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Original research article

THE INFLUENCE OF STRENGTH AND SPEED ON A SELECTED GROUP OF TESTS OF AGILITY

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Abstract. *The aim of this study is to determine the influence of strength and speed on a group of selected tests of agility. The sample of participants consisted of 77 second-year students of the Faculty of Sport in Ljubljana (28 females and 49 males). The tests of general motor skills were focused on the targeted motor characteristics of the participants (speed, agility, strength). The tests of agility and speed were measured using the Brower Timing System (Salt Lake City, UT, USA), and the tests of explosive strength using the Opto Jump (Microgate, Bolzano, Italy), an optical device which measures the duration of the contact and flight time, while the strength of the hand squeeze was measured using a Hydraulic Hand Dynamometer (Baseline, USA). The study determined a high correlation between speed and the criterion variables, especially in situations in which the eccentric-concentric contractions are not pronounced (zig-zag movement, lateral movement), and recognized the influence of the countermovement jump as a significant predictor of the manifestations which are characteristic of eccentric-concentric contractions.*

Key words: *strength, speed, agility.*

INTRODUCTION

For complex polystructural sports, it is a rule that numerous changes in movement can be identified in their specific movement structures. Authors give very different definitions of agility. It is considered a type of speed (Čoh, 2003), the primary dimension of coordination (Metikoš, Milanović, Prot, Jukić & Marković, 2003), as well as a feature which consists of the speed of the change of direction and cognitive factors (Young, James & Montgomery, 2002), the ability to keep and control proper posture while quickly change in direction through a series of movements (Twist & Benicky, 1995).

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Person (2001) cites four basic elements of agility: balance, coordination, programmed agility (familiar conditions of movement) and unprogrammed agility (unfamiliar conditions of movement). Viewed as a whole, on the basis of the research results of various authors, agility includes a complex manifestation of motor skills on which the quick and effective connection of speeding up and slowing down depends, that is, change in the direction and the repeated increase in speed and slowing down with the constant control of movement in the vertical, that is, horizontal direction (Drabik, 1996; Plisk, 2000; Verstegen & Marcello, 2001). Even though they disagree on a clear definition of agility, most authors consider agility an important component, necessary for success in many sports (Sporiš, Jukić, Milanović, & Vučetić, 2010; Tomljanović, Spasić, Gabrilo, Uljević, & Foretić, 2011; Ackland, Elliott, & Bloomfield, 2009).

This ability, from the viewpoint of the conditional fitness training of athletes, is of great importance. The development of agility is closely bound to the development of other motor skills, including: explosive strength, speed, coordination, balance, flexibility and precision (Piek, 1998). This multidimensional ability is highly genetically conditioned, but its development is susceptible to the influence of programmed sports training.

The authors of previous studies have regularly begun experimental procedures with the idea that different manifestations of agility can depend on predictors. On the basis of that assumption, trainers could make training sessions which would be aimed at developing the determined predictors. Nimphius, Mcguigan & Newton (2010) point out that most trainers and researchers try to use training programs to develop muscle strength and force in order to achieve a decrease in the duration of the manifestations which include changes in the direction of movement. By analyzing the published studies, it was concluded that authors mainly studied the influence of strength and speed on the manifestation of agility, and often reached the conclusion that these two motor features are relatively weak predictors of it (Young, Hawken & McDonald, 1996; Sekulić, Spasić, Mirkov, Ćavar & Sattler, 2013; Tomljanović et al., 2011). Little & Williams (2005) proposed the hypothesis that considering the similar morphological and biochemical basis of acceleration, maximum speed and agility, these values are highly connected. The results have shown a statistically significant correlation between acceleration, maximum speed and agility, but also that the tests which have the best intercorrelation (the test of acceleration and the test of maximum speed) share only 39% of the variance. Marković, Sekulić, & Marković, (2007) studied the connection between agility and the dimensions of strength and concluded that the factors of strength of the leg extensors are poor predictors of success in motor skills – agility among physically active males. Salaj & Marković (2011) studied the relations between the jumping ability, sprinting and the speed of change in direction, and their conclusion indicated the low correlations between separate components, citing limited transfer between them. Uzunović (2008) had found relation between strength and speed with sport dance which is characterized by often change of direction.

Speed can be defined as the “rate of performance” of an activity (Jovanović, Sporiš, Omrčen & Fiorentini, 2011) in some sports velocity at which one executes a movement can be the difference between success and failure. Muscular strength is the ability of a muscle or group of muscles to contract with maximal force. It describes how strong a muscle is or how much force it can exert. Development of muscle strength has a positive influence on certain abilities which leads to better preformance in sports.

The aim of this study is to determine the influence of strength and sprinting speed on a group of selected tests of agility. The tests of agility included: the T–TEST, which represents a combination of lateral and frontal agility, the KAMIKAZE test, which represents frontal agility in the forward-backward direction and the ILLINOST test, as a representative of complex agility.

THE METHOD

The sample of participants

The sample of participants consisted of 77 second-year students of the Faculty of Sport in Ljubljana (28 females and 49 males), aged 21,44±1,6 (females 21,21±1,31 and males 21,39±1,41). The testing took place during their regular classes in the facilities of the Faculty of Sport where the microclimate suited the standards of metric testing. The data collection procedure met the international ethical standards and was in accordance with the Helsinki declaration. All the participants voluntarily agreed to take part in the study and were informed in advanced of the testing protocol described in the study project. The ethics committee of the Faculty of Sport approved the study prior to its beginning.

The sample of variables

The tests of general motor skills were focused on the targeted motor characteristics of the participants (speed, agility, strength). The tests selected for this study were based on their use in previous studies. Tests used for assesment of agility were taken from Brown (2000). Each test was carried out three times with a suitable pause between repetitions so that the spent anaerobic sources of energy could be replenished, and the best score was used as the variable. All of the tests were carried out in the gymnasium of the Faculty of Sport in Ljubljana. The testing was preceded by a fifteen-minute warm-up which included running at a moderate tempo, movements to the side, exercises of dynamic flexibility and several types of jumps. Due to the daily variations in the fitness skills of the participants, all of the testings were carried out at the same time (in the period between 9-11 AM).

The tests of agility and speed were measured using the Brower Timing System (Salt Lake City, UT, USA), and the tests of explosive strength using the Opto Jump (Microgate, Bolzano, Italy), an optical device which measures the duration of the contact and flight time, while the strength of the hand squeeze was measured using a Hydraulic Hand Dynamometer (Baseline, USA).

The predictor variables

The motor tests used in this study were the tests of explosive strength (the countermovement jump (CMJ), continuous jumps for a duration of 15 sec and the standing triple jump), the tests of speed (the 60m sprint, the 10 m run on one leg) and the dynamometer of the hand grip as the test of strength.

The countermovement jump (CMJ) is the test for the evaluation of explosive strength of the vertical jumping ability, which requires that the jump be performed upwards with a previous eccentric contraction. The test was performed without a hand swing (the palms of the hands were on the hips during the performance of the jump). The participant first started from a semi-squat and then explosively stretched his legs and jumped up. The best result achieved over three consecutive measurings was taken as the test result, measured in centimeters. The pause between the tests was 10-15 seconds. The variable of this test was height (CMJH), flight time (CMJT) and the realized strength of the jump W/kg (CMJP).

The continuous jumps (VS15) made up the test for the evaluation of endurance in terms of explosive strength of the vertical type which included the performance of sequential high jumps with a previous eccentric contraction which lasted for 15 seconds. The test was performed without a hand swing (during the performance the palms of the hands were on the hips). The participant started from the position of a semi-squat after which he explosively stretched his legs and jumped into the air. The test result was the top score of three consecutive measurings. The pause between the tests was 5-8 minutes.

The standing triple jump (TRIM), unlike the athletic discipline of the triple jump, is performed with alternate changes in the left and right leg during the performance of the first and second test jump. The participant took off on both feet from the starting line and landed on one leg, took off on the same leg and jumpedon both legs as far as possible. A two-foot landing was obligatory, and it represented the third and final movement in the test. The participants were able to choose the leg on which they would start the triple jump, but could also change legs in the following two attempts. The highest result scored in three consecutive measurements was taken as the test result, measured in centimeters. The pause between the tests was 3-4 minutes.

The test for the evaluation of sprinting speed on the 60m run (S60M) was performed with a standing (high) start from a starting line set at 0.5 meters in front of the start line so as to avoid the influence of the starting technique on the result. The participants could choose which foot they wanted to start running on, but they could also change feet during the following two attempts, along with the start time (the participants started running when they felt ready). The best score achieved through three measurements was taken as the result, measured in the hundredth of a second. The pause between the measurings was 5-8 minutes.

The test of running on one leg (TJN) was performed at a distance of 10 meters between the start and finish line. The participants were able to choose which leg they wanted to perform the test on, but could also change their choice of leg in the next two attempts, as well as the starting moment (the participants started the run when they felt ready). The test result was the top score achieved after three trials, measured in the hundredth of a second. The pause between the measurings was 4-6 minutes.

The dynamometrics of the hand test (DINR) was performed in the position when the upper arm was parallel with the body and next to it, and the angle between the upper arm and forearm was 90º. The test was performed three times with a break of approximately 10 seconds between the attempts, and the better result was taken down in Newtons (N).

The criterion variables

The Kamikaze test (KAM) consisted of four lines. The first line was the starting point, and then three more lines followed at a distance of 4,8 and 12m from the starting line. The test started the moment when the participant activated the transmission bar, ran to the 4m line, made a 180 degree turn, returned back to the starting line, continued the same procedure to the 8m line, then to the 12m line, while passing over the starting line represented the end of the test, and the time marked by the transmission bar was taken as the variable. The test result was the best result scored over three measurements, noted down in the hundredths of a second. The pause between the measurings was 5-8 minutes.

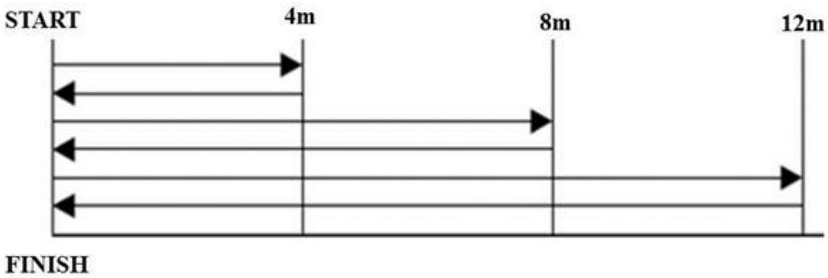

Fig. 1 Kamikaze test

The t-test (TT) consisted of four markers which were placed in the shape of the letter T. One at the start (A), then one at a distance of 10m (B), as well as two in the same plain at a distance of 5m on both sides (C, D). The participant started at point A, ran to point B and touched the base with his right hand, moving sideways on both feet (step-step sideways) and continued on to point C, touched the base with his left arm, then also by moving sideways (step-step sideways), made his way to point D, touched the base on the right side, returned moving sideways to base B, and then ran backwards to the starting line. The passing of the participant over the starting line represented the end of the test, and the time recorded with the passing near the transmission barwas taken as the variable. The test result was the best score achieved over three measurements, measured in the hundredths of a second. The pause between the measurings was 5-8 minutes.

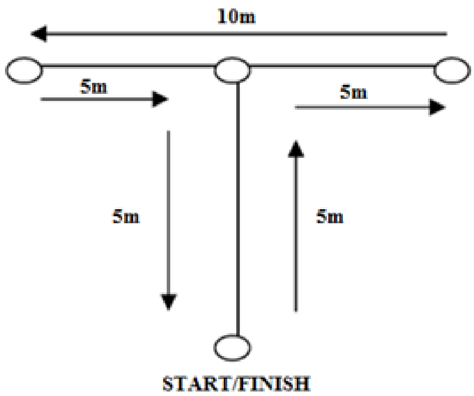

Fig. 2 Kamikaze test

The Illinois test (ILN) was performed in a space that was 10mlong, and 5m wide (the distance between the initial and final point). Four posts were set to mark the beginning, end, and two turning points, as well as an additional four posts were used to mark a straight line in the central part ofthe testing space at an equal distance (3,3m). The participant started the test from a starting position by breaking the transmission bar, ran along a path, as presented in the image, to the goal. The pass of the participant over the goal line represented the end of the test, and the time marked by the passingnear the transmission barwas taken as the variable. The best result scored over three measurements, measured in the hundredths of a second. The pause between the measurings was 5-8 minutes.

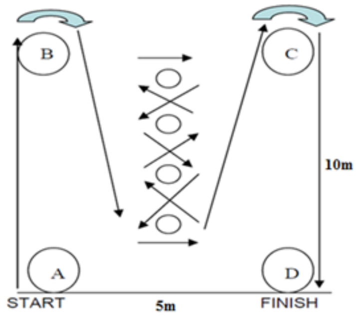

Fig. 3 Illinois test

Statistical data analysis

The statistical data analysis was carried out using the SPSS program. The basic descriptive parameters were calculated, the variable distribution and the intercorrelation matrix. The connection between the predictor and the criterion (the T – test, Kamikaze and Illinois test) was determined using a linear multiple regression analysis.

THE RESULTS

Table 1 shows the basic descriptive parameters of the motor space (strength, speed and agility), as well as data on the age, gender, height and body weight of the participants. Based on the minimal and maximal results of the variables for speed, strength and agility, we can determine that the sample of participants is quite heterogeneous, despite the fact that the process of positive selection had been adhered to (the participants included in the research were students of the Faculty of Sport).

Table 1 Basic statistics

	Mean	Minimum	Maximum	Std. Deviation
AGE (y)	21,44	19	30	1,67
BW (kg)	71,43	48	93	10,94
BH (cm)	176,46	150	194	9,41
TRIM (cm)	666,71	498	873	85,83
CMJT (s)	0,83	0,70	0,99	0,04
CMJH (cm)	40,16	18,90	57,30	7,40
CMJP (w/kg)	10,85	2,43	25,59	4,74
VS15 (cm)	26,50	15	43	5,35
TT (s)	8,57	7,37	10,64	0,71
KAM (s)	12,59	11,29	16,80	0,95
ILN (s)	17,29	13,30	20,28	1,12
S60M (s)	8,51	7,32	11,37	0,87
DINR (N)	40,48	22	67,50	11,52
TJN (s)	2,54	2,14	3,68	0,31

Legend: (AGE – age of the participants, BW – body weight, BH – body height, TRIM – the standing triple jump, CMJT – the time of the countermovement jump, CMJH – the height of the countermovement jump, CMJP – the force of the countermovement jump, VS15 – connected vertical jumps, TT – the T test, KAM – the Kamikaze test, ILN – the Illinois test, S60M – the 60 m sprint, DINR - the dynamometrics of the hand grip, TJN – running on one leg, y – age, kg – kilograms, cm – centimeters, s – seconds, N – Newtons)

Table 2 The correlation matrix of the space of explosive strength, speed and agility

	AGE (y)	BW (kg)	BH (cm)	TRIM (cm)	CMJT (s)	CMJH (cm)	CMJP (w/kg)	VS15 (cm)	TT (s)	KAM (s)	ILN (s)	S60M (s)	DINR (N)	TJN (s)
AGE (y)	1													
BW (kg)	0,173	1												
BH (cm)	0,059	0,828	1											
TRIM (cm)	0,018	0,664	0,642	1										
CMJT (s)	-0,001	-0,129	-0,175	-0,130	1									
CMJH (cm)	-0,041	0,588	0,511	0,862	-0,118	1								
CMJP (w/kg)	-0,180	0,293	0,303	0,511	-0,371	0,432	1							
VS15 (cm)	-0,066	0,264	0,289	0,628	-0,152	0,702	0,340	1						
TT (s)	0,039	-0,504	-0,460	-0,732	0,066	-0,718	-0,425	-0,664	1					
KAM (s)	0,054	-0,472	-0,469	-0,780	0,144	-0,757	-0,433	-0,628	0,855	1				
ILN (s)	-0,011	-0,407	-0,387	-0,682	0,165	-0,604	-0,301	-0,625	0,774	0,753	1			
S60M (s)	0,051	-0,673	-0,557	-0,844	0,169	-0,785	-0,408	-0,641	0,811	0,854	0,733	1		
DINR (N)	0,331	0,699	0,586	0,664	-0,116	0,646	0,282	0,460	-0,564	-0,553	-0,458	-0,616	1	
TJN (s)	0,087	-0,543	-0,464	-0,786	0,210	-0,756	-0,437	-0,638	0,793	0,852	0,728	0,893	-0,508	1

The tests of agility (TT, KAM, ILN) were determined to be in a mutually high correlation. They also showed a high correlation with the tests for the evaluation of speed (S60M, TJN) and the tests of explosive strength of the lower extremities (TRIM, VS15, CMJH). A more moderate correlation can be noted for the test of strength (DINR) and the anthropometric tests (TKG, VCM) in comparison to the tests of agility.

The T-test

The multiple correlation of the T–test with the predictor variables is R = 0.92. The amount of the explained variance is 79%. A dominant role was played by the flight time for the countermovement jump (CMJT, sig. 0,005), the strength of the countermovement jump (CMJP, sig. 0,029) and the 60 m sprint which is on the very verge of statistical significance (S60M, sig 0.071).

Table 3 The regression analysis of the T-test in the space of strength and speed

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Si
	,918[a]	0,843	0,795	0,344	Sig. 0,000
	Unstandardized Coefficients		Standardized Coefficients		
Imputation Number	B	Std. Error	Beta	t	Sig.
(Constant)	6,718	1,948		3,449	0,001
BW (kg)	0,016	0,009	0,26	1,764	**0,078**
BH (cm)	-0,006	0,009	-0,078	-0,642	0,521
TRIM (cm)	0,002	0,001	0,196	1,191	0,234
TJN (s)	0,534	0,36	0,226	1,482	0,139
CMJT (s)	-3,232	1,143	-0,191	-2,827	**0,005**
CMJH (cm)	-0,009	0,013	-0,088	-0,645	0,519
CMJP (w/kg)	-0,025	0,011	-0,17	-2,182	0,029
VS15 (cm)	-0,016	0,013	-0,123	-1,272	0,203
DINR (N)	-0,007	0,006	-0,114	-1,124	0,262
S60M (s)	0,301	0,165	0,359	1,826	**0,071**

The KAMIKAZE test

The multiple correlation of the KAMIKAZE test with the predictor variables is R = 0.93. The amount of the explained variance is 82%. A dominant role was played by running on one leg (TJN, sig. 0,013), and the 60 m sprint (S60M, sig. 0,001). The predictor variable of the countermovement test was on the verge of statistical significance, (CMJH, sig. 0,081) as was the dynamometrics of the hand (DINR, sig. 0,080).

Table 4 The regression analysis of the KAMIKAZE– test in the space of strength and speed

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Si
	,930[a]	0,865	0,823	0,44	Sig. 0,000
	Unstandardized Coefficients		Standardized Coefficients		
Imputation Number	B	Std. Error	Beta	t	Sig.
(Constant)	7,309	2,198		3,326	0,001
BW (kg)	0,045	0,01	0,545	4,377	**0**
BH (cm)	-0,022	0,01	-0,222	-2,114	**0,035**
TRIM (cm)	0,001	0,002	0,081	0,584	0,56
TJN (s)	0,967	0,389	0,31	2,484	**0,013**
CMJT (s)	-1,644	1,283	-0,074	-1,281	0,2
CMJH (cm)	-0,026	0,015	-0,204	-1,744	0,081
CMJP (w/kg)	-0,016	0,013	-0,086	-1,254	0,211
VS15 (cm)	0,02	0,015	0,112	1,348	0,178
DINR (N)	-0,011	0,006	-0,149	-1,754	**0,08**
S60M (s)	0,572	0,172	0,518	3,326	**0,001**

The Illinois test

The Ilinois test is the most complex motor task of agility. The multiple correlation of that test with the predictor is R= 0.87. The amount of the explained variance is 68%, which is the smallest value among all the tests of agility. None of the individual predictors is statistically significant.

Table 5 The regression analysis of the ILLINOIS test in the space of strength and speed

	R	R Square	Adjusted R Square	Std. Error of the Estimate	Si
	,870[a]	0,757	0,676	0,694	Sig. 0,000
	Unstandardized Coefficients		Standardized Coefficients		
Imputation Number	B	Std. Error	Beta	t	Sig.
(Constant)	11,318	4,143		2,732	0,007
BW (kg)	0,022	0,019	0,22	1,203	0,229
BH (cm)	0,004	0,018	0,037	0,251	0,802
TRIM (cm)	-0,004	0,003	-0,289	-1,255	0,214
TJN (s)	0,879	0,72	0,229	1,22	0,224
CMJT (s)	0,155	2,258	0,006	0,069	0,945
CMJH (cm)	0,032	0,028	0,198	1,137	0,256
CMJP (w/kg)	0,016	0,022	0,066	0,703	0,482
VS15 (cm)	-0,042	0,026	-0,195	-1,644	0,1
DINR (N)	0	0,012	-0,002	-0,015	0,988
S60M (s)	0,279	0,352	0,206	0,794	0,432

Discussion

The univariate connections between the predictor and criterion variables indicate the fact that we are dealing with relatively homogenous connections between the variables of strength and speed and the measures of agility studied here. Considering the possible occurrence of suppressor effects (the mutual connection between the predictor variables) more on the very nature of the connection will be determined through a regression analysis. The approach to a regression analysis proved to be justified in the analysis of the multivariate connections, that is, in the definition of the influence of certain predictors on the criteria.

The influence of certain predictors on the criteria is most pronounced in the case of the second criterion variable, where as the significant predictor in the overall regression model surfaces as the explanation of 82% of the variance of the criteria (KAM) the following variables are identified: the 60 m sprint (S60M), running on one leg (TJN), body weight (BW) and height (BH), while the variables of the triple standing jump (TRIM), the countermovement jump (CMJ) and the dynamometry of the hand grip (DINR) are on the verge of statistical significance. The regression model itself can be explained as the dimension of speed and explosive strength with an increase in body weight and height. The best results on this test are achieved by participants with high sprint speed, explosive strength of the lower extremities and pronounced body mass. This result was, basically speaking, expected. Namely, movement during the KAM test consists of the sprint back-forth. In such manifestations, the sprint can occur in several situations. Thus it comes as no surprise that it is precisely the sprint that has a great partial influence on the criterion. The explosive strength of the lower extremities, which is manifested in the tests of CMJ and TJN, probably did not make a significant contribution due to similar types of movement, but because of the fact that in numerous cases there is a change in the movement backward into the movement forward, where there is a change from the eccentric to the concentric contraction, which is similar to the manifestation needed during the performance of the jumps. What was unexpected was the positive influence of body mass on the result of the KAM test, due to the fact that for stopping a certain mass from moving at a certain speed in a certain direction, a certain amount of force is needed. However, high values of body height (BH) directly influence body weight. The sample of participants in this study consisted of the students of the Faculty of Sport, who were still active or recreational athletes, and increased body mass was the result of the increased muscle mass which characterizes this sample. Along with increased muscle mass, there was a high value of the general muscle mass which had a positive influence on agility, and thus the test of general muscle strength (DINR) is on the very verge of statistical significance with the criterion variable.

The TT variable has a very similar univariate correlational structure of partial connections as the previous variable (KAM). While the multivariate regression analysis isolates the variables of CMJT and CMJP with a 79% of variance, indicating that they are significant predictors, as well as the variables of S60M and BW as the predictors on the verge of statistical significance. The results suggest logical relations between explosive strength as the motor skill and agility as the complex motor skill, in which explosive strength makes up the main component. The test is characterized by a greater number of phases of increases and decreases in speed, four changes in direction of movement which require a pronounced transfer from the eccentric to the concentric contraction. These characteristics of movement, on their own, include the manifestation of explosive strength as a motor skill. What can be found are short bouts of sprint speed, which is the reason behind the smaller influence of speed on this criterion variable. Body weight, as in the case of the previous criterion variable, justifies its statistical significance through the greater values of muscle mass which characterizes the studied sample. This regression model is explained as the dimension of explosive strength with an increase in the values of speed and body weight.

In the case of the variable ILN, the percentage of variance of 67% is relatively large, and there was no partial influence of the predictor variables on the criterion variable. Since the Illinois test is in a motor sense more demanding than the other tests, the low partial influences can be explained through differences in the coordination-wise different conditions for the evaluation of speed and explosive strength in relation to the aforementioned test. In the explanation of this phenomenon we should probably take into consideration the possibly insufficient level of training of the participants to manifest their maximum abilities in the tests. The univariate correlation connections indicate a somewhat greater influence of the S60M and TJN variables. Due to the continued participant movement during the performance of the test, the manifestation of the change in direction does not require a pronounced eccentric contraction that we find in the countermovement jump. In these forms of agility in which circular movement occur, it is clear that the optimum model requires pronounced sprinting speed.

By analyzing the aforementioned correlations, the conclusion of this study is not in agreement with the conclusion of recent research (Young et al., 1996; Sekulić et al., 2013; Tomljanović et al., 2011) which claims that speed and explosive strength are relatively weak predictors of agility.

Researchers have found low to moderate correlation between strength and agility (Young et al (2002), Marković et al (2007), Chaouachi et al (2009)) and speed and agility (Young & Farrow (2006), Sekulić et al (2013)) in males. Sekulić et al. (2013) in the research conducted on a similar sample (32 male and 31 female student aged athletes), found that speed and power are most significant predictors in females, while balance test proved to be most important for males. Nimphius (2010) found strong correlation between relative strength and ability of rapid change of directions in female softball players. We suppose that sinceour sample included both male and female students, the results of the female students had an influence on the positive relations between speed and strength with agility.

CONCLUSION

The study determined a high correlation between speed and the criterion variables, especially in situations in which the eccentric-concentric contractions are not pronounced (zig-zag movement, lateral movement), and recognized the influence of the countermovement jump as a significant predictor in the manifestations which are characteristic of the aforementioned eccentric-concentric contractions. By analyzing the obtained results, we reached the conclusion that speed and explosive strength arecomponentsof agility.

Considering that agility movement structures can be successfully trained and learned, it is important for the sports where agility plays an important role to select persons with pronounced speed and explosive strength of the lower extremities. However, this study deals solely with the influence of the speed of running and the influence of explosive strength on agility. On the other hand, the study should be expanded to include the correlation with other motor skills (balance, coordination, flexibility), so as not to neglect the influence of the morphological makeup of the participant, and to study the so-called reactive agility (in which the participant should in a timely manner and in as short a time span as possible make a decision and react). Longitudinal studies should be carried out in which the transformational program would focus on the changes in a particular predictor skill (speed, explosive strength and reactive strength), which could lead to an answer to the question of which skills should be developed during training and to which extent the aforementioned agility should be acted upon.

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UTICAJ SNAGE I BRZINE NA IZABRANU GRUPU TESTOVA AGILNOSTI

Cilj ove studije je da odredi uticaj snage i brzine na izabrane testove agilnosti. Uzorak ispitanika sastavljen je od 77 studenata druge godine Fakulteta za Sport u Ljubljani (28 žena i 49 muškarca). Testovi opštih motoričkih sposobnosti skocentrisani su na ciljane motoričke karakteristike ispitanika (brzina, agilnost, snaga). Testovi agilnosti i brzine mereni su uz pomoć foto-ćelija (Brower Timing System, Salt Lake City, UT, USA), testovi eksplozivne snage korišćenjem Opto džampa (Opto Jump, Microgate, Bolzano, Italy), oprički uređaj koji meri vreme kontakta i vreme leta, snaga stiska šake merena je dinamometrom (Hydraulic hand dynamometer, Baseline, USA). Studija je utvrdila visoku korelaciju brzine sa kriterijskim varijablama pogotovo u situacijama u kojima ekscentrično-koncentrične kontrakcije nisu naglašene (cik-cak kretanja, lateralna kretanja) i prepoznala uticaj vertikalnog skoka sa pripremom kao značajan prediktor u manifestacijama koje su karakteristične ekscentrično-koncentrične kontrakcije.

Ključne reči: *snaga, brzina, agilnost.*