64 - MUSCULATION TRAINING FOR HYPERTROPHY: TENSIONAL OVERLOAD AND METABOLIC OVERLOAD

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doi:10.16887/88.a1.64

Introduction

Currently, a large part of the population suffers from diseases due to unhealthy living habits. Among these habits, sedentary lifestyle, poor eating habits and the ingestion of alcohol and tobacco are included. As a result of these practices, cardiometabolic diseases such as hypertension, diabetes, obesity, among others cause millions of deaths annually. As a result of this situation, many researches related to physical activity and health have been carried out, and with this, we already know the importance of the practice of physical exercise for human health. It is a fact that for individuals to have a quality of life considered as good it is necessary to practice regular physical exercises. One of the modalities of exercise that has been highlighting and being quite indicated for improvement in the health frameworks of the general population is bodybuilding. The modality can contribute in the promotion of the health of its practitioners, promoting from an increase of the muscle mass, reduction of the percentage of corporal fat and in the increase of the levels of force. Bodybuilding is considered an essential component of a physical fitness program, encompassing the development and maintenance of strength, endurance and muscle mass (Graves and Franklin, 2006). In addition to these benefits related to improvements in the quality of life of its practitioners, the modality is also very efficient in terms of body aesthetics. According to Rodrigues et al. (2016), bodybuilding is one of the main activities sought also by individuals in search of aesthetic improvements.

In bodybuilding training different types of stimuli can promote physiological adaptations in the body. One of these stimuli is known as tensional overload, which is characterized by the application of high loads and a low number of repetitions, and as a result of these periods of longer intervals aiming to restore the energy stocks, and may vary slightly according to the literature. The physiological adaptation resulting from this type of overload is the increase in the size of contractile myofibrils. Another type of stimulus resulting from bodybuilding training is metabolic overload, characterized by low and / or moderate load applications, using a higher number of repetitions, and relatively shorter intervals for recovery of muscle energy stores. The type of adaptation resulting from this type of overload is the increase of sarcoplasmic content, generally increasing concentrations of glycogen, water and intramuscular CP (GUEDES, 2003).

Considering the relevance of the exposed content, the intention of this study was to evaluate the impact on the hypertrophic response to the use of two types of different overload stimuli in bodybuilders.

Methodology

The study was characterized as intervention or experimental, whose characteristic is the intervention of the researcher in the researched reality, with a predominantly quantitative and longitudinal approach. It was a controlled study, where the researcher establishes variables that constitute cause for a given effect. The sample consisted of 10 males aged 18 to 28 years, bodybuilders for at least 6 consecutive months, divided by lot in two groups: tensional overload group (GST) and metabolic overload group (GSM). All the volunteers signed a free and informed consent form (TCLE). The study followed the recommendations contained in resolution 466/12 of the CNS.

To the subjects that were applied a training plan with tensional overload, the trainings were divided in 3 different routines. The training routine started with the individuals performing 5 minutes of warm-up in an aerobic activity and after that they performed the specific training plan of the bodybuilding. Routine A was composed of 8 exercises in which 3 exercises were for the muscular groups of the back (barbell graviton, paddled with neutral support and open back pull), 3 exercises for the triceps (triceps on the high pulley, French triceps and unicex triceps triceps), 1 exercise for the trapeze (High Remodel with bar) and 1 exercise for the abdomen (Abdominal supra) totaling 25 series. Routine B was composed of 8 exercises in which 3 exercises went to the pectoral (Supine straight bar, horizontal crucifix, Incline supine with the bar), 4 exercises for the lower limbs (Leg 45, extensor chair, flexor table, knee flexion standing) and 1 exercise for the abdomen (Abdominal board) being performed on that training day 25 series. The routine C was composed of 8 exercises in which 3 exercises were for deltoids (Development of shoulder with halter, shoulder abduction, alternating shoulder flexion), 3 exercises of biceps (direct thread bar, scott thread, concentrated thread) and 2 exercises to the calf (sitting plantar flexion, standing plantar flexion in the machine) totaling 24 series. For the tension training program, 3 sets were used in each exercise, with repetitions varying from 10 to 12, and the recovery interval adopted was 1 minute. For GSM, the same training program was adopted, differing from the other group due to the use of different stimuli regarding the training variables as number of repetitions, where a range of 15 to 20 repetitions was adopted and the time of interval between series that was set at 45 seconds.

In the first week of training, the perimetry of the relaxed and contracted right arm was measured, and the percentage of fat was measured. After 10 weeks the tests were performed again to carry out the comparison between the beginning and the end of the training. Data collection was performed using a manual Omron Bioelectrical Impedance device, model HBF-306, whose function is to estimate the percentage of body fat and lean mass. Already for the measurement of the perimetry of the relaxed and contracted arm, a tape measure with millimetric precision was used. As statistical treatment, the descriptive statistics and data distribution were first performed by the Kolmogorov-Smirnova test to verify the normal distribution of the data. Then, for the data with normal distribution, the analytical statistic was performed for independent measurements, difference between groups (normal distribution, Student's t-test). For the study, a significance level of 5% was adopted.

Results

Table 1 shows the anthropometric and 1RM data of GST subjects divided into two moments, before and after 10 weeks of intervention.

Table 01: Results of the values of the anthropometric variables evaluated and the 1RM test of the GST subjects before and after the 10 weeks of intervention.

Tension Overload	Variable	Average	p
Fat (%)	Before	13,60	
	After	12,42	0,115
Lean Mass (kg)	Before	58,34	
	After	59,90	0,049*
Perimetry Relaxed Arm (cm)	Before	30,46	
	After	31,30	0,033*
Perimetry Contracted Arm (cm)	Before	32,86	
	After	34,28	0,05*

In relation to fat percentage, GST presented a mean value of 13.60% and 12.42% after the training period, revealing that there was no significant difference (p=0.115). For the values of lean mass, the volunteers presented before the experiment an average value of 58.35 kg, after the intervention period the group presented a value of 59.90 kg, which according to the analysis showed a statistically significant difference (p=0.049). The pre-experiment value for the perimetry of the relaxed arm was on average 30.46cm and 31.30cm in mean post-experiment, which revealed a significant difference (p=0.033). The mean value initially found for the contracted arm was 32.86 cm, and the post-experiment was 34.28 cm, thus presenting a significant difference (p=0.05).

Table 2 shows the anthropometric and 1RM data of the GSM subjects divided into two moments, before and after 10 weeks of intervention.

Table 02: Results of the values of the anthropometric variables evaluated and the 1RM test of the GSM subjects before and after the 10 weeks of intervention.

Metabolic Overload	Variable	Average	p
Fat (%)	Before	14,14	
	After	14,18	0,947
Lean Mass (kg)	Before	58,76	
	After	60,74	0,021*
Perimetry Relaxed Arm (cm)	Before	31,18	
	After	32,62	0,052
Perimetry Contracted Arm (cm)	Before	33,84	
	After	35,00	0,049*

Regarding fat percentage, GST initially presented a mean value of 14.14% and 14.18% after the training period, which showed no significant difference (p = 0.947). For the values of lean mass, the participants had before the experiment an average value of 58.76 kg, and after the intervention period the group presented a value of 60.74 kg, which according to the analysis showed a statistically significant difference (p=0.021). The pre-experiment value for the perimetry of the relaxed arm was on average 31.18 cm, and 32.62 cm post-experiment, which revealed no significant (p = 0.052). The mean value initially found for the contracted arm was 33.84 cm, and post-experiment was 35.00 cm, thus presenting a significant difference (p = 0.049).

Discussion

In the study, no significant difference was found in relation to the% fat of the volunteers in the two training protocols adopted, considering the pre-intervention and post-intervention periods. The findings corroborate with the results found in the study conducted by Costa, Rogatto and Rogatto (2007), who did not find significant changes in the% of fat in trained individuals performing a training with characteristics similar to ours, using stress and metabolic overload. An interaction between training and a specific diet prescribed by a nutrition professional with the amount and type of nutrients needed for each individual may be more effective than just the training stimulus when the goal is to decrease body fat%. Another important aspect worth highlighting about our study is that the main objective of the individuals was muscle hypertrophy, which may require a high daily intake of nutrients necessary for muscular anabolism. An increase in muscle hypertrophy seems to be related to a large supply of nutrients for protein resynthesis to occur, which ingestion may have contributed to the maintenance of body fat% of the subjects. However, this is only speculation, since the study had limitations on nutritional monitoring for individuals.

Our study showed that 10 weeks of bodybuilding training using stress overload and metabolic overload were able to cause a significant increase in lean mass in subjects tested. GST increased by an average of 1.56 kg of lean mass, while GSM increased by an average of 1.98 kg. These findings contrast with those found by Costa, Rogatto and Rogatto (2007), who in their study, after 9 weeks of strength training protocol in 2 groups of young individuals, 1 trained with tension overload and the other trained with overload did not find significant increases in lean mass in the subjects of their research. However, our findings are similar to those of Schmitz, Hofheins and Lemieux (2010), who found a significant increase in lean mass of 2.4 kg in one of the groups tested with a strength training protocol using tension stimulus (8 to 15 maximal repetitions with the interval between series between 1 to 2 minutes), in young men and supplementation by 4 times. In assessing the impact of repetitive force training on repetitive zones in untrained men, Campos et al. (2002) found that zones of lower repetitions 3 to 5 MRI and 9 to 11 MRI, that is, tension stimulus, significantly increased values of the muscular cross section of the leg, while the highest repetition zone 20 28 MR, metabolic stimulus did not significantly alter the cross section of the muscle. These findings showed that exercises with higher intensities and volume of lower repetitions had a higher hypertrophic potential than high repetitions and consequently a lower exercise load. Despite the findings of Campos et al. (2002), there is evidence that training with lower intensities may generate stimuli for muscle hypertrophy. Recent discoveries have shown that high-volume training can generate superior anabolic stimuli to a high-intensity training (BURD et al, 2010). In this study, 15 young male subjects were divided into 3 groups where each group performed 1 training protocol other than 4 series in unilateral knee extension where one group performed the exercise with 90% of 1 RM until failure, the other group performed 30% of 1 RM with approximate external load with the 90% protocol of 1RM and the other performed 30% of 1RM until voluntary failure. Muscle biopsies increased protein synthesis and mixed myofibrillar rates, myogenic gene expression and post exercise muscle anabolism measured at 4 hours and 24 hours after. As a result, it was observed that low intensity and high volume exercises could induce an increase of acute muscular anabolism

superior to the exercise of high intensity and low volume and also combinations of different intensities and volumes.

Regarding the perimetry of the relaxed arm, GST increased in mean values 0.84 cm, which according to the analysis was statistically significant, while the GSM increased in mean values 1.44 cm, but according to the analysis, did not present significant difference. In the perimetry of the contracted arm GST had an increase in mean values of 1.42 cm, and it was significant, whereas the GSM increased in mean values 1.16 cm, a value that was also statistically significant. The increase in perimetry presented by individuals may be directly associated with increased muscle mass. This is affirmed that this can be supported by the statistically significant lean mass found in both groups, associated with the relative stabilization in the percentage of body fat found in the subjects of the study. In this way, the increase in body perimetry may have indicated an increase in the muscular volume of the arm. This parameter was used to supplement the body composition parameter, which identified a lean mass gain. Our findings are different from those found by Roggato (2004), who did not find alterations in the muscular area of the arm and also in the lean mass in elderly women submitted to a training program of bodybuilding.

Conclusion

According to the study proposal, and the results obtained, it can be concluded that in relation to fat percentage, the observed values allow to affirm that changes in body fat content through bodybuilding training, manifested through the use of tension stimuli and did not result in significant changes in subjects taking part in the study. With regard to the increase in lean mass, in view of the results found we can conclude that both training strategies used were efficient in promoting muscle mass gain within the period considered in the study. The experiment also allowed us to verify that in relation to the evaluated perimetry of the arm, the only variable that did not present significant difference in the study was the perimetry of the relaxed arm using a metabolic overload stimulus, in the others there was a significant gain both for GST and for the GSM. It can be affirmed that, in view of the results found in the study, it is important to note that there are a great variability of strategies to optimize muscle hypertrophy gain, and that training variables such as number of repetitions, muscle contraction, interval time between sets, as well as applied training load, should be carefully considered at the time of bodybuilding training prescription according to the individual's experience, capacity and training period, emphasizing the importance of fitness of the subject's diet in order to optimize his hypertrophic gains.

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MUSCULATION TRAINING FOR HYPERTROPHY: TENSIONAL OVERLOAD AND METABOLIC OVERLOAD

The objective of this study was to evaluate the impact on the hypertrophic response to the use of two types of different overload stimuli in bodybuilders. The sample consisted of 10 subjects with ages ranging from 18 to 28 years of age, divided into 2 groups: tension overload group (GST) and metabolic overload group (GSM). The variables were: perimetry of the relaxed and contracted right arm, and the measurement of fat percentage through bioimpedance and tape measure, before the intervention began, and after the 10-week period for comparison of the data. The Kolmogorov-Smirnova test was used as the statistical treatment first to verify the normality in the distribution of the data, and then to the data with normal distribution, the analytical statistic was performed for independent measurements, difference between the groups (normal distribution, t test Student), adopted a level of significance of 5%. The results showed that there was no significant difference in the percentage of fat in both post intervention groups. In relation to the lean mass, there was a significant gain difference in both protocols adopted after the 10-week period. Regarding the perimetry of the arm, the only variable that did not present significant difference in the study was the perimetry of the relaxed arm using a metabolic overload stimulus, the other perimetry measurements showed that there was a significant gain after the experiment period. It can be concluded from the results obtained, considering the limitations of the study, that from the variables evaluated in the study, both training protocols adopted, were efficient in promoting hypertrophic gains in the participants of the research.

Keywords: Training; Bodybuilding; Hypertrophy.

FORMATION DE MUSCULATION POUR L'HYPERTROPHIE: SURCHARGE DE TENSION ET SURCHARGE METABOLIQUE

L'objectif de cette étude était d'évaluer l'impact sur la réponse hypertrophique sur l'utilisation de deux types différents de frais généraux dans les stimuli culturistes. L'échantillon était constitué de 10 sujets âgés de 18 à 28 carrossiers divisés en 2

groupes: un groupe de surcharge de tension (TPS) et le groupe de surcharge métabolique (GSM). On a mesuré les variables suivantes: périmétrie détendue bras droit et contracté, et la mesure du pourcentage de matières grasses par bioimpédance et un ruban à mesurer, avant l'intervention, et au bout de 10 semaines pour comparer les données. Il a été utilisé comme premier traitement statistique test de Kolmogorov-Smirnova pour vérifier la normalité dans la distribution de Dasos, puis pour les données de distribution normale a été effectuée à des statistiques analytiques pour des mesures indépendantes, différence entre les groupes (distribution normale, test t Étudiant), a adopté un niveau de signification de 5%. Les résultats ont montré qu'il n'y avait pas de différence significative dans le pourcentage de graisse dans les deux groupes post-intervention. En ce qui concerne la masse maigre, il y avait une différence de gain significative dans les deux protocoles adoptés après la période de 10 semaines. En ce qui concerne la circonférence du bras, la seule variable qui n'a pas montré de différence significative dans l'étude était le périmètre du bras détendu en utilisant un stimulus de surcharge métabolique, d'autres mesures de périmétrie ont montré qu'il y avait un gain significatif après la période expérimentale. On peut en conclure sur les résultats, compte tenu des limites de l'étude, à partir des variables évaluées dans l'étude, les deux protocoles de formation adoptés, ont été efficaces dans la promotion des gains hypertrophiques participants à la recherche.

Motsclés: Formation; Musculation; Hypertrophie.

ENTRENAMIENTO DE MUSCULACIÓN PARA HIPERTROFÍA: SOBRECARGA TENSIONAL Y SOBRECARGA METABÓLICA

El objetivo de este estudio fue evaluar el impacto en la respuesta hipertrófica ante la utilización de dos tipos de estímulos de sobrecarga diferentes en practicantes de musculación. La muestra del compuesto de 10 sujetos con edades entre 18 a 28 años practicantes de musculación divididos en 2 grupos: grupo de sobrecarga tensional (GST) y grupo de sobrecarga metabólica (GSM). Se midieron las variables: perimetría del brazo derecho relajado y contraído, y la medición del porcentaje de grasa a través de bioimpedancia y cinta métrica, antes del inicio de la intervención, y después del período de 10 semanas para la comparación de los datos. Se utilizó como tratamiento estadístico primero la prueba de Kolmogorov-Smirnova para verificar la normalidad en la distribución de los huesos, y luego para los datos con distribución normal se realizó la estadística analítica para medidas independientes, la diferencia entre los grupos (distribución normal, Prueba t (Student), adoptó un nivel de significancia del 5%. Los resultados mostraron no haber diferencia significativa en relación a la variación en el porcentaje de grasa en ambos grupos post intervención. En cuanto a la masa magra hubo diferencia significativa de ganancia en ambos protocolos adoptados después del período de 10 semanas. En cuanto a la perimetría del brazo, la única variable que no presentó diferencia significativa en el estudio fue la perimetría del brazo relajado utilizando un estímulo de sobrecarga metabólica, las demás medidas de perimetría mostraron haber habido una ganancia significativa después del período del experimento. Se puede concluir ante los resultados obtenidos, considerando las limitaciones del estudio, que a partir de las variables evaluadas en el estudio, ambos protocolos de entrenamiento adoptados, se mostraron eficientes en la promoción de ganancias hipertróficas en los participantes de la investigación.

Contraseñas: Entrenamiento; Musculación; Hipertrofia.

TREINAMENTO DE MUSCULAÇÃO PARA HIPERTROFIA: SOBRECARGA TENSIONAL E SOBRECARGA METABÓLICA

O objetivo deste estudo foi avaliar o impacto na resposta hipertrófica diante da utilização de dois tipos de estímulos de sobrecarga diferentes em praticantes de musculação. A amostra do constituída de 10 sujeitos com idades entre 18 a 28 anos praticantes de musculação divididos em 2 grupos: grupo de sobrecarga tensional (GST) e grupo de sobrecarga metabólica (GSM). Foram mensuradas as variáveis: perimetria do braço direito relaxado e contraído, e a aferição do percentual de gordura através de bioimpedância e fita métrica, antes do início da intervenção, e após o período de 10 semanas para comparação dos dados. Foi utilizado como tratamento estatístico primeiro o teste de Kolmogorov-Smirnova para verificar a normalidade na distribuição dos dasos, e em seguida para os dados com distribuição normal realizou-se á estatística analítica para medidas independentes, diferença entre os grupos (distribuição normal, Teste t Student), adotado um nível de significância de 5%. Os resultados mostraram não haver diferença significativa em relação à variação no percentual de gordura em ambos os grupos pós intervenção. Já em relação à massa magra houve diferença significativa de ganho em ambos os protocolos adotados após o período de 10 semanas. Em relação à perimetria do braço, a única variável que não apresentou diferença significativa no estudo foi a perimetria do braço relaxado utilizando um estimulo de sobrecarga metabólico, as demais medidas de perimetria mostraram ter havido um ganho significativo após o período do experimento. Pode-se concluir diante dos resultados obtidos, considerando as limitações do estudo, que a partir das variáveis avaliadas no estudo, ambos os protocolos de treinamento adotados, mostraram-se eficientes na promoção de ganhos hipertróficos nos participantes da pesquisa.

Palavras-Chave: Treinamento; Musculação; Hipertrofia.