

## COMPARISON OF MOTOR AND FUNCTIONAL ABILITIES OF YOUNG HANDBALL PLAYERS AND STUDENTS

*(Original scientific paper)*

**Hadži Saša Ilić<sup>1</sup>, Tatjana Popović Ilić<sup>1</sup>, Igor Ilić<sup>1</sup> and Hasim Mekić<sup>2</sup>**

<sup>1</sup>*University of Priština, Faculty of Sport and Physical Education, Leposavić*

<sup>2</sup>*State University of Novi Pazar, Department of Biomedical Sciences,  
Study Program and Physical Education, Novi Pazar*

### **Abstract**

*The goal was to determine statistically significant differences in motor and functional abilities between young handball players and students. The study was conducted on a sample of 78 15-years-old subjects. Age was defined by chronological range of  $\pm 6$  months. The subjects were divided into two subgroups: 38 young handball players and 40 students. Subsample of young handball players is made up of new members of the handball club "Železničar" from Nis. Young handball players were included in motor activities training for basic character. Their training course lasted for 24 training sessions. The students likewise had 24 training sessions. One-half of those were carried out with regular physical education activities, and the other half with out-of-curriculum handball training activities. We were using measuring instruments for the assessment of motor abilities in the segment of explosive power and segment speed, and the functional abilities was measured by heart rate after exercise, maximum anaerobic capacity, and vital lung capacity. Processing of data for purposes of realizing the goals of the research was carried out by the method of canonical discriminant analysis. The results showed higher levels of motor and functional abilities in young handball players.*

**Keywords:** *training activities, physical education, explosive power, segment speed, heart rate after exercise, maximal anaerobic power, vital lung capacity, canonical discriminant analysis*

### **INTRODUCTION**

Handball is creative, high pace group contact sport in which player activity is based on natural forms of movement, which along with specific forms of movement characteristic for its competitive activity structure classifies handball as a multidimensional complex sport with unpredictable dynamic activity of cyclic and acyclic type.

In recent years, the requirements for the optimal development of skills and characteristics that are incorporated in the training process of young handball players are significantly increased. According to some researchers (Milanović, 2007; Ilić, Drašković and Marković, 2009), this is mainly contributed by the increased application of scientific methods for more efficient procedures in the methodical training process shaping according to individual abilities and characteristics of the athletes.

The goal of this study was to compare them and determine the differences between levels of motor and

functional abilities of young handball players included in the training process and students which were engaged in regular physical education as well as extracurricular handball activities.

### **METHODS**

The subject sample in this research consisted of 78 15-years-old  $\pm 6$  months boys. The subjects were divided into two groups, one consisting of 38 young handball players, members of the handball club Železničar from Niš, and the other of 40 students. The young handball players were included in the training program consisting of basic motor activities, while the students' program consisted of one half sessions of regular physical education classes, and the other of extracurricular handball related activities. Both subject groups' programs lasted for 24 training sessions.

The assessment of motor abilities of young handball players was done using the standard motor instruments to Kurelić at al. (1975). Six motor tests were applied. The

applied tests for the evaluation of segment speed were: hand taping - MTAP, foot taping - MTAN and feet taping on the wall - MTPZ. For the assessment of explosive strength: standing long jump - MSDM, standing triple jump - MTRS and throwing balls to maximum distance - MBLP.

The tests used to assess the functional abilities were: heart rate after exercise - FPOP, Margaria test - FMAR and vital lung capacity - FVKP. The measurement was carried out according to the procedures proposed in the study Heimer and Medved (1997).

The training program of the young handball players consisted of three 60 minute long sessions per week, i.e. 24 training sessions in the two months period. The students had simultaneously attending two 45 minute long classes of the regular physical education, and two 45 minute classes of extracurricular handball related activities per week. Thus, the students had an overall physical activity of 180 minutes per week, which is the same as the training plan of the handball players.

The measuring of motor and functional abilities was conducted by experienced physical education teachers. During the two months of training, and the physical education classes, a record was kept of the presence of the participants. After the completion of the two month program, there was a transversal measurement of the results using the applied tests on both groups.

For the handball training sessions for young handball players, as well as regular physical education and extracurricular classes in handball for the students, we applied motor exercises, loads, and work methods for which we assume to have the highest impact on the success in handball. Special attention was paid to increase coordination of movement for faster adoption of technical and tactical skills, as well as improving joint mobility and elasticity of the spine, which is achieved with exercises that gradually increase the amplitude of movement. In addition, we took into account the need to increase strength levels, jump and speed in muscle groups that are especially engaged in handball.

Processing of the obtained data, from the motor and from the functional tests separately was carried out using the canonical discriminant analysis.

## RESULTS

The results of the canonical discriminant analysis (table 1) show that only one significant discriminant function was obtained. The results of the discriminant strength of the motor variables, which are defined by Wilks-Lambda test, are high (.65). This suggests that the motor skills differences between young handball players and students are statistically significant ( $P = .001$ ).

Table 2 presents the structure of discriminant functions, and its correlations with motor abilities tests. Based on these correlations, we see that almost all of the tests have a contribution in defining said structure. However, the greatest contribution to the discriminant functions provides tests: standing long jump (MSDM

*Table 1. Statistically significant isolated discriminant function of the motor abilities (canonical correlation coefficient - Rc; squared coefficient of the canonical correlation - Rc<sup>2</sup>, Wilks' Lambda; Chi-square test - Chi-Sqr; level of statistical significance of the discriminant variables - P)*

	Rc	Rc <sup>2</sup>	Wilks' Lambda	Targ %	Chi-Sqr.	P
1	.69	.47	.65	51.34	48.02	.001

*Table 2. Structure of the isolated discriminant function of the subjects' motor skills*

Motor abilities tests	Discriminant function
MSDM	.529
MTRS	.502
MPTS	.470
MTAN	.433
MTAP	.424
MTAZ	.358

.529), standing triple jump (MTRS .502) and standing five paces jump (MPTS .470). Some tests have a lower contribution, such as foot tapping (MTAN .433), hand tapping (MTAP .424), and the lowest contribution was observed in feet taping on the wall test (MTAZ .358).

Therefore, the discriminant function can be defined as a dimension which is saturated primarily with explosive strength and overthrew the segment speed. This means among other things that the young handball players differ significantly from students in the level of motor skills explosive force that interacts with motor ability was segment speed.

Therefore, the discriminant function can be defined as a dimension which is saturated primarily with explosive strength, followed by the segment speed. This suggests that there is a statistically significant difference between the young handball players and students when explosive strength motor abilities that interact with segment speed motor ability is observed.

The table 3 results show the values of the centroids in relation to the groups of young handball players and students. Based on the values of these centroids we can make the final interpretation regarding the realization of the research objectives. A positive value of the centroids

*Table 3. Centroids of the subject groups*

Groups	Centroids
Handball players	1.460
Students	-1.460

Table 4. Statistically significant isolated discriminant function of functional abilities (canonical correlation coefficient - Rc; squared coefficient of the canonical correlation - Rc<sup>2</sup>, Wilks' Lambda; Chi-square test - Chi-Sqr; level of statistical significance of discriminant variables - P)

	Rc	Rc <sup>2</sup>	Wilks' Lambda	Targ %	Chi-Sqr	P
1	.68	.46	.71	48,40	40.63	.003

(1.46) for young handball players indicates that they possess statistically significant greater explosive power and segment speed abilities compared to the centroids of the students, whose value has a negative sign (-1.46).

Canonical discriminant analysis (table 4) is indicating similar results when analyzing functional abilities of the subjects. In doing so, one statistically significant discriminant function was obtained. It is significant at the .003 value. This is in accordance with the Wilks' Lambda and Chi-Sqr test values. The diversity of the applied tests for functional abilities assessment among young handball players and students is defined by 48.40%.

Table 5 presents the structure of discriminant function in participation of the functional abilities tests which forms unique statistically significant discriminant functions. Results indicate that the following tests possess the greatest contribution in defining the discriminant function: maximal anaerobic power (FMARG - .586) and heart rate after exercise (FPUPO .562). It can be seen that there is a smaller contribution of a vital lung capacity test in explaining the function (FVKPL .337). However, despite this, it can be said that the vital lung capacity has a statistically significant affect in the illustration of the functional abilities of subjects.

In this way, all the applied tests for assessing

Table 5. Structure of the isolated discriminant function of the functional abilities

Functional tests	Discriminant function
FMARG	-.586
FPUPO	-.562
FVKPL	.337

Table 6. Centroids of the subject groups

Groups	Centroids
Handball players	.460
Students	-.460

functional abilities provide the basis for distinguishing between groups of test subjects. This is evident from the data presented in table 6, where the values of centroids of the functional abilities of these groups are represented. Signs before the centroids values indicate that young handball players are characterized by a higher level of functional abilities.

## DISCUSSION AND CONCLUSION

The results of the canonical discriminant analysis for motor abilities (tables 1-3) show that there was a statistically significant improvement of the adaptive changes of the dimensions of these abilities in young handball players (P = .001). The improvement is related to the dimension of explosive strength, and to a lesser degree on the segmentary speed.

This was probably because of the overall content of applied exercise in young handball players has increased the ability of faster and more comprehensive activation of the motor units with high intensity training, allowing increased activity of agonist muscles and the strength increase of the whole body.

In addition, the increase of motor skills in young handball players was also contributed by utilizing applied loads (volume, intensity and relaxation intervals) in accordance with the biological and psychological characteristics, as well as exercises with speed and explosive strength properties contents aimed for fast direction change (running techniques changing the direction of movement, jumps and landings, squats followed by jumps, etc.) near the maximum of the functional abilities. Application of means of physical exercises during the training process was under supervision, regarding the intensity and size of the load, as well as in the process of restoring energy, i.e. phases of rest, when the physiological changes caused by the process of training mostly occur.

Some authors (Malacko & Rađo, 2004; Lakota, Talović, Mekić & Bajramović, 2008) support this approach to training and suggest that this allows a significant development of motor foundation in young handball players, based on which is possible to later develop complex motor skills and facilitate transition to the phase of specialization.

To increase the level of motor abilities, a method of maximal fast execution of parts of the elements or the entire techniques was used in facilitated or difficult circumstances. Loads that were used were not greater than 5% to 10% of maximum effort that are needed when performing the entire techniques in some situational-motor exercises of the handball game.

Results of canonical discriminant analysis for functional abilities (tables 4 - 6) also show a statistically significant improvement (P = .003) of the adaptive processes of the functional abilities in young handball players.

It can be assumed that the improvement of the adaptive processes of functional abilities was caused, among other things, by the use of the selected means

of the handball physical exercises of the explosive and repetitive character to raise the functional abilities of the phosphocreatine and glycolytic energy mechanisms and increase the efficiency of neural structures in specific conditions of oxygen debt. It is likely that the use of the sprint training with acceleration to maximum speed, intensity 60-80%, has also contributed in development of these abilities in young handball players.

Optimal rotation of work and rest intervals in the training process in the development of functional abilities of the subjects contributes to the increased working capacity in relation to the initial level according to some authors (Malacko, 2002). The increase in working capacity is based on the positive functional reaction of the organism, which in turn allows further increase and develop overall fitness condition.

Increasing number of researchers with an interest in the development of functional abilities of athletes (Kuleš & Šimenc 1983, Gardašević 1989; Heimar & Medved, 1997) supports this concept of functional training of young athletes.

Similar case was determined in this study, because more intensive activities for the development of functional abilities in young handball players compared to students were used, with motor exercises focused on improving abilities of rapid muscles engagement i.e. speed power. In the same sense, in young handball players, during endurance development training focused on speed and strength endurance, there has been more prominent repetition of quick movements. This was realized by intense exercise regime with change of pace, and also with the use of interval work training methods. In addition to this, so-called supraliminal load contributed to the final results, which was used at certain stages of the recovery process.

The results obtained in this study, in general terms indicate that the work programs of the regular physical education and additional extracurricular handball training activities (handball section in schools), are conceptualized with the greater intensity of motional physical activities which allow improvement of motor and functional abilities. Of course, such programs should be based on the results of further research, whose case would be compatible with the subject of this study.

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Correspondence:

Hadži Saša Ilić

University of Priština, Leposavić

Faculty of Sport and Physical Education

Dositeja Obradovica b/b, 38218 Leposavić, Serbia

E-mail: sasa.ilic@pr.ac.rs