

LONG TERM STRENGTH TRAINING EFFECT ON TRICEPS BRACHII PENNATION ANGLE.

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INTRODUCTION

The long-term strength training alters the muscle geometry which can be monitored by image techniques, as the ultrasound (US). However, there is not a consensus about the homogeneity of the hypertrophy in different muscle sites. The aim of the present study is to verify the effect of 12 weeks of dynamic strength training programs on pennation angle (PA) at proximal, middle, and distal sites of the long head *triceps brachii* muscle.

METHODS

The training group (TG) was composed by thirty four men. Eight men were set as a Control Group (CG).

The TG underwent a strength training program for 12 weeks, two sessions per week. The exercises were free-weight bench press, machine lat pull-down, standing free-weight biceps curl with a straight bar, and a triceps extension in lat pull-down. To measure the muscle geometry, an US apparatus was used to analyze PA, with the probe oriented longitudinally, in three different muscles sites of the long head *triceps brachii* (proximal-PS, middle-MS and distal-DS). The sites were 70%, 60% and 50% of the distance between the posterior crista of the acromion and the olecranon of the elbow joint [1].

Maximal voluntary isometric contraction test (MVIC) for elbow extension was accessed pre and post the training period.

Multi factorial ANOVA and Tukey post hoc were applied to test the differences between PS, MS, DS; pre and post training; TG and CG (3x2x2) for PA. The level of significance was set as 5% ($p=0.05$).

RESULTS AND DISCUSSION

The results for the elbow extension MVIC were 22.79 ± 4.78 and 25.85 ± 4.73 KgF ($p=0.0003$), for the TG, pre and post the program, respectively, showing a significantly increase of the muscle force production as a positive effect of the 12 weeks of strength training. The CG showed no MVIC differences.

The values of *triceps brachii* PA in the present study ranged from to 22-26° in ML, similar to Ikegawa et al [2] who found for that same muscle a PA of approximately 21.7° for young weightlifters.

Figure 1 shows the significantly increase of the PA in all three different muscle sites after 12 week of resistance training (approximately 17%), for the TG group, similar to other study [3], which only analyzed the 60% site. The relative PA increase at the three muscle sites was similar after a 12 weeks training. Similar result was found for the quadriceps muscle [4].

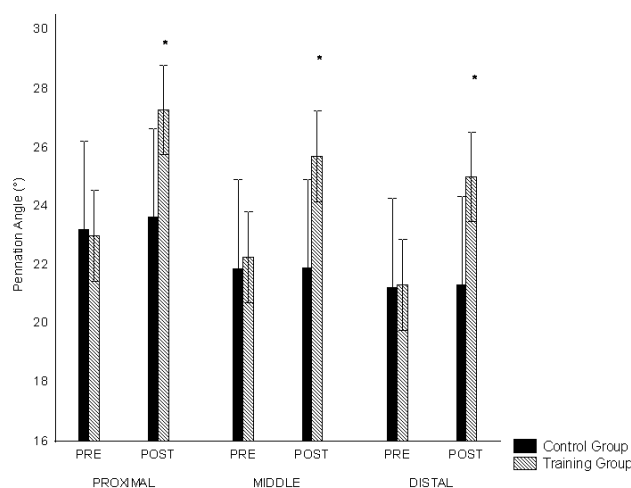


Figure 1: Pennation Angle (Mean and SD) of *Triceps Brachii* in PS, MS and DS in pre and post-12 weeks of resistance training of CG and TG. * $p<0.05$ between pre and post.

CONCLUSIONS

It was determined the changes in the fiber arrangement of the *triceps brachii* long head muscle after a long-term strength program. The increase of the fiber pennation angle was similar at the three muscle sites studied, suggesting a homogeneous adaptation to the force stimulus provided by the selected exercises.

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