104 - LEVEL OF LACTATE, FLEXIBILITY, STRENGHT AND RESISTENCE ON INFERIOR MEMBERS AFTER A MICROCYCLE OF STRENGTH

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INTRODUCTION

The motor capacity and flexibility are considered an ideal combination between the articular mobility and muscular elasticity. Commonly, the term "stretching" is using in substitution of flexibility; then, "training stretching" turned derivatives to the training to improvement of the flexibility (MAGNUSSON et al., 1995).

Exist studies showed that stretching exercises have the capacity to change the viscoelastic property of unit muscle-tendon (MAGNUSSON, 1998; TAYLOR et al., 1990). The function of tendons is the transference of strength produced by skeletal musculature to the bones and articulates. We also know that the rigidity degree of skeletal musculature connect positively with the production of strength muscular concentrics and isometrics (WILSON et al., 1994)

In other side, the training stretching may cause descent in the income of maximal strength (TRICOLI & PAULO, 2002). But WORRELL et al (1994) researched the relation between stretching and performance of strength in thigh posterior muscles. They found significant increase in the production of torque isokinetic afters the improvement of stretching.

However, not exist a consensus that the training of strength may improve the flexibility degree of a particular musculature (FOWLES, 2000). How may be observed, the studies described anteriorly to show controversial results about the valence physics and flexibility. Beyond that, few researches were the research about the effect of practice to stretching in maximal strength performance and the even happen when compared to the research about strength and degree of interference of this training in performance of flexibility.

This research had to objective to investigate the effects of strength about the flexibility on quadriceps and thigh posterior muscles after acute sessions of strength training.

METHODS

Subjects

The volunteer of this research were ten men selected, apparentment healthy between 17,42±0,81 years old; corporal mass 144,93±15,86 pounds, that practiced the modality muscle training of more than three months. All signed agreement term and received an informative letter about how be the realization of research.

Was exclude all the volunteer who uses ergogenics substance, has take caffeine or others kind of stimulates in the day of the test and also the people with deficiency osteomioarticular that impeded total or partialment the execution of movement during the exercise.

Laboratory measurements

In the first day, was measured his flexibility and coordination in the realization of movement on leg-press, extension chair, press-up table and hack. The individual after the warming repeated the movement to 2 series of 15 times and 1 minute in rest.

In the second day, was measured the maximal load (ML), to accord with Guimarães Neto (1997):

1º- Execution of geral warming like a stretching.

2º- Execution of a series of warming in the exercise, with low load (only with the bar).

3º- Application of a load close the maximal capacity of individual, that should do one complete repetition. The chose of this initial load must to the degree of before experience of volunteer trained.

4°- Case the first load was inferior the maximal, increasing the load, waiting a period od recuperation of 1 minute to the new try (McARDLE et al., 1996).

In the third day, realized the test of resistence, describe below:

1°- Realize a initial warming witout load.

2°- Rest a intervalo 2 minutes.

3º- Add 60% of maximal load get in the test of 1MR.

4°- The individual should realize the maximum of repetitions possible in only 1 serie, he should realize the contraction concentric and excentric with 3 seconds of duration in each contraction.

5°- When start the fatigue muscular, the indivudual stop the serie and observe the number of repetitions done and the total time that was waste in this serie.

In the third day, two hours before the test, the alimentation was light and controlled, because we know that the lactate in the blood increase after the alimentation (Mascini et al., 1985 and Palleschi et al., 1990). Was measured the cardiac frequency for the Frequencimeter Interface (Polar, S610) and the arterial pressure for the Sphygmomanometer (Sanny) that was measured in the interval of the test as a method of security. They were doing stretching on the inferior members and realized 2 series sequential of 15 repetitions and an interval of 1 minute in the leg-press exercise with just the cart. Following after doing the test of resisted exercise with crescent load, that started with 10% of ML and increasing in 10 to 10% in each stage.

The rhythm of the movement was reestablished to do 3 seconds of the movement in concentric and 3 seconds in excentric on one frequency of 8 repetitions, it was controlled for sonorous signal. The end of the test was determinated for the incapacity to realize the movement inside of the correct mechanic preestablished or for the incapacity to realize the number of complete repetitions in time, or to show variation in (FC) or (PA) that might compromise the health. The duration of each stage was 45 seconds, with 2 minutes in passive rest, it was intended for the collection of blood. Just was valid the stages completely realized (45 seconds of exertion).

This tests was realized in the end of each phase or period of training, to observe if had or not a addition in the performance of individual, for that would be sustained or store in its intensity on training.

Was collected (25 µL) of blood with capillary heparin and put in mini-tube contained 50 µL of one solution fluoride of sodium to 1% and store in ice for in maximum 2 hours and frozen to -176°F up to analyze.

The sanguine lactate was analized by method eletro-enzimatic (lactimeter YSI Sport of Yellow Springs). The definition of threshold anaerobic of lactate (AT) selected was to Wasserman et al (1986).

Statistical analysis

O t-Studant test to the dependent samples was used to identify if there difference between the medias of thresholds of plasmatic lactate, flexibility, maximal repetitions and maximal load after and before the session. The coefficient of correlation of Pearson was used to determine the correlation between the concentration of sanguine lactate, flexibility, maximal repetitions and maximal load after and before the session with á=0,05. The interval of dependence was used to reaffirm the obtain results.

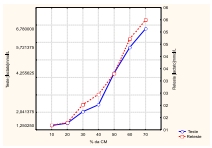
Training Program

They had an adaptation phase of 15 days training with 50% of maximal load (ML), starting straight after the session with 90% of ML, doing 6 series of 4 repetitions and an interval of 3 minutes between the series and 5 minutes between the exercises, during 6 weeks training 3 times in week.

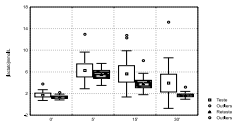
The chose equipment was two monoarticulates and one biarticulate, like the press-up table, extension chair, leg-press and squat.

RESULTS

The analyze of correlation between the media value of concentration of sanguine lactate, before and after the sessions obtained of volunteer rate in each stage of exercise, announced r=0,78 and p=0,0031. The behavior of two variable, showed by the correlation obtained, that the lactate rate before and after the sessions of strength was not significant different, p<0,05 (Picture 1). The picture 2 represent the relation between the value of lactate in rest, before and after the 2 test of crescent load, realized in the begging and in the end of sessions for all volunteer. Also show a significative difference (p<0,05), in the value of lactate after the sessions in training os strength, was more lower.



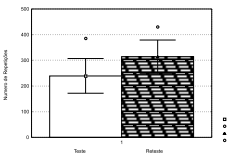
Picture 1. Show the media of the value of lactate before and after test. In the axis Y was the value of lactate in mmol/L. In the right of the asis Y, is the value of lactate of volunteer in retest. In the axis X is the exercise s tages in 10% to 70% of ML and the increment of load.



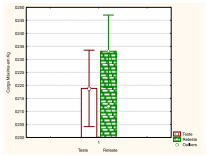
Picture 2. Show the media and the standard deviation of the value of lactate in rest after and before test. In the left of the asis Y, is the value of plasmatic lactate in mmol/L of all volunteer befor e test and after retest. In the axis X, is the times before 0' and after 5', 15' and 30', before and after test. Also show the difference significant (*) with a p<0,05, and value more lower after the training sessions.

The number of repetitions with 60% of ML, increased significantive to a p=0,00007 after the training of strength, like show in the picture 3. The maximal load also had an increased significant to a p=0,0021 after the training sessions (Picture 4).

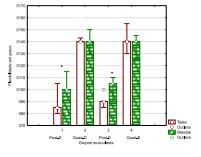
In the picture 5, the relation between the value in degree of flexibility in muscular groups, quadriceps, right and left, and thigh posterior meuscles, right and left, in the beginning and in the end of training sessions. Show the difference significant (p<0,05), with value of flexibility in muscular group in thigh posterior muscles, right and left, was more higher.



Picture 3. Show the media and the standard deviation of the value of the maximal repetitions before and after test. In the axis Y, is the value the maximal repetitions be fore and after test. In the axis X, is the group in test and retest. Also show the difference significant with a p=0,0021 with value more higher after the training sessions.



Picture 4. Show the media and standard deviation of the value of maximal load before and after test. In the aix Y, is the value of maximal repetitions before and after test. In the axis X, is the group in test and retest. Also show the difference significant with a p=0,00007, with value more higher after the training sessions.



Picture 5. Show the media and standard deviation of the value of flexibility before and after test. In the axix Y, is the value of flexibility in degree. In the axis X, the muscular groups that was analyzed before and after test. Also show the difference significant (*) with a p<0,05, with value more lower after the training sessions, in the thigh posterior muscle, right and left.

DISCUSSION

Through the analyze of flexibility with the equipment fleximeter, was found the increase of flexibility on muscular group, thigh posterior muscle and any significant alteration in the others muscular groups studied, we may not say that with the training if strength increase the flexibility of the muscular group trained, but we also may not say that the training od strength reduce the flexibility muscular and articular. Accord with the studies of VALE, NOVAES e DANTAS (2005), that not found loss of flexibility in their samples.

ISRAEL(1991), say in your research that in the training of strength, not have a gain of resistence, because of the increase of transversal strias, that may have a descompesation of relations between substratum availability, oxygen and metabolics, that define the capacity of resistence. But in this study was found a increase of 31,26% in the maximal repetitions after the application of microcycle with characteristic of strength.

At in the same time, the increase of strength to increase the eletromiografic activity, showing a high number of motors unit active and increase in frequency of activation in these motors units (Sale, 1988). Also there are an increase of glicogenio reserve and creatina phosphate, that may happen an increase of 20 to 75% of creatina phosphate store, depend on the training of strength chose (Hollman et al., 1980). Research with muscular biopsia in athletes of culturism, showed an increase of the number of muscular thread with training of strength (Antonio & Gonyea, 1993). These studies confirmed the ours results with increase of strength after the sessions of training of strength. .

Referências bibliograficas

Antonio, J. W. Gonyea: Skeletal muscle fiber hyperplasia. **Méd. and Sci. In Sports and Exerc**.25 (1993).1333-1345

FOWLES, J.R et al. Reduced strength after passive stretch of the human plantarflexors. **Journal of Applied Physiology**. v.89, nº3, p.1179-88, 2001.

Guimarães neto,W.N. Musculação, Anabolismo Total. Phorte Editora, SP. 1997.

Hollmann, W., T. hettinger: Sportmedizin- Arbeits- und Trainingsgrundlagen, 2. Aufl. **Schattauer**, Stuttgart-new york 1980

Israel,S.: konkurrenzreaktionen bei hochgradiger fähigkeitsausprägung. **Sprtwissenschaft** 21 (1991) 337-353

MAGNUSSON, S.P Passive properties of human skeletal muscle during stretch maneuvers. **Scandinavian Journal of Med and Sci in Sports**. v.8, nº2, p.65-77, 1995.

McARDLE, W.P.; KATCH, F.I.; KATCH, V.L. Exercise physiology, energy, nutritiion and humam performance. WilliamsWilkins, 4.ª ed, 1996.

MAGNUSSON, S.P et al. Viscoelastic response to repeated static stretching in the human hamstring muscle. **Scandinavian Journal of Med.and Sci in Sports.** v.5, nº6, p.342-7, 1995.
Mascini, M., Mazzei, R., Moscone, D., Calabrese, G. & Massi Benedetti, M. (1987). Lactate and pyruvate electrochemical biosensors for whole blood in extracorporeal experiments with na endocrine artificial pancreas**.** ***Clin. Chem****.,* 33, 591-593.
Sale, D.G.: neural adaptation to resistance training**. Med and Sci. In Sports and Exerc.**20(1988), suppl., S135-S145
TAYLOR, D.C et al. Viscoelastic properties of muscle tendon units. **The American Journal of Sports Medicine**. v.18, nº3, p.300-9, 1990.
VALE, R.G.S; NOVAES, J.S; DANTAS, E.H.M. Efeitos do treinamento de força e de flexibilidade sobre a autonomia de mulheres senescentes. **R. Brás. Ci e Mov**. 13(2):33-40,2005.
WILSON, G.J et al. Musculotendinous stiffnes: its relationship to eccentric, isometric, and concentric performance. **Journal of Applied Physiology**. v.76, nº6, p.2714-19,1994.
WORREL, T.W. et al. Effects of hamstring stretching on hamstring muscle performance. **Journal of Orthopaedic Sports and Physical Therapy**. v.20, nº3, p.154-9, 1994.

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LEVEL OF LACTATE, FLEXIBILITY, STRENGHT AND RESISTENCE ON INFERIOR MEMBERS AFTER A MICROCYCLE OF STRENGTH

ABSTRACT

The purpose of this research was verifying the lactate profile, maximal load and flexibility of quadriceps and thigh posterior muscles after a realization of microcycle with caracteristic of strength. Ten volunteers between 17,42±0,81 years old; corporal mass 144,93±15,86 pounds, realized tests to flexibility of quadriceps and thigh posterior muscles. The volunteers realized tests of crescent load the started with 10% of maximal load (ML), increasing in 10 to 10% up to the volunteer gets exhaustion. Within a short period of time, started the training with 6 series of 4 repetitions to 90% of ML with 3 minutes in rest between the series and 5 minutes between the exercises, while 3 times per week in 6 weeks. We collected blood samples to analyze of the plasmatic lactate. The results showed a significative increase of strength (p=0,0021), resistance (p=0,00007) and flexibility of thigh posterior right muscle after the training of strength with significant p<0,05. We did not find difference in the test of crescent load by the lactate concentration rate, with a r=0,99 and p=0,0031 to correlation in the Pearson, but did not have a significative difference (p<0,05) in the value of lactate after the training sessions was lower. We verify that after the training may occur an increase of strength, resistance and not had a scathe in the flexibility.

KEYWORDS: Periodization, Flexibility, Lactate, Strength.

NIVEAU LACTIQUE, FLEXIBILITÉ, FORCE ET RÉSISITANCE DES MEMBRES INFÉRIEURS APRÈS UN MICROCYCLE DE FORCE.

Résumé

L'intention de cette recherche fut de vérifier le profil lactique, la charge maximum et la flexibilité du quadriceps et muscle postérieur de la cuisse, après la réalisation d'un microcycle à caractéristique de force.Dix volontaires agés de 17,42 0,81ans, masse corporelle 65,8, 7,2kg réalisèrent des test de flexibilité des muscles postérieurs et quadriceps de la cuisse. Ils firent des test de charges croissantes qui commençaient avec 10% de charges maximum, augmentant de 10 à 10% jusqu'à l'épuisement. Sitôt commencèrent les entrainements de six séries de quatre répétitions avec 90% de CM avec trois minutes de repos entre les séries et cinq minutes entre les exercices, ceci trois fois par semaine durant six semaines. Nous avons fait une prise de sang pour entreprendre une analyse lactique plasmatique. Les résultats montrèrent une augmentation significative de la force (p=0,0021), de la résisitance (p=0,00007) et de la flexibilité du muscle postérieur de la cuisse droite après un entrainement de force signifiant p<0,05 ; nous n'avons pas observé de différence lors du test de charge croissante dans l'avaliation de la concentration lactique, avec un r=0,78 et p=0,0031 dans la corrélation de Pearson. Mais il y avait une différence significative (p<0,05) où les valeurs lactiques furent plus faibles après les sessions d'entrainement. Nous observons que, après l'entrainement il pourrait se produire une augmentation de force, de résistance sans aucune compromission de la flexibilité.

Mot-clé : périodicité, flexibilité, lactique, force.

NIVEL DE LACTATO, FLEXIBILIDAD, FUERZA Y RESISTENCIA DE LOS MIEMBROS INFERIORES TRAS UN MICROCICLO DE FUERZA

Resumen

El objetivo de esta investigación fue el de verificar el perfil del lactato, carga máxima y flexibilidad del cuadriceps y posterior de muslo tras la realización del micro ciclo con característica de fuerza. Diez voluntarios con edad 17,42± 0,81; masa corporal 65,8±7,2 Kg realizaron testes de flexibilidad de los músculos cuadriceps y posterior del muslo. Los voluntarios realizaron testes de cargas crecientes que empezaban con 10% de la carga máxima, aumentando de 10 en 10% hasta el voluntario entrar en el estado exhaustivo. En seguida se dio inicio a los entrenamientos con 6 series de 4 repeticiones con 90% de la CM con descanso de 3 minutos entre las series y 5 minutos entre los ejercicios, durante 3 veces por semana en el decurso de 6 semanas. Colectamos muestras de sangre para el análisis del lactato plasmático. Los resultados mostraron un aumento significativo de fuerza (p=0,0021), resistencia (p=0,00007), y de la flexibilidad del posterior del muslo derecho tras el entrenamiento de fuerza con el valor significativo de p<0,05. No fueron encontradas diferencias en el teste de carga creciente a través de la evaluación de la concentración del lactato, con un r= 0,78 y p=0,0031 en la correlación de Pearson. Pero hubo una diferencia significativa (p<0,05) cuando los valores de lactato tras las sesiones de entrenamiento fueron más bajos. Verificamos que tras el entrenamiento puede ocurrir un aumento de fuerza, resistencia y no hubo comprometimiento de la flexibilidad.

Palabras claves: Periodo, Flexibilidad, Lactato, Fuerza.

NÍVEL DE LACTATO, FLEXIBILIDADE, FORÇA E RESISTÊNCIA DE MEMBROS INFERIORES APÓS UM MICROCICLO DE FORÇA

Resumo

O propósito desta pesquisa foi de verificar o perfil do lactato, carga máxima e flexibilidade do quadríceps e posterior de coxa após a realização do microciclo com característica de força. Dez voluntários com idade 17,42± 0,81; massa corporal 65,8±7,2 Kg realizaram testes de flexibilidade dos músculos quadríceps e posterior de coxa. Os voluntários realizaram testes de cargas crescentes que iniciavam com 10% da carga máxima, aumentando de 10 em 10% até o voluntário entrar em exaustão. Em seguida deu inicio aos treinos com 6 séries de 4 repetições com 90% da CM com descanso de 3 minutos entre as séries e 5 minutos entre os exercícios, durante 3 vezes por semana no decorrer de 6 semanas. Coletamos amostras de sangue para analise do lactato plasmático. Os resultados mostraram um aumento significativo de forca (p=0,0021), resistência (p=0,00007), e da flexibilidade do posterior de coxa direito após o treino de força com significância p<0,05, não encontramos diferenças no teste de carga crescente através da avaliação da concentração de lactato, com um r= 0,78 e p=0,0031 na correlação de Pearson, Mas houve uma diferença significativa (p<0,05) onde os valores de lactato após as sessões de treino foram mais baixos. Verificamos que após o treinamento pode ocorrer um aumento de força, resistência e não houve comprometimento da flexibilidade.

Palas chaves: Periodização, Flexibilidade, Lactato, Forca.