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Motoric Abilities of Basketball Players According to Different Ranks of Competition and Playing Positions

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Abstract

Basketball is a complex sports game, interrupted by the constant change of defense and offense, and it is a combination of cyclic and most often acyclic movements. Since basketball involves sudden and intense changes in the movement direction, high frequencies of initiating dribbling and movement in posture, stoppings, and physical contact allowed by game rules, there is a link between the abilities needed for successful basketball playing and playing positions. This research aimed to determine the differences in motoric abilities, i.e. the change of direction speed, explosive strength, and running speed of basketball players who compete in different ranks of the competition in relation to the playing positions. The sample of 25 basketball players was divided into two subsamples in relation to the rank of the competition (elite and sub-elite). Eleven motoric ability tests were used in the study (change of direction speed – four tests, explosive strength – four tests, and running speed – three tests). Applying the analysis of variance (ANOVA and MANOVA), differences in motoric abilities were determined between basketball players of different ranks of a competition in relation to the playing positions in the team. Based on the results, a conclusion was reached that the players differ in favor of a higher rank of a competition in the tested abilities, namely those ones who play in the forward position. It can be inferred that a higher rank of a competition requires better quality preparation and players who differ in tactical thinking and better performance of measured abilities.

Keywords: *basketball, change of direction speed, explosive strength, running speed, playing positions, level of competition*

Introduction

Basketball is a complex sports game, interrupted by the constant change of defense and offense, and it is a combination of cyclic and most often acyclic movements (Erčulj, Blas & Bračič, 2010). Basketball is also characterized by frequent periods of high-intensity play which require frequent changes of direction, as well as specific technical skills and well-developed speed of movement (Stojanović et al., 2018). Since basketball involves sudden and intense changes in the course and direction of movement, high frequencies of initiating dribbling and movement in posture, stoppings, and physical contact allowed by the game rules, there is a link between abilities needed to successfully playing basketball and playing positions (Hobbs, 2008). Playing positions, as well as the specificities they bring with them in terms of preparation and tasks in the game, have been the subject of many studies (Apostolidis, Nassis, Bolatoglou & Geladas, 2004; Sallet et al., 2005; Cormery, Marcil & Bouvard, 2008; Mitić et al., 2018; Kocić, Mitić, Berić, Bojić & Milenković, 2019).

Playing positions can be mainly divided into three groups - guards (point and shooting), forwards (small and power), and centers. Besides, with the change of rules and the development of basketball tactics, playing positions are classified according to the specific role of the individual (Harris,

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Stone, O'Bryant, Proulx & Johnson, 2000). Guards play a more important role in organizing the basketball match-play. Forwards should help the guards in the organization of the offense when they are in offensive activities, while during defense they help to enclose their own basket in order to win the ball. Centers should use their superior characteristics and abilities compared to other players, to take the best possible position with their specific movement during the offensive and defensive jump and setting blocks (Sallet, Perrier, Ferret, Vitelli & Baverel, 2005). Each position in the team should necessarily have particular requirements and characteristics of motoric and specific motoric abilities, as well as technical and tactical mastery, in order to meet the goals of the basketball game and to implement planned realization during the match (Kryeziu & Asllani, 2016). Skillfulness, explosive strength, and sprint performance should be a prerequisite for successful basketball playing at the elite level, in all positions (Abdelkrim, Chaouachi, Chamari, Chtara & Castagna, 2010). Researches show that there are significant differences in physical abilities between basketball players of different levels of competition (in favor of higher-ranking players), especially in explosive and repetitive strength (Vukašević, Bubanja, Žarković, Jabučanin & Mašanović, 2021). Differences can also be seen in the maximum speed and isoinertial power (Marković, Ćuk, Radonjić & Momčilović, 2021). In terms of playing position, the biggest differences in physical abilities (agility and explosive strength) are recorded between guards and centers (Mitić et al., 2018).

One of the main problems in the game is selecting the best set of players who will be sent to the court to achieve the best result at any time during the game. This choice is a complex and delicate task because it can be influenced by many factors (Bianchi, Facchinetti & Zuccolotto, 2017). The change of direction speed, explosive strength, and running speed, in combination with other characteristics and abilities from the equation of specification of success in basketball, give an opportunity to create top basketball players. High-intensity basketball activities consist of a large number of jumps and explosive accelerations, often followed by quick stops, which lead the players to achieve maximum speed. Since it should be pointed out that considering the size of the basketball court (28x15m), there is not enough space to achieve the maximum running speed, then in the training process, it should be insisted on the development of starting speed and ability to accelerate. The activities of rapid change of direction and jumps are vastly applied in the game in terms of basketball structure, regardless of the playing position, so the training and the development of these abilities are of great importance in basketball. (Asadi & Arazi, 2012; Lehnert, Hůlka, Malý, Fohler & Zahálka, 2013; Nikolić, 2016; Nikolić, Kocić & Veličković, 2017; Mitić et al., 2018; Kocić et al., 2019). The change of direction speed depends on the number of factors, which include coordination, mobility of articular systems, reaction speed, stability of the locomotor system, and biomechanical structure of the movement. Therefore, during the game, it is necessary to make an adequate and correct decision depending on the situation, in order to achieve the expected results. A properly made decision depends primarily on the perception and analysis of the situation based on an assessment of available options.

This research was conducted out of the need to obtain additional information and suggestions for easier creation of training programs in specific playing positions in order to develop as many skills specific to basketball players as possible. So, this research aimed to determine the differences in motoric abilities, i.e. the change of direction speed, explosive strength, and running speed of basketball players who compete in different ranks of the competition in relation to the playing positions.

Methods

Participants

The sample consisted of 25 male basketball players between 19 and 30 years old, divided into two subsamples: a group of 12 elite basketball players (First Basketball League of Serbia team – Napredak Aleksinac) and a group of 13 sub-elite basketball players (Second Basketball League of Serbia team – Konstantin Niš), each of them divided into three groups (guards, forwards and centers). All of the players were in good health and had at least five years of basketball practice experience. This study was approved in advance by the Ethics Committee of the Faculty of Sport and Physical Education, University of Niš (approval number 04-2170/2). Having been informed about the details of the testing each participant voluntarily provided written consent for taking part in it. Participants, sports experts, and club management were acquainted with the manner and rules of testing. The consent of the club's management that the data obtained through testing could be used for scientific purposes was also acquired.

Measuring instruments

Four tests were used to estimate the change of direction speed: Agility T-Test, Hexagon Agility Test, Illinois Agility Test, and Lane Agility Drill (Pauole, Madole, Garhammer, Lacourse & Rozenek, 2000; Sigmon, 2005; Beekhuizen, Davis, Kolber & Cheng, 2009). The following tests were used to assess the explosive strength of the lower extremities: Squat jump, Countermovement Jump, Drop Jump and One-legged Countermovement Jump (Bosco, Luhtanen, & Komi, 1983). "Optojump" was used for measuring the explosive strength of vertical jumping performance (Microgate, Italy). Three tests were used to estimate running speed: 10x5m Shuttle Test (Boone & Bourgois, 2013; Kucsa & Mačura, 2015; Nikolić, Berić, Kocić & Daskalovski, 2017), Sprint fatigue test, and 15m running speed (Aleković, 2016; Nikolić et al., 2017).

Statistical processing of data

Data processing was performed by the statistics program SPSS (IBM Corp. Released 2011. IBM SPSS Statistics for Windows, Version 20.0). From the descriptive statistics, the basic central and dispersion parameters were used (Mean and St.Dev). To determine changes in the change of direction speed, explosive strength and running speed between basketball players of different ranks of competition about the playing positions, analysis of variance was used (ANOVA and MANOVA). The level of statistical significance is $p<0.05$.

Results

The following chapter presents the obtained research results in change of direction speed, explosive strength and running speed (Tables 1, 2 and 3), as well as their interpretation.

Using univariate analysis of variance of change of direction speed according to the playing positions between elite and

Table 1. Differences in Change of Direction Speed Between Elite and Sub-elite Basketball Players According to Playing Positions

Change of direction speed - Guards	Sub-elite basketball players	Elite basketball players	ANOVA	
			F	p
Agility T Test	9.35 (±0.30)	9.55 (±0.41)	0.64	.454
Hexagon Agility Test	13.00 (±1.34)	12.83 (±1.90)	0.02	.890
Illinois Agility Test	15.95 (±0.87)	16.33 (±1.06)	0.31	.597
Lane Agility Drill	12.85 (±0.84)	12.78 (±1.09)	0.01	.917
			MANOVA F= 2.13; p= .280	
Change of direction speed - Forwards	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
Agility T Test	10.00 (±0.67)	9.32 (±0.33)	3.31	.119
Hexagon Agility Test	11.75 (±0.84)	10.79 (±0.41)	4.27	.084
Illinois Agility Test	17.40 (±1.07)	16.22 (±0.45)	4.15	.088
Lane Agility Drill	13.95 (±0.93)	12.76 (±0.30)	5.96	.050*
			MANOVA F= 15.10; p= .025*	
Change of direction speed - Centers	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
Agility T Test	10.00 (±0.14)	10.00 (±0.50)	0.00	.992
Hexagon Agility Test	13.44 (±1.03)	14.79 (±1.39)	2.79	.139
Illinois Agility Test	17.00 (±0.80)	16.97 (±0.41)	0.00	.948
Lane Agility Drill	14.24 (±0.71)	13.46 (±0.40)	3.74	.094
The data represent Mean (±St.Dev) *Differences between groups are presented at the level of p<0.05			MANOVA F= 4.10; p= .100	

sub-elite basketball players (Table 1), it was found that there was no statistically significant difference in any test at guards. At forwards, there was a significant difference only in the LA Drill test (.050), while at centers there was also no statistically significant difference. At the multivariate level, there was no statistically significant difference betweenthe two teams for the guards and centers, while for forwards there was a statistically significant difference (.025).

Table 2. Differences in Explosive Strength Between Elite and Sub-elite Basketball Players According to Playing Positions

Explosive strength - Guards	Sub-elite basketball players	Elite basketball players	ANOVA	
			F	p
SJ	35.23 (±5.53)	38.30 (±3.39)	0.90	.380
CMJ	38.13 (±4.19)	36.77 (±4.21)	0.21	.665
DJ	46.90 (±7.24)	48.28 (±5.99)	0.09	.780
O-L CMJ	18.05 (±3.23)	23.15 (±2.47)	6.28	.046*
			MANOVA F= 6.38; p= .080	
Explosive strength - Forwards	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
SJ	34.85 (±5.01)	51.35 (±2.54)	34.48	.001*
CMJ	37.45 (±5.07)	43.95 (±2.92)	4.93	.068
DJ	44.63 (±5.79)	58.48 (±6.31)	10.47	.018*
O-L CMJ	16.07 (±2.88)	26.60 (±0.49)	52.07	.000*
			MANOVA F= 16.14; p= .023*	
Explosive strength - Centers	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
SJ	34.74 (±2.23)	37.10 (±6.08)	0.66	.442
CMJ	38.54 (±4.27)	35.63 (±6.01)	0.73	.421
DJ	47.88 (±7.01)	45.40 (±5.88)	0.32	.590
O-L CMJ	20.76 (±3.07)	18.98 (±4.24)	0.54	.486
The data represent Mean (±St.Dev) *Differences between groups are presented at the level of p<0.05			MANOVA F= 4.49; p= .079	

Note. SJ: squat jump; SMJ: counter movement jump; DJ: drop jump; O-L CMJ: one-legged counter movement jump

Using univariate analysis of variance of explosive strength according to the playing positions between elite and sub-elite basketball players (Table 2), it was found that at guards a statistically significant difference exists only in One-legged Countermovement Jump (O-L CMJ .046). At forwards, a significant difference was shown in Squat jump (SJ .001), Drop jump (DJ .018) and One-legged Countermovement Jump (O-L CMJ .000), while at centers there was no statistically significant difference in any test. At the multivariate level, no statistically significant difference was shown between guards and centers of the two teams, while at forwards, a statistically significant difference was shown (.023).

Table 3. Differences in Speed BetweenElite and Sub-elite Basketball Players According to Playing Positions

Speed - Guards	Sub-elite basketball players	Elite basketball players	ANOVA	
			F	p
15m running speed	2.59±0.07	2.51±0.13	1.15	.324
10x5m Shuttle Test	15.19±0.62	14.42±0.63	3.01	.133
Sprint fatigue test	0.98± 0.02	0.99±0.02	1.17	.320
			MANOVA F= 1.20;p= .417	
Speed - Forwards	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
15m running speed	2.53±0.16	2.32±0.08	5.96	.050*
10x5m Shuttle Test	14.18±1.51	13.79±0.21	0.26	.625
Sprint fatigue test	1.00±0.02	0.97±0.02	6.00	.050*
			MANOVA F= 2.42; p= .206	
Speed - Centers	**Sub-elite basketball players**	**Elite basketball players**	**ANOVA**	
			F	**p**
15m running speed	2.58±0.16	2.52±0.10	0.48	.512
10x5m Shuttle Test	13.70±0.33	14.53±0.65	6.24	.041*
Sprint fatigue test	1.00±0.03	0.98±0.03	1.25	.300
The data represent Mean (±St.Dev) *Differences between groups are presented at the level of p<0.05			MANOVA F= 2.59;p= .166	

Using univariate analysis of the variance of speed according to the playing positions between elite and sub-elite basketball players (Table 3), it was determined that there was no statistically significant difference among guards in any speed test. In the case of forwards, there are significant differences in 15m running speed (.050) and Sprint fatigue test (.050), while at centers there was a statistically significant difference in only one test, 10x5m Shuttle Test (.041). At the multivariate level, no statistically significant difference was found in the playing positions of the two teams.

Discussion

The results of this research showed that there are differences in basketball players who compete in a higher rank of a competition and that the level of preparation and quality of players determines the playing position. These results are also confirmed by other researches (Köklü, Alemdaroğlu, Koçak, Erol & Fındıkoğlu, 2011; Korkmaz & Karahan, 2012). Basketball is a sports game in which height is a crucial factor. When eliminating the factors of body height and weight, it was found that the differences between the individual positions of the players are reduced, but not completely eliminated (Erčulj, Bračič & Jakovljević, 2011). Training of change of direction speed should be individualized depending on the playing position in the team (Delextrat & Cohen, 2009; Abdelkrim et al., 2010; Ademović, 2016). Today's approach to change of direction speed training differs from the one that used to be applied in the past and involves a combination of different training systems. Directed training of change of direction speed is the basis for training technical and tactical tasks of players in all playing positions (Trunić & Mladenović, 2015). The results obtained this way were expected, considering the fact that the tasks of change of direction speed type are the most pronounced with players in external positions and they confirm former results that, players in external positions achieve better results than players in internal positions, especially those who play in the higher ranks of competition (Scanlan, Tucker & Dalbo, 2014; Sekulić et al., 2017; Garcia-Gil et al., 2018; Ferioli et al., 2018; Trapero et al., 2019). The results of this study also confirm that players who play in the position of centers achieve the weakest results in the conducted testing (Abdelkrim et al., 2010; Erčulj et al., 2011), and that basketball technical and tactical skills (specific basketball motorics and tactical thinking) are the factors that make the difference between these two groups of basketball players (Ilić, 2013). That is why it can be concluded that activities such as change of direction speed are highly correlated with competitive success. The fact that the forwards from a higher rank achieved better results than the ones in a lower rank is probably a consequence of the specificities of movement which characterize that very position, as well as of a better subjective feeling of focus on the game, which is reflected primarily in the quality of the players themselves because they play in a higher rank of the competition (Gonzalez, Hoffman, Scallin-Perez & Fragala, 2012). The research also confirms that the level of physical qualities and performance of explosive strength is significantly related to the quality of the players themselves in relation to the rank of the competition. The results also showed that in the vertical jump tests, centers achieved significantly lower results than players in other positions, while forwards have more muscular

strength than players in other positions (Boone & Bourgois, 2013; Kostopoulos, 2015; Pehar et al., 2017). Unlike researches (Mitić et al., 2018; Stamenković, 2018) in which the obtained results show that the greatest difference between guards and centers is in favor of the guards and that the differences are the greatest between guards and forwards and guards and centers, and that they also exist between forwards and centers only in some of the variables of explosive strength, this research found that only forwards differ for the benefit of those who compete in a higher rank of the competition. It is important to note that during the game, the maximum speed of movement is almost never developed because the ability to perform repeated runs of high, submaximal intensity is still a more dominant form (Alp, 2020). When the basketball game is decomposed, it can be seen that sprints usually last from two to six seconds (McInnes, Carlson, Jonnes & McKenna, 1995), at distances of 10–20m (Drinkwater, Pyne & McKenna, 2008), which is insufficient to develop maximum speed. However, it should be emphasized that all aspects of this motoric ability are present and necessary during the game where there are constant and fast shifts of defense and offense, a large number of sprints over short distances, as well as requirements for efficient and fast placement (reaction speed) in the best possible position for receiving the ball and successful realization. Also, the speed of movement with the ball during dribbling is very important, which is reflected in the reaction speed of the lower and upper extremities in relation to the direction of movement of the opponent and the ball (Zwierko & Lesiakowski, 2007). In the not-so-distant past, players were classified into positions in relation to morphological characteristics and based on technical-tactical tasks (Bianchi et al., 2017), while in recent years the situation is slightly different in the sense that playing positions (especially "low positions" of guards and forwards) are classified exclusively according to physical abilities, among which speed occupies a significant place. Hoare (2000) found in his study that running speed and playing position are related and that guards are significantly faster and more successful in running speed and change of direction in relation to forwards and centers, which was not confirmed in this study.

Conclusion

A conclusion was reached that the players differ in tested abilities in favor of a higher rank of the competition, especially those ones who play in the forward position. It was found that a higher rank of the competition requires better quality preparation and players who differ in tactical thinking and better performance of measured abilities. Previous studies had mainly dealt with playing positions according to pre-determined tasks and activities in the team. However, today's basketball especially stands out and appreciates the so-called polyvalent players who could play in all positions. There are a significant number of such players who play in the highest quality leagues. Monitoring the state of the change of direction speed, explosive strength, and running speed of basketball players and comparison with the corresponding sample can affect more correct planning and programming of the training process. The results obtained in this way provide information and suggestions for experts in the field of sports and coaches who should create a training program in specific positions, to develop as many skills specific to basketball players as possible. In addition, team leaders from lower levels of competition are encouraged to refine talent identification based on key fitness determinants in playing positions highlighted in current findings. Fitness trainers could develop training programs based on the weaknesses of the players shown during the testing, taking into account the specificity of the situation during the game in each position. In particular, it is proposed to focus more attention on training of change of direction speed and the explosive strength of players in the position of center. This can be integrated into tactical offensive and defensive training, to improve their efficiency and response to situational impulses.

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