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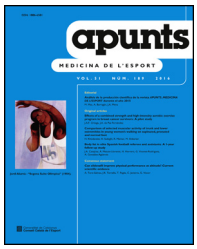

ORIGINAL ARTICLE

Effect of involved muscle mass in resistance exercise on post exercise blood pressure and rate pressure product

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KEYWORDS
Resistance training;
Body regions;
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Abstract As the blood pressure (BP) and heart rate (HR) response during the recovery period can be influenced by size of activated muscle mass, it is possible that this variable also has some distinct effects on post-exercise rate pressure product (RPP). The aim of the present study was to investigate and compare the systolic (SBP) and diastolic blood pressure (DBP), HR, and RPP responses during recovery to resistance exercise with different body regions.

Twelve normotensive young men randomly performed three resistance exercise trials with upper limbs (UL), lower limbs (LL), and whole body (WB), and a control session (CON). All exercise trails included 3 sets of 10 repetitions, with 65% of 1-repetition maximum (1RM) with 2 min rest interval between sets and exercises. SBP, DBP, HR, and RPP were measured before and at each 15 min after exercise until 60 min. Blood lactate (bLAC) was also measured before, and at the 1st minute after the end of exercise. Analysis of variance (ANOVA) and Bonferroni post hoc were used to analyze the data, with a $p < .05$.

The SBP decrease for 60 min after UL, LL, and WB exercise trials was similar, whereas there was no change in post-exercise DBP after the trials. Significant increases were observed in RPP for 15 min after LL, and 30 min after UL and WB. The blood lactate concentration significantly increased after UL, LL and WB resistance exercise when compared to the rest values, as well as in the CON sessions.

UL, LL and WB resistance exercise lead to post-exercise hypotension, similar in magnitude and duration, and almost produce the same cardiovascular responses, despite different muscle mass involvement.

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PALABRAS CLAVE
Entrenamiento de resistencia;
Regiones corporales;
Presión arterial;
Hipertensión postejercicio

Efecto de la masa muscular implicada en los ejercicios de resistencia sobre la presión arterial postejercicio y el producto frecuencia-presión

Resumen La presión arterial y la frecuencia cardíaca (FC) durante el período de recuperación pueden estar influenciadas por el tamaño de la masa muscular activa, y es posible que esta variable también tenga algunos efectos diferentes sobre el doble producto en el postejercicio (RPP). El objetivo del presente estudio fue investigar y comparar la presión arterial sistólica (PAS) y la presión arterial diastólica (PAD), la FC y el RPP durante la recuperación de ejercicio de resistencia con distintas regiones del cuerpo.

Doce jóvenes normotensos realizaron al azar 3 ensayos de ejercicio de resistencia con los miembros superiores (MS), los miembros inferiores (MI) y todo el cuerpo (TC), y una sesión de control (CON). Todos los tipos de ejercicio incluyeron 3 series de 10 repeticiones con un 65% de 1RM con 2 min de intervalo de descanso entre series y ejercicios. La PAS, la PAD, la FC, y el RPP se midieron antes y cada 15 min después del ejercicio, hasta 60 min. El lactato sanguíneo (lacS) también se midió antes y en el primer minuto después del ejercicio. Los análisis de varianza (ANOVA) y de Bonferroni post hoc se utilizaron para analizar los datos a $p \leq 0,05$.

La PAS disminuyó durante los 60 min postejercicio de MS, MI y TC de manera similar, mientras que después del ejercicio la PAD no mostraba ningún cambio. Se observaron aumentos significativos en RPP durante 15 min después del elercicio de MI y 30 min después del de MS y de TC. La concentración lacS aumentó significativamente después del ejercicio de resistencia de MS, de MI y de TC en comparación con los valores de descanso, así como sesiones CON.

Los diferentes ejercicios de resistencia de MS, MI y TC provocan una hipotensión post ejericio de similar magnitud y duración y casi producen las mismas respuestas cardiovasculares, a pesar de que en ellos participa una masa muscular diferente.

Introduction

Hypertension, a main contributing cause of heart disease, is a major public health problem in the world. Physical activity has been recommended as a non-pharmacological alternative in the prevention and treatment of the arterial hypertension.[1] Recently, attention has been paid not only on the cardiovascular benefits of exercise training, but also on the effects of one acute exercise session. After an acute exercise bout, blood pressure (BP) levels are reduced for minutes or hours in relation to pre-exercise levels.[2–4] This phenomenon is called post-exercise hypotension (PEH) and has been widely investigated because of its importance for the prevention and treatment of arterial hypertension.[1,2,4,5] PEH has been demonstrated after aerobic exercise[1] while controversial results have been observed after resistance exercise. Investigators reported increase,[6] decrease[7–10] or no change[11,12] in BP after resistance exercise. Also, there are few studies in the literature regarding to investigation and comparison of the hypotensive effects of resistance exercises performed with upper limbs (UL), lower limbs (LL) and whole body (WB). Most studies on WB resistance exercises used several exercise that each one targeting a specific muscle group, involving UL and LL. In this case, Simão et al.[13] verified that a single bout of conventional regimen (6-repetition maximum [6RM]) or circuit (50% of 6RM) resistance exercise produces a significant PEH in normotensive subjects, while others[12] observed no change in BP after WB resistance exercise. PEH of systolic blood pressure (SBP) and no change of diastolic blood pressure (DBP) are shown after both UL and LL resistance exercises.[14] However, some studies observed PEH of SBP only after LL resistance exercise.[15]

The possible mechanisms underlying PEH include a reduction of sympathetic nerve activity and decreased vascular responsiveness to α-adrenergic receptor activation, which elicit a sustained reduction of peripheral vascular resistance.[16] Taking into account vasorelaxation effects, local substances released by exercising muscles may also be involved in PEH.[3] At the same relative exercise intensity, the total active muscle mass and absolute metabolic rate would be greater for WB, LL and UL resistance exercise, respectively. It also follows that while intramuscular concentration of metabolites and ions (e.g., adenosine and K+) would be similar for the three modes of exercise, the absolute production of these vasodilator substances and release into the circulation would be greater with WB resistance exercise. Therefore, it can be expected that WB, LL and UL resistance exercise lead to greater decline in BP, respectively, if PEH is mediated by some peripheral factors.

It has been well established that higher size of exercising muscle mass and higher produced metabolites as a result of rose cellular activity can contribute to stimulate increases in HR during resistance exercise.[17] The magnitude of neural and hemodynamic responses during resistance exercise is related to size of activated muscle mass.[17] Thus, it is possible that activated muscle mass has also different effects on cardiovascular changes after resistance exercise. In this

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