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Blood Pressure Responses in Isokinetic Dynamometry Test in Elderly Community Women: An Exploratory Study

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ORIGINAL ARTICLE

ABSTRACT

The aim of the study was to verify the systolic, diastolic and mean arterial pressure response in elderly women during isokinetic test. The study included 54 females (68.8 ± 5.9 years) divided into two age groups (Group 1: 60 to 70 and group 2: above 71 years). BP was measured before and immediately after the isokinetic knee extension / flexion test in the concentric-concentric mode. After the test, significant elevations were observed in relation to the pre-test in SBP (G1: Δ% = 29.7%, G2: Δ% = 20.6%, p <.01, respectively) and in MAP (G1: Δ% = 7.6 %, G2: Δ% = 8.4%, p <.01, respectively). The use of isokinetic tests produces elevations in systolic blood pressure and mean arterial pressure in elderly women. Increases occur independently of the age group studied. However, the increases detected do not appear to be of sufficient magnitude to constitute a health hazard whereby isokinetic tests can be safely applied in this population.
Keywords: muscle strength dynamometer, blood pressure, stress test.

INTRODUCTION

Muscle strength is one of the most important physical capacity, since it is fundamental for any movement. With the aging process, the body suffer many losses including the muscle strength capacity, which is related to sarcopenia and neuromuscular atrophy (Aagaard, Suetta, Caserotti, Magnusson, & Kjær, 2010). The study of muscle strength has largely contributed to the prescription of physical exercise in elderly individuals, aiming to attenuate the losses of advancing age (Haraldstad et al., 2017; Walston, 2012). In addition, arterial hypertension also have been investigate in the aging field, because it has a high prevalence in the elderly population, generating a need for greater targeting of strategies to assist in the control of this variable in the elderly. The increase in blood pressure (BP) during the aging process is a contributor to the development of cardiovascular disease and hypertension (Da Cunha Nascimento et al., 2018).

The benefits of having an active life, doing exercise and avoiding the sedentarism is well known and recommended by important health organizations in the world (Chodzko-Zajko et al., 2009). Lately the recommendations not only focus in aerobic capacity but also to strength capacity (Peterson, Rhea, Sen, & Gordon, 2010). Nowadays the combined exercise is the best option to preserve the functional capacity and prolong an independent life (Teixeira et al., 2016). Exercise plays an important role in the aid process in control of age-related disorders, however, to be able to assess whether the exercise was effective, it is necessary that individuals who undergo training programs do an assessment test of strength maximum muscle mass.

Some tests can be run to evaluate the strength capacity however, the gold test (Maximum muscular strength test) can be tricky for the

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elderly population, once it is associate with increased BP during the test. The test is associate with physiological changes that can, in fact, influence the responses to exercise (Levinger et al., 2009), including the BP (Featherstone, Holly, & Amsterdam, 1993). In the study by Blanchard et al. (2018), the authors hypothesized that individuals with high resting BP would exhibit lower rates of isokinetic muscle strength than individuals with normal BP. Contrary to the initial hypothesis, individuals with higher resting BP had higher values of muscular strength. BP responses during maximal muscle strength tests at different stages of aging need to be further clarified. We hypothesized that older women with more advanced ages may exhibit higher rates of BP and lower rates of muscle strength than those with the lower age range after isokinetic test.

Thus, to help clarify and reinforce the safety of isokinetic test application in this specific population the aim of the present study was to verify the acute response of BP in elderly women during the assessment of maximal muscle strength.

METHOD

Participants

The study is characterized as descriptive, transversal and *quasi*-experimental. The sample consisted of 54 females (68.58 ± .09 years) participants in a university program of physical exercise. The subjects were categorized into two age groups, Group 1: 60 to 70 years old (65.45 ± 2.62 years) And Group 2: above 71 years (74.14 ± 3.07 years). The inclusion criteria were: a) age equal to or greater than 60 years; b) have no muscle-articular limitations in the involved segments; c) have medical release for participation. The exclusion criteria were: a) complete the test by voluntary / involuntary interruption; b) BP at rest above 140x90mmHg. Participants were given medical release for the practice and were advised to follow the usual medical advice regarding medications. All participants were informed about the methodological procedures and signed a Free and Clarified Consent Term (FCCT). The study respected the ethical procedures for research in humans (Res. 466/2012 of the National Health Council) and the Declaration of Helsinki. The protocol was approved by the Ethics and Research Committee of Unicatólica (nº 1175.175).

Measures

The evaluation of lower limb muscle strength was performed on a Biodex 3 System Pro® Isokinetic Dynamometer (Biodex Biomedical Systems, Inc., Shirley, NY) and preliminary cycle ergometer heating (Monark Ergomedic 828). The maximum isokinetic torque (Nm) was measured in the concentric-concentric mode at 60º/s and three repetitions maximum extension/flexion of the knee dominant (Aquino Amorim & Helm, 2006). Familiarization with the isokinetic test was performed in the week prior to the tests.

Procedures

The SBP and DBP were measured at rest and immediately after the test was performed using an automatic sphygmomanometer (Omron HEM 7113®). During the resting measurement, participants were instructed to remain seated for a period of 3 to 5 minutes in a calm environment and were instructed not to talk during the measurement. Participants were instructed to stand with uncrossed legs, feet flat on the floor, backslid in the chair and relaxed; The arm was positioned at the level of the heart, supported, with the palm of the hand turned upwards and the clothes relaxed. The procedures for the measurement of Blood Pressure followed the recommendations of the 7th Brazilian Guideline of Arterial Hypertension (Malachias et al., 2016).

Statistical analysis

A descriptive analysis of the data was performed (mean and standard deviation (±)). Normality was verified by the Shapiro-Wilk test and independent *student* t tests for the Torque Peak and paired for the variables SBP, DBP and MBP. MBP was calculated using the formula: $MBP = [(2DBP) + SBP] / 3$. The percentage of change (Δ%) was calculated using the formula: $\Delta\% = ((pos\text{-}pre) / pre) * 100$. The level of significance was 95% ($p < 0.05$). For all statistical analysis,

Statistical Package for the Social Sciences version 23.0 was used (Armonk: NY, IBM Corporation).

RESULTS

The peak torque values (Nm) showed no significant differences between the groups (EPT Group 1 vs. Group 2. *P* = .357; 95% CI: -4. 1 to 12.6; FPT. *P* = .609; 95% CI: -3.5 to 6.06, respectively).

Table 1

Mean values, standard deviation (±), and Δ% of SBP, DBP and MBP before and after isokinetic test.

	60-70 years (n=33)			Above 70 years (n=21)		
Variables	Pre	Post	Δ%	Pre	Post	Δ%
SBP (mmHg)	112.9 ± 9.6	146.5 ± 7.2**	29.7%	123.7 ± 9.1	149.3 ± 7.1**	20.6%
DBP (mmHg)	78.4 ± 6.7	77.1 ± 4.3	-1.6%	79.9 ± 6.7	79.1 ± 3.7	-1.0%
MBP	93.2 ± 6.3	100.3 ± 4.2**	7.6%	94.5 ± 6.3	102.5 ± 3.4**	8.4%

Note. **p<0.01 related to pretest; SBP = Systolic Blood Pressure (mmHg), DBP = Diastolic Blood Pressure(mmHg), MBP = Medium Blood Pressure.

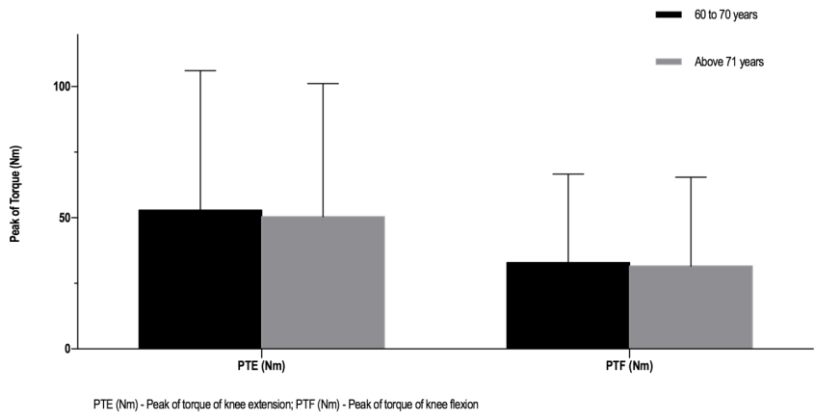

Figure 1. Peak of torque of Right and Left extension/flexion

DISCUSSION

In this paper, we describe BP responses to maximum isokinetic test in elderly women. This report is unique because it is a study that analyzes the BP at different stages of aging for maximum concentric effort in women of the community.

The responses in SBP, DBP and MBP observed in our study can be considered similar in both age groups. However, the mean values of MBP were significantly higher after the isokinetic test in the two age groups. It is possible that such elevation was influenced by increases in SBP. The observed increase in SBP in both groups can be explained by the type of muscle contraction used in the test.

Concentric contractions may induce elevated responses in cardiovascular variables when compared to eccentric contractions (Okamoto, Masuhara, & Ikuta, 2006). Isokinetic contractions, when compared to isotonic and isometric contractions, may also present higher acute values in both SBP and DBP (Iellamo et al., 1997). Besides the type of contraction, the amount of muscle mass involved during muscle contractions can directly influence the pressure responses during exercise (House et al., 2010). Our study focused on the immediate acute response of BP during maximal isokinetic testing. Unlike acute responses, resistance exercise, when performed chronically, for example at 28 weeks, SBP and DBP may show significant reductions (Reichert et al., 2016). The results showed that the proposed exercises are safe, since they did not increase the BP values exaggerated. Our study shows, in agreement with other authors, that, from the cardiovascular point of view, strength exercises are well tolerated by the elderly (Bakke, Hisdal, Kroese, Jørgensen, & Stranden, 2007; Blanchard et al., 2018; Overend, Versteegh, Thompson, Birmingham, & Vandervoort, 2000; Symons, Vandervoort, Rice, Overend, & Marsh, 2005; Vallejo, Schroeder, Zheng, Jensky, & Sattler, 2006). The observation of blood pressure values, from maximal work up to the end of the exercise, may be due to the more or less constant

intensity of the effort and the progressive vasodilatation (decrease of the peripheral resistances). Thus, at this point, blood flow seems to have been sufficient to meet the metabolic needs of exercise (Carvalho, Marques, & Mota, 2008).

The present study presents some limitations: the first is that the BP response was not controlled in the recovery period after exercise. The second is that the sample was composed only of women. Therefore, studies with different methodological designs are recommended.

CONCLUSION

The use of isokinetic tests produces elevations in systolic blood pressure and mean arterial pressure in elderly women. The increases occur independently of the studied age group, requiring a control for each applied test. However, the increases detected do not appear to be of sufficient magnitude to constitute a health hazard, so that isokinetic tests can be safely applied in this population.

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