AGILITY, SPRINT AND VERTICAL JUMP PERFORMANCE RELATIONSHIP IN YOUNG BASKETBALL PLAYERS

Denis Čaušević[1], Ensar Abazović[1], Semir Mašić[1], Amila Hodžić[1], Šemso Ormanović[1], Ivor Doder[1], Nedim Čović[1], Rasim Lakota[1]

[1] Faculty of Sport and Physical Education, University of Sarajevo, Bosnia and Herzegovina

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Abstract

This study aimed to examine the relation between agility, sprint ability, and vertical jump performance of young basketball players. Fifty (n=50) young basketball players (mean±SD: age = 12.63±0.95; height = 160.84±6.31 cm; body mass = 50.82±6.88 kg) participated in the study. The agility T-test and 505 test were assessed to determine agility, 10m and 20m sprint was measured to determine sprint ability and countermovement jump (CMJ) for jumping performance. The results of Pearson's Product Moment Correlation analysis indicated large to very large relation between agility tests and sprint performance (r = 0.61 to 0.85); agility and jump performance (r = - 0.64 to - 0.67); sprint and jumping performance (r = -0.59 to -0.77). The results of the study suggest that agility, sprint, and jumping performance share common physical demands, therefore it is necessary to develop them during the training.

Keywords*: athletic performance, training, speed, power, field test*

Introduction

In the last few years, it's noticeable a growing interest of researchers in improving the performance of athletes especially in team sports (Popović et al., 2013; Bjelica, Popović & Gardašević, 2016). Basketball, by its structure, is a poly-structural, aerobic-based anaerobic sport (Čaušević, D. 2016; Delextrat & Cohen, 2009; Meckel et al., 2009), which requires movements of high intensity such as jumps, accelerations, and rapid change of direction (COD) (Čaušević, Ćirić, Čović & Ormanović, 2017). Due to the complexity of movements during a basketball game, many coaches were advised to focus on short and intense actions (speed and agility) (Jakovljevic et. al., 2012) such as T-test, different vertical jumps, and short distance (5-10m) sprints.

Several authors have suggested that agility, strength, and speed are predominant skills in basketball players (Alemdaroğlu, 2012; Erčulj, Blas & Bračič, 2010; Bhadu & Singh 2016; Šimonek, Horička & Hianik, 2017). Agility, as a skill, is considered a physiological prerequisite in basketball (Hoffman, Epstein, Einbinder & Weinstein, 2000), because basketball players are often involved in various COD movements during the game. Also, sprinting ability includes that players, during the game, must run as fast as possible, both in offense and in defense. Jumping ability as the main representative of explosive strength in basketball plays an important to take the ball during rebounds (offense or defense).

As for the young players in the training process, it is necessary to assess physical capacities make a quality selection, or monitor the efficiency of training. However, due to many tests and the primary focus of the researcher for assessment of performances (Asadi, 2016), it is necessary to determine relations between different tests and their validity in contemporary studies.

Many authors pointed to the relation between sprint ability and jump performance (Barr & Nolte, 2011; Köklü, Alemdaroğlu, Özkan, Koz, & Ersöz, 2015; Bissas & Havenetidis, 2008; Young, Cormack & Crichtonm, 2011; Vescovi & Mcguigan, 2008). However, in terms of a relation between agility, sprint ability, and jumping performances in basketball players, there is a relatively small number of studies (Shalfawi, Sabbah, Kailani, Tønnessen, & Enoksen 2011; Alemdaroğlu, 2012; Asadi, 2016; Bhadu & Singh, 2016; Poomsalood & Pakulanon, 2015). Most of the mentioned authors investigated the relationship between these motor abilities in older basketball players (age ≥ 17) and found correlations ranging from -0.47 to -0.76, provides evidence that 4-week plyometric training can be an effective training program to improve agility, speed, and vertical jump height at the same time in basketball players (Poomsalood & Pakulanon, 2015), whilst Bhadu & Singh (2016) compared basketball and handball players and have found significant difference in speed but not agility.

Since the period between 11 and 14 (age) is considered the second phase of youth sports training (Jakovljevic et al., 2012), the athletes of this age must work on improvement of basic motor skills, to select talents. Therefore, this study aimed to determine the relationship between agility, sprint ability, and vertical jump performance of young basketball players. Hypothetically, there should be a significant and relatively high interdependence between these motor abilities.

Methods

Subjects

Fifty (n=50) young basketball players (mean±SD: age = 12.63 ± 0.95 yrs.; height = 160.84 ± 6.31 cm; body mass = 50.82 ± 6.88 kg) voluntarily participated in this study, with a written signed consent of their parents. This study was conducted during period of 2018/2019 in pre-season training and all subjects were not included in any other trainings or matches. Subjects were members of the same team (KK Spars - Sarajevo) and they all played in elite academy league, and had trainings 4 times a week.

Procedures

Testing was conducted during the training (14:00) in basketball gym, where height (cm) and weight (kg) was measured. Subjects were introduced with procedure of testing. Measurement was done by mr.sc. of sport and physical education. Subjects were asked to give their best during the test.

Anthropometric measurements

Body height was measured with possible mistake of 0.1 cm, measured by digital stadiometer (InBody BSM 370, Korea), while body mass was measured on a digital scale with an accuracy of 0.1 kg on digital scale TANITA BC-420MA (TANITA Europe GmbH, Sindelfingen, Germany).

Vertical jump measurements

Vertical jump performances (countermovement jump - CMJ) were measured Optojump (Microgate Bolanzo, Italy) (Mašić et al., 2020). Testing was conducted by procedure of Glatthorn et al. (2011), which includes complete explanation of tasks after which there is a warm-up, treadmill running (5 min on 6-10 km/s), submaximal vertical jumping for familiarization (5 minutes), and stretching of lower extremity muscles. Each subject made 3 jumps and every jump was made from standing point with their hands on the hips (to prevent lunge), bend their knees (approx. 90°) run as fast as possible and after that to jump as high as possible. Examinees were explained to leave the floor with the knees and ankles extended and land in a similarly extended position. Period of rest between each jump was 30 secs, and the best jump of subject was taken as the result.

Sprint tests

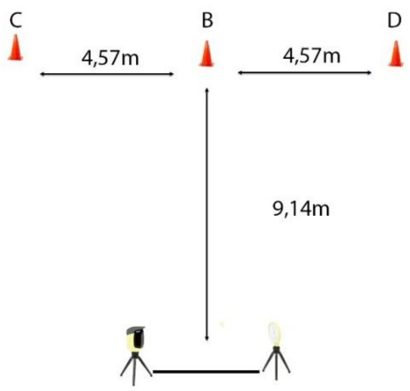
Sample subjects performed maximum 2 sprints on 20m (with 10 m sprint time also recorded) on basketball court with wooden pad. Period of rest between sprints is 3 min. Before testing sprint, subjects had warm-up which included 10 min of easy jogging (60 – 70% of HRmax) which was followed by 5-minute easy exercises, where lower limbs were in focus (skipping, cariocas etc.). Photocells were used for recording time, and the best result was noted (Microgate photocell, Bolanzo, Italy).

Agility measurements

T- test protocol

Test was conducted according to procedure and recommendation of author Semenick (1990) (Figure 1), in order to be very objective and reliable test for determination subjects had 2 attempts intercepted by 3-minute rest between attempts. This test is considered to be very objective and reliable test for determination agility in basketball players (Jakovljevic et al., 2012). Subjects start from standing position at line between photocells, after which they do linear sprint to cone B. After that they slide to the left side (cone C), they reach cone with their left hand, then they slide and touch cone D. They come back and touch cone B, then run backward to the start position. Photocells are set at the goal line (Microgate photocell, Bolanzo, Italy), and only their best results are recorded.

Figure 1. T-test protocol



505 protocol

Test was conducted by procedure and recommendation by Draper (1985). Subjects move from the standing position with their foot on the line on which pair of photocells are placed. (Microgate photocell, Bolanzo, Italy), after which on their own sign they go and do sprint to the line of 15m (on 10m is set next pair of photocells). They reach the line by their foot and make a twist of 180º, then they sprint additional 5m through the timing gates (Figure 2). All subjects had 2 attempts with 3-minute rest between attempts and only their best results were recorded.

Figure 2. 505 protocol

Statistical analyses

The mean and standard deviation values for each test were calculated for all players. The relationships between agility, vertical jump performance and sprint ability were analyzed using the Pearson Correlation Analysis (r), with the level of statistical significance set at p ≤ 0.05. Criterion for interpretation of the amount of the correlation is taken from the author Hopkins (2002). An r value was interpreted as: 0 to ± 0.30 was considered small; ± 0.31 to ± 0.49 moderate; ± 0.50 to ± 0.69 large; ± 0.70 to ± 0.89 very large; and ± 0.90 to ± 1 near perfect for predicting relationships. All statistical analyses were processed using Statistic for Windows, version 13 (TIBCO Software Inc., Palo Alto, CA, USA).

Results

The anthropometric characteristics and test performance of young basketball players are shown in Table 1. The results of the Pearson correlation indicate large to very large correlation between agility tests times (505 and T-test) with 10m and 20m sprint times. Countermovement jump showed large to very large correlation with both agility tests times (505 and T-test) and sprint performances (10m and 20m sprint times) (Table 2).

Table 1. Basketball player's anthropometric characteristics and test performance

	Minimum	Maximum	Mean	Std. Dev.
Age (year)	12.00	14.00	12.63	0.95
Height (cm)	149.10	172.90	160.84	6.31
Body mass (kg)	39.40	63.20	50.82	6.88
10-m sprint (s)	1.19	2.58	2.19	0.21
20-m sprint (s)	3.25	4.39	3.85	0.27
CMJ (cm)	16.70	37.60	24.02	5.21
505 test (s)	4.32	5.75	5.06	0.35
T – test (s)	10.59	15.12	12.40	1.26

CMJ - Countermovement jump

Table 2. Correlations between agility, sprint ability and vertical jump performance

	505 test (s)	T – test (s)	CMJ (cm)	10-m sprint (s)	20-m sprint (s)
505 test (s)	1				
T – test (s)	.767**				
CMJ (cm)	-.636**	-.667**			
10-m sprint (s)	.740**	.614**	-.595**		
20-m sprint (s)	.850**	.749**	-.775**	.720**	1

Discussion

The purpose of the present study was to examine relationships between agility, sprint ability, and vertical jump performance of young basketball players. Obtained results of the study show existence of statistically significant relations between mentioned performance indicators.
This study showed the existence of a large to a very large correlation between agility (T-test and 505 test), sprint, and vertical jumps in young basketball players (r = 0.614 to 0.850). Agility is a multi-featured physical ability, which is affected by speed, strength, balance, flexibility, and coordination (Chaouachi et al. 2009; Asadi, A. 2016). These findings are confirmed by this study.

Based on the correlation of coefficients values (Table 2) correlation between 505 test with 10m (r = 0.740) i 20 m (r = 0.850) are identified as large and very large correlation of T-test with 10m (r = 0.614) i 20 m (r = 0.749). In line with the present study, Asadi (2016) reported a strong correlation between T-test and 20m (r = 0.77) similarly to the results obtained in the study of Latorre, et al. 2018 (T-test with 20 m; r = 0.458); Jakovljevic et al. (2012) (T-test with 20 m; r = 0.517); However, obtained results are opposite to the results of Chaouachi et al. (2009), where significant correlations between T-test and sprint on 5, 10 and 30 m are not evident. Possible reasons for this are the age of subjects and different tests, which affect the results of the study. Since subjects are young athletes (age = 12.63 ± 0.95), their ability to perform muscle power and different morphological development of muscles, which directly leads to different results in applied tests of agility (Jakovljevic et al., 2012).

The findings of the present study also show vertical jump ability has a large correlation with agility tests (r = - 0.636 to - 0.667) of young basketball players. Findings of this study is in correlation to the studies of Chaouachi et al. (2009) (CMJ with T-test; r = - 0.61); Alemdaroğlu, 2012 (CMJ with T-test; r = - 0.59). based on this acknowledgment and previous acknowledgment's it is possible to state that obtained results are caused by specific and characteristic basketball movements, which demand a high level of agility and jumps from basketball players. Agility is a complex ability, which demands the development of muscular strength and power (Sheppard & Young, 2006) confirms previous conclusions. However, the results of Latorre Román et al. (2018) study, show that there is no statistically significant correlation of CMJ with T-test, and the reason for this is the age of the subjects.

On the other hand, CMJ indicate large correlation with 10m sprint time (r = - 0.595) and large correlation with 20m sprint time (r = - 0.775). Similar results obtained Asadi, A 2016 (CMJ with 20m; r = - 0.61); Shalfawi et al. (2011) (CMJ with 10m; r = - 0.41; and CMJ with 20m; r = - 0.46). Since CMJ performance is considered to be crucial for a basketball game (Cortis et al., 2011), they are mostly trained under maximal and fatigue conditions, it can be assumed that young players early develop not only good jump capacities but sprint performances as well. Since the height of the jump made a statistically bigger correlation with sprint on 20m than 10m, this can be explained by the fact that athletes need to express maximal muscle effort action at the beginning, after which the body is speeding up forward and gradually reaches maximum velocity. As the athlete is speeding up in a distance of 20m contacts with the pad becomes shorter, which forces leg strength to be more important than power (Weyand, et al., 2000). This implicates that basketball players in this study expressed higher force on the ground in the acceleration phase (10 to 20m) than at the start of acceleration (0 to 10m). This is also confirmed by the study of Baker and Nance (1999) who state that tests that include high-intensity movement (CMJ) in the end have stronger relations with top speed than in start acceleration.

Conclusion

In summary, findings on agility, jumping ability, and sprint performance indicate a significant correlation, provide another piece of information that needs to be further confirmed, and lead to the finding that they should be essential in the physical preparation of young basketball players. Since dynamic movements are included and they demand the same energy system (phosphagen system ATP-PC) it is necessary to prepare players for these kinds of conditions during the match.

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Corresponding information:

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Correspondence to: *Denis Čaušević*
University: *University of Sarajevo - Faculty of Sport and Physical Education*
E-mail: *denis.causevic@fasto.unsa.ba*