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Effects of physical activity on the transformation of morphological characteristics of recreationists

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Abstract. *A total of 24 training sessions were conducted in a period of 8 weeks. Trainings were held three times a week for 60 minutes. Strength exercises for the muscles of the whole body were carried out in combination with high-intensity interval activities in the organizational form of circuit training or through a bicycle ergometer. The training was structured with the aim of achieving body recomposition of the subjects, i.e. reducing subcutaneous fat while simultaneously increasing muscle mass. The aim of this work was to determine the changes that occurred in morphological characteristics. The sample of respondents consisted of 25 respondents. Initial and final measurements of a total of 13 variables of morphological characteristics were performed on all subjects. By analyzing the collected results, it was concluded that the training program can partially influence changes in morphological characteristics. Five measures of body folds recorded a statistically significant change (p=0.00), as well as the skin fold of the lower leg (p=0.04) and the circumference of the abdomen, which in the mentioned period was reduced by 3.03 cm (p=0.01). Other measures of morphological characteristics did not achieve a statistically significant change. It is recommended to carry out more research on this topic, but with a more homogeneous sample of respondents so that the transformational effects of the training program can be tested on a precisely defined population.*

Keywords: *Effects, morphology, transformation, recreation.*

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Introduction

Nowadays, there is more discussion than ever about a healthy lifestyle, about taking care of physical and spiritual condition, about proper nutrition, about the importance of movement for the human body. For these reasons, in 1995, the World Health Organization (WHO) determined a declaration called "Physical activity for health" and sent open letters to all governments of the world to organize programs of recreational activities to the best of their ability to preserve and improve health[1]. Special vulnerable groups of the population are listed, namely: children, adolescents, people exposed to stressful situations, people in the third age of life and people with chronic non-communicable diseases. As it can be seen, children are in the first place in terms of being threatened by physical inactivity and require the most urgent undertaking of the most serious strategy for increased programmed and organized physical activity starting from kindergartens, schools and universities, with the aim of optimal growth and development and preserving the health of children and youth[2,6]. Each training program aims to achieve a certain transformation, or positive change. Sekulić and Metikoš (2007)[14] claim that everyone already knows that with a well-programmed training program, we can positively influence changes in morphological characteristics, that is, changes in body composition. Morphological characteristics are divided into two dimensions: dimensions of hard tissues and dimensions of soft tissues[8,11,12].

In this paper, we will focus exclusively on the dimensions of soft tissues, which represent the active amount of muscle mass and subcutaneous fat tissue. From a kinesiological point of view, active muscle mass is the most important factor in morphological characteristics because it directly affects general motor and functional efficiency[4,5,14]. The amount of muscle, or its volume, is proportional to the ability to develop force within the same muscle. The greater the amount of muscle, i.e. its volume, the greater the possibility of developing greater force. Greater force enables more efficient action during movement, overcoming external loads or certain obstacles. On the other hand, subcutaneous adipose tissue represents ballast mass in certain motor behavior[16]. Excess subcutaneous fat negatively affects motor manifestations of any type. Precisely for this reason, the goal of any transformation program must include the reduction of subcutaneous fat tissue in accordance with the individual characteristics of the individual. In accordance with the above information, the training program that was carried out over a period of eight weeks was designed in such a way as to be specific enough to improve those dimensions of motor skills that were tested, and on the other hand, sufficiently intensive and optimally structured to achieve adequate changes in the morphological characteristics of the respondents[9,15]. today's modern sport has set high standards because it requires an increase in muscle mass with the simultaneous loss of subcutaneous fat tissue with the aim of optimizing sports performance. In addition to the fact that in this way we improve motor efficiency and positively influence the achievement of successful results in sports, the standards of "beautiful appearance" have also been imposed outside the sports framework, in everyday life. It is for this reason that the need to reduce subcutaneous fat while increasing muscle mass has become a fundamental postulate of morphological transformations outside of sports as well[13] , i.e. in recreational exercise[17]. The primary goal of this paper is to determine and analyze the changes that occurred in morphological characteristics after an eight-week training program.

Method

Sample of participants

The sample of participants in this paper consists of a total of 25 participants with an average age of 30.3 years, body height of 178.2 cm, and body weight of 76.5 kg. All subjects were familiarized with the initial and final measurement protocol and the outline plan and program according to which the eight-week training program was implemented. All participants voluntarily decided to participate in this research. The main criterion for the selection of candidates was a subjective assessment of their motivation and the expected level of engagement during the implementation of the training program.

Sample of measuring instruments

In this work, a total of thirteen variables of morphological characteristics were measured, of which seven measures of body circumference, and six skin folds.

Measuring instruments for assessing body circumference:

Upper arm circumference in extension (UACE),

Forearm circumference (FC),

Chest circumference (CC),

Hip circumference (HC),

Abdominal circumference (AC),

Waist circumference (WC),

Leg circumference (LC).

Measuring instruments for assessing body folds:

Upper arm skin fold (UASF),

Back skinfold (BS),

Abdominal skin fold (ASF),

Suprailiocrystal skin fold (SSF),

Suprapatellar skin fold (SPSF),

Lower leg skin fold (LLSF).

Description of the experimental protocol

The training program was carried out three times a week: on Mondays, Wednesdays and Fridays for a total duration of 60 minutes. A total of 24 training sessions were held over a period of eight weeks. All training sessions as well as the initial and final measurements were conducted in the sports studio "V sport performance". Strength exercises for the muscles of the whole body were performed. The training operators were adapted to the individual characteristics of each subject, so the exercises were carried out with different props, for example, with the help of their own body weight, TRX, Russian bells, dumbbells and the Olympic bar. In all strength exercises, the total load was monitored, on the basis of which a progressive increase in intensity as well as the total volume of training was carried out. The trainings included high-intensity interval activities in the organizational form of circuit training or through a bicycle ergometer. Each training consisted of 4 phases. The first phase was the warm-up and preparation for training, and all subjects were given predetermined exercises for the first phase and had the task of coming 15 minutes early to the training to do them independently. The second phase was strength training, which consisted of six strength exercises for the muscles of the whole body, adapted to each subject according to his knowledge, capabilities and experience. The average duration of the second phase was between 40 - 45 minutes. The third phase consisted of high-intensity interval activities that were carried out for a total duration of 10-15 minutes with the aim of maximizing the energy consumption of the subjects. The fourth phase was the final part of the training, in which the subjects performed stretching exercises for a maximum of 10 minutes. Before the very start of the eight-week training program, an initial measurement was carried out, which included seven measures of body circumference, six skin folds and eight tests to assess some motor skills. The measurement was carried out according to a standardized protocol, and all respondents were previously informed about the course of the measurement. After eight weeks, the final measurement of the same variables was performed again according to the standardized protocol.

Statistical data processing

Univariate analysis of variance, or ANOVA, was used to determine the statistical significance of the differences between the arithmetic means of repeated measurements of all measured variables. After the obtained results, we could conclude whether or not there is a statistically significant difference between the repeated measurements of the variables used in this work.

Results with discussion

Table 1. Differences between initial and final measurements in body circumferences

Variables	F value	P value
UACE	1.13	0.30
FC	0.29	0.60
CC	0.02	0.88
HC	1.07	0.31
AC	7.31	0.01
WC	0.51	0.48
LC	2.71	0.12

After the end of the eight-week training program and the collected data from the final measurement, certain changes were determined. From the measurements of body circumference, positive changes were recorded in the form of an increase in the total amount of circumference in the following variables: upper arm circumference (+0.30 cm), forearm circumference (+0.11 cm) and upper leg circumference (+0.41 cm). Variables such as chest circumference (-0.11 cm), calf circumference (-0.23 cm) and hip circumference (-0.84 cm) also achieved certain positive changes, but in the form of a reduction in the total average amount. The changes that occurred in the aforementioned variables of body circumference measurements are not statistically significant. However, one variable, i.e. one measure of body circumference, recorded a statistically significant change (p=0.01), namely the abdominal circumference. The total average change in the "abdominal circumference" variable at the level of all twenty subjects during the eight-week training cycle is (-3.03 cm) and represents the largest change in all measured body circumference variables.

Table 2. Differences between initial and final measurements in body folds

Variables	F value	P value
UASF	40,48	0.00
BS	28.95	0.00
ASF	24.61	0.00
SSF	12.60	0.00
SPSF	10.71	0.00
LLSF	4.70	0.04

Skinfold thickness is a simple way to monitor changes in body composition[10]. The changes in all seven compared variables are statistically significant (p=0.00), which is why we can claim that there was a significant change in the body composition of all respondents. The lower leg skin fold also had a statistically significant change, but with a slightly higher p value=0.04. The smallest change occurred in the variable "LLSF" and it shows an average decrease of 2.05 mm in skinfold thickness. All remaining variables of skin folds achieved a similar change in the form of a reduction in their values. The skin fold over the triceps was reduced by 3.16 mm, the subscapular skin fold was smaller by 3.90 mm, the suprailioclast skin fold (-3.48 mm) and the suprapatellar skin fold (-3.47 mm). The biggest change in the six measured variables was recorded in the abdominal skinfold, i.e. the skinfold of the stomach, where the average value of the thickness of the skinfold decreased by 4.45 mm. After the implementation of the eight-week training program, the value of the sum of skin folds determined after the final measurement is 134.96 mm. Thus, a total average reduction of 20.51 mm in skinfold thickness was determined, p=0.00.

Three basic principles were used for the transformation of motor skills, namely: the principle of specificity, the principle of progressive load increase and the principle of individuality[18]. The principle of specificity explains how physical changes occur in accordance with the exercises we perform and their primary goal. This principle is important because its proper application enables the implementation of a precise and effective program that will lead to the desired and targeted changes[7]. The principle of progressive load increase means the systematic application of training stimuli that force the body to adapt and grow. Adaptation of training implies

manipulation of specificity, frequency, duration and intensity variables[3]. In this work, the increase in load was done in such a way that the number of repetitions was progressively increased from eight to twelve, after which the load would be increased by a total of 5 kg and it would start again from eight repetitions. We should also mention the principle of individuality, which indicates the need to adapt training operators, training systems and workloads in accordance with the individual characteristics of the individual[19].

Conclusion

The transformational effects that were determined after the eight-week training program point to the successful implementation of the body recomposition process of the subjects. Body circumferences, which are used to determine body voluminousness, did not record statistically significant changes, except for the abdominal circumference, which was reduced by 3.03 cm (p=0.01). Such results point to the conclusion that muscle mass is largely preserved, and in some subjects even an increase in certain circumferences was recorded, which points to an increase in the amount of muscle mass, i.e. hypertrophy (upper arm circumference +0.30 cm, upper leg circumference +0.41 cm). On the other hand, changes in body composition were assessed by measuring the thickness of skin folds. The results presented in this paper indicate a statistically significant (p=0.00) change in the thickness of skin folds, on the basis of which we can conclude that there has been a change in body composition due to the reduction of subcutaneous fat tissue. So, during this eight-week training program, the test subjects statistically significantly reduced their subcutaneous fat while simultaneously increasing their muscle mass or at least maintaining the existing amount of their muscle mass.

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