32 - THE INFLUENCE OF DIFFERENT RANGES BETWEEN SERIES OF REPEATS IN PERFORMANCE OF A MAXIMUM STRENGTH TRAINING

VINÍCIUS MISIAK GODOY
EDUCADOR FÍSICO, ESPECIALISTA EM TREINAMENTO INDIVIDUAL E QUALIDADE DE VIDA.
PONTIFÍCIA UNIVERSIDADE CATÓLICA – CURITIBA/PR
vinnigodoy@hotmail.com

INTRODUCTION

Strength training that aims at to increase muscle power is performed with fast and explosive efforts which are interspersed with series of repetitions of a particular exercise with rest intervals. The relation between intense exercise and rest interval among the sets influences directly to the production of upper limb muscle power. However, this relation is not well understood for lower limbs exercises.

According with studies done by Martins et al 2008, the strength training could reduce risks associated to coronary artery disease and diabetes Mellitus type II, beside to help on obesity control, aging and others effective method for increasing muscle strength and bone mass.

According to Monteiro, Simon and Farinatti 2005, resistance exercise plays an important role in prescribing physical activity being prescribed by health care organizations, in order to promote improved functional, cosmetic and therapeutic.The physiological adaptations promoted by resistance exercise are characterized in terms of the manipulation of several variables, such as type, shape and ordering the execution of exercises, number of sets and repetitions, intensity, speed of movement and rest intervals between sets and between sessions training.

Resistance exercises are effective for increasing strength, hypertrophy and muscular power, however, the goals and individual differences may have variations. Some variables must be controlled by the resistance training prescription, among them: the order of the exercises, the interval between sets and sessions, weekly frequency, the number of reps and sets and intensity of loads worked (SIMÃO et al 2006).

Among all the variables that can be studied, one has less prominence, the duration of periods of rest between sets and exercises is considered of great importance when developing a program of resistance exercises, and different periods of rest between sets and exercises have been adopted in accordance with the objectives to be achieved (SIMÃO et al 2006).

The recovery interval during resistance training is a great variable of importance for researchers, athletes, coaches, and practitioners of resistance exercises. According to Libardi et al 2007, the amplitude of the rest interval between sets influences the acute metabolic responses, reply chronic muscle strength, performance series and subsequent hormonal responses.

For Polito et al 2007, rest intervals influence on the workout stress and the total load that can be used. These ranges also influence on the degree of energy recovery ATP-CP, the blood lactate concentration and can influence factors such as fatigue and anxiety.

Careful manipulation of the interval periods is essential to avoid inappropriate and unnecessary tension in the individual during training. The objective of this study was to investigate the influence of different rest intervals on the performance of maximum repetitions between sets of strength training.

METHODOLOGICAL PROCEDURES

SAMPLE

A sample scenario it was compost by 12 young males (ages between 21 to 31), healthy proven according to the form PAR-Q (Conory Risk Test). All the evaluated resided in Cascavel/PR and participated voluntarily. All were informed of the study purpose, procedures, possible discomforts, risks and benefits, before signing the consent form.

The follow inclusion criteria were use: a) have at least 6 months of weight training targeting the goal of strength, b) have often training with weights at least four times per week, c) do not have any kind of compromise cardiorespiratory d) do not have any type of musculoskeletal injury, and) do not have any type of metabolic disease.

ANTHROPOMETRIC ASSESSMENT

Aiming to better describe the sample were measured: 1) height by a stadiometer (Seca) with scale measures 0.1 centimeters (cm) 2) body mass using a balance (ID-1500 Filizola), with capacity of 150 kg and a resolution of 100g, and possession of these measures was calculated BMI.

1RM TEST

The 1RM tests involve attempts to lift a certain weight at once according with a prior standardization. The test should start with a load below the maximum level of the individual, so that if the motion is carried out correctly, the weight should be increased for the next attempt until the individual cannot perform the movement with perfection (FLECK e SIMÃO 2008).

Pediction test of 1RM are indicated for the assessment of muscle strength in adolescents, heart disease, and hypertensive elderly estimating the load in maximal and submaximal efforts in being safer for such populations (FLECK e SIMÃO 2008).

EXPERIMENTAL PROCEDURES

The volunteers had access to resistance training protocols with at least two weeks in advance of the research to become familiar with it. They were instructed to avoid consuming caffeine and alcohol for a period of 24 hours before each test, as well as not to perform physical exercises for a period of 48 hours before testing. To avoid the various hormone concentrations circadian rhythm, the volunteers attended the venue of experimental protocols at the same time of day (morning shift), keeping the same schedule for each evaluated. The experimental protocols were conducted on three different days within a period of five days.

Participants were instructed to perform a standard diet one hour before the resistance training. The participants underwent by a warm up procedure which consisted of a series of twelve to fifteen repetitions with 50% load on days training usual, however, did not undergo stretching.

The test was performed on a Leg Press machine 45º, which induces the performance of the movement of knee extension against a pressure plate, using 90% of the maximum load identified in the first test day.

The test was conducted in three days with an interval of forty-eight hours between them. On the first day (Monday) was applied 1 RM test, on the second day (Wednesday) the participants were instructed to perform four series with the maximum number of repetitions, using the two-minute interval between each series, however, on the third day of evaluation (Friday) the same procedure was performed using four minute interval between sets.

Exercise and equipment used for the second and third day of evaluation was the same used in the 1RM test. It is important to note that volunteers were already in the process of weight training aimed at increasing strength.

RESULTS

In Table 1 are the values related to sample characteristics.

Table 1: Mean values of the variables age, height, weight and BMI of the sample.

	Minimim amount	Maximum amount
Age	21 anos	31 anos
Weight	72 kg	98,5 kg
Height	1,73 m	1,85 m
BMI	24,05 kg/m^2	29,09 kg/m^2

Table 2 shows the amount (kg) for the loads used by assessed for Test 1 Repetition Maximum (1RM).

Table 3 shows the distribution of the sample in relation to the number of repetitions performed by each volunteer in four series with recovery interval of two minutes between them. Table 4 shows the distribution of the sample in relation to the number of repetitions performed by each volunteer in four series with recovery interval of four minutes apart.

Table 2: Amounts (kg) related to charges assessed for use by the Test of 1 Repetition Maximum (1RM).

	Warm up	Attempt 1	Attempt 2	Attempt 3	100%	90%
1	160	240	280	320	320	288
2	120	240	320	X	320	288
3	320	400	460	480	480	432
4	110	150	190	200	200	180
5	110	200	230	X	230	207
6	140	240	260	270	270	243
7	100	150	170	180	180	162
8	150	250	280	300	300	270
9	180	290	320	340	340	306
10	150	260	270	X	270	243
11	150	250	260	X	260	234
12	200	320	340	350	340	306

Table 3: Number of repetitions performed in series with each recovery interval of two minutes.

Evaluated	1º Series	2º Series	3º Series	4º Series
1	4	3	4	4
2	4	3	3	3
3	3	3	3	2
4	3	3	3	2
5	3	3	2	2
6	4	4	3	3
7	2	2	2	1
8	3	3	2	2
9	2	2	2	2
10	4	3	2	2
11	3	3	3	2
12	4	4	3	3
Total Reps	39	36	32	28
Average Reps	3,25	3	2,66	2,33

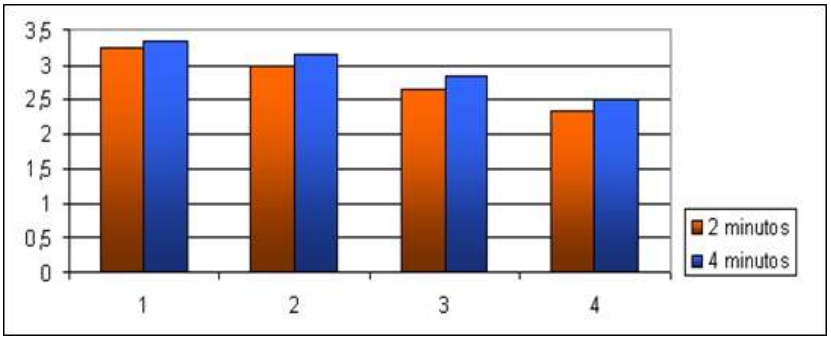
Table 4: Number of repetitions performed in series with each recovery interval of four minutes.

Evaluated	1º Series	2º Series	3º Series	4º Series
1	3	4	4	4
2	4	3	3	4
3	2	3	3	2
4	3	4	3	2
5	4	3	3	3
6	3	3	3	2
7	3	2	2	2
8	3	3	2	2
9	3	3	3	2
10	4	3	2	2
11	4	3	3	2
12	4	4	3	3
Total Reps	40	38	34	30
Average Reps	3,33	3,16	2,83	2,5

Graph 1 shows the performance of maximum repetitions between sets with different recovery intervals.

According to the graph, the recovery interval did not influence in the performance of maximum repetitions in each set, however, showed a significant difference in the performance of maximum repetitions between sets.

Graph 1: Performance of maximum repetitions between sets with different recovery intervals.



DEBATE

The aim of this study was to investigate the influence of different rest intervals on the performance of maximum repetitions between sets of strength training. For both, it was taken as the basic principle for 1RM load set to be used in subsequent tests.

The maximum load tests can be very useful in training prescription, but you should be aware of the relationship between the percentage of 1RM and the number of repetitions that can be performed, because this relationship varies with the amount of muscle mass involved in exercise (FLECK e SIMÃO 2008).

From tests using intervals of two and four minutes, it was found that the difference in recovery time between sets not influence directly on the volunteers performance perform on repetitions in the Leg Press 45º. Simon et al 2006, showed that strength training for intermediate and advanced practitioners should be used intervals between 2 and 3 minutes for exercises that involve more than one joint and 1 to 2 minutes for exercises with lower muscle mass. Such determination underscores that these intervals appear to be sufficient to cause the recovery between sets.

However, it was verified decreasing the performance among the sets of the same time interval. Ernesto et al 2009, argue that the rest period between sets and exercises during a training session has significant influence on the response to training; there are major differences in hormonal response and lactic acid in the blood in identical sessions, but with periods resting different. The interval time also determines the characteristic of the recovery will occur between sets and exercises.

Regarding the muscle fibers behavior, it is known that they do not have the same biochemical functions (metabolic). Some are better suited, in physiological terms, to operate under anaerobic conditions while others work better under aerobic conditions.

By running a series of ER, the fast-twitch fibers (white) are recruited first, and to the extent that the exercise requires greater amount of force, the slow-twitch fibers (red) are progressively recruited, indicating that the higher the intensity, the greater the share of fiber type (MONTEIRO, SIMÃO e FARINATTI 2005).

The slow twitch fibers are fast and reasonably equivalent proportions within the body, strength training does not affect, supposedly, this relationship of half and half in a very significant degree. Strength training, however, affects the fiber size (BOMPATO 2001).

The slow-twitch contraction of the motor unit is faster and more powerful. The successful athletes in strength sports speed-equipped, genetically, with a higher proportion of fast-twitch fibers, but they also get tired faster. Individuals with slower twitch fibers get more success in endurance sports, as they are capable of performing a job of lower intensity for a longer time (BOMPATO 2001).

The fast-twitch fibers are used in activities shorter and faster, but it is not the speed of contraction, but yes to muscle strength, which makes the motor nerves recruit the fast twitch fibers (BOMPATO 2001).

The charge is that determines the order of muscle fibers. As the load increases, more fast-twitch fibers are activated during a contraction (BOMPATO 2001).

The physiological mechanisms that attempt to elucidate the role of fatigue on performance in the series and their respective intervals are still incipient. Typically, bodybuilders using short rest intervals, causing high stress muscle, primarily due to increased release of anabolic hormones, however, this depends on the training phase in which the individual is. In addition, short intervals periods are accompanied by considerable muscular discomfort due to occlusion of blood flow, lactate production and thus decrease the force output (SIMÃO et al 2006).

CONCLUSION

According to the results obtained in this study, the difference in recovery time interval between sets proposal did not directly influence the performance of volunteers to run the maximum repetitions, however, we found that a full recovery of muscle strength seems to be achieved between sets of the same interval causing a drop in performance of volunteers.

For this reason, we suggest future studies with longer periods of follow-up, involving a larger sample size and other characteristics of training status, gender and age.

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VINÍCIUS MISIAK GODOY.
Endereço: Rua 7 de Setembro, n 2602
CEP 85801-140, CASCAVEL/PR.
vinnigodoy@hotmail.com

THE INFLUENCE OF DIFFERENT RANGES BETWEEN SERIES OF REPEATS IN PERFORMANCE OF A MAXIMUM STRENGTH TRAINING

ABSTRACT

Introduction: The strength training that focuses on increasing muscle power is done with quick and explosive efforts are interspersed series of repetitions of a particular exercise with rest intervals. The breadth of the recovery interval between sets affects the acute metabolic responses, the chronic responses of muscle strength, performance of subsequent sets, and hormonal responses.

Objective: To investigate the influence of different rest intervals on performance of maximum repetitions between series of strength training.

Methods: The sample comprised 12 young men (21-31 years old). Initially held an evaluation for anthropometric measurements of weight, height and BMI of the sample, then the subjects participated in the 1RM test for the evaluation of muscle strength. Tests of maximum repetition for determining intervals of two and four minutes were performed in a leg press machine 45º, which induces the creation of motion knee extension against a pressure plate, we used 90% of maximum identified in first day of testing.

Results: The recovery interval didn't influence the performance of maximum repetition in each series, however, showed a significant difference in the performance of maximum repetitions between sets.

Conclusion: The time used in the intervals between sets of maximum repetitions doesn't influence directly the performance of resistance training.

KEYWORDS: Resistive Exercise, Strength, Interval

RÈSUMÉ

Introduction: Le travail de la puissance qui augmente la force musculaire est obtenu grâce à des efforts rapides et explosifs qui sont entrecoupés par des séries de répétitions d'un exercice particulier avec des temps de repos entre les exercices. Le temps de récupération entre les séries à une incidence sur les réponses métaboliques, les réponses chroniques de la force musculaire, la performance des séries à venir, ainsi que les réponses hormonales.

Objectif: Etudier l'influence des différents intervalles de repos sur la performance des répétitions entre les séries de travail de puissance.

Méthodes: L'échantillon comprend 12 jeunes hommes (21-31 ans). Au départ, une évaluation du poids anthropométrique a été mise en place, la taille et l'Indice de Masse Corporelle(IMC) de l'échantillon, ensuite les sujets ont participé au test (1rm?) pour l'évaluation de la masse musculaire. Des tests de séries de répétition maximum de 2 et 4 minutes ont été conduits afin de déterminer les intervalles grâce à une presse oblique (45), qui provoque un mouvement d'extension du genou contre la pression de la plaque, nous avons utilisé 90% du maximum (?) le premier jour de test. (I think there is a word missing in this sentence).

Résultats: Les intervalles de repos n'ont pas influencé la performance des répétitions maximum durant chaque séries, cependant, elles ont montré une différence significative sur la performance des répétitions maximum entre les séries.

Conclusion: L'ampleur du temps de repos entre les séries de répétitions maximum n'a pas d'impact direct sur la la performance du travail de résistance.

RESUMEN

Introducción: El entrenamiento de fuerza que objetiva el aumento de potencia muscular es realizado con esfuerzos rápidos y explosivos alternando series de repeticiones de un determinado ejercício con intervalos de recuperación. La amplitud del intervalo de recuperación entre series influencia las respuestas agudas metabólicas, las respuestas crónicas de la fuerza muscular, el desempeño de las series subsecuentes y las respuestas hormonales.

Objetivo: Verificar la influencia de diferentes intervalos de recuperación en el desempeño de repeticiones máximas entre series de un entrenamiento de fuerza.

Métodos: La muestra fué compuesta por 12 hombres jóvenes (21 a 31 años de edad). Inicialmente, se realizó una avaluación antropométrica para verificación de peso, estatura e IMC de la muestra. Luego los avaluados participaron del teste de 1RM para avaluación de la fuerza muscular. Los testes de repetición máxima para verificación de los intervalos de dos y cuatro minutos fueron realizados en una máquina de Leg Press 45°, la cual induce la realización del movimiento de extensión de rodillas contra una placa de presión. Fueron utilizados 90% de la carga máxima identificada en el primer día de teste.

Resultados: El intervalo de recuperación no influenció en el desempeño de repeticiones máximas en cada serie. Sin embargo, se presentó diferencia significativa en el desempeño de repeticiones máximas entre las series.

Conclusión: El tiempo utilizado en los intervalos de recuperación entre series de repeticiones máximas no influencia directamente en el desempeño de entrenamientos de resistencia.

PALABRAS CLAVE: Ejercício de Resistencia, Fuerza, Intervalo.

A INFLUÊNCIA DE DIFERENTES INTERVALOS DE RECUPERAÇÃO ENTRE SÉRIES NO DESEMPENHO DE REPETIÇÕES MÁXIMAS DE UM TREINAMENTO DE FORÇA

RESUMO

Introdução: O treinamento de força que objetiva o aumento da potência muscular, é realizado com esforços rápidos e explosivos intercalando-se séries de repetições de um determinado exercício com intervalos de recuperação. A amplitude do intervalo de recuperação entre as séries influencia as respostas agudas metabólicas, as respostas crônicas da força muscular, o desempenho das séries subseqüentes, e as respostas hormonais. Objetivo: Verificar a influência de diferentes intervalos de recuperação no desempenho de repetições máximas entre séries de um treinamento de força. Métodos: A amostra foi composta por 12 homens jovens (21 a 31 anos de idade). Inicialmente realizou-se uma avaliação antropométrica para verificação de peso, estatura e IMC da amostra, em seguida os avaliados participaram do Teste de 1RM para a avaliação da força muscular. Os testes de repetição máxima para verificação dos intervalos de dois e quatro minutos foram realizados em uma máquina de Leg Press 45º, a qual induz a realização do movimento de extensão de joelhos contra uma placa de pressão, foram utilizados 90% da carga máxima identificada no primeiro dia de teste. Resultados: O intervalo de recuperação não influenciou no desempenho de repetições máximas em cada série, entretanto, apresentou-se diferença significativa no desempenho de repetições máximas entre as séries. Conclusão: O tempo utilizado nos intervalos de recuperação entre séries de repetições máximas não influencia diretamente no desempenho de treinamentos resistidos.

PALAVRAS-CHAVE: Exercício Resistido, Força, Intervalo.