# ORGINAL SCIENTIFIC PAPER

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## THE EFFECTS OF CONDITIONING PREPARATION PROGRAM OF FEMALE CADET ATHLETES MORPHOLOGIC CHARACTERISTICS

***Abstract***

*The research was performed in order to determine the effects of conditioning preparation program on morphological characteristics of female cadet athletes aimed at sports. The sample consisted of 104 female cadets aged 15-16 years of which 50 are in the experimental group and training handball and 54 in the control group training volleyball and basketball. By calculating basic descriptive parameters and using methods ANOVA, MANOVA, MANCOVA and ANCOVA, the results showed a statistically significant effect on the upper arm volume, chest circumference, lower leg volume, abdomen wrinkles, thigh and lower leg wrinkles, but no effects to the weight of the body.*

***Key words:*** *effects, cadets, conditioning training, handball, volleyball, basketball*

## 1. INTRODUCTION

In the conditional training means of physical exercises should be such to provide proper growth and development of the organism, which is among other things achieved by optimal training load dosage according to morphological age characteristics, motor and functional abilities of athletes.

Fitness and conditioning training was the subject of a large number of scientists research and special interest of researchers (*Željaskov, 2004; Bompa, 2006; Milanovic, 2007*) was aimed at determining the effects of load volume in process of conditioning training realisation.

These and other researchers (*Bala, 1981; Durakovic, 2007*) indicate that the tasks in the conditional training given to athletes require multi-disciplinary approaches to the problem of sports creation, with the use of the latest scientific achievements and methods whose application provide faster growth of sports results.

In order to achieve excellent results in the sport with a maximum stress of the body, the body of an athlete must be both general and special physically extremely prepared. Reaching that level of preparedness involves constant influence of various factors on the body of an athlete.

Managing physical conditioning of athletes is a complex process consisting of several components: determining program objectives and forecasting results, programming, operation and implementation of the program with the introduction of any corrections needed. Special attention should be paid to the management of the sports form development through programming calendar of athletes all level competitions.

The main task for the coaches is to provide not only a better insight into the state of preparedness of athletes, but also an adequate influence on the factors, one of which depends on the achievement of planned results.

If the loads are under the so-called. threshold, in the body there is no positive change. This is best achieved when the load volume increases and decreases in intervals that are consistent

with the specifics of energy recovery, and possibilities of the body to receive a new load. The concept of homeostasis means a permanent tendency of the body to maintain a state of physiological balance.
Such a case is in the conditional training three times per week. A greater number of trainings per week to change something. The concept of homeostasis means a permanent tendency of the body to maintain a state of physiological balance function that want to develop and thus cause adaptive changes in the body.

It is important that in the process of conditioning training, with greater work intensity, set aside time for the so-called. resting intervals. Purpose of rest is enabling the body to provide energy to continue the exercise. This means that the following exercise should be held at a time when the working ability is re-established. In the intervals of rest are implemented recovery tasks, to ensure the higher frequency, or frequency of motor task, which is typical in the training with athletes.

Positive results of conditioning training influence to increase the level of capabilities and motor skills of athletes occur as a result of the application of scientific knowledge in the process of planning, programming, implementation, controlling of the exercise effects and loads dosage.

## 2. RESEARCH METHODS

### 2.1 SAMPLE

The sample consisted of 104 female cadets aged 15-16 years aimed at sport, included in regular school physical education and training process in sports clubs.
The overall sample of respondents was divided into two homogenized subsamples.

The first subsample of 50 female cadets is **experimental group**. Inside this group are classified students that are in addition to regular physical education classes were included in the *program of conditioning training* in handball clubs as cadets focused on sport, three times a week for 60 minutes, for a period of twelve weeks.

The second subsample of 54 female cadets is **control group**. Inside this group are classified students that are in addition to regular physical education classes were included in the *regular training* in volleyball and basketball clubs as cadets focused on sport, three times a week for 60 minutes, for a period of twelve weeks.

Prior to the research start for all respondents previously were defined conditions which must be met in order to be included in the research: that during measuring, testing and evaluating are healthy and to have voluntarily agreed to participate in the study.

### 2.2 EXPERIMENTAL PROGRAM

Table 1. Conditioning training program structure in experimental period

| PROGRAM WHOLES | |
|---|---|
| Initial diagnosis of:<br>• Morphological characteristics<br>• Motoric abilities<br>• Functional abilities | Before program realisation |

| | |
|---|---|
| Program of technical elements in handball | Program realisation |
| Program of tactical elements in handball | |
| Program of motoric situational exercises in handball | |
| Running speed exercises program | Program realisation |
| Sprinting speed exercises program | |
| Agility exercises | |
| Dynamic flexibility exercises | |
| Coordination upgrading exercises | |
| Power upgrading exercises | |
| Torso power upgrading exercises | |
| Endurance upgrading exercises | |
| Power exercises with medicine ball | |
| Warm up exercises | |
| Stretching exercises | |
| Final diagnosis of:<br>• Morphological characteristics<br>• Motoric abilities<br>• Functional abilities | After program realisation |
| Total: | 36 hours |

**2.3 RESEARCH AIM**

The main aim of this study was to determine the effects of influence of conditioning training program on morphological characteristics on female cadets aged 15-16 years.

An additional aim of this study was to determine the transformation processes of morphological characteristics compared to the initial measurement, under the influence of applied program of conditioning training in handball clubs on female cadets of the experimental group.

The specific aim of this study was to determine transformation processes of morphological characteristics in the final, compared to the initial measurement, under the influence of programs in volleyball and basketball clubs on female cadets of the control group.

### 2.4 MEASUREMENT INSTRUMENTS SAMPLES

Measurement instruments for estimation of morphological dimensions

**Circular dimensionality and body mass**:

1. Upper arm girth in cm **(AONDL)**
2. Middle girth of thorax in cm **(AOGRK)**
3. Lower leg girth in cm **(AOPTK)**
4. Body mass in kg (AMAST)

Underskin far tissue:

5. Abdomen skin wrinkles in mm (ANTRB)
6. Thigh skin wrinkles in mm (ANNAT)
7. Lower leg skin wrinkles in mm (ANPTK)

The proposed model of anthropometric measurement sample for evaluation of morphological characteristics is taken based on the recommendations of International Biological Program (*Lohman, Roche and & Martorell, 1988*).

### 2.5 METHODS

To reach the results of scientific research adequate procedures are applied that enable the identification of differences and effects. Statistical analysis was done on the basis of statistical package SPSS and Statistics.

Basic descriptive parameters are calculated: Mean value (Mean), minimum result (Min.), maximum result (max.), standard deviation (Std.dev.), Skewness (Skewn) and Kurtosis (Kurtos).

To determine the effectiveness of the transformation process of the experimental and control groups in the final, as compared to the initial measurement, multivariate analysis of variance (MANCOVA), and for the individual differences between groups were determined by the measuring instruments on the univariant analysis of covariance (ANCOVA).

Applying this analysis all possibly existing differences in the initial measurement are neutralized between the experimental and control group, while determining the differences conducted using partial corrected mean values on the final measurement.

## 3. RESULTS AND DISCUSSION

### 3.1 Experimental group

Table 2. Basic statistic parameters for estimation of morphological characteristics experimental group on initial measurement

| Test mark | N | Mean | Min. | Max. | Std.dev. | Skewn. | Kurtos. |
|---|---|---|---|---|---|---|---|
| **AONDL** | 50 | 24.73 | 19.00 | 35.00 | 7.25 | 0.579 | -3.245 |
| **AOGRK** | 50 | 77.52 | 68.00 | 89.00 | 1.48 | 0.009 | 0.167 |
| **AOPTK** | 50 | 32.76 | 27.00 | 38.00 | 2.58 | 0.316 | -2.963 |
| **ATEŽT** | 50 | 54.88 | 48.00 | 63.00 | 12.15 | 0.229 | 2.058 |
| **ANTRB** | 50 | 16.10 | 10.00 | 24.00 | 5.00 | 0.257 | 2.726 |
| **ANNAT** | 50 | 14.72 | 9.00 | 17.00 | 13.35 | -1.210 | -1.428 |
| **ANPTK** | 50 | 11.63 | 7.00 | 15.00 | 4.54 | 0.729 | 2.200 |

*Legend***:** Mean value (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

**Table 3.** Basic statistic parameters for estimation of morphological characteristics experimental group on final measurement

| Test mark | N | Mean | Min. | Max. | Std.dev. | Skewn. | Kurtos. |
|---|---|---|---|---|---|---|---|
| **AONDL** | 50 | 29.42 | 20.00 | 36.00 | 4.05 | 0.578 | 1.139 |
| **AOGRK** | 50 | 84.47 | 70.00 | 91.00 | 5.82 | 0.432 | 1.841 |
| **AOPTK** | 50 | 37.85 | 28.00 | 40.00 | 4.45 | 1.623 | 2.153 |
| **ATEŽT** | 50 | 56.72 | 49.00 | 64.00 | 10.14 | 0.754 | 2.125 |
| **ANTRB** | 50 | 11.43 | 9.00 | 22.00 | 7.74 | 0.342 | 2.453 |
| **ANNAT** | 50 | 9.28 | 6.00 | 15.00 | 4.72 | -0.121 | -0.076 |
| **ANPTK** | 50 | 6.51 | 4.00 | 13.00 | 7.26 | 0.642 | 2.708 |

*Legend*: Mean value (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

### 3.2 Control group

**Table 4.** Basic statistic parameters for estimation of morphological characteristics control group on initial measurement

| Test mark | N | Mean | Min. | Max. | Std.dev. | Skewn. | Kurtos. |
|---|---|---|---|---|---|---|---|
| **AONDL** | 54 | 23.24 | 17.00 | 32.00 | 5.72 | 0.565 | 1.547 |
| **AOGRK** | 54 | 76.28 | 66.00 | 87.00 | 4.46 | 0.036 | 0.425 |
| **AOPTK** | 54 | 31.40 | 25.00 | 38.00 | 2.56 | -1.125 | 0.858 |
| **ATEŽT** | 54 | 52.64 | 46.00 | 66.00 | 0.44 | 0.578 | 2.951 |
| **ANTRB** | 54 | 16.90 | 12.00 | 25.00 | 7.04 | -1.236 | 1.070 |
| **ANNAT** | 54 | 15.14 | 10.00 | 19.00 | 8.93 | -0.614 | -1.504 |
| **ANPTK** | 54 | 12.73 | 8.00 | 15.00 | 5.66 | 0.017 | 2.529 |

*Legend*: Mean value (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

**Table 5.** Basic statistic parameters for estimation of morphological characteristics control group on final measurement

| Test mark | N | Mean | Min. | Max. | Std.dev. | Skewn. | Kurtos. |
|---|---|---|---|---|---|---|---|
| **AONDL** | 54 | 24.73 | 18.00 | 34.00 | 16.57 | 0.350 | 1.854 |
| **AOGRK** | 54 | 77.26 | 67.00 | 88.00 | 15.79 | 0.846 | 1.449 |
| **AOPTK** | 54 | 32.43 | 26.00 | 39.00 | 14.37 | 0.137 | 2.355 |
| **ATEŽT** | 54 | 53.84 | 47.00 | 69.00 | 0.43 | 1.359 | 1.933 |
| **ANTRB** | 54 | 15.26 | 12.00 | 24.00 | 2.48 | 0.977 | 1.689 |
| **ANNAT** | 54 | 13.75 | 9.00 | 16.00 | 2.28 | -0.219 | 3.240 |
| **ANPTK** | 54 | 10.38 | 7.00 | 14.00 | 7.95 | 0.407 | 1.215 |

*Legend*: Mean value (Mean), minimum (Min), maximum (Max), standard deviation (Std. dev.), Skewness (Skewn.), Kurtosis (Kurtos.)

### 3.3 Differences between experimental and control group in morphological characteristics on initial measurement

**Table 6.** Multivariant analysis of variance between experimental and control group in morphological characteristics on initial measurement

| | |
|---|---|
| **WILK'S LAMBDA TEST** | .725 |
| **RAO-va F-aprox** | 1.22 |
| **Q** | .255 |

*Legend***:** Barthlet test value(Wilks' Lambda), Rao F-aproximation (Rao's F) and importance level (Q)

Analizing Table 6 the results of testing show the significance of the difference level of the arithmetic means of all the anthropometric measures between the initial measurement of the experimental and control group was not statistically significant difference, since WILK'S LAMBDA is .725, which gives to Ra's F-approximation of 1.22 a difference significance at the level of Q = .255. Accordingly, in the applied system of morphological characteristics are shown no statistically significant differences.

**Table 7**. Univariant analysis of variance between experimental and control group in morphological characteristics on initial measurement

| Test mark | Mean (E) | Mean (K) | F-odnos | P-level |
|---|---|---|---|---|
| **AONDL** | 24.73 | 23.24 | 1.33 | .220 |
| **AOGRK** | 77.52 | 76.28 | 0.33 | .567 |
| **AOPTK** | 32.76 | 31.40 | 0.50 | .482 |
| **ATEŽT** | 54.88 | 52.64 | 0.90 | .346 |
| **ANTRB** | 16.10 | 16.90 | 1.47 | .188 |
| **ANNAT** | 14.72 | 15.14 | 1.15 | .199 |
| **ANPTK** | 11.63 | 12.73 | 0.00 | .974 |

*Legend***:** Mean value experimental group (Mean (E), Mean value control group (Mean (K), F-test value(F-odnos) and signifikance level (P-Level)

In table 7 Univariant analisis of variance of morphological characteristics is shown, and comparing mean values of experimental and control group on initial measurement. Based on F-test value i P-level signifikance we can confirm that there are no statistically important differences in morhological characteristics experimental and control group on initial measurement.

### 3.4 The effects of conditioning preparation program on development of morphological characteristics

**Table 8**. Multivariant analysis of Covariance between experimental and control group in morphological characteristics on final testing with differences neutralization on initial testing

| Wilks' Lambda | F | df 1 | df 2 | P-level |
|---|---|---|---|---|
| .545 | 10.85 | 7 | 98 | .001** |

*Legend***:** Berthlet test value (Wilks' Lambda), Raos F-aproximation (F) i level of importance (P-Level)

Table 8 shows the multivariate analysis of covariance which determines the realized effects of conditioning training program on morphological characteristics experimental group in comparison to the control group in the final test with the neutralization of the recorded differences in the initial testing. There was a statistically significant difference on the multivariate level between the experimental and control group at the level of P-level = .001 **, which is confirmed by the value of Wilks' Lambda test (.545) and the F-test (10.85). The current difference occurs under the influence of the experimental treatment and conditioning training program, which is working efficiently in the development of the morphological characteristics of the experimental group.

**Table 9**. Univariant analysis of Covariance between experimental and control group in morphological characteristics on final testing with differences neutralization on initial testing

| Test mark | Adj.Means (e) | Adj.Means (k) | F-odnos | P-Level |
|---|---|---|---|---|
| **AONDL** | 29.42 | 24.73 | 3.03 | **.011** |
| **AOGRK** | 84.47 | 77.26 | 6.89 | **.001** |
| **AOPTK** | 37.85 | 32.43 | 3.32 | **.010** |
| **ATEŽT** | 56.72 | 53.84 | 1.26 | .112 |
| **ANTRB** | 11.43 | 15.26 | 4.24 | **.014** |
| **ANNAT** | 9.28 | 13.75 | 3.72 | **.010** |
| **ANPTK** | 6.51 | 10.38 | 3.94 | **.020** |

*Legend***:** Mean value experimental group (Adj.Mean (e), Mean value control group (Adj.Mean (k), F-test value (F-odnos) i level of signikance (P-Level)

Univariant level analysis of Covariance between experimental and control group in tests for astimation of morphological characteristics on final testing with differences neutralization and results partialisation on initial testing (table 9), shows that there is statistically significant effect in test upper arm girth (AONDL .011), thorax middle girth (AOGRK.001), lower leg girth (AOPTK .010), abdomen skin wrinkles (ANTRB .014), thigh skin wrinkles (ANNAT.010), lower leg skin wrinkles (ANPTK.020), except no effects on body mass (ATEŽT .112).

## 4. CONCLUSION

Applied conditioning training program in handball clubs influenced the improvement of the results of morphological dimensions between the initial and final measurements of the subjects in the experimental group (P =.004-level), while in the control group under the influence of regular basketball and volleyball training in clubs were not statistically significant ( P-Level = .242). Achieved a statistically significant increase of the morphological dimensions of the experimental group is certainly a result of proper design of the program and methodical conditioning training in the planning and programming, the dosage, distribution and control of the applied loads, and an increase in the intensification of the training loads in accordance with the individual needs of athletes. This can be explained by some researchers (*Željaskov, 2004; Duraković, 2007*) as inner redistribution of subcutaneous adipose tissue in the organism, which was aimed at increase of the muscular system as a result of the adaptive process. The results of this research on the final measurement indicate that the Experimental group is significantly different from the Control group in the morphological dimensions. In this regard, it can be assumed that the conditioning training program was absolutely appropriate to morhological characteristics of the experimental group subjects. Results of the analysis of the transformation processes in subjects of the experimental group showed that the applied conditioning training program is an effective tool for the transformation of morphological dimensions and can be

recommended for use in the handball clubs and the optional physical education in high schools for students aimed to handball.

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