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ORIGINAL SCIENTIFIC PAPER

Differences of Physical Fitness Performance between Basketball Players from Different Competitive Levels (Elite and Sub-Elite) in the State Union of Serbia and Montenegro for the 2004/2005 Season

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Abstract

The purpose of this research was to describe the physical fitness of basketball players from different competitive levels for the 2004/2005 season and to make comparisons between them. The sample included 96 participants divided into two sub-samples; the first sub-sample comprised 48 participants who competed in the First Basketball League of Serbia and Montenegro; the second sub-sample comprised 48 participants who competed in the Second Basketball League of the State Union of Serbia and Montenegro. Standardized tests for the assessment of physical fitness performance were used. Data were analysed using SPSS software, and the descriptive statistics were expressed as a mean and standard deviation for each variable, while the t-test for small independent samples was carried out to detect the possible differences. The results showed that significant differences were found for all nine tests, and the highest differences are found in the results of sit-up and vertical jump tests. Therefore, these findings may give coaches from the region better working knowledge and help them select talented players in the best manner possible.

Keywords: *basketball, motor ability, first league, second league*

Introduction

Basketball is a sport that is essentially available to anyone because it does not require expensive equipment and courts are found in many places; this accounts for the sport's incredibly rapid spread and great popularity (Dogan & Ersoz, 2019). More than 25 million people play basketball casually worldwide (Stopher, 2020); however, the success and opportunity to play basketball professionally is reserved exclusively for the most talented and most capable individuals (Popovic, Akpinar, Jaksic, Matic, & Bjelica, 2013; Vukasevic, Mitrovic, & Masanovic, 2020).

The basic measuring unit of success in elite basketball is the score of the game (Arruda et al., 2014); first, it is necessary to select athletes with an appropriate physique (Monsoon, Brasil, & Hlusko, 2019; Masanovic, 2018), with exceptional psycho-physical predispositions (Karalejić & Jakovljević, 2008; Remiszewska, Miller, Graczyk, & Lachowicz, 2020), and then through long-term and diligent work to improve their performance (Branquinho et al., 2020; Jeon & Eom, 2020; Gardasevic & Bjelica, 2018; Gardasevic & Vasiljevic, 2017). It is generally known that an elite basketball player must possess a polyvalent technique, exceptional morphological characteristics, high functional capacity, as well as explosiveness, coordination, precision and balance, accompanied by cognitive factors of per-

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ceptual reasoning (Trninić, 1996; Sekeljic & Stamatovic, 2008; Karalejić & Jakovljević, 2008; Dragaš, 2011; Ozen, Atar, & Koc, 2020). However, the extent of the influence of certain elements on the success of elite athletes remains difficult to distinguish. This is also influenced by the fact that basketball is a game of divided roles (point guard, the shooting guard, the small forward, the power forward and the centre), and that different characteristics are needed to fulfil different tasks in the game (Krespi, Sporis, & Popovic, 2019; Masanovic, 2019). Therefore, a separate specification equation can be compiled for each playing position (Dragaš, 2011). To specify the extent of the influence of individual characteristics on success would contribute to discovering the nuance that distinguishes good players and those who win medals and to make the training process more economical; this would further contribute to shifting the boundaries of sporting success in certain disciplines.

Characteristics contributing to success in basketball are possible to identify by comparing elite basketball players and sub-elite-level players or comparing basketball players and athletes from other sports with the same fitness level (Delextrat, & Cohen, 2008). In this study, the role of physical fitness on the success of elite basketball players was considered, and success was equated with the rank in which they compete. Therefore, this study aims to determine the level of motor abilities of basketball players from different competitive levels (elite and sub-elite) to assess whether there are differences in motor abilities between basketball players of different levels of competition which motor abilities have the highest difference.

Method

The population of this retrospective cross-sectional study comprises a total of 96 male basketball players divided into two groups. The first sub-sample consisted of 48 players who play for four teams in First League of the State Union of Serbia and Montenegro (Hemofarm from Vršac, Atlas from Belgrade, Mornar from Bar, Lovcen from Cetinje), with an average age of 23.92±5.03 years, while the second sub-sample consisted of 48 players who play for four teams in the Second League of the State Union of Serbia and Montenegro (Vrbas from Vrbas, Lions from Vršac, Ulcinj from Ulcinj, Tivat from Tivat), with an average age of 22.27±4.03 years. The study was approved by the Basketball Federation of Serbia and Montenegro and was conducted in January 2005. The condition for participation in the experiment was optimal psycho-physical health, s minimum of five years of active training and playing, and 70% of games played in the previous season. All study participants gave written informed consent to participate in this study, and they were also able to revoke their participation in testing at any time, but none of them decided to do so.

For the assessment of the motor abilities, nine standard motor tests were applied (Karalejić & Jakovljević, 1998; Rinaldo, Toselli, Gualdi-Russo, Zedda, & Zaccagni, 2020). Movement tasks have been chosen so as to cover all the essential physical characteristics of an athlete and an ever-increasing topographic muscular region. The following motor skills were tested: speed (20m dash), lower and upper limb explosive strength (vertical jump, standing triple jump and distance ball), trunk and upper body repetitive strength and muscle endurance (sit-up and push-ups), agility (4×5m run, T drill), speed endurance (suicides). All motor tests were conducted in an indoor basketball court. Before testing, the players performed a 20-minute warm-up, under the guidance of a coach.

The data obtained by the research were processed using descriptive and comparative statistical procedures. The descriptive statistics were expressed as a mean (SD) for each variable. Differences in the motor skills of basketball players from different competitive levels (elite and sub-elite) in the State Union of Serbia and Montenegro were assessed using a discriminative parametric procedure, t-test for small independent samples. A level of $p<0.05$ was considered statistically significant. All statistical analyses were conducted using SPSS software version 20.0 (Chicago, IL, USA).

Results

The motor abilities of basketball players from different competitive levels (elite and sub-elite) in the State Union of Serbia and Montenegro are shown in Table 1. Based on the values obtained with the t-test, it can be observed that there is a statistically significant difference in the performance on each test in favour of elite basketball players (First League). The highest difference was found in the vertical jump (t=7.414; p=.000) and sit-up (t=7.439; p=.000) tests.

Table 1. Descriptive data and differences of male basketball players from different competitive levels enrolled in the study (n=96)

Variable	First League (Mean±SD)	Second League (Mean±SD)	t	p
20m dash (s)	3.22±0.22	3.35±0.28	-2.619	.010*
Distance ball throw (m)	18.53±1.48	17.36±1.02	4.522	.000*
Vertical jump (m)	59.35±5.59	51.54±4.69	7.414	.000*
Standing triple jump (m)	7.67±0.51	7.16±0.36	5.643	.000*
Sit-up (30s)	35.83±3.56	30.48±3.49	7.439	.000*
Push-ups (n)	14.9±5.24	12.1±5.77	2.482	.015*
4×5m run (s)	6.94±0.35	7.26±0.41	-4.177	.000*
T drill (s)	9.07±0.49	9.53±0.69	-3.731	.000*
Suicides (s)	27.77±1.4	29.36±1.52	-5.347	.000*

Legend: Mean - Arithmetic mean; SD - Standard deviation; t - t test value; p - Statistical significance; * - Significant difference

Discussion

This study aimed to make a specific contribution to supplement the existing database regarding basketball players' fitness for a set period and discover which motor abilities had contributed most to success. It was known that the players and teams, as well as the national team of the Federal Republic of Yugoslavia (i.e., the State Union of Serbia and Montenegro as it was called between 2003 and 2006) always achieved sig-

nificant success on the international competition scene. The exceptional morphological predisposition of players from this area had certainly contributed to these successes, because it is generally known that the inhabitants of this region are among the tallest in the world (Popovic, Bjelica, Molnar, Jaksic, & Akpinar, 2013; Popovic, 2017; Gardasevic, 2019a; Gardasevic, 2019b; Gardasevic, Masanovic, & Arifi, 2019; Starc et al., 2019; Masanovic, Gardasevic, & Arifi, 2019; Masanovic, Bavcevic, & Prskalo, 2019; Popovic, Masanovic, Martinovic Bjelica, & Gardasevic, 2020; Arifi, Masanovic, & Gardasevic, 2020; Masanovic, Gardasevic, & Bjelica, 2021), but without exceptional motor potential, they would not be able to achieve top results (Rienhoff et al., 2013; Masanovic et al., 2020). The proportion of certain characteristics has been described by the specification equations calculated for each sport separately (Gusic, Popovic, Molnar, Masanovic, & Radakovic, 2017; Masanovic, Corluka, & Milosevic, 2018; Arifi, Bjelica, & Masanovic, 2019). Earlier studies have argued that the elements contained in the specification equation should be a guideline for work, regardless of whether it is a selection process or a training process. However, basketball is changing, the tasks that players have to perform are becoming more complex, and the shares of individual characteristics in the equation of specification are changing. Also, the differentiation between positions in the team is higher than before, so different characteristics are required for different individual tasks that players perform; consequently, the specification equation can be set for each position separately (Petway, Freitas, Calleja-González, Medina Leal, & Alcaraz, 2020). This trend of change will continue to exist, and in order to be able to predict it, it is necessary to know at what pace the changes have taken place thus far. Therefore, it is periodically necessary to present data on top athletes' characteristics and update the databases with unpublished data for certain periods. Given that in certain sports, the details decide the winner (Masanovic, Milosevic, & Bjelica, 2019), the share of each motor ability in success must be calculated as precisely as possible.

Previous research does not fully agree regarding the order of motor skills according to their impact on basketball success: some emphasize that speed comes first (Abdelkrim, El Fazaa, & El Ati, 2007), some that it is strength (Delextrat & Cohen, 2008; Chaouachi et al., 2009; Ziv & Lidor, 2010), some that it is agility (Spiteri et al., 2014), but all agree that abilities must be expressed efficiently and economically over the course of four quarters with contributions from both aerobic and anaerobic energy pathways (Schelling & Torres-Ronda, 2016).

The results of descriptive statistics show that elite players from this study (the First League of the State Union of Serbia and Montenegro) achieved significantly better results than players of sub-elite level of competition (the Second League of the State Union of Serbia and Montenegro) for each motor ability. A difference in favour of the elite players is the highest for trunk muscle repetitive strength and endurance (elite players perform an average of 5.35 sit-up more in 30 seconds than sub-elite level players), than for lower and upper limb explosive strength (elite players have an average of 7.81 cm higher vertical jump than sub-elite level players, an average of 51 cm longer triple jump, and an average of 117 cm longer distance ball throw) speed endurance (elite players perform the distance in suicides test on average 1.99 seconds faster than sub-elite level players). A slightly lower difference, but still observable, is in the level of agility (elite players 4×5 m on average perform 0.32 seconds faster, and the T drill test 0.46 seconds faster than sub-elite level players). A difference in favour of the elite players is the lowest for speed (elite players distance 20 m on average perform for only 0.15 seconds faster than sub-elite level players) and upper body repetitive strength and muscle endurance (elite players perform an average of 2.8 push-ups more than players of sub-elite levels). Based on all the above, it can be concluded that success in basketball is significantly affected by all tested motor skills and that their order from the most influential to the least influential is as follows: trunk muscle repetitive strength and endurance; lower limb explosive strength; upper limb explosive strength; speed endurance; agility; speed; upper body repetitive strength and muscle endurance.

It is also interesting to compare the results of the players covered by this study with the professional players from other countries. It can be observed that players from the First League of the State Union of Serbia and Montenegro ran a distance of 20 metres at an average 3.22 seconds which is a few hundredths of a second slower than professional players from Norway and Croatia who ran the same distance with an average time of 3.2 seconds (Milanović, Jukić, & Marković, 2004; Shalfawi, Sabbah, Kailani, Tønnessen, & Enoksen, 2011), and a few hundredths of a second faster than elite British players who ran a distance of 20 metres at an average 3.29 seconds. The time in which the players from the Second League in the State Union of Serbia and Montenegro run the same distance is slower (3.35 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Although faster in running, the same group of professional players of Norway, in the values of the vertical jump lags significantly behind the players from the First League in the State Union of Serbia and Montenegro. The average Norwegian jump height is 48.2 cm, which is considerably lower than the 59.35 cm of players from the First League in State Union of Serbia and Montenegro and 51.54 cm of players from the Second League in the State Union of Serbia and Montenegro. Also, significantly lower results on the same test were achieved by professional Tunisian players and British elite players who measured a 49.5 cm and 56.6 cm jump, respectively (Delextrat & Cohen, 2008; Chaouachi et al., 2009). However, these results are far lower than those achieved by players in the NBA league, who had the average value of a vertical jump of 72.9 centimetres (Hoffman, 2006), which is not a surprise given that it is the highest quality basketball league in the world.

Something similar is seen in the T drill test for the evaluation of agility, where the average running result of players of the First League in State Union of Serbia and Montenegro (9.07 seconds) is slightly faster than the result of the professional players from Tunisia (9.7 seconds), also from elite players from Great Britain (9.21 seconds) and Turkey (9.25 seconds) (Delextrat & Cohen, 2008; Chaouachi et al., 2009; Alemdaroglu, 2012). The time for which the same test is completed by the players from the Second League in the State Union of Serbia and Montenegro is slower (9.53 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Finally, when it comes to speed endurance, players from the First League of State Union in Serbia and Montenegro showed slightly faster-than-average running time (27.77 seconds) for suicide test compared with elite Australian (28.1

seconds) and British (28.97) players (Bloomfield, Ackland, & Elliot, 1994; Delextrat & Cohen, 2008). The time for which the players from the Second League of the State Union of Serbia and Montenegro complete the same test is also slower (29.36 seconds), based on which it can be concluded that they still have lower performance than elite European players.

Based on the results, it can be concluded that players who play in the First League in the State Union of Serbia and Montenegro had high motor potential in the 2004/2005 season. The fact that the measurement was performed at the start of the second part of the competitive season certainly influences the results, and it is to be expected that the results during the playoffs would be far better. This study also has one limitation: the sample of elite players did not include basketball players from Partizan from Belgrade and Red Star from Belgrade, who are traditionally the best teams in Serbia, and also Buducnost from Podgorica, which is the most famous Montenegrin club. However, Hemofarm from Vršac played in the playoff finals that year and was defeated by Partizan with a close result, and Atlas from Belgrade was better placed in the championship than Buducnost from Podgorica, which means that the sample still included the best players in the league.

It is also worth noting that this study has achieved its goal: specifically, it has notably supplemented the existing database regarding the motor abilities of the players from First and Second Leagues in the State Union of Serbia and Montenegro for the 2004/2005 season. A complete sample of the respondents gives a clear picture of the situation in the elite and sub-elite competition level. The strength of this study is that the data contain accurate information about the time the measurement was performed, which allows these data to be used as a reference for comparison with the situation today and in the future.

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Conflict of Interest
The authors declare that there are no conflicts of interest.

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