*Journal of Physical Education and Sport* ® (JPES), 17 Supplement issue 5, Art 247, pp.2297 - 2300, 2017
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

**Original Article**

# Monitoring the explosive strength parameters in BCM U Pitesti Basketball team

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Published online: November 24, 2017
(Accepted for publication November 15, 2017
**DOI:10.7752/jpes.2017.s5247**

**Abstract**

*Problem statement.* In the basketball game the explosive strength of the lower train is one of the main concerns of each coach or physical trainer during the training period from the beginning of each championship. In order to direct the physical training process in a correct way, the explosive strength parameters must be evaluated both during the training period and during the championship.

*Purpose*. The assessment of the explosive strength parameters level that are specific to the lower limbs in order to efficiently achieve physical training at the senior basketball players' level.

*Methods*. The experimental approach aimed to apply some tests in order to measure the explosive strength parameters level at a senior men's basketball team in the National League. In order to achieve these measurements, we used the OptoJump Next motion measurement and analysis system; the protocols used being selected from the system test battery, respectively the Squat jump test, the 15 sec. jump and Stiffness Test.

*Results.* During the S.J. the best result was obtained by O.D. with a value of 58.4 cm while the weakest result was obtained by L. L. player, measuring only 30.6 cm.

*Discussions and conclusions.* Both the results from the Squat Jump Test and the results from the following two tests (15 jump test and Stiffness Test) show an average level of results due to the fact that the team is at the beginning of the training period, an accumulation and growth period maximum strength. At the same time, the OptoJump Next measurement system proved to be an efficient and objective tool of measuring the parameters of the explosive strength at the level of the subjects from our research.

**Key Words**: jump, lower limbs, physical training, power.

## Introduction

Basketball is becoming increasingly popular in many countries and is played worldwide by more and more people. At the professional level, numerous tests and training programs are being used to monitor the cardiovascular (McInnes *et.al.,* 1995) and athletic (Lange & Bury, 2001) performances of players. The results of these evaluations are used to adjust training techniques in an attempt to prevent traumatic and overuse injuries. Explosive strength of the lower extremities and agility are important parts of game performance in basketball. Although numerous studies have focused on the assessment of the training effect of plyometric training, studies focusing on elite players are missing (Lehnert et.al, 2014).

At the beginning of each competitive season in basketball, the teams reunite with 30-45 days ahead to start training and to form a new team for the next season. Besides technical and tactical training, physical training exercises occupy the highest importance and are the binder that binds all the other components of the training. Monitoring the speed, strength and endurance parameters of basketball play are crucial throughout this training period.

Previous researches support the use of complex training to improve the upper and lower body explosivity levels in young basketball players and showed that more strength conditioning is needed during the sport practice season. Furthermore, they also conclude that complex training is a useful working tool for coaches, innovative in this strength-training domain, equally contributing to a better time-efficient training (Santos &Janeira, 2008). Physical training can compensate, at one point, technical training. An inadequate physical preparation can affect the technical components of the game (free throws, assists, passing from attack to defense, defense itself). Physical performance is measured by the amount of acquired skills and motor abilities. It has been found that the most successful teams are those that possess the most explosive capabilities (Hoffman & Maresh, 2000; Hoffman *et al.,* 1996, citet by Fagaras, 2016).

We started this study from the *hypothesis* that if we will use the Opto Jump Next system as a measuring tool we will be able to obtain objective data regarding the level of the physical training in what concerns the strength parameters of the basketball players.


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The aim of this research was the evaluation of the explosive strength parameters level that are specific to the lower limbs in order to achieve an efficient physical training in senior basketball players. In order to achieve this aim we had followed the accomplishment of the next objectives:

- the identification of the explosive strength parameters values specific to the basketball players from the highest level of the Romanian Championship;
- the analysis of the results and the determination of the explosive strength for the entire team;
- the analysis of the results of each player and the individualization of the physical training in order to optimize the measured parameters.

**Materials and methods**

The experimental approach aimed at the application of some tests to measure the level of explosive strength parameters at the BCM U Pitesti men's basketball team, from the National League. In order to achieve these measurements, we used the OptoJump Next motion measurement and analysis system; the protocols used being selected from the system test battery, respectively the Squat jump test, the 15 sec. jump and Stiffness Test.

The OptoJump Next system (fig.1) is an optical measurement system consisting of a transmitting and receiving bar. Each of these contains 96 leds (1.0416cm resolution). The leds on the transmitting bar communicate continuously with those on the receiving bar. The system detects any interruptions in communication between the bars and calculates their duration.

This makes it possible to measure flight and contact times during the performance of a series of jumps with an accuracy of 1/1000 of a second. Starting from these fundamental basic data, the dedicated software makes it possible to obtain a series of parameters connected to the athlete's performance with the maximum accuracy and in real time. The absence of moving mechanical parts ensures accuracy and great reliability. (http://www.optojump.com/What-is-Optojump.aspx, 21.10.2017)

*Fig. 1. The OptoJump Next system*

The measurement tests of the explosive parameters strength have the following features:

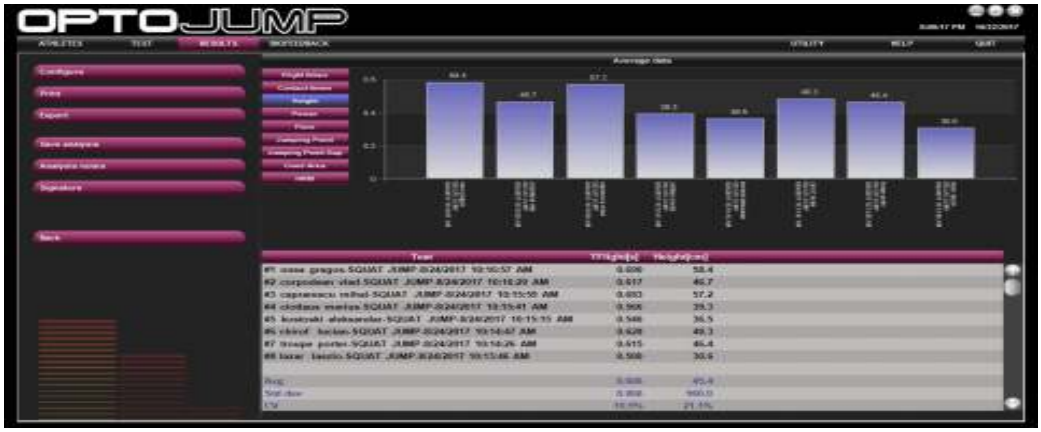
*1.Squat Jump* – it is a test that has as target the evaluation of explosive force of lower limbs by executing single jump from a squatting position (angle of 90° at the knee) with hands on hips and without counter movement. The parameters acquired are: flight time, height reached from center of mass (http://www.optojump.com/Applications/Test-Typologies/Squat-Jump.aspx).

*2. Jumps 15/30/60 sec* – measures the analysis of the anaerobic power by performing 15/30/60 seconds of jumps during which enables the acquiring of the next parameters: contact times, flight times and height of jumps and power of each jump (http://www.optojump.com/Applications/Test-Typologies/60-sec.aspx).

*3. Stiffness* - this test aims the evaluation of reactive force by performing 7 jumps with straight knees. During this jumps it requires the following parameters: contact times, flight time, height of jumps, power of each jump (http://www.optojump.com/Applications/Test-Typologies/Stiffness.aspx).

**Results and discussion**

These tests performed by each of the basketball team members at the start of the training period show us the level of explosive strength at the lower limbs and give us an overview of the entire tested team. Another important aspect is that the three chosen tests were selected so as to draw as close as possible to the motor pattern of the basketball game, but also be close to the ergo-genesis of the basketball-specific effort. As can be seen from the following graphs, the first test measures the maximal explosive strength – having one bounce is performed, the second test follows the explosive strength in resistance mode, and the third test follows the reactive strength.




Referring the *Squat Jump* test, the best performance in terms of the *height* of the center of body mass was recorded by athlete O.D. with a value of 58, 4 cm. On the other hand, the worst performance was obtained by athlete L.L. with a score of 30, 6 cm. In the same time we can see that there is only 1,2 cm between the best *height* and the second one, in terms of *flight time* the difference between the two basketball players being even smaller i.e. 0.007 s. The average of the *height* that the center of body mass of the whole team jumps is 45,4 cm.

*Fig. 2. The results obtained in Squat Jump test*

In the case of the *15 sec. repetitive jumps* (fig. 3) the results obtained by subjects of the research were analyzed from the *height*, *contact* and *flight times* the jumps having the following dynamic: the best two values of the *height* were obtained by O.D. and C.M. with a performance of 44,5 cm and 43,2 cm, the first one having the second longest period of time spent in *contact* with the ground and the longest *flight time*. The average of the team jumps' *height* measured 35 cm with 9,5 cm lower than the individual best.

An interesting thing was represented by the *power* results, which recorded a value of 26.99 W/Kg in the case of subject C.M. despite the fact that he obtained a lower value of the jumps *height* compared with subject O.D. who performed the jumps with a *power* of 26.71 W/Kg and had higher jumps.


*Fig.3. The results of the height, contact and flight times obtained in the 15 sec. jumps test*

The *stiffness test* performed to identify the reactive force elements allowed us to obtain information on the following parameters: jump height, power, flight time and contact time. Regarding the height of each jumping, the best result was obtained by the subject O.D and the worst result by the L.L. subject, the average of the jumping heights for the whole team being 36.8 cm (fig.4). A similar situation is also found in the case of power (fig.4), where the subject L.L. recorded the lowest value (35.75 W / kg). At this parameter, O.D. recorded a value of 52.46 W / kg on the second position, with the highest level of power being achieved by subject C.M. (61.36 W / kg), which in the case of the height is in the third position with a value of 40.6 cm.

*Fig.4. The results of the height and power obtained in the stiffness test*

In the case of values specific to contact and flight times, in fig. 5 it can be noticed that the highest values were obtained by the subject O.D. (0.250 ms / 0.628 ms). From the values obtained within these parameters it can be noticed that the subject C.M. obtains the lowest value of the contact time and the second time flight value. By comparing these values with those recorded in the case of power it is found that he succeeds in obtaining the highest value in the conditions of a short contact time compared to the others.


*Fig.5. The results of the flight and contact time obtained in the stiffness test*

**Conclusions**

The use of the Optojump Next measurement system has proved to be an effective and objective means of measuring and assessing the level of physical training from the perspectives of the explosive specific parameters of the BCM U Pitesti basketball players.

The best results and the weakest results are obtained by almost the same subjects in all 3 tests performed. The results obtained in the batch are modest and somehow normal given that at the time of testing the team is in the second week of training. The average of the results of the entire tested lot shows modest values according to the period in which the test was performed. Major discrepancies are observed between the subjects who have achieved the best results and the subjects with the worst results. During the training period, it is advisable to have a better uniformity in the team in terms of monitored parameters.

**References**

Făgăraş, P.S. (2016). Modeling physical training in young basketball players. *Palestrica of the third millennium – Civilization and Sport Journal, 17, (3):219–223*

http://www.optojump.com/Applications/Test-Typologies/Squat-Jump.aspx

http://www.optojump.com/Applications/Test-Typologies/Stiffness.aspx

http://www.optojump.com/What-is-Optojump.aspx

Lange, B. & Bury, T. (2001). Physiologic evaluation of explosive force in sports. *Rev Med Lie`ge.;56(4):233–238.*

Lehnert, M., Hulka, K., Toth, L., Malý, T.(2014). Changes of explosive strength in professional basketball players after a six week training cycle with plyometric training and resistance training. *Tělesná Kultura, 37, (2): 9-25*

McInnes, S.E., Carlson, J.S., Jones, C.J., McKenna, M.J. (1995). The physiological load imposed on basketball players during competition. *J Sports Sci.;13(5):387–397.*

power of each jump (http://www.optojump.com/Applications/Test-Typologies/60-sec.aspx

Santos, E.J. & Janeira, M.A. (2008). Effects of complex training on explosive strength in adolescent male basketball players. *J Strength Cond Res. 22(3):903-911*

Schiltz, M., Lehance, C., Maquet, D., Bury, T., Crielaard, J.M, Croisier, J.L. (2009). Explosive Strength Imbalances in Professional Basketball Players. *Journal of Athletic Training ;44(1):39–47*