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LACTACIDEMIA IN TWO DIFFERENT WEIGHT TRAINING MODELS

LACTACIDEMIA EM DOIS DIFERENTES MODELOS DE TREINO DE MUSCULAÇÃO

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ABSTRACT: The knowledge of the physiological aspects in the execution of the training in the bodybuilding is important to improve the training; being the lactate concentration an important marker applied in several types of exercises. Some studies have evaluated lactacidemia and training models but did not use squatting in their protocols. The aim of the study was to analyze blood lactate concentration in free squat exercise training in two training models: strength and resistance. Experimental study with a sample of five men of 24 ± 4.6 years, physically active and practicing for at least one year, with no history of orthopedic and cardiovascular problems. The tests were performed in two days, in the strength session the volunteers performed 12 sets, 6 to 12 maximal repetitions and in the resistance session 12 series, 13 to 20 maximum repetitions. In both tests the interval was 1 minute and 30 seconds between sets and 2 minutes every 4 sets. Blood lactate was collected at rest, during and after the test. No significant differences were found in the lactate concentration during and after the tests in the strength training and the resistance training. However, the lactacidemia variation between the first and last collection presented a significantly higher result in strength training. We conclude that the models of strength and resistance training, in the free squat exercise, do not present significant differences in lactate concentration during and after the tests. The total lactacidemia variation was greater in strength training.

KEYWORDS: Lactate. Performance. Resistance exercise. Squat exercise.

INTRODUTION

Bodybuilding is understood as a practice of resistance exercise, which uses equipment and weights in order to develop strength, power, hypertrophy and muscular strength located (KRAEMER; RATAMESS, 2004); being still characterized as an exercise with anaerobic predominance (CUSTÓDIO et al., 2011). And the knowledge of the physiological aspects of this exercise is important to improve them; Being the blood lactate concentration a reasonable parameter to observe the intensity of the load during the performance of the training helps to establish in an individual and objective way the intensity of the exercise to which you want to develop (GRECO et al., 2003).

Post-exercise lactate removal is also an important factor for athletes who need to achieve high performance levels in a short period (FRANCHINI et al., 2004) and active recovery with exercise in the intensity of 60% of maximal oxygen uptake improves the lactate removal at its optimization point (ÅSTRAND, 2006)

Lactate is produced in anaerobic glycolysis and is a source of energy that accumulates as a result of the production by the active skeletal muscle proportionally to the exercise intensity, the individual's physical condition and the recovery of a session of exercises (MACHADO, 2008; VILLAR and DENADAI, 1998) Soon after recovery, the lactate is oxidized in order to form ATP (MCARDLE; KATCH, F.; KATCH, V., 2011). Maughan, Michael and Greenhaff (2000) states that lactate has two main destinations, first the oxidation for CO^2 and H_2O in the inactive skeletal muscle and in the myocardium, and according to hepatic gluconeogenesis.

Considering that the squat exercise is present and is widely performed in several training areas; can be played with or without adding external load, in a triple flexion of lower limbs, used both in sport and in various daily activities (DURWARD; BAER; ROWE, 2001; ESCAMILLA, 2001). Moreover, it is one of the most complex and

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complete movements for the strengthening of muscles of the lower limbs, such as the quadriceps and the gluteus maximus; As well as, for the musculature of the thighs, the hip, the lumbar, the erectors of the spine, the legs and abdominal muscles (WEISS et al., 2000).

Through the above and by the fact that several studies have evaluated the parameter of lactacidemia in some training models (AZEVEDO et al., 2005; BARROS et al., 2004; MIGUEL et al., 2018) however, did not utilize free squatting in their protocols. Thus, our study aimed to analyze the concentration of blood lactate in the training of the free squat exercise in two training models: strength and endurance. As a hypothesis we hope to find significant differences in the lactate concentration in both tests.

MATERIALS AND METHODS

The research is of an experimental nature, was a pilot study conducted in the Laboratory of Exercise Physiology (FISIOEX) of the Center for Research and Evaluation in Human Performance, of the Faculty President Antônio Carlos of Uberlândia (UNIPAC). Were used in the study: Free squat bar of the brand Jogging Sport Fitness, two meters of lengths of twenty kilos support for free squat of the brand Movimentar Sport Fitness, Brand Washers Gears, de 25, 20, 15 e 10, Kilos, Brand crawler Moviment, RT250.

Sample

The sample consisted of convenience, being male individuals, aged 24 ± 4.6 years, physically active, practicing resistance training for at least 1 year, with practice in the execution of free squat. They could not present musculoskeletal injuries and history of cardiovascular diseases and should be students enrolled regularly in the Physical Education Course of UNIPAC Uberlândia.

Ethical Considerations

The study was approved by the Ethics and Research Committee of Human Beings of the Federal University of Uberlândia-UFU, Protocol N^{o}: 337/11. All participants who agreed to participate in the study signed the informed Consent form, elaborated according to the CNS Resolution 466/12, authorizing their participation.

Crouching Test

The initial position of the free squat exercise is standing, with the bar resting on the back and without backing on the cervical vertebra, the hands should be placed comfortably. From the initial position, perform the flexion of the hip and knees until the hip reaches the angle of 90 º in relation to the knees. After reaching this angle the volunteer makes the extension of the hip and knees and returns to the initial position (CAMPOS, 2002).

Blood lactate Analysis

Blood lactate was collected in the resting phase, shortly after heating and immediately after the last repetition performed in each training series and five minutes after the training. To this end, a Roche (Accutrend Plus model) Lacmeter was used, with the Roche (Accusport BM Lactate) brand strips. And a lancet of the Esteril brand, collecting two drops of blood (~ 0, 1ml) from the tip of one of the fingers of the individual, which were placed in the center of the reagent test strip for the analysis of blood lactate concentration.

Test Protocol

The tests were performed in two days, with a one-week interval for physical recovery of the volunteers, and on the first day the volunteers performed a force session, consisting of 12 series of the free squat exercise, with 6 to 12 repetitions maximum on the second day, the volunteers performed a resistance session with 12 series of the same exercise, with 13 to 20 maximal repetitions. Both sessions maintained an interval of 1 minute and 30 seconds between each series and an interval of 2 minutes every 4 series, with a total time of 35 minutes per session and for each volunteer.

Since the volunteers were trained and familiarized with the exercise of free squat, the load used in both tests was stipulated according to the number of repetitions that they had already performed in their training routine and according to the perception Subjective effort (BORG, 1982, 1998). During the sessions of the tests the load was readjusted for more or less, with the intuition of the volunteer performing all 12 series with the number of repetitions stipulated in the experimental protocol.

The volunteers made a 5-minute warm-up on the treadmill with a speed of 5km/h and a specific heating of 15 to 20 repetitions of weight-free squats; in order to prepare the joints and musculature involved in the movement and avoid injuries during the test.

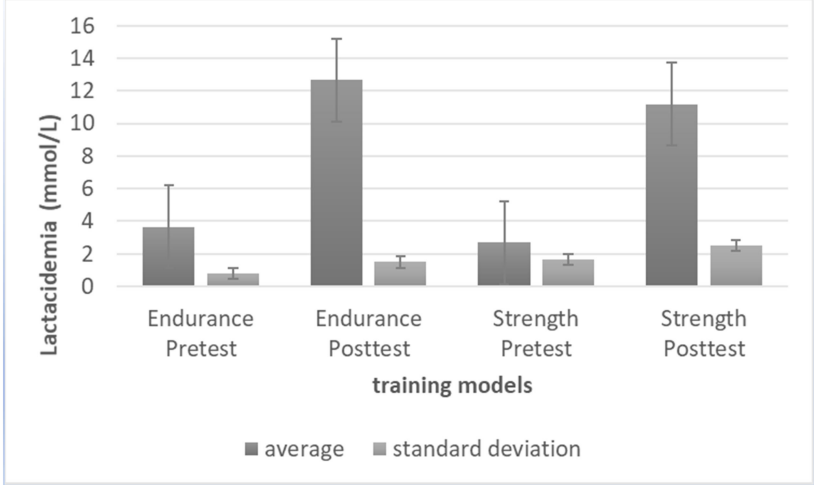
Statistical Analysis

Descriptive statistics were used to summarize the data and to present measures of

central tendency (median) and dispersion (interquartile deviation). The *Mann-Whitney* test was performed to compare the values of the median of lactacidemia between the 2 tests. The lactacidemia was compared during the test, post-test and the total variation of the lactacidemia (the difference between the first and the last collection). The significance level for the present study was $p < 0.05$.

RESULTS

The experimental study involved the participation of trained adult men, aged 24 ± 4.6 years, physically active, practicing resistance training for at least 1 year, with practice in performing free squats. The mean and standard deviation values of pretest and posttest lactacidemia between the resistance and strength tests were described in figure 1 below.



Source: elaborated by the authors.

Figure 1. Values in mean and standard deviation of lactacidemia pretest and posttest between the resistance and strength tests.

The Five volunteers completed the two test sessions and it was observed that the median between the mean values of the lactacidemia during the tests did not present significant differences, although their value was moderately higher in the strength test. Also, no significant difference was found in the comparison of the post-test lacatacidemia, although it was discretely higher in the resistance test. The only significant difference ($P = 0.02$) was found in the comparison between total Lactacidemia variation (Table 1), which was higher in the strength test.

Table 1. Comparison of the lactacidemia values between the resistance and strength tests by the Mann-Whitney test.

	Strength Test	Endurance Test	P value
	During the test	During the test	
Median			
Interquartile Deviation	11,50 1,10	10,70 0,41	0,34
	Posttest	Posttest	
Median	10,80	12,40	0,17
Interquartile Deviation	1,30	1,00	
	Variation between pretest and final test	Variation between pretest and final test	
Median	13,30	9,40	0,02
Interquartile Deviation	1,73	0,99	

Source: elaborated by the authors.

DISCUSSION

The lactacidemia tests are usually applied in high performance athletes to analyze the

performances. The present study analyzed the lactacidemia with volunteers trained in two training models and a significant difference was found only in the total variation of the subjects ' lactacidemia, and its value was higher in the strength test.

Our results reported a significant difference in lactate concentrations for strength training in pre- and post-exercise conditions. This finding corroborates with previous studies, which showed that in the exercise intensity above 30% of 1RM the participation of the anaerobic metabolism is more significant, with greater effect of resisted acyclic contractions causing relative occlusion, lower oxygen supply and consequent accumulation of blood lactate (HOLLMANN; HETTINGER, 1989; SIMÕES et al., 2010; WEINECK, 1999).

This occlusion, which also occurs in squatting, is the main cause for the relationship between the lactate phenomenon and resistance training (BARROS et al., 2004; MOREIRA et al., 2009), the increase of the intramuscular pressure that is performed in the concentric phase decreases the blood flow, causing the collapse of the capillaries (SOUSA et al., 2011). In a similar study Miguel et al. (2018) reported that the results verified, with procedures similar to the present study, but with other methods, found a significant increase in blood lactate after performing strength training and hypertrophy.

Barros et al. (2004), performed an analysis of relative and absolute values of the lactate threshold of two different exercises with volunteers, trained and untrained with the maximal load stop performing the exercises, where it did not show a difference in the relative values of the lactate threshold, in the absolute values, a positive significance was found in the groups studied.

It was demonstrated in the studies by Barros et al. (2004) and Azevedo et al. (2005), who analyzed the blood lactate behavior in two different resistance exercises and used an experimental procedure similar to that of the present study, that the Lactate threshold occurred in intensities between 28% and 31% of 1RM, and no statistical differences were found between relative intensities (% 1RM) corresponding to the thresholds identified for each exercise, in both studies. Disparities between studies can be attributed to the fact that they work similar methods, but with different exercises.

The study by Miguel et al. (2018) analyzed the acute response of the lactate threshold in different strength training methods and observed that there was no statistical difference between the exercises and the types of stress induced by them; however, in the training for hypertrophy, the acute responses of the lactate threshold increased significantly due to the higher metabolic stress.

Corroborating the results of our study, we have the research of Carvalho et al. (2017), which analyzed the resistance training with 15 adult male volunteers, with strength sessions (80%) and power (60%) and blood lactate levels increased in relation to rest. And in relation to the types of training: strength and potency, did not present significant alterations. Similarly, Gentil et al. (2006) analyzed different methods of strength training in young and trained men; here the tested methodologies showed an increase in blood lactate, but also showed no significant difference between them.

There are some limitations to our study. Firstly, the loads used for the execution of the exercises were not originated from any test, but in the subjective perception of exertion of each subject. And secondly, the small number of subjects, which can be partially justified by the eligibility criteria of the study and which could potentialize our results. Even with these limitations, the results can be considered consistent with what has already been researched in the literature of the area.

CONCLUSION

According to the results found, it is concluded that there is no significant difference between the values of lactacidemia during and shortly after the execution of strength and endurance training models in the squats. Only the total variation of the lactacidemia is significantly higher in strength training. It is believed that further studies are needed to confirm these findings by analyzing with a larger sample and greater control of training loads.

RESUMO: O conhecimento dos aspectos fisiológicos na execução do treino na musculação é importante para aprimorarmos os treinamentos; sendo a concentração de lactato um importante marcador aplicado em diversos tipos de exercícios. Alguns estudos já avaliaram lactacidemia e modelos de treinamento, porém não utilizaram o agachamento em seus protocolos. O objetivo do estudo foi analisar a concentração de lactato sanguíneo no treino do exercício agachamento livre em dois modelos de treinamento: força e resistência. Estudo experimental, com amostra de cinco homens de 24 ± 4.6 anos, fisicamente ativos e praticantes há pelo menos um ano, sem histórico de problemas ortopédicos e cardiovasculares. Os testes foram realizados em dois

dias, na sessão de força os voluntários executaram 12 séries, 6 a 12 repetições máximas e na sessão de resistência 12 séries, 13 a 20 repetições máximas. Em ambos os testes o intervalo foi de 1 minuto e 30 segundos entre as séries e de 2 minutos a cada 4 séries. O lactato sanguíneo foi coletado no repouso, durante e no pós-teste. Não foram encontradas diferenças significativas na concentração de lactato durante e após os testes no treino de força e no treino de resistência. No entanto, a variação da lactacidemia entre a primeira e a última coleta apresentou resultado significativamente maior no treino de força. Concluímos que os modelos de treinamento de força e de resistência, no exercício agachamento livre, não apresentam diferenças significativas na concentração de lactato durante e após os testes. Sendo a variação total de lactacidemia maior no treinamento de força.

PALAVRAS-CHAVE: Exercício resistido. Exercício de agachamento. Lactato. Performance.

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