



## Research Article

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# Speed, agility and explosive leg power in female junior volleyball players: A comparative study

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## Abstract

**Background:** Success in performing professional volleyball is determined by many factors such as: motor abilities and skills, psychological conditions, and morphological structure of the players. Modern volleyball game requires from all players a high level of general motor abilities, as well as specific motor skills that are defining the volleyball game and certain playing positions. **Aims and Objectives:** The objectives of this study are: 1) to evaluate motor abilities (speed, agility and explosive leg power) in Macedonian Junior National League players; and 2) to compare Macedonian players with players from other countries in a qualitative manner. **Study Design:** A sample of 191 participants, female volleyball players aged 13-18 years, that are part of Junior National League in Macedonia, Albania, Serbia, Croatia, and Spain, was included. **Setting:** Macedonian Junior National League players (N=30) were evaluated at the Faculty of physical education, sport and health in Skopje, Republic of Macedonia. In order to extract data for players from other countries (N=161), papers published in peer-reviewed journals were used. **Materials and Methods:** Speed, agility and explosive leg power in Macedonian Junior National League players were assessed by applying: T20m, T505, squat jump, countermovement jump and countermovement jump with arm swing. The data regarding motor abilities in players from other countries were extracted from published papers. **Statistics:** To examine whether data have a normal distribution, Skewness and Kurtosis values, as well as Kolmogorov-Smirnov test were used. Basic mathematical and appropriate statistical methods were used in order to calculate descriptive statistical parameters by applying Microsoft Office Excel 2010. In order to compare Macedonian players, with players from Albania, Serbia, Croatia, and Spain, a Microsoft Office Excel spreadsheet was created. **Results:** Players that are part of Macedonian Junior National League are faster than the players from Croatian and Serbian Junior National League, but less agile than the players from Spanish Junior National League, and have lower explosive power of legs than players from Albanian and Serbian Junior National League. **Conclusion:** Thus, advice to Macedonian coaches would be to work more in a direction of motor abilities development, especially in pioneer and youth categories, instead of putting the main emphasis on player specialization at early age.

**Keywords:** Volleyball, Speed, Agility, Explosive power of legs, Comparison.

## INTRODUCTION

Success in performing professional volleyball is determined by many factors such as: motor abilities and skills, psychological conditions, and morphological structure of the players. Modern volleyball game requires from all players a high level of general motor abilities, as well as specific motor skills that are defining the volleyball game and certain playing positions [1]. In contemporary volleyball, players must be prepared to perform technical and tactical elements perfectly, because the match outcome depends on a variety of specific elements, and the final score depends on the quality of attacks, blocks, serves, as well as the number of the opponent's errors [2-4].

According to Miskin *et al.* (2010) volleyball coaches should estimate different performance skills and abilities of individual players during sets and matches, and then adjust the training cycle of the team focusing on the development of key motor skills that significantly determine players' scoring abilities [5].

Scoring opportunities in elite volleyball youth teams are significantly affected by quick and powerful attacks. Furthermore, player's dynamic force and speed of locomotion are dominant in attacks and blocks, which in most cases determine the set outcome [6]. The players' maximal reach ability in running jumps in attacks and in standing jumps in blocks, is decisive for their effective actions [7]. This ability is an important indicator in the process of selecting young volleyball players. Marques *et al.* (2009) stress the importance of the vertical jump (one-foot or two-foot; standing or running; with or without a semi-squat) which requires a high level of explosive leg power [8].

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Since, it is obvious that Macedonia has still not achieved significant result on an international competition, either in Junior or Senior category, the objectives of our study are: 1) to evaluate motor abilities (speed, agility and explosive leg power) in Macedonian Junior National League (NL) players; and 2) to compare Macedonian players with players from other countries in a qualitative manner.

## MATERIALS AND METHODS

### Participants

The comparative study is realized on a sample of 191 participants, female volleyball players aged 13-18 years, that are part of Junior NL in Macedonia, Albania, Serbia, Croatia, and Spain. Players from Macedonian Junior NL (N=30) were evaluated at the Faculty of physical education, sport and health in Skopje, Republic of Macedonia. In order to extract data for players from other countries (N=161), papers published in peer-reviewed journals were used [9-13].

### Instruments

In order to realise the particular aim of the study, motor abilities such as: speed, agility and explosive leg power were assessed in Macedonian Junior NL players, by applying:

- T20m from Milenkovski (1999) [14];
- T505 from Collins & Hodges (2001) [15];
- Squat jump (SJ) from Marques (2017) [16];
- Countermovement jump (CMJ) from Marques (2017) [16];

- Countermovement jump with arm swing (CMJAS) from Marques (2017) [16].

The data regarding motor abilities in players from other countries were extracted from published papers [9-13]. Only studies applying the same motor tests with this study were included.

### Data analysis

To examine whether data have a normal distribution, Skewness and Kurtosis values, as well as Kolmogorov-Smirnov test were used. Basic mathematical and appropriate statistical methods were used in order to calculate descriptive statistical parameters by applying Microsoft Office Excel 2010. In order to compare Macedonian players, and players from Albania, Serbia, Croatia, and Spain, a Microsoft Office Excel spreadsheet was created.

## RESULTS

According to the data presented in Table 1, results of Macedonian players have a normal distribution, with a normal asymmetry, which is considered when values for Skewness are in a range between -1,00 to 1,00 [17]. Except the Kurtosis value for height, that is not in the ideal range of -3 to 3, but if we take in consideration the SD value in addition to the Kurtosis value, as proposed by Kallner (2013), this might be acceptable [18].

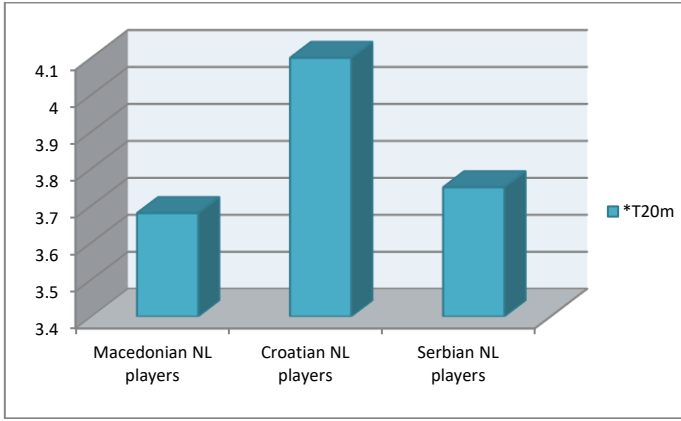
**Table 1:** Descriptive statistical parameters of female Macedonian Junior NL players

	N	Min	Max	X	SD	CV%	Skewness	Kurtosis	K-S
T20m*	30	3,35	3,98	3,68	0,15	4,07	-0,18	-0,15	p > .20
T505*	30	2,60	3,43	2,94	0,16	5,47	0,51	1,93	p > .20
SJ	30	14,30	33,30	22,23	4,94	22,22	0,23	-0,34	p > .20
CMJ	30	15,30	35,00	22,52	4,75	21,10	0,80	0,77	p > .20
CMJAS	30	25,50	42,70	31,18	4,94	15,83	1,22	0,61	p > .20
SET (R-L)	30	29,00	40,00	34,69	3,27	9,42	-0,57	-0,41	p > .20
FP (R-L)	30	14,00	29,00	22,69	4,12	18,16	-1,18	0,44	p > .20

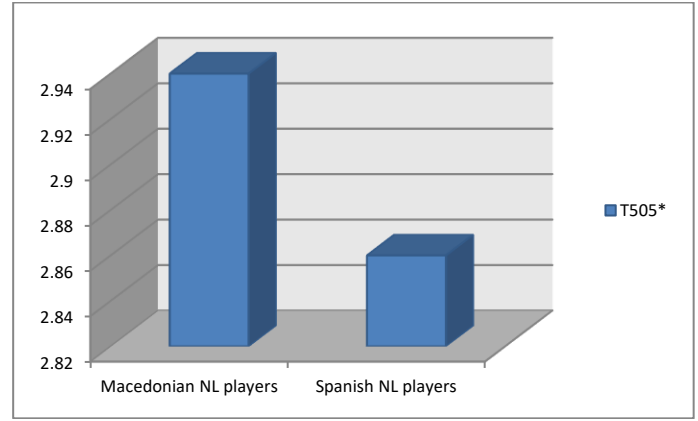
Based on data presented in Table 2 and Figure 1, players of Macedonian Junior NL are faster than players from Junior NL in Croatia and Serbia. [10, 11]

**Table 2:** Arithmetic mean and standard deviation of motor abilities in female Junior NL players from other countries

Country	Authors	N	X±SD				
			T20m	T505	SJ	CMJ	CMJAS
Albania	Dhurata & Enkeleida (2012)	24	/	/	25,34±3,40	30,69±3,80	/
Serbia	Nesic <i>et al.</i> (2014)	20	3,75±0,17	/	25,62±4,31	25,74±3,91	31,76±3,34
Croatia	Krneta & Pocek (2015)	36	4,10±0,3	/	/	/	/
Croatia	Grgantov <i>et al.</i> (2013)	56	/	/	23,15±3,20	23,75±3,38	29,65±4,38
Spain	Vega, Marban & Viciano (2014)	25	/	2,86±0,13	/	/	/



\*Variable with an opposite metric orientation



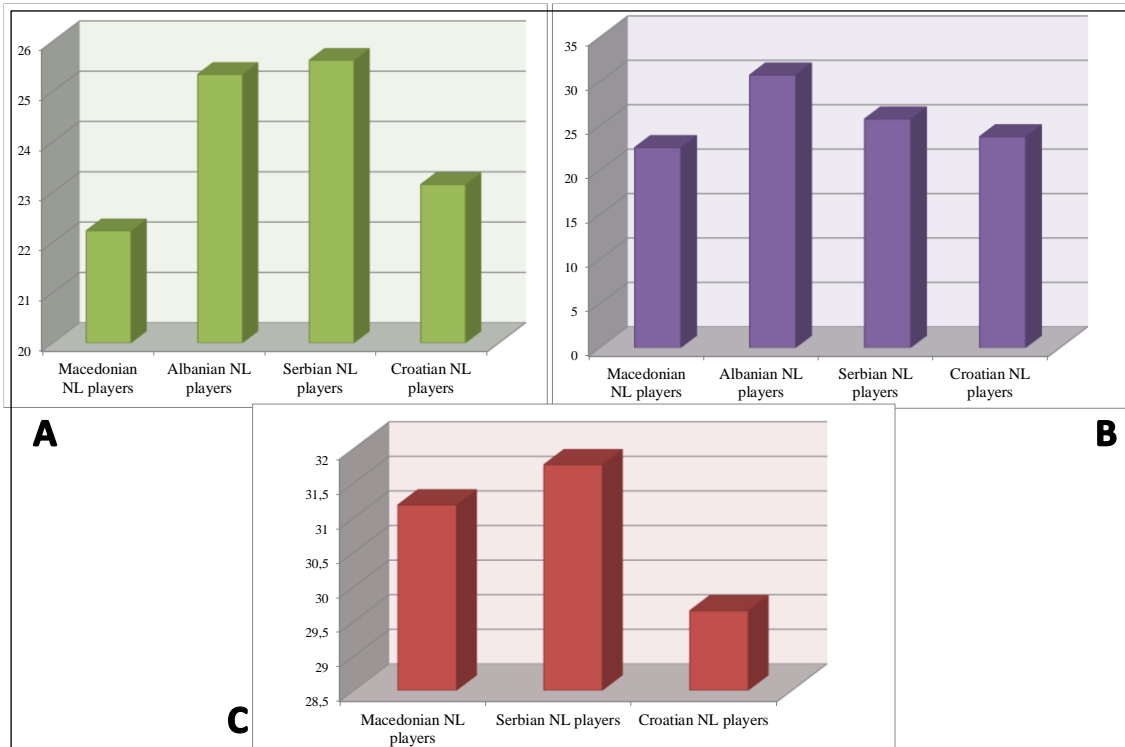
\*Variable with an opposite metric orientation

**Figure 1:** T20m in Macedonian Junior NL players and Junior NL players from other countries

**Figure 2:** T505 in Macedonian Junior NL players and Spanish Junior NL players

However, players from the study of Vega *et al.* (2014) [13] which are part of Spanish Junior NL, are more agile than Macedonian Junior NL players (Figure 2).

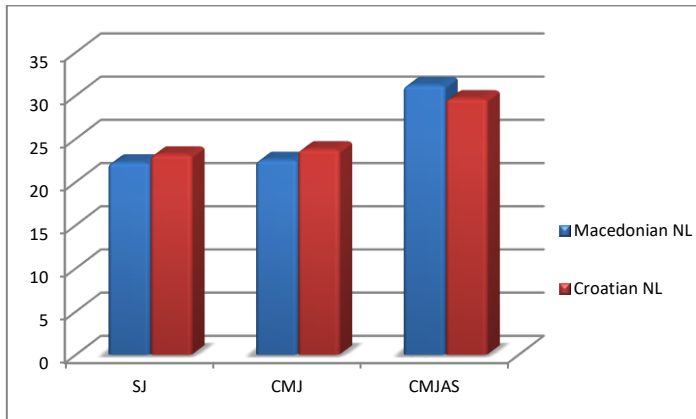
In addition, players from the studies of Dhuarata & Enkeleida (2012) and Nestic *et al.* (2014), that are part of Albanian and Serbian Junior NL, respectively, have bigger explosive power of legs [9, 10] than Macedonian Junior NL players (Figure 3).



**Figure 3:** A) SJ; B) CMJ; C) CMJAS (cm) in Macedonian Junior NL players and Junior NL players from other countries

However, if we compare the values for SJ, CMJ, and CMJAS between Macedonian players and players in the study of Grgantov *et al.* (2013)

that are part of Croatian Junior NL, we may conclude that Macedonian players have lower values for SJ and CMJ, but higher value for CMJAS [12].



**Figure 4:** SJ, CMJ, CMJAS (cm) in Macedonian Junior NL players and Croatian Junior NL players

## DISCUSSION

Results presented above (Table 2 and Figure 1) indicate that players that are part of Macedonian Junior NL are faster than Serbian and Croatian Junior NL players [10, 11]. And a motor ability such as speed, is considered as a key-important factor in performing high-quality volleyball [1]. On the other hand, both - Serbia and Croatia - have accomplished better results on International competitive level than Macedonia [19], in Junior and Senior categories. Actually, here comes into consideration the heterogeneity of the samples in terms of competitive level. Unfortunately, we do not have information about the competitive level of the players that are included in our study. Our inclusion criteria was players to be part of Junior NL, but some of the players that are part of Junior NL, might also be part of the Junior National Team, or even Senior NL and Senior National Team, meaning that their competitive level would be higher. So, we assume that this methodological weakness might influenced the results. Because, as higher as the competitive level of a player is – the higher the quality and efficiency of the player should be [7]. The efficiency in attack is vertical reach dependent, and the greater the velocity is, the greater the vertical acceleration will be, meaning that the higher vertical reach will be achieved, and the greater the efficiency of the player would be [20].

However, players from the study of Vega *et al.* (2014) which are part of Spanish Junior NL [13], are more agile than Macedonian players (Figure 2). Since agility deals with the changes in direction and the ability to start and stop quickly, as well as to effectively couple eccentric and concentric actions in ballistic movements in response to a stimulus [21], it is considered as an important component of volleyball game [22]. In addition, players from the studies of Dhuarata & Enkeleida (2012) and Nestic *et al.* (2014), that are part of Albanian and Serbian Junior NL respectively, have bigger explosive power of legs [9, 10] than Macedonian players (Figure 3).

It is generally reported in literature that volleyball players that are part of high-quality leagues have motor abilities developed on a higher level than non-elite league players [1, 23-25]. And, since Spain and Serbia have achieved significant results on International competitions, both in Junior and Senior categories, and the quality of their NL is better than the quality of Macedonian NL [19], their players have demonstrated higher agility [13], and higher explosive power of legs [10], than Macedonian players. Albania and Macedonia, quote almost the same level at FIVB ranking [19], but Albanian players have higher explosive power of legs than Macedonian players.

Thus, the advice for Macedonian volleyball coaches would be to work more in a direction of motor abilities development, since speed, agility, and power, are very important components of game performance [22].

However, if we compare the values for SJ, CMJ, and CMJAS between Macedonian players and players in the study of Grgantov *et al.* (2013) that are part of Croatian Junior NL, we may conclude that Macedonian players have lower values for SJ and CMJ, but higher value for CMJAS [12]. It indicates on a bigger effect of the arm swing on the vertical ground reaction force and a bigger rate of eccentric utilization [26] in Macedonian players, over the Croatian players (Figure 6). This is probably a result of a better spiking technique of Macedonian players [26, 7], but as we mentioned before, we might take in consideration the methodological weakness of this study in terms of the competitive level of the players that were included, before doing a general conclusion.

## CONCLUSION

Players that are part of Macedonian Junior NL are faster than the players from Croatian and Serbian Junior NL, but less agile than the players from Spanish Junior NL, and have lower explosive power of legs than players from Albanian and Serbian Junior NL. Thus, advice to Macedonian coaches would be to work more in a direction of motor abilities development, especially in pioneer and youth categories, instead of putting the main emphasis on player specialization at early age.

## Conflicts of interest

The author declares no conflict of interest.

## Authors' Contribution

Fidanka Vasileva collected the data, conceived, designed and performed the analysis, and wrote the paper.

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