-based exercises as physical training programs in elderly. *The journal of sports medicine and physical fitness*, 2018; 58(6): 802-9. doi: [10.23736/S0022-4707.17.07307-8](https://doi.org/10.23736/S0022-4707.17.07307-8)
24. Vieira JR, Alves MO, Luzes R. Efeitos da hidroterapia em pacientes idosos com osteoartrose de joelho. *Rev discente da UNIABEU*, 2016; 4(8): 11-15.
25. Freire GV, Silva IP, Moura WB, Rocha FCV, Madeira MZA, Amorim FCM. Perfil de idosos que frequentam um centro de convivência da terceira idade. *R Interd*, 2015; 8(2): 11-19.
26. Prazeres MMV, Mendes MT, Sousa IRC, Mazzocante RP, Maciel DG, Ribeiro C et al. Capoterapia como lazer e atividades física lúdica para idosos: uma percepção dos capoterapeutas. *Licere*, 2016; 18(4): 320-340.