

# The transformational processes involving motor skills that occur under the influence of basic preliminary training in young handball players

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## Annotation:

The population from which we extracted a sample of 76 subjects consisted of elementary school students in Kursumlija, all male, aged 12-13, who were divided into a sub-sample consisting of 38 young handball players who took part in the training sessions of a school of handball and another sub-sample consisting of 38 non-athletes, who only took part in their regular physical education classes. The aim of the research was to determine the transformation processes involving motor skills, which occur under the influence of basic preliminary training in young handball players. The subject matter of the study was to examine whether a statistically significant increase in the level of motor skills would occur under the influence of physical exercise as part of basic preliminary training in the final as compared to the initial state. Six motor tests which define the dimensions of explosive and repetitive strength were used. The results of the research indicate that significant transformational processes involving the motor skills of young handball players occurred in the final as compared to the initial measuring, under the influence of basic preliminary training.

**Маркович С., Маркович К., Крамской С. Трансформаційні процеси, що включають рухові навички, які відбуваються під впливом основної попередньої підготовки серед молодих гандболістів.** В експерименті брали участь 76 учнів школи в Куршумлії, які були розділені на групи: 38 молодих гандболістів у віці 12-13 років, які беруть участь у підготовці сесій школи гандболу, і 38 неспортсменів, які брали участь у їх регулярних заняттях з фізичного виховання. Метою дослідження було визначення трансформаційних процесів з урахуванням рухових навичок, які відбувалися під впливом основної підготовки молодих гандболістів. Предметом дослідження було вивчити питання про статистично значущому збільшенні рівня моторних навичок, що відбуваються під впливом фізичних вправ, при остаточному результаті в порівнянні з вихідним станом. Використовувалися шість тестів, що визначають ступінь дії вибуху і повторюваної сили. Результати дослідження показують, що значні трансформаційні процеси рухових навичок молодих гандболістів були у фіналі.

**Маркович С., Маркович К., Крамской С. Трансформационные процессы, включающие двигательные навыки, которые происходят под влиянием основной предварительной подготовки среди молодых гандболистов.** В эксперименте принимали участие 76 учащихся школы в Куршумлии, которые были разделены на группы: 38 молодых гандболистов в возрасте 12-13 лет, принимающие участие в подготовке сессий школы гандбола, и 38 неспортсменов, которые принимали участие в их регулярных занятиях по физическому воспитанию. Целью исследования было определение трансформационных процессов с учетом двигательных навыков, которые происходили под влиянием основной подготовки молодых гандболистов. Предметом исследования было изучить вопрос о статистически значимом увеличении уровня моторных навыков, происходящих под влиянием физических упражнений, при окончательном результате по сравнению с исходным состоянием. Использовались шесть тестов, определяющие степень действия взрыва и повторяющейся силы. Результаты исследования показывают, что значительные трансформационные процессы двигательных навыков молодых гандболистов были в финале.

## Keywords:

motor skills, basic preliminary training, young handball players.

рухові навички, основні попередньої підготовки, молодих гандболістів.

двигательные навыки, основные предварительной подготовки, молодых гандболистов.

## Introduction.

Modern handball requires that the players manifest a high level of fitness and technical-tactical knowledge and skills, in order to be as efficient as possible in various situations during the game. The demands made on the handball players have increased and are the consequence of the innovative changes made to the structure of handball as a game. Many researchers have pointed out (*Simenc & Pavlin 1982, Hosek & Pavlin 1984, Kules & Simenc 1990, Platonov 2007*) that motor activity in handball is primarily characterized by high intensity, which is primarily manifested in quick and sudden sprints as part of the situation of the game itself, especially during the phase of attack. Thus, handball players need to be able and equipped to utilize their maximum speed and be in possession of specific endurance in order to play an entire game at a high tempo.

It has been determined (*Bompa 2006*) that load exercise and the methods applied during basic preliminary work contributes most to the development of abilities and skills on which the achievement of the desired results in handball is actually based. According to *Zeljaskov (2004)* basic preliminary training enables a further increase in the functional abilities of various organs and systems of organs, an improvement in nervous-muscular

coordination, an increase in strength dimension, speed, endurance and flexibility and an improvement in the ability for efficient recovery, all of which makes up the basis for future successful work on the development of the specific fitness abilities of handball players. Our research problem was to determine whether any statistically significant increase in the motor skills of the subjects occurred under the influence of physical exercise during basic preliminary training (between the initial and final measuring). The aim of the research was to determine the transformational processes involving motor skills that occur under the influence of basic preliminary training among the subjects of the experimental group.

The method.

The population from which we extracted the sample of 76 subjects consisted of elementary school students from Kuršumlija, all of them male, aged 12 and 13 ± 6 months. This sample was divided into two sub-samples. The first sub-sample consisted of 38 subjects, young handball players, who in addition to their physical education classes, also took part in the training sessions of a school of handball (the experimental group), and the second sub-sample also consisted of 38 subjects who, apart from their regular physical education classes, did not take part in any sports activities (the control group).

The sample of measuring instruments used for the

evaluation of motor skills consisted of a battery of tests used to evaluate repetitive (torso lifts on a bench – MDTK, mixed pull-ups – MMZG) and explosive strength (throwing a medicine ball from a seated position – MBMS, the standing high jump – MSVIS, the standing depth jump – MSDM). The instruments used to evaluate motor skills were the ones included in the research carried out by *Kurelic et al., 1975*.

The data was processed with the help of the Statistika 7.0 package. We calculated a multivariate and univariate analysis of variance and a canonical discriminant analysis.

2.1 The structure of the motor exercise program during the basic preliminary training

The subjects in the experimental group trained to a basic preliminary training work model for a period of 8 weeks, or in other words, for 24 training sessions. An initial and final testing was carried out for the purpose of determining the level of repetitive and explosive strength among the experimental and control group of subjects. The motor activities used to develop repetitive strength included: short-distance running (10-20m) forward, backward, laterally; jumping in place or in motion, reactive take-off in three directions (with both feet, left-right leg alternately and single leg); running with a change in direction (forward, backward, to the side, in a circle, various combinations); running from various starts, push-ups and pull-ups with and without the aid of equipment). The exercises used to develop explosive strength included skips forward, backward, lateral skips, vertical with a change in rhythm and jumps with a lift using plyometric work. This kind of work increased the subjects' ability to activate motor units and agonistic muscle groups more quickly and completely. The work also included motor exercises of an aerobic and anaerobic character with a ball, which in the future, according to (*Flisk 2007; Milanovic 2007*), enabled a faster and more efficient improvement in the technical-tactical abilities in an anaerobic regime, or in other words, the speed endurance of handball players. Special attention was paid to the development of movement technique under varying conditions of a game involving a ball and an opponent, in order to achieve optimum speed and maximum muscle contraction force. Aerobic work done with the handball players was an essential part of the warm-up during certain training sessions (same speed running and slow motor exercise in the form of circular training).

Research results.

3.1 The canonical discriminant analysis of significance between the initial and final measuring for the subjects of the experimental and control group

The discriminant analysis was used in the study to determine whether there is a statistically significant difference between the results obtained at the initial and final measuring, and then to determine which of the variables made the greatest contribution to the identified difference, that is, discrimination. Tables 1 and 5 show the squares of the discriminant coefficients (Eugenvalue), the canonical correlation coefficients (Canonical R), values of Bartlett's test (Wilks' Lambda), the Chi-square test (Chi-Sqr), the degree of freedom (df) and the probability

of error (P-Level) in rejecting the hypothesis that the actual value of the canonical correlation is zero.

Table 1 shows the significant discriminant function of high intensity (CR=85%) which indicates the correlation of the data, on the basis of which we performed the discriminant analysis of the obtained results. The results for the discriminant value of the motor variables were obtained with the help of the Wilks'-Lambda test (.598), indicate that the differences are statistically significant in the final in relation to the initial measuring in the area of motor skills in the case of the experimental group ( $p=.000$ ), which is confirmed by a high value of the Chi-square test (Chi-Sqr = 120.06).

Table 2 shows the structure of the discriminant function of the part played by the variables of repetitive and explosive strength of the experimental group in forming significant discriminant functions. The shown group centroids represent the means of the results from the initial and final measuring. The results obtained for the subjects indicate that the greatest contribution to the discriminant function was made by the standing high jump (MSVIS .704), push-ups (MSKL .658) and torso lifts (MDTK .456). The remaining tests made a smaller contribution to the discriminant function.

The results shown in Table 3 represent the discriminant function of the centroids on the basis of the motor tests, which has a value of -2.987 and 2.987. The significance of the shown measuring centroids, which is tested by means of the significance of the discriminant function, indicates that their distance (discrimination) is significant.

The separation of the groups shown in Table 4 indicates that the discrimination of the results is explained by a precision of 75.32% of the canonical correlation coefficient CR = 85%.

*The results obtained from the discriminant analysis in the final measuring as compared to the initial one, for the subjects of the experimental group, indicate that the influence of the basic preliminary training of young handball players led to statistically significant changes in the motor skills at the level of the dimensions of repetitive and explosive strength.*

Table 5 shows the discriminant function of mid intensity CR=28.7% which indicates the correlation of the data, one on the basis of which the discriminant analysis of the results was carried out. The results of the discriminant value of the variables obtained with the help of the Wilks' Lambda test (.314), indicate that the differences between the initial and final measuring in the area of motor skills of the control group are not significant (P-Level = .162), which was confirmed by the low values of the Chi-square test (Chi-Sqr = 12.46).

Table 6 shows the structure of the discriminant function of the role the variables of repetitive and explosive strength of the subjects in the control group played in the forming of the significant discriminant functions. The shown group centroids represent the means of the results from the initial and final measuring. The obtained results indicate that none of the variables indicate a statistically significant contribution to the discriminant function.

The results shown in Table 7 indicate the discriminant function of the centroids on the basis of all the motor variables

Table 1

*The significance of the isolated discriminant function for the experimental group*

Disc Func.	Eugenvalue	Canonical R	Wilks' Lambda	Chi-Sqr	df	P-Level
1	6.172	.850	.598	120.06	6	.000

Table 2

*The factor structure of the isolated discriminant function for the experimental group*

Variable	Root 1
MSVIS	.704
MSKL	.658
MDTK	.456
MSDM	-.399
MMZG	.376
MBMS	-.325

Table 3

*Measuring centroids for the experimental group*

Measuring	Root 1
Initial	-2.987
Final	2.987

Table 4

*The classification matrix of the experimental group*

	Percent	Initial	Final
Initial	72.26	38	0
Final	78.38	0	38
Total	75.32	38	38

Table 5

*The significance of the isolated discriminant function for the control group*

Disc Func.	Eugenvalue	Canonical R	Wilks' Lambda	Chi-Sqr .	df	P-Level
1	.378	.287	.314	12.46	6	.162

Table 6

*The factor structure of the isolated discriminant function for the control group*

Variable	Root 1
MSDM	-.314
MSVIS	-.295
MSKL	.285
MBMS	.203
MDTK	.042
MMZG	.036

Table 7

*Measuring centroids for the control group*

Measuring	Root 1
Initial	.429
Final	-.429

which have values of .429 and -.429. The significance of the shown measuring centroids, tested by means of the significance of the discriminant function, indicates that their distance (discrimination) is not significant.

The separation of the groups shown in Table 8 indicates that the performed separation (discrimination) of the results is explained with a precision of 53.94% of the canonical correlation coefficient which has a value of CR = 38.7%.

*The results obtained by means of the discriminant analysis in the final as compared to the initial measuring for the subjects of the control group indicate that under the influence of the physical education classes, no significant changes in the level of dimensions of repetitive and explosive strength of motor skills took place.*

### 3.2 THE ANALYSIS OF VARIANCE BETWEEN THE EXPERIMENTAL AND CONTROL GROUP AT THE FINAL MEASURING

By means of the analysis of the results (Table 9) of the test of significance between the values of the arithmetic means of all the motor tests from the final measuring of the sample of the experimental and control group, a statistically significant difference was determined, since Wilks' Lambda has a value of .173, which with Rao's

F-approximation of 3.04 gives the difference significance at the P= .000 level. Therefore, statistically significant differences were determined in the applied system used to measure the motor skills of the subjects (P = .000).

Table 10 shows the results of the univariate analysis for the tests of motor skills by comparing the results of the means of the experimental and control group at the final measuring. On the basis of the F-relation coefficients and their significance (P-Level), we can conclude that a statistically significant difference was determined between the experimental and control group of subjects in all the tests of *repetitive* (torso lifts MDTK .000, push-ups MSKL .002, mixed pull-ups MMZG .000) and *explosive strength* (throwing a medicine ball from a seated position MBMS .001, the standing high jump MSVIS .000, the standing depth jump MSDM .004).

*The results obtained from the analysis of variance at the final measuring between the experimental and control group of subjects indicate that the transformational processes involving motor skills during the basic preliminary period have enabled the experimental group to differ in a statistically significant way in all the variables of repetitive and explosive strength from the subjects of the control group.*

Table 8

*The classification matrix for the control group*

	Percent	Initial	Final
Initial	52.63	20	18
Final	55.26	17	21
Total	53.94	37	39

Table 9

*The multivariate analysis of variance between the experimental and control group of subjects in terms of motor skills at the final measuring*

Wilks' Lambda	F	P
.173	34.04	.000

Table 10

*The univariate analysis of variance between the experimental and control group of subjects regarding motor skills at the final measuring*

Test	Mean (E)	Mean (K)	F-relation	P-level
MDTK	17.55	13.02	20.63	.000*
MSKL	28.87	14.79	46.11	.002*
MMZG	19.36	15.21	11.14	.000*
MBMS	543.98	503.27	18.70	.001*
MSVIS	55.26	47.82	187.24	.000*
MSDM	223.98	186.72	37.06	.004*

**The discussion.**

Modern handball requires a certain level of motor efficiency from the players (*Kules & Simenc 1990*), quick and strong movements, the ability to speed up and stop suddenly, quick changes in the direction of the movement, placing the body in the most appropriate position, and all this in relation to the handball, the situational manipulation of the ball at full speed and in contact with the opponent under the conditions of high energy consumption. Motor skills play an important role in the realization of these requirements, the most important of which are repetitive and explosive strength (*Hosek & Pavlin 1984 and Durakovic 2008*). In addition, the conditional training of handball players must be at a high level, in order to develop endurance (aerobic and anaerobic) and speed strength. The results of the transformational processes of motor skills under the influence of the basic preliminary training indicate that the applied physical exercises had an effect on the obtained statistically significant global differences between the initial and final measuring of the motor skills among the subjects of the experimental group.

**Conclusion.**

This study was carried out with the aim of determining the effects of the transformational processes of repetitive and explosive strength under the influence of basic preliminary training by means of applying a training work model for the development of motor skills. The sample of 76 subjects was divided into two sub-samples. The first sub-sample consisted of 38 subjects, young handball players who, in addition to physical education classes were also included in the training work done in a school of handball (the experimental group), while the second sub-sample also consisted of 38 subjects, who apart from their regular physical education classes did not take part in any. The initial and final state of the subjects was determined by means of measuring instruments used to evaluate repetitive and explosive strength. The results of the canonical discriminant analysis and the analysis of variance at the final measuring have shown that statistically significant results for repetitive and explosive

strength have been achieved at the end of the experimental period among the members of the experimental in relation of the control group of subjects. What made the greatest contribution to it were appropriate physical exercises, adequate application of load intensity, the applied methods and forms of work and rest intervals for the recovery of the functional energy systems of the subjects.

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