

CHANGES IN THE ANTHROPOMETRIC STATUS OF THE UPPER ARM AND FOREARM IN ADOLESCENTS FOLLOWING A SIX-WEEK PROGRAMMED EXERCISES WITH STANDARD AND MODIFIED REPETITIVE LOADS

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Abstract

A programme was carried out on a sample of 51 subjects (adolescents) for transformation of the maximal muscle strength of the flexors in the elbow during a period of 6 weeks, performed on Scott bench. The subjects were divided in 3 groups. The first group performed exercises according to a matrix system, the second group performed the workout according to a reduced amplitudes method (from semi-flexion to full elbow flexion), and the third worked in accordance with the reduced amplitudes method (from maximal extension to half elbow flexion). The subjects were tested in six anthropometric measures, measured on the upper arm and the forearm, on three occasions (at the beginning, after 3 weeks of exercise and after 6 weeks of exercise). From the differences between groups it was concluded that there is no difference between the groups, which means that the subjects behaved similarly during the entire programme. The analysis of the possible changes within each individual group, throughout the entire experimental procedure, also did not show statistically significant changes in the anthropometric indicators. This points out the fact that most probably the benefit from exercises for transformation of the maximal muscle strength of elbow flexors is not based on physiological changes (covered by the anthropometric measures). Answers should, perhaps, be looked for in the mechanisms for management with movements at central level.

Key words: *anthropometry, maximal muscle strength, experimental procedure*

INTRODUCTION

Anthropometry is a field of biology which deals with measuring the physical dimensions of the human body (Peric, 1999). Relations between strength and anthropometric indicators are evident and objective. A typical example of this relation is the strength bodybuilding regime of work. The workout designed in such a manner has emphasised anabolic effect which results into muscle mass increasing. In addition, the anthropometric measures, especially on the trained muscles volumes, become extremely big. In training programmes focused on the transformation of the maximal strength capacity, most authors present the growth of indicators for one maximal repetition independent from the anthropometric indicators on volumes and adipose tissue (Ozmun et al, 1994; Ramsay et al., 1990), which means that no significant changes in the anthropometry field are noted.

Such dilemmas on the connection between the strength capacities and the anthropometric indicators depend on the type of programmes for transformation being delivered, which are directly related to the manner in which trainings are executed (external load intensity, work volume and extent, weekly frequency, load regime, manner of performing movements, etc.).

WORK PROGRAMME

Strength training is frequently connected with changes of anthropometric indicators. It was precisely this paradigm that produced the work realisation idea. Experimental procedure was designed during the six weeks of training in order to create impact on the maximal strength component transformation, not using methods for expressed hypertrophy of local muscles. The problem was posed from here, and the same was to answer the follow-

ing question: Do methods for maximal strength transformation have an impact on possible (local) changes of anthropometric measures, covered in this research? For that reason, a hypothesis was developed claiming that there won't be any statistically significant differences in the arithmetic means of the researched arithmetic indicators.

The six-week experimental procedure was conducted on 51 subjects (students at 18-20 years of age). The subjects were placed in 3 experimental groups (E1, E2 and E3) and their task was to perform "biceps" exercises for the flexor muscles of the elbow of the non-dominant arm, on Scott bench. The load intensity was individually set for each subject and was 90% of the maximal lifted load (in attempt for one elbow flexion) tested through the test for one maximal repetition -1PM (Tan,1999). The work programme for the three groups was identical regarding the load intensity (90% of 1PM), the training volume: 3 series per day – until failure, with 5 minutes break between series (Zaciorski,1975 Kukolj,1996;) 3 workout units in one week (Ramsay et all.,1990; Moss et all.,2004; Marx, et all 1998) and a total duration of 6 weeks (Rasch et all.,1956). After the first 3 weeks of exercising, the 1PM test was again performed so as to, if needed, modify the load for performing the exercises. In addition, the number of series during one training was increased from 3 series to 4 series performed until failure.

The groups differed only in terms of the muscle contractions while exercising on Scott bench: E1 group worked a matrix load system (Redzpegikj, 2004), E2 group – in the zone from half-flexion to maximal flexion of the elbow and vice versa, and E3 group – in the zone from maximal extension to half-flexion and vice versa.

The following anthropometric measures were tested (Toteva M.,Slnehev,1990, Kurelic, N i sar, 1975):

- Volume of forearm minimal (OPMIN)
- Volume of forearm maximal (OPMAX)
- Volume of upper arm minimal (ONMIN)
- Volume of upper arm maximal (ONMAX)

Under skin fatigue and subcutaneous adipose tissue on forearm – dorsally (KDP)

Under skin fatigue and subcutaneous adipose tissue on upper arm-mm.triceps (KDN).

RESULTS (ANALYSIS AND DISCUSSION)

The results obtained from the tested anthropometric indicators have shown that there is no statistically significant difference of the initial, the control or the final testing between the subjects of the three groups (E1, E2 and E3), in the anthropometric measures covered with the research (Tables No 1, 2 and 3). This points out the fact that the groups, that is, the different samples of subjects, were homogenous in accordance with the researched indicators.

Table 1. Anova result from initial test

INITIAL testing (E1 + E2+ E3)				
Wilks'	Initial			
Lambda	Rao's R	df 1	df 2	p-level
0.88	0.48	12	86	0.92

Table 2. Anova result from control test

CONTROL testing (E1 + E2+ E3)				
Wilks'	cotrol			
Lambda	Rao's R	df 1	df 2	p-level
0.85	0.62	12	86	0.82

Table 3. Anova result from final test

FINAL testing (E1 + E2+ E3)				
Wilks'	final			
Lambda	Rao's R	df 1	df 2	p-level
0.92	0.30	12	86	0.99

The multi-variant analysis of possible differences in the anthropometric measures in E1, E2 and E3 groups, for the six weeks of the experimental programme showed no statistically significant differences of the entire system of variables (Tables No 4, No 5 and No 6).

The training programme in this research enabled similar changes in the anthropometric indicators in the three groups (E1, E2 and E3), although each of the groups had its own manner of performing muscle loads of elbow with the non-dominant arm, and although in terms of motor skills, positive significant changes were noted in the maximal strength of flexors of the subjects from the three groups. Most probably, a similar physiological stimulus is in question, given in the three experimental groups; hence, the anthropo-

metric changes between the groups were not observed.

Table 4. Anova result for E1 group

E1 (Ini to fin)				
Wilks'				
Lambda	Rao's R	df 1	df 2	p-level
0.66	1.68	12	86	0.08

Table 5. Anova result for E2 group

E2 (Ini to fin)				
Wilks'				
Lambda	Rao's R	df 1	df 2	p-level
0.65	1.74	12	86	0.07

Table 6. Anova result for E3 group

E3 (Ini to fin)				
Wilks'				
Lambda	Rao's R	df 1	df 2	p-level
0.65	1.74	12	86	0.07

The stimulus was directed towards improving the maximal strength component, and not towards increasing the circular dimension of the engaged muscle groups (as the case is in the bodybuilding work regime). Changes in the tested arithmetic means of the under skin fatigues are lacking because the energy regime in which the work was carried out consumes ATP and creatine phosphate reserves, and the adipose tissue is not in the mechanisms that donate energy due to which stable condition is present in the consecutive arithmetic mean tests of the researched anthropometric indicators. The initial hypothesis that there won't be any statistically significant differences in the arithmetic means of the researched arithmetic indicators is not abandoned. The application of such directed workout protocols enables realisation of the kinesiological effects determined in advance.

CONCLUSIONS

The programme directed towards improvement of the strength potential of the elbow flexors, as presented in this research, had no impact on the change of anthropometric measures, in the three experimental groups (E1, E2 and E3).

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**ПРОМЕНИ ВО АНТРОПОМЕТРИСКИОТ СТАТУС НА НАДЛАКТОТ И
ПОДЛАКТОТ КАЈ АДОЛЕСЦЕНТИ ПО ШЕСТ НЕДЕЛНО ПРОГРАМИРАНО
ВЕЖБАЊЕ СО СТАНДАРДНИ И МОДИФИЦИРАНИ РЕПЕТИТИВНИ
НАПРЕГАЊА**

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(Оригинален научен труд)

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Апстракт

На примерок од 51 испитаник (адолесценти), пласирана е програма за трансформација на максималната мускулната сила на флексорите во зглобот на лакотот во период од 6 недели, изведени на скотова клупа. Испитаниците се поделени во 3 групи. Првата група работи вежби по матрикс систем, втората група по метод на скратени амплитуди (од полуфлесија до целосна флесија на лакотот), третата по метод на скратени амплитуди (од максимална екстензија до половина флесија на лакотот). Испитаниците се тестирана во шест антропометриски мерки, измерени на подлакотот и надлакотот, во 3 наврати (на почетокот, по 3 недели вежбање и по 6 недели вежбање). Од меѓу групните разлики се констатира дека не постои разлика меѓу групите, што значи дека испитаниците слично се однесувале во текот на целата програма. Анализата на евентуалните промени внатре во секоја група засебно, во текот на целата експериментална постапка исто така не покажа статистички значајни промени кај антропометриските показатели. Ова наведува на фактот дека најверојатно бенефитот од вежбите за трансформација на максималната мускулна сила кај флексорите на лакотот, не се темели на физиолошки промени (опфатени со антропометриските мерки). Можеби одговорите треба да се бараат во механизмите за управување со движењата на централно ниво.

Клучни зборови: антропометрија, максимална мускулна сила, експериментална постапка