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The Body Composition and High-Speed Related Test Effects on the Change-of-Direction Speed

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EFFECTS OF BODY COMPOSITION AND HIGH-SPEED RELATED TESTS ON THE CHANGE-OF-DIRECTION SPEED IN U15 SOCCER PLAYERS

Kastriot Shaqiri[1ABE], Fadil Mamuti[2CDE*], Blerim Sulejmani[3DE]

[1 2 3]University of Tetovo, Faculty of Physical Education, Tetovo, Macedonia
**Corresponding author: fadil.mamuti@unite.edu.mk*

Authors' Contribution: A: Study design, B: Data collection, C: Data analysis, D: Manuscript preparation, E: Discussion and conclusion

ABSTRACT

Study aim(s): The aim of the study is to determine the effects of the body composition factors such as height, weight, and BMI, the jump performance (long jump test), and acceleration (10m, 50m running) on the change-of-direction speed such as 10x5m shuttle, side steep to the U15 soccer players.

Methods: To ascertain the importance of body composition and high-speed related tests on the change-of-direction speed in U15 soccer players, several body measurements were taken, such as Height, Weight, and BMI. To determine the high-speed related tests on the change-of-direction speed in U15 soccer players, the long jump test, 10m, 50m, 10x5m shuttle, side steep was used. One hundred and sixty young male soccer players, aged 15 years old (± 6 months) participated in the study. In the data analysis, SPSS 26 packet program was used. The descriptive statistics include; mean, standard deviation, skewness, kurtosis, and percentiles. The effects of other independent variables on the dependent variables have been determined by using regression analysis.

Results: The regression analysis has shown a significant effect of the 10M running speed on the 10x5m shuttle run ($p<0.05$). Also, when zero-order correlation values have been analyzed even though it is not significant the weight seems to have a tendency for correlation with the 10x5 meters shuttle run ($p=.09$). Whereas partial correlation has shown significance between a dependent variable and standing broad jump ($p<0.05$).

Conclusions: It has been concluded that the construct of the tests included in this research seems that among all factors that make these tests effects each-other face validity has been more effective on the results.

Keywords: Body Composition, Acceleration, Agility, High Speed Strength.

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INTRODUCTION

Soccer has a lot of moments where high-intensity actions such as jumps, changes of direction, and sprints can become determining factors in the success of the players [1, 2]. For executing many soccer-specific movements such as sprinting, changing direction, and contesting for the ball's possession are very important to have strengths and speed [3]. Short sprints, rapid acceleration or deceleration, turning, jumping, kicking, and tackling are elements by that soccer is characterized [4].

Anthropometric measures, body composition, and physiological and physical capabilities, including endurance, muscular strength, and flexibility, are generally assessed through the testing of soccer players [5, 6]. Body composition has an important role in the players' ability to achieve maximum performance in several performance tests which are related to soccer [6].

Low-intensity exercise and rest breaks during match play are necessary for muscle relaxation, body recovery, and lactate utilization, as well as for paying the oxygen debt which develops during the performance of high- and maximal-intensity exercise. Speed in soccer is more complicated than covering the distance between two points in the shortest time possible, for this reason, the skill to show fast reactions to unexpected developments in soccer is directly related to speed performance. [7].

Agility and speed are two of the most important performance components for the success of soccer players. A significant correlation between performance in an agility T-test and 40-yard sprint time in both men and women was found by Pauole et al. [8]. It was reported low common variances of 21% between tests for straight sprinting speed and agility by author Draper and Lancaster [9]. But other authors reported no significant correlations between straight agility speed tests and sprinting in Australian soccer players. [10, 11].

The aim of the study is to determine the effects of the body composition factors such as height, weight, BMI, jump performance (long jump test), and acceleration (10m, 50m running) on the change-of-direction speed such as 10x5m shuttle, side steep to the U15 soccer players.

METHODS

Study design

To ascertain the importance of body composition and high-speed related tests on the change-of-direction speed in U15 soccer players, several body measurements were taken, such as Height, Weight, and BMI. To determine the high-speed related tests on the change-of-direction speed in U15 soccer players, the long jump test, 10m, 50m, 10x5m shuttle, side steep was used.

Study Sample

One hundred and sixty young male soccer players, aged 15 years old (± 6 months) participated in the study, which was conducted during soccer competition season. These players were members of regional representative teams competing at the first level of competition for their category in Kosovo. Players attend the training for 90 minutes 3 times per week and played a match during the weekend. Each training season generally consisted of a 15-minute warm-up, 20-minute technical training, 20-minute tactical training, 30-minute simulated competition, and at the end of training a 5-minute cool-down. All players from different positions were trained together except for the Goalkeepers who attended a specific training. The study was conducted according to the Declaration of Helsinki. Before measuring, all players and their parents were properly informed of the nature of the study.

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Data Collection Tools

The height (cm) and weight (kg) of each player were measured, and the BMI was calculated as weight (in kg) divided by height (m2). The body weight and body mass index were measured with medical scales (Tanita BC 545 N Innerscan Segmental Personal Body Analysis) and the data was read with an accuracy of 0.1 kg. Sprint test 10-meter, and 50m, measurements were performed according to Bjelica and Fratrić's protocol (the result is given with an accuracy of 0.1 sec) [12]. The 10x5m shuttle and side steep were administrated a standard version from previous literature [13].

Data analysis

In the data analysis, SPSS 26 packet program was used. The distribution of the data has been tested by using the skewness (> 1 - positive, 0 - normal, < - 1 - negative) and kurtosis (> +2 leptokurtic, 2 mesokurtic, < -2 platykurtic) values. The descriptive statistics include; mean, standard deviation, skewness, kurtosis, and percentiles. The effects of other independent variables on the dependent variables have been determined by using regression analysis. In order to determine the effects of the dependent variables on the dependent variables without the interference of the other variables the zero-order and partial correlations have been determined.

FINDINGS

Table 1. Distribution and percentiles of the tests included in the study

	H	W	BMI	SBJ	CMJ	10M	50M	10x5 SHR	SS
M ± SD	167.4±8.0	57.8±9.21	20.5±2.01	185.4±15.2	41.91±4.35	1.85±.08	8.07±.702	12.42±.47	8.71±.52
S	.16	.42	.11	.11	-.30	.63	.31	.09	.00
K	-.87	.02	.03	.12	-.56	-.63	-1.09	-1.05	-1.25
25th	160.0	51.0	19.1	175.0	39.00	1.80	7.38	12.02	8.14
50th	167.0	57.0	20.5	185.0	42.00	1.83	8.08	12.29	8.75
75th	174.0	63.0	21.9	197.7	45.00	1.90	8.65	12.85	9.12

S: Skewness, K: Kurtosis. H: High (cm), W: Weight (kg), BMI: Body Mass Index (kg/m2), SBJ: Standing broad jump (cm), CMJ: Countermovement jump (cm), 10mR: 10 Meters running (s), 50M running (s), 10x5SHR: 10x5 Meters Shuttle Run (s), SS: Side steps (s).

The skewness and kurtosis values have shown that normal distribution of the data has been carried out. Besides the normality of the data's percentile groups (25th, 50th, 75th) has been determined.

Table 2. the effects of body composition, jump performance, and acceleration on change-of-direction speed (10x5 meters shuttle run) performance.

V	ANOVA	R square	B	p	ZO	Partial
H	.000	.514	-.053	.156	.265	-.115
W			.086	.115	.097	.127
BMI			-.286	.067	-.144	-.147
SBJ			.001	.819	.203	.019
CMJ			.010	.362	.321	.074
10M			3.239	.000	.680	.516

V: Variables, B: Unstandardized coefficient. H: High (cm), W: Weight (kg), BMI: Body Mass Index (kg/m2), SBJ: Standing broad jump (cm), CMJ: Countermovement jump (cm), 10mR: 10 Meters Running (s), ZO: Zero-Order

The R square value has shown that 51% of variances are explained by the results of the regression analysis. The regression analysis has shown a significant effect of the 10M running speed on the 10x5m shuttle run ($p<0.05$). Also, when zero-order correlation values have been analyzed even though it is not significant the weight seems to have a tendency for correlation with the 10x5 meters shuttle run ($p=.09$). Whereas partial correlation has shown significance between a dependent variable and standing broad jump ($p<0.05$).

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Table 3. The effects of body composition, jump performance, and acceleration on change-of-direction speed (side steeps) performance

	ANOVA	R square	B	p	Zero-order	Partial
(C)			4.967	.529		
H			-.026	.549	.284	-.048
W			.040	.531	.244	.051
BMI	.000	.443	-.096	.601	.079	-.042
SBJ			.003	.444	.219	.062
CMJ			.006	.637	.316	.038
10M			3.760	.000	.644	.511

B: Unstandardized coefficient. C: Constant, H: High (cm), W: Weight (kg), BMI: Body Mass Index (kg/m2), SBJ: Standing broad jump (cm), CMJ: Countermovement jump (cm), 10mR: 10 Meters Rerunning (s).

The R square value has shown that 44% of variances are explained by the results of the regression analysis. The regression analysis has shown a significant effect of the 10M running speed on the side steeps test ($p<0.05$). Also, when zero-order ($p=.07$) and partial correlation ($p=-04$) values have been analyzed even though it is not significant, the body mass index seems to tend to have a correlation with the side steeps test. Partial correlation has shown a significant correlation between a dependent variable and countermovement jump ($p=.03$), also a tendency to have a correlation between a dependent variable and standing broad jump ($p=0.06$), and weight ($p=.05$).

DISCUSSION

In order to determine the effects of the body composition factors, the jump performance, and the acceleration on the change-of-direction speed, tests such as height, weight, body mass index, standing broad jump, and 10-meter run has been analyzed.

The results of the analysis made on this study concur that the 10x5 meters shuttle run test is affected significantly by the 10 meters run acceleration test. A significant correlation between performance in an agility t-test and the 40-yard sprint time was found in both men and women [14]. Pauole et al. (2000) also found positive effects between agility training and power performance [14]. Based on the construct of the tests seems that among all factors that make these tests affect each other, face validity has been more effective on the results. The face validity determines the similarities in the construct of the test where as a result the tests have a tendency to have similarities in the motor ability requirements. The other studies show no difference was found between running speed and agility performances between soccer players according to their playing positions. The results show that soccer players have the same running speed and agility performance no matter what position they play [15].

When other independent variables have been taken out, the countermovement jump and standing broad jump also has shown significant correlation to the 10x5 meters shuttle run. Obviously, the counter-movement which includes a stretch-shortening cycle is important and has the same construct as the turns that happens at 10x5 meters run at every end of the run. Numerous studies have detailed significant relationships between jumping ability and linear sprint speed over a variety of distances [16, 17, 18, 19, 20]. The results from other studies provided support for these studies, as each jump test significantly correlated with all intervals from sprint [21].

Based on the literature, agility is expressed by the change-of-direction speed also the reactive strength index is an important factor. The effects of speed and strength/power on agility have been frequently investigated in previous studies [22-26]. A study by Čoh, M., et al. (2018), found a wide range of correlations were found between agility performance and sprint starting speed, sprint maximal speed, and reactive power [27]. So, the countermovement jump test has the construct and face validity that fits the reactive strength index which may be the cause of the significant correlations.

Similar results have been carried out when the same independent variables' effects have been analyzed to the side steeps test which is a specific test of change-of-direction speed in soccer players. The 10 meters run test has shown a significant effect on the side steeps test. So, it can be concluded that for the tests of agility such as 10x5m shuttle run and side steps, the key factor is acceleration. A study by Little & Williams (2005) showed significant correlations between sprint and zigzag agility test scores in professional football players [28]. In parallel, the other study showed significant correlations between 5 m, 10 m, and 30 m sprint tests with all of the agility tests we practiced on referees. Also, the results showed positive and higher correlations between agility tests in soccer referees [29]. Not very different from the 10x5 meters shuttle run, when other independent variables are not interfering the side steps test seems to be correlated closely to the jumps tests such as standing broad jump and countermovement jump. Propulsive power in a squat jump significantly correlated with the velocity in the Zig-Zag test and the t-test in a mixed group of male and female handball players (r = 0.42 * and r = 0.51 *, respectively) [31]. As we mentioned in the previous paragraphs, the ability agility besides the change-of-direction speed contains also reactive strength and maneuverability factors that are closely correlated to the stretch and shortening cycle, eccentric contractions signals for the concentric phase etc. In their study, Lockie et al. (2014) applied a training program with speed and agility training which specifically afforded eccentric muscle actions during rapid decelerations in recreationally trained sports athletes. In their study, these authors demonstrated significant speed performance improvements (i.e., change of direction and acceleration test and test) after 6 weeks of training [32].

CONCLUSION

We can conclude that based on the construct of the tests included in this research seems that among all factors that make these tests effects each other face validity has been more effective on the results. The face validity determines the similarities in the construct of the test where as a result the tests have a tendency to have similarities in the motor ability requirements.

We also can conclude that tests of explosive force also have shown a significant correlation to agility tests. Obviously, the counter-movement which includes a stretch-shortening cycle is important and has the same construct as the turns that happens at 10x5 meters run at every end of the run.

CONFLICT OF INTERESTS

No potential conflict of interest was reported by the authors.

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INFORMATION ABOUT THE AUTHOR(S):

Kastriot Shaqiri; (Corresponding Author); ORCID: 0000-0002-5945-0060; kastriot.shaqiri@unite.edu.mk; University of Tetovo, Faculty of Physical Education, Tetovo, North Macedonia
Fadil Mamuti: ORCID: 0000-0003-0086-6835; fadil.mamuti@unite.edu.mk; University of Tetovo, Faculty of Physical Education, Tetovo, North Macedonia
Blerim Suleymani: ORCID: 0000-0002-9058-354X; blerim.sulejmani@unite.edu.mk; University of Tetovo, Faculty of Physical Education, Tetovo, North Macedonia

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