Poster Presentations

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SESSION II

STRENGTH TRAINING EFFECTS ON PRE-PUBERTAL BOYS

V. Lopes, A. Monteiro, T. Barbosa, P. Magalhães

Polytechnic Institute of Bragança, Portugal

There are some incongruent results in strength training effects on pre-pubertal boys. Vrijens (1979) shows that prepubescent boys were incapable of increasing strength or muscle cross-sectional area of the extremities following a program of resistance training. Various recent studies have shown that prepubescent boys are capable of making strength gains following an appropriate training program (Ramsay, et al., 1990). However the mechanisms underling strength gains following resistance strength training programs is not well clarified. There is some evidence that the gains are associated with neuromuscular adaptations with no muscle hypertrophy, but this later issue is an unresolved question. The purpose of this study is to investigate the resistance strength training effects on pre-pubertal boys, that is, the enhancement of strength and its correlates, namely the changes in muscular mass and neuro-muscular activity.

The sample comprises 11 boys, aged 9,52±0,55 years, divided in an experimental group (EG) (n=6) and in a control group (CG) (n=5). All boys were in stage 1 according to Tanner's scale of sexual maturation. The sample was evaluated in serum testosterone level, and all boys were above the level of 50 $ng*dl^{-1}$,wich is considered to be within the normal range for pre-pubertal boys (Winter, 1978). The EG group was submitted to a training program with callisthenic exercises three sessions a week for 10 weeks. In each session the training comprised the following exercises: push-ups, modified pull-ups and the 2 exercises with elastics (elbows flexion and extension and extension of the arms above the head) until exhaustion. The training volume was being gradually adapted from 3 series between the 1st and 3rd week to 4 series between the 4th and 6th week and to 5 series between the 7th and 10th week. The sample was evaluated in pre and in post-test in maximal isometric voluntary force (MIVF), muscle mass, and in EMG. The MIVF was evaluated during the Shoulder Press (SP), the Arm Curl (AC) and the Triceps Press (TP). The MIVF was measured using a dynamometer (TST 121C from Biopac Systems Inc.). We also evaluated the maximal number of push ups (PU) and modified pull ups (MPU), and the distance in over arm throw with roller-skate hockey ball (THW). The EMG signals were acquired during the MIVF exercises (SP, AC, and TP). During the AC exercise, one surface electrode (TSD 150A from *Biopac Systems Inc*.) was attached to each biceps. During the SP and TP, one surface electrode was attached to the vastus medialis of each of the triceps. A ground electrode was attached to the elbow. The EMG signals were amplified through a differential amplifier with 2MW, a gain of 1000 and a bandwidth between 15-450Hz. The EMG signals were full-wave rectified and smoothed, allowing to determinate the integral (iEMG) and the amplitude (aEMG) of the EMG signal. The iEMG was standardised according to the duration of the contraction. Both aEMG and iEMG results of both arm in each exercise were summed. The muscle thickness of the biceps and of the triceps of both arms were measured by B-mode ultrasonography, using real-time electronic scanner with 7.5MHz scanning head (Ecocamera Aloca SSD-500). The data were analysed using the ANOVA repeated measures (group x training program).

In THW the results indicate a significant interaction effect ($F(1, 9) = 7,814$; $p = 0,021$), with an increase of 22% in EG and a slight decrease in CG. In PU the results indicate a significant main effect ($F(1, 9) = 15,537$; $p = 0,003$), and a significant interaction effect ($F(1, 9) = 16,61$; $p = 0,003$), with an increase of 150% in EG and no changes in CG. In MPU the results indicate a significant main effect ($F(1,) = 8,006$; $p = 0,019$), and a significant interaction effect ($F(1, 9) = 17,667$; $p = 0,002$), with an increase of 120,9% in EG and a slight decrease in CG. There were no significant changes in the three tests of MIVF and in iEMG, aEMG, or in the muscle mass.

These results indicate that pre-pubertal boys could increase the resistance strength after a training program that include callisthenic exercises, but seems that the isometric strength could not be enhanced. The increase in resistance strength is not accompanied by an increase in muscle mass. Although in this study we only evaluated the neuro-muscular factors in MIVF, it seems that the factors underlying the enhanced strength might be neuro-muscular.

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