QUALITATIVE CHANGES OF BASIC MOTOR ABILITIES AFTER COMPLETING A SIX-WEEK TRAINING PROGRAMME

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Abstract

The research was conducted on 120 young football players aged 15 from the following football clubs: Sutjeska FC, Čelik FC, Polet Stars FC and Nikšić YFC, all from town Nikšić. They were tested by 21 motor tests for estimating 7 hypothetical motor abilities. After completing a six week training process (an experimental activity) using the factor analysis the qualitative changes have been established. In the initial state 4 latent dimensions are identified: power, endurance, speed of movement and coordination. In the final state as well are identified 5 latent dimensions: power, agility, flexibility, endurance, and speed of movement. The positive qualitative changes are certainly the result of professional performance of the tasks that the experimental programme provides.

Keywords: *motor tests, experimental programme, football players, cadets- U15, factor analysis*

Introduction

Football game is said to be "the most important secondary thing in the world" as it congregates large masses at stadiums and in front of the TV, and from our point of view, we can say that the whole world "revolves around football". The world of football entails enormous amount of money, and according to Opavsky (2009), one should always keep in mind the fact that the annual financial balance in sports is bigger than the balance of many developed industrial branches. Football is a collective sport played between two teams, each comprised of 11 players. The contemporary football game has developed since the foundation of the first Football Federation in England, 1863. Nowadays, football is for certain the number one sport in the world. It is played by men, women, boys, and girls from six continents. However, football does not have any standard techniques for complex movements, because they change as the objective situations and the subjective physical condition of the performer change during a game. Therefore, there are 3600 possible combinations for each ball kick (Bjelica, 2008). The interrelations between motor abilities and internalising motor knowledge (skills) are multidimensional and complex. It is considered that high level of motor skills is the fundamental precondition for effective learning and performance of new motor structures. All the football players have one thing in common – each player must undergo a hard-working and extensive training process in order to improve the skills that make this game so exciting. Practice has shown that football "maturation" can even last for two decades (Bjelica, 2008). In order to be able to meet the demands that modern football imposes, players are required to display the absolutely highest skills regarding technical and tactical, as well as physical conditioning. The continual increase of overload during game demands for players' permanent increase of their motor abilities to a higher level.

Basic motor skills are of primary importance and they are the basic value regarding the total area of human motor skills. It is the part of general psychosomatic abilities which refer to a certain developmental level of basic latent motor dimensions in human, and which are the condition for successful movement, regardless of their origin, i.e. whether they are congenital or acquired by training. This paper shows a programmed training process and its effects on motor skills of cadet football players. Modern football is also characterised by technical and tactical rationality of performing elements of game, which results in higher fitness level among football players. Hence, modern training necessitates consideration about the extent, intensity, and quality of work, especially when working with younger categories. It is necessary, then, to determine those factors which, more or less, lead to success in football by systematic training. According to previous research studies, factors affecting success in football play are hierarchically divided in three groups (Rađo and Talović, 2003): 1) The first group includes morphological characteristics, motor skills, functional abilities, cognitive and conative factors, and sociological characteristics; 2). The second group of factors include theoretical knowledge, technical and tactical skills, specific motor skills, etc.; 3) The third group includes situational effectiveness and results achieved in a competition. The problem of this research research refers to determining effects of the presented model of training stimuli within the conditioning period, and their influence on qualitative changes in basic motor skills of football cadets. The subject of this research is basic motor skills of football cadets as well as their variability as a result of the applied training model in the conditioning period. The main objective of this research is to determine the qualitative changes in basic motor skills of football players influenced by a programmed football

training which includes one conditioning period, i.e. to determine whether there are any significant changes in the quality/quantity of basic motor and situational motor skills as a result of the programmed football training process in this category of football players.

Methods

This research was realised as an experiment involving one group. In terms of duration, this is a longitudinal study for the purpose of determining qualitative changes in basic motor skills of football cadets (15 years old ± 6 months) in two different points of time, being subjected to a programmed training in the conditioning period for 2009/10 season of competition, in the only cadet league of Monte Negro and the cadet league of the Middle Region of Monte Negro. The training programme lasted for forty-two (42) days, or six (6) weeks, and was conducted on the auxiliary pitch of *Sutjeska FC* in Nikšić. The training programme contained forty-four (44) training units, in which eight (8) friendly matches were played. Data processing included only the results of those subjects who completed the entire training programme, and who were subject to initial and final measurements. The research was conducted as follows: Determining initial status by measuring variables for assessment of basic motor skills of all the subjects separately; Conducting a training programme with duration of forty-two (42) days; Programme realisation by coaches from youth football schools of *Sutjeska FC, Čelik FC, Polet Stars FC, and Nikšić YFC*, all from Nikšić; Determining final status by measuring the same variables under the same conditions as those for the initial status. The research included a sample of 120 young football players. The chosen variables in this research hypothetically covered the area of basic motor skills (21 variables, according to Metikoš et al., 1989).

Measuring instruments for assessment of basic motor skills
- *For assessment of movement speed, the following tests were applied:* 1. Leg tapping against a wall (MBFTAZ), 2. 20 m sprint, flying start (MB20MV), 3. 60 m sprint, falling start (MB60MV);
- *For assessment of explosive power, the following tests were applied:* 4. Standing long jump (MESSDM), 5. Vertical jump (MESSVM), 6. Standing triple jump (MESTRM);
- *For assessment of flexibility, the following tests were applied:* 7. Floor touch test (MFLPRK), 8. Sitting wide-legged forward bend (MFLPRR), 9. Side legs wide spread (MFLBOŠ);
- *For assessment of coordination, the following tests were applied:* 10. Making figure eight with bending (MKOOSS), 11. Side steps (MKOKUS), 12. Leg slalom with two balls (MKOSNL);
- For assessment of agility, the following tests were applied: 13. Runs with 90-degree cuts (MAGTPP), 14. Curved runs (MAGVTR), 15. Shuttle runs 10x5m (MAGČUT);

- *For assessment of repetitive strength, the following tests were applied:* 16. From lying to sitting position for 30 s (MRSLSJ), 17. Push-ups (MRSSKL), 18. From lying position – raising torso (MRSZUL);
- For assessment of endurance, the following tests were applied: 19. Cooper test (MIZKUP), 20. 15 m bleep test (MIZT90), and 21. Persistent shuttle runs (MIZIČT).
The data from this research was determined by factor analysis – with orthogonal varimax rotation with statistical package SPSS for Windows 17.0.

Results

The results of orthogonal varimax transformation (Table 1) is the isolation of seven (7) factors, with the characteristic roots greater than one ($\lambda > 1$). The first isolated factor (V1) has a maximum value of the root $\lambda = 2.54$ and it explains the largest portion of total explained variance of the system 12.08%, second isolated factor (V2) has the value of the root $\lambda = 2.44$ and explains 11.62% of explained variance of the system, the third isolated factor (V3) has the value of the root $\lambda = 2.15$ and explains 10.24% of explained variance of the system, the fourth isolated factor (V4) has the value of the root $\lambda = 2.08$ and explained 9.91% of explained variance of the system, the fifth isolated factor (V5) has the value of the root $\lambda = 1.89$ and explained 8.99% of explained variance of the system, the sixth isolated factor (V6) has a value of the root $\lambda = 1.71$ and explained 8.15% of explained variance of the system, and the seventh isolated factor (V7) has, in the hierarchy, the lowest value of the roots of all the seven major components and is $\lambda = 1.43$ and explained 6.81% of explained variance of the system. From the seven (7) isolated factors, by the orthogonal varimax transformation, is possible to clearly define four (4) factors.

Table 1. Orthogonal varimax rotation of basic - motor skills in the initial state ("I"*)

Variables	V1	V2	V3	V4	V5	V6	V7
MBFTAZI*	0,27	0,00	0,43	-0,03	0,51	0,16	-0,01
MB20MVI	-0,34	-0,01	-0,21	-0,22	0,60	-0,27	-0,19
MB60MVI	-0,09	-0,06	-0,04	0,07	0,77	0,01	-0,11
MESSDMI	0,76	0,08	0,19	0,04	-0,09	-0,16	0,19
MESSVMI	0,80	0,19	0,01	0,09	-0,09	0,21	-0,02
MESTRMI	-0,05	0,44	0,37	-0,36	-0,11	-0,06	0,07
MFLPRKI	0,23	0,81	0,10	0,15	-0,10	0,11	0,20
MFLPRRI	0,23	0,79	0,16	-0,03	0,06	0,02	0,07
MFLBOŠI	-0,26	0,51	-0,05	-0,42	-0,11	-0,02	0,44
MKOOSSI	-0,20	-0,12	-0,19	-0,15	0,22	-0,60	-0,04
MKOKUSI	-0,48	-0,44	-0,11	-0,08	0,03	0,36	0,14
MKOSNLI	-0,07	-0,01	0,13	-0,06	0,09	0,84	0,00
MAGTPPI	-0,26	-0,17	-0,73	0,04	-0,02	-0,05	0,20
MAGVTRI	0,07	-0,10	-0,77	-0,27	0,17	-0,22	0,10
MAGČUTI	0,11	-0,04	-0,24	0,04	0,63	-0,13	0,54
MRSLSJI	0,35	0,11	0,57	0,21	-0,06	0,18	0,33
MRSSKLI	0,56	0,34	0,22	0,05	0,25	0,21	0,24
MRSZULI	0,22	0,25	-0,08	0,13	-0,18	0,08	0,69
MIZKUPI	0,19	-0,01	0,03	0,77	-0,03	0,12	0,05
MIZT90I	0,23	0,47	-0,05	0,55	-0,20	0,36	-0,25
MIZIČTI	-0,15	0,01	0,28	0,78	0,04	-0,19	0,18
λ - Lambda	2,54	2,44	2,15	2,08	1,89	1,71	1,43
Percent	12,08	11,62	10,24	9,91	8,99	8,15	6,81
Cum Percent	12,08	23,70	33,94	43,85	52,84	60,99	67,80

At the first isolated factor (V1), statistical significant projections have two variables for assessing explosive power - Standing long jump (MESSDMI) and Vertical jump (MESSVMI), and two variables for evaluating the repetitive power - From lying to sitting position for 30 s (MRSLSJI) and Push-ups (MRSSKLI), which means that on this factor significant saturation have variables for assessing the power, but can not be purely defined. On the second isolated factor (V2), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing the flexibility - Floor touch test (MFLPRKI), Sitting wide-legged forward bend (MFLPRRI) and Side legs wide spread (MFLBOŠI). This factor can be called the factor of flexibility. On the third isolated factor (V3), statistical significant projections have two variables for assessing the agility - Runs with 90-degree cuts (MAGTPPI) and Curved runs (MAGVTRI), as well and variables for assessing explosive power - Standing triple jump (MESTRMI) which indicates that the test of explosive power, in this sample, has a considerable amount of agility, but also in tests of agility, there are a lot of movements that require explosive power, so this factor can not often be interpreted logically. On the fourth isolated factor (V4), statistically significant projections towards the structure of a hypothetical set model of basic - motor ability, have all three variables for assessing durability - the Cooper test (MIZKUPI), 15 m bleep test (MIZT90I) and Persistent shuttle runs (MIZIČTI), so this factor can be defined as an endurance factor. On the fifth isolated factor (V5), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for estimation speed of movement – Leg tapping against a wall (MBFTAZI), 20 m sprint, flying start (MB20MVI) and 60 m sprint, falling start (MB60MVI), so this factor can be defined as a factor for speed of movements. On the isolated sixth factor (V6), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing coordination – Making figure eight with bending (MKOOSSI), Side steps (MKOKUSI) and Leg slalom with two balls (MKOSNLI), so this factor can be defined as a factor for movement's coordination. On the seventh isolated factor (V7), statistically significant projection has a variable for evaluating repetitive power - From lying position – raising torso (MRSZULI), so this factor can not be purely defined. The three isolated factors, the first (V1), third (V3) and seventh (V7), can not be defined clearly, because no basic - motor space, according to the structure of a hypothetical set models in the initial measurement, has no statistically significant projection for all three variables of some of these three factors. The results of orthogonal varimax transformation (Table 2) is the isolation of seven (7) factors with the characteristic root greater than one (λ>1). The first isolated factor (V1) has a maximum value of the root λ=2.54 ,and it explains the largest portion of the total explained variance of the system 12.08%, the second isolated factor

(V2) has the value of the root λ=2.43 and explains 11.55% of explained variance of the system, the third isolated factor (V3) has the value of the root λ=2.24 and explains 10.66% of explained variance of the system, the fourth isolated factor (V4) has the value of the root λ=1.90 and explained 9.05% of explained variance of the system, the fifth isolated factor (V5) has the value of the root λ=1.77 and explained 8.44% of explained variance of the system, the sixth factor isolated (V6) has a value of the root λ=1.71 and explained 8.13% of explained variance of the system, and the seventh isolated factor (V7) has, in the hierarchy, the lowest value of all roots from the seven major components and is λ=1.55 and explained 7.36% of explained variance of the system.

Table 2. Orthogonal varimax rotation of the basic - motor skills in the final state ("F"*+)

Variables	V1	V2	V3	V4	V5	V6	V7
MBFTAZF**	0,03	-0,33	0,17	0,02	0,24	0,03	0,66
MB20MVF	-0,32	0,26	-0,17	-0,33	-0,35	-0,16	0,40
MB60MVF	-0,13	0,03	-0,31	-0,13	-0,24	0,06	0,45
MESSDMF	0,63	-0,25	0,33	0,16	-0,08	-0,14	-0,15
MESSVMF	0,58	-0,12	0,20	0,16	0,22	0,28	-0,02
MESTRMF	0,18	-0,46	0,24	-0,55	-0,11	0,18	-0,04
MFLPRKF	0,34	-0,06	0,74	0,08	0,06	0,31	-0,01
MFLPRRF	0,16	-0,14	0,81	-0,03	0,15	0,23	0,18
MFLBOŠF	-0,02	0,09	0,66	-0,34	-0,12	-0,12	-0,05
MKOOSSF	-0,30	0,12	-0,08	0,06	-0,60	-0,02	0,17
MKOKUSF	-0,07	0,05	-0,23	0,03	0,17	-0,85	0,01
MKOSNLF	-0,20	-0,10	-0,02	0,01	0,77	-0,07	0,14
MAGTPPF	-0,11	0,82	-0,13	-0,14	-0,09	-0,06	-0,09
MAGVTRF	0,00	0,84	0,06	-0,21	-0,20	-0,05	0,06
MAGČUTF	-0,01	0,36	0,26	0,13	-0,24	-0,35	0,60
MRSLSJF	0,60	-0,47	-0,13	0,03	0,08	0,05	0,22
MRSSKLF	0,50	-0,11	0,06	0,12	0,27	0,44	0,43
MRSZULF	0,76	0,18	0,14	-0,07	-0,07	0,08	-0,10
MIZKUPF	0,33	-0,16	-0,21	0,65	0,14	0,24	-0,02
MIZT90F	0,21	-0,14	0,00	0,32	0,46	0,53	-0,17
MIZIČTF	0,02	-0,31	0,05	0,82	-0,16	-0,03	-0,01
λ - Lambda	2,54	2,43	2,24	1,90	1,77	1,71	1,55
Percent	12,08	11,55	10,66	9,05	8,44	8,13	7,36
Cum Percent	12,08	23,63	34,29	43,34	51,78	59,91	67,27

From the seven (7) isolated factors, by the orthogonal varimax transformation is possible to clearly define five (5) factors. On the first isolated factor (V1), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing the repetitive power - From lying to sitting position for 30 s (MRSLSJF), Push-ups (MRSSKLF) and From lying position – raising torso (MRSZULF) and two variables for assessing explosive power - Standing long jump (MESSDMF) and Vertical jump (MESSVMF), so this factor can be defined as a general power factor. On the second isolated factor (V2), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing agility - Runs with 90-degree cuts (MAGTPPF), Curved runs (MAGVTRF) and Shuttle runs 10x5m (MAGČUTF), and this factor can be defined as a factor of agility. On the third isolated factor (V3), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing the flexibility - Floor touch test (MFLPRKF), Sitting wide-legged forward bend (MFLPRRF) and Side legs wide spread (MFLBOŠF).

This factor can be defined as the flexibility factor. On the fourth isolated factor (V4), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for assessing durability - the Cooper test (MIZKUPF), 15 m bleep test (MIZT90F) and Persistent shuttle runs (MIZIČTF), so this factor can be defined as the endurance factor. On the fifth isolated factor (V5), statistical significant projections have two variables for assessing coordination – Making figure eight with bending (MKOOSSF) and Leg slalom with two balls (MKOSNLF), and it is not a complete structure with three variables set by the hypothetical model that have a statistically significant saturation on the same factor, so this factor can not be defined purely. On the isolated sixth factor (V6), statistically significant projection has only one variable for estimation of coordination - Side steps (MKOKUSF), so that the other two variables are set according to the hypothetical structure of a model for coordination evaluation have significant statistical projections to the previous factor, so not this one nor the previous factor can be defined purely as factors of coordination. On the seventh isolated factor (V7), statistically significant projections towards the structure of a hypothetical set model of basic - motor skills, have all three variables for estimation the speed of movement – Leg tapping against a wall (MBFTAZF), 20 m sprint, flying start (MB20MVF) and 60 m sprint, falling start (MB60MVF), so this factor can be defined as a factor for the speed of movement.

Discussion and conclusion

The aim of this study was, to use the bases of the longitudinal studies, for determination the transformations' level of basic - motor skills of footballers -cadets, under the influence of programmed football training which included one preparation period. Results were obtained by using battery of tests in the area of basic - motor skills. In the area of basic - motor skills were used twenty-one (21) variables, which by the structure of the hypothetical set model covered the latent dimensions - the speed of motion, explosive power, flexibility, coordination, agility, repetitive power and endurance. The structure of a hypothetical set model of basic -motor skills at the initial state, was analyzed by the factor analysis of orthogonal varimax rotation, which isolated seven (7) factors, of which four (4) could be defined clearly and logically interpreted. The structure of a hypothetical set model of basic -motor skills at the final state, was analyzed by the factor analysis of the orthogonal varimax rotation, which isolated seven (7) factors, of which five (5) could be defined clearly and logically interpreted. Looking generally at the basis of these results, the conclusion is that this training work program, in the preparation period, led to a statistically significant positive changes for all basic - motor skills that were a subject of this work. It has been shown, through this work, that the planning and programming of football training units according to the new vision of UEFA, where are represented mostly situational methods through the game, can significantly improve abilities of football players at this age.

Coaches, who implement training programs of work, and with this and with all other age- groups of football players, must be educated with the adopted modern methods to access the soccer training, in order to contribute to positive effects of training programs for the football players they train. They should also be trained in testing and measurements, as they could see periodically the results of their work. The significance of this experimental work is in fact that it encompassed issues of the transformation processes in the basic-motor space of young football players, all in order to improve the quality of work with young footballer's categories. In addition to the diagnosing, planning and programming of the training process, the results can be also applied and in order to monitor individual players, the introduction of corrections in the training methods, the identification and promotion of differences in observed characteristics and capabilities, as well and the directing of the entire training process in the desired direction.

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KVALITATIVNE PROMJENE BAZIČNO-MOTORIČKIH SPOSOBNOSTI NOGOMETAŠA NAKON REALIZACIJE ŠESTOTJEDNOG TRENAŽNOG PROGRAMA

Sažetak

Istraživanje je provedeno sa 120 mladih nogometaša 15 godišnjaka, članova nogometnih klubova: FK Sutjeska, FK Čelik, FK Polet Stars i OFK Nikšić, svi iz Nikšića. Na njima je primijenjen 21 motorički test za procjenu 7 hipotetskih motoričkih sposobnosti. Nakon realizacije šestotjednog trenažnog procesa (eksperimentalni tretman) pomoću faktorske analize identificirane su kvalitativne promjene. U inicijalnom stanju definirane su četiri latentne dimenzije: fleksibilnost, izdržljivost, brzina i koordinacija. U finalnom stanju je definirano pet latentnih dimenzija: snaga, okretnost (agilnost), fleksibilnost, izdržljivost i brzina. Pozitivne kvalitativne promjene nedvojbeno proizlaze iz stručne realizacije eksperimentalnog programa.

***Ključne riječi:** motorički testovi, eksperimentalni program, igrači, kadeti-U15, faktorska analiza*

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