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## Editorial

Homosporticus is a scientific journal published jointly by Faculty of Sport and Physical Education University of Sarajevo. The journal is published twice a year, and presents the views of all scientific disciplines in sport, concerning a wide area of sport (Physical Education, Training, Sport for all, Fitness and Health-related Activities, Sociology of Sport, Philosophy of Sport, Physical Conditioning, Pedagogy of Sport, Research Methodology, Top-level Sport, Management of Sport, History of Sport and the Olympic Movement, Biomechanics, Motor Control, Biology, Medicine of Sport and Exercise, Adapted Physical Activity and Sport for the Disabled, Biochemistry).

Up till 2008 the journal was published in English language and are now making arrangements to implement this new policy. I hope that with your help the journal Homosporticus will receive more attention in the sports sciences community. I encourage authors to make submissions electronically at homosporticus@fasto.unsa.ba. The editorial review process and correspondence with authors will also be conducted electronically.

The first electronic development is that the full text from Homosporticus are now available online on www.fasto.ba. This is likely to extend the journal's audience and impact in the coming years. Now we are indexed in the COBISS.BH databases and we will look forward to apply to others indexed databases soon. This is very good news for authors of the excellent and innovative research published in this journal. Our mission for Homosporticus is to continue to publish high-quality original research that will elucidate the impact of sport on all aspects of sport and well-being in general.

Editor-in-Chief
Ph.D. Izet Radjo

Ekrem Čolakhodžić[1], Izet Rađo[2], Ifet Mahmutović[1] and Nijaz Skender [3]

# Qualitative changes of Motoric Abilities at Soccer Players under the Effect of Situational Soccer Training

Key words: **soccer players, motoric capabilities, qualitative changes, situational training**
Ključne riječi: **nogometaši, motoričke sposobnosti, kvalitativne promjene, situacijski trening**

**Abstract**
The aim of this research conducted on a sample of 75 soccer players aged 12 to 15, was to specify qualitative changes occurring due to programmed soccer training process. The programme, having been based on situational problem solution through game in all phases of training, lasted six months and it included 72 training units and 8 league games. The span of this research covers detection of effects of programmed training activity in the field of motoric abilities of soccer players aged 12-15, and than to detect the essence of these changes. The results can serve as a guideline for enhancement and correction of mistakes in planning and programming future training units in work with this age group of young players. Factor analysis is used in the process of determination of qualitative changes - method of congruency (compliance of factor scores). Based on the factor analysis, we can conclude that systematic qualitative changes have occurred under the effect of structured soccer programme. In the basic structure of motoric dimensions, after completing factorization of the initial measuring, six latent dimensions were determined, explaining 65.7% of the overall variability. After completion of the soccer programme we conducted factor analysis of the results provided with final measuring and it can be concluded that reduction and condensation of latent dimensions appears since we got five latent dimensions explaining 63% of the overall variability. The analysis has shown that through the course of time of implementation of the project, motoric dimensions had restructured taking up a different position. Their structure isn't as dispersed as in initial measuring, as certain form of condensation took place, so that the motoric abilities entered a more orderly relation, for which the credit can be given to programmed soccer procedure.

**Sažetak**
**Kvalitativne promjene motoričkih sposobnosti kod nogometaša pod utjecajem situacionog nogometnog treninga**
U cilju utvrđivanja nivoa kvalitativnih promjena u skupu motoričkih sposobnosti nastalih pod utjecajem programiranog nogometnog treninga u trajanju od šest mjeseci, analizirani su rezultati dobijeni na uzorku od 75 mladih nogometaša uzrasta 12 -15 godina. U prostoru motoričkih sposobnosti primjenjeno je 18 varijabli koje su pokrivale hipotetska područja eksplozivne snage, repetitivne snage, koordinacije, brzine, fleksibilnosti i ravnoteže. Kvalitativne promjene, tj. promjene u strukturi i odnosima unutar strukture motoričkih sposobnosti, analizirane su kao razlike matrica kovarijansi manifestnih i latentnih varijabli u dvije vremenske tačke, iz kojih je izveden komponentni model faktorske analize, metod kongruencije ili slaganja faktorskih skorova. Na osnovu faktorske analize u prostoru motoričkih sposobnosti možemo zaključiti da je došlo do sistematskih kvalitativnih promjena pod utjecajem struktuiranog nogometnog programa. Motoričke dimenzije su se kroz vrijeme realizacije programa prestrukturirale i zauzele drugačiju poziciju. Njihova struktura nije više tako razuđena kao u inicijalnom mjerenju, nego je izvršena određena kondezacija tako da su motoričke sposobnosti došle u jedan uređeniji odnos kada je u pitanju ovaj prostor kod nogometaša, što se može pripisati programiranom nogometnom trenažnom procesu.

## Introduction

From the numerous conducted researches up till now on the subject of successfulness in the game of soccer (Elsner, 1983; Gabrijelić, 1983, 1987; Talović, 2001), motor abilities take up the main spot but the anthropological field of soccer players is the effect of interaction of a greater number of regulatory mechanisms. Motor abilities can simpler be defined as a set of abilities which contribute to resolving motor tasks and they define successful movement, regardless if they are acquired or not (Malacko and Rađo 2004). Higher extent of performable motor abilities is the main precondition for efficient learning and performing of new elements of soccer technique. Most elements in the game of soccer, especially those involving a ball, are highly complex and for their enhancement and flawless implementation in the game, previous preparation of the entire loco-motor apparatus is required, which is directly related to other systems, cardiovascular, respiratory, muscles, nervous system, etc. Understanding of the hierarchical structure of those factors on which the result in the contemporary game of soccer depends, presents the basic precondition for selection of soccer talents and more efficient planning and programming of everyday training. The subject of this research covers qualitative changes of motor abilities based on solving soccer tasks in the course of a match, and essential problems are solved through situational training. Situational training is founded on a modern vision of soccer training with younger age groups promoted by the UEFA, being based on acquiring soccer elements through play (Michels, 2001). Training process is structured in such a manner that it combines exercise and playing. The main goal of the training is to produce a relaxed environment of play and competing, so that, through play, young soccer players unconsciously develop motor and intellectual abilities, acquire and improve technical and tactical elements of soccer. Such are especially those conditions which are surprising, stressful for young soccer players which play the decisive role in overtaking the dominant role within a game. The sense of every programmed training activity, as well as of this soccer programme is condensation of the set of motor abilities for the purpose of more efficient and rational display of capacities of soccer players.

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## Methods

### Sample of the examined

The research was conducted on a sample of 75 young soccer players (age 12 – 15). Final evaluation took into consideration only the results provided by those who participated in initial and final measuring, which regularly taking part in programmed training process of soccer school, and did not have morphological, psychological and other aberrations.

### Sample of variables

In selecting variables, the results of research conducted up till the present have been used, and only those variables in which measurable characteristics could be accounted were chosen (validity, reliability, objectivity, etc.), and which were appropriate for this age group (Šoše and Rađo, 1998). For evaluation of space of motoric abilities 18 variables have been used: 1. Forward bow- stretch- touch (MBFPTZ), 2. Foot tapping (MBFTAN), 3. Foot tapping off the wall (MBFTAZ), 4. Long jump from position (MESSDM), 5. High jump from position (MESSVM), 6. 20-meter dash from a high start (MES20V), 7. Bat twist (MFLISK), 8. Forward bow on a bench (MFLPRK), 9. Forward bow with legs stretched in a sitting position (MFLPRR), 10. Leg slalom with two balls (MKOSNL), 11. An eight form with bending over (MAGOSS), 12. Steps aside (MAGKUS), 13. Sit-ups (MRSLES), 14. Push-ups (MRSSKL), 15. Bowing aside in laying position- alignment of the body (MRSZTL), 16. Standing on one foot longitudinally on a bench with eyes open (MBAU10), 17. Standing on one foot longitudinally on a bench with eyes closed (MBAU1Z), 18. Standing on two feet sideways on a bench with eyes closed (MBAP2Z).

### Data processing methods

For processing, inputting data and analysis of the results, SPSS 12.0 program package for Windows was used. Factor analysis was applied on a multivariable level for determining qualitative changes. Beginning with matrixes of variable correlation in initial and final measuring, main component method was used (Hoteling's factor approach) with diagonal direct oblimin transformation. Kaiser-Gutman's criterion was applied for evaluation of relevance of main components according to which as relevant is declared such main component of which the variance or the typical root greater or equal to 1.

### Results and Discussion

Established inter-correlations among motor tests in initial (table 1) and final measuring (table 2) are real and positive so it is justifiable to continue with further analyzing of the acquired data. Kaiser-Mayer-Olkin measure of sampling adequacy variables and Bartlett's test of sphericity have provided data which tells us about compatibility of the matrix for analysis conducted with the use of the factor analysis method. From the overall space of variables of a motor set in initial measuring, according to Kaiser- Gutman's criterion, 65.7% of joint valid variance which can be explained with 6 isolated factors (table 5) is exhausted. First isolated factor consumes the greatest number of information on applied measuring system (27%), while others consume lesser percentage of information. The second consumes 10.19%, the third 8.28%, the fourth 7.63%, the fifth 6.79% and the sixth 5.7% of joint variance. Unlike the initial measuring, in the final measuring (table 6) 63.63% of cumulative variance is exhausted, which can in this case be explained with 5 isolated factors. First factor in final measurement, after application of the programme, consumes overall 32.01% of valid variance. Second factor consumes 9.54% of variance, the third 8.68%, the fourth 7% and the fifth factor 6.35% of valid variance. First typical root in initial measuring has value of 4.86, while in final measuring typical root is bigger and it mounts up to 5.76. Analysis of the matrixes of communality in initial measuring (table 3) and in final measuring (table 4) it can be seen that almost all variables take part with rather high projections in definition of variability of the trialled area. By analyzing matrix of set we can see that in initial measurement (table 7) first factor is saturated with a certain number of variables that have significant projections. Most significant projections have variables of explosive strength MESSVM, MESSDM, all three variables of repetitive strength MRSLES, MRSZTL and MRSLES, two variables of coordination MAGKUS and MKOSNL. When addressing matrix structure in final measurement (table 9), we can not notice certain structural changes, and that the first factor barer of the greatest part of variability. The second isolated factor in initial measurement can be interpreted as balance factor, because highest projections have variables MBAU1O and MBAP2Z. Significant projection also has the variable of explosive strength MES20V. The structure in the final measuring changed only to a small extent, where the second factor is still largely defined by dimensions of balance. Variable MES20V moved from second factor to the first. Third isolated factor in initial and final measuring has completely different structure. While in initial measuring high projections had variables for measuring the speed of movement, MBFTAN, MBFTAZ and MBFPZD, in final measuring the highest projections have flexibility rates MFLPRK and MFLPRR and therefore we can call this factor the flexibility factor. This discrepancy we can without doubt identify as the result of the programme, and it is explained with a great number of stretching and relaxation exercises in almost all phases of training. In the fourth isolated factor initially are singled out high balance projections MBAU1Z and coordination MAGOSS. In final measuring we can call the fourth one factor of movement frequency, because highest projections have variables MBFTAN, MBFTAZ and MBFPZD. It is noticeable that speed changed position from third to fourth factor. In the fifth isolated factor both in the initial and in the final measuring highest projection has the MFLISK variable, and therefore we can call this factor the factor of flexibility of the shoulder range and it represents a pure artefact because of minor effect of upper extremities in resolving situations typical for soccer. The sixth factor of initial measurement we can call the flexibility factor with variables MFLPRR and MFLPRK. In final measuring motor field is in a way reconstructed and it is no more dispersed and wide as in initial measuring as there is no sixth factor which is now inexistent. In tables 8 and 10 matrixes of correlations of isolated components of motor abilities are shown both initially and finally and as it can be seen greatest correlations with general motor factor has the factor of segmented speed in initial (.34) and in the final measuring (.40).

***Table 1.***

*Values of KMO and Bartlett's test in motor abilities initially*

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | ,64 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 430,14 |
| | df | 153 |
| | Sig. | ,00 |

***Table 2.***
*Values of KMO and Bartlett's test in motor abilities finally*

| | | |
|---|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | | **,78** |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 498,02 |
| | Df | 153 |
| | Sig. | ,00 |

***Table 3.***
*Matrix of communality of motor abilities initially*

| INITIALLY | Initial | h2 |
|---|---|---|
| MBFPZD | 1,000 | ,591 |
| MBFTAZ | 1,000 | ,694 |
| MBFTAN | 1,000 | ,773 |
| MFLPRK | 1,000 | ,862 |
| MFLPRR | 1,000 | ,800 |
| MFLISK | 1,000 | ,744 |
| MAGOSS | 1,000 | ,564 |
| MAGKUS | 1,000 | ,556 |
| MKOSNL | 1,000 | ,503 |
| MBAU1O | 1,000 | ,699 |
| MBAU1Z | 1,000 | ,769 |
| MBAP2Z | 1,000 | ,596 |
| MESSDM | 1,000 | ,601 |
| MESSVM | 1,000 | ,640 |
| MES20V | 1,000 | ,673 |
| MRSLES | 1,000 | ,563 |
| MRSZTL | 1,000 | ,602 |
| MRSSKL | 1,000 | ,600 |

***Table 4.***
*Matrix of communality of motor abilities finally*

| FINALLY | Initial | h2 |
|---|---|---|
| MBFPZD | 1,000 | ,550 |
| MBFTAZ | 1,000 | ,700 |
| MBFTAN | 1,000 | ,618 |
| MFLPRK | 1,000 | ,761 |
| MFLPRR | 1,000 | ,732 |
| MFLISK | 1,000 | ,718 |
| MAGOSS | 1,000 | ,642 |
| MAGKUS | 1,000 | ,433 |
| MKOSNL | 1,000 | ,542 |
| MBAU1O | 1,000 | ,684 |
| MBAU1Z | 1,000 | ,733 |
| MBAP2Z | 1,000 | ,651 |
| MESSDM | 1,000 | ,694 |
| MESSVM | 1,000 | ,750 |
| MES20V | 1,000 | ,539 |
| MRSLES | 1,000 | ,427 |
| MRSZTL | 1,000 | ,568 |
| MRSSKL | 1,000 | ,710 |

***Table 5.***
*Accepted roots in the field of motor abilities initially*

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings (a) |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumula-tive % | Total | % of Variance | Cumu-lative % | Total |
| 1 | 4,865 | 27,030 | 27,030 | 4,865 | 27,030 | 27,030 | 4,020 |
| 2 | 1,835 | 10,195 | 37,226 | 1,835 | 10,195 | 37,226 | 1,726 |
| 3 | 1,491 | 8,282 | 45,508 | 1,491 | 8,282 | 45,508 | 3,034 |
| 4 | 1,375 | 7,637 | 53,145 | 1,375 | 7,637 | 53,145 | 1,462 |
| 5 | 1,224 | 6,797 | 59,943 | 1,224 | 6,797 | 59,943 | 1,405 |
| 6 | 1,039 | 5,775 | 65,717 | 1,039 | 5,775 | 65,717 | 2,109 |

***Table 6.***
*Accepted roots in the field of motor abilities finally*

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings (a) |
|---|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumula-tive % | Total | % of Variance | Cumu-lative % | Total |
| 1 | 5,762 | 32,014 | 32,014 | 5,762 | 32,014 | 32,014 | 4,947 |
| 2 | 1,719 | 9,549 | 41,562 | 1,719 | 9,549 | 41,562 | 1,586 |
| 3 | 1,562 | 8,681 | 50,243 | 1,562 | 8,681 | 50,243 | 2,470 |
| 4 | 1,266 | 7,034 | 57,277 | 1,266 | 7,034 | 57,277 | 3,548 |
| 5 | 1,144 | 6,357 | 63,634 | 1,144 | 6,357 | 63,634 | 1,475 |

***Table 7.***
*Matrix of motoric abilities circuit initially*

| Variables | Component | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 |
| MBFPZD | ,255 | ,296 | ,400 | -,154 | -,373 | ,042 |
| MBFTAZ | ,007 | -,048 | ,825 | -,078 | ,035 | ,052 |
| MBFTAN | ,063 | -,023 | ,854 | ,090 | -,077 | -,079 |
| MFLPRK | -,073 | -,116 | -,029 | ,182 | ,137 | ,916 |
| MFLPRR | ,027 | ,302 | -,055 | -,297 | -,196 | ,737 |
| MFLISK | ,248 | -,094 | -,083 | -,072 | ,842 | ,030 |
| MAGOSS | -,161 | ,029 | -,375 | -,573 | -,008 | ,026 |
| MAGKUS | -,802 | -,063 | ,147 | ,036 | ,017 | ,166 |
| MKOSNL | -,538 | -,001 | -,120 | ,152 | ,235 | -,151 |
| MBAU1O | ,107 | ,805 | -,064 | -,005 | -,166 | -,027 |
| MBAU1Z | -,121 | ,179 | -,165 | ,834 | -,111 | ,054 |
| MBAP2Z | ,088 | ,645 | -,033 | ,328 | ,093 | ,143 |
| MESSDM | ,482 | -,125 | ,296 | ,121 | -,027 | ,269 |
| MESSVM | ,602 | -,062 | ,311 | ,183 | -,050 | ,002 |
| MES20V | -,289 | ,456 | ,387 | -,115 | ,499 | -,120 |
| MRSLES | ,655 | ,266 | ,001 | ,040 | ,134 | ,057 |
| MRSZTL | ,587 | -,043 | ,219 | ,088 | ,041 | ,197 |
| MRSSKL | ,680 | -,034 | ,097 | -,066 | ,276 | ,080 |

***Table 8.***
*Matrix of correlations of isolated factors of motor abilities initially*

| Comp. | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1,000 | ,080 | ,346 | ,055 | -,056 | ,260 |
| 2 | ,080 | 1,000 | ,087 | ,015 | -,040 | ,084 |
| 3 | ,346 | ,087 | 1,000 | ,057 | ,047 | ,104 |
| 4 | ,055 | ,015 | ,057 | 1,000 | ,037 | ,092 |
| 5 | -,056 | -,040 | ,047 | ,037 | 1,000 | -,102 |
| 6 | ,260 | ,084 | ,104 | ,092 | -,102 | 1,000 |

***Table 9.***
*Matrix of motoric abilities circuit finally*

| Variables | Component | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| MBFPZD | ,117 | ,344 | -,079 | ,576 | -,157 |
| MBFTAZ | -,028 | -,115 | ,222 | ,792 | -,001 |
| MBFTAN | ,123 | ,008 | ,051 | ,710 | ,061 |
| MFLPRK | -,065 | -,016 | ,852 | ,115 | ,156 |
| MFLPRR | ,108 | ,000 | ,793 | ,090 | ,052 |
| MFLISK | ,043 | -,078 | ,103 | -,095 | ,828 |
| MAGOSS | -,514 | -,028 | -,029 | -,406 | ,293 |
| MAGKUS | -,227 | -,011 | -,088 | -,510 | ,038 |
| MKOSNL | -,672 | ,040 | -,021 | -,131 | ,016 |
| MBAU1O | -,186 | ,783 | ,167 | ,123 | -,006 |
| MBAU1Z | ,115 | ,133 | ,518 | -,559 | -,434 |
| MBAP2Z | ,026 | ,807 | -,133 | -,138 | ,011 |
| MESSDM | ,716 | -,127 | ,109 | ,155 | ,031 |
| MESSVM | ,867 | -,050 | -,053 | ,051 | -,095 |
| MES20V | -,621 | -,021 | -,241 | -,017 | ,016 |
| MRSLES | ,288 | ,208 | ,141 | ,093 | ,427 |
| MRSZTL | ,575 | ,130 | ,036 | ,100 | ,306 |
| MRSSKL | ,896 | -,020 | -,097 | -,179 | ,121 |

***Table 10.***
*Matrix of correlations of isolated factors of motor abilities finally*

| Comp. | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1,000 | ,065 | ,284 | ,400 | ,129 |
| 2 | ,065 | 1,000 | ,104 | ,076 | -,082 |
| 3 | ,284 | ,104 | 1,000 | ,143 | ,018 |
| 4 | ,400 | ,076 | ,143 | 1,000 | ,080 |
| 5 | ,129 | -,082 | ,018 | ,080 | 1,000 |

Based on everything previously said, it is noticeable that programme features have lead to structural changes in the scope of motor abilities of subjects from this sample. Structure of motor field is to the greatest extent defined by information regarding manifestation of repetitive strength, explosive strength, coordination and segment speed of movement, which greatly contribute to resolving concrete tasks which are set forth before them in the game of soccer. The position of the flexibility factor is also significant, which can be contributed to age characteristics of the sample and to the great number of stretching and relaxation practices throughout the course of the programme.

## Conclusion

For the purpose of defining the level of qualitative changes in a set of motor abilities appearing under the effect of programmed six-month soccer training, results gathered on a sample of 75 soccer players aged 12 to 15 were analysed. In the field of motoric abilities 18 variables have been applied, covering hypothetical areas of explosive strength, repetitive strength, coordination, speed, flexibility and balance. The results are an outcome of measuring same variables before and after the programme in two points in time. Qualitative changes, meaning changes in structure and relations within a structure of motor abilities, have been analysed as matrix covariance differences of manifesting and latent variables in two points in time, from which the component model of factor analysis is derived - method of congruency or gathering of factor scores. The goal of factor analysis in this research was to provide insight into qualitative changes after implementation of a soccer programme. Based on factor analysis in the field of motor abilities we can conclude that systematic qualitative changes have occurred under the effect of structured soccer training. In the basic structure of motoric dimensions, after completing factorization of initial measuring, six latent dimensions have been identified, explaining 65.7% of variability. After execution of the programme, factor analysis of the results of the final measurement has been conducted, and it can be concluded that reduction and condensation of latent dimensions had occurred because there could be identified only 5 latent dimensions at the end, explaining 63% of the overall variability. In the course of implementation of the programme, motor dimensions had restructured taking up a different position. Their structure is not as much dispersed as it used to be in the initial measurement, as certain condensation occurred so that motor abilities entered a more orderly relation in regard to this field in soccer players, for which the credit can be given to program soccer training process.

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Almir Mašala[1]

# Correlations Between the Generic
## Segments of Generated Incomes in Team Sports and the Business and Sporting Achievements

Key words**: correlation, income, business and sporting achievements**
Ključne riječi: **povezanost, prihodi, poslovni i sportski uspjeh**

**Abstract**
Based on the generally accepted industrial forces analysis concept, which was developed by Michael Porter during the 80s in the last century (Šunje, 2003), it is possible to present the model analysis of the correlation between the relevant generic segments in team-sports and the business and sporting achievements as the structural industrial forces in sports. In this context, it would be very easy to draw a conclusion that the status in the sporting industry and the dangers for the individual sporting branches – sports, vary from sport to sport, in terms of sports belonging to the sporting industry being attractive to a greater or a lesser extent (football, basketball, volleyball, and team-handball). Attractive aspects of sports are reflected in a larger or a smaller room for the sporting organisations within these sports to provide higher levels of profitability, that is, stronger financial effects (incomes). Proceeding from the aforementioned, and to objectify the state of attractiveness of sports that are represented in this research work, and the strategic operation and the performance at the sporting organisation market, this research defines a correlation between the structural and generic significance of the generated income segment within the following sports: football, basketball, volleyball and team-handball from the Canton of Sarajevo in the 2003/04 season, and the business and sporting achievement segment.

**Sažetak**
**Korelacije generičkog segementa ostvarenih prihoda timskih sportova sa poslovnim i sportskim uspjehom**
Na osnovu opće prihvaćenog koncepta analize industrijskih sila koji je razvio Michael Porter 80-tih godina prošlog stoljeća (Šunje, 2003), moguće je predočiti model analize povezanosti značajnih generičkih segmenata timskih sportova sa poslovnim i sportskim uspjehom kao strukturalne industrijske sile u sportu.
U tom kontekstu bilo bi vrlo jednostavno zaključiti da stanje koje djeluju u sportskoj industriji i opasnosti za pojedine sportske grane – sportove, varira od sporta do sporta, u smislu da su sportovi koji pripadaju sportskoj industriji u većoj ili manjoj mjeri atraktivni (nogomet, košarka, odbojka i rukomet).
Atraktivnost sporta se ogleda u većem ili manjem prostoru za sportske organizacije da unutar tih sportova osiguraju veći stepen profitabilnosti, odnosno, bolje finansijske efekte (prihode).
Polazeći od navedenog, u svrhu objektiviziranja stanja atraktivnosti sportova predočenih u ovom istraživačkom radu, strategijskog djelovanja i nastupa na tržištu sportskih organizacija, utvrđena je povezanost strukturalno generički značajnih segmenata ostvarenih prihoda unutar sportova nogometa, košarke, odbojke i rukometa Kantona Sarajevo u sezoni 2003./04. sa poslovnim i sportskim uspjehom.

## Introduction

Contemporary sport is an activity with the above average economic performances, relevant for the capital market, and a relevant resource allocation tool and, as such, it has all the attributes of a sporting industry. This gives the sports even a greater significance, which is interesting for the business, the advertisers and the sponsors (Malacko & Rađo, 2006; Tomić, 2001). These are the reasons why this research is based on the general proposition that sporting clubs from the analysed team-sports contain characteristics of complex organisational and economic structures, which are essentially run as enterprises or companies and whose survival in the competition with same or similar organisations depends on the managerial achievements and the quality of the governance strategies. Focus of this research is primarily put on the correlation analysis of the managerial functions and the activities reviewed in the end effects of the generically significant financial income segment of the sporting clubs in team-sports (football, basketball, volleyball, and team-handball) from the Canton of Sarajevo in relation to the realised business and sporting achievements in a single competitive season. Based on the produced research outcomes, it is possible to analyse the effects of the actual market mechanisms that have the primary impact on business and sporting achievements of the sporting organisations in team-sports, such as football, basketball, volleyball, and team-handball, and, in this context, to assess which of the listed team-sports (football, basketball, volleyball, and team-handball) is, to a greater or a lesser extent, more attractive and more appealing for the sporting industry market. This research demonstrates the correlations between the generically significant generated income segment and the business and sporting achievements segment at the Canton of Sarajevo level and rationalises the conditions for the managerial methods application in the development of primary, complementary and business sporting products. The purpose of this research is determine relations between the business and sporting achievements with the generically significant generated income segment of team-sports, such as, football, basketball, volleyball, and team-handball, from the Canton of Sarajevo in the competitive 2003/04 season in relation to the business and sporting achievements, and to objectify the actual market mechanisms operations that have the primary impact in developing significant economic performances of the analysed sporting organisations.

## Methods

### Sample of the examined

The sample of respondents for the needs of this research is defined as a cluster of 62 analysed sporting clubs in team-sports, such as football, basketball, volleyball, and team-handball, in the competitive 2003/04 season from the Canton of Sarajevo,

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for which the previous researches determined that they have the high levels of marketing and entrepreneurial potentials (Mašala, 2008).

## Sample of variables

This work required the analyses of the following 18 criteria variables of the generically significant generated income segment, and which are as follows: club income percentage, generated by advertisements and presented in money (INADVER); club income percentage, generated by donations and presented in money (INDONAT); club income percentage, generated by budget and presented in money (INBUDG); percentage of planned financial requirements of the club presented in money (FINREQ); percentage of total generated financial turnover club presented in money (FINTURN); club income percentage, generated by selling gate receipts and presented in money (INGATER); club income percentage, generated by selling rights to live television broadcasting and presented in money (INLIVTVBR); club income percentage, generated by competitor compensation and presented in money (INCOMCOMP); club income percentage, generated by membership fees and presented in money (INMEMBFEE); club income percentage, generated by sponsorship and presented in money (INSPONS); income percentage, generated by renting the club premises and presented in money (INPREMIS); income percentage, generated by renting the club field and presented in money (INRENFIELD); income percentage, generated by renting the club equipment and presented in money (INRENEQUIP); income percentage, generated by the club business subject and presented in money (INBUSSUBJ); income percentage, generated by personal assets engaged in the club and presented in money (INPERSASSET); percentage of other generated incomes of the club presented in money (INOTHER); business achievement (BUSACHI); and sporting achievement (SPACHI).

## Data processing methods

To objectify the research outcomes, this research used a nonparametric computing procedure called the Spearman's rank-correlations (Ro-correlation coefficient). Based on this statistical package, this research presented the reviews of the Spearman's correlation coefficients values, as well as their levels of significance in testing the correlations between the business and sporting achievements and the other criteria variables.

## Results and Discussion

a) Correlations between the generated income segment and the business and sporting achievement segment in football

Table 1 gives the review of correlation coefficients in the analysis of the generated income structure segment in football and the correlation with the business and sporting achievements for the 2003/04 season.

Based on the outcomes of the Spearman's coefficients nonparametric correlation analysis in football, presented in Table 1, this research determined statistically significant correlations between the business achievement variable (BUSACHI) and the income from advertising (INADVER), income from gate receipts (INGATER), and income from live television broadcasting (INLIVTVBR) variables. Likewise, there are significant correlation coefficients related to the correlation between the sporting achievement variable (SPACHI) and the income from advertising (PRIHREKL), income from gate receipts (INGATER), income from live television broadcasting (INLIVTVBR) variables and the other generated incomes variable (INOTHER). Outcomes of the statistically significant correlation coefficients in football verified the significant correlation between the business achievement variable (BUSACHI) and the sporting achievement variable (SPACHI) of the sporting organisations in football. Based on the conducted correlation analysis and the obtained outcomes of the statistically significant correlation coefficients of the generated income structure in football variables, and which are as follows: income from advertising (INADVER); income from gate receipts (INGATER); and income from live television broadcasting (INLIVTVBR), and the business achievement variable (BUSACHI), in the first case, and the outcomes of the statistically significant correlation coefficients of the following variables: income from advertising (PRIHREKL); income from gate receipts (INGATER); income from live television broadcasting (INLIVTVBR); and the other generated incomes variable (INOTHER), and the sporting achievement variable (SPACHI), it can be concluded that in average the most significant proportion of the financial means in sporting organisations is realised by income from advertising, gate receipts and live television broadcasting, which are simultaneously closely related to the sporting product quality viewed from the aspect of successful sporting achievements realised and the positioning of sporting organisation at the targeted market. Furthermore, outcomes of the statistically significant correlation coefficients of the

***Table 1.***

*Correlation between the business and sporting achievement and the financial income variables in football for the 2003/04 season*

| SPORT Football | Spearman's rho | INADVER | INGATER | INLIVTVBR | INCOMCOMP | INMEMBFEE | INDONAT | INSPONS | INBUDG | INPREMIS | INRENFIELD | INRENEQUIP | INBUSSUBJ | INPERSASSET | INOTHER | BUSACHI | SPACHI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSACHI | Correlation Coefficient | ,414(*) | ,465(*) | ,385(*) | ,350 | -,224 | ,156 | ,207 | ,170 | ,310 | ,186 | . | -,173 | -,077 | -,154 | 1,000 | ,452(*) |
| | Sig. (2-tailed) | ,032 | ,014 | ,047 | ,074 | ,262 | ,437 | ,300 | ,396 | ,115 | ,353 | . | ,389 | ,702 | ,442 | . | ,018 |
| | N | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |
| SPACHI | Correlation Coefficient | ,447(*) | ,501(**) | ,430(*) | ,451(*) | -,292 | ,086 | ,376 | ,110 | ,304 | ,019 | . | ,172 | ,318 | -,425(*) | ,452(*) | 1,000 |
| | Sig. (2-tailed) | ,019 | ,008 | ,025 | ,018 | ,139 | ,670 | ,054 | ,585 | ,123 | ,924 | . | ,391 | ,105 | ,027 | ,018 | . |
| | N | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 | 27 |

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

business achievement variable (BUSACHI) and sporting achievement (SPACHI) indicate the synergic and strategic operation of the sporting organisations in football in terms of providing the maximum degree of the business and sporting achievement in the 2003/04 season, which verifies the presence of the generic strategies in the generated income segment, and which contain a clear orientation of the organisation to the competition, on one side, and to the buyers-clients, on the other.

b) Correlations between the generated income segment and the business and sporting achievements segment in basketball

Table 2 gives the review of correlation coefficients in the analysis of the correlation between the business and sporting achievement segment and the generated income segment in basketball for the 2003/04 season.

Based on the outcomes of the Spearman's Ro-coefficient non-parametric correlation analysis in basketball, this research defined a statistically significant correlation between the business achievement variable (BUSACHI) and the generated income from sponsorship variable (INSPONS), while the sporting achievement variable (SPACHI) is in the statistically significant correlation with the gate receipt generated income (INGATER) and the sponsorship generated income (INSPONS) variables. Outcomes of the statistically significant coefficients in basketball verify the significant correlation between the business achievement variable (BUSACHI) and the sporting achievement variable (SPACHI) of the sporting organisations in basketball. Based on the outcomes of the conducted analysis, it is observed that in sporting organisations in basketball income from sponsorship variable (INSPONS) is in a statistically significant correlation with the business achievement variable (BUSACHI), which indicates a strong strategic orientation of the basketball clubs management to the sponsors. Statistically significant correlation between the gate receipt generated income (INGATER) and the sponsorship generated income (INSPONS) variables and the sporting achievement variable (SPACHI) also indicates the interest of the public and sponsors as the most significant segments at the sporting market for this type of primary sporting product (official competitions), which is also closely related to the sporting product quality, that is, realisation of successful sporting achievements and the positioning of the club at the targeted market.
In this case, as well as in the previous one, there is a presence of statistically significant correlation coefficients of the business achievement variable (BUSACHI) and the sporting achievement variable (SPACHI), which indicates the application of the generic strategies of the basketball clubs in the generated income segment in terms of providing the maximum degree of the business and sporting achievement for the 2003/04 season.

c) Correlations between the generated income segment and the business and sporting achievement segment in volleyball

Table 3 gives the review of correlation coefficients in the analysis of the correlation between the business and sporting achievement segment and the generated income segment in volleyball for the 2003/04 season.

***Table 2.***
*Correlation between the business and sporting achievement variable and the financial income variable in basketball for the 2003/04 season.*

| SPORT Basketball | Spearman's rho | INADVER | INGATER | INLIVTVBR | INCOMCOMP | INMEMBFEE | INDONAT | INSPONS | INBUDG | INPREMIS | INRENFIELD | INREQUIP | INBUSSUBJ | INPERSASSET | INOTHER | BUSACHI | SPACHI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSACHI | Correlation Coefficient | ,433 | ,421 | . | . | ,441 | ,372 | ,688(**) | ,393 | . | . | . | . | . | ,024 | 1,000 | ,673(**) |
| | Sig. (2-tailed) | ,073 | ,082 | . | . | ,067 | ,129 | ,002 | ,106 | . | . | . | . | . | ,926 | . | ,002 |
| | N | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |
| SPACHI | Correlation Coefficient | ,174 | ,712(**) | . | . | ,282 | -,002 | ,725(**) | ,299 | . | . | . | . | . | ,129 | ,673(**) | 1,000 |
| | Sig. (2-tailed) | ,490 | ,001 | . | . | ,258 | ,992 | ,001 | ,227 | . | . | . | . | . | ,611 | ,002 | . |
| | N | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 | 18 |

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

***Table 3.***
*Correlation between the business and sporting achievement variable and the financial income variable in volleyball for the 2003/04 season.*

| SPORT Volleyball | Spearman's rho | INADVER | INGATER | INLIVTVBR | INCOMCOMP | INMEMBFEE | INDONAT | INSPONS | INBUDG | INPREMIS | INRENFIELD | INREQUIP | INBUSSUBJ | INPERSASSET | INOTHER | BUSACHI | SPACHI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSACHI | Correlation Coefficient | -,180 | -,180 | . | . | -,285 | ,416 | ,182 | -,181 | . | . | . | . | . | . | 1,000 | ,489 |
| | Sig. (2-tailed) | ,620 | ,620 | . | . | ,425 | ,232 | ,616 | ,617 | . | . | . | . | . | . | . | ,151 |
| | N | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |
| SPACHI | Correlation Coefficient | -,175 | -,175 | . | . | -,381 | ,392 | ,105 | -,136 | . | . | . | . | . | . | ,489 | 1,000 |
| | Sig. (2-tailed) | ,629 | ,629 | . | . | ,277 | ,263 | ,772 | ,708 | . | . | . | . | . | . | ,151 | . |
| | N | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 | 10 |

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

Based on the outcomes presented in the Table, this research defined that there are no statistically significant coefficients of the correlation between the business achievement variable (BUSACHI) and the sporting achievement variable (SPACHI) and the generated income variables in volleyball for the 2003/04 season. Conducted analysis indicate that there is no statistically significant correlation between the variables of the business and sporting achievement of clubs in volleyball, based on which can be concluded that there is an absence of synergic and strategic operation of the volleyball clubs in terms of providing the maximum degree of business and sporting achievement in the 2003/04 season.

d) Correlations between generated income structure segment and the business and sporting achievement segment in team-handball

Table 4 gives the review of correlation coefficients in the analysis of the correlation segment between the business and sporting achievement and the generated income in team-handball for the 2003/04 season..

Based on the outcomes presented in the Table 4, this research defined that there are no statistically significant coefficients in the correlations between the business achievement variable (BUSACHI) and the sporting achievement variable (SPACHI) and the generated income variables in team-handball for the 2003/04 season.
As was the case with volleyball, in the case of team-handball the analyses conducted indicate that there is no statistically significant correlation between the business and sporting achievement variables in the clubs in team-handball, based on which can be concluded that there is an absence of synergic and strategic operation of the team-handball clubs in terms of providing the maximum degree of business and sporting achievement in the 2003/04 season.

## Conclusion

Outcomes of the statistically significant coefficients of the Spearman's rank-correlations (Ro-coefficient) in football indicate that, in average, the major proportion of the financial means in sporting organisations is realised by income from advertising, gate receipts and television live broadcasting, which are closely related to the sporting product quality viewed from the aspect of successful sporting achievements realised (Mašala, 2002). Furthermore, outcomes of the statistically significant coefficients of the correlation between the business and the sporting achievements indicate the synergic and strategic operation of the sporting organisations in football in terms of providing the maximum degree of financial incomes in the 2003/04 season, which verifies the successful application of the generic strategies in the generated income segment, and which contain a clear orientation of the organisation to the competition, on one side, and to the buyers-clients, on the other (Čičić, 1985). Based on the outcomes of the statistically significant coefficients in basketball, it is observed that incomes from sponsorships are in a significant correlation with the business achievement, which indicates a strong strategic orientation of the basketball clubs management to the sponsors. Correlation between the generated income from gate receipts and the sponsorship generated income and the sporting achievement indicates the interest of the public and the sponsors, as the most significant segments of the sporting market for this type of primary sporting product (official competitions), which is also closely related to the sporting product quality, that is, the realisation of successful sporting achievements. In the case of basketball, too, the presence of statistically significant correlation coefficients of the business and sporting achievements verifies the successful application of the generic strategies of the basketball clubs in terms of providing the maximum degree of business and sporting achievements for the 2003/04 season. Correlation analyses outcomes for the team-sports of volleyball and team-handball do not verify a statistically significant correlation between the generic segment of generated income and the business and sporting achievements, and it can be concluded that there is an absence of synergic and strategic operations of volleyball clubs and team-handball clubs at the market in terms of providing the maximum degree of business and sporting achievements in the 2003/04 competitive season. Based on the produced research outcomes, it can be concluded that that status of forces and dangers that are active inthe sporting industry in the case of the analysed sporting organisations in team-sports, such as football, basketball, volleyball, and team-handball from the Canton of Sarajevo, vary from sport to sport, that is, that sporting organisations in team-sports of football and basketball from the Canton of Sarajevo to a significant extent demonstrate more attraction and appeal for the sporting industry market than the sporting organisations in team-sports of volleyball and team-handball (Council of Europe, 1996). In fact, this verifies the general proposition that sporting clubs in team-sports contain characteristics of complex organisational and economic structures (Šunje, 2002; Čičić, 1985), which are essentially run as enterprises or companies and whose survival in the competition with same or similar organisations depends on the managerial achievements and the quality of the governance strategies.

***Table 4.***
*Correlation between the business and sporting achievements variable and the financial income variable in team-handball for the 2003/04 season.*

| SPORT Team-handball | Spear-man's rho | INAD-VER | IN-GATER | INLI-VTVBR | INCOM-COMP | IN-MEMB-FEE | INDO-NAT | IN-SPONS | IN-BUDG | IN-PREMIS | INREN-FIELD | IN-RENEQUIP | INBUS-SUBJ | INPER-SAS-SET | INOTH-ER | BUSACHI | SPACHI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BUSACHI | Correlation Coefficient | ,076 | -,202 | -,309 | ,206 | ,673 | ,282 | ,000 | -,413 | . | . | . | . | . | ,000 | 1,000 | ,018 |
| | Sig. (2-tailed) | ,872 | ,664 | ,500 | ,658 | ,098 | ,540 | 1,000 | ,357 | . | . | . | . | . | 1,000 | . | ,969 |
| | N | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |
| SPACHI | Correlation Coefficient | -,066 | -,135 | ,618 | -,412 | -,400 | ,227 | ,216 | -,110 | . | . | . | . | . | -,618 | ,018 | 1,000 |
| | Sig. (2-tailed) | ,888 | ,773 | ,139 | ,358 | ,374 | ,624 | ,641 | ,814 | . | . | . | . | . | ,139 | ,969 | . |
| | N | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 | 7 |

**Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

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# The Level of use of Technical and Tactical Elements in Boxing Based on the Analysis of the 15th B&H Individual Boxing Championship

Key words: **dodging, aberrations, technique, knockout.**
Ključne riječi: **eskivaža, kategorije, tehnika, nokaut**

**Abstract**
A research has been conducted on a sample of 80 competitors in 40 fights. The objective of this research was to determine the level of use of technical and tactical elements in boxing based on situational efficiency of boxers participating in the "15th B&H INDIVIDUAL BOXING CHAMPIONSHIP BANOVIĆI 2007. Based on video records, an analysis of fights was conducted, using twenty five variables. The collected data were processed using descriptive statistics and shown in frequency and percentage values.The research results showed equal use of direct and hook punches and more frequent use of advanced than basic defensive techniques in boxing during the competition of boxers. Achieved results may contribute to better understanding of monitoring and analysis of situational efficiency parameters in boxing at all competition levels.

**Sažetak**
**Zastupljenost tehničko – taktičkih elemenata u boksu na osnovu analize „xv pojedinačnog prvenstva BiH u boksu"**
Istraživanje je sprovedeno na uzorku od 80 takmičara u 40 borbi. Cilj ovog istraživanja je utvrđivanje zastupljnosti tehničko – taktičkih elemenata u boksu na osnovu situacijske efikasnosti boksera XV POJEDINAČNOG PRVENSTVA BIH U BOKSU BANOVICI 2007. Na osnovu video zapisa izvršena je analiza borbi uz pomoć dvadeset šest varijabli. Prikupljeni podaci su se obradili deskriptivnom statistikom, izraženi u frekvencijama i procentualnim vrijednostima. Rezultati istraživanja pokazali su ujednačenu primjenu direktnih i kroše udaraca, te veću primjenu naprednih od osnovnih odbrana u boksu tokom takmičarske aktivnosti boksera. Dobijeni rezultati mogu doprinijeti boljem razumjevanju praćenja i analiziranja parametara situacijske efikasnosti u boksu na svim nivoima takmičenja.

## Introduction

It is unnecessary to emphasize how important it is to prepare organism for exposure to a large strain in sport. In any kinesiological activity, including boxing, the organism is exposed to a specific strain. The magnitude of this strain will depend on many factors, such as mastering the technique, condition training, psychological training, and most of all the knowledge about the opponent we are fighting against (Milanović, 1999). In the same way, fighters with a larger motive to achieve success in sport will be exposed to different strains (Shim, 2003). If a sportsman is being prepared using modern training methods, and especially if he masters well the defence tactics and techniques, in that case there will be no undesired punches or they will be reduced to a minimum. The sports life of a boxer is not long enough to allow him to thoroughly master every move and to learn everything that is necessary about boxing. Once he learns everything he needs to know about this martial art, it is time for him to withdraw from the ring, and his chances to win the world championship are very small (Bonacin, 2006). The structural analysis of the boxing technique should indicate to specific characteristics of motor movements in this sport (Liao, & Lui, 2003). This covers the analysis of a phase of each individual technique, the importance of these phases for overall efficiency of the technique and conditions that ensure such efficiency.

A large number of techniques in boxing make the structural analysis of each individual technique impossible, due to a limited scope, and this research will therefore analyze only the basic groups of techniques. Most previous research papers in the field of boxing and other martial arts K-1, karate, judo (Hassell, 1984; Kapo, 2006, Kajmović et al., 2007) were published from the aspect of morphological characteristics and motor knowledge and presented as a complex multidimensional research. Special attention must be paid to the following papers, published by the authors (Kapo, 2006) who were researching the impact of basic motor abilities on the efficiency of technique and tactics performance in karate on a sample of 60 karate fighters using 21 basic motor tests and three situational motor tests in karate. Research results clearly show that basic motor abilities have large and significant impact on the efficiency of karate technique and tactics performance, where variables of coordination with the stick (MCWS), foot tapping against a wall (MFTAW) have the dominant role, and can therefore be used for the selective purposes.

On a sample of eight first-rate K-1 fighters from Southeast Europe, who participated in K-1 tournament "KING OF THE COLOSSEUM" SARAJEVO 2002 (Kapo et al. 2004.) were researching a certain technique-tactic elements in martial arts existing even in K-1. Research results showed the dominance in Boxing and Muay thai, based on the statistical share of punches from these martial arts that were applied during competition activities in K-1 sport.
Research conducted on a sample of 43 competitors, in 31 fights and 116 analyzed rounds of all weight classes, from fourteen countries participating in the 9th "HAKIJA TURAJLIĆ" INTERNATIONAL MEMORIAL BOXING TOURNAMENT", Sarajevo 2003, (Kapo et al., 2005) divided into the lightweight class (48-57 kg), middleweight (57-71 kg) and heavyweight (over 71 kg) with the purpose to determine an influence due to change of rules in boxing and dominance of technique – tactics elements during the fight. Research results showed the dominance of hook punches concerning other arm punches in boxing what was exactly contributed by rules changing i.e decreasing time duration of the fight from three to two minutes per round where the largest frequency of punches was in heavyweight and lightweight classes (over 71 kg) and (48-57 kg).

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The hypothetical model of periodisation in katate (Kafeđić et al., 2005) of a one-year cycle of preparation of first-rank karate fighters from the "Bušido" Karate Club was applied in this research. The results achieved best show the value and efficiency of the one-year cycle of karate fighters' preparation. The results achieved by karate fighters of the "Bušido" Karate Club from Sarajevo, Arnela Odžaković and Adnan Beširević, who worked on the basis of the shown periodisation model in a one-year cycle of preparation, may confirm its value and effectiveness, and therefore the efficient application in training of the first-rank karate fighters. Research objective was to determine the level of use of technical and tactical elements in boxing, based on the situational efficiency of boxers, participants of the "15th B&H INDIVIDUAL BOXING CHAMPIONSHIP, BANOVIĆI 2007".

## Methods

### Sample of the examined

Sample comprised of 80 first-rank competitors from Bosnia and Herzegovina.

### Sample of variables

The total number of variables for this research was 25, in order for the presence of technical and tactical elements during forty fights to be analysed in as much detail as possible.

Data were collected on the basis of video records of forty fights, based on which the analysis was performed by qualified experts in that field making the special protocols for monitoring sport activities with the analyze of all parameters which specified this collection.

#### Data processing methods

Collected data were processed by descriptive statistics, and expressed in frequency and percentage values, which was all supported by graphical display. Variables were processed on the basis of the equation of efficiency of application of technical and tactical elements in boxing fights.

$$\underline{Box = x / Ny\ 100\ \%}$$

Where:

Box = Overall level of use in the boxing tournament

x = Number of successfully performed technical and tactical elements,

Ny = Total number of successfully performed technical and tactical elements,

The above mentioned equation allows fast calculation of the use a certain technique and tactics during the attack and defence in boxing.

## Results and Discussion

### Analysis of the use of punches in boxing

Table 2 and graph 2 show that punches with the left and right hand demonstrate dominance that is most pronounced with the left direct punch to the head with frequency of 1890 or 28.9 % and right direct punch with the frequency of 1011 or 15.5% of the total number of techniques applied with left and right hand at this tournament. The second most frequently used punch is left (front) hook to the head with the frequency of 1514 or 23.2 % and right hook to the head with the frequency of 1277 or 19.5%. This data tells us that fights were very dynamic, and that half-distance fighting and clinching were dominant, therefore the direct punches, without which the modern boxing cannot be imagined, were used frequently, as well as hooks which are the most natural and some of the strongest punches in boxing. Punches with the smallest frequency of use were uppercuts, especially those to the head, with the frequency of left hand of 28 or 0.4 % and right hand of 106 or 1.6%. Data show that although a large number of punches was exchanged in a half-distance fighting and in clinch, we have a very small percentage of use of uppercuts, which leads us to conclude that fighters did not adequately master the boxing techniques, since we know that the uppercut is one of the most complex punches in boxing, and that can immediately be concluded on the basis of the results achieved. The table and

***Table 1.***
*Variables of technical and tactical elements in boxing*

| HAND PUNCHES | | | | | | | | | | | | BASIC DEFENCE AGAINST HAND PUNCH | | | | | | ADVANCED DEFENCE AGAINST HAND PUNCH | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V.1 | | V.2 | | V.3 | | V.4 | | V.5 | | V.6 | | V.7 | | V.8 | | V.9 | | V.10 | V.11 | V.12 |
| Direct punch to the head | | Direct punch to the abdomen | | Uppercut to the head | | Uppercut to the head | | Hook to the head | | Hook to the abdomen | | Blocking with the arms against direct punches | | Blocking with the arms against hooks | | Blocking with the arms against uppercuts | | Dodging | Slipping | Aberration |
| L | D | L | D | L | D | L | D | L | D | L | D | L | D | L | D | L | D | | | |

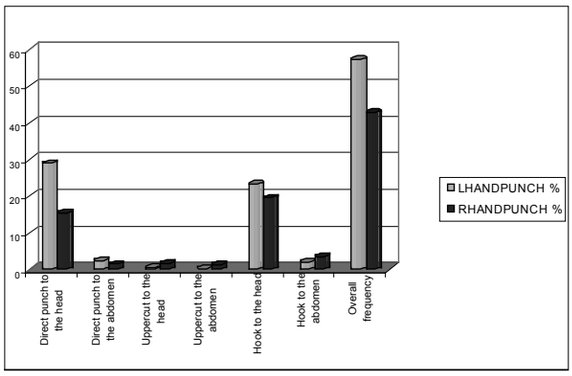
| APPLICATION OF TACTICS | | | KNOCKOUT TECHNIQUE | | | | | | NUMBER OF KNOCKOUTS | MANNER OF WINNING | | | INJURY | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V.13 | V.14 | V.15 | V.16 | | V.17 | | V.18 | | V.19 | V.20 | V.21 | V.22 | V.23 | | V.24 | V.25 | |
| Offensive | Defensive | Combined | Direct punch | | Hook | | Uppercut | | Number of knockouts in a match | By knockout | By decision of referees | Resignation due to injury | Arm | | Torso | Head | |
| | | | L | D | L | D | L | D | | | | | L | D | | | |

graph below clearly show that the frequency of punches to the torso is much smaller than the frequency of punches to the head. Significant difference in the frequency between left and right hand is also visible (for left hand it is 3737 or 57.2%, while for the right hand it is 2800 or 42.8 %), which tells us about importance of the left hand in fighting and preparation for the final punch with the right hand.

***Table 2.***
*Analaysis of use of hand punchs to the head and torso in boxing*

| PUNCHES | LHANDPUNCH | % | RHANDPUNCH | % |
|---|---|---|---|---|
| Direct punch to the head | 1890 | 28,9 | 1011 | 15,5 |
| Direct punch to the abdomen | 158 | 2,4 | 94 | 1,4 |
| Uppercut to the head | 28 | 0,4 | 106 | 1,6 |
| Uppercut to the abdomen | 19 | 0,3 | 86 | 1,3 |
| Hook to the head | 1514 | 23,2 | 1277 | 19,5 |
| Hook to the abdomen | 128 | 2 | 226 | 3,5 |
| Overall frequency | 3737 | 57,2 | 2800 | 42,8 |

***Graph 2.***
*Analaysis of use of hand punchs to the head and torso in boxing*

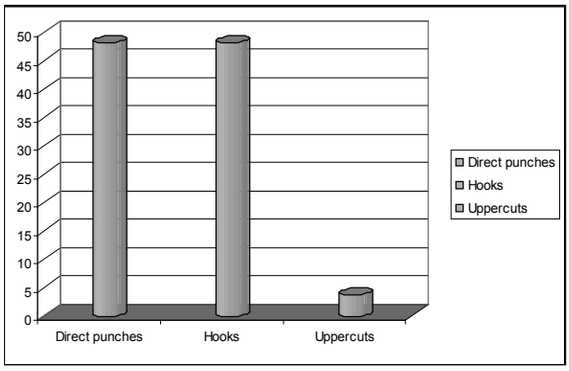



Overall level of use of hand punches in boxing (table 2.a. and graph 2.a.) during the analysed "15th B&H INDIVIDUAL BOXING CHAMPIONSHIP, BANOVIĆI 2007" is to a large extent the same with regard to direct punches (3153 or 48.2 %) and hook punches (3145 or 48.1 %), while the uppercut punches were much less frequently used (239 or 3.7 %). The results indicate that the change in the rules contributed to a larger frequency of hook punches, due to their technical characteristics which became pronounced during dynamic fights and reduced distance between fighters, which finally resulted in this score when application of punches is concerned.

***Table 2.a.***
*Analysis of application of hand punches in boxing*

| PUNCHES | FREQUENCY | % |
|---|---|---|
| Direct punches | 3153 | 48.2 |
| Hooks | 3145 | 48.1 |
| Uppercuts | 239 | 3.7 |

***Graph 2.a.***
*Analysis of application of hand punches in boxing*



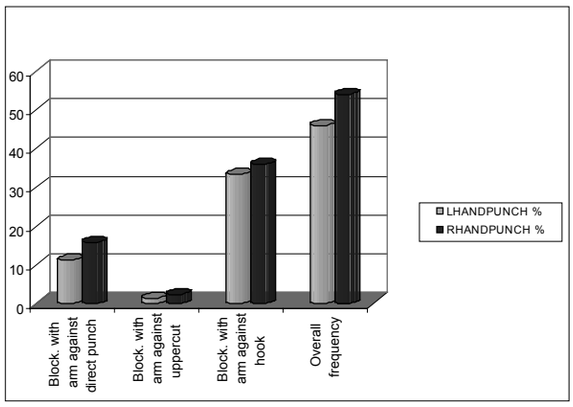

## Analysis of use of basic defence against hand punches in boxing

Table 3 and graph 3 show that the most used basic defence technique is blocking with arm against hook. Blocking with right arm was used 224 times, which is 35.9 %, and blocking with left arm was used 207 times, which is 33.2 %. The second most used defence technique is blocking with arm against direct punches, where blocking with right arm again has larger frequency, 99 or 15.9 %, compared to blocking with left arm which amounted to 70 or 11.2 %. As it can be seen, blocking with arm against uppercuts was used with smallest frequency, which is understandable since this type of punches had smallest use at the tournament. Generally, it may be concluded that right arm is more used for basic defence in boxing, with the frequency of 338 or 54.2 %, while left arm has frequency of 286 or 45.8 % in the total number of applied basic blocking techniques in boxing. This shows that left arm was more used, and was much more active in fight, which resulted in larger frequency of blocks with right arm.

***Table 3.***
*Analysis of use basic defence against hand punches in boxing*

| BASIC DEFENCE | LHANDPUNCH | % | RHANDPUNCH | % |
|---|---|---|---|---|
| Block. with arm against direct punch | 70 | 11.2 | 99 | 15.9 |
| Block. with arm against uppercut | 9 | 1.4 | 15 | 2.4 |
| Block. with arm against hook | 207 | 33.2 | 224 | 35.9 |
| Overall frequency | 286 | 45.8 | 338 | 54.2 |

***Graph 3.***
*Analysis of use basic defence against hand punches in boxing*



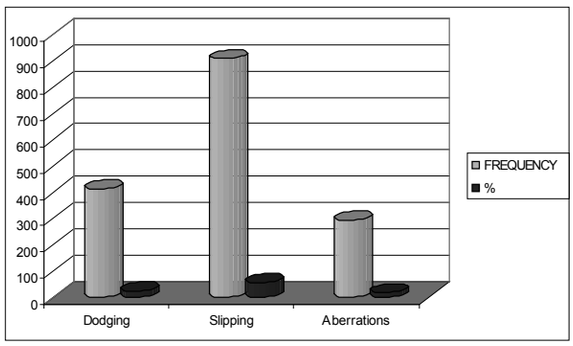

## Analysis of use of advanced defence against hand punches in boxing

Table 4 and graph 4 show much larger use of advanced defence in relation to the basic defence, which tells us that the fighters who participated in this state championship to a large extent mastered the advanced defence techniques as well. It can be seen that the most frequently used advanced techniques were slipping with the frequency of 909 or 56.2 %, then dodging with the frequency of 412 or 25.5 % and aberrations with frequency of 295 or 18.3 %, which is understandable if we take into account that direct punches and hooks were most frequent punches during this competition. These data also indicate that competitors who participated in this state championship were well trained, in technical terms, and that they used advanced body defence techniques.

***Table 4.***
*Analysis o use of advansed defence against hand punches in boxing*

| ADVANCED TECHNIQUES | FREQUENCY | % |
|---|---|---|
| Dodging | 412 | 25.5 |
| Slipping | 909 | 56.2 |
| Aberrations | 295 | 18.3 |

***Graph 4.***
*Analysis o use of advansed defence against hand punches in boxing*



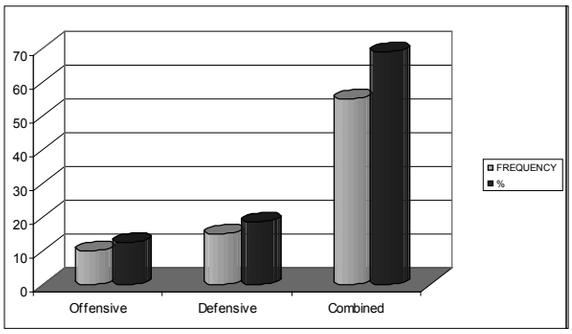

## Analysis of use of tactical elements in boxing

Table 5 and graph 5 show that most dominantly used element was combined tactics with the frequency of 55 or 68.8 %, then defensive tactics with the frequency of 15 or 18.7 % and finally offensive tactics with the frequency of 10 or 12.5 %. Percentage values for applied tactics at this B&H state championship tell us that the fighters were well prepared in terms of tactics, which is confirmed by the obtained indicators that the largest number of fighters successfully used combined tactics. Smaller group of competitors applied also the defensive tactics, which was most probably caused by the fact that they were not well prepared in terms of condition, which resulted in application of this tactics. The least applied was the offensive tactics, most probably because the competitors were cautiously entering into the fight, since they were not well prepared in terms of condition, and because of larger exchange of punches, which was result of new rules where fighters were in constant exchange, and combined tactics became pronounced.

***Table 5.***
*Aplication of tactical elements during completition*

| Application of tactics | FREQUENCY | % |
|---|---|---|
| Offensive | 10 | 12.5 |
| Defensive | 15 | 18.7 |
| Combined | 55 | 68.8 |

***Graph 5.***
*Aplication of tactical elements during completition*



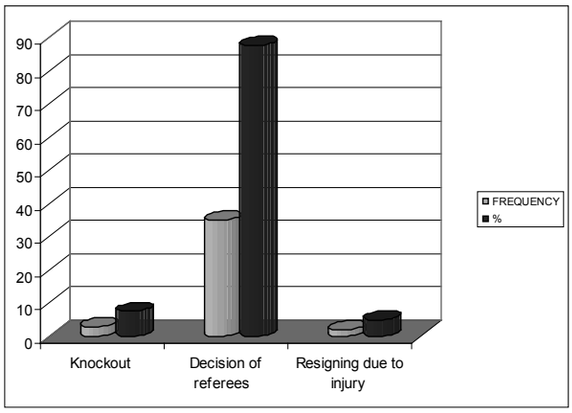

## Analysis of the ways of winning during boxing competitions

Table 6 and graph 6 show that the largest number of wins during the analysed "15th B&H INDIVIDUAL BOXING CHAMPIONSHIP, BANOVIĆI 2007" was achieved by the decision of referees, which indicates that the participants of B&H state championship in boxing were rather equal, which resulted in the fact that largest number of fights was ended by the decision of referees, with the frequency of 35 or 87.5 %. Three fights ended before the regular match time was over, while two fights ended by forfeiting of competitors due to injury.

***Table 6.***
*Aanalaysis of the ways of wining during boxing competitions*

| Way of winning | FREQUENCY | % |
|---|---|---|
| Knockout | 3 | 7.5 |
| Decision of referees | 35 | 87.5 |
| Resigning due to injury | 2 | 5 |

***Graph 6.***
*Aanalaysis of the ways of wining during boxing competitions*




the frequency of 412 or 25.5 %, and aberrations with frequency of 295 or 18.3 %, which is understandable considering that direct punches and hooks actually were the most frequent punches during competition. These data also indicated that competitors participating in this B&H state championship were well trained in terms of technique, and they used the advanced body defence techniques very well.

All of the above mentioned facts lead to the conclusion that change of the boxing rules significantly influenced the fight and use of technical, and therefore the tactical elements in boxing as well. Shortening of the round from 3x3, to 4x2, resulted in a greater level of dynamics and combativeness of boxers, which caused a larger change in technical elements during half-distance fighting and clinching, and this resulted in application of a larger number of hooks and techniques of defence, both basic and advanced, against hooks.

Very small percentage of use of uppercuts during this tournament tells us that fighters were not fully trained, in terms of technique, since we know that the uppercut is most complex punch in boxing, which requires long period of training and a lot of work on perfecting this blow. This was reflected in a larger use of direct and hook punches, which required more training with regard to condition, due to incomplete technical level of preparation, and this all impacted the application of tactics at the championship held in Bosnia and Herzegovina.

## Conclusion

Based on the results obtained through analysis of the "15th B&H INDIVIDUAL CHAMPIONSHIP IN BOXING, BANOVIĆI 2007", we may conclude that the most used punches at this championship were direct punches with the frequency of 3153 or 48.2 %, most probably because of the advantage they give in terms of speed, and easy and precise performance and use of these punches, where the possibility for injury is smallest as well as the energy expenditure. The second most used punch was hook punch with the frequency of 3145 or 48.1 %, most probably because hook is one of the most natural ways of punching. These are the punches moving around the imaginary axis of our body, and punches that provide largest precision, and they are performed during a half-distance fighting. Uppercuts were the least used punches at this state championship, with the frequency of 239 or 3.7 %, which is most probably because these are, in technical terms, most requiring punches in boxing, which demand long period of technical improvement and years of experience in competition. With regard to the use of basic defence against hand punches, most frequently used was defence against hook, with the frequency of 431 or 68.8 %, then against direct punches, with the frequency of 169 or 26.8 %, while the least used defence was technique of defence against uppercut, with the frequency of 24 or 3.8 %, which was logical if we take into consideration the use of the above mentioned techniques during competition.

The analysis of the use of advanced defence against hand punches in boxing, indicates to a much larger frequency of advanced techniques in relation to the basic techniques, which tells us that the fighters who participated in this championship to a large extent mastered the advanced defence techniques. It may be seen that the most frequently used advanced technique was slipping, with the frequency of 909 or 56.2 %, then dodging, with

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# Level of Situational Motor Abilities
## qualitative changes and football player's performance successfulness under the influence of complex football training

Key words: **complex football training, transformational process, situational motor abilities, performance successfulness, qualitative changes**
Ključne riječi: **kompleksni nogometni trening, transformacioni proces, situaciono motoričke sposobnosti, uspješnost u igri, kvalitativne promjene**

**Abstract**
The aim of the research is to determine the level of qualitative changes of situational motor abilities of situational motor abilities and performance successfulness of football players under the influence of the complex footbal training. The samples of examinees represent 107 football players, 16 to 17 years old. All of the examinees are registered football players in cadet teams' competing in municipality and regional leagues. They are involved in long-term training process in their clubs and taking that in consideration they are the bearers of football quality in this age group. Variables selected for this examination hypothetically covered the area of specific motor abilities with 11 variables and are of performance successfulness in football with 15 variables, 7 variables for the successfulness in defense and 8 for forward successfulness.
The programming of training activities applied in this investigation had multidimensional character, whereas through the different training methods we tried to improve the situational motor abilities as well as the performance successfulness in football game. Load quantity was according to the age characteristics of the sample, and was applied through the 134 training matches and 46 matches (28 leagues and 18 controls).
For the determination of the quality changes created under the influence of complex football program, notable in a change of situational motor abilities ang performance succesfullness in football game, we aplied the factor analysis – congruency metod.
General analysis of the program with its operators, methods and load had significant influence at qualitative changes in situational motor abilities, and in area of performance successfulness in football game we can say that the structure had no rearranging of the variables in isolated factors. Therefore we can conclude that there were no statistically significant qualitative changes. Based on the results we can conclude that the treated sample reached high level of specific, technical training, which now should be applied more in a match and get to know all the unpredicted situations when confronted with the opposite team player.

**Sažetak**
**Nivo kvalitativnih promjena situaciono motoričkih sposobnosti i uspješnosti u igri nogometaša pod uticajem kompleksnog nogometnog treninga**
Cilj istraživanja je utvrditi nivo transformacionih promjena situaciono motoričkih sposobnost i uspješnosti u igri kod 107 nogometaša uzrasta 16-17godina nastalih pod uticajem jeednogodišnjeg programa rada. Za procjenu situaciono motoričkih sposobnosti korišteno je 11 varijabli a za procjenu uspješnosti u igri vršili su nezavisni suci, ocjenama od 1 do 5 koji imaju bogato igračko i trenersko iskustvo, profesori sporta i tjelesnog odgoja, te nogometni treneri koji posjeduju UEFA B ili A licencu. Korišteno je sedam varijabli za procjenu uspješnosti igre u odbrani i osam varijabli za procjenu uspješnosti igre u napadu. Za utvđivanje kvalitativnih promjena situaciono motoričkih sposobnosti i uspješnosti u igri nastalih pod uticajem programa rada primjenjena je faktorska analiza. U inicijalnom mjerenju situaciono motoričkih sposobnosti, izolovane su 3 glavne komponente i to: faktor brzine krivolinijskog trčanja – agilnosti, faktor baratanja i brzine vođenja lopte i faktor snage udarca po lopti i preciznosti glavom. U finalnom mjerenju izolovana su 4 faktora: faktor snage udarca po lopti i preciznosti glavom, faktor brzine krivolinijskog trčanja – agilnosti, faktor baratanja loptom ili faktor spretnosti i faktor baratanja i brzine vođenja lopte. Globalno gledajući program rada svojim sadržajem i trenažnim operatorima, opterećenjima imao je značajan utjecaj na kvalitativne promjene situaciono motoričkih sposobnosti, a u prostoru uspješnosti u igri možemo reći da se struktura nije bitnije mjenjala, da nije došlo do pregrupisavanja varijabli unutar izolovanih faktora. Stoga se može zaključiti da nije došlo do statistički značajnih kvalitativnih promjena. Na osnovu dobijenih rezultata može se zaključiti da je tretirani uzorak dostigao visok nivo specifične, odnosno tehničke obuke, obuke koju sada treba što više primjenjivati u igri i suočavati sa svim onim nepredvidivim situacijama koje nam donosi suočavanje sa protivnikom.

## Introduction
Players each movement is connected to the one or more anthropometric dimensions, and the complex of movements for respective dimension complex. (Corluka, M., 2008.)
Basic precondition for the efficient movement is rational technique, that makes fully visible each players motor potential. Without that bad technique becomes the noise factor during the realization of movement and limiting factor during the display of motor capacity.
Football technique (Talovic, M. 1998.) is the basic means in sports fight, and enables the player to better express its abilities and itself depends on personal level of those abilities. The conclusion is that the technique is characterized by individuality.
Football game requires not only rational movement technique, but also the ability to control and regulate the movement depending on situations solving requirements during the match. Football does not have standard movements, but variable, although their structional basis is the same. (Bajramovic, I., 2008.) From that we can say that in football there are no standard, fixed and closed movements' stereotypes, bet they are variable and plastic stereotypes that are in every moment ready for alternative movements.Taking in consideration a many structure analysis of football game it can be presumed that the success in football game depends on large number of different abilities and characteristics. Certainly that from those abilities and characteristics which affect the football successfulness are specific – motor abilities, however significant

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attention in last decades is paid to the game successfulness as the basic indication of the football players abilities level.
Problem of the investigation are the level of qualitative changes of situational motor abilities of situational motor abilities and performance successfulness of football players aged 16 to 17. The aim of the investigation is to determine the level of transformational changes created under the influence of one – year - long training program.

## Method

### Sample of the examinees

The sample of the examinees in this investigation is presented by 107 football players aged 16 to 17. All of the examinees are registered football players in cadet teams competing in municipality and regional leagues. They are involved in long-term training process in their clubs and taking that in consideration they are the bearers of football quality in this age group.

### Sample of the variables

Eleven variables were used for the evaluation of situational motor abilities:
1. SNPPNV- foot aiming – vertical aim, 2. SNPEGH Elevational head aiming – horizontal aim, 3. SNKOST Horizontal wall deflections 20 seconds, 4. SNKSLA Ball control speed (slalom), 5. SNBUPP Ball control speed with lateral change of direction, 6. SNBV20 Ball control speed at 20 m standing start, 7. SNESNO Foot kick strength, 8. SNESGL Head kick strength, 9. SNBTPO Running speed in half circle, 10. SNBTPP Running with change of direction laterally, 11. SNBTSL Slalom run.
Evaluation of the football game successfulness was done by five independent judges, by opservation, with previous football players and coaching experience, professors of Sport and Physical Education and football coaches with B or A UEFA license, by evaluating subjects with marks from 1 to 5.Variables are:
Variables for the evaluation of defense successfulness:
1.Level of pressure during defense 2. Assisting defense 3. Turnovers,
4. Free kick successfulness, 5. Successfulness in transformation when ball lost,
6. Blocking, 7. Ability to play at different positions in defense
Variables for the evaluation of defense successfulness:
1.Ball control, 2. Ability to pass, 3. Protrusions with a ball, 4. Play without a ball, 5. Successfulness in transformation when ball won, 6. Ability to play at different positions in forward, 7. Game kicks, 8. Free kick successfulness in forward

### Methods of data processing

For the determination of the qualitative changes of the situational motor abilities and football game successfulness created under the influence of training program factorial analysis was performed. Analyzed were, as the difference in structure of covariance matrix of manifest and latent variables in two different time point from which we deducted the component model of factorial analysis. The Guttman-Kaiserov criterion, by which significant are all of the latent dimensions whose characteristic root is higer than on or equals 1. (Radjo, I., Wolf, B., 2002.) Using Bartlett testa we tested the posibility to perform any kind of factorisation at the treated variables.

## Results and Discussion

### Factorial analysis results of the situational motor abilities

Table 1. shows characteristic roots and explained variance at the initial measurement of situational motor abilities, where by the analysis of numerical values we can say that there are 3 main components isolated, covering 59,44% of total variance explained (around 40% of variance is under the influence of iniquity). First main component has the highest level of variance explained 32,61%, second main component explains 15,71% and third 11,12% of total variance explained.
Difference from initial is that at the final measurement (table 2.) 63,97% of total variability was explained with 4 isolated factors. First factor at final measurement, after the training program explains 27,34% of total variance, second d 15,38% , third 11,62% and fourth 9,62%. Taking in consideration this outcome it can be concluded that the relation between situational motor abilities had certain changes. Comparing the values of final and initial measurement it can be seen that is a larger number of isolated main components at the final measurement.
Analysis of the initial measurement (table 3.) shows that in the first isolated main component, the largest amount of the variance explained have variables SNBTPO Running speed in half circle, SNBTPP Running with change of direction laterally, SNBTSL Slalom run so that this factor can be called factor of the speed of change of direction run – agility factor.
At the second main component, the largest projection have variables SNKOST Horizontal wall deflections 20 seconds and SNBTSL Slalom run as the foot technique variables SNBUPP Ball control speed with lateral change of direction, SNBV20 Ball control speed at 20 m standing start as a foot technique variables. Because of more areas that show high projections this factor can be defined as a mixed factor of the foot technique and speed of the ball control.
At the third main component, highest projection have variables SNPEGH – elevational head aiming and SNESGL – head kick strength. This factor is mixed and can be called the factor of the ball kick strength and head aiming.
Analysis of the matrix structure results of the final measurement (table 4.), at the first main component are isolated variables SNPEGH – elevational head aiming and SNESGL – head kick strength. This factor is mixed and can be called the factor of the ball kick strength and head aiming. The appearance of this factor as the main isolated factor can be explained and added to the large number of the repetitions these kinds of movements during the worm-up (passing, long and short distances) and cool – down (vertical and horizontal aiming), were these exercises dominated , so it is possible that in this way they improved this ability.
At the second main component the highest projection have variables SNBTPO Running speed in half circle,, SNBTPP Running with change of direction laterally and SNBTSL Slalom so that this factor can be called factor of the speed of change of direction run – agility factor. As it can be seen second factor clearly differentiated agility, running without ball, which can be also explained by the training program in which the players had large number of short runs, change of direction so this found its place in second factor deriving total explained variance of 15,38%.
At the second main component, the largest projection have variables SNKOST Horizontal wall deflections 20 seconds so this factor can be called as a factor of ball control and coordination. This factor behaved the same a the initial measurement, only difference at the final measurement was that this factor of ball control or coordination divided in two factors so that we get one

single factor defined as a ball control – wall deflections. Possible explanation of this isolation of two factors as single factors can be find in a fact that it is the product of the large number of the specific movement stereotypes repetition. Large number of training sessions started with the continued deflections or ball passes between two players, or wall deflections, whereas it produced automatism and could add to a increase in values of the final compared to the initial measurement.

At the fourth main component, highest projection have variables SNBTSLA – slalom run as a variable called ball control, SNBUPP Ball control speed with lateral change of direction as a variable called ball control. This factor is mixed and can be defined as a ball control or speed of ball control run factor.

Regrouping of the variables occurred in the results of final compared to the initial measurement, as well as the enlargement of factor quantity, which shows us that there had been quality changes in a structure, and a transformation of some numeric attributes of the situational motor abilities of the examinees.

Generally, the training program with its elements, methods and load had a significant influence at the qualitative change in situational motor abilities. Analyzing the elements of training it is visible that they influenced the changes because the basis of the work with this age of examinees was predetermined movements, or the automatic execution of predetermined tasks with or without a ball.

Compared to the initial, final measurement isolated another main component, called coordination or the ball control ability, and compared to the other isolated factors it can be said that the drill training and work without ball extremely effective in perfection in the mechanically adopted movements.

## Factorial analysis results of the football players successfulness

Analysis of the isolated components of the football players successfulness (table 7) showed that two main components isolated and explained the area of the football players successfulness with 70, 83% of common variance.

Individual parts to the common variance explanation of these two isolated function are 57, 12% for the first and 13, 70% for the second.

Analysis of the final results values (table 8) show that there are as well two main components isolated and that the total value of the explained variance is 69,12%, with first component in value of 55,06% explained variance, and second of 14,05.

Based on the matrix structure of the successfulness at the initial measurement (table 9) it can be shown that at the first main component are all of the variables that determine and are dominant for the defense play, so this factor can be defined as a defense factor, no matter that in the first component there is a one variable defining forward play UIPN Free kick successfulness

***Table 1.***

*Isolated components of the football players successfulness at initial measurement*

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 3,587 | 32,612 | 32,612 | 3,587 | 32,612 | 32,612 |
| 2 | 1,728 | 15,710 | 48,321 | 1,728 | 15,710 | 48,321 |
| 3 | 1,223 | 11,122 | 59,443 | 1,223 | 11,122 | 59,443 |

***Table 2.***

*Isolated components of the football players successfulness at final measurement*

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 3,008 | 27,342 | 27,342 | 3,008 | 27,342 | 27,342 |
| 2 | 1,692 | 15,380 | 42,723 | 1,692 | 15,380 | 42,723 |
| 3 | 1,279 | 11,628 | 54,351 | 1,279 | 11,628 | 54,351 |
| 4 | 1,058 | 9,622 | 63,973 | 1,058 | 9,622 | 63,973 |

***Table 3.***

*Structure matrix of football players successfulness at the initial measurement*

| | Component | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| SNPPNVI | -,441 | ,135 | -,018 |
| SNPEGHI | ,057 | -,062 | ,706 |
| SNKOSTI | ,178 | ,631 | ,311 |
| SNKSLAI | ,066 | -,813 | ,274 |
| SNBUPPI | ,044 | -,813 | ,159 |
| SNBV20I | ,256 | -,602 | -,144 |
| SNESNOI | -,070 | ,470 | ,409 |
| SNESGLI | -,193 | -,011 | ,657 |
| SNBTPOI | ,789 | ,008 | -,189 |
| SNBTPPI | ,943 | ,052 | ,018 |
| SNBTSLI | ,931 | ,054 | ,052 |

***Table 4.***

*Structure matrix of football players at the final measurement*

| | Component | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| SNPPNVF | ,318 | -,352 | -,005 | -,449 |
| SNPEGHF | -,719 | ,081 | ,321 | ,101 |
| SNKOSTF | -,191 | -,151 | ,806 | -,153 |
| SNKSLAF | ,277 | -,102 | ,424 | ,657 |
| SNBUPPF | ,016 | -,045 | -,305 | ,797 |
| SNBV20F | ,300 | ,311 | ,068 | -,041 |
| SNESNOF | -,406 | -,202 | ,018 | -,316 |
| SNESGLF | -,788 | ,132 | -,107 | -,178 |
| SNBTPOF | ,341 | ,509 | ,359 | ,008 |
| SNBTPPF | -,015 | ,910 | -,019 | -,029 |
| SNBTSLF | -,012 | ,873 | -,150 | ,002 |

In to the second main component isolated variables ball control, passing skill, ball attack, forward play without a ball, successfulness in transformation after ball won, successfulness in playing different positions in defense, action shots, so variables that are dominant in moments when we are attacking opposite goal, so second main component can be called attack factor.

In a structure matrix of the final measurement (table 10) it can be seen that there are two main components isolated, so there were no enlargement or decrease of the isolated components.

As in the initial measurement, there is isolated, this time clear main component that could be called pure factor of the defense and the second one that can be called pure factor of attack.

It is shown from the tables 11 and 12 that there is a high correlation, which can be explained by tight connection of the treated sample variables of player's successfulness.

Comparing the results of initial and final measurement, or the evaluation of the player's abilities in a match, we will see that there are differences, but also a differences that does not improve qualitative changes.

Surely, these are the indications that in the future the elements of the training have to be adjusted to the requirements of the game, because it is of the great importance that the player wins not only the space with its motor abilities but also the opposite player so he could quickly and more efficiently realize the attack or prevent the one.

So, for the player to bring the timely decisions and solve new coming situations during the match, it is of great importance to have those elements in training and in more number of the repetitions. In a same way, more number of training sessions in a week, which biological age and quality level allows, would probably add to the positive improvements of quality changes.

***Table 7.***
*Isolated components of the football players successfulness at initial measurement*

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 8,569 | 57,127 | 57,127 | 8,569 | 57,127 | 57,127 |
| 2 | 2,056 | 13,707 | 70,833 | 2,056 | 13,707 | 70,833 |

***Table 8.***
*Isolated components of the football players successfulness at final measurement*

| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 8,260 | 55,068 | 55,068 | 8,260 | 55,068 | 55,068 |
| 2 | 2,108 | 14,056 | 69,125 | 2,108 | 14,056 | 69,125 |

***Table 9.***
*Structure matrix of football players successfulness at the initial measurement*

| | Component | |
|---|---|---|
| | 1 | 2 |
| KLI | -,097 | -,946 |
| VDI | -,035 | -,928 |
| PLI | -,071 | -,953 |
| IBLI | ,381 | -,515 |
| UTNI | ,092 | -,929 |
| SIVPNI | ,215 | -,451 |
| UIPNI | ,547 | -,206 |
| SII | ,232 | -,444 |
| RPOI | ,841 | -,029 |
| POI | ,797 | -,084 |
| OLI | ,850 | ,011 |
| UIPOI | ,831 | ,083 |
| UTOI | ,856 | -,003 |
| SIVPOI | ,929 | ,100 |
| SSI | ,816 | ,013 |

***Table 10.***
*Structure matrix of football players at the final measurement*

| | Component | |
|---|---|---|
| | 1 | 2 |
| KLF | -,139 | ,926 |
| VDF | ,012 | ,734 |
| PLF | -,104 | ,915 |
| IBLF | -,005 | ,816 |
| UTNF | ,121 | ,758 |
| SIVPNF | ,131 | ,749 |
| UIPNF | ,130 | ,379 |
| SIF | ,162 | ,607 |
| RPOF | ,856 | ,045 |
| POF | ,784 | ,139 |
| OLF | ,842 | ,112 |
| UIPOF | ,852 | -,022 |
| UTOF | ,946 | -,084 |
| SIVPOF | ,873 | -,068 |
| SSF | ,903 | ,016 |

## Conclusion

Significant qualitative improvements in a area of the specific abilities can be explained with the fact that the training program was planed in that way that the examinees met with different elements structured mainly of large number of isolated technique elements, like different passes between two players, technique elements, ball control, runs with or without ball from point A to point B an with large number of repetitions. To conclude, training in which we would know the sequence of the exercise in advance, number of repetitions, lines of movement surely could influence the improvement of the aforementioned abilities. Weaker transfer from initial to final state in the area of the game successfulness can be explained by small number of training with the actual game situations or their simulations in which the players would be in situations that paint the picture of the actual game. This brings us to the conclusion that in every case it should through the training secure more "situations from game" that will provide player improvements in a game, and develop football intelligence through the different situations in which he should decide right and on time. To include such elements that will simulate different situations, in which the player constantly finds him in a solutions of certain technical-tactical tasks, with the opposite player (pressure, guarding, blocking) which demands that player thinks and acts creatively.

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# Prediction of Achivement in Athletic disciplines 60m running, 60m Hurdles and Triple Jump by Means of Some Morphological and Motor Dimensions

Key words: **sprint and jump athletic disciplines, basic motor abilities, specific coordination qualities**
Ključne riječi: **Sprintersko-skakačke atletske discipline, osnovne motoričke sposobnosti, specifične koordinacijske kvalitete**

**Abstract**
On a sample of 54 male students (age 19 – 21) of sport studies at the Teachers' Faculty in Mostar, the multiple regression analysis – Stepwise method, determined the predictive general and partial contribution of some morphological and motor variables in achieving successful results in the sprint and jump athletic disciplines (60m running, 60m running with hurdles and triple jump) being discussed. Cross-correlation analysis was used in order to find out relations between predictor morphological and motor variables and criteria variables. The results of this research proved that these speed and jump abilities are the most important factor in achieving efficient results in all sprint and jump athletic disciplines, and that a successful result in these athletic disciplines is the expression of a high synergy between motor abilities and movement coordination

**Sažetak**
**Predikcija postignuća u atletskim disciplinama trčanje na 60m, trčanje na 60m prepone i troskok pomoću nekih morfoloških i motoričkih dimenzija**
Na uzorku od 54 studenta starosti od 19 - 21 godinu studija sporta na Nastavničkom fakultetu u Mostaru primjenom višestruke regresione analize - metodom Stepwise utvrđivan je prediktivni opći i parcijalni doprinos nekih morfoloških i motoričkih dimenzija u ostvarivanju rezultatske uspješnosti u tretiranim sprintersko - skakačkim atletskim disciplinama (trčanje na 60m, trčanje 60m sa preponama i troskok). Kros-korelacionom analizom je ostvaren uvid u relacije tretiranih sprintersko - skakačkih atletskih disciplina sa morfološkim i motoričkim varijablama.
Potvrdili su se rezultati mnogih dosadašnjih istraživanja sa sličnom problematikom da su ove brzinsko – skakačke sposobnosti najvažniji faktor u ostvarivanju rezultatske efikasnosti u svim sprinterskim – skakačkim disciplinama, te da je rezultatska uspješnost u ovim atletskim disciplinama izraz visoke sinergije motoričkih sposobnosti i koordinacije pokreta.

## Introduction

Athletics is a very complex multidisciplinary sport branch. Athletic disciplines belong to the group of mono-structural movement of cyclical, encyclical or compound type. In athletics, i.e. in athletic disciplines that define it, there is typically a great number of different types, i.e. structures of movement, mostly including take-offs, swings, falls, landings, and consequently a very complex system of demanding values in the morphological and particularly motor abilities space with respect to result efficiency in individual athletic disciplines. The basis of successful results in sprint and jump athletic disciplines of 60m running, 60m hurdles and triple jump is made up both of primary motor abilities of speed-cyclic character and specific coordination qualities.

Running in short athletic disciplines (60, 100, 200 and 400m) belongs to cyclic exercises of maximum intensity, and is characterized by relatively short action 6.5 – 50 seconds (phosphate – glykolitic work). General time of running over the track depends on several factors, the ability to respond fast to the starter's signal, the quality of start acceleration (how fast they reach the appropriate running speed), and the athletes ability to maintain the same speed to the end of track without significant decrease while running (Petrovski, Sadovski, 1977). Running speed is also determined by step length and step frequency. While running along distance, the most favorable ration between these two factors' values is determined by the runner's anthropometric characteristics and motor abilities. Step frequency is closely related to the duration of contact phase (Mero, Komi and Gregor, 1992). The shorter the contact time, the bigger the running step frequency. Duration of contact also shows the level of explosive strength of lower extremities' muscles during take-off (Luhtanen and Komi, 1980; Komi, 1984). According to numerous researches (Komi, 1984; Čoh, 1988; Kampmiller et al., 1996), duration of step contact phase is one of the most important predictors of sprint running efficiency.

Hurdles' running belongs to compound and coordinated technical athletic disciplines with cyclical, speed-power movement. The major problem of the technique in running with hurdles is crossing athletic hurdles with the so-called hurdle-step. The analysis of motor abilities which lie in the basis of the runner's successful result reveals a need for a broad range of various abilities. Top results in athletic disciplines with hurdles require above-average coordination, sense of rhythm, speed, strength, flexibility, endurance on the track and good technique (Smajlović & Babić, 1998). Still, regardless of the hurdler's technical skill, he should always have a high level of speed on the track and use the speed efficiently in negotiating hurdles. Without strength, particularly the specific one, success in running with hurdles is inconceivable. Flexibility is a necessary motor ability of hurdle-runner for improvement in the technique of negotiating hurdles.

Triple jump is technically a compound athletic discipline, where phases of support and flight in 'hop'. 'step', and 'jump', i.e. the first, second and third jump alternate with the speed of 10.5 m/sec. The length of a triple-jumper's flight depends on the starting speed of flight, angle and height of body gravity center after each take-off (Krejer, 1977). With respect to a triple jump successful result and creating an efficient movement form, the level of triple-

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jumpers specific movement coordination and level of speed and strength motor abilities has a decisive influence (Krejer, 1977).
Since the basis of successful results in sprint and jump disciplines of 60m running, 60m hurdles and triple jump consists of both primary motor ability of speed-cyclic character and specific coordination qualities, the problem of this research was to determine relations of these motor qualities through a system of predictive variables relative to the three discussed sprint and jump athletic disciplines as criteria variables. A great number of researches dealt with relations of individual anthropological areas to successful results in individual athletic disciplines.
The goal of this research is to evaluate predictive general and partial contribution of the variables representative of contents that are typically used in methodological approach to teaching and improving the technique of the discussed athletic disciplines, as well as the content for developing motor abilities that form the basis of successful results in sprint and jump athletic disciplines (Smajlović, Babić, 1998).

## Methods

### Sample of the examined

The sample of respondents consisted of 54 male students (age 19 – 21) of sport studies at the Teachers' Faculty of University "Džemal Bijedić" in Mostar, who were attending the course in Athletics in accordance with the curriculum.

### Sample of variables

The sample of variables in this research consisted of 20 predictive and three criteria variables. The Logic of the predictive variables choice was based on contents typically used in methodological procedure of teaching and improving the technique of discussed sprint and jump athletic disciplines, as well as the content for developing motor abilities that form the basis of successful results in these athletic disciplines (Smajlović, Babić, 1998). The sample of predictive variables consisted of three variable groups.
The first group consisted of three predictive variables for estimating anthropometric dimensions: stature (ATVIS), body mass (ATMASA), lower extremities' length (ADUZNO). Body mass index (ABMI) joined the group of anthropometric variables.
The second group consisted of ten predictive variables for estimating basic motor abilities: a) variables for estimating speed-strength abilities of body: strength of abdominal muscles (MSTRB), strength of back muscles (MSLED), strength of side abdominal muscles – left hip (MSBOCL), strength of side abdominal muscles – right hip (MSBOCD); b) variables for estimating the speed of locomotion: 7,5-meter running (MBL7), 15-meter running (MBL15), 30-meter running (MBL30); c) variables for estimating speed-strength abilities of jumping type: high jump from the spot (MBSM), high jump from the spot with landing from a 33cm-high stool (MBSS), and quintuple jump from the spot (MBSP).
The third predictive group of variables consisted of six variables for estimating respondents' specific coordination ability: flamingo test with closed eyes (KOFLA), dosing–control of neuromuscular excitation in long jump from the spot (KDOSM), dosing–control of neuromuscular excitation in triple-step jump (KODOTR), coordination in space (KOPRO), movement decomposition (KODEK), long jump from the spot backwards (KODSUN).
The criteria sample of variables included variables for estimating successful results in the taught athletic disciplines: 60m running (REZ60), 60m running with hurdles (REZ60PR), and triple jump (REZTRO).

### Data processing methods

Predictive general and partial contribution of variables of morphological and motor area to the successful results in discussed sprint and jump athletic disciplines was estimated by means of multiple regression analysis. The Stepwise method was used. Stepwise is a successive procedure of the selection of introducing variables into a regression equation. Cross-correlation analysis was used in order to gain insight into the level of variable relations in the discussed sprint and jump athletic disciplines with morphological and motor abilities variables.

### Results and Discussion

Results of this research successively singled out three variable of the greatest statistical predictive significance for the dependent variable of 60m running (table 1). The greatest predictive value for the result of 60m running is attached to the result of 30m running (MBL30) with the determination coefficient .031. The logical determinant for the result of 60m running with the variables 30m running and quintuple jump from the spot results from the fact that acceleration in 30m running is achieved by means of multiple explosive feet take-offs, which are characteristic of the locomotion structure of the variable quintuple jump from the spot. Variable body coordination in space (KOPRO) additionally determines the prediction of the 60m running result with the determination coefficient of .02. The predictive significance of the variable body coordination in space (KOPRO) is probably conditioned because this variable perceives fast coordination of movement in space. These three variables together determine the prediction of 60m running variable with 75 per cent.

Results of research successively singled out two variable of the greatest statistical predictive significance for the dependent variable of 60m hurdles (table 2). The greatest statistically significant prediction of the athletic discipline of 60m hurdles is possessed by the variable of 30m running (MBL30) with the determination coefficient of .64, which points to a more rational way of negotiating hurdle which, in turn, implies running across them with a less vertical oscillation of the trajectory of the body gravity center above the hurdle. Variable quintuple jump from the spot (MBSP) participates in the prediction of the result in 60m running with hurdles with the determination coefficient of .0638, which in turn confirms the significance of multiple repeated take-offs (5) necessary in take-off and attack on hurdles.

***Table 1.***
*Multiple regression analysis – dependent variable 60 m running (REZ60)*

| Variables in the Equation | | | | | | |
|---|---|---|---|---|---|---|
| Variables | R Square ch. | B | SE B | Beta | T | Sig. T |
| MBL30 | .71819 | 1.197523 | .219502 | .613639 | 5.456 | .0000 |
| MBSP | .03070 | -.171266 | .067789 | -.284240 | -2.526 | .0147 |
| KOPRO | .02029 | .072121 | .034400 | .142677 | 2.097 | .0411 |
| (constant) | | 3.911758 | 1.847333 | | 2.118 | .0392 |

Research analysis successively singled out two variables of the greatest statistical predictive significance for successful results in triple jump (table 3). Variable quintuple jump from the spot has the predictive value with a partial determination coefficient of .67, and the variable body-mass index (ABMI) has a manifest predictive determination coefficient at .036 level. The impact of this variable is negatively manifest by the value of B coefficient (-.077). Contribution of variable quintuple jump results from the almost identical locomotion structure with the variable of taught athletic discipline – triple jump. The negative contribution of body mass index (ABMI) for the result in triple jump can be explained by fact that respondents which have bigger values of body mass index has bigger ballast body mass, and because of that have more difficulties in performing triple jump than respondents which have thin body constitution.

Research results of Cross-correlation Analysis, used in order to gain insight into the level of relations of criteria variables of sprint and jump athletic disciplines with morphological and motor predictive variables, are shown in table 4.

Results in 60m running are determined by variables of basic motor abilities of the strength of left and right side of abdominal muscles (MSBOCL and MSBOCD) at the significance level of $p<.01$. All the other variables of basic motor abilities have correlations at the level of $p<.001$. The highest level of correlation with the result in the athletic discipline of 60m running is possessed by variables of 30m running (MBL30, $r=.8475$) and variable quintuple jump from the spot (MBSP, $r=.7812$). Logical link between the result in 60m running with the variable 30m running and quintuple jump from the spot stems from the fact that in 30m running, start acceleration is achieved by multiple explosive feet take-offs, which is characteristic for the locomotion structure of variable quintuple jump from the spot. 60m running correlates with only one variable of specific coordination ability – long jump from the spot backwards (KODSUN) at the significance level of $p<.01$.

The result of 60m hurdles has correlation with the anthropometric variable – lower extremities' length (ADUZNO) at the significance level of $p<.01$. This connection stems from the fact that a greater length of legs has a significant impact on the efficiency of hurdle negotiation technique. The variable of basic motor ability of the strength of the side part of abdominal muscles (MSBOCL) is significantly related to the result of running with hurdles at the level of $p<.01$ ($r=.4128$). It is assumed that this connection is due to the synergic impact of the strength of abdominal side muscles during the swinging leg attack on the hurdle. Same as in 60m running, all the other variables of basic motor abilities are significantly related to the results in 60m running with hurdles at the $p<.001$ level. The 60m hurdles is also related to a single variable of the specific coordination ability – long jump from the spot backwards, at the $p<.01$ level ($r=.3455$).

The result in the athletic discipline of triple jump is determined by the anthropometric variable of the lower extremities length (ADUZNO) at the significance level of $p<.001$. This is the highest level of determination of this variable with respect to all observed athletic disciplines ($r=.4609$), and can be considered logical, having in mind the selective factor of achieving higher results in jumping athletic disciplines. The variable of basic motor ability of the strength of abdominal side muscles (MSBOCL) is significantly related to the result in the athletic discipline of triple jump at the level of $p<.01$, due to the nature and sequence of triple jump take-offs (left – left – right). The other variables of basic motor abilities are related to the results in the athletic discipline of triple jump at the significance level of $p<.001$. The greatest contribution is manifested by the variable quintuple jump from the spot (MBSP, $r=.8184$), followed by the variable 30m running (MBL30, $r=.7383$). Results of the discipline of triple jump are related with the variable of specific coordination ability – decomposition of movement by a long jump from the spot backwards (KODSUN) at the significance level of $p<.01$.

## Conclusion

Research results of regression analysis determined the highest predictive value on the result in 60m running are possessed by the variable result in 30m running (MBL30), variable quintuple jump from the spot (MBSP), and the variable coordination in space (KOPRO). The dominant predictive value on the result in 60m hurdles is also possessed by the variable 30m running, which indicates a more rational way of negotiating hurdles, which in turn implies their crossing with as small vertical oscillation as possible of the trajectory of the body gravity center above the hurdle. Statistically greatest predictive significance for the result in the dependent variable of triple jump is possessed by variable quintuple jump from the spot (MBSP) and variable body mass index (ABMI). The contribution of the variable quintuple jump stems from the almost identical locomotion structure with the variable of athletic discipline triple jump.

Cross-correlation analysis was used in order to gain insight into the level of relations of sprint and jump athletic disciplines as criteria variables with morphological and motor predictive variables.

***Table 2.***
*Multiple regression analysis – dependent variable 60m hurdles (REZ60PR)*

| Variables in the Equation | | | | | | |
|---|---|---|---|---|---|---|
| Varijabla | R Square ch. | B | SE B | Beta | T | Sig. T |
| MBL30 | .64020 | 1.454844 | .393028 | .466769 | 3.702 | .0005 |
| MBSP | .06386 | -.402560 | .121349 | -.418314 | -3.317 | .0017 |
| (constant) | | 9.041699 | 3.270820 | | 2.764 | .0079 |

***Table 3.***
*Multiple regression analysis – dependent variable triple jump (REZTRO)*

| Variables in the Equation | | | | | | |
|---|---|---|---|---|---|---|
| Varijabla | R Square ch. | B | SE B | Beta | T | Sig. T |
| MBSP | .66980 | .904070 | .082387 | .838246 | 10.973 | .0000 |
| ABMI | .03583 | -.076870 | .030852 | -.190328 | -2.492 | .0160 |
| (constant) | | .155057 | 1.159557 | | .134 | .8942 |

Results of 60m running, 60m hurdles and triple jump have correlations with all basic motor variables for estimating the speed of locomotion and variables for estimating speed-strength abilities of jumping type at the significance level of $p<.001$. The highest level of connection with the criteria variables of 60m running (REZ60) and 60m hurdles (REZ60PR) are possessed by the variable 30m running (MBL30) and variable quintuple jump from the spot (MBSP). The greatest contribution with criteria variable of triple jump (REZTRO) is possessed by variable quintuple jump from the spot (MBSP), followed by the variable 30m running (MB30). The result in the athletic discipline of triple jump is determined by the anthropometric variable length of lower extremities (ADUZNO) at the significance level of $p<.001$. All three criteria variables are correlated only with a single variable of the specific coordination ability – long jump from the spot backward (KODSUN), at the significance level of $p<.01$. It again proved the results of numerous previous researches dealing with similar issues, that these speed and jump abilities are the most important factor in achieving efficient results in all sprint and jump athletic disciplines, and that a successful result in these athletic disciplines is the expression of a high synergy between motor abilities and movement coordination.

***Table 4.***
*Cross-correlation of results of athletic disciplines and results of morphological and motor variables*

| Cross – correlations | REZ60 | REZ60PR | REZTRO |
|---|---|---|---|
| ATMASA | -.1395 | -.0970 | .0822 |
| ADUZNO | -.2852 | -.4006 * | .4609 ** |
| ABMI | -.0732 | .0248 | -.1030 |
| MSTRB | -.2888 | -.2365 | .2119 |
| MSLED | -.0404 | -.1723 | .1914 |
| MSBOCL | -.3785 * | -.4128 ** | .3405 * |
| MSBOCD | -.3289 * | -.2287 | .2419 |
| MBL7 | .5623 ** | .5214 ** | -.4949 ** |
| MBL15 | .6443 ** | .6459 ** | -.5078 ** |
| MBL30 | .8475 ** | .8001 ** | -.7383 ** |
| MBSM | -.5277 ** | -.4676 ** | .5680 ** |
| MBSS | -.5107 ** | -.4823 ** | .5151 ** |
| MBSP | -.7812 ** | -.7903 ** | .8184 ** |
| KOFLA | .0136 | .0207 | .0655 |
| KDOSM | -.0594 | -.0868 | .1702 |
| KDOTR | -.0567 | -.0654 | .0701 |
| KOPRO | .1899 | -.0529 | -.1453 |
| KODEK | -.0294 | .1559 | -.0366 |
| KODSUN | -.3372 * | -.3455 * | .3615 * |

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# The Efects of Combined Fitness Training Towards Amelioration of Motor-Condition Abilities of Handball

Key words: **fitness training, transformational process, motor-condition abilities, handball, quantitative changes**
Ključne riječi: **transformacioni procesi, rukomet, kvantitativne promjene**

**Abstract**
The aim of this work was confirmation of quantitative changes of motor-condition abilities of students under the influence of programmed work lasting for 60 hours. The research was done at the sample of 32 students of I year of study at the University of Tuzla. Weekly program applied in this research contented usage of fitness program, precisely weight lifting, two times a week and work in sports hall that included pliometric regime, once a week. Variables for the motor-condition abilities are chosen to cover four latent dimensions: managing ball, speed of mowing with the ball, speed of moving without the ball and power of throwing out the ball (total 9 variables). For the confirmation of global quantitative differences, in two time points, the canonic discriminative analysis was used. After the analysis of the founded results, we can make conclusion that realized program positively affected firstly advancement of results in situational tests of managing ball, secondly moving without the ball and finally power of throwing the ball from jump.

**Sažetak:**
**Efekti programiranog rada na poboljšanje situaciono-motoričkih sposobnosti u rukometu**
Cilj ovog rada je bio utvrđivanje kvantitativnih promjena situaciono motoričkih sposobnosti studenata pod uticajem programiranog rada u trajanju od 60 sati. Istraživanje je sprovedeno na uzorku od 32 studenta I godine Univerziteta u Tuzli. Program primjenjen u ovom istraživanju trajao je 60 sati. Sedmični rad se sastojao od upotrebe fitnessa to jest rada sa tegovima, dva puta sedmično te rada u dvorani, koji je uključivao pliometrijski režim rada, jedan put sedmično. Varijable za procjenu situaciono motoričkih sposobnosti odabrane su da pokriju četiri latentne dimenzije i to: baratanje loptom, brzina kretanja s loptom, brzina kretanja bez lopte i snaga izbačaja lopte (ukupno 9 varijabli). Za utvrđivanje globalnih kvantitativnih promjena, u dvije vremenske tačke, korištena je kanonička diskriminitavna analiza. Nakon analize dobijenih rezultata, može se konstatirati da je sprovedeni program u trajanu od 60 sati je pozitivno utjecao u prvom redu na poboljšanje rezultata u situacionim testovima baratanja s loptom, kretanje bez lopte i snagu izbačaja lopte iz skoka.

## Introduction

Recently handball becomes more and more dynamic and more interesting for the spectators. Fast changing of rhythm, frequent transitions, attractive shoots, shifts of different tactical variants and many other things that attract audience more and more to the handball court are the manifestation of better physical preparation of handball players. Motor-condition abilities, practically that what audience can see as technical elements, handing, moving in defense are additions to the basic motor abilities and they depend on their capacity. We can say that they are directly responsible for achieving quality results (Mujezinović, 2008) Programmed transformational processes, without which nowadays no one sport cannot exist, have to have optimally positive influence to the development and improvement of motor abilities (basic and specific ones) that are relevant for the success of any sport. After the transitional fazes when most of the athletes train the strength a little, it is scientifically and methodically to start program of strength for the reason of adapting to the new program (Malacko & Rađo, 2004).. Main goal of this faze is to activate and prepare most of the muscles, ligaments, tendons and joints for further long and hard fazes of training (Bompa, 2004). Gym workout and engagement of muscles that are the most active in performance of moving structures of the handball game are the most important segments of conditional preparation of handball. Training process in handball can be advanced with choice of the proper load and training exercises, which should be individually adapted to every individual athlete.

There are not enough scientific research effects of the training process and proves of efficiency of every separate training methods meaning different kind of programs for conditional preparation of handball, especially in Bosnia and Herzegovina. That was exactly the reason for the realization of this research that included programming of conditional training, with aim of advancement of motor-conditional abilities. As there were about the students not active in some sport's activities, program was adapted to them and then divided in more fazes. The first faze was the one in which gym workout and techniques of weight lifting was introduced to the examined students. In further fazes they were following linear load that was defined by 1 RM (repetitium maximum), precisely based on how much examined in one maximal muscle strain can achieve external resistance. After two weeks of introduction followed work on development of strength repetition and strength endurance. That is followed by gradual increase of intensity until sub maximal and maximal when the accent was on a development of strength. Subject of research are students. Problem of this research are differences between motor-condition abilities appeared between two time points under the influence of combined fitness program. The aim of the work was to confirm global quantity changes of motor-condition abilities appeared under the influences of realized fitness program.

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## Methods

### Sample of the examined

The research is done with male students of Fakulty sports and physical education, 19-21 years old, whom the subject *Fitness* was chosen one. Examined were not participate in any other additional organized sport activities. Included were only the students that realized program provided for this research (N=32).

### Sample of variables

For the estimation of motor-condition abilities 9 variables were used:

**1. Ability of handling the ball**

SPR2LO – playing with two balls,

SBHZ1R – ability to throwing and catching the ball bounced from the wall with one hand

SBHL2R – throwing and catching the ball from the wall, jump and shoot with two hands

**2. Moving speed with ball**

SBVLS20 – speed of leading the ball in slalom 20m

SSBL20 – start peed with ball on 20m

**3. Moving speed without ball**

SKOTBBL – moving in defense triangle without he ball

SBIDP – Aside and deep mobility

**4. Strength of throwing the ball**

SSBLDS – strength during horizontal jump throw of the handball ball

SSBLM – strength of throwing team handball from the position

### Data processing methods

For the confirmation of quantitative differences in tested motor-condition abilities of the students after the combined fitness program canonic discriminative analysis was applied.

### Results and Discussion

Equality of the matrix covariance of the population we tested with Box method. By the received results from the Table 1 we can see that differences in matrix covariance are not statistically important (sig. 911) and supposition about equality of matrix covariance necessary for the Fisher's approach of linear discrimination in our case is valid.

***Table 1.***
*Box test Results*

| | | |
|---|---|---|
| Box's M | | 38.045 |
| F | Approx. | .730 |
| | df1 | 45 |
| | df2 | 1,61E+07 |
| | Sig. | .911 |

Statistical importance of discriminative function we tested with Burttllet Hi-square test (Table 3). As it is evident we received one discriminative function that statistically discriminate a lot (sig.= .000) the results received by motor-condition tests in handball at the initial and final measuring. The value of canonic correlation (Table 2) that actually represents Pirson's correlation between scores of discriminative functions and appurtenance to the group is extremely high (0.737). That shows that based on 9 motor-condition applied tests they can be clear differed initially from fin al measurement.

***Table 2.***
*Eigenvalues*

| Function | Eigenvalue | % of Variance | Cumulative % | Canonical Correlation |
|---|---|---|---|---|
| 1 | 1.189[a] | 100.0 | 100.0 | .737 |

***Table 3.***
*Wilks' Lambda*

| Test of Function(s) | Wilks' Lambda | Chi-square | df | Sig. |
|---|---|---|---|---|
| 1 | .457 | 51.323 | 9 | .000 |

The results of the Table 4 show the positions of centroid group at the function of 9 variables of motor-condition tests in handball. Positive side is represented by the results of final measurement, and negative side from initial measurement.

***Table 4.***
*Functions at Group Centroids*

| GROUP | Function |
|---|---|
| | 1 |
| 1 (initial measurement) | -1.075 |
| 2 (final measurement) | 1.075 |

Positive side, precisely final measurements are best defined by variables SBHZ1R, SBHLZ2R, SKOTBL, SBIDP, while negative side, precisely initial measurements are best defined by variables SSBL20, SBVLS20 (Table 5).

***Table 5.***
*Matrix of the structure*

| GROUP | Variables | Function 1 |
|---|---|---|
| FINAL MEASUREMENT | SBHZ1R | .743 |
| | SBHLZ2R | .508 |
| | SKOTBL | .436 |
| | SBIDP | .393 |
| | SSBLM | .241 |
| | SSBLDS | .240 |
| INITIAL MEASUREMENT | SSBL20 | -.222 |
| | SBVLS20 | -.159 |
| | SPR2LO | -.011 |

Received results shows that the biggest contribution to the differentiation from the initial to the final measurement have variables SBHZ1 and SBHLZ2RI – those that test abilities of throwing and catching the balls bounced from the wall, with one or two hands. Values of the correlations with discriminative function of these variables are .743 and .508. It could be said that realized program mostly influence transformation, precisely advancement of the results using these tests. This is also result of raising the level of hands' strength, under the influence of applied program. it is

imposed the fact that for the raising of good results in specific tests of handling the ball it is necessary the wide range of movement, agility and explosive strength of arms, shoulder part and legs. (Vuleta at al., 2006.) If we know the structure of mentioned tests for the estimation of abilities of throwing and catching the balls bounced from the wall with one or two hands in which examined student has to rebound the ball as much as possible in certain time frame, than it is not hard to connect realized program with increase of the tested abilities level. However the program with weight lifting, and specially it's preparatory part, than part of development of muscle endurance that followed, contributed for sure to the results of these tests. The structure of the exercise itself with weight like pressure of the weight from horizontal and angled bench is very similar to movement that structure of the test needs. Precisely engagement of the muscle groups is same in both concerning very small genetic conditioning of muscle endurance, the transformation of this ability of the examined students were expectable.

Also, significant correlation with function, variables SKOTBLI – test moving in defense, triangle formation without ball, SBIDP – side and deep moving and SSBLM – strength of throwing team handball from the position contributed to the discrimination of the results for two tests. Improvement of the results in mentioned tests we can give to the rising of the level of maximal strength of the examined students. It can be directly connected to the last three weeks of workout with weight lifting. At that time after the enlargement of the muscle mass of the examined students it was about raising of their maximal strength, through smaller number of repetition in serial with sub maximal and maximal load. Applying transformational pliometric training, intention was to "transform" maximal strength and realize it in frame of improvement of moving speed and agility, explosive strength of arms and shoulder part.

Even the variables that represent negative side SSBL20 – start speed with ball on 20m and SBVLS20 – speed of leading the ball in slalom for 20m, meaning better results on initial measurement, no chance we can say that they represent even better result from first test because there are the tests that have better results if less number. So we can conclude that these variables contributed differing of initial from final measurement, final test being better. Simply said examined students realized better results after the realization of the program. With application of T-test for dependent samples there were noticed statistically important changes on 7 to 9 variables in the space of motor-condition abilities. At the variables SPR2LO – playing with two balls and SBVLS20 – speed of leading the ball in slalom 20m we didn't notice statistically important changes. It can be assumed that test of playing with two balls is too complicate and hard test, and this fact can be added to the lower level of technical knowledge of examined students. Pliometric transformational training realized in gym hall previously mentioned as raising the level of explosive strength of legs, which contributed to the augmentation of moving speed and acceleration abilities of examined students.

## Conclusion

Based on discriminative analysis in the frame of motor-condition abilities it was received one discriminative function that statistically differ a lot (sig. 000) results received by testing of motor-condition tests in handball on initial and final measurement. The results show that there are global quantity differences in results of tested abilities after the realization of program. Firstly, realized programmed work lasting for 60 hour positively influenced improvement of results in condition tests of handling the ball, moving without the ball and strength of throwing the ball. Secondly it is probably the result of raising the level of strength of upper extremities and raising the level of maximal strength of examined students. It was realized through pliometric transformational training in form of positive transformation of explosive strength and speed accelerating ability of examined students. Combination of these two trainings in the gym with weight and pliometriccally produced important effects concerning researched frame of motor-condition of handball players. In available literature there is the smallest amount of research and proves that considers problems of this research and treated population. Realized fitness program, lasting for 60 hours provoked statistically important changes in motor-condition abilities of the examined group of students. It can be said that this experimental program could be used not only as a streamline to the creation of future curricula concerning subject handball, but can also serve as a kind of work in handball clubs. Having in mind that just a little if any the fitness program doesn't realizes, we think that work in gym and generally raising the level of motor readiness, the quality of realization of handball techniques and game tactics improve.

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# Sociological Characteristics of

## Basketball Players in 3 Competitive Levels

Key words: **sociological characteristics, basketball players**
Ključne reči: **Sociološke karakteristike, košarkaši**

**Abstract**
Based on up to now researches on sociological characteristics of basketball players, as well as the sportsmen generally, this research had an aim to establish and analyze the differences between basketball players of three competitive levels in their sociological characteristics. Participants sample (n=113) was formed of 38 players from Premier league of Bosnia and Herzegovina (M=26 yrs, SD=4.1 yrs), 37 players from the First league of entity Republic of Srpska (M=22.5 yrs, SD=2.5 yrs) and 38 players from the Second league of entity Republic of Srpska (M=18.5 yrs, SD=1.7 yrs). Modified survey SSMAXIP (Hošek, 2004) was used as an instrument of this research. There were found significant differences between groups (ANOVA) in the majority of measured variables. The most significant difference was found in criterion of socially-economical factor, then the family factor, while the least significant difference found amongst groups was in criterion of educational factor. Results suggest that the influence of sociological factor on basketball players' success is evident.

**Sažetak**
**Sociološke karakteristike košarkaša 3 takmičarska nivoa**
Ovo istraživanje imalo je za cilj da se utvrde razlike između košarkaša 3 takmičarska nivoa u njihovim sociološkim karakteristikama, te na osnovu toga, izvuku određeni zaključci. Uzorak ispitanika (n=113) činilo je 38 igrača iz Premijer lige Bosne i Hercegovine (M=26 god., SD=4.1 god), 37 igrača iz 1. lige Republike Srpske (M=22.5 god., SD=2.5 god.) i 38 igrača iz 2. lige Republike Srpske (M=18.5 godina, SD=1.7 god.). Kao instrument istraživanja korišćena je anketa. Pronađene su značajne razlike između grupa (ANOVA) u većini merenih varijabli. Najveća razlika evidentirana je po obeležjima društveno-ekonomskog faktora, zatim porodičnog faktora, dok su obeležja obrazovnog faktora najmanje doprinela razlici između grupa.

## Introduction

Sport sociology, in its most extensive terms, as theoretical and empiric science, researches sociological characteristics of sportsmen, social phenomenons related to sport and its sociological function, and it researches influence of society on sport, as well the influence of sport on society. It represents the answer on realistic needs of sport movement, indicates close dependence among sport development and development of certain domains of social life, certain phenomenons of culture and civilizations (Koković, 2000a). Sport sociology treats mutual relation of players, relation bewteen older and younger players, relation with coach, audience, referees, management. Relations of players with family, local environment, school, and their behaviour in everyday life are also significant (Koković, 2000b).

Aim of many researches was to establish certain differences between basketball players of different competitive level. Examined differenences mostly related on morphological, motorical and functional dimensions of basketball players (Dopsaj, & Matavulj, 1993; Ostojić et al., 2006). Sociological characteristics, as a segment of basketball equation of specification, are quite neglected. However, significant researchers (Petrović, & Hošek, 1986; Koković, 2000; Karalejić, & Jakovljević, 2001; Wootten, 2003; Hošek, 2004) are saying that the influence of sociological factor in sport is very great.

Rowe et al. (1995) have researched a sample od 107 Belgian basketball players of different competitive level. With large number of tests they have evaluated sociological, anthropometrical, motorial and psychological characteristics of basketball players. Basketball players who play at different positions (centres, guards and forwards) have mutually differed the most in antropological characteristics (body height, height of reach), then in specific motorics and psychological variables. The least differences recorded are in criterion of sociological characteristics (material situation of a family from which he comes from, education of basketball players, number of family members).

Researching nutritious problematics at Spanish first league basketball players, Schreder et al. (2004) come to conclusion that poor nutritious conscience at a certain number of players is not connected with their current material situation, since the mentioned players are very satisfied with their salaries they are making. Majority of yonder players has their highschool finished (79%), but 45% of players are going to faculties.

In the Hollembeak and Amorose study (2005) there were shown psycho-social relations between college sportsmen and sportswomen (n=280) and their coaches. Results of socio-demographic part of the survey show that participants are very satisfied with the support of family in greatest percent (60%). Coach's professional qualities are evaluated as very good (19%) and excellent (58%), and his pedagogical characteristics are slightly less appreciated (good 38%, very good 37%).

Martin (2005) has established differences in certain psycho-social attitudes between sportsmen who participate in sports with physical contact with the opponent and sportsmen who participate in sports without any contact with opponent. On sample of 362 highschool scholars and 431 students, socio-demographic items are indicating that majority of participants come from families of American middle class (82%), fathers are mostly middle (46%) and higher and highly educated (42%), and mothers are equally middle, higher and highly educated (≈39%). Great majority of participants (84%) decribe their living conditions as very good.

From demographic survey researched by Heuz et al. (2006) with an aim to establish relations between team cohesion and success of French first leagued teams (n=154 players), it is shown

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that majority of participants practise only basketball (48%), 29% of them study besides basketball, 23% of them finished college. Majority comes from middle civil class.

Vučković (2006) researched differences between basketball players of better-placed and worse-placed teams of First League of Serbia and Montenegro in their opinions on coach's professional and pedagogical qualities. He states that very small number of players of both groups of teams has negative opinion on their coach's professional qualities. Players of worse-placed teams has more positive opinion concerning pedagogical qualities of their coaches.

Blancharda and co-authors (2007) have established motivation for playing in their team on the sample of 2 independent groups of college-basketball players. Through the analysis of demographic items it is seen that majority od basketball players is very satisfied with familiar and material circumstances in which they evolved as basketball players. Majority of them come from family with 2 or 3 children.

Psychologists intervention in elite Izraelian basketball teams was the subject of Lidera's et al. research (2007). Besides physical, technical and tactical programs, basketball players were exposed to psychological techniques as well. Interesting was authors' constatation that work with a) more educated players, b) foreigners and c) players of middle generation had most effect.

In her dissertation, Farneti (2008) researched the influence of team cohesion and leadership on team's success. From the analysis of socio-demographic items (n=9) it is seen that majority (75%) of total number of examined students (n=145) come from averagly situated families; 84% of students come from state Ohio, where is the University itself; great majority are not an only child (87%); the greatest pleasure in college they find in basketball.

## Methods

### Sample of the examined

By the end of league competition season 2005/2006, there were identified per 3 the best ranked teams of 3 competitive levels in Bosnia and Herzegovina. To be precise, participants sample was formed of 38 players from Premier league of Bosnia and Herzegovina (professionals, M=26 yrs, SD=4.1 yrs), 37 players from the first league of Republic of Srpska (semi-professionals, M=22.5 yrs, SD=2.5 yrs) and 38 players from the second league of Republic of Srpska (amateurs, M=18.5 yrs, SD=1.7 yrs). Therefore, that is 113 players altogether.

### Sample of variables

Based on isolated latent dimensions from several up to now researches of human's sociological characteristics (Petrović, & Hošek, 1974; Hošek, 1988; Hošek, 1992; Hošek, & Korać, 1993), in this research were used independent variables which authors considered significant in development of basketball players. After modification of questionnaire SSMAXIP (Hošek, 2004), from *Family factor* domain, there were data extracted about 1) participant's place of growing-up, 2) material status of family in which he grew up, 3) participant's family's members number, 4) marital status of participant's parents, 5) relations in participant's family, 6) father's support to participant in terms of basketball career, 7) mother's support to participant in terms of basketball career. From *Socially-economical factor,* there were data extracted about 1) conditions under which participant developed as a basketball player (training objects quality), 2) conditions under which participant developed as a basketball player (coach's quality), 3) conditions under which participant developed as a basketball player (number of trainings in a week), 4) participant's evaluation of overall socially-political environment in which he developed as a basketball player. From *Educational factor,* there were data extracted about 1) participant's education, 2) participant's father's education, 3) participant's mother's education, 4) participant's momentary activities; 5) participant's present material situation.

Construction of dependent variable was made based on the level of competition in which examined teams perform. The level of competition is the one which represents reliable indicator of quality of each team as a whole._

### Data processing methods

Surveying was performed in the morning hours, before any kind of training activities. Author, along with his 2 assistents, and coaches of the teams examined, attended in the poll of players in a specially chosen room inside training gym.

Scaling of data with the Lancaster procedure in tables of contigence (Cheng et al., 2006) was made on nonparametrical sizes. On scaled data, differences were analized between 3 groups of teams with unvariant analysis of variance (ANOVA), and calculated the values of Pearson's coefficient of contingency (Cj), Correlation (R), Fisher's test (F), discrimination coefficient and Mahalanobis' distance. Critical value p=.01 was used for accepting hypothesis.

### Results and Discussion

Significance of differences between groups of teams in examined sociological characteristics was illustrated with 3 tables. Players of Premier League od Bosnia and Herzegovina were named First Group, players of First League of Republic of Srpska were named Second Group, and players of Second League of Republic of Srpska were named Third Group.

***Table 1.***

*Significance of difference among groups compared with specific criterion of family factor*

| | Cj | R | F | p |
|---|---|---|---|---|
| *PLGR* | .293 | .286 | 4.863 | .001 |
| FAMS | .143 | .137 | 1.042 | .036 |
| NOFM | .296 | .282 | 4.702 | .001 |
| PD18 | .139 | .140 | 1.094 | .034 |
| ODUP | .219 | .224 | 2.883 | .006 |
| FASU | .302 | .260 | 3.959 | .002 |
| MOSU | .254 | .247 | 3.531 | .003 |

Analizing p-values in table 1, it is noted that criterions: ''place of growing up'' (plgr), ''number of family members'' (nofm), ''I had my father's support'' (fasu), ''I had my mother's support'' (mosu), and ''relations in the family'' (refa) significantly contributed the discrimination between groups. Since the p>.01 for criterions ''parents are divorced'' (pd18) and ''family's material situation'' (fams), it is clear that there is no significant difference between groups.

***Table 2.***
*Significance of difference among groups compared with specific criterions of socially-economical factor*

| | Cj | R | F | p |
|---|---|---|---|---|
| EOTG | .319 | .287 | 4.999 | .001 |
| QUCO | .356 | .381 | 9.416 | .000 |
| NTIW | .404 | .440 | 13.347 | .000 |
| ENVI | .351 | .320 | 6.323 | .000 |

After analizing p-values from table 2, it is noticeable that (all 4) criterions: ''evaluation of training gyms'' (eotg), ''quality of up to now coaches'' (quco), ''number of trainings in a week'' (ntiw), and ''overall socially-political environment'' (envi) have significantly contributed discrimination between groups.

***Table 3.***
*Significance of difference among groups compared with specific criterions of educational factors*

| | Cj | R | F | p |
|---|---|---|---|---|
| PLED | .452 | .417 | 11.341 | .000 |
| FAED | .218 | .202 | 2.295 | .011 |
| MOED | .327 | .344 | 7.256 | .000 |
| MIOW | .398 | .368 | 8.452 | .000 |
| PPMS | .186 | .185 | 1.906 | .015 |

Analizing p-values from table 3, it is noticeable that criterions ''player's education'' (pled), ''player's mother's education'' (moed) and ''momentarily I am occupied with'' (mlow) have significantly contributed discrimination between groups.
Since $p>.01$ for criterions ''player's father's education'' (faed) and ''player's present material situation'' (ppms), it is evident that there is no significant difference between groups.

Concerning the family factor, and considering the differences among groups of participants, it can be said:
1) percentage of players on specific statuses of place of living depends on competitive level of a basketball player. It appears that place of growing up is very significant factor in creating of basketball career. The city offers more basketball courts then towns and smaller towns, greater competition, more played games in younger categories, and possibility of quality selection of young players. Rowe et al. (1995) and Farneti (2008) had similar results in their researches.
2) since there are no significant differences between groups in criterion ''family's material situation'', it can be said that this life's aspect does not make essential contribution for an average basketball player career in Bosnia and Herzegovina. Evidently, basketball is still available to younger population.
3) the greatest difference in criterion ž'number of family members'' is noted in *only child* status. Amongst most quality players (First Group) there is only one player who is an only child, which is considerably less comparing the less quality players (in Second Group - 6 players that are an only child, in Third Group – 8 players that are an only child). Also, in First group there are 7.9% players who have more than 2 brothers or sisters, which is considerably more comparing the other 2 groups of teams. Hence, the best players come from families with more family members. That phenomenon was explained long ago by sociologists: children from families with more family members are more persistent, conscientious, obedient, motivated, fond to team work, i. e. have those characteristics which supreme sport requires.
4) considering there are no significant differences between groups in criterion ž'parents are divorced'', it can be infered that marital status has no influence on difference in quality of examined players. However, it must be said that smaller percentage of parents of the most quality group (2.6%) divorced, than in players of Second (10.8%) and Third Group (10.5%). On the other hand, parents of basketball players who more fit in perennial standard of divorced marriages in Bosnia and Herzegovina, where every twelfth marriage did not work ($\approx$8% of divorced; data of Republic Institute for Statistics of Republic of Srpska).
5) the data that players of all 3 groups of teams in great percentage (81.1%-89.5%) relations in their family evaluate as good is impressive. Smaller ''deviation'' both in positive and in negative sense are players of Third Group.
6) players of First Group of teams had more of father's support than players in other 2 groups. It is probable that noticed talent at players of First Group was more evident, and their fathers realized that they should give a support to a young player in development of a basketball career.
7) from adequate table there are noticed certain differences between groups in terms of having mother's support during up to now career. However, it can not be said that this support significantly discriminated good and bad players, because the results of First and Third Group are similar.
The greatest difference (the greatest coefficients of discrimination) in examined groups are in criterion ž'place of growing up'' (.131), ''number of family members'' (.092) and ž'relations in family'' (.050). It can be said that these 3 criterions of family factors, and in this direct order of importance, most significantly determined quality of a player. Accordingly to excpectations, on established statuses, the most homogeneous group was the First Group, while the greatest difference is between (Mahalanobis) First and Third group of teams.
Concerning the socially-economical factor it can be said:
1) players of the First Group have the most positive opinion about gyms where they trained. A bit unexpected result was that Second Group of teams has the most negative opinion on this criterion. However, concerning that cities from which examined teams of Second and Third Group come from, are equal by size and economical power, this kind of relation becomes acceptable and reasonable.
2) result on criterion ''coach's quality'' is unexpected, since the players of Second Group have the most negative opinion concerning their up to now coaches. It would be logical that players of the Third Group are the most dissatisfied with their up to now coaches.
3) players of the First Group are significantly different then the players of Second Group, because they consider that the number of weekly trainings was sufficient for ther basketball development in the greater percentage.
4) players of the Second Group are significantly dissatisfied with entire socially-political environment in which they developed as basketball players, then players in the other 2 groups. It is interesting that players of Third Group are the most satisfied with the environment mentioned.
Concerning that groups have the greatest difference (the greatest discrimination coefficient) in criterion ''number of trainings in a week'', it can be said that this criterion most significantly discriminated examined groups. Players of Second and Third Group as the most significant reason of their bad quality see in the number

of trainings they had during their career. First Group was the most homogeneous in established statuses, while the greatest distance (Mahalanobis) is among First and Second Group of teams. Apparent frustration of players of Second Group is explained with their unfulfilled ambition to become excellent basketball players, and they think that the reason of their unsuccess are the ''outer'' circumstances, and not themselves.

On the aspect of differences among groups of participants in criterions of educational factor, it can be said:

1) there are significant differences among groups in criterion ''player's education'', but we must be careful with discussion of extracted informations. If we look at the age structure of participants (M=22.5 yrs), it becomes clear it is about very young players. Great percentage od them is still in school. Players of the First Group are professional basketball players and we can see quite clearly concerning their education. If we consider that 26.3% of players still haven't finished their education, we come to conclusion that professional basketball players have proper education. Among players of Second Group there are many students and the impression is that this group has the most evident educational potential. The worst educational situation is in the players of Third Group.

Comparing educational status and potential od basketball players from Bosnia and Herzegovina with American basketball players (Farneti, 2008), it becomes evident that American basketball players are on the greater educational level. The reason is sistematic. With series of facilities for sportsmen, American university system stimulates perspective sportsmen to finish college after high school.

2) considering there are no significant differences among groups, it can be said that education of player's father had not contributed differences in quality of examined basketball players.

3) the most evident differences in criterion ''player's mother's education'' are in favour of Second Group, because mothers of players of Second Group are the most educated. Therefore, player's quality is not proportional, nor dependent on mother's education.

Comparing this research with the research done by Martin (2005), it is seen that parents of young American sportsmen are slightly more educated than parents of basketball players in Bosnia and Herzegovina: fathers-Americans=42% higher and highly educated, Bosnia and Herzegovina-fathers=36% higher and highly educated; mothers-Americans=39% higher and highly educated, Bosnia and Herzegovina-mothers=31% higher and highly educated.

4) results of players of Third Group declaring on criterion on ''momentarily I am occupied with'' are surprising: nay 65.8% of players declared they only want to practice basketball. This information is surprising concerning that these are players-amateurs.

5) even though significant differences among groups are not recorded statistically, it is noticeable certain connection of competition levels with material situation of basketball players. Players of First Group have the best material situation, and the players of Third Group the worst.

Examined groups have the greatest difference (the greatest discrimination coefficient) in criterions ''player's education'' (.288) and ''momentarily I am occupied with'' (.155). It can be said that these two criterions of educational factor have most significantly determinated player's quality. The First Group was the most homogeneous in established statuses, while the greatest distance (Mahalanobis) is among Second and Third Group of teams.

## Conclusion

Based on up to now researches on sociological characteristics of basketball players, as well as the sportsmen generally, this research had an aim to establish and analyze the differences between basketball players of three competitive levels in their sociological characteristics. Participants sample (n=113) was formed of 38 players from Premier league of Bosnia and Herzegovina, 37 players from the First league of entity RS and 38 players from the Second league of entity RS. Modified survey SSMAXIP (Hošek, 2004) was used as an instrument of this research. There were found significant differences between groups (ANOVA) in the majority of measured variables. The most significant difference was found in criterion of socially-economical factor, then the family factor, while the least significant difference found amongst groups was in criterion of educational factor. Results suggest that the influence of sociological factor on basketball players' success is evident. Concerning all of this, in conclusion authors suggest coaches to consider sociological factor in basketball success during selection of young players. Results extracted with this research can help the coach as a concept or an idea for his comprehension of sociological situation of his own team.

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