THE EFFECT OF 3 MONTHS RESISTANCE TRAINING ON MUSCLE MASS AMONG MALE STUDENTS

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Keywords: **resistance training, muscle mass, male students**

Abstract

Objective: The present study aimed to evaluate the effects of a three months resistance training on muscle mass among male students.

Methods: Six students without previous experience in strength training were included in the study. The training program included exercises for upper and lower limb muscles with an intensity of 75% of 1RM over a period of 3 months (10 reps x 75% of 1RM, 1 set for each exercise, 6 exercises per training session, 4 times a week, 60 minutes each training session). Muscle mass was estimated using bioelectrical impedance (Tanita MC 780, Tanita Europe).

Results: At the end of the study, the results of 6 male students were analyzed. A significant improvement was noted in the muscle mass after 3 months compared to the baseline results.

Conclusion: Resistance training program using 10 reps x 75% results in improvement on muscle mass in male students.

Introduction

It is well known that workouts aimed at increasing muscle strength induce muscle hypertrophy (Kraemer, Nindl, & Ratamess, 2004) through mechanical, metabolic and hormonal processes. The hypertrophy process involves a proportional increase of the net accumulation of the actin of the contractile protein and of the myosin, as well as of other structural proteins. Mechanical loading leads to a series of intracellular events that ultimately regulate gene expression and protein synthesis. Muscle strength training can modify the activity of nearly 70 genes (Roth, Ferrell, & Peters, Influence of age, sex, and strength training on human muscle gene expression determined by microarray, 2002), factors that regulate myogenesis and regulate growth factors. growth inhibitors (Roth, Martel, & Ferrell, 2003). Protein synthesis in human skeletal muscles increases after only one vigorous training session aimed at increasing muscle strength, and this protein synthesis peaks at approximately 24 hours post-training (Phillips, Tipton, Aarsland, Wolf, & Wolfe, 1997).

Neural adaptations predominate in the early stages of training (Moritani & DeVries, 1979). Muscle hypertrophy becomes evident within the first 6 weeks after the start of strength training, although changes in protein quality and protein synthesis speed occur much earlier (Phillips S. M., 2000). From this moment, there seems to be an interaction between neural adaptation and hypertrophy in the expression of power. These findings indicate that progressive overloading is necessary for maximal recruitment of muscle fibers and, therefore, for hypertrophy of muscle fibers. This also indicates that changes in the design of programs

targeting both neuronal and hypertrophic factors may be beneficial for maximizing strength and hypertrophy (American College of Sports Medicine, 2009).

Material and methods

Participants in the study: 6 male students, age 19±15, range; were required to present with a medical certificate verifying their otherwise good health, to have not previously engaged in resistance training, and to have not any contraindication to participation in resistance training. The training program was conducted over a period of three months, four times a week and includes exercises for the development of the strength of the main muscle groups at the lower and upper limbs. Each training session lasted approximately 50 minutes, and the sessions took place in the gymnasium of Ştefan cel Mare Suceava University – Faculty of Physical Education and Sport. The subjects had a period of two weeks of familiarization with the exercises and learning the correct technique of execution, and in this two weeks the intensity used was 40% of 1RM with a number of 12 – 15 repetitions for each set. Subsequently, in the third week the intensity increased to 50% of 1RM, followed by the fourth week to use the specific method (6 x 75% of 1RM). The weekly exercise program consists of barbell back squat, 45-degree seated leg press, machine leg curl, seated hip abduction, calf raise, seated hip adduction (Monday); lat pull-down, chin-up, seated pulley row, one-arm row, Scott bench biceps curls (Tuesday); barbell bench press, dumbbell bench press, incline barbell bench press, incline fly, cable cross-over (Thursday) and

dumbbell shoulder shrug, lateral dumbbell raise, dumbbell triceps extension, close-grip bench press, incline bumbell curl (Friday).

Muscle mass was estimated using bioelectrical impedance (Tanita MC 780, Tanita Europe). This device is reported as valid compared with dual energy X-ray absorptiometry for estimating body composition in healthy adults (Leahy, O'Neill, Sohun, & Jakeman, 2012).

Statistical analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS, Inc., Chicago, IL, USA) version 20. The data were expressed as the mean and standard deviation (SD) for each variable and. The Shapiro-Wilk test was used to test the normality of the data and Levene's test was used to assess the equality of variances. Paired sample *t* test was used for within-group comparisons. A *p*-value < 0.05 was considered statistically significant.

Results

All students completed the study and table 1 presents data on the descriptive and dependent baseline and post-test variables of the studied group.

Subjects weight was lower (Δ% = -1.25%) at the end of the study (*M* = 79.2, *SD* = 9.1) compared to the baseline (*M* = 80.2, *SD* = 9.4) and a paired sample *t* test showed that the difference was significant, *t*(8) = 3.51, *p* = .008, *d* = 1.17, 95% CI [0.34, 1.66].

Table 1
Baseline and Post-test Results for Male Students

	Pre	Post	*p*	*ES*
Weight (kg)	80.2±9.4	79.2±9.1*	.008	1.17
BMI (kg/m^2)	23.7±3.0	23.4±2.9*	.012	1.07
Fat mass (%)	14.2±5.3	13.5±4.9*	.001	1.73

Note. Results are represented as mean and standard deviation (±); BMI = Body Mass Index; The symbol (*) indicate p ≤ .05 intra-group; *ES* = Effect Size.

Body mass index recorded a statistically significant decrease (Δ% = -1.17%) at the end of the study (*M* = 23.4, *SD* = 2.9) compared to the baseline results (*M* = 23.7, *SD* = 2.9), *t*(8) = 3.22, *p* = .012, *d* = 1.07, 95% CI [0.48, 3.22].

Fat percentage decreased (Δ% = -5.1%) after 3 months (*M* = 13.5, *SD* = 4.9) compared to the baseline (*M* = 14.2, *SD* = 5.3), *t*(8) = 5.19, *p* = .001, *d* = 1.73, 95% CI [1.04, 5.19].

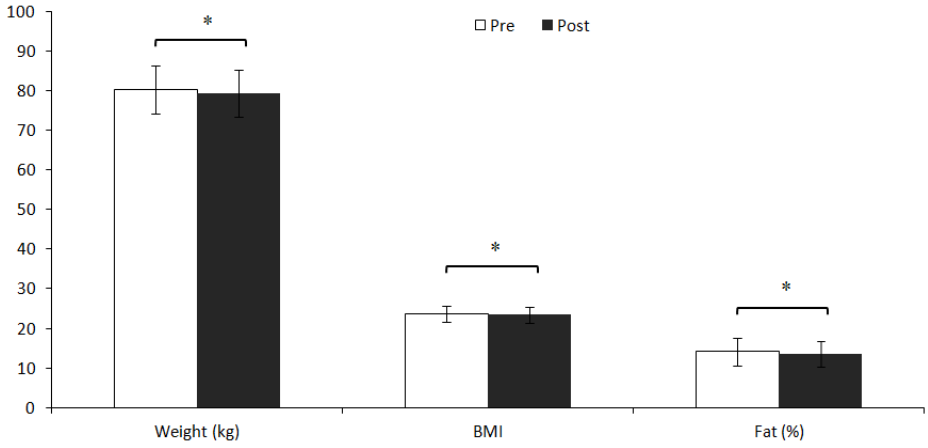

Figure 1. The pre and post-tests results with 95% confidence interval; The symbol (*) indicate intra-groups differences ($p < .05$) differences ($p < .05$).

Discussions

The site of body fat distribution plays a role in overall health, with excessive adiposity around the waistline (abdominal obesity) being a major risk factor for CVD and metabolic disorders (R, Mendis, Reddy, & Chan, 2010). The negative influence of central obesity as a cardiometabolic risk factor most likely derives from excessive accumulation of visceral fat (visceral obesity) than that in the subcutaneous compartment in the abdominal region (Fox, Massaro, Hoffman, & Pou, 2007).

Higher training efficiency is superior to lower one for improving muscle strength (Steib, Schoene, & Pfeifer, 2009). Therefore to specifically increase muscle size (hypertrophy-specific training), medium-to-heavy loading is needed (70%–80% of one-repetition maximum [1RM]). When the training goal is muscular hypertrophy, sets with short rest intervals (about 1–2 min) is suitable, whereas longer resting periods (several minutes) are needed to increase especially absolute strength (Salles, Simão, Miranda, Novaes, Lemos, & Willardson, 2009).

Optimal exercise time is below 45–60 min because thereafter training intensity reduces significantly. Resistance training under the supervision of a personal trainer usually leads to greater workout intensities (Ratamess, Faigenbaum, Hoffman, & Kang, 2008). Varying the number of repetitions and length of rest and to some extent the types of exercises over time (periodization), it may be possible to achieve greater benefits. At rest, skeletal muscle consumes energy of 54.4 kJ/kg (13.0 kcal/kg) per day which is larger than adipose tissue at 18.8 kJ/kg

(4.5 kcal/kg) (Heymsfield, Gallaghe, Kotler, Wang, & Allison, 2002). Because resistance training increases muscle mass it does not result in weight loss without caloric restriction. However, resistance training, even without caloric restriction, has favorable effect on body composition because it decreases fat mass including abdominal fat (Tresierras & Balady, 2009).

There are studies that have used different training methods to see if there are changes in the percentage of fat in women and men. Antonio et. al. investigate whether functional training has similar effects the traditional on body composition and muscle strength components in physically active older women (n = 47). Functional training showed a significant decrease in fat percentage ($\Delta\%$ = 3.51, p = .015) and traditional training showed a significant increase in lean mass ($\Delta\%$ = 3.51, p = .008) (Resende-Neto, Andrade, Cyrino, G.Behm, MeloDe-Santana, & Silva-Grigoletto, 2019).

Another study from 2019, compared the effects of a high-intensity interval body weight training with the effects of a combined training among young women (n = 25) who were divided into two groups, HIBWT (n = 10) and COMT (n = 15). The HIBWT group performed a training protocol (length time ∼ 20 min) consisting of ten sets of 60 s of high intensity exercise (30 s of stepping up and down on a step and 30s of squatting up and down with body weight as fast as possible) interspersed by a recovery period of 60 s of low intensity exercise. The COMT group performed a training protocol (length time ∼ 60-min) consisting of a 30 min walk of moderate intensity following by five resistance exercises (three sets of 8–12 repetitions at 70% of 1RM,

with a 1.5-min rest period between sets and exercises). All training sessions were performed in the university gym facility three days a week (no consecutive days) for 12 weeks; Both groups reduce similarly body fat percentage (M.A.S.Carneiroa, Oliveira, F.M.Martins, A.P.Souza, P.R.P.Nunes, & F.L.Orsatti, 2018).

Conclusion

This study provides a brief presentation of the effects that resistance training (using the 10 x 75% of 1RM method) has on the body weight, fat percentage and body mass index in male students.

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EFECTUL ANTRENAMENTULUI DE FORȚĂ PE O PERIOADĂ DE 3 LUNI ASUPRA MASEI MUSCULARE LA STUDENȚII DE GEN MASCULIN

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Cuvinte cheie: **antrenament de forță, masă musculară, studenți**

Abstract

Obiectiv: Studiul de față a urmărit să evalueze efectele unui antrenament de forță, desfășurat pe o perioadă de 3 luni asupra masei musculare în rândul studenților de gen masculin.

Metode: Șase studenți fără experiență anterioară în participarea la antrenamentele de forță au fost incluși în studiu. Programul de antrenament a inclus exerciții pentru mușchii membrelor superioare și inferioare, cu o intensitate de 75% din 1RM pe o perioadă de 3 luni (10 repetări x 75% din 1RM, 1 set pentru fiecare exercițiu, 6 exerciții pe sesiunea de antrenament, de 4 ori pe săptămână, cu o durată de 60 de minute a ședinței de antrenament). Masa musculară a fost estimată folosind impedanța bioelectrică (Tanita MC 780, Tanita Europe). *Rezultate:* La sfârșitul studiului, rezultatele celor șase studenți au fost

analizate. O îmbunătățire semnificativă a fost observată după 3 luni comparativ cu rezultatele inițiale, privind masa muscular.

Concluzii: Antrenamentul de forță folosind metoda 10 repetări x 75% din 1RM conduce la îmbunătățiri cu privire la masa musculară în rândul studenților de gen masculin.