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POWER-STRENGTH CURVE IN BASKETBALL PLAYERS

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KEY WORD: optimal load, peak power, half squat, basketball

ABSTRACT: The purpose of this study was to examine the power-strength curve in a half squat exercise in trained basketball players of the EBA league. For that, a cross sectional, descriptive study was carried out to 8 high-level male basketball players. After controlling the participants 1RM, a progressive test, consisted on moving loads of 30, 45, 60, 70 and 80% of 1RM as fast as possible in the concentric phase, was performed. The participants showed the highest peak power output with loads of 45% of 1RM. These results differ from the wide literature, which shows values ranged between 30% and 70% of 1RM; this can be due to: a) the analyzed sample; b) the experience of the participants; and c) the methodology used for the record. Therefore, we concluded that, the basketball players studied present values of peak power output, in competitive period, near to 45% of 1RM in the half squat exercise.

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Introduction

In basketball there are a lot of factors that influence the chance to reach an optimal performance (Sánchez, 2007), being the physical conditioning one more factor inside a complex studding. To the date, it has been described different physical, physiological and functional characteristics in the basketball players, in fact, it has been afforded greater importance to the energetic demands that are going to increment performance (Vaquera, Rodríguez, Villa, García & Avila, 2002). However, there are just a few studies that show the way for improving the explosive strength in elite players (Bradic, Bradic, Pasalic & Markovic, 2009).

In basketball, the resistance, plyometric, and/or the combination of both training methods, are usually referenced in the literature as the most effective methods for developing muscular power (Santos & Janeira, 2008). For that, it is necessary to know the optimal load that increases muscular power.

A lot of studies (Asci & Acikada, 2007; Baker, Nance & More, 2001; Cromie, McBride & McCaulley, 2007) show that there are different optimal loads for power training depending of the different moments of the season (Baker & Nance, 1999). One way to know its improvement is using the strength-velocity (S-V) and power-strength (P-S) curves. However, there are not studies that show the accuracy load in high-level basketball players. Therefore, the aim of the present study was to describe the P-S curve in the final stage of the season in a basketball team of the EBA league.

Method

Eight high-level male basketball players volunteered for the study (age: 24.80 ± 3.35; size: 196.80 ± 4.09; weigh: 99.70 ± 11.16; 1RM half-squat: 198.00 ± 24.08; 1RM body weight ratio: 2.02 ± 0.38). All of them were members of the EBA league.

The participants were notified about the characteristics and objectives of this study and informed consent was obtained from all subjects before participation in the study.

A cross-sectional, descriptive and non-experimental study was carried out. This study was developed in a laboratory session at the end of the season.

All participants' anthropometric data, such as size and weigh, were obtained during the session. Late on, they perform a specific warm-up (Winchester, Erickson, Blaak & McBride, 2005). After the warm-up, the 1RM was assessed, with a 5 min rest between each attempt.

On a modified Smith machine, a rotary encoder (Real Power, Globus, Codogne, Italy) attached to the barbell and interfaced with a computer allowed the recording of bar position with accuracy of 0.002 second. Fifteen minutes after testing for the maximum strength of the lower limbs, the subjects were asked to perform 5 sets of 3 repetitions of bench presses using resistances of 30%, 45%, 60%, 70%, and 80% of 1-RM with 3 min passive rest between sets. The concentric phase was performed at maximum velocity. Simultaneously, vertical ground reaction forces were assessed by a force platform (IBV Dinascán 600M, Valence, Spain). Both variables (vertical velocity and vertical ground reaction force) were synchronized at a frequency of 100 Hz. The power output in each repetition in half-squat (Cormie et al., 2007), was calculated through the integration of these variables, using the peak power output of the best repetition for the analysis.

The record and storage of the data was carried out with the Excel 2003 software (Microsoft corp., Redmond, WA), with the

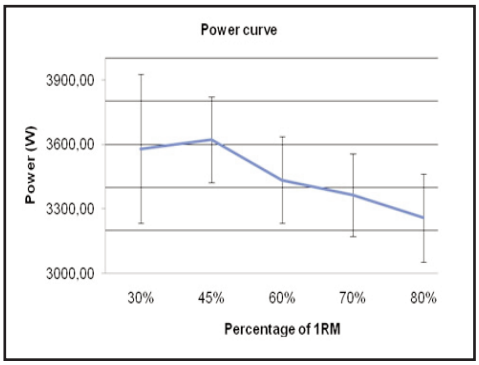

Figure 1. Power-Strength curve (n = 8). Mean ± SD.

aim of achieving a statistical descriptive analysis detailing the characteristics of the sample participant in the study.

Results

Figure 1 presents the participants´ P-S curve analyzed in the study in the half-squat exercise. In this figure we can see that subjects got the peak power output with low loads (45% of 1RM), and how the power output decrease progressively as the load to displace increases.

Discussion and Conclusions

In basketball, the movements on the field must be fast and explosive; therefore, the generation of high levels of power is required. In order to get it, the players have to perform training with a specific load and a specific velocity, corresponding to the muscular performance in the competition (Wilson, Newton, Murphy & Humphries, 1993). In this sense, F-V and P-V curves are some of the important variables for considering when coaches want to know the conditions of the muscular work required for each different specialty. For this reason, the main aim of this study was to define the P-S curve in high-level male basketball players.

In the present study, the curve (P-S) shows values of maximum mechanical power output with loads of 45% 1RM, at the end of the competitive period. Baker et al. (2001) described that the changes in the highest part of the curve (more strength for the same velocity) are mainly due to strength training (Baker, 2001), corresponding with the beginning of the training period. However, the changes in the low part (same strength at higher velocity) are mainly due to velocity training (Baker, 2001), corresponding with a competitive period.

Several researchers explain that the work in the half-squat exercise for improving power output should range from 30 to 70% 1RM (Izquierdo et al., 2001), but this range is very wide. The load should depend, especially, on the moment of the season, or the cycle of training in which the basketball players are.

Hence, the study of the power curves becomes necessary in different moments of the season; mainly in the sports where the power training is very important, in this case like basketball.

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