

Letter to the Editor

YOUTH BASKETBALL SPECIFIC EFFORT TEST

Dear Editor-in- Chief

Basketball requires specific abilities. It compels precise movements and particular muscular actions at different speeds during competition and training. This is due to abrupt and frequent changes in direction as well as decelerations and jumps (Gerodimos et al., 2003). On its own, the practice of basketball does not have any beneficial effect on strength performance (Amiridis et al., 1997). The athletic preparation for a basketball player, therefore, requires more physical conditioning than actually used in competition. In order to better manage the physical condition of the players, evaluation must be an integral part of training. With the goal of using performance evaluation as an almost daily tool, the measurements must be quick and explore the principle physical qualities required for high level practice of this activity. The objective of this study is to evaluate certain physical aspects by a simple protocol so that the physical shape of the athletes is preserved without disturbing the training schedule.

A population of 21 basketball players with 10 'minims' (height: 176.9 ± 11.4 cm, weight: 66.7 ± 13.2 kg, body fat percentage: 11.8 ± 6.3 % and age: 13.2 ± 0.7 years) and 11 'cadets' (height: 185.6 ± 5.1 cm, weight: 74.4 ± 11.1 kg, body fat percentage: 12.1 ± 3.8 % and age 16.4 ± 0.7 years) participated in the study.

The players were equipped with cardio-frequency meters. The effort was measured for a period of 2 minutes with 15 second intervals of 15 seconds of high jumps and 15 seconds of passive recuperation between the bars of an Optojump.

The use of this protocol reveals different indicators, marks of performance. The evolution of these performances and the cardiac adaptation can give consequential information about the state of the athlete's physical shape. The indicators taken into consideration during the test are the following:

1. The **time of contact** (TC) with the Optojump represents for each jump the shock absorption phase of the landing of the preceding jump and the propulsion phase. A short TC represents explosive motivity. The explosive force (force/speed) where the strength is the display of maximum force in a minimum amount of time (Wilmore and Costill, 1994).
2. The **time of suspension** (TS) is the total time of the aerial phase. The TS should be as high as possible. A high TS reveals proportionately developed strength during a jump directly correlated to the height of the center of gravity of the subject.
3. The **time of the jump** (TJ) is, as a result, equal to TC + TS, where TC and TS represent a percentage of TJ. The best performance should be a quick TC giving long TS. The optimal performance corresponds to a **ratio of TS/TC** the weakest possible for the entire test. This ratio gives the capacity to store and use elastic energy of muscular work (Bosco, 1997).
4. The **kinetic variation of the times of contact or of suspension** is an indicator of the capacity of an athlete to maintain quality effort in time. The decrease rate of muscular strength was the subject of numerous studies in order to correlate it with the rapid fiber percentage.
5. The **variation of the HR during the test** reflects the speed and the mobilization amplitude of the cardio-vascular system as well as the kinetics of effort recuperation, whether between series of jumps or at the end of the test. The HR represents the work that must be done by the heart to respond to the increasing needs required by the exercise (Wilmore and Costill, 1994).

The study allows us to remark, that the trial put into action without being exhaustive, explores the parameters of a basketball player's physical shape. It is possible to observe the evolution of the TC and TS during different series of jumps that comprise the test. One must note that the 'cadets' have a higher suspension time than the 'minims'. However, the TS decreases for the both groups as the series go on. These observations show that the quality of the jumps can be maintained for only a short period of time. In fact, the muscular fatigue induced by the repetition of the jumps reduces the impulsion efficiency (Skurvydas et al., 2000). The different 15-second series of continuous jumps provoke an important depletion of adenosine triphosphate (ATP) in the muscular reserves. Depending on the exhaustion induced by a maximal exercise, the stored ATP is close to 90-95% after 3 minutes of recuperation (Connolly et al., 2003). According to Signorile et al. (1993), repletion is

crucial to the reproduction of short and intense effort. The succession of the series every 15 seconds does not allow the subject to reproduce identical performances. Depending on the endurance capacities of the athletes, fatigue or even exhaustion can appear rather quickly during the test.

The processing of the allows us to judge the efficiency of the impulsions according to the jump components induced by the ratio TC/TS. The use of the ration TC/TS rationalizes the efficiency of the succession of jumps. In fact, the time of suspension added to the time of contact corresponds to the total time of the jump, thus $TS+TC=TJ$. Thus, it seems interesting to observe what proportion is taken by the support phase (shock absorption and propulsion) compared to that of the flight phase. The more the ratio is reliable, the more the TS will be induced by a TC brief and efficient. According to this fact, it is possible to objectively and quickly compare athletes between themselves. Thus, for all of the tests, the 'minims', with an inferior ratio, must be more efficient than the 'cadets'. For all of the tests, this efficiency can be related to a mechanical output better than 6% for the 'minims'.

The observations of the performances during the entire test bring forth the kinetic variation between the contact and suspension times. The measurements show that the 'minims' are more effective during the first jumps, but are not able to maintain intensity and effort in time. They have less capacity to repeat quality actions such as maximum jumps; their endurance is less developed.

The cardio-frequency meters record the HR during the test. They let us know the percentage of HR max of our population during the test to determine the physiological impact. The 'minims' are at an average of 184.2 ± 7.2 beat·min⁻¹ at the end of the test; and the 'cadets' are at an average of 173.1 ± 11.6 beat·min⁻¹ thus at 95.5% and 89.6% respectively of the maximal intensity recorded during competition. Thus, the test brings the subjects to less than 90% of the HR max. The intensities enter 90% and 95% represent the HR zone maintained the most during the real game time (McInnes et al., 1995). During competition, a player spends half of the real game time at intensities more than or equal to 90% of the HR max. So, this constitutes a primordial marker for the physical condition of a basketball player. It is at this high percentage of HR max that the athlete must produce an effort to make a difference. The effort provided by the subjects at the end of the test is representative of their ability in competition.

Consequently, for the two populations studied, the 'minims' appear to be more efficient in the succession of jumps. Their capacity to maintain effort in time is however weaker than that of the

'cadets'. At the end of the test and for an effort intensity slightly inferior, the 'cadets' perform better.

The test, as it is presented, must be modified to produce more pertinent results. The measure before the maximum jumps in RJ can also show at what intensity the athletes produce the jump repetitions. The knowledge of the maximal performance during a jump constitutes a reference with which one can evaluate a subject's commitment and efficiency during the test. The results of the study show that this type of test protocol can be a good method to evaluate the physical condition of an athlete during training.

REFERENCES

- Amiridis, I.G., Cometti, G., Morlon, B. et Van Hoecke, J. (1997) Concentric and/or eccentric training-induced alterations in shoulder flexor and extensor strength. *Journal of Oorthopaedic and Sports Physical Therapy* **25**, 26-33.
- Bosco, C., Taggini, R. and Viru, A. (1997) The influence of different floor stiffness on mechanical efficiency of leg extensor muscle. *Ergonomics* **40**, 670-679.
- Connolly, D., Brennan, K. and Lauzon, C. (2003) Effects of active versus passive recovery on power output during repeated bouts of short term, high intensity exercise. *Journal of Sport Science and Medicine* **2**, 47-51.
- Gerodimos, V., Mandou, V., Zafeiridis, P., Ioakimidis, P., Stavropoulos, N. and Kellis, S. (2003) Isokinetic peak torque and hamstring/quadriceps ratios in young basketball players. Effects of age, velocity, and concretion mode. *Journal of Sports Medicine and Physical Fitness* **43**, 444-452.
- McInnes, S.E., Carlson, J.S., Jones, C.J. and McKenna, M.J. (1995) The physiological load imposed on basketball players during competition. *Journal of Sports Sciences* **13**, 387-397.
- Signorile, J. F., Ingalls, C. and Tremblay, L.M. (1993) The effects of active and passive recovery on short term, high intensity power output. *Canadian Journal of Applied Physiology* **18**, 31-42.
- Skurvydas, A., Jascaninas, J. and Zachovajevs, P. (2000) Changes in height of jump, maximal voluntary contraction force and low-frequency fatigue after 100 intermittent or continuous jumps with maximal intensity. *Scandinavian Physiological Society*. **169**, 55-62.
- Wilmore, J.H. and Costill, D.L. (1994) *Physiology of sport and exercise*. Champaign: Human Kinetics.

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