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POSTURE MAINTENANCE CAPACITY IN DIFFERENT FUNCTIONAL ACTIVITIES OF HYPERTENSIVE AND NON-HYPERTENSIVE ELDERLY

Capacidade de manutenção postural em diferentes atividades funcionais de idosos hipertensos e não hipertensos

Capacidad del mantenimiento de la postura de ancianos hipertensos y no hipertensos en distintas actividades funcionales

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ABSTRACT

Objective: To compare static and dynamic posture maintenance capacity in functional activities between hypertensive and non-hypertensive elderly individuals. **Methods:** This study was held with participation of individuals aged 60 years or older, coming from a Primary Health Center (PHC) in a small municipality in the north of the Piauí State. The posture maintenance capacity was assessed through the Timed Up and Go (TUG) test; the static balance, by means of the Functional Reach Test (FRT); and the muscle strength (MS) of the lower limbs, through the Short Physical Performance Battery (SPPB) test. The elderly were divided into: group HAS (hypertensive) and control group (non-hypertensive). The data was analyzed with use of the Graph Pad Prism Software, and unpaired Student's t-test was applied for identification of differences between the groups. **Results**: Of the 88 volunteers, 43 belong to the hypertensive group and 45 to the control group. For the FRT, group HAS had a mean functional reach measuring 15 (±5.60) centimeters, while the control group had an average of 17 (±5.88) centimeters. In the SPPB test, the mean MS for group HAS was 17.67 (±6.46) seconds and, for the control group, it was 17.01 (±3.53) seconds. The mean TUG for group HAS was 14.03 (±2.95) seconds and, for the control group, it was 12.41 (±3.90) seconds. There were associations between groups HAS and Control for FRT (p=0.03) and SPPB (p=0.02). **Conclusion:** Systemic arterial hypertension seems to interfere with static posture maintenance in the elderly.

Descriptors: Hypertension; Elderly; Postural Balance.

RESUMO

Objetivo: *Comparar a capacidade de manutenção postural estática e dinâmica em atividades funcionais entre idosos hipertensos e não hipertensos.* ***Métodos:*** *Participaram deste estudo indivíduos com idade igual ou superior a 60 anos, provenientes de uma Unidade Básica de Saúde (UBS) em um município de pequeno porte no norte do estado do Piauí. A capacidade de manutenção postural foi medida através de três testes. A mobilidade funcional foi ponderada através do teste Timed Up and Go (TUG); o equilíbrio estático, por meio do Teste de Alcance Funcional (TAF); e a força muscular (FM) dos membros inferiores, pelo teste Short Physical Performance Battery (SPPB). Os idosos foram divididos em grupo HAS (hipertensos) e grupo controle (não hipertensos). Os dados foram analisados através do Software Graph Pad Prism, utilizando o teste t student não pareado para identificar diferenças entre os grupos.* ***Resultados:*** *Dos 88 voluntários, 43 pertencem ao grupo de hipertensos e 45 ao grupo controle. Para o TAF, o grupo HAS teve média da mensuração do alcance funcional de 15 (±5,60) centímetros, enquanto o grupo controle teve média de 17 (±5,88) centímetros. No teste SPPB, a média da FM para grupo HAS*

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foi de 17,67 (±6,46) segundos e, para o grupo controle, foi de 17,01 (±3,53) segundos. A média do TUG para o grupo HAS foi 14,03 (±2,95) segundos e, para o grupo controle, foi 12,41 (±3,90) segundos. Houve associação entre grupos HAS e controle para os testes TAF (p=0,03) e SPPB (p=0,02). ***Conclusão:*** *A hipertensão arterial sistêmica parece interferir na manutenção postural estática em idosos.*

Descritores: *Hipertensão; Idoso; Equilíbrio Postural.*

RESUMEN

Objetivo: *Comparar la capacidad del mantenimiento de la postura estática y dinámica en actividades funcionales de ancianos hipertensos y no hipertensos.* ***Métodos:*** *Participaron de ese estudio individuos con edad mayor o igual a 60 años vinculados a una Unidad Básica de Salud (UBS) de un municipio pequeño del norte del Estado de Piauí. La capacidad del mantenimiento de la postura ha sido medida a través de tres pruebas. La movilidad funcional fue evaluada a través del test Timed Up and Go (TUG); el equilibrio estático con el Teste de Alcance Funcional (TAF); y la fuerza muscular (FM) de los miembros inferiores con el teste Short Physical Performance Battery (SPPB). Los ancianos se dividieron en: grupo HAS (hipertensos) y grupo Control (no hipertensos). Se analizaron los datos con el Software Graph Pad Prism utilizando la prueba t de student no pareado para identificar las diferencias entre los grupos.* ***Resultados:*** *De los 88 voluntarios, 43 son del grupo de hipertensos y 45 del grupo control. El grupo HAS tuvo la media de la mensuración del alcance funcional en el TAF de 15 (±5,60) centímetros; el grupo control tuvo una media de 17 (±5,88) centímetros. La media de la FM en el teste SPPB para el grupo HAS fue de 17,67 (±6,46) segundos y de 17,01 (±3,53) segundos para el grupo control. La media del TUG para el grupo HAS fue de 14,03 (±2,95) segundos y 12,41 (±3,90) segundos para el grupo control. Hubo asociación entre los grupos HAS y control para los testes TAF (p=0,03) y SPPB (p=0,02).* ***Conclusión:*** *La hipertensión arterial sistémica parece influenciar en la manutención de la postura estática de ancianos.*

Descriptores: *Hipertensión; Anciano; Balance Postural.*

INTRODUCTION

The world's older population has been increasing over the past years. According to the World Health Organization (WHO), the percentage of older people will double by the year 2050 – from 11% to 22%[1]. The same phenomenon is also experienced by Brazil, where the number of older people must grow faster than the worldwide average. The percentage of older people in the Brazilian population is estimated to be 12.5%, and it should reach 30% by the middle of the 21st century[2].

The growth of the older population is due to improvements in general health conditions, particularly in quality of life, advances in the health field, and reduction in birth and mortality rates[3,4]. These facts have changed the profile of recurrent diseases and have influenced health care and promotion and public policies[5]. The guarantee of autonomy and the provision of social support to the older person should be given special attention as they can have positive effects on the various forms of care[6].

The natural aging process in human beings causes functional impairment that compromises the ability to maintain body balance[7,8]. This results from loss of muscle mass and decreased adaptive balance and information processing responses in the Central Nervous System (CNS)[9]. All these alterations generate imbalances which directly interferes with older people's locomotion capacity[10].

The aging process leads to a progressive functional decline in various organ systems, culminating in functional impairment associated with the onset of chronic and degenerative diseases[2,11]. Systemic arterial hypertension (SAH) is one of the most common diseases in this age group resulting from the progression of senescence, which decreases the capacity of the cardiovascular system to maintain homeostasis[5,12]. The correlation between SAH and changes in balance has been observed previously in older people[13] and in young adults[14]. In addition to this susceptibility, which is a characteristic of older people, there is also the influence of lifestyle habits, which tend to generate physiopathological mechanisms that increase the risk of onset and the severity of this morbidity[7,9,15].

Physical inactivity is an aggravating factor found in the geriatric population[16]. Such behavior tends to accelerate the morphofunctional decline of the nervous and vestibular systems, causing inability to maintain static or dynamic postural control[17]. Thus, daily functional activities are compromised and several organ systems (musculoskeletal, cardiovascular and neurological) are affected, which generates harmful effects on the older people's health[6,10,12]. Given that, the objective of this study was To compare static and dynamic posture maintenance capacity in functional activities between hypertensive and non-hypertensive older individuals.

METHODS

This is a quantitative exploratory and descriptive cross-sectional research. The research was carried out in primary health center (PHC) in a small municipality in the north of the State of Piauí from November 2014 to January 2015. The municipality

has an older population aged 60 years and older[2] that corresponds to 10.4% of the total population. The PHC where this research took place serves 163 older people. The lottery method was used to select one PHC out of the 6 centers that are located in the urban area of the municipality. A total of 95 older individuals attended the PHC to volunteer in the study[18].

The study included older people attending the PHC who agreed to participate in the study and confirmed participation by signing a Free and Informed Consent Form. The eligible participants should present physical and mental autonomy. Each participant was informed about the research stages and issues such as anonymity and withdrawal.

The study excluded volunteers who did not complete the assessment because of significant impairment of their physical and mental autonomy due to cognitive and motor alterations that could affect the performance of the proposed tests.

All the anamnesis data used in this study were obtained by the researchers in partnership with Community Health Workers (CHW) of the PHC.

Interviews were carried out with the participants who met the research criteria. In this stage, the older people answered a questionnaire that allowed researchers to collect information on age, gender, education, income, marital status, anthropometric data, comorbidities and level of physical activity (patient's self-perception).

The functional kinetic requirements for static and dynamic postural maintenance of the lower limbs of older people were assessed. Thus, maintenance of static body posture was simulated using a static balance test and maintenance of dynamic body posture was simulated using tests that assess the muscular strength of lower limbs and the functional mobility. The tests were performed by a previously trained examiner who did not know that the volunteers had SAH.

Static balance was assessed using the Functional Reach Test (FRT). The participants were instructed to remain in an orthostatic position with slightly abducted lower limbs and erect spine. They should look straight and keep their shoulder of the right upper limb (RUL) flexed at 90º with elbow and wrist fully extended. The right side of the body should be next to the wall and the participants should move their RUL forward as far as they could. The location of the 3rd metacarpal was recorded at start and end positions using a measuring tape affixed to the wall at the level of the volunteer's acromion. A reach of less than 15 cm indicates fragility and fall risk[19].

Muscular strength (MS) of the lower limbs (LL) was assessed using the Short Physical Performance Battery (SPPB). The participants should sit down and get up from a chair 5 consecutive times without using the upper limbs. The performance of the sit-to-stand maneuver was timed. A maximum score of 4 points was assigned to a time of 11.19 seconds or less. Times ranging 11.20 to 13.69 seconds scored 3 points; 13.70 to 16.69 seconds scored 2 points; and 16.70 seconds or more scored 1 point. No scores were assigned to participants who were not able to get up from the chair five times or who completed the test in more than 60 seconds[20,21].

Functional mobility was assessed by the Timed Up and Go (TUG) test, which measures the time (in seconds) spent by an individual to rise from a chair, walk 3 meters, turn, walk back to the chair and to sit down[22]. A Kenko digital timer (model KK-2808 - China) and an armchair of 46 cm in height were used in the test. The volunteer was instructed to sit in the chair with his/her back against the chair back and feet on the ground. The participants received information on the procedures prior to the test. The TUG and the timing started simultaneously at the assessor's verbal command to rise from the chair. The time taken to perform the test is related to the falls risk: time of less than 20 seconds indicates a low risk of falls; time ranging 20 to 30 seconds indicates moderate risk; and time longer than 30 seconds indicates high risk of falls[23].

The test results were divided into two groups according to the diagnosis of SAH, which was determined by the physician responsible for each participant. It should be noted that the diagnosis was an independent activity of this study. The information were self-reported and confirmed by checking on the exams brought by the participants.

The student's t-test was used to check for differences between the experimental groups in each variable analyzed. The significance level was set at 5% ($p<0.05$). All the data were analyzed using the GraphPad Prism for Windows (version six).

This research is in line with the principles of Resolution No. 466/2012 of the National Health Council (*Conselho Nacional de Saúde – CNS*) and the procedures related to data collection and analysis were approved by the Research Ethics Committee of the Unified Education Center of Teresina (*Centro de Ensino Unificado de Teresina – CEUT*) with Approval No. 6597/2014.

RESULTS

A total of 88 older people out of the 95 who were initially included in the sample were present at the time of assessment. Of these, 43 individuals were included in the SAH group and 45 in the control group. Anthropometric and sociodemographic characterization of the groups are described in Table I.

Table I - Anthropometric and sociodemographic characterization of older people served in a Primary Health Center in a city in Northern Piauí. 2014-2015.

Characteristic		SAH group		Control group		Total	
		n	%	n	%	n	%
Gender	Men	18	41.8	19	42.3	37	42.1
	Women	25	58.2	26	57.7	51	57.9
Age	60 – 64	11	25.6	12	26.7	23	26.1
	65 – 69	7	16.3	18	40.0	25	55.5
	70 – 74	16	37.2	8	17.7	24	53.4
	75 – 79	3	6.7	5	8.8	8	9.0
	>80	6	13.3	2	4.4	8	9.0
BMI	Underweight	0	0	5	11.0	5	56.8
	Normal weight	14	32.6	24	53.3	38	43.1
	Overweight	22	51.1	15	33.3	37	42
	Class 1 obesity	5	11.6	2	4.4	7	7.9
Marital status	Married	25	58.1	31	68.88	56	63.6
	Single	2	4.6	0	0	2	2.3
	Divorced	1	2.3	6	13.3	7	7.9
	Widowed	15	34.8	8	17.7	23	26.1
Education	Illiterate	29	67.4	30	66.7	59	67.0
	Incomplete PE	14	32.6	14	31.1	28	31.8
	Complete PE	0	0	1	2.2	1	1.1
Household income	<1 wage	2	4.6	0	0	2	2.3
	1 wage	39	90.8	44	97.7	83	94.3
	>1 wage	2	4.6	1	2.3	3	3.4

SAH: Systemic Arterial Hypertension; BMI: Body Mass Index. PE: Primary Education.

In the SAH group, 48.83% (n=21) of the individuals had a history of falls, 27.9% (n=12) had Diabetes Mellitus (DM) and 67.4% (n=29) were physically inactive (no physical activity for at least 30 minutes at least three times a week). In the control group, 44.44% (n=20) of the participants had a history of falls and 55.5% (n=25) were physically inactive. None of the controls had DM.

The statistical analysis revealed significant differences in FRT and MS values between the SAH group and the control group – p=0.0399 and p=0.0205, respectively. However, there were no significant differences in TUG values between the groups (p=0.1749).

Figures 1, 2 and 3 show the comparisons of FRT, MS and TUG tests between the groups.

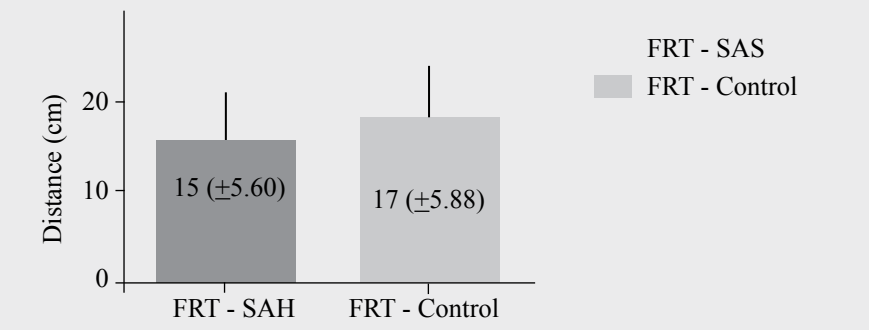

Figure 1 - Static balance comparison between the group of hypertensive (SAH) and non-hypertensive (control) older people served in a Primary Health Center in a city in Northern Piauí. 2014-2015.
SAH: Systemic Arterial Hypertension; Functional Reach Test (FRT). *p<0.05.

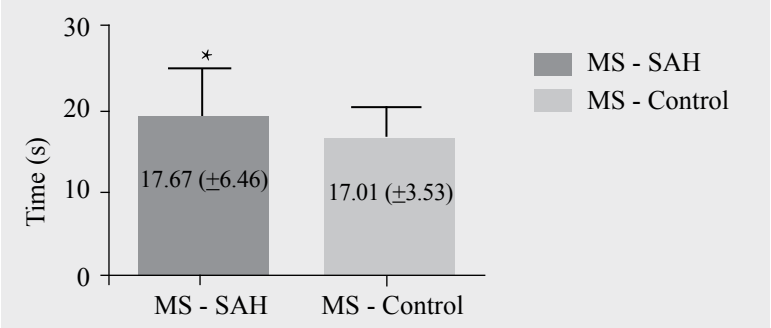

Figure 2 - Muscle strength (MS) comparison between the group of hypertensive (SAH) and non-hypertensive (control) older people served in a Primary Health Center in a city in Northern Piauí. 2014-2015.

SAH: Systemic Arterial Hypertension; MS: Muscle Strength. *p<0.05.

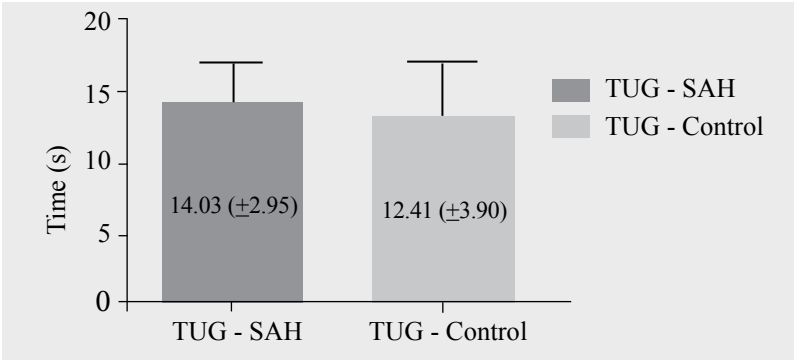

Figure 3 - Static balance comparison between the group of hypertensive (SAH) and non-hypertensive (control) older people served in a Primary Health Center in a city in Northern Piauí. 2014-2015.

SAH: Systemic Arterial Hypertension; TUG: Timed Up and Go. *p<0.05.

DISCUSSION

The results showed that the non-hypertensive participants had a better performance in the static balance test and in the muscle strength test. This theme requires a contextualization of factors that determine the impact of hypertension on older people, such as compliance with treatment, healthy lifestyle and the presence of other morbidities that commonly affect hypertensive individuals[24,25].

The groups presented several similar sociodemographic characteristics. Most of the participants were married, lived with their spouse, were illiterate, and had a monthly income of one minimum wage. Some of these characteristics play an important role in the adoption of a healthy lifestyle. Illiteracy, for instance, hinders the access to information and the understanding of the preventive and therapeutic aspects of chronic diseases[26]. Low income limits the possibility of implementing these measures[27].

Functional mobility was assessed using the TUG test. This instrument is useful in identifying problems that affect older people's balance in daily activities in a simple, effective, fast and cheap way[28]. In the present study, the hypertensive group performed the test in the same speed and with the same balance as the control group. This finding differs from the findings of an integrative review of studies published from 2007 to 2014[26]. The review suggests that the comorbidities that affect hypertensive individuals cause deleterious effects on the patients, thus enhancing functional impairment.

Physical activity is recommended as a form of non-pharmacological treatment and prevention of arterial hypertension[29,30]. Although adherence to physical activity programs is encouraged, most of the participants were physically inactive. This finding highlights the lack of intervention strategies aimed at minimizing the harms caused by older people's sedentary lifestyle[31].

Muscle action is required for static and dynamic posture maintenance as it enables the alignment and adjustments needed to maintain balance. In this study, the Short Physical Performance Battery (SPPB) was used to assess the MS of the LL because its execution requires the ability of the muscle to exert great amount of force in speed[21]. The sitting-rising maneuver is a classic example of a basic and instrumental activity of daily living that requires muscular power[20,32].

The hypertensive participants had a worse performance in the MS test, i.e., they took longer to complete it. Muscle flexibility may interfere with the ability of a muscle to contract and produce force, a factor that may have contributed to the poorer performance of the hypertensive participants. This hypothesis is supported by some authors who suggest[33] that older patients with hypertension present less flexibility in the LL muscles, especially in the soleus and gastrocnemius muscles. We

suggest that this characteristic also influenced FRT results. The SAH group had a lower anterior reach measure in this test, which may be indicative of lower balance; however, it can also indicate a biomechanical limitation caused by the shortening of lower limbs muscle chains[6,11].

In this context, muscle and functional losses have been reported to accelerate after the age of 70, when atrophy and muscle weakness appear to occur much more rapidly[34]. Considering the absolute mean age of the participants, the SAH group was slightly older. This characteristic can optimize the deleterious functional repercussion of aging; however, no statistically significant results that could determine such influence were found in the present study.

DM compromises the locomotor system, posture control and balance, reducing adaptive responses and contributing to a decrease in gait speed[35]. A study carried out with older people in a community center[36] compared the functional mobility of diabetic and non-diabetic older patients and found that lower functional mobility was associated with the diagnosis of DM. This finding is similar to those of other studies on the same theme and which have also reported effects on muscle strength[10,11]. Diabetes was present in the hypertensive group only, with a percentage of 27.9%. The comorbidity did not influence functional mobility results; however, it may have influenced the results of muscular power and static balance tests.

Functional kinetic features, such as muscle strength and static and dynamic balance, are required to perform functional activities with static and dynamic body control[7,19,37]. The tests performed in this study sought to simulate these variables. Only the TUG did not differ statistically between the groups, although hypertensive individuals were predisposed to alterations that could impair performance in this test[28]. The similarity in functional mobility can be a result of aerobic exercises such as walking. However, new exercise modalities should be implemented in order to stimulate muscular power and balance maintenance[38].

Strategies to maintain functional independence in the health care of the geriatric population are needed[5]. Assessment tools should be used for the early identification of the impact of aging so as to plan intervention programs that can meet the main needs of the older population[32,39]. One of the limitations of this study was the use of restricted resources to investigate the systems related to posture control. However, such more detailed assessment features are common only in medium and high complexity care centers, since they are quite expensive for use in primary care. The contribution of this study to the scientific and population community lies in the use of low-cost and easy-to-use instruments whose reliability has been widely discussed in the literature and which can effectively contribute to primary care.

CONCLUSION

The hypertensive older individuals analyzed presented poorer static balance and muscle strength; therefore, systemic arterial hypertension seems to interfere with older people's static posture maintenance.

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