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Original research article

STANDARDIZATION OF MEASURING TESTS FOR THE JUMPING ABILITY IN VOLLEYBALL

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Abstract. *The aim of this paper was the standardization of tests for measuring the vertical jump in volleyball, that is, to theoretically explain and by practical testing show discrimination, reliability and validity of the specific tests to measure vertical jump in volleyball, as well as their applicability in the training process. The research was conducted on 28 male participants over the age of eighteen, profiled as volleyball seniors, by two tests for the assessment of explosive strength in jumping performance: the slide step jump block (SBKU) and crossover step jump block (SBUK). To process the obtained data following were used: discrimination, reliability and validity. It can be concluded that SBKU and SBUK tests are characterised by good discrimination, extremely high reliability and satisfactory validity. The tests are easy to explain and easy to use so they are recommended for use in the training technology and selection of volleyball players in junior categories.*

Key words: *standardization, volleyball specific tests, vertical jump.*

INTRODUCTION

Specific motor abilities in modern sport are probably one of the decisive factors in resolving sports tasks and achieving sporting success. Powerful jumps and quick changes of direction accompanied by frequent landing (falls) allow volleyball players to more successfully address competitions.

Quick changes of direction and powerful jumps are conditions for explosive strength to be one of the dominant strengths in volleyball. It means the manifestation of maximum strength in the shortest possible time. Jumping speed is largely determined by morphological and physiological characteristics of players and skills acquired during the training process. Genetic conditionality of explosive strength does not leave much room for its

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additional development, therefore it is essential to advance it properly and in a timely fashion. That is why different tests and controls by which it is possible to monitor the improvement of this type of strength are created.

In contemporary volleyball the most important motor abilities are explosiveness, speed, jumping ability, coordination. The elements of the volleyball game such as serving, spiking (attack), blocking and defense are the dominant techniques that allow volleyball players to score points and win the competition. Explosive strength of jumping performance therefore is emerging as a dominant strength in volleyball and as such is subject of the special interests of both researchers and coaches.

The knowledge obtained from research on the development of explosive strength and its jumping ability type in volleyball has contributed to improving the training process, both of professional athletes and young, still developing athletes, to talent identification and early selection, to the increase in the overall strength of volleyball players, to the development of the jumping ability of the players but also to the attractiveness of volleyball as a sport.

Research may be focused on the structure of the training process, the structure of the achieved fitness form levels and the structure and characteristics of the abilities (Kukolj, Jovanovic, & Ropret, 1992, 78).

Researchers who have studied the development of explosive leg strength in volleyball players came to the conclusion that the application of the plyometric training model enabled an increase of the explosive strength in jumping, to perform jump blocks and the jump smash (Stojanović & Kostić, 2002), as well as to perform one and both leg jumps (Milić, Nejić, & Kostić, 2008). Also, a specific training program to develop explosive strength in jumping performance leads to positive changes in the development of explosive leg strength (Kostanić, Cigrovski, & Prlenda, 2011). An interesting fact is that the pre-set training process which took place in the preparatory period and whose training content and load were not primarily aimed at the development of explosive strength jumping performance, contributed to the development of this type of explosive strength (Marelić, Đurković, & Rešetar, 2007). Regarding anthropometric characteristics, it was determined that it is possible to predict the tests results of explosive strength based on the anthropometric measures status of participants aged 13 (Stojanović, Nikolić, & Nešić, 2006).

The object of this testing derives from previous knowledge and research, and represents measuring characteristics (discrimination, reliability and validity) of the specific motor tests of the crossover step jump block (SBUK) and slide step jump block (SBKU). Based on the subject matter of work, the aim of this paper is to theoretically explain and by practical testing show discrimination, reliability and validity of the specific tests to measure jumping ability in volleyball, as well as their applicability in the training process.

METHODS

The sample of participants

This test sample comprised 28 male participants over the age of eighteen, profiled as volleyball seniors. At the time of testing, all of the participants were competitors in the second rank of the competition in the Serbian national championship for men. The competitive experience range of the participants in the senior rank varied from two to fourteen years. Of the total number of participants, most players played the position of right front (11), then middle blocker (6), right back (4), setter (4) and libero (3).

Measuring instruments sample

The selected participants were tested by two tests for the assessment of explosive strength in jumping performance: the slide step jump block (SBKU) and crossover step jump block (SBUK).

Measuring instruments and tests description

The test is performed in a sports hall where the participants regularly perform their training process. The participants were pre-acquainted with the theoretical part of the test. Before testing there followed a warm-up period with a special focus on the warm-up of the lower extremities. The invigilator stands facing the meter and records the maximum standing reaching height and maximum jumping reaching height.

1. Slide step jump block (SBKU)

Instruments: jump block height meter

Task: A participant stands left of the jump block height meter. At the observer's signal "Go!" he performs a slide step flight for the jump block. He performs a take-off on both feet. The participant tries to maximally reach jump block height meter with his hands. Three heights in three jumps are measured. All three results are used in data processing (SBKU1, SBKU2, SBKU3), and expressed in centimeters.

Assessment: Maximal jump height when the volleyball player touches jump block height meter is measured.

Note: A participant jumps barefoot or in trainer shoes, checking first flight length to perform a precise take-off in front of the jump block height meter

2. Crossover step jump block (SBUK)

Instruments: jump block height meter

Task: A participant stands left of the jump block height meter. At the observer's signal "Go!" he performs a slide step flight for the jump block. He performs a take-off on both feet. The participant tries to maximally reach jump block height meter with his hands. Three heights in three jumps are measured, and expressed in centimeters. All three results are used in data processing (SBUK1, SBUK2, SBUK3).

Assessment: Maximal jump height when the volleyball player touches jump block height meter is measured.

Note: A participant jumps barefoot or in trainer shoes checking first flight length to perform a precise take-off in front of the jump block height meter

Data collecting and processing

For data collection, the research technique of observation with recording was applied. For this purpose, we used the computer program Microsoft Office - Excel 2007 (Dodge & Stinson, 2007), designed for tabular input, processing, analysis and presentation of data, and data transfer diagrams. After the measurement process, the resulting data were immediately entered into Microsoft Office - Excel program.

To process the obtained data and to select appropriate statistical procedures, processing and easier interpretation of the results Discrimination Test, Reliability Test and Validity Test were used.

RESULTS

Table 1 Descriptive statistics

Variables	N	Mean	Min	Max	Range	SD	Error	Skew	Kurt
SBKU1 (in cm)	28	46.14	32	61	29	6.04	1.14	0.272	0.613
SBKU2 (in cm)	28	46.32	30	63	33	6.30	1.19	0.136	1.675
SBKU3 (in cm)	28	47.14	31	64	33	6.93	1.31	0.030	0.379
SBUK1 (in cm)	28	55.61	37	73	36	7.96	1.50	-0.040	0.148
SBUK2 (in cm)	28	55.54	38	74	36	8.03	1.52	0.146	0.353
SBUK3 (in cm)	28	55.79	35	71	36	7.74	1.46	-0.366	0.903

A review of Table 1 shows the basic parameters for the tests: slide step jump block (SBKU) and crossover step jump block (SBUK), for the first, second and third measurement, enabling us to reach the conclusion that all three measurements have good discrimination of both applied tests, since the standard deviations (SD) are always 3 to 5 times in the Range. Also, there is an optimal symmetry in the zones around the arithmetic mean (Mean) because the skewness results (Skew) are very close to zero. From kurtosis (Kurt), however, one can observe a bit higher compaction of results in the second measurement of the slide step jump block (SBKU2), while in other measurements distribution is mesokurtic.

Table 2 Reliability of SBKU test

Case Processing Summary				Reliability Statistics		
		N	%	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Cases	Valid	28	100.0	0.975	0.977	3
	Excluded[a]	0	0.0			
	Total	28	100.0			

Table 3 Inter-Item Correlation Matrix

Variables	SBKU1	SBKU2	SBKU3
SBKU1	1.000		
SBKU2	0.932	1.000	
SBKU3	0.925	0.942	1.000

Table 4 Item-Total Statistics

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SBKU1	93.46	169.739	0.942	0.888	0.968
SBKU2	93.29	161.767	0.955	0.912	0.956
SBKU3	92.46	146.851	0.950	0.904	0.964

Table 2 shows the value of Cronbach's Alpha coefficient, which amounted to 0.975. This coefficient is extremely high, but considering the fact that in Table 2 and Table 3

there are no negative numbers, it can be concluded that the items measure the same characteristic. This indicates to a very high reliability of the test slide step jump block (SBKU). This is confirmed by the very high values of the Corrected Item-Total Correlation in Table 4 showing the degree of correlation of each item with the total score.

Table 5 Reliability of SBUK test

Case Processing Summary				Reliability Statistics		
		N	%	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
Cases	Valid	28	100.0	0.987	0.987	3
	Excluded[a]	0	0.0			
	Total	28	100.0			

Table 6 Inter-Item Correlation Matrix

Variables	SBUK1	SBUK2	SBUK3
SBUK1	1.000		
SBUK2	0.967	1.000	
SBUK3	0.958	0.962	1.000

Table 7 Item-Total Statistics

Variables	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
SBUK1	111.32	244.226	0.972	0.945	0.980
SBUK2	111.39	241.358	0.975	0.951	0.978
SBUK3	111.14	251.608	0.968	0.937	0.983

Table 5 shows the value of Cronbach's Alpha coefficient, which amounted to 0.975. This coefficient is extremely high, but considering the fact that in Table 5 and Table 6 there are no negative numbers, it can be concluded that items measure the same characteristic. This indicates to a very high reliability of the test crossover step jump block (SBUK), This is confirmed by the very high values of the Corrected Item-Total Correlation in Table 7 showing the degree of correlation of each item with the total score.

Table 8 Isolated factors (Extraction Method: Principal Component Analysis)

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.900	94.983	94.983	1.900	94.983	94.983
2	0.100	5.017	100.000			

Table 8 shows only one statistically significant factor isolated by principal components method. It explained about 95% of the common variance of the entire system (94.983), which indicates the validity of the tests applied.

Table 9 Component Matrix

Variables	Component
	1
SBKUM	0.975
SBUKM	0.975

These tests belong to a hypothetical factor responsible for the evaluation of the specific explosive strength of volleyball players' legs. Bearing in mind that only one characteristic root with a value greater than 1 was obtained, only one major component was extracted, so that the procedure of the orthogonal and parallel transformations is redundant. All factors have a very high correlation with the first principal component. These correlations are so high, and the differences in the measurements so small that when testing it is enough to perform just one measurement.

DISCUSSION

In many game situations the middle blocker will still be pressed to quickly execute lateral displacement. Thus, it is important to use the technique that guarantees the fastest movement time (Buekers, 1991). According to Scates (1973), most volleyball coaches seem to prefer the cross-over step as the best technique for a fast lateral displacement, while Cox (1978) pointed to the superiority of the slide step technique. In spite the prospective lack of a consensus on the choice between those two movement techniques, explosive strength plays a decisive role in blocking performance.

Previous research studies have tried to explain the extent of the explosive strength jumping performance on a volleyball game, and above all to explain the mechanisms and processes that facilitate the development and impact of the jumping ability (Đurković, 2009; Nejić, Herodek, Živković, & Protić, 2010; Bubanj et al., 2010), which in turn is an important factor for success in volleyball.

The tests used to measure the vertical jump, which were used in previous research can successfully serve in the evaluation of the development of this motor ability. Kostanić et al. (2011), Milić et al. (2008), Stojanović & Kostić (2002) in their research used a larger number of instruments, among others, tests on which these 2 tests were designed (SBKU and SBUK). This study demonstrated a high applicability of these tests in such research because of their reliability, validity and discrimination. The application of these tests in the training process of the male and female seniors one can monitor and analyze the performance of a specific system of training/exercises for the development of the vertical jump. Also bearing in mind that the greatest impact on the vertical jump is exerted by the explosive strength that is largely innate, specific tests (SBKU and SBUK) may be applied in the selection process of the young male/female volleyball players.

CONCLUSION

The subject, aim and tasks of this paper result from the need to monitor and influence the development of the vertical jump in volleyball training process. Testing was carried out in the Republic of Serbia, town of Niš, on a sample of 28 male volleyball players over the age of 18. Two composite tests were applied: the crossover step jump block test (SBKU) and slide step jump block test (SBUK), characteristic for the volleyball sport.

The results obtained in this study allowed us to draw conclusions relating to the measurement characteristics of the applied variables (discrimination, reliability, validity).

SBKU and SBUK tests are characterised by good discrimination, extremely high reliability and satisfactory validity. This is confirmed by the test results where a value of Cronbach's Alpha coefficient is extremely high (0.975), standard deviations are always 3 to 5 times within the range, and all factors have an extremely high correlation with the first principal component. Skewness and kurtosis results are very close to zero. Also, the test is easy to explain and easy to use.

Based on the obtained results, the test is recommended for use in the training technology and selection of volleyball players in junior categories.

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STANDARDIZACIJA TESTOVA ZA MERENJE SKOČNOSTI U ODBOJCI

Cilj ovog rada bio je da se uradi standardizacija testova za merenje skočnosti u odbojci, odnosno, da se teorijski objasni i praktičnim testiranjem prikaže diskriminativnost, pouzdanost i valjanost specifičnih testova za merenje skočnosti u odbojci, kao i njihova primenjivost u trenažnom procesu. Istraživanje je sprovedeno na 28 ispitanika muškog pola starijih od osamnest godina, profilisanih kao odbojkaši seniori, pomoću dva testa za procenu eksplozivne snage tipa skočnosti: skok za blokiranje korakom u stranu (SBKU) i skok za blokiranje ukrštenim korakom (SBUK). Za obradu dobijenih podataka, odrađena je: diskriminativnost, pouzdanost i valjanost testova. Može se zaključiti da testove SBKU i SBUK odlikuje dobra diskriminativnost, izuzetno visoka pouzdanost i zadovoljavajuća valjanost. Testovi su laki za objašnjenje i jednostavni za primenu pa se preporučuju u trenažnoj tehnologiji i selekciji odbojkaša i u mlađim kategorijama.

Ključne reči: *standardizacija, specifični odbojkaški testovi, vertikalna skočnost*