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**CHANGES IN FUNCTIONAL CHARACTERISTICS OF FEMALE CADETT HANDBALL PLAYERS UNDER THE INFLUENCE OF TRAINING CONDITIONING PROGRAM***Abstract*

*This research was conducted in order to determine the changes on the functional characteristics of handball female players aged 15-16 years under the influence of experimental conditioning training program. The sample consisted of 50 girls who had regular physical education at schools as well as three trainings a week of conditioning program in handball clubs. By calculating basic statistical parameters and intercorrelation of applied variables, as well as using the canonical discriminant analysis, the results showed a statistically significant difference in the results of tests of functional abilities of women at the final measure in relation to the initial, in all three tests.*

**Key words:** changes, functional, handball, conditioning training, initial measurement, final measurement

**1. INTRODUCTION**

It is known that science is an integral part of the work in all spheres of human activity and that the scientific results of research are determining factor of technological and manufacturing advances at all.

Theory of sports training serves as a transitional stage towards science in sport. Methods of personality transformation influenced by efficient means of optimum loads, can be solved only by scientific research.

Top achievements in sports require creativity. It is both the creative work of trainers, as well as to "developing" creative abilities of athletes. Respect of fundamental principles and rules of sports training is very important in the modern sport and training.

An important training segment is certainly and conditioning training of athletes, which is largely related to the functional area. In the conditional training means of physical exercise should be such to provide proper growth and development of the organism, which is among other things achieved by optimal dosing custom load adjusted to morphological age characteristics, motor and functional abilities of athletes.

It is important to adjust the load to athletes age, objectives and level of competition. The theoretical model of conditioning training pay attention to work and rest intervals, also burden the body above the so-called. threshold so the effects of training would be visible.

Functional abilities of athletes were the subject of many studies, already in the 70s and 80s of the last century made the serious research on functional abilities of athletes in certain sports branches as well as students and amateurs (*Matkovic, 1971; Horvat, 1978; Heimar, 1980*) and later, among others, (*Brankovic, 1998 Jukic 1998; Beets and Pitetti, 2005*).

## 2. METHOD

### 2.1 SAMPLE

The sample consisted of 50 girls 15-16 years old. Pupils that were covered besides regular physical education in schools with conditioning training program in handball clubs, three times a week for 60 minutes, a period of twelve weeks.

Prior to the start of implementation research for all respondents is established: that during measuring, testing and evaluation are all healthy and to have voluntarily agreed to participate in the study. Since it is a sample of juveniles, all parents have signed consent and familiar with the testing program.

### 2.2 EXPERIMENTAL PROGRAM

**Table 1.** Structure of the conditioning training program

PROGRAM	
The initial diagnosis of functional abilities	Before implementation of the program
The program of technical and tactical elements in handball	Program realization
Program of situational motoric exercises in handball	
Speed running exercises	
Sprint running exercises	
Agility exercises	
Dynamic flexibility exercises	
Exercises to develop coordination, explosive power, hull strength, general endurance	
Power exercises with a medicine ball	
Shaping and stretching exercises	
Final diagnosis of functional capabilities	After program realisation
Total:	36 hours

### 2.3 RESEARCH GOAL

*The main goal* of the study was to determine the differences under the influence of conditioning training program on functional characteristics on handball female cadets aged 15-16 years.

### 2.4 TASKS OF RESEARCH

1. The initial state of functional characteristics of female players is defined.
2. The final state of functional characteristics of female players is defined.
3. The differences between initial and final functional characteristics state of female players.

### 2.5 MEASURING INSTRUMENTS

Measuring instruments for assessing functional abilities

1. The frequency of the pulse after the load (**FPPOP**)
2. Margaria anaerobic ability test (**FMARG**)
3. Vital lung capacity (**FVKPL**)

Functional tests in this study were taken from the model of functional tests (*Heimar and Medved, 1997*).

## 2.6 METHODS OF DATA PROCESSING

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

Data analysis in this research, in addition to basic statistical parameters contained also inter-correlation of applied variables as well as canonical discriminant analysis.

## 3. RESULTS AND DISCUSSION

**Table 2.** Basic statistical parameters for the evaluation of the functional capacities of female players on initial measuring

Test mark	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
<b>FKVPL</b>	50	3140.00	2950.00	3380.00	1.56	-1.413	0.855
<b>FMARG</b>	50	3.84	3.42	4.38	9.05	-0.243	-0.174
<b>FPPOP</b>	50	172.53	167.00	179.38	2.45	0.679	-1.564

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

Analyzing the normality of results distribution (Table 2), where the curve curvature tested with Skewness (Skewn.), it can be concluded that most of the variables are within normal limits, except for Vital capacity (FKVPL -1413). One of the variables has a positive sign, in other words more results that are greater than the arithmetic mean (better results), while the other two variables have a negative sign, which indicates that there are more results that are smaller than the arithmetic mean.

The second normality parameter of distribution is Kurtosis (Kurtos.). It explains analysis of the degree of curvature of curve top. For all functional tests it is a fuzzy or platykurtic distribution (the results of less than 2.75).

**Table 3.** Basic statistical parameters for the evaluation of the functional capacities of female players on final measuring

Test mark	N	Mean	Min.	Max.	Std.dev.	Skewn.	Kurtos.
<b>FKVPL</b>	50	3260.00	3015.00	3400.00	6.29	-0.914	1.311
<b>FMARG</b>	50	3.42	3.26	4.27	7.62	0.606	-0.237
<b>FPPOP</b>	50	162.47	158.00	171.00	7.28	-0.313	-3.260

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

Normality parameters of the results distribution (Table 3), where the curvature of the curve is tested with Skewness (Skewn.), indicates that all the variables are within normal limits. One of the variables has a positive sign or more results that are greater than the arithmetic mean (better results), while the other two variables have a negative sign, which indicates that there are more results that are smaller than the arithmetic mean.

The second normality parameter of distribution is Kurtosis (Kurtos.). It explains analysis of the degree of curvature of curve top. In two functional variables we have fuzzy or

platykurtic distribution (the results less than 2.75), except for the pulse frequency after the load (FPPPOP -3260).

**Table 4.** Inter-correlacional matrix of female players functional capabilities on initial testing

Test mark	FVKPL	FMARG	FPPPOP
FVKPL	1.00		
FMARG	.56	1.00	
FPPPOP	.41	.54	1.00

Table 4 shows experimental group inter-correlacional matrix in the initial functional abilities measurement. Statistically significant correlations have all of the tests, but the biggest are recorded between Margaria test (FMARG) and vital lung capacity (FVKPL) in the value of 0.56.

**Table 5.** Inter-correlacional matrix of functional capabilities of female players on final testing

Test mark	FVKPL	FMARG	FPPPOP
FVKPL	1.00		
FMARG	.44	1.00	
FPPPOP	.21	.32	1.00

In Table 5 shows inter-correlacional matrix of female players in the final functional abilities measurement. Statistically significant correlations have all of the tests, but the biggest are recorded between Margaria test (FMARG) and vital lung capacity of the (FVKPL) in the value of 0.44.

**The differences between the initial and final testing of female players in functional abilities**

**Table 6.** The significance of the isolated functional abilities discriminant function

Disc Func.	Eugenvalue	Cannonical R	Wilks' Lambda	Chi-Sqr.	df	P-Level
1	2.123	.71	.202	103.13	3	.000**

Legend: squared coefficient of discrimination (Eugenvalue), canonical correlation coefficient (Cannonical R), Bertlet test values (Wilks' Lambda), Chi-square test size (Chi-Sqr), freedom degrees (df), and the significance level of the determination coefficient (P-Level)

In Table 6 we have one important function of high intensity (CR = 71%), which indicates in which correlation is set of data on the basis of which is carried discriminant analysis of the results obtained. The results of discriminant functional abilities strength of variables are shown with test Wilks' Lambda (.202), indicating that the differences between the initial and final measurements in functional abilities area are significant (P = .000) as the size of a Chi square test has a high value ( Chi-Sqr = 103.13).

**Table 7:** Factor structure of isolated discriminant functions of functional capabilities

Test mark	Root 1
FVKPL	0.598
FMARG	0.477
FPPOP	0.354

Table 7 presents the structure of discriminant function variables of functional ability participation in the formation of significant discriminant functions. Presented groups centroids represent the arithmetic means of the results of the initial and final measurements. In order to verify the effectiveness of the experimental model are measured three tests of functional abilities, which are supposed to be good predictors of this area. The results show that the largest contribution to the discriminant function has a vital lung capacity (FVKPL .598).

**Table 8.** Measurement centroids

Measurment	Root 1
Initial	-3.111
Final	3.111

The results in Table 8 represent the discriminant function based on the centroids of all the tests of functional abilities equal to -3.111 and 3.111. The significance of the displayed measurement centroids, which is tested for significance by the discriminant function is indicated that their distance (discrimination) is important.

**Table 9.** Classification Matrix

MERENJE	Inicijalno	Finalno	Ukupno
Inicijalno	21	2	23
Finalno	4	19	23
Inicijalno	<b>91.30%</b>	8.70%	100%
Finalno	17.40%	<b>82.60%</b>	100%

Separation of the groups shown in table 9 as percentiles, demonstrate that the committed separation (discrimination) of the measurement results explained with an accuracy of 86.95% (percentage average of the groups) of the canonical correlation coefficient which is CR = 71%. The discriminant analysis results obtained in the final compared to the initial measurement in the female players indicate that under the influence of experimental training program have been significant changes in the functional capacities of the respondents. Results of canonical discriminant analysis of functional ability of female players show that at the end of the experiment under the influence of conditioning training program, there was a statistically significant change in the functional capacities (P-Level = .000).

#### 4. CONCLUSION

The final results of canonical discriminant analysis of *functional capabilities* as compared to the initial measurement of respondents indicate that under the influence of conditioning training program were established *statistically significant changes*. The results of

the discriminant functions of tests with Wilk's Lambda indicate that the differences between the initial and final measurements are *statistically significant (P-Level = .000)*.

It has been demonstrated that, with the proper execution of the conditioning training program and with the appropriate intensity, the duration and extent of exercise can be provided an efficient way to continuously improve functional abilities.

The results of the research can also contribute to a more efficient organization of the individual forms of realization of the conditioning training program, and can will contribute to a healthier development of capabilities and increasing the level of technical and tactical skills of high school students in handball clubs and high school students aimed at handball in additional class of physical education.

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