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Comparison of Agility and Dynamic Balance in Elderly Women with Endomorphic Mesomorph Somatotype with Presence or Absence of Metabolic Syndrome

Comparación de la Agilidad y Equilibrio Dinámico en Mujeres Adultas Mayores con Somatotipo Mesomorfo Endomorfico y Presencia o Ausencia de Síndrome Metabólico

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SUMMARY: Physical function declines in efficiency with advancing age, contributing to disability. Furthermore, metabolic syndrome is a common illness in elderly populations, somatotayping is a technique for description of the physique and can establish a relation with performance and pathology. The aim of this work was to compare the agility, dynamic balance in elderly women with endomorphic mesomorph somatotype with presence or absence of metabolic syndrome. A sample of 18 volunteers was obtained (age 66.5±4.7 years old), all were elderly sedentary women. They were assessed whit anthropometric variables in accordance with ISAK protocol in order to determine Heath & Carter somatotype; presence of metabolic syndrome they were evaluated according with the NCEP ATP-III, the agility and dynamic balance was assessed with the functional test Time Up and Go (TUGT). Mean of somatotype in subjects with absence or presence of metabolic syndrome was 6.2-7.9-0.2 and 6.5-8.7-0.1 respectively; Shapiro–Wilk test checked the normality of the distribution in the functional test Time Up and Go, in the group with absence or presence of metabolic syndrome, based on its normality distribution for the intergroup comparison, the Student t test was applied, the significance level, utilized was 95% ($P \leq$, 0.05) for the sample assessed without metabolic syndrome, the execution time of the functional test TUGT was better in spite of the same somatotype intergroup. The pathological components of metabolic syndrome can be related whit dysfunctional mobility in elderly women.

KEY WORDS: Somatotype; Elderly; Metabolic Syndrome; Agility; Dynamic Balance.

INTRODUCTION

The process of aging is characterized by a decrease in the physiological capacity, progressively declining functions of the organs and systems (Fulop *et al.*, 2010), older adults presenting a natural progressive loss of physical capacities and a dysfunction of the musculoskeletal system by gradual changes in their body mass index (Rexhepi *et al.*, 2011), as well as body composition, decreasing muscle mass and bone mineral density and increasing the body fat mass content (Rolland *et al.*, 2009); These effects result in a unbalance of motricity, becoming more weak (Jang & Van Remmen, 2010; Doubova *et al.*, 2010; Blain *et al.*, 2010, Fraga *et al.*, 2011; Guzmán *et al.*, 2011), predisposing the elderly to have lower functional autonomy in activities of daily living such as walking, climbing stairs, or rising from a chair without the help of a person or device (Molt *et al.*, 2010; Reid *et al.*, 2008; de Noronha *et al.*, 2010).

Studies report that the decrease in agility and equilibrium is associated with the risk of falls (Rockwood *et al.*, 2000), this being a high incidence factor at this stage of life (Formiga *et al.*, 2008; Molt & McAuley, 2010; McPhail *et al.*, 2010), enhancing motor disability, which affects more than half of 60+ year old people (Chevalier *et al.*, 2008) predisposing these type of populations to be more fragile and increases dependence by losing their functional autonomy, being these causes the most common reason for isolate them into nursing homes (Vivanti *et al.*, 2011).

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Heath & Carter (1972) define the somatotype as a method that describes an individual's current body shape and composition, expressed in the quantification of three components (endomorphy, which expresses body fat content, mesomorphy is the development of skeletal muscle and ectomorphy is the linearity or thinness of the body) relative to height (Norton & Olds, 1996). The assessment of somatotype in the field of medicine has been associated with the level of fitness, a variety of risk factors for health and the presence of chronic degenerative pathologies (Williams *et al.*, 2000; Saitoglu *et al.*, 2007; Martínez *et al*., 2008). The classification of endomorphic mesomorph somatotype is characterized by dominance in the mesomophy component and a tendency to endomorphy (Carter & Heath, 1990).

Metabolic syndrome (MS) is a health complication that has been strongly associated whit the elder population (Bener *et al*., 2010), which is a disease of complex nature, consisting of five major clinical components: abdominal obesity, atherogenic dyslipidemia, elevated blood pressure and insulin resistance without glucose intolerance in potentially harmful combinations that significantly rise cardiovascular risk (Luk *et al.*, 2008), various authors report straight associations of the MS with an endomorphic somatotype (Gordon *et al.*, 1987; Koleva *et al*., 2002; Herrera *et al*., 2004; Kalichman *et al*., 2004; Buffa *et al.*, 2007).

Elder adults show different rates of classification in their somatotypes (Buffa *et al*., 2005), furthermore physical characteristics modify the form of the body in general population (Kolpakov *et al*., 2009), as well as different classifications in physically active people compared with sedentary (Rodríguez *et al.*, 2010). The aim of thise investigation was to compare the agility and dynamic balance in older adults with endomorphic mesomorph somatotype with presence or absence of metabolic syndrome.

MATERIAL AND METHOD

The study design was cross-sectional, descriptive and comparative of two groups with non probabilistic and convenience sampling. Subjects with interest of joining an aquatic stimulation program at the aquatic complex of the school of sports at the Autonomous University of Baja California were recruited. The sample consisted of 18 volunteer women over 60 years old (66.5±4.7), apparently healthy who meet the following criteria: ambulation capacity, not have performed a systematical routine of exercise in the previous six months, a somatotype rated as endomorphic mesomorph, quantification of clinical and biochemical parameters by a medical and laboratory evaluation to assess the presence or absence of MS and evaluation of the agility and dynamic equilibrium by a functional test.

The total number of subjects was divided into two groups, one diagnosed with MS (n=8) and the other without MS (n=10). All participants signed an informed consent (according with Helsinki declaration of 2008); the study was approved by the ethics committee of the School of Sports of the Autonomous University of Baja California. (nº 2011-1/01).

To determine the somatotype, the Heath & Carter method was used; Anthropometric measurements were conducted by a level two antropometrist following the guidelines set by the International Society for Advancement of Kinanthropometry (ISAK) with a technical error of measurement less or equal to 1%. The following measurements were taken: body weight (cm), height (cm), four skinfolds (mm) triceps, sub scapular, supra spinal and medial calf, two circumferences (cm) flexed arm, maximum calf, and two bone diameters (cm) humeral and femur. The equipment used was a Seca 220 scale and stadiometer, and the Rosscraft Inc. Tomkit (Slimguide skinfold caliper, bone diameter vernier and Lufkin metal anthropometric tape).

A medical and laboratory evaluation assessed the clinical and biochemical parameters to evaluate the existence of MS using the guidelines of the National Cholesterol Educational Program Adult Treatment Panel-III (NCEP ATP-III). The blood pressure (BP) was obtained sitting at rest for 5 minutes by a sphygmomanometer (Omron hem-713c), umbilical abdominal circumference (UAC) was measured by a Lufkin metal anthropometric tape. Fasting venous blood was obtained to evaluate the biochemical variables of total cholesterol (TC), high density lipoprotein cholesterol (HDL-C) and triglycerides (TG). The values of TC and TG were analyzed using an enzymatic colorimetric method and HDL-C with a homogeneous enzymatic assay in which enzymes modified by Polyethylene Glycol (PEG) produce the separation in presence of magnesium and dextrin sulfates at the same time of analysis, the quantification was performed in a modular selective multichannel photometric auto analyzer P800 (Roche Diagnostics), and plasma blood glucose with an auto analyzer by the method of glucose oxidase-peroxidase (Beckman C5 Cincron, Bayer).

MS was diagnosed in older women who had three or more of the following criteria: abdominal obesity (UAC > 88 cm), TG values X ≥ 150 mg.dl-1, HDL-C values X <50 $mg.dl^{-1}$; BP values ≥ 130/85 mmHg, or taking antihypertensive treatment, and plasma fasting glucose levels 110 ≥ $mg.d^{l-1}$ (Luk *et al.*, 2008).

Agility and dynamic balance were assessed using the Timed up and go Test (TUGT), whose implementation began with the subject seated in the middle of a chair (43.18 cm) with both hands on the thighs and their feet on the ground, set slightly one below the another, a signal was given to start the test, the test started when the subject raised from the chair, walk as fast as possible around a cone placed 8 feet (2.4 m) in front of the chair and sit back, the timer started as soon as the subject moved and stopped when the person sat down again, the test was administered twice, and the shortest time recorded was used (Rikli & Jones, 2001).

The variables were analyzed by descriptive and inferential statistics (SPSS 17.0), the somatotype was processed by the computer program Nolds LifeSize Sports Scientific (1998) setting out the components in a somatochart.

RESULTS

The values of the variables are shown in mean, standard deviation and range. Table I shows the general and anthropometric characteristics, and somatotype components are referred in Table II, Table III reports the clinical and biochemical parameters of metabolic syndrome, and the results of the test of agility and dynamic balance in both groups.

The spatial distribution of somatotype and dispersion (SDD) and attitudinal distances (SAD) of both groups with respect to their average value can be seen in Figures 1 and 2. The SDD values X for both groups were 6.6 ± 3.4 and 5.2 ± 2.5 somatotype units, for the SAD X were 3.4 ± 2.0 and 2.7 ± 1.5 somatotype units respectively.

Table I. Mean, standard deviation and range of general anthropometric characteristics in both groups (n=18).

	with MS (n=8)		***without MS (n=10)***	
	X±DS	**Range**	**X±DS**	**Range**
Basics				
Age (years)	68.0 ± 4.9	62-75	65.4±4.5	60-73
Body weight mass (kg)	77.7±8.9	64.9-90	72 ± 13.4	49.3-92.1
Height (cm)	151.4±3.8	146-156	154.5 ±7.2	146.6-167
IMC (kg/m^2)	34.2±5.1	29.5-42.5	30.5 ± 4.9	22.9-41.9
Skinfolds (mm)				
Ttriceps	20.4 ± 5.5	11.5-26.5	19.8 ± 4.2	11.5-25.2
Sub scapular	22.1±5.7	13.2-30.2	21.9 ±9.8	13.5-49
Supra spinal	20.3±3.8	15.2-26.0	18.1±6.4	8.2-31.5
Medial calf	26.5±10.5	12.5-46.7	18.5±5.7	7.9-25.5
Circumferences (cm)				
Flexed arm	35.8±4.1	31.1-42.2	34±3.8	28-38
Maximum calf	37.2±6.0	31.5-48.9	35.5±3.9	29.5-42
Bone diameters (cm)				
Humeral	6.9±.3	6.4-7.4	7.1±.6	6.1-7.9
Femur	10.4±.7	9.3-11.6	9.9±.6	9-11

Table II. Mean, standard deviation and range of somatotype components in both groups (n=18).

	with MS (n=8)		***without MS (n=10)***	
	X±DS	**Range**	**X±DS**	**Range**
Endomorphy	6.5±1	4.5-8	6.2±1.3	4.6-9.4
Mesomorphy	8.7 ± 2	7-12	7.9 ± 1.5	5.6-10.6
Ectomorphy	0.1 ±.0	0.1-0.1	0.2 ±0 .2	0.1-0.9
SDD	6.6±3.4	3.3-12	5.2 ±2.5	1.4-10
SAD	3.4±2.0	1.6-6.8	2.7 ± 1.5	.73-6.24
X Coordinate	-6.4 ± 1	-7.9- -4.4	-6 ± 1.4	-9.3- -3.7
Y Coordinate	10.8±3.3	7.5-16	9.4±2.2	5.7-12.4

Table III. Mean, standard deviation and range of clinical and biochemical parameters of metabolic syndrome, and the results of the test of agility and dynamic balance, in both groups (n=18).

	with MS (n=8)		***without MS (n=10)***	
	X±DS	**Range**	**X±DS**	**Range**
Umbilical abdominal	107.3±10.8	90.4-126.5	98.7±10.6	82.5-117.3
Sistolic blood pressure (BPS)	143.6 ± 12.7	128-166	121 ± 18.3	97-158
Diastolic blood pressure (BPD)	77.5 ±5.5	69-85	72.5 ± 15.2	47-92
High density lipoprotein	40.7 ± 7.4	31.5-52.6	46 ±7.98	31.5-52.6
Triglycerides (TG) $mg.dl^{-1}$	149.2 ±55.4	95-263	126.4 ± 26.1	94-190
Glucose $mg.dl^{-1}$	133.5 ± 98.5	61-367	82.2 ± 11.9	67-100
Timed up and go Test TUGT	8.4±1.5	6.9-11.58	6.2±1	4.8-8.3

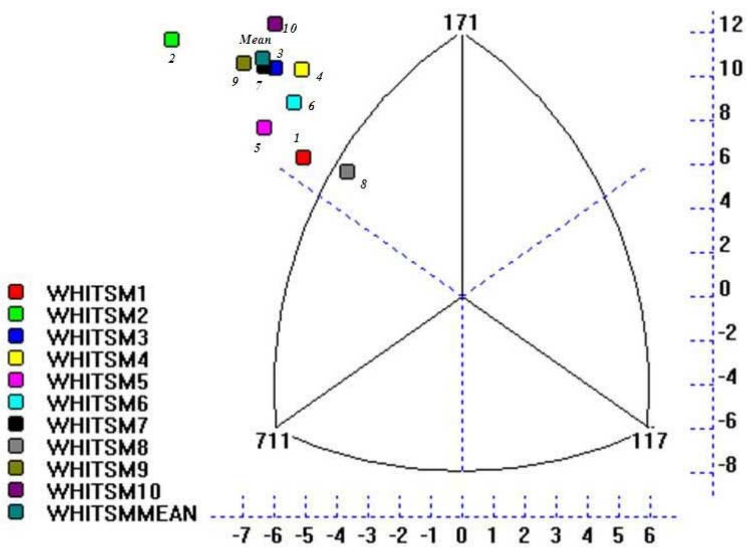

Fig. 1. Spatial distribution of somatotype in the group with MS (n=8).

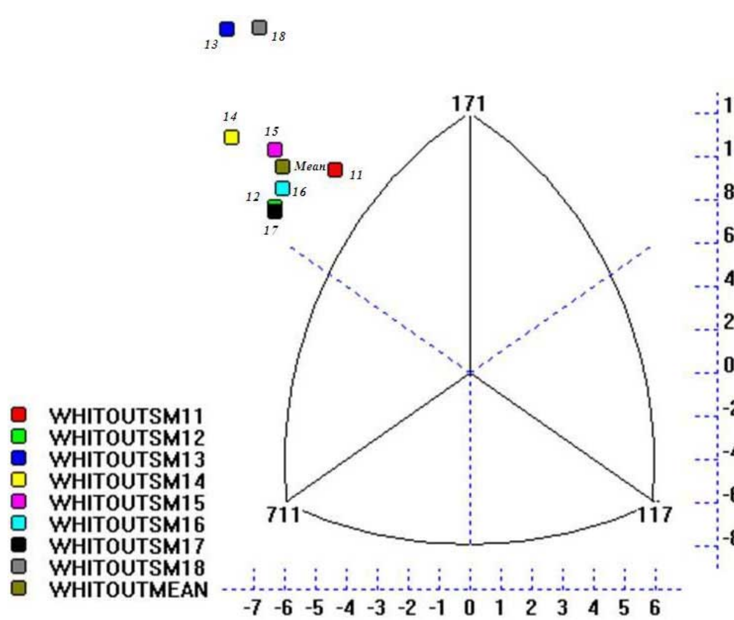

Fig. 2. Spatial distribution of somatotype in the group without MS (n=10).

The Shapiro-Wilk test of normality was used to establish homogeneity in the test of agility and dynamic balance between the groups with presence or absence of MS, the values X were (.148 and .755 respectively) p >0.05, to analyze the comparison of the TUGT between groups the t-test of Student was used, the group without MS had a significantly better agility and dynamic balance (p = .005). There were no significant differences between the other study variables.

DISCUSION

In the present investigation, the values X of clinical and biochemical parameters, and somatotype did not differ between groups. However, the group with absence of MS showed better agility and dynamic equilibrium, indicating a possible lower risk of falling and greater functional autonomy. The components of the MS have been linked to somatotype, studies show that a dominance in the endomorphic component tends to be directly related to abdominal obesity (Koleva *et al.*, 2002), elevated blood pressure (Herrera *et al.*, 2004; Kalichman *et al.*, 2004), high fasting glucose values (Buffa *et al.*, 2007), low HDL-C and elevated TG (Gordon *et al.*, 1987).

The anthropometric and somatotype characteristics of both study groups were similar, showing a dominance of the mesomorphic component and a trend towards endomorphy, which differs from data published by Buffa *et al.* (2007) which indicate that in older women with type 2 diabetes mellitus, the endomorphic component is predominant, which is recognized as a major factor of prevalence for the presence of chronic non communicable diseases. This particular somatotype of the group with MS in this study does not concur with those found in the literature (Carter & Heath, 1990; Gordon *et al*., 1987), however, the average value of endomorphy in both groups is considered high, according to the classification given by the authors of this morphological indicator, although it could be suggested that the inconsistency of these results is attributable to no differences in the body composition between groups.

Bouchard *et al*. (2011) showed in a population of metabolically healthy obese women and others with some type of co-morbidities, that functional capacity is better in the group without co-morbidities, attributing a lower risk of disability. Another study in population with low functional autonomy, central adiposity in the body and the presence of MS (Rush *et al*., 2011) concluded that high levels of fat combined with the presence of MS decreased functional autonomy. The data found in our study is similar to those found in a study in older adults associated with low functional capacity and presence of MS (Roriz-Cruz *et al*., 2007) because the agility and dynamic balance were significantly better in older adults with absence of SM despite having a similar somatotype, so this variable in the sample tested is not a good indicator to identify older adults prone to falling risk with low functional autonomy through their walking ability.

To conclude, it is possible that the pathological components of the metabolic syndrome may be associated with a loss of functional autonomy in these groups of older women, and the somatotype did not serve as a good indicator to identify MS and risk factors of falling in this type of elderly women's population.

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RESUMEN: Conforme la edad progresa, se presenta una pérdida en la funcionalidad física del ser humano, contribuyendo al deterioro de su autonomía funcional, además el síndrome metabólico (SM) es un padecimiento común en poblaciones de adultos mayores. El somatotipo es una técnica utilizada para describir la forma del físico en diferentes tipos de poblaciones que puede establecer una relación con su rendimiento físico y patologías. El objetivo de este trabajo fue comparar la agilidad y equilibrio dinámico en adultas mayores con un somatotipo mesomorfo-endomorfico con presencia o ausencia de SM. Fue reclutada una muestra de 18 mujeres adultas mayores sedentarias (edad promedio de 66.5±4.7 años). Las variables antropométricas fueron valoradas utilizando los lineamientos establecidos por ISAK y se determinó el índice morfológico del somatotipo por el procedimiento de Heath & Carter. La presencia de SM fue evaluada de acuerdo al NCEP ATP-III, la agilidad y equilibrio dinámico fue medido mediante el test funcional de Timed up and go (TUGT). La media del somatotipo en las sujetos con ausencia y presencia de SM fue de 6.2-7.9-0.2 y 6.5-8.7-0.1 respectivamente; el test de Shapiro–Wilk fue utilizado para observar la normalidad de la distribución de los datos en el test de funcionalidad (TUGT)de ambos grupos, ya comprobada la normalidad de los datos, se aplicó la prueba t de Student con el nivel de significancia 95% (P≤ , 0.05), comprobando que el grupo con ausencia de SM presentó una mejor agilidad y equilibrio dinámico. Es posible que los componentes patológicos del SM puedan estar relacionados con una pérdida de autonomía funcional en mujeres adultas mayores.

PALABRAS CLAVE: Somatotipo; Ancianos; Síndrome Metabólico; Agilidad; Equilibrio Dinámico.

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