145 - PRESSOR RESPONSE OF STRENGTH TRAINING IN DIFFERENT PERIODS OF THE DAY IN NORMOTENSIVE

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INTRODUCTION

There are many studies on the blood pressure (BP), involving the systolic and diastolic response of the cardiovascular system. However, there is a lack of studies related to training in resistance exercises that involve the difference in blood pressure in different shifts of day.

The interest in the area of strength training, and also by the need to have a reference on the pressure response at different times of day, Trassem the objective of the study. Therefore, the purpose of this study was to determine whether there is any significant change in blood pressure in males, group exercises held overhead in three shifts a day, on different days.

The blood pressure according to Powers (2005), is the force exerted by blood against the arterial walls, as determined by the amount of blood pumped and the resistance to blood flow. It is usually expressed in millimeters of mercury (mmHg) (Simões, 2005).

The ACSM (American College Sports Medicine) (2003) classifies blood pressure as follows for adults aged 18 years or more:

SYSTOLIC BP (mmhg)	Category	DIASTOLIC BP (mmhg)
< 120	Excellent	<80
120 – 129	Normal	80 – 84
130 – 139	Normal High	85 – 89
140 – 159	Stage 1 Hypertension	90 – 99
160 = 179	Stage 2 Hypertension	100 – 109
>= 180	Stage 3 Hypertension	>= 110

Krieger (1999), states that the cardiac output (CO) and peripheral vascular resistance (PVR), are determinants of blood pressure, or any change in DC, or PVR, interferes with normal blood pressure levels.

Cardiac output is the total volume of blood pumped by the heart per minute (ml / min) and is a product of heart rate (HR), the stroke volume (SV). It is usually recorded in liters or milliliters (Uchida, 2006).

Irigoyen (2003), states that blood pressure can be regulated through some complex and redundant mechanisms that determine appropriate adjustments in heart rate and cardiac contractility, the contractility of vessels, and capacitance and distribution of fluid inside and outside the vessel , ie the neuro-hormonal regulation via the arterial baroreceptors and by means of the renin-angiotensin-aldosterone system.

To measure blood pressure, there are some methods, and the most widely used in clinical practice according to the V Brazilian Guidelines on Hypertension is the method with the auscultatory technique and with the mercury sphygmomanometer or aneroid.

STRENGTH TRAINING

Today, the capitalist world, has as a requirement, a stable financial life, which can result in work overload, reducing the availability of time, generating a sedentary lifestyle, poor diet, resulting in a lack of physical activity, increased body fat, thus causing chronic degenerative diseases such as hypertension.

In terms of recommendations for physical exercise, particularly suitable are the aerobic and resistance, generating an impact on resting metabolism, which is responsible for 60% to 70% of total energy expenditure, contributing to weight loss and decreased risk of developing degenerative diseases including hypertension (CIOLAC, 2007).

Forjaz (2003), states that resistance training can also be very effective and safe for normotensive and hypertensive population. Thus confirming that resistance exercise has been used in cardiac rehabilitation programs, providing benefits such as lower risk and contributing to the reduction and maintenance of resting blood pressure (BERMUDES, 2003).

Resistance exercise or resistance are also known as weight training. The terms resistance training, weight training and strength training has been used to describe a type of exercise that requires the muscles of the body promotes movement (or try to move) against an opposition force and generally carried on by any type of equipment (JUNIOR Kohlmann, 1996).

Kohlmann (1996) also states that the cardiovascular adaptations happen in a way similar to what happens to skeletal muscle. The heart muscle also suffers adaptations with strength training. Like all other adaptations of resistance training, the responses are dependent in part on the strength of the volume.

Fleck (2007), states that the acute response to strength training refers to the physiological responses during a series of exercises, or multiple sets of an exercise or a training session. "The intra-arterial catheterization is needed to determine more accurately the PA, as can also be measured with a sphygmomanometer during concentric and eccentric phases of repeats.

According to Fleck and Dean (1987); MC Dougall et al (1985), Sale et al (1994), both BP and HR increased with the progression of the series, then the highest values occurring during the last repetitions of the series until the volitional fatigue, the Valsalva maneuver is executed or not.

Heart rate and systolic and diastolic blood pressures increase substantially during exercise of high intensity dynamic strength (Fleck, 1988; HILL & BUTLER, 1991). Values of systolic and diastolic BP may reach high levels when atigem 320mmHg and peak HR of 170 bpm, this has been shown during the execution of a series of leg-press. Both BP and HR increased with the progression of the series. (MC Dougall et al, 1985)

CIRCADIAN CYCLE

According to Kolb and Whishaw (2001), states that all organisms, have alternating patterns of daily rest and activity. When a body is placed in constant conditions of light or darkness, this rhythm persists, apparently due to its internal clock. In mammals, the clock seems to be localized in the nucleus supra-chiastic the hypothalamus, which receives sensory information on light cycles from the eyes. The authors also claim that, in humans, our main discussion period is marked by the behavior known as sleep.

Arthur Guyton (1996) asserts that one of the major mysteries of brain function is the daily cycle of sleep and

wakefulness. Even when a person remains in total darkness or under permanent lighting, still retains the same cycle of sleep - waking at intervals of about 24.

Sleep is a state of inactivity easily reversible, unlike the coma. It is characterized by a lack of interaction with the external environment. During some periods of sleep, sensory stimuli and motor responses of the brain are interrupted.

Commonly, the nervous system shows signs of fatigue just before falling asleep and showed signs of having rested after sleeping over. It thus appears that fatigue plays a role in neuronal causes of sleep and that sleep, in turn, relieves fatigue. Guyton (1996) also states that the physiological studies on the brain have shown that when a person is awake, many impulses are continually, incessantly, by the nervous system. However, during most sleep stages, considerably smaller numbers of pulses are recorded. Thus, wakefulness appears to be caused by high level of brain activity, while the sleep is caused by decreased level. This process is associated with a low peripheral vascular tone as many other body functions. Moreover, there is a decrease from 10 to 30% of blood pressure, and respiratory rate and intensity of metabolism.

THEORY OF SLEEP

The sleep-wake rhythms, similar to other biological cycles, cycles are usually 24-hour light-dark like a day ago, and are known as circadian rhythms [circa, about dies, day] (Kolb & Whishaw, 2001).

Sleep is a complex consisting of at least four stages. Sleep also appears to include a rhythmic component that lasts about 90 minutes, in which the EEG (electro encephalogram) becomes gradually slower and then faster. Finally, in one of these stages, the sleeping brain is a waking EEG in the motor system is paralyzed, except for minor shakes and people have more vivid dreams than in other sleep stages (Kolb & Whishaw, 2001).

The REM (rapid eye moviments), a person goes through a dream state, associated with minor involuntary muscle jerks and rapid movements of the eyes. These rapid movements of the eyes (in English: rapid eye moviments) gave this sleep stage name: REM sleep.

The electrostatic encephalographs recorded during these periods showed significant brain activity while it is more difficult to wake a person during REM sleep than during other phases of sleep. Muscle tone throughout the body is diminished almost to zero, the heart rate might be 20 beats below normal and the blood pressure decreased by up to 30mmHg. So the person seems, in physiological terms, in deep sleep, instead of light sleep, dreaming and despite his being very active electroencephalogram.

If REM sleep BP may reach values up to 30mmHg, maybe that shows that sleep can interfere with blood pressure. As already discoursed sleep is related to the circadian cycle which can affect blood pressure, making the proposed work is relevant periods of changing blood pressure measurement. Because of this behavior can be said that the various characteristics or behaviors that can influence this aspect, is often associated with the time when we dream, the heart and respiratory rates usually become irregular, which is characteristic of the dream state.

REM sleep occurs about 3 to 4 times during the night, at intervals of 80 to 120 minutes, with each episode lasting 50 to 30 minutes until 50% of the sleep cycle of a baby are occupied by REM sleep in adults about 20%.

According to Guyton (1996), the causes of REM sleep and its cyclical pattern are still unknown. It has been asserted by some psychologists that the lack of REM sleep a person can develop severe psychotic instability.

Guyton (1996), states that the sympathetic stimulation caused by waking moderately elevates blood pressure, increases the intensity of metabolism in all body tissues and, in general, just makes your body is ready to work even harder. This means that the better an individual to sleep, the greater their use for your day, less fatigue, lower stress, less fatigue, ie more time executing their daily activities.

After the long sleep, all parts of the nervous system will usually regains its normal levels of excitability and returning to a state of serenity (Guyton, 1996). It also cites the lack of sleep does not directly affect the intrinsic functions of the different organs. However, lack of sleep often causes severe autonomic disturbances, and these, in turn, by indirection, they cause gastrointestinal disturbances, loss of appetite and other deleterious effects. Thus, sleep loss can affect the whole body besides the nervous system itself that is directly related to PA.

METHODOLOGY

The study is quantitative, descriptive and exploratory and comparative study.

The sample consisted of a volunteer group of males aged between 18 and 30 years, with a single group with 10 individuals each with at least 6 months experience in strength training and diagnosed as normotensive. All study participants had a brief explanation of the research and everyone agreed that signed the Informed Consent (Term of Consent).

The procedure used initially, was that individuals travel through the 1RM test to determine 85% of its maximum load for which the tests were carried out uniformly for all, that is, all subjects performed the test with 85% of its maximum load in all three types of exercises were the leg extension (leg extension), leg press (leg-press 45) and leg flexion (hamstring curl). For there to be greater reliability in the study and a minimization of the variables that could alter the blood pressure was done before all tests in all periods with the following questions: What time did you sleep last night?, How many hours you sleep last night? ; you consider that she slept: bad () good () good (); you consider that this tired () rested (); You went through some stress over the past two days?. If the individuals before conducting the tests had answered any questions differently to the previous day of testing, no testing was performed.

All subjects before starting the tests had their blood pressure measured at rest. After measured the resting pressure was initiated tests.

The tests were identical in all periods in which the exercises were performed, ie in the morning, afternoon and evening. Measurements of blood pressure (systolic and diastolic) were obtained using a sphygmomanometer anaeróide Premium brand with dimensions of the rubber bag for adults with capacity of up to 300mmHg, calibrated and validated in accordance with the guidelines of the Brazilian Society of Cardiology and a stethoscope from the same brand. At the beginning of each session, we measured the pressure of each of the individuals chosen before starting the exercises with the weights. The subjects performed a single sequence of exercises, so that research had validity. Was performed three sets of ten repetitions of each exercise, and at the end of each series of exercises pressure was measured on the individual. Participants performed the exercises for three alternate days at different times, the pressure was measured before and after the end of each series of training of the individual. It was following the same sequence of machines for all individuals, ie, leg extension, leg press 45, leg curl.

In the statistical study we have used statistical parametric aims to organize, describe and present the data so that it can meet the objectives of the study, using the program SPSS, version 16.0 checking the mean and standard deviation.

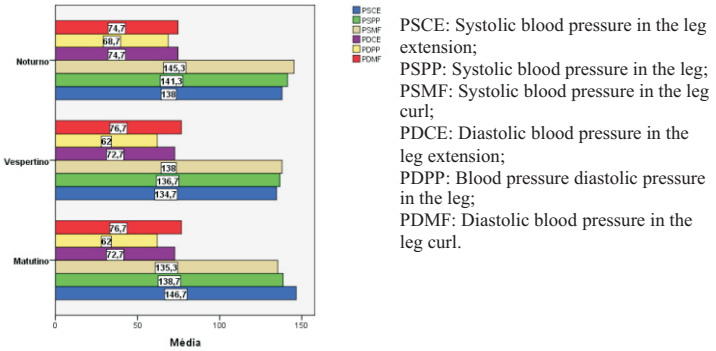
It was considered statistically significant when $P < 0.05$ was used and analysis of variance (ANOVA).

ANALYSIS AND DISCUSSION OF RESULTS

The search results in all three periods in which it was performed tests are collected data of systolic and diastolic, the chart below shows the colors through the exercises that were performed. The blue color indicates the values of systolic pressure

in the leg extension in the three periods of the day, an average of 146.7 mmHg in the morning, 134.7 mmHg in the afternoon, and 138mmHg at night. In lilac values of diastolic pressure in the leg extension in the three periods of the day, an average of 72.7 mmHg in the morning, 72.7 mmHg in the afternoon, and 74.7 mmHg at night. Green shows the values of systolic pressure in the leg press in a three day period, with an average of 138.7 mmHg in the morning, 136.7 mmHg in the afternoon, and 141.3 mmHg at night. The yellow color indicates the values of diastolic pressure in the leg press in a three day period, with an average of 62mmHg in the morning, 62mmHg in the afternoon, and 68.7 mmHg at night. Gray indicates the values of systolic pressure in the leg curl the three periods of the day, an average of 135.3 mmHg in the morning, 138.7 mmHg in the afternoon, and 145.3 mmHg at night. And the color red indicates values of diastolic pressure in the leg curl the three periods of the day, an average of 76.7 mmHg in the morning, 76.7 mmHg in the afternoon, and 74.7 mmHg at night. With these data, we concluded that there was a small difference, but there was no significance in blood pressure, as the results exceeded the value of $p \leq 0.05$.

Analyzing the unknowns, set forth herein, we can see that more specific information about the conditions of blood pressure in different shifts of day can help physical education teachers in the prescription of strength training to their customers. We noticed that the fact that individuals had not submitted indices of changes in blood pressure at different times does not mean that all individuals behave similarly, including individuals classified as hypertensive. Another relevant factor is that individuals are trained for at least six months and are classified as intermediate and advanced, and may already have a physiological adaptation to exercise.



PSCE: Systolic blood pressure in the leg extension;
PSPP: Systolic blood pressure in the leg;
PSMF: Systolic blood pressure in the leg curl;
PDCE: Diastolic blood pressure in the leg extension;
PDPP: Blood pressure diastolic pressure in the leg;
PDMF: Diastolic blood pressure in the leg curl.

This table shows that no significant change in the periods in which the tests were performed.

	MORNING	VESPERTINE	NIGHT
PSCE	146,7	134,7	138
PDCE	72,7	72,7	74,7
PSPP	138,7	136,7	141,3
PDPP	62	62	68,7
PSMF	135,3	138,7	145,3
PDMF	76,7	76,7	74,7

FINAL

Through this study reached the following basic conclusions: that there is significant change in blood pressure in different shifts of the day with resistance exercise during periods in which the tests were performed.

Blood pressure is widely studied, but we believe this study has contributed to a poorly investigated area of study which are the shifts and the circadian cycle. The research may help professionals in physical education, prescription of exercises on different shifts and with this suggestion is the development of other similar studies involving different samples with different audiences and samples. And for the professionals who work with strength training to undertake training without the worry of significant change in blood pressure at different times of day.

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PRESSOR RESPONSE OF STRENGTH TRAINING IN DIFFERENT PERIODS OF THE DAY IN NORMOTENSIVE

ABSTRACT

The research aimed to analyze the behavior of blood pressure during strength training at different times of day, i.e., in three shifts, morning, noon and night. The sample comprised 10 individuals, male, 18-30 years, normotensive, healthy and without use of any drug that may interfere with blood pressure, and had experience and knowledge in fitness, i.e., practitioners and advanced intermediates . The volunteers performed resistance exercises for the legs, into equipment, leg extension (leg extension), leg press (pressure leg), leg curl (leg curl) in a uniform fitness workout with 3 sets of 10 repetitions. The subjects answered a questionnaire before starting to run the tests and signed the informed consent (IC). Pressure was measured at rest preceding the execution of the first series and after gauging the end of the series in all units following the same order of execution of the unit for all individuals, leg extension, leg press and leg curl. The load was determined using the 1RM test, calculating 85% of the maximum load of each individual. At the end of the study we can conclude that there was a change in blood pressure at the end of the exercises, but there was no significant change at different times of day. However, our research may help to have possible studies involving the circadian cycle in various other forms of physical activity.

KEY - WORDS: 1. Blood pressure. 2. Strength training. 3. Circadian rhythm.

RÉPONSE PRESSIVE DE LA MUSCULATION À DIFFEÉRENTES PÉRIODES DU JOUR NORMOTENDUS

RÉSUMÉ

La recherche visait à analyser le comportement de la pression artérielle au cours de l'entraînement en force à différents moments de la journée, c'est à dire, en trois équipes, matin, midi et soir. L'échantillon comprenait 10 personnes, hommes, 18-30 ans, normotendus, sain et sans utilisation de tout médicament qui peut interférer avec la pression sanguine, et avait l'expérience et la connaissance de la condition physique, c'est à dire, intermédiaire et avancé des praticiens . Les bénévoles effectué des exercices de résistance pour les jambes, dans les équipements, extension des jambes (leg extension), appuyez sur la jambe (la jambe de pression), flexion des jambes (jambes curl) dans un entraînement de fitness uniforme avec 3 séries de 10 répétitions. Les sujets ont répondu à un questionnaire avant de commencer à exécuter les tests et signé le consentement éclairé (IC). La pression a été mesurée au repos précédant l'exécution de la première série de mesure et après la fin de la série dans toutes les unités dans le même ordre d'exécution de l'unité pour toutes les personnes, extension des jambes, appuyez sur la jambe et flexion des jambes. La charge a été déterminée en utilisant le test 1RM, le calcul de 85% de la charge maximale de chaque individu. À la fin de l'étude, nous pouvons conclure qu'il ya eu un changement de la pression artérielle à la fin des exercices, mais il n'y avait aucun changement significatif à différents moments de la journée. Cependant, notre recherche peut aider d'avoir des études possibles impliquant le cycle circadien dans diverses autres formes d'activité physique.

MOTS - CLÉS: 1. Pression artérielle. 2. La musculation. 3. Le rythme circadien

COMPRESOR DE RESPUESTA DE ENTRENAMIENTO DE FUERZA EN PERIODOS DISTINTOS DEL DÍA NORMOTENSAS

RESUMEN

La investigación tuvo como objetivo analizar el comportamiento de la presión arterial durante el entrenamiento de fuerza en diferentes momentos del día, es decir, en tres turnos, mañana, tarde y noche. La muestra está compuesta por 10 personas, hombres, años 18-30, normo tensos, saludable y sin el uso de un medicamento que pueda interferir con la presión arterial, y la experiencia y conocimientos en física, es decir, intermedio y avanzado profesionales. Los voluntarios realizan ejercicios de resistencia para las piernas, en el equipo, extensión de piernas (extensión de la pierna), prensa de la pierna (pierna de presión), curl femoral (pierna rizo) en una sesión de ejercicios de fitness uniforme con 3 series de 10 repeticiones. Las personas que respondieron a un cuestionario antes de comenzar a ejecutar las pruebas y firmado el consentimiento informado (CI). La presión se mide en reposo antes de la ejecución de la primera serie y después de medir el final de la serie en todas las unidades en el mismo orden de ejecución de la unidad de todas las personas, extensión de piernas, prensa de piernas y enrollamiento de la pierna. Al final del estudio se puede concluir que hubo un cambio en la presión arterial al final de los ejercicios, pero no hubo ningún cambio significativo. Sin embargo, nuestra investigación puede ayudar a que los posibles estudios que involucra el ciclo circadiano en varias otras formas de actividad física.

PALABRAS - CLAVE: 1. La presión arterial. 2. El entrenamiento de fuerza. 3. El ritmo circadiano.

RESPOSTA PRESSÓRICA DO TREINAMENTO DE FORÇA EM DIFERENTES PERÍODOS DO DIA EM INDIVÍDUOS NORMOTENSOS

RESUMO

A pesquisa teve como objetivo a análise do comportamento da pressão arterial durante o treinamento de força em diferentes horários do dia, ou seja, nos três turnos, manhã, tarde e noite. A amostra foi composta por 10 indivíduos, do sexo masculino, de 18 a 30 anos, normotensos, saudáveis e sem uso de qualquer medicamento que venha interferir na pressão arterial, e que tinha experiência e conhecimento em musculação, ou seja, praticantes intermediários e avançados. Os voluntários realizaram exercícios resistidos de membros inferiores, nos aparelhos: cadeira extensora (extensão de perna), leg-press (pressão de perna), mesa flexora (flexão de perna) em um treino uniforme de musculação com 3 séries de 10 repetições. Os indivíduos responderam a um questionário antes de começar a executar os testes e assinaram o termo de consentimento livre e esclarecido (TCLE). Foi aferida a pressão de repouso antecedendo a execução da primeira série e logo após aferindo ao final das séries em todos os aparelhos seguindo a mesma ordem de execução do aparelho para todos os indivíduos, cadeira extensora, leg-press e mesa flexora. A carga foi determinada através do teste de 1RM, calculando 85% da carga máxima de cada indivíduo. Ao final da pesquisa podemos concluir que houve uma variação na pressão arterial no final dos exercícios, mas não houve uma mudança significativa nos diferentes períodos do dia. No entanto, nossa pesquisa poderá ajudar a ter possíveis estudos envolvendo o ciclo circadiano em diversos outros meios de atividade física.

PALAVRAS – CHAVE: 1. Pressão arterial. 2.Treinamento de força. 3. Ciclo circadiano.