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Body Composition And Motor Abilities Of Young Football Players

Stefan Mijalković[1], Kristina Mladenović[1], Tamara Ilić[1]

[1]Faculty of sport and physical education, University of Niš

Abstract

The aim of this study was to explore the correlation between body composition and motor abilities of young football players. The sample of respondents consisted of 18 football players with a mean chronological age of 14.9 ± 0.28 and with a sports experience of 7.83 ± 2.07 years. The monitored variables of body composition were: body height, body mass, muscle percentage, fat percentage and body mass index. Subsequently, the assessment of motor abilities was carried out by the following tests: speed (10, 20 and 30m sprint), agility (Slalom, Agility T-test and Illinois) and explosive power (Counter Movement Jump, Counter Movement Jump With Arm Swing and Squat Jump). Results indicated that there was a statistically significant positive correlation between body composition and motor abilities of football players. Therefore, it could be concluded that physical preparation together with good monitoring of body composition parameters could lead to the achievement of maximum sports performance.

Keywords: *speed, agility, explosive power, football, anthropometric characteristics*

Introduction

Football is a semi-structured team sport with very fast and dynamic characteristics which contains cyclic and acyclic movement with dynamic and complex kinesiology activities (Sermaxhaj, Popovic, Bjelica, Gardasevic, & Arifi, 2017). Monitoring of the anthropological and individual characteristics of the players as well as the realization of an adequate training process is necessary in order to achieve top success in sports (Gardasevic & Bjelica, 2020). Unfortunately, the focus is on improving physical preparation and less importance is given to body composition (Triki et al., 2012), and a serious approach to the improvement of these components leads to a good technical-tactical preparation of football players (Chamari et al., 2004). Monitoring of body composition and anthropological characteristics is very important because they are a prerequisite for improving motor abilities as well as for achieving maximum success in sports (Reilly, Bangsbo, & Franks, 2000; Gomes, Ribeiro, & Soares, 2005). It has been shown that higher values of body mass, body mass index (BMI) and fat percentage have a negative effect on motor abilities (Gil, Gil, Ruiz, Irazusta, & Irazusta, 2007), while lower values of these parameters lead to better sprint, acceleration, agility and jumping ability (Dodd & Newans, 2018).

There are some studies that have dealt with the issue of the relationship between body composition and motor abilities of football players (Atakan, Unver, Demirci, Bulut, & Turnagol, 2017; Leão et al., 2022; Wong, Chamari, Dellal, & Wisløff, 2009). Furthermore, higher values of body composition parameters such as body mass, BMI and fat percentage have a negative impact on the performance of explosive power, agility and speed. On the other hand, the percentage of muscles can have a positive influence on the results of these motor abilities (Gardasevic, Bjelica, Corluka, & Vasiljevic, 2019).

Identifying ideal values of the body composition is very important for athletes in order to perform motor skills at the best possible level. It is especially important to monitor the progress of these parameters of younger football players because they need to be prepared for achieving sports success. Therefore, the aim of this study was to determine the correlation between body composition and motor abilities of young football players.

Method

The sample of respondents

For the realization of this study, the sample of respondents consisted of 18 football players with a mean chronological age of 14.9 ± 0.28 years, with sports experience of 7.83 ± 2.07 years. The

Correspondence:

S. Mijalković
University of Niš, Faculty of Sport and Physical Education, Čarnojevića 10A, 18000 Niš, Serbia
Email: stefimijalkovic@gmail.com

football players were healthy during the testing and were familiar with the tests before the testing began and gave their consent to participate in it.

Testing Procedure

Testing of motor abilities and measurement of the anthropological characteristics of the respondents were on an open auxiliary football field. The respondents were warmed up after the anthropological characteristics were taken. Warm up protocol consisted of running around the field with a change of direction and acceleration, static and dynamic stretching exercises in order to prepare as efficiently as possible for the motor abilities tests. Body height was measured by Martin's anthropometer GPM 101 (GPM GmbH Switzerland) with an accuracy of 0.1 cm, while body mass, muscle and fat percentage and body mass index were determined using an Omron BF511 bioelectrical impedance (Omron Healthcare Co, Kyoto, Japan) with an accuracy of 0.1 kg. Reliability and validity of the instrument have been previously reported by Dehghan & Merchant (2008).

The speed test consisted of 10, 20 and 30 meter sprints. Witty photocell gates (Microgate, Italy) with an accuracy of 0.01s were used to measure transit times on these sections. The respondents were behind the starting line in a high start position. They were supposed to run the given sections in the shortest possible time at the signal of the meter.

Agility assessment consisted of the following tests: Slalom, Agility T-test and Illinois. Witty photocell gates (Microgate, Italy) were also used in the realization of these tests. In the slalom test, the respondent was in a high start position behind the starting line while the task was to run between the cones. There were five cones in total. The first cone was 1m away from the starting line, while the distance between the other cones was 2m. The respondent ran with a change of direction from right to left, reaching the last cone and making a 180° turn and returning along the same path between the cones. Reliability and validity of this test was reported by Sporis, Jukic, Milanovic, & Vucetic, (2010). The Agility T-test was carried out by having the respondents in a high start position behind the starting line. At the signal of the meter, they run in a straight line to the placed cone which is 9.14m away, after touching it, they need to use the stepping technique to go to the side cone which is 4.57m away, touch it, then also with a stepping technique to the second side cone, which is at a distance of 9.14m, touch the cone, then with a stepping technique to the central cone, which is also touched. Finally, they were required to complete the last 9.14m by running backwards until they crossed the finish line. Reliability and validity of this test was previously reported by Pauola, Madola, Garhammer, Lacourse, & Rozenek, (2000). For the Illinois test, an area 10m long and 5m wide was required, and cones were placed in the middle of that area at a distance of 3.33m from each other. The respondents were behind the starting line in a standing position, where they started running at the signal of the meters. First, they ran a straight section to the cone located 10m from the start line, go around the cone and run diagonally to the central cones that cross the slalom, then run diagonally to the cone, go around it and run across the 10m section to the finish line. Reliability and validity of this test was shown by Hachan et al., (2013).

The following tests were used to assess the explosive power: Counter Movement Jump (CMJ), Counter Movement Jump With Arm Swing (CMJwAS) and Squat Jump (SJ). Optojump photoelectric cells were used, and its validity and reliability was shown by Glatthor et al., (2011). The CMJ required respondents to move from an upright shoulder-width stance with their arms fixed on their hips to a half-squat and perform a vertical jump. The procedure for realization of CMJwAS was the same as for CMJ. The only difference was that respondents had arm swing during the jump. The starting position for SJ was a half-squat with fixed arms on the hips, and from that position respondents performed a vertical jump. Reliability and validity of these tests was previously reportedn by Markovic, Dizdar, Jukic, & Cardinale, (2004).

Statistical data processing

The IBM SPSS Statistics 20 program was used for statistical data processing. Descriptive statistics of monitored variables were presented and the normality of data distribution was examined by the Kolmogorov-Smirnov test. Pearson's correlation analysis was used to determine the correlation between body composition and motor abilities of young football players. The correlation coefficient was presented accordning to Hopkins, Marshall, Batterham, & Hanin, (2009): trivial ($0 < r < 0.1$), small ($0.1 < r < 0.3$), moderate ($0.3 < r < 0.5$), large ($0.5 < r < 0.7$), very large ($0.7 < r < 0.9$) and almost perfect ($0.9 < r < 1$).

Table 1. Results of descriptive statistics and Kolmogorov-Smirnov test of monitored variables.

	Mean ± Std. Deviation	**One-Sample Kolmogorov-Smirnov Test**
BH (cm)	171.73 ± 8.54	0.680
BM (kg)	59.75 ± 9.89	0.633
BMI (kg/m2)	20.13 ± 2.23	0.969
fat (%)	10.68 ± 2.78	0.930
muscle (%)	41.95 ± 1.50	0.487
10m	1.90 ± 0.12	0.995
20m	3.24 ± 0.20	0.836
30m	4.49 ± 0.27	0.568
Slalom	7.65 ± 0.39	0.769
T-test	10.26 ± 0.68	0.626
Illinois	16.69 ± 0.57	0.611
CMJ	28.48 ± 3.44	0.876
CMJwAS	36.27 ± 4.67	0.918
SJ	26.65 ± 3.76	0.995

Legend: BH – body height; BM – body mass; BMI – body mass index; fat - fat percentage; muscle - muscle percentage; 10m – 10 meter sprint; 20m – 20 meter sprint; 30m – 10 meter sprint; Slalom – agility test; T-test – agility test; Illinois – agility test; CMJ – Counter Movement Jump; CMJwAS – Counter Movement Jump With Arm Swing; SJ – Squat Jump.

Results

Kolmogorov-Smirnov test results, mean and standard deviation of body composition parameters (body height, body mass, body mass index, fat percentage and muscle percentage) and results of motor abilities (10, 20 and 30m sprint, Slalom, Agility T-test, Illinois, Counter Movement Jump, Counter Movement Jump With Arm Swing and Squat Jump) were shown in Table 1.

The results of Pearson's correlation analysis between body composition and motor abilities of football players were presented in Table 2.

Table 2. Results of Pearson's correlation analysis.

	10m	20m	30m	Slalom	T-test	Illinois	CMJ	CMJwAS	SJ
BH (cm)	-0.109	-0.260	-0.354	0.570†	0.089	-0.158	0.132	0.225	0.221
BM (kg)	-0.222	-0.445	-0.542†	0.315	-0.209	-0.363	0.418	0.513†	0.369
BMI (kg/m2)	-0.292	-0.518†	-0.593†	0.000	-0.405	-0.463	0.567†	0.613†	0.418
fat (%)	0.063	-0.007	-0.040	0.170	0.032	0.025	-0.106	0.232	-0.201
muscle (%)	-0.028	-0.086	-0.142	0.123	0.179	-0.109	0.106	-0.028	0.248

Legend: † - statistical significance ($p < 0.05$); BH – body height; BM – body mass; BMI – body mass index; fat - fat percentage; muscle - muscle percentage; 10m – 10 meter sprint; 20m – 20 meter sprint; 30m – 30 meter sprint; Slalom - agility test; T-test – agility test; Illinois – agility test; CMJ – Counter Movement Jump; CMJwAS – Counter Movement Jump With Arm Swing; SJ – Squat Jump.

Results of Pearson's correlation analysis indicated that there was a statistically significant positive moderate to large correlation between body composition and motor abilities of young football players. Body height had a statistically significant correlation with the slalom agility test (r=0.570, p=0.013). Also, body mass had a statistically significant correlation with CMJwAS (r=0.513, p=0.030) and 30 meter sprint (r=-0.542, p=0.020). Finally, a statistically significant correlation was found between BMI and the CMJ (r=0.567, p=0.014), CMJwAS (r=0.613, p=0.007), 20 meter sprint (r=-0.518, p=0.028) and 30 meter sprint (r=-0.593, p=0.009) tests.

Discussion

The aim of this study was to explore the correlation between body composition and motor abilities of young football players. Analysis of the results indicated that there was a statistically significant correlation between certain parameters of body composition (body height, body mass, BMI, fat and muscle percentage) with motor abilities (speed (10, 20 and 30 meter sprint), agility (slalom, T-test and illinois) and explosive power (CMJ, CMJwAS and SJ)).

Speaking of body height and mass, body height had a statistically significant positive correlation with the results of the slalom test. More precisely, it could be concluded that taller football players passed this agility test more efficiently than shorter ones. Body mass had a statistically significant positive correlation with the results of the 30 meter sprint and CMJwAS. This result of the analysis stems from the fact that football players had a much higher percentage of muscle than the percentage of fat in their body. Furthermore, it could be suggested that football players who had a higher body mass also had a higher percentage of muscles and therefore better results in these motor abilities tests. Gardasevic, Bjelica, Corluka, & Vasiljevic, (2019) had similar results. Namely, it could be concluded that higher values of body mass could lead to a positive influence on motor abilities if there was a higher percentage of muscles in the body. It is recommended that football players reduce the percentage of fat and increase the percentage of muscles in the body in order to achieve the best possible sports success.

The results of the study indicated that BMI had a statistically significant positive correlation with explosive power (CMJ and CMJwAS) as well as with speed (20 and 30 meter sprint). This indicated that higher BMI values led to higher vertical jump and faster running times in sprint. Wong, Chamari, Dellal, & Wisløff, (2009) came to a different result because the football players who made up their sample of respondents had a higher percentage of fat than percentage of muscle, which greatly affected BMI. However, it should be emphasized that BMI is not a reliable indicator, since it can not distinguish muscle mass from fat mass. On the other hand, Leão et al., (2022), found in their study a small positive correlation between BMI and explosive power. It is recommended that monitoring BMI can influence speed and explosive power.

The limitation of the study would be reflected in the small number of sample respondents who could participate in the testing. Also, the testing was carried out immediately after the end of the competitive season. Therefore, it is assumed that if the testing was done before the start of the competition season, the motor abilities of the respondents could be at a more enviable level. Because of all the above, the results of this study cannot be generalized and cannot be applied to the entire population.

Conclusion

Morphological, physiological and motor characteristics play an important role in achieving sports results. Based on the analysis of the results of this study, it has been shown that body composition parameters have a statistically significant positive correlation with speed, agility and explosive power. Identifying the ideal body composition of a football player would have a great impact in sports science. The results of the study can be useful to coaches and other experts in the field of sports, within the training program, as well as in the better guidance of athletes.

Conflict of interest

The authors declare that there is no conflict of interest.

Future research

For future studies, it is desirable to have a larger sample of respondents as well as a larger number of motor ability tests. In this way, more accurate correlation results of body composition and motor abilities could be obtained.

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