112 - CREATINE KINASE QUANTITY IN HIGH INTENSITY ACUTE RESISTANCE TRAINING AND BORG SCALE

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INTRODUCTION

Markers of muscle damage are often used to check the effectiveness of the training (FRY; KRAEMER, 1997). One of the main markers is the activity of creatine kinase (CK) (KIM, LEE, KIM, 2007).

CK is an enzyme that acts in the amount of energy that is designed to striated muscles, with great participation in the skeletal muscle. Assessment of the activity of this enzyme is used as a marker for muscle damage. Diagnosis allows to evaluate a possible resistance or not tolerance to effort (GLEESON, 2002; HARTMANN; MESTER, 2000).

There are three possible isoforms of creatine kinase (CK): CK-BB or CK-1, CK-MB and CK-2 and CK-MM or CK-3. According on the tissue where is acting there will be a greater variation of the amount of CK isoforms. CK-BB or CK 1 is located predominantly in the brain but also in the stomach, intestine, bladder, and lung (LANG, WURZBURG, 1982). CK or CK-MB 2 is in appreciable quantity just in the myocardium (FREDERICKS et al., 2002). CK-MM or CK 3 is in skeletal muscle (APPEL, SOARES, DUARTE, 1992; APPLE et al., 1988).

Generally, it is used as a marker the total CK, because the elevation of the amount of CK released immediately after exercise is of CK-MM and its default value varies from 15 to 160 U/mL for men and 15-130 U/mL for women, fits serum sample taken however to total CK value may vary from 26 to 189 U/mL (APPLE et al. 1988; JONES, SWAMINATHAN, 1990).

Resistance exercise, also known for bodybuilding , could provide larger or smaller benefits in accordance with the use of its variables : duration, frequency , intensity and volume of exercise (CARVALHO et al., 1996; HOWLEY, 2012). The training intensity may vary according to the group and its specificities such as sex , race and pathologies . The high intensity training contraction have been shown effectiveness in hypertrophy and may be related to greater muscle damage (RODEN, 2012; SCHOTT; McCULLY; RUTHERFORD, 1995; TAKARADA; SATO; ISHII, 2002).

The elevation of CK is related to the pain posterior to the exercise and the intensity of the same (NIEMAN et al., 2005). The latter can be assessed by the Borg scale , also known as perceived exertion . This is a scale where individuals can classify the degree of effort that was provided by training (BORG, 1982).

AIM

The aim of this study was to evaluate whether there is increased amount of creatine kinase in the high -intensity resistance exercise and the scale of perceived exertion is able to diagnose the intensity of this exercise.

METHODOLOGY

Once approved by the ethics committee of the Federal University of Sergipe, protocol number 387.704, it was selected 20 healthy men with an average age of 53.9 ± 8 years. All participants signed a consent form authorizing the participation and use of data collected in this study, according to Resolution 196/96 of the National Health Council of Brazil.They were subdivided into two groups of 10, where one group performed the resistance exercise protocol at 60 % and the other at 75 % of the maximum load. This study was a pilot project.

The one repetition maximum (1RM) test was made for determining the maximum load. The volunteer had allowed 3 attempts. When could overcome the resistance it was added 10% of the load and in case of failure 10% was taken out. The maximum load test was carried out three days before the exercise protocol.

A stretch lasting for five minutes was conducted and thereafter was promoted a brief warm up for large muscle groups. The volunteers made 6 training exercises into the training protocol that obeyed the following order: bench press, triceps pulley, low rowing , barbell curl, lateral raises with dumbbells and barbell squats. At the end of the protocol participants answered the Borg scale.

The inclusion criterion was the irregular practice of physical activity, less than three times per week. On the test day volunteers remained at rest for exactly 30 minutes before starting the protocol and blood was collected for at the end of the resting time and 10 minutes after training at the amount of 4 ml per tube. The specimens were collected from the antecubital venal. All material used was disposable. Data collection was conducted by a suitably qualified health professional at all times.

Dosages

A centrifuge was used, branch CELM, and an automatic spectrophotometer, brand Human 300, HumaStar for centrifugation and biochemical analyzes, respectively. The method used to make the dosage was the kinetic colorimetric analysis of plasma. The blood was placed in tubes. These were exposed for 30 minutes at room temperature to produce coagulation and then were immediately centrifuged for 10 minutes at a speed of 3000 rpm and at 4C to promote separation and serum can then be analyzed to design the filter reading spectrophotometer at 340 nanometers (nm).

Statistical Analysis

Data were expressed as mean and standard error, and for the statistical analysis we used the Student's t test for paired data (two-tailed) and the normality of the sample was evaluated by the Kolmogorov-Smirnov test. The significance level adopted was $p<0,05$.

RESULTS

On the scale of perceived exertion also known as the Borg scale it was identified by calculating the average of the participants the following: G- 60 = 3 and G-75 = 6. Borg scale have an assessment that goes from zero to ten, where each number corresponds to an intensity of effort. Only 5 and 6 correspond to the same intensity (severe) and the numbers corresponding to 7 and 8 indicates a very intense activity.

On the Borg scale , the number 3 is the classification of physical exercise as moderate and the identification of the

number 6 as intense, respectively. Thus, the exercise groups in high and moderate intensity, represented the expected value to the exercise by the scale of perceived exertion.

The evaluation of pre-and post-training CK is shown in figure 1. The comparison between high intensity exercise and moderate the influence of variation of CK activity is shown in figure 2. The exercise done at a high intensity with p<0,05 when analyzed pre-and post operative protocol presented a significative difference. When compared the variation presented by high intensity exercise with moderate intensity it was found that p<0,05. The exact values of the standard error found are shown in the figure subtitles.

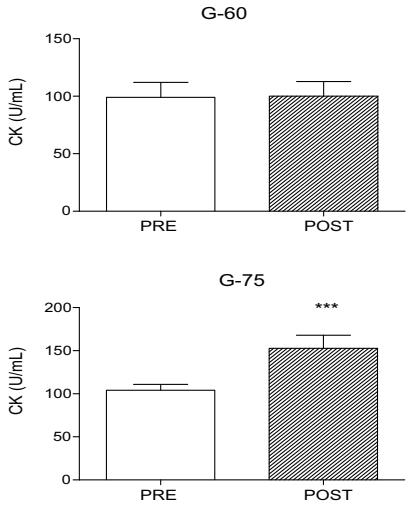

Figure 1. Mean and standard error of CK groups exercised at 60% and 75% of 1RM. *** p <0,05.

G-60 presented an average 1,0±0,6U/mL while G-75 showed mean and standard deviation of 48,7±26,2U/mL.

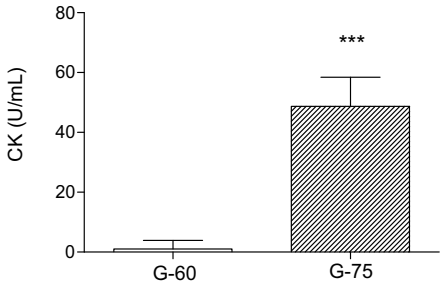

Figure 2. Mean and standard error of the parametric t-test between the variation of CK in groups exercised at 60% and 75% of 1RM. *** p <0,05.

DISCUSSION

It is possible to measure the stress of exercise by Borg scale, also known as scale of perceived exertion . The Borg scale is correlated with elevated CK levels in our body (SANTOS et al., 2012).

For bodybuilding workouts, in general, we use the anaerobic energy system that is subdivided into ATP-PC system, used in exercises to 15 seconds long and lactic system that prevails in practice more than 15 seconds and will up to 3 minutes (FOSS; KETEYIA, STEVEN , 2000). CK is active in both systems. The differences in serum concentration between the pre and post workout CK is one of the baselines of muscle damage (KIM; LEE; KIM, 2007).

The CK-MM or CK-3 corresponds to 95% of CK activity in skeletal muscle and approximately 70-75 % of the enzyme present in the myocardium . As the total amount present in the skeletal muscle in the body is much greater than that found in the myocardium, increasing the fraction MM has always been related to favor the occurrence of injury or hypoxic skeletal muscle and can be diagnosed by total CK (RAVEL, 1997).

Moderate activity was identified by the participants and it was related to lower elevations of CK while exercising identified as high intensity provided higher and significant increases of CK when compared to moderate. It is, therefore, suggesting that the identification of high intensity exercise by Borg scale is linked to the possibility of causing further muscle damage.

Therefore, if it is possible to diagnose the level of intensity exerted by the Borg scale it is possible to diagnose that there was more or less muscle damage.

CONCLUSION

The high intensity acute resistance training is able to increase significantly the amount of CK and the scale of Borg is perfect index of evaluation of physical exertion, suggesting, therefore , that identification of high intensity exercise on the Borg scale is related to a greater amount of CK .

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CREATINE KINASE QUANTITY IN HIGH INTENSITY ACUTE RESISTANCE TRAINING AND BORG SCALE

ABSTRACT

Introduction: Markers of muscle damage are often used to check the effectiveness of the training. Aim: The aim of this study was to identify if there is elevation of the quantity of creatine kinase (CK) in high intensity acute resistance training and if the effort´s subjective perception scale is able to identify the intensity of this exercise. Methodology: 20 health males were selected with age between 53,9±8 anos. These were subdivided into two different groups. One of the groups did the protocol training of acute resistance exercise at 60% and the other at 75% of the maximum load. At the end of the protocol the participants answered the Borg scale. Blood samples were collected 30 minutes before the training and ten minutes after. To the biochemical analysis it was used the kinetic colorimetric method. Kolmogorov-Smirnov was done to check the normality of the sample. Student T test was done. It was adopted p<0,05. Results: In Borg scale was identified the following means: G-60= 3 e G-75 = 6. G-60 did not present positive result between previous and posterior exercise program with a medium and desvious of 1,0±0,6U/mL. Therefore G-75 showed mean and standard deviation of 48,7±26,2 U/mL with p<0,05, revelating a high significance level. The high intensity exercise presented p<0,05 when compared to the moderated. Conclusion: High intensity acute resistance training can get the CK activity higher and the effort´s subjective perception scale or Borg scale is a valid scientific method to evaluate the effort of the training, being suggested that the evaluation and identification of the high intensity exercise training is related to a higher CK quantity.

KEYWORDS: creatine kinase, resistance training, muscle proteins.

A QUANTITÉ DE LA CREATINE KINASE DANS RESISTE EXERCICE AIGU ET ÉCHELLE D'INTENSITE HAUTE BORG

RÉSUMÉ

Introduction: des marqueurs de lésions musculaires sont souvent utilisés pour vérifier l'efficacité de la formation. Objectif: L'objectif de cette étude était d'évaluer s'il y a augmentation de la quantité de créatine kinase (CK) dans des exercices de résistance aiguë d'intensité élevée et si l'échelle de perception de l'effort est en mesure de diagnostiquer l'intensité de cet exercice. Méthodes : Nous avons sélectionné 20 hommes, âge moyen, en bonne santé et allant de 53,9 ± 8 ans . Ils ont été divisés en deux groupes de 10. Un groupe a effectué le protocole de l'exercice de musculation aiguë à 60 % et l'autre à 75% de la charge maximale . À la fin, les participants du protocole répond à l'échelle de Borg . Le sang a été collecté 30 minutes avant et dix minutes après l'entraînement. Pour les dosages, nous avons utilisé la méthode colorimétrique cinétique. Test de Kolmogorov-Smirnov pour la normalité et appliqué au T -test échantillon ont été faites. p < 0,05 a été fixé. Résultats: Dans l'échelle de Borg les moyennes suivantes ont été identifiés entre les participants: du G- 60 et G- 3 = 75 = 6 . G-60 n'ont montré aucun résultat significatif entre l'exercice avant et après . G-75 avait une moyenne et écart type de 48,7 ± 26,2 p < 0,05, ont fait preuve d' un haut degré d' importance. L' exercice de haute intensité a montré p <0,05 par rapport au exercise modéré. Conclusion : L' exercice de

la résistance à haute intensité peut augmenter le nombre CK sérique de manière significative et que l'échelle de l'effort perçu ou échelle de Borg est un indice précis de l'évaluation de l'effort physique , et influençable , ainsi que l'évaluation et l'identification des exercice de haute intensité sur l'échelle de Borg est liée à une plus grande quantité de CK .

MOTS-CLÉS: la créatine kinase , l'exercice de la résistance, les protéines musculaires.

CREATINA QUINASA CANTIDAD EN EJERCICIO AGUDO DE RESISTENCIA DE INTENSIDAD ALTA Y LA ESCALA DE BORG

RESUMEN

Introducción: los marcadores de daño muscular se utiliza a menudo para comprobar la eficacia de la formación. Objetivo: Este estudio tuvo como objetivo evaluar si hay un aumento de la cantidad de la creatina quinasa (CK) en el ejercicio de resistencia agudo alta y si la escala de esfuerzo percibido es capaz de diagnosticar la intensidad de este ejercicio. Metodología: Se seleccionaron 20 varones saludables, con una media de edad 53,9 ± 8 años. Estes se dividieron en dos grupos de 10. Un grupo realizó el protocolo de ejercicio de resistencia aguda en el 60 % y el otro 75 % de la carga máxima. Al final los participantes han contestado a la escala de Borg. Se recogió sangre 30 minutos antes e diez minutos después del entrenamiento. Se utilizó el método cinético colorimétrico. Kolmogorov- Smirnov para la normalidad y se aplicó a la muestra el teste T. Se fijó p < 0,05. Resultados: En la escala de Borg se identifican de la siguiente media entre los participantes del G- 60 y G- 3 = 75 = 6. G- 60 no mostraron resultados significativos entre el pre y post ejercicio con una media e desviación de 1,0±0,6U/mL. G- 75 tuvo una media y desviación estándar de 48,7 ± 26,2U/mL p<0,05, mostrando que han tenido un alto grado de importancia. El ejercicio de alta intensidad mostró p<0,05 en comparación con los moderados. Conclusión: El ejercicio de resistencia de alta intensidad puede aumentar la cantidad de la CK significativamente y que la escala de esfuerzo percibido o escala de Borg es un índice de la evaluación precisa de un esfuerzo físico, y influenciable, por lo que la evaluación y la identificación del ejercicio de alta intensidad en la escala de Borg se relaciona con aumento de la cantidad en el sangre de la CK.

PALABRAS CLAVE: creatina quinasa, ejercicio de resistencia, proteínas musculares.

A QUANTIDADE DA CREATINA QUINASE NOS EXERCÍCIOS RESISTIDOS AGUDOS DE ALTA INTENSIDADE E A ESCALA DE BORG

RESUMO

Introdução: Marcadores de danos musculares são muito utilizados para checar a efetividade do treino. Objetivo: O objetivo deste estudo foi avaliar se existe aumento da quantidade da creatina quinase (CK) no exercício resistido agudo de intensidade alta e se a escala de percepção subjetiva do esforço é capaz de diagnosticar a intensidade deste exercício. Metodologia: Foram selecionados 20 indivíduos do sexo masculino, saudáveis e com idade média variando entre 53,9±8 anos. Foram subdivididos em dois grupos de 10. Um dos grupos realizou o protocolo de exercício resistido agudo a 60% e o outro a 75% da carga máxima. Ao fim do protocolo os participantes responderam a escala de Borg. Foi coletado sangue 30 minutos antes do treino e dez minutos após. Para as dosagens utilizou-se do método cinético colorimétrico. Realizou-se Kolmogorov-Smirnov para a normalidade da amostra e aplicado o teste T de Student. Foi adotado p<0,05. Resultados: Na escala de Borg foi identificado a seguinte média entre os participantes: G-60= 3 e G-75 = 6. G-60 não apresentou resultado significativo entre o pré e pós exercício sendo sua média e desvio 1,0±0,6U/mL. Já o G-75 apresentou uma média e desvio padrão de 48,7±26,2U/mL com p<0,05, mostrando ter tido alto grau de significância. O exercício de alta intensidade apresentou p<0,05 quando comparado com o moderado. Conclusão: Os exercícios resistidos de alta intensidade podem elevar a quantidade sérica da CK significativamente e que a escala de percepção subjetiva do esforço ou escala de Borg é um índice acurado de avaliação do esforço físico, sendo sugestionado, portanto, que a avaliação e identificação do exercício de alta intensidade na escala de Borg está relacionada a uma maior quantidade da CK.

PALAVRAS-CHAVES: creatina quinase, exercício resistido, proteínas musculares.