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The Effect of Exercises on Resistin of Post-Menopausal Pre Hypertension Women

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Abstract

Background: Emerging evidence suggests a role for resistin in inflammation and vascular dysfunction, which may contribute to the pathogenesis of hypertension, but the association between resistin levels and incident hypertension is unknown. The strength exercise can be used to prevent the degenerative processes and inflammation associated with ageing.

Aim of Study: To Investigate the effect of strength exercises on serum resistin levels of post-menopausal women.

Subjects and Methods: Twenty three sedentary post-menopausal women conduct in this study. The strength exercises lasted 12 months and consisted of two week sessions with three sets of 8-12 maximum repetitions and one exercise for each main muscle group. Maximum muscular strength was tested in the following exercises: Bench press, 45º leg press, and standing elbow extension. Serum resistin level was determined using the ELISA method. ANOVA (with repeated measures) was used for the comparisons between periods pre, 6 months and 12 months (p<0.05); Pearson's correlation test was used to evaluate the correlations between resistin X blood pressure, resistin X muscle strength and strength X blood pressure.

Results: Women presented the following anthropometric profile: 61.33±3.8 years; height 148.5±32.7cm; body weight 67.56±10.85kg. The Strength exercise decreased resistin levels (30272.4±8100.1 to 16350.6±2404.6pg./mL) and systolic blood pressure (120.5±11.8 to 1 15.8±1 .6mmHg), and increased muscular strength in the leg press 45º (172.3 ±27.3 to 348.6± 40.8kg), bench press (31.9±4.1 to 41.8±5.6kg) and arm curl (21.0±2.4 to 26.5±2.9kg) after 12 months (p<0.05).

Conclusion: Long-term strength exercises increases maximum muscular strength, decreases systolic blood pressure and serum resistin levels, which are beneficial physiological alterations that reduce the risk for cardiovascular diseases in post-menopausal women.

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Key Words: *Post-menopausal women – Blood pressure – Strength exercises – Resistin.*

Introduction

AGING process is accompanied by an increase in serum levels of different inflammatory mediators, such as C-reactive protein, tumor necrosis factor alpha, interleukin 6, interleukin-1 beta and resistin [1]. That found associated with the physiopathology of systemic arterial hypertension [2]. In pre-menopausal women present a lower prevalence of arterial hypertension and associated diseases relation to men, after menopause, it becomes similar to men's [3]. In modern society the constant increase in the number of women in relation to men and especially the overload of work [4]. Have caused them an increased prevalence of diseases that were previously more related to men for instance, the cardiovascular and cerebrovascular diseases [5]. Alterations in lipid profile, weight gain and sedentariness are due to the main factors of Estrogen deficiency, associated with arterial hypertension in post-menopausal women [3]. Resistin, an adipokine that has been recently identified and that belongs to a cysteine-rich protein family an important marker related to alterations in the lipid profile, blood pressure and cardiovascular diseases [6]. Resistin is specifically expressed in the white adipose tissue, and its secretion is strongly associated with inflammation, obesity, insulin resistance, diabetes, dyslipidemias, arterial hypertension and the onset of coronary artery disease [7]. Exercise improved mineral bone density and quality of life, reduction of pain and inflammation in post-menopausal women [8] the modalities of exercise, strength exercise has been responsible for emotional aspects [9]. It is recommended as an important component of physical exercise programs for elders [10] promoting strength and muscle mass gain [11]. Studies have showed a possible association between muscle strength and a reduction of cardiovascular risk factors in addition to these factors [12], obesity [13], blood pressure [14,15], metabolic syndrome [16,17] and early death [18]. However, there is a need for studies to confirm the efficiency of strength exercises as a therapeutic intervention for the reduction of cardiovascular risk, including the resistin biomarker in elders [19]. Thus, this study aimed to assess the effects of a 12-month strength exercises on resistin levels, the reduction of Systolic Blood Pressure (SPB), Diastolic Blood Pressure (DPB), Mean Arterial Pressure (MAP) and Pulse Pressure (PP) of post-menopausal women.

Material and Methods

A 23 women (61.33±3.8 years) were selected and clinically assessed (general physical examination, vital signs assessment, stress test and musculoskeletal system examination) in (assessments). This study took place in the physiotherapy clinic and the gym. The study extended from March 2016 to June 2017. They met the following inclusion criteria, a minimum of three years of post-menopause, be sedentary no current hormone replacement therapy, or endocrine disorders that could affect either bone or muscle mass, and be cognitively able to understand the instructions. They also met the following exclusion criteria: Musculoskeletal alterations (orthopedic) that prevented the execution of the strength protocol proposed, diagnosis of congestive heart failure, severe arrhythmia and uncontrolled hypertension. Initially, the participants took four weeks to get familiar with the strength exercises. Then, they underwent one repetition maximum testing (1-RM) for determining the load settings of the training program. The strength exercises program lasted (12 months), with two sessions a week) and one full-body stretching session a week). The measurements of Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), Pulse Pressure (PP) and serum resistin occurred in three moments: Before the strength exercises (pre), 6 months and after 12 months after the strength exercises. SBP and DBP were assessed by the oscillometric method, employing the methodology recommended by the V Brazilian Guidelines for Arterial Hypertension [20]. Having the elder in a sitting position after a 10-minute rest and with the right arm supported at heart level, the device cuff (adjusted to the arm size) was placed circa 3cm above the antecubital fossa, placing the center of the bladder over the brachial artery pulse. SBP and DBP values obtained were used to calculate MAP using the equation: MAP = DBP+ [(SBP DBP) ÷ 3] [21]. PP was determined by the equation: PP = SBP – DBP [21]. During four weeks, the participants were informed about the adequate execution of each exercise. Then, in order to become familiar with the exercises, they performed two sessions of two sets of 12-15 submaximal repetitions in the exercises 45º leg press (=40kg), bench press (=10kg) and biceps curl (=6kg). After that, the 1-RM tests were performed in four different days, with a 10-minute interval, by the same evaluator, according to recommended descriptions [22]. The strength training consisted of 13 exercises alternating between sets of upper and lower body exercises in the following order: 45º leg press, barbell bench press, knee extension, low row, and cable elbow extension, knee flexion, standing elbow extension, smith machine calf raise, adduction chair, abduction chair and two sets of 20-30 repetitions of abdominal exercises. The exercises lasted 12 months and was performed twice a week with three sets of 8-12 maximum reps (8-12RM) for each exercise, each repetition lasting 3-4 seconds. The exercises intensity was readjusted every session in order to ensure the RM zone. Blood samples (3mL) were drawn from antecubital vein in vacuum centrifuge tubes for 20 minutes at 4ºC and 2500rpm; later, serum was separated in aliquots of 500 µL and stored in a freezer at –80ºC waiting for analyses. ELISA method determined the resistin dosage according to the specifications of the High Sensitivity Kit RayBioTM (Ray Biotech, Inc., Norcross, GA, USA). In order to ensure accuracy of results, all dosages were determined in duplicate and presented in pg/mL. Regarding the statistical analyses, all data were expressed in mean ± standard deviation (SD). Initially, Shapiro-Wilk (normality) and Levene's tests were performed, followed by ANOVA (repeated measures), to compare moments Pre-, 6 months and 12 months. In order to assess potential correlations between resistin X blood pressure, resistin X muscular strength and strength X blood pressure, Pearson's r was applied considering the following classification: Null=0.0; weak=0.01-0.3; regular=0.31-0.6; strong=0.61-0.9; very strong= 0.91-0.99; and full=1.0 [23]. For all calculations the critical value was set at 5% (p<0.05). The participants signed the free informed consent form and then the research was carried out.

Results

After 12 months of strength exercises, no significant alterations occurred in body weight (67.5kg

± 10.8 versus 66.5kg± 10.9) or body mass index (28.0kg/m^2 ±4.9 versus 27.5kg/m^2 ±4.5). However, there was a significant reduction in SBP within 6 months (–3.6mmHg) and 12 (–4.8mmHg) months, if compared to the pre-exercises moment Fig. (1). There was a significant reduction in serum resistin concentration in all moments (pre X 6 months; pre X 12 months; 6 months X 12 months) assessed (Table 2). There was a 46%-reduction after 12 months of strength exercises. A significant increase in muscular strength was observed in the 45º leg press, bench press and elbow flexion (Table 3) in all the moments (pre X 6 months; pre X 12 months; 6 months X 12 months). There was an increase of 98.5% in 45º leg press; 29.6% in bench press and 26.5% in biceps curls within 12 months. Table (4) shows the correlation coefficients between resistin, SBP and muscular strength. There is a very strong positive correlation between resistin X SBP; and there is a very strong negative correlation between resistin X muscular strength and muscular strength X SBP.

Table (1): Blood pressure value in pre, 6 months and 12 months of strength exercises program.

	Pre	6 months	12 months
SBP mmHg	120.5± 1 1.86mmHg	116.9±01.11 mmHg	115.8± 1.6mmHg
DBP mmHg	80.4± 13.68mmHg	79.2±33.48mmHg	79.9±21.38mmHg

Table (2): Serum resistin concentration in moments pre, 6 months and 12 months of strength exercises program.

	Pre	6 months	12 months
Resistin (pg/ml)	30272.49±8100.15	20114.52±4416.50	16350.62±2404.67

Data are expressed as mean ± SD (n=23).
Pre: Assessment before the start of the strength exercises program.
* : p<0.01 in comparison to pre-exercises moment.
p<0.01 in comparison to 6 months. ANOVA test (repeated measures).

Table (3): Maximum strength in the moments pre, 6 months and 12months of the strength exercises program.

Exercises	Pre	6 months	12 months
45º leg press (kg)	172.35±27.35	226.96±31.36	348.64±40.82
Bench press (kg)	31.95±4.18	38.73±6.03	41.80±5.61
Elbow extension (kg)	21.00±2.43	23.31±2.67*	26.56±2.91

Data are expressed as mean ± SD (n=23).
Pre: Data are expressed as mean ± SD (n=23).
Pre: Assessment before the start of the strength exercises program.
*: p<0.01 in comparison to pre-strength exercises moment.
#: p<0.01 in comparison to 6 months. ANOVA test (repeated measures).

Table (4): Correlation coefficient between physiological variables at rest.

Correlations	r	Classification	p-value
Resistin X S.B.P	0.99	Very strong	0.02
Resistin X muscular strength	0.98	Very strong	0.01
Muscular strength X S.B.P	0.97	Very strong	0.01

r: Pearson's correlation coefficient.
*: Classification of coefficient according to Albuquerque et al. (2010).

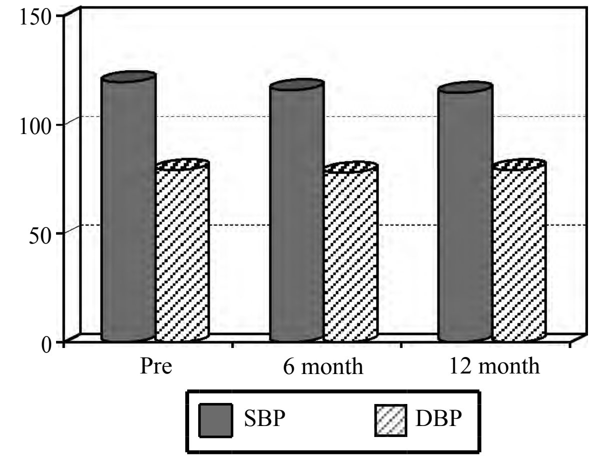

Fig. (1): Blood pressure values (mean ± SD, n=23) in the moments pre, 6 months and 12 months of strength exercises program.

Pre : Pre-exercises moment.
SBP : Systolic Blood Pressure.
DBP : Diastolic Blood Pressure.
Δ : Absolute value of reduction in comparison to pre-exercises moment.
* : $p<0.05$ in comparison to pre-exercises moment.

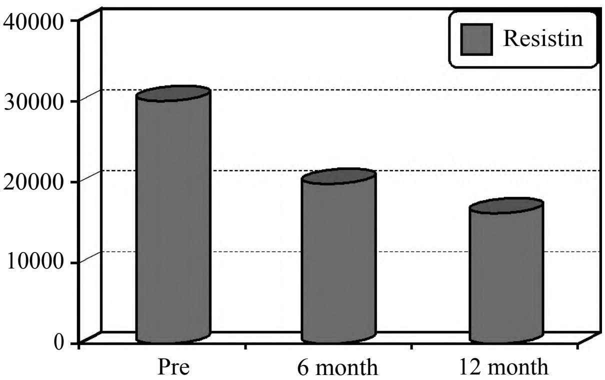

Fig. (2): Serum resistin concentration in moments pre, 6 months and 12 months of strength exercises program.

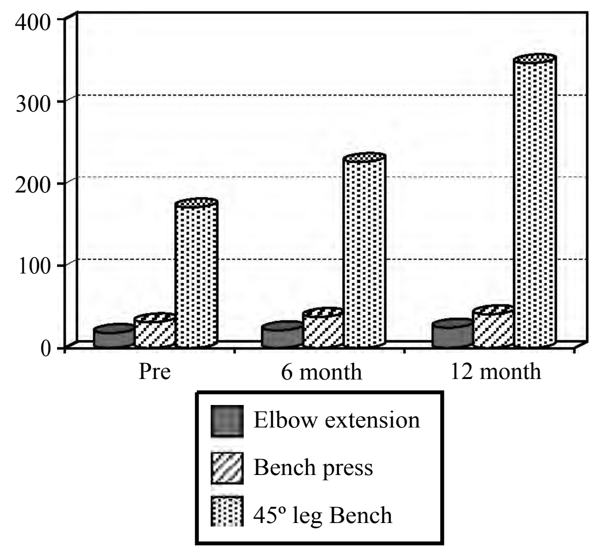

Fig. (3): Maximum strength in the moments pre, 6 months and 12 months of the strength exercises program.

Discussion

This study aimed to assess the effects (12 months) of strength exercises on hemodynamic variables and serum resistin concentration in post-menopausal women. The hypothesis was partially confirmed, and there was a clinically significant reduction in SBP values and serum resistin levels. However, there were no alterations in DBP, MAP and PP values within 12 months of strength exercises. Additionally, there was a strong correlation between SBP, resistin, muscular strength. As it was expected, the strength exercises program increased muscular strength of the muscle groups assessed. Regarding blood pressure control. The American College of Sports Medicine [24]. Additionally, American Heart Association [25]. Recommend strength exercises as a form of prevention and/or non-drug therapy for cardiovascular diseases in women and elders. In this research, there was a reduction of 4.8mmHg in SBP values and DBP was maintained (4% and 2%, respectively) at rest after 12 months of strength training. These results corroborate the findings of a meta-analysis [26]. That found a reduction of 2% and 4% in SBP and DBP values, respectively. Another meta-analysis of nine randomized controlled studies observed a reduction of 3.2 and 3.5mmHg in SBP and DBP, respectively [27]. Although the reduction in SBP values of the aforementioned studies is small, it is clinically important and strongly related to the reduction from 5% to 9% in cardiac death, 8% to 14% in the occurrence of cerebrovascular accident and 4% in mortality by all the causes [28]. Among the physiological mechanisms involved in blood pressure control, the number and caliber of small arteries and arterioles stand out with an important role in the control of total peripheral resistance and MAP [21]. In clinical practice, blood pressure is defined by the values of SBP and DBP. However, a more detailed analysis of the arterial pressure curve should take into account the sum of the mean component the MAP-and the pulse component-the PP. The MAP is the pressure for the proper delivery of blood flow and oxygen to tissues and organs, depending mainly on cardiac output and peripheral vascular resistance. PP is characterized by the role of major arteries that minimize the plausibility and depends on ventricular ejection, arterial stiffness and the timing of wave reflection [29]. MAP and PP are associated with the adequate control of blood pressure and independent cardiovascular risk factors, especially for cardiac death in women between 50 and 60 years old [21]. Thus, it is evident the clinical importance of this research, which, in addition to the reduction of SBP, promoted the maintenance of MAP and PP during 12 months of strength exercises program. Evidences show that age induces the onset of aging-associated diseases and disturbs (breast cancer, osteoporosis, cardiovascular diseases, etc.), in post-menopausal women which are common and are associated with high morbidity and mortality rates in this population [30].Evidences show that resistin is an inflammatory marker and has been associated with the onset of cardiovascular diseases [6]. Furthermore, there is a negative correlation between physical activity and the levels of circulating inflammatory mediators [31]. There was an association of resistin levels, senile inflammation and vascular disorders with increased incidence of hypertension in post-menopausal women over 55 years old [6]. This study observed a reduction of 46% in serum resistin concentration and a strong correlation between SBP and resistin after 12 months of strength exercises, may contribute to the reduction of senile inflammation and cardiovascular risk in the group of postmenopausal women [32,33]. Confirm the results of this study concerning the increase in muscular strength. There has been an increase in resistance and walking speed, climbing up stairs and dynamic balance, with consequent fall prevention [28]. It was also observed a reduction serum resistin levels after 16 weeks of ST in postmenopausal women [10]. One of the aspects that should be highlighted in this research is that the reduction of serum resistin levels and the increase in muscular strength occurred after 6 and 13 months of training. The strong inverse relation between SBP and muscular strength was also another interesting finding. Previous studies conducted with sedentary middle-aged women have showed similar results [6,14]. Furthermore, there have been higher incidences of arterial hypertension in men with low muscular strength [34] and mortality in middle aged and elderly men with hypertension and low muscular strength [35]. A possible beneficial relationship between the increase in muscular strength and the reduction in blood pressure may be explained by the peripheral arterial complacency reduction, which occurs during exercises that require muscular strength. This alteration in complacency is a long-term protective effect caused by changes in the smooth muscle tissue of arterial walls and in collagen and elastin properties, which partly reduces blood pressure at rest [36]. Additionally, the results from a control group do not show a positive effect on muscular strength and cardio vascular risk factors [37,38].

Conclusion:

Finally, the levels of resistin and systolic blood pressure of the patients assessed reduction in the 12-month strength exercises promoted an increase in muscular strength. These adaptations are very important to the reduction of the risk of diseases and cardiovascular events in postmenopausal women, highlighting the clinical importance of ST to this population.

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تآثير التمرينات على مصل ريساستين الدم لدى سيدات الضغط المرتفع بعد إنقطاع الطمث

الهدف من هذه الدراسة: هو تقيم تآثير تمرينات التقوية على مصل ريساستين الدم لدى سيدات الضغط المرتفع بعد إنقطاع الطمث.

مواد وآساليب البحث: تم إجراء ذلك البحث على ٢٣ سيدة بعد إنقطاع الطمث لديهم فرط ضغط الدم الشريانى والتى تتراوح آعمارهم بين (٦١.٣٣±٣.٨ سنة) وطولهم بين (١٤٨.٥±٣٢.٧ سم) وزنهم ما بين (٦٧.٥٦±١٠.٨٥ كجم) إستمرت دراسة برنامج التدريب لتقوية العضلات لمدة ١٢ شهرا لقياس تآثير مستوى مصل ريساستين الدم على ضغط الدم الشريانى بمقارنة برنامج التقوية (قبل وبعد ٦، ١٢ شهر) لإيجاد العلاقة بين مستوى مصل ريساستين الدم وضغط الدم الشريانى والعلاقة بين مستوى مصل ريساستين الدم والقوة العضلية وضغط الدم الشريانى مع القوة العضلية.

آثبتت نتائج التحاليل الإحصائية للبحث: إن برنامج التدريب لتقوية العضلات آدى إلى معدل إنخفاض مستوى مصل ريساستين الدم من (٣٠٢٧٢.٤±٨١٠٠.١) إلى (١٦٣٥٠.٦±٢٤٠٤.٦) ملى/جرام، وإنخفاض ضغط الدم الشريانى من (١٢٠.٥±١١.٨) إلى (١١٥.٨±١.٦) وزيادة القوة العضلية لتمرين ضغط الرجل ٤٥° (١٧٢.٣±٢٧.٣) إلى (٣٤٨.٦±٤٠.٨) كجم، وتمرين ضغط المقعد (٣١.٩±٤.١) إلى (٤١.٨±٥.٦) كجم، وتمرين فرد مفصل الكوع من (٢١.٠±٢.٤) إلى (٢٦.٥±٢.٩) كجم بعد ١٢ شهرا.

الملخص: تمارين القوة العضلية طويلة المدى تعمل على إنخفاض ضغط الدم الشريانى وإنخفاض مستوى مصل ريساستين الدم الذى لديه تغير فسيولوجى على الآقلال من مخاطر آمراض القلب والآوعية الدموية لدى السيدات بعد إنقطاع الطمث.