FACTA UNIVERSITATIS
Series: **Physical Education and Sport**, Vol. 17, No 3, 2019, pp. 591 - 599
https://doi.org/10.22190/FUPES191103053R

Research article

THE RELATIONSHIP BETWEEN MAXIMUM STRENGTH, THE VERTICAL JUMP, ACCELERATION AND CHANGE OF DIRECTION PERFORMANCE

UDC 796.42.012-057.87

Igor Ranisavljev, Milan Matić, Nenad Janković

Faculty of Sport and Physical Education, University of Belgrade, Belgrade, Serbia

Abstract. *The goal of the present study was to explore the relationship between Maximum strength, the vertical jump, acceleration and change of direction performance in healthy young male students. The sample of variables included the following variables: body mass (BM), one repetition maximum on the half-squat test (Squat 1RM), one repetition maximum normalized for body mass (Squat 1RM_rel), peak power during the concentric phase of countermovement jump (Ppeak CMJ), vertical jump height during CMJ (CMJ_H), time for the 20m sprint (20m Srint) and time for the agility T-Test (Agility T-Test). The relationship was tested with the Pearson Coefficient of linear correlation (r). The results showed significant correlation between body mass with Squat 1RM_rel and peak concentric power during CMJ (r=-.424, and r=.377, respectively). Peak concentric power during CMJ additionally has a significant correlation with the change of direction abilities, 20m sprint, and vertical jump height, (r=-.401; r=-.467; r=.656; p<0.05, respectively). Also, significant correlation was determined between the 20m Sprint and Agility T-Test (r=.443; r=-.570, respectively), and Agility T-Test vertical jump height (r=-.498). The level of relationships between Maximum strength, acceleration, COD and CMJ may be attributable to differences in the control and coordination of several muscle groups during execution of these tests.*

Key words: *Muscle Strength, Acceleration, Agility, Countermovement Jump, Relationships, Students*

INTRODUCTION

In the majority of sport activities, athletes need different manifestations of strength, speed and power. The speed over the first steps, the ability to accelerate and change of direction (COD) and stop and jump has great importance for successful performance.

Received November 03, 2019/ Accepted December 26, 2019
Corresponding author: Igor Ranisavljev
Faculty of Sport and Physical Education, University of Belgrade, Blagoja Parovića 156, 11000 Belgrade, Serbia
Phone: + 381 11 3531000 • E-mail: igor.suns@gmail.com

The acceleration phase for the majority of athletes is much shorter in comparison with top level sprinters (Baker & Nance, 1999). Achieving maximum speed as soon as possible has huge performance advantage in sport. Understanding the interrelations between the abilities to display different components of speed, strength, COD and stretch-shorten cycle (SSC) during sprinting and jumping tasks is of essential importance for performance improvement. Maximum strength is considered an essential physical component for speed and jump performance training, especially for plyometric training and optimal jumping height (Matić & Ranisavljev, 2018). The assessment of power can be used to track performance changes over a period of time and determine the efficacy of training programs (Kraemer et al., 2001).

Studies about relationships between muscle strength, sprint and COD performance showed a variety of results in the range of different sports and samples of different training experience. Also, leg strength and power are frequently assessed using the single joint isokinetic knee test quite nonspecific for regular strength training, and COD ability is assessed using different types of COD tests. Some studies indicated that the COD T-test has a moderate correlation with the 40-yard dash and the countermovement jump (Sassi et al., 2009). As well, a weak relationship was found between linear sprint performance and COD performance (Tsitskarsis, Theoharopoulus, & Garefis, 2003; Buttifant, Graham, & Cross, 1999) and also between strength and COD performance (Young, James, & Montgomery, 2002; Young, Hawken & McDonald, 1996). Novel studies indicated that individuals with a higher level of Maximum strength might experience potentiation of 20-m sprint performance after a 5RM split squat exercise (Lockie, Orjalo, & Moreno, 2018). While some studies showed a high correlation between Maximum strength and speed parameters in elite soccer players (Wisløff, Castagna, Helgerud, Jones, & Hoff, 2004) others reported opposite results in elite rugby players (Cronin & Hansen, 2005). As well, only one research involving a small sample of female softball players (Nimphius, McGuigan, & Newton, 2010), has tried to holistically identify the association between parameters of Maximum strength, acceleration, COD and jumping performance.

The goal of the present study was to explore the relationship between Maximum strength, the vertical jump, acceleration and change of direction performance in healthy young male students.

METHODS

Participants

The sample included 30 male participants, students of the Faculty of Sport and Physical Education, University of Belgrade (age 20.73±1.26 years; body height 183.9±6.63 cm; body mass 77.4±9.5 kg; percentage of body fat content 11.6±3.6, Mean±SD). All of the participants during the previous two years had not participated in professional sport, except at the level of university sport. They were physically active through their standard academic curriculum (average 4-7 classes per week that included low-, moderate-, and high-intensity exercises). The participants did not report any medical problems or recent injuries that could compromise the tested performance. Before the experiment, all participants received a complete explanation about the purpose and procedures of the study, as well as the possible risks. The Ethics Committee of the Faculty of Sport and Physical Education, University of Belgrade approved the implementation of the research.

Testing procedures

All of the experimental measurements were carried out at the Research Laboratory of the Faculty of Sport and Physical Education, University of Belgrade from 10 A.M. until 2 P.M. Testing included Anthropometric measures and performance tests. The experiment consisted of 2 testing sessions separated by at least 3 days of rest.

The first session included anthropometric measurements and body composition assessment. Procedures recommended by the International Society for the Advancement of Kinanthropometry served as guide for anthropometric measurements (Norton, 2000). Body height and body mass were measured to the nearest 0.5 cm and 0.1 kg, respectively. Body composition (percentage of body fat content) was assessed using method of the bioelectric impedance (In Body 720, Biospace, Seoul, Korea). Also, in the first session, familiarization for performance testing was performed.

Performance Testing procedures were performed on the second day and they included: maximum strength (1RM squat test), the Countermovement jump (CMJ test), acceleration (20m sprint) and change of direction (agility T-test). Standardized 30 min warm-up procedures preceded every testing session and they included medium intensity running, static and dynamic stretching as well as sprinting and jumping exercises with gradual increase in intensity. All tests were performed twice with a 3-min break between the attempts, and the better result was used for further analysis.

Maximum Strength Testing. A standardized procedure (McBride, Triplett-McBride, Davie, & Newton, 1999) with the standard Smith machine was applied in assessment of the leg extensor strength through 1RM squat test on the. Prior the warm-up procedure and during the squatting, a manual goniometer was used to visually establish the attainment of a 90˚ knee flexion angle. The applied loading and the number of the associated warm-up sets and repetitions are given as follows: 30% (8 repetitions), 50% (4-6 repetitions), 70% (2-4 repetitions), and 90% (1 repetition) of an estimated 1RM either based on the participant's recommendation or calculated as 1.5 times the participant's body mass (Logan, Fornasiero, Abernethy, & Lynch, 2000). The test consisted of 2-3 trials of 1RM assessment. Each participant was asked to move the external load upward in a controlled but forceful fashion, back to the normal standing position. Adequate rest is provided between the trials (3-5 minutes).

Countermovement jump testing. According to the manufacturer's specifications (AMTI, Inc., Newton, MA, USA) the force plate was mounted and calibrated, with sampling frequency was set at 1000 Hz. In the assessment of muscle power in vertical jumping the guidelines provided by Vanrenterghem, De Clercq, & Cleven (2001) were used. The instruction was to achieve the highest vertical jump possible, with the shortest duration of ground contact. During the jumps, the hands were placed on the hips, in order to eliminate the impact of the arm swing.

The Agility T-Test and *20m sprint test*. Using an electronic timing system (Globus, Microgate, SARL, Italy) agility and sprinting performances were recorded. For the Agility T-test, one pair of the electronic timing system sensors mounted on tripods was set approximately 0.75 m above the floor and was positioned 3 m apart facing each other on either side of the starting line. For the 20m sprint test, two pairs of the electronic timing system sensors were placed at the starting and finish lines. The Agility T-Test (figure 1) was used to determine speed with directional changes such as forward sprinting, left and right shuffling, and backpedaling based on the protocol outlined by Pauole, Madole, Garhammer, Lacourse, & Rozenek, 2000).

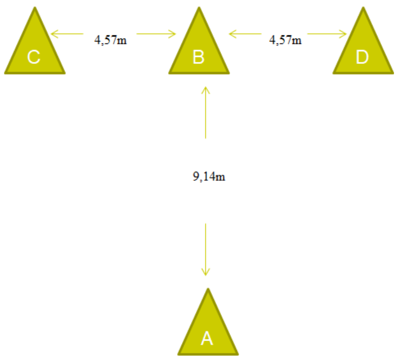

Fig. 1 Agility T-test: an athlete runs straight forward from cone A to cone B, then shuffles to the left (cone C), and shuffles to the right (cone D), and shuffles back (to point B), before running backwards to the start position (point A) (Pauole et al., 2000).

The sample of variables

The sample of variables included nine variables: body height (BH), body mass (BM), percent of body fat mass (PBF), one repetition maximum on the half-squat test (Squat 1RM), one repetition maximum normalized for body mass (Squat 1RM_rel), peak power during the concentric phase of the countermovement jump (P_{peak} CMJ), vertical jump height during CMJ (CMJ_H), time for the 20m Sprint and time for the Agility T-Test. In order to increase the validity of the obtained results, all data recorded for the half-squat test were normalized in order to eliminate the influence of body size. Data normalization was carried out in relation to body mass according to Jarić (2002).

Normalization of the results from the 1 RM half-squat test was calculated by the formula:

$$R = 1\ RM / BM^{0.67}$$

R - Normalized value of the results on the half-squat test;
1RM - one repetition maximum on the half-squat test;
BM - body mass of participants.

Statistical analysis

Descriptive statistics included the central and dispersion parameters: the arithmetic mean (M) and standard deviation (SD). Before using the Pearson product-moment correlation coefficient (r), preliminary analyses were carried out to test normality, linearity, homogeneity of variance and determine if there are any outliers. Outliers were determined by the Box-plot. The r values in the ranges from .10 to .29 are considered to be low, from .30 to .49 moderate, and over .50 high (Cohen, 1988). The reliability of the calculated dependent variables was high: the 20 m sprint (ICC=.91), the T test (ICC=.95), P_{peak} CMJ (ICC=.90). No significant differences were recorded between 2 consecutive trials (dependent-samples t-test, sig. .406 and .08 respectively). The relationship between one repetition maximum (1RM), body mass (BM), one repetition maximum normalized with body mass (Squat 1RM_rel), peak power during the concentric phase of the countermovement jump (P_{peak} CMJ), the 20m Sprint and the Agility T-Test were tested with the Pearson Coefficient of linear correlation (r). The level of statistical significance was p<.05 for all measurements. Statistical analysis was performed using SPSS 16.0 (SPSS Inc, Chicago, IL, USA) and Excel 2003 (Microsoft Corporation, Redmond, WA, USA).

RESULTS

The basic descriptive statistics (Mean±SD) for anthropometric and performance variables are presented in Table 1.

Table 1 Basic descriptive statistics of the sample

Variable	Mean±SD	MIN - MAX
BM (kg)	77.4 ± 9.5	60.5 - 95.6
Squat 1RM (kg)	128.1 ± 21.3	90.0 - 180.0
Squat 1RM_rel	7.0 ± 1.3	4.7 - 10.5
P_{peak} CMJ (W)	227.12 ± 30.14	177.92 - 319.49
20m Sprint (s)	3.23 ± 0.14	3.01 - 3.67
Agility T-Test (s)	10.32 ± .40	9.72 - 11.19
CMJ_H (cm)	35.25 ± 5.58	24.25 - 42.73

The correlations between variables are presented in Table 2.

Table 2 Correlations between physical and performance variables

Variables		BM	Squat 1RM	Squat 1RM_rel	P_{peak} CMJ	20m Sprint	Agility T-Test
Squat 1RM	r	.034					
	p	.857					
Squat 1RM_rel	r	**-.424***	**.888****				
	p	.020	.000				
P_{peak} CMJ	r	**.377***	.071	-.130			
	p	.040	.707	.492			
20m Sprint	r	.137	-.097	-.146	**-.467****		
	p	.471	.612	.441	.009		
Agility T-Test	r	-.208	-.160	-.050	**-.401***	**.443***	
	p	.271	.397	.791	.028	.014	
CMJ_H	r	.135	.266	.166	**.656****	**-.570****	**-.498****
	p	.476	.155	.379	.000	.001	.005

Legend: *p<.05; ** p<.01

The results showed significant correlation between body mass with Squat 1RM_rel and peak concentric power during CMJ (r=-.424, and r=.377, respectively). Peak concentric power during CMJ additionally has a significant correlation with the change of direction abilities, 20m sprint, and vertical jump height, (r=-.401; r=-.467; r=.656; p<.05, respectively). Also, significant correlation was determined between the 20m Sprint and Agility T-Test (r=.443; r=-.570, respectively), and Agility T-Test vertical jump height (r=-.498).

DISCUSSION

Power is considered as a fundamental ability for successful athletic performance (Kraemer et al., 2001; Potteiger et al., 1999). The data collected in this study would initially suggest that the vertical jump, acceleration, and change of direction share common physiological and biomechanical determinants, as well as that level of concentric power production is the most important parameter. Concentric force development is essential for sprint start performance (5m sprint) and the Maximum concentric jump power is related to sprint acceleration (Sleivert & Taingahue, 2004). For all three tests in our study (CMJ, 20m and COD), peak concentric effort from the leg extensor apparatus was desired for good performance. High angular velocity in the CMJ, which is a consequence of the rotation different body segments, leads to complete muscle activation in this test. High muscle activation during the eccentric contraction leads to an increase in the overall work during the CMJ (Stojanović, Čoh, & Bratić, 2016) and this explains the medium high correlation between CMJ power and CMJ height.

CMJ jump height showed the medium-high correlation with acceleration and COD performance (r = -0.5 to -0.57). Our results are in line with previous studies of Young, Hawken, and McDonald (1996) who reported that CMJ in football players is significantly related (r=-.66) to their 20m sprint times. Cronin and Hansen (2005) reported similar correlations (r=-.56 to -.62) between CMJ and 5m, 10m and 30m sprint. The magnitude of the correlations in these studies, including the current research in the sample of students, is surprisingly similar despite the variation in the population, training status and the sprint distance used. While COD performance requires a dominantly horizontal component, this indicates the positive effects of coordinated work of leg extensor apparatus both in vertical and horizontal testing performance. Previous reports on samples of female volleyball players of different level showed that training dominantly in the vertical domain may also improve certain types of COD performance (Barnes et al., 2007). As well, negative medium correlation with 20m and COD suggest that with higher power production, the time needed for these tasks will be shorter. It should be noted the both the sprint and COD require a relatively high level of running technique and coordination in COD, so it is reasonable not to expect a high correlation between these tests and peak leg power. This kind of relationship is possible to explain due to differences in kinematical and kinetic characteristics of different speed and power tests. Therefore it is commonly accepted to analyze the vertical jump, acceleration and COD as relatively independent abilities (Vescovi & Mcguigan, 2008; Little & Williams, 2005).

Medium correlation between the linear 20m sprint and COD test is in line with different previous reports. Previous studies in professional soccer and rugby players reported that acceleration and agility are relatively independent attributes with a relatively low level of explained variance (Little & Williams, 2005; Cronin & Hansen, 2005). This also suggests that some other different factors, including high power production and coordination, contribute to performance in each speed test. Thus, the predictors of sport speed on shorter distances could be quite different compared to 100-m track sprint speed (Cronin & Hansen, 2005). The reason for this is the running technique of athletes who participate in ball sports, which differ from the running technique of the sprinters (Young, James & Montgomery, 2002). Therefore it is possible that the predictors of acceleration, Maximum speed and COD will have some similarities, but also could significantly vary between athletes. As well, considering high number of different COD tests, the level of correlation between sprint and COD depends on the type of test used for change of direction.

It might be expected that a significant relationship may exist between squat 1RM and CMJ due to movement patterns similarities. However, on the present sample of students, although a low-level correlation exists (r=.266, p=.15), there was no significant relationship between Maximum strength (1RM squat) and CMJ test performances (p>.05). Considering the low speed of execution during the Maximum squat test and relatively fast execution during CMJ, these tests share very little variance and asses different strength qualities: maximum strength and speed strength. This explains why speed strength abilities (Maximum power) are significantly related to the vertical jump, acceleration and COD performance while 1RM Maximum strength is not. This supports the argument that strength and power abilities are not the same (Abernethy, Wilson, & Logan, 1995) and that they should be evaluated separately (Cronin & Hansen, 2005).

The non-existence of a significant correlation between Maximum muscle strength in the 1RM squat and speed/jump tests can be explained by the fact that acceleration, COD and CMJ tests require a high level of synergistic work of the entire body, while 1RM squats represent the basic maximum strength potential of the leg muscles. Similar results regarding the relationship of Maximum strength and sprint/vertical jump ability were reported for a sample of basketball players (Alemdaroğlu, 2012). In the sample of rugby players, Cronin and Hansen (2005) reported a non-significant (r=-.01 to -.29) relationship between 3RM squat strength and 3 acceleration tests. As well, for a sample of professional rugby players there was no significant relationship between 3RM squat and 10m (r=-.06) and 40m (r=-.19) sprint performance (Baker & Nance, 1999). On the other side, a few studies involving samples of soccer players showed different results. Wisløff et al. (2004) showed that Maximum strength in the half squat highly correlates with sprint and jump performance on a sample of top level soccer players. Also, a significant correlation between 1RM squat and CMJ was found in high level American soccer players (Nuzzo, Mcbride, Cormie, & Mccaulley, 2008). These differences are likely to be explained by the elite participants involved in these studies. Explanations for achieving high work in the concentric phase of the CMJ is that this movement offers the opportunity for the muscles to gradually develop force (Stojanović et al., 2016). Considering that elite athletes have a higher level of neuromuscular coordination, with the ability to produce more force, they can transfer Maximum strength potential to the vertical jump much better than healthy young students involved in this study. This supports the point that cross-sectional relationships between variables should be evaluated cautiously and that correlation per se does not necessary represent causation for the performance of different samples.

CONCLUSION

The results of the study show that the production of peak concentric power during the CMJ has a significant correlation with the vertical jump, acceleration and change of direction performance in a sample of healthy young males. This accentuates the importance of peak power of the leg muscles for different speed and power performances. As well, the results showed that Maximum strength in the squat cannot adequately express or provide insight into all the mechanisms responsible for the athletic performance of young males.

However, it does not mean that a parameter such as maximum strength is not important for the performance or staying injury free. The level of relationships between Maximum strength, acceleration, COD and CMJ may be attributable to differences in the control and coordination of several muscle groups during the execution of these tests.

REFERENCES

Abernethy, P., Wilson, G., & Logan, P. (1995). Strength and power assessment. *Sports Medicine*, *19*(6), 401-417.

Alemdaroğlu, U. (2012). The relationship between muscle strength, anaerobic performance, agility, sprint ability and vertical jump performance in professional basketball players. *Journal of Human Kinetics*, *31*, 149-158.

Baker, D., & Nance, S. (1999). The relation between running speed and measures of strength and power in professional rugby league players. *The Journal of Strength & Conditioning Research*, *13*(3), 230-235.

Barnes, J.L., Schilling, B.K., Falvo, M.J., Weiss, L.W., Creasy, A.K., & Fry, A.C. (2007). Relationship of jumping and agility performance in female volleyball athletes. *The Journal of Strength & Conditioning Research*, *21*(4), 1192-1196.

Buttifant, D., Graham, K., & Cross, K. (1999). Agility and speed of soccer players are two different performance parameters. *Journal of Sports Science*, 17, 809-816.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (*2nd ed*.). Hillsdale, NJ: Erlbaum

Cronin, J. B., & Hansen, K. T. (2005). Strength and power predictors of sports speed. *The Journal of Strength & Conditioning Research*, *19*(2), 349-357.

Jarić, S. (2002). Muscle strength testing. *Sports Medicine*, *32*(10), 615-631.

Kraemer, W.J., Mazzetti, S.A., Nindl, B.C., Gotshalk, L.A., Volek, J.S., Bush, J.A., & Fleck, S.J. (2001). Effect of resistance training on women's strength/power and occupational performances. *Medicine & Science in Sports & Exercise*, *33*(6), 1011-1025.

Little, T. & Williams A.G. (2005). Specificity of acceleration, maximum speed, and agility in professional soccer players. *The Journal of Strength and Conditioning Research*, 19(1), 76-78.

Lockie, R.G., Orjalo, A., & Moreno, M. (2018). A pilot analysis: can the bulgarian split-squat potentiate sprint acceleration in strength-trained men?. *Facta Universitatis Series Physical Education and Sport, 15*(3), 453-466.

Logan, P., Fornasiero, D., Abernethy, P., & Lynch, K. (2000). Protocols for the Assessment of Isoinertial Strength. In: C.J. Gore (Ed.). *Physiological Tests for Elite Athletes,* (pp. 200-222). IL: Human Kinetics.

Matić, M., & Ranisavljev, I. (2018). Maximum muscular strength as a predictor of optimum drop height. *Facta Universitatis Series Physical Education and Sport*, *16*(3), 577-585.

McBride, J. M., Triplett-McBride, Davie, A., & Newton, R.U. (1999). A comparison of strength and power characteristics between power lifters, Olympic lifters, and sprinters. *The Journal of Strength & Conditioning Research*, *13*(1), 58-66.

Nimphius, S., McGuigan, M.R., & Newton, R.U. (2010). Relationship between strength, power, speed, and change of direction performance of female softball players. *The Journal of Strength & Conditioning Research*, *24*(4), 885-895.

Norton, K.I. (2000). *The evolution of the size and shape of athletes: Causes and consequences*. PhD Thesis, International Society for the Advancement of Kinanthropometry.

Nuzzo, J.L., Mcbride, J.M., Cormie, P., & Mccaulley, G.O. (2008). Relationship between countermovement jump performance and multijoint isometric and dynamic tests of strength. *The Journal of Strength & Conditioning Research*, *22*(3), 699-707.

Pauole, K., Madole, K., Garhammer, J., Lacourse, M., & Rozenek, R. (2000). Reliability and validity of the T-test as a measure of agility, leg power, and leg speed in college-aged men and women. *The Journal of Strength and Conditioning Research* 14, 443-450.

Potteiger, J.A., Lockwood, R.H., Haub, M.D., Dolezal, B.A., Almuzaini, K.S., Schroeder, J.M., & Zebas, C.J. (1999). Muscle power and fiber characteristics following 8 weeks of plyometric training. *The Journal of Strength and Conditioning Research, 13*, 275-279.

Sassi, R.H., Dardouri, W., Yahmed, M.H., Gmada, N., Mahfoudhi, M.E., & Gharbi, Z. (2009). Relative and absolute reliability of a modified agility T-test and its relationship with vertical jump and straight sprint. *The Journal of Strength & Conditioning Research*, 23(6), 1644-1651.

Sleivert, G., & Taingahue, M. (2004). The relationship between Maximum jump-squat power and sprint acceleration in athletes. *European Journal of Applied Physiology*, *91*(1), 46-52.

Stojanović, N., Čoh, M., & Bratić, M. (2016). The role of countermovement in the manifestation of explosive leg strength in vertical jumps. *Facta Universitatis Series Physical Education and Sport*, *14*(1), 13-22.
Tsitskarsis, G., Theoharopoulus, A., & Garefis, A. (2003). Speed, speed dribble and agility of male basketball players playing in different positions. *Journal of Human Movement Studies*, 45, 21-30.
Vanrenterghem, J., De Clercq, D., & Cleven, P. V. (2001). Necessary precautions in measuring correct vertical jumping height by means of force plate measurements. *Ergonomics*, *44*(8), 814-818.
Vescovi, J. D., & Mcguigan, M. R. (2008). Relationships between sprinting, agility, and jump ability in female athletes. *Journal of Sports Sciences*, *26*(1), 97-107.
Viitasalo, J. T., Salo, A., & Lahtinen, J. (1998). Neuromuscular functioning of athletes and non-athletes in the drop jump. *European Journal of Applied Physiology and Occupational Physiology*, *78*(5), 432-440.
Wisløff, U., Castagna, C., Helgerud, J., Jones, R., & Hoff, J. (2004). Strong correlation of Maximum squat strength with sprint performance and vertical jump height in elite soccer players. *British Journal of Sports Medicine*, *38*(3), 285-288.
Young, W. B., James, R., & Montgomery, I. (2002). Is muscle power related to running speed with changed of direction?. *Journal of Sports Medicine and Physical Fitness*, *42*(3), 282-288.
Young, W., Hawken, M., & McDonald, L. (1996). Relationship between speed, agility and strength qualities in Australian Rules football. *Strength Conditioning Coach*, *4*(4), 3-6.

POVEZANOST MAKSIMALNE SNAGE, VERTIKALNOG SKOKA, UBRZANJA I PROMENE PRAVCA

Cilj ovog istraživanja bio je da se istraži odnos između maksimalne snage, vertikalnog skoka, ubrzanja i promene pravca, mladih i zdravih muškaraca. Uzorak varijabli obuhvatao je sledeće promenljive: telesna masa (BM), jednoponavljajući maksimum u polučučnju (Squat 1RM), jednoponavljajući maksimum normalizovan za telesnu masu (Squat 1RM_rel), maksimalna snaga tokom koncentrične faze skoka sa počučnjem (Ppeak CMJ), visina kod vertikalnog skoka tokom CMJ (CMJ_H), vreme sprinta na 20m (20m Srint) i vreme za sprovođenje T-testa agilnosti (Agility T-Test). Povezanost je testirana sa Pearsonovim koeficijentom linearne korelacije (r). Rezultati su pokazali značajnu povezanost između telesne mase sa jednoponavljajućim maskimumom u polučučnju (Squat 1RM_rel) i vršnom koncentričnom snagom tokom skoka sa počučnjem (Ppeak CMJ) (r=-. 424, i r=.377, respektivno). Najviša koncentrična snaga tokom CMJ ima takođe, značajnu povezanost sa sposobnošću promene pravca, sprintom na 20m i vertikalnom visinom skoka (r=-.401; r=-.467; r=.656; p<0,05, tim redosledom). Takođe, utvrđena je značajna povezanost između sprinterskog trčanja na 20m, T-testa trčanja i okretnosti (r=.443; r=-. 570, respektivno) i vertikalne visine skoka I T-Testa agilnosti (r=-. 498). Nivo odnosa između maksimalne snage, ubrzanja, COD i CMJ može se pripisati razlikama u kontroli i koordinaciji nekoliko mišićnih grupa tokom izvođenja ovih testova.

Ključne reči: *snaga mišića, ubrzanje, agilnost, skok sa počučnjem, povezanost, studenti*