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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 MBAU10 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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