TESTING AND EVALUATING THE MOTOR POTENTIAL OF YOUNG BASKETBALL PLAYERS DURING THE 2007 FIBA INTERNATIONAL BASKETBALL CAMP IN POSTOJNA

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Basketball is a relatively multifaceted and complex team game combining cyclic and acyclic movement structures that mainly involve fast and dynamic movements with the ball and without it. The most frequent movements include short sprints, abrupt stops, fast changes in direction, acceleration, and different jumps, shots and passes of the ball. The successful and efficient execution of all these movements and, consequently, the playing performance of male and female basketball players of different ages depend most on the following psychomotor and functional abilities: explosive strength of the legs, agility with the ball and without it, co-ordination, speed of acyclic and cyclic movements, anaerobic lactate and alactate capacities, shooting accuracy, and the ability to handle the ball.

Motor abilities, i.e. the motor potential, of male and female basketball players are established and monitored through tests of motor abilities. In broader basketball practice motor tests are the most widely available and applicable as they are implemented in conditions similar to those of training or game. They enable a fairly accurate verification of all motor and functional abilities that impact on one's basketball playing performance. The systematic monitoring of male and female players' abilities through motor tests is mainly helpful in the following:

- monitoring and controlling the efficiency of the training process;
- monitoring the development of male and female players' motor abilities;
- determining the motor potential of male and female players as well as its use during games;
- selecting male and female players and guiding them towards appropriate playing roles (positions);
- creating a database at club and national levels (in the case of a standard test battery); and
- setting norms for male and female players of different ages and for all three major playing positions (guard, forward and post).

For several years, at the Faculty of Sport in Ljubljana we have been systematically monitoring the motor abilities of elite young Slovenian male and female basketball players. We have created an extensive database and based on that we have established norms for different age categories and playing positions. This enables a comparison between different generations of male and female players and, based on the established norms, an evaluation of the results they achieve during the tests.

From 25 to 30 June 2007 an FIBA International Basketball Camp for U15 Girls was held in Postojna, Slovenia. It was organised by the Basketball Federation of Slovenia. During this camp top young female basketball players from 15 European countries (the Czech Republic, Slovakia, Greece, Belgium, Croatia, Italy, Romania, Finland, Portugal, Germany, the Netherlands, Bulgaria, Austria, Wales and Scotland) were tested. Each country was represented by two elite basketball players who were also members of their national team. Unfortunately, due to time pressure and the strenuous schedule of the basketball camp, we were unable to test all players who attended the camp and to use the complete test battery which is commonly applied when testing young Slovenian male and female basketball players. The reduced test battery which was applied in this camp covers the basic dimensions of the morphological-motor potential of young female players.

The test battery consisted of nine motor tests (Table 1). The subjects performed each test three times and the best result was included in the data processing.

Table 1: Motor tests

CODE	**TEST**	**ABILITY**	UNIT
CMJ	Counter movement jump	Speed strength and elasticity	cm
BBT	Basketball throw	Speed strength and acyclic speed	dm
MBT	Medicine ball throw	Explosive strength	dm
DJ25	Drop jump – height 25 cm	Explosive strength and elasticity	cm
S20	20 m sprint – high start	Acceleration and cyclic speed	sec
TT5	T-test (5 + 5 m)	Agility and take-off reaction time	sec
S6x5	6 x 5 m sprint run	Agility (changing of direction by 180°)	sec
D20	20 m sprint dribbling	Acceleration and cyclic speed with a ball	sec
D6x5	6 x 5 m sprint dribbling	Agility in dribbling (changing of direction by 180°)	sec

The body height and body mass of the players were also measured.

The subjects underwent selected motor tests which were set up at five measurement stations:

1) The height of vertical jumps (CMJ, DJ25) was measured using the OptoJump measurement technology (Microgate, Italy). This proven measurement system from a renowned manufacturer (Microgate, Italy) uses optical sensors to measure jump height on the basis of flight time. The measurement accuracy was ± 1 mm.
   For the vertical counter movement jump (CMJ) the subject was instructed to step with both feet into the OptoJump zone and execute a jump in such a way as to land as fast as possible in a semi-squat position (knee angle 90°) and to then take off as fast and high as possible without swinging her arms (hands placed on the hips). The landing had to be on both feet.
   With the drop jump (DJ25) the subject was instructed to step on the edge of a 25-cm-high bench, put her hands on her hips and jump with both feet into the OptoJump zone and then, after landing, immediately take off as fast and high as possible. After each jump the subject was informed about the jump and was instructed how to perform the next jump. In the phases of jumping off the bench and landing on the ground, the knee and ankle joints had to be extended. The landing had to be on both feet.

2) The time of acceleration with a ball and without it in the 20-metre sprint tests (S20, D20) was measured by a system of infrared photocells (Brower Timing System, USA). The measurement accuracy was ±0.01 sec. The photocells were located at the start and finish (20 m). The subject was instructed to assume a high-start position with her front foot placed approximately 30 cm behind the start line, start as fast as possible, and run to the finish. The subject must change the dribbling hand at a distance of 10 m when sprinting with the ball (D20).

Figure 1. 20 m sprint (S20)

3) The basketball and medicine ball throws (BBT, MBT) were measured with a tape measure fastened to the ground in the direction of the throw. The measurement accuracy was ±0.1 m. The subject first threw a women's basketball (size 6) three times and then a medicine ball (2 kg) three times. The subject was instructed to sit on a chair and rest both her feet against the chair legs; she was told not to move her back away from the back of the chair during the throw and to throw the ball from her chest as far as possible with both hands. Any counter movement with the ball was not allowed.

4) The shuttle run tests (S6X5, D6X5) were measured with a stopwatch and the measurement accuracy was ±0.1 sec. The subject performed the test three times. She was instructed to assume a high-start position behind the start line. At the measurer's signal she ran to a line 5 m away, crossed it with one foot, turned around, and ran back to the starting line. During the test the subject turned 180° towards the direction indicated by the measurer. When performing the motor task with the ball the subject started dribbling with the right hand and changed the dribbling hand each time she crossed the 5 m line.

Figure 2. The shuttle run test, 6 x 5 m sprint run (S6X5)

5) The T-test run time (TT5) was established by a special measurement system, Newtest (Newtest Oy, Finland), consisting of the following modules: a terminal unit with indicator lights, jump mat, photocell gate, and a portable computer with Powertimer Analyzer^{TM} software.

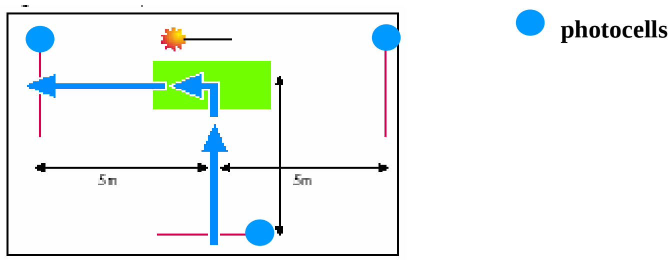

Figure 3. T-test (TT5), including the arrangement of the photocells, jump mat and indicator lights.

The T-test time was measured by infrared photocells. The subject was instructed to assume a high-start position behind the starting line and to run as fast as possible to the jump mat 5 m away. She made a jump stop on the jump mat, changed direction 90°, and ran towards the flashing indicator light to the finish line, which was positioned 5 metres away from the jump mat. The T-test time was measured with an accuracy of ±0.01 sec.

Figure 4. Use of the T-test and measuring of reaction time to a light signal

Thirty female basketball players were tested during the camp, classified as 18 guards, 8 forwards and 4 posts. All players were healthy and had no injuries. Their average age was 14.73 (±0.45) years, body height 170.38 (±7.36) cm, body mass 61.88 (±7.28) kg, and number of playing years 4.83 (±1.66).

Table 2 shows the arithmetic means and standard deviations of selected players' motor tests.

Table 2. Arithmetic means and standard deviations of the motor tests

		Guards		**Forwards**		**Centers**		**All**	
Code	Unit	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
CMJ	cm	27.52	4.76	29.22	2.94	27.64	2.94	27.64	4.19
BBP	dm	68.77	7.28	78.37	7.52	78.37	7.52	72.64	8.60
MBP	dm	43.77	4.90	48.62	4.17	48.62	4.17	45.62	5.02
DJ25	cm	25.21	3.81	25.82	2.04	25.82	2.04	25.22	3.27
S20	sec	3.52	.15	3.51	.14	3.51	.14	3.55	0.18
TT5	sec	3.22	.21	3.19	.07	3.19	.07	3.22	0.18
S6x5	sec	9.65	.46	9.48	.43	9.48	.43	9.67	0.47
D20	sec	3.75	.22	3.73	.20	3.73	.20	3.75	0.21
D6x5	sec	10.03	.54	9.91	.50	9.91	.50	9.99	0.56

The test results of individual players were processed by a special SMMS 1.0 software application designed at the Faculty of Sport. The application is based on multi-parameter decision-making. Figure 1 shows the hierarchical structure of the decision-making system of the morphological-motor potential of guards as well as the weights and limits (normalisers) for classifying the results in five quality categories (very bad ≤ 0.5, bad 0.5-1.5, appropriate 1.6-2.5, good 2.6-3.5, very good 3.6-4.5, excellent ≥ 4.6). The limits for each test were defined on the basis of arithmetic means and standard deviations separately for each playing position.

Figure 5. An example of the decision-making system for guards (age 15)

Decision tree	Unit	Weight	Normalisers
POTENTIAL		100	
├─Morphological potential		6.5	
│ └─BH (Body height)	cm	6.5	157:0, 162.5:0.5, 166.3:1.5, 169:2.5, 171.4:3.5, 174.2:4.5, 182:5
└─Motor potential		93.5	
├─Conditional abilities		63.5	
│ ├─Strength		43	
│ │ ├─Speed strength		33	
│ │ │ ├─Legs		18.5	
│ │ │ │ └─CMJ (Counter movem. jump)	cm	9	21.3:0, 25.9:0.5, 28.6:1.5, 30.6:2.5, 32.3:3.5, 34.3:4.5, 41.5:5
│ │ │ └─Arms		14.5	
│ │ │ ├─BBP (Sitting ball put)	dm	7.5	54:0, 62.4:0.5, 67.8:1.5, 71.7:2.5, 75.1:3.5, 79:4.5, 90:5
│ │ │ └─MBP (Sitting medicine ball put)	dm	7	32:0, 33.7:0.5, 37.4:1.5, 40:2.5, 42.3:3.5, 45:4.5, 49:5
│ │ └─Explosive strength		10	
│ │ └─DJ25 (Drop jump 25 cm)	cm	10	18.1:0, 22:0.5, 25.5:1.5, 28.1:2.5, 30.3:3.5, 32.9:4.5, 41.5:5
│ └─Speed		20.5	
│ ├─Acceleration		10	
│ │ └─S20 (20 m sprint run)	sec	10	3.14:5, 3.36:4.5, 3.46:3.5, 3.54:2.5, 3.64:1.5, 3.77:0.5, 4.4:0
│ └─Reaction		10.5	
│ └─TT5 (T Reaction time)	sec	10.5	2.91:5, 3.14:4.5, 3.29:3.5, 3.41:2.5, 3.55:1.5, 3.75:0.5, 4:0
└─Technique and co-ordination		30	
├─Without a ball		9.5	
│ └─S6X5 (6 x 5 m sprint run)	sec	9.5	7.8:5, 8.9:4.5, 9.1:3.5, 9.3:2.5, 9.6:1.5, 9.9:0.5, 11.7:0
└─With a ball		20.5	
├─D20 (20 m sprint dribbling)	sec	10.5	3.31:5, 3.6:4.5, 3.69:3.5, 3.76:2.5, 3.85:1.5, 3.96:0.5, 4.7:0
└─D6X5 (6 x 5 m sprint dribbling)	sec	10	8.1:5, 9.3:4.5, 9.5:3.5, 9.7:2.5, 10:1.5, 10.4:0.5, 12.1:0

Figure 6 shows a printout of the results of three guards of different quality levels. It consists of a decision tree, the players' rough results and their conversion into numerical and descriptive forms. The application multiplies the numerical results with respective weights and divides the result by the weight specified on the first branch of the tree. Then the results on each first branch of the decision tree are summed up. The outcome is an evaluation of the factor which determines each first branch of the tree. This procedure involving multiplication, division and addition is carried out in the same way at all higher-level branches, up to the trunk of the tree (POTENTIAL). It yields an evaluation of the development of all factors at all levels of the morphological-motor potential tree.

Figure 6. Printout of selected results

		Player 1			Player 2			Player 3		
Decision tree	Unit	Res	f(x)	Estim	Res	f(x)	Estim	Res	f(x)	Estim
POTENTIAL			4.5	excell		3.3	good		1.0	bad
├─Morphological potential			0.8	bad		1.6	appro		0.1	vbad
│ └─BH	cm	163.8	0.8	bad	166.5	1.6	appro	158.2	0.1	vbad
└─Motor potential			4.8	excell		3.5	good		1.0	bad
├─Conditional abilities			4.8	excell		3.6	vgood		1.0	bad
│ ├─Strength			4.7	excell		3.4	good		0.5	bad
│ │ ├─Speed strength			4.9	excell		3.2	good		0.6	bad
│ │ │ ├─Legs			5.1	excell		3.2	good		0.5	bad
│ │ │ │ └─CMJ	cm	42.4	5.1	excell	31.8	3.2	good	25.9	0.5	bad
│ │ │ └─Arms			4.7	excell		3.1	good		0.9	bad
│ │ │ ├─BBT	dm	83	4.7	excell	69	1.8	appro	61	0.4	vbad
│ │ │ └─MBT	dm	47	4.8	excell	45	4.5	excell	37	1.4	bad
│ │ └─Explosive strength			3.7	vgood		3.1	good		0.4	vbad
│ │ └─DJ25	cm	30.9	3.7	vgood	29.4	3.1	good	21.2	0.4	vbad
│ └─Speed			5.0	excell		4.0	vgood		2.0	appro
│ ├─Acceleration			4.9	excell		3.6	vgood		2.5	good
│ │ └─S20	s	3.19	4.9	excell	3.45	3.6	vgood	3.54	2.5	good
│ └─Reaction			5.1	excell		4.4	vgood		1.5	bad
│ └─TT5	s	2.864	5.1	excell	3.157	4.4	vgood	3.557	1.5	bad
└─Technique and co-ordination			4.7	excell		3.1	good		1.0	bad
├─Without a ball			4.5	excell		2.1	appro		0.5	vbad
│ └─6X5S	s	8.82	4.5	excell	9.41	2.1	appro	10	0.5	vbad
└─With a ball			4.8	excell		3.5	vgood		1.3	bad
├─D20	s	3.27	5.1	excell	3.51	4.7	excell	3.79	2.2	appro
└─6X5D	s	9.19	4.5	excell	9.75	2.3	appro	10.66	0.4	vbad

Legend:

Res rough result of measurement

f (x) numerical evaluation (from 0.0 to 5.5)

Estim descriptive estimation (from very bad to excellent)

The data in the printout are analysed for each player separately at the highest levels of the decision tree (POTENTIAL, Morphological potential and Motor potential). Then the analysis covers the results at lower levels as regards the morphological and motor potentials. In the decision tree that was used, the morphological potential only consists of body height. Motor potential is structured at three levels, which is why the data are first analysed at the top level (Conditional abilities and Technique and co-ordination) and then also at lower levels.

Thus, the evaluations of each individual player in terms of all levels of the morphological-motor potential tree reveal their strengths, weaknesses and her specificities within the structure of the abovementioned potential.

The Faculty of Sport uses a similar method to process and evaluate the results of testing all young male and female players of the Slovenian national teams. A more complex decision tree is used, comprising a wider battery of motor, functional and psycho-social tests as well as higher norms for evaluating the achieved results (by gender, age and playing position). The results of our studies show that the male and female basketball players of the Slovenian national teams with high scores for the said morphological-motor potential were also better players in general.