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A brief review on physiological commitment in basketball: An interpretative key

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ABSTRACT

The physiological commitment is widely investigated because is the basis of physical training methods and sports sciences. Every sport has a characteristic pattern of exercise and range of exercise intensities which determine the energy requirements in the sport. The review of the literature and scientific documents was conducted through the use of several databases: PubMed, MedLine, Google Scholar. Several studies carry out a lot of data and then they have applied to team sports such as soccer, basketball, handball, rugby. Performance analysis studies show that each team sport has the own and different characteristics and has unique profiles because the indicators are different. The physiological commitment may be different in the several situations analysed and be dependent on the type of mechanics of the running. The results, relative at the intensity, fatigue resistance and ability of to cover wide distances, in varied way, by basketball players during matches, can substantially affect basketball theory and practice. The purpose of this work is to analyse and evaluate the physiological commitment required of basketball players (linear and varied running with and without dribble), trying to extract relevant information from a series of research carried out in different countries of the world, for an interpretative analysis of theoretical and documental results. **Key words**: Varied running; Physical effort; Physical training; Performance.

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INTRODUCTION

The basketball, in accord to the analysis given by Professor Dal Monte (1969), is classified as a sport in which they are considered, in addition to matters bioenergy (commitment cardiovascular and type of mainly energy system), also aspects of the biomechanics of muscle under both aerobic and anaerobic energy (Altavilla & Raiola, 2015) and in different proportions depending on the intensity, of the density, of the volume of the charge, of the frequency (Bompa & Haff, 2009; Raiola & D'Isanto, 2016). Team sports such as basketball present multiple and different dynamics during the game as a result of variability in offensive and defensive performances (Bourbousson et al, 2010). Spreading in sport of technologies able to detect and organize in real time a wide range of data relative to the performance (tracker, GPS, accelerometers, bio-sensors) offers a great opportunity to collect data (Ferrara & Di Tore, 2018; Altavilla et al, 2017). During a game, a team executes about 90 offences on average (Dežman, 2003) and most of them consist of a sub-phase consisting of a fast transition from defense to offence and often also a quick counter-attack. The varied running, typical of team sports, have biomechanical characteristics and bioenergetic different with respect to the ride in a line. The several types running vary according to physical characteristics and sports activity (Pisapia & D'Isanto, 2018). This diversity justifies a specific training method in activity, such as team sports (football, basketball, rugby), where the running is characterized by continuous acceleration and deceleration phases, which entail a greater energy expenditure. In particular, the basketball is an intermittent high-intensity physical activity that requires a well-developed aerobic and anaerobic fitness and it is featured from activity of short time at high intensity (Castagna et al, 2008); as well as the rugby is generally considered a physical sport characterized by multiple high-intensity activities interspersed with low-intensity activities (Da Cruz-Ferreira & Ribeiro, 2013; Argus et al., 2012). At the same way in the football, the physical demands imposed at players have been widely documented in recent years (Bradley et al., 2009; Dellal et al., 2011, Altavilla et al., 2018a). Explosive actions are elements of success in football, as well as sprint times, which occur every 2-4 seconds (Mathisen GE & Danielsen KH, 2014). The analysis of the workload during the competition is today fundamental for the planning of training (Altavilla & Raiola, 2018), since currently physical conditioning is increasingly characterized by the integration of exercises that reproduce specific technical-tactical gestures (Bosco et al, 1994); even if, sometimes, some individuals tried to improve in artificial way their performances, legal or illegal, healthy or harmful to health (Mazzeo et al., 2018). The research and training, in Italy as in the world, must to contrast the doping (Raiola et al., 2018). Finally, two other aspects should not be underestimated: the transition period, especially by amateur teams, should be planned and finalized (Forte & Altavilla, 2018) to avoid, in the first period of preparation, anaerobic/aerobic stress (Senatore & D'Elia, 2018) and the impact on performance by psycho-social skills (Valentini et al., 2018). The purpose of this work is to analyse and evaluate the energy cost of the physiological commitment required of basketball players, trying to extract relevant information from a series of research carried out in different countries of the world, for an interpretative analysis of theoretical and documental results.

WORK METHODS

The review of the literature and scientific documents was conducted through the use of several databases: PubMed, MedLine, Google Scholar. Relevant bibliographies were sought to identify the energetic cost of the physiological commitment required of basketball players. Interest has been placed on some physiological parameters, particularly on the oxygen uptake, metabolic cost, lactate and heart rate.

RESULTS

The physiological commitment is widely investigated because is the basis of physical training methods and sports sciences. Every sport has a characteristic pattern of exercise and range of exercise intensities which determine the energy requirements in the sport (Morgan et al, 1989). Basketball players have high capability to move quickly, jump, bounce the ball, coordinating lower and upper limb movements (Cortis et al., 2011) and must be able to effectively perform specific tasks under conditions of physical fatigue that occurs during different training and game-play intensities (Kamandulis et al., 2013). For example, in a study of Ben Abdelkrim et al. (2010), playing at the 80% of the heart rate significantly decreases the percentage of shooting with respect to 50% heart rate; therefore, training of shoot in conditions of from moderate-to-high fatigued state is necessary to maintain high percentage of shooting during match. Other studies (Dupont et al, 2003; Dupont et al, 2005; Spencer et al, 2006; Castagna et al, 2008;) investigations challenge the common assumption that active recovery is beneficial in fostering blood lactate clearance during exercise. The lactate remains a good, indirect marker for the conditions that induce metabolic acidosis (Robergs et al, 2004). In addition, Ratel et al. (2006) reported that children fatigue less during repeated sprinting compared to adults. Rodriguez-Alonso et al., (2003) detected physiological variables including heart rate (HR) and blood lactate concentration (LA) in actual basketball games and demonstrated relatively high physiological demands of competitive basketball, as evidenced by the elevated LA and sustained high HR response despite the relatively low percent of live time spent in high-intensity activities. The range of mean match heart rates (87–95% maximal heart rate) detected in several studies on basketball (Grosgeorge, 1990; McInnes et al., 1995; Rodriguez-Alonso et al., 2003) shows that the physical demands of this sport may vary according to many factors, such as the level of competition, the physical capacity of players and certainly from type of training. It is possible to define the maximal heart rate with the equation: HRmax=208-0.7×age (Alltavilla et al., 2018b). Another investigation described the physical and physiological demands of seasonal competition, where players typically play one game each week (Klusemann et al, 2013). The higher frequency of high intensity movements in seasonal games likely reflects the advantage of being fresh physically for each single game with minimal cumulative fatigue effects from previous games. The heart rate values measured during both seasonal and tournament competition confirms the high physiological demands experienced during basketball games (Matthew & Delextrat, 2009; Scanlan et al, 2012). Studies on time motion analysis detected that the players perform different movements, resulting a high number of actions every 2 sec, which shows the highly intermittent nature of basketball (Ben Abdelkrim et al., 2007). In the last few years, many researchers have focused mainly on the shuttle run with different direction changes (Montgomery et al, 2010; Zamparo et al, 2014; Bekraoui et al, 2018). The energy expenditure of the running, in activities such as basketball, is strongly correlated to the number of acceleration phases and deceleration phases, as well as to the change in stride frequency. In fact, the necessity of having to run with the control of the ball, or controlling the action of the opponent, involves the adoption of a step frequency that moves away from the natural frequency resulting in a greater energy expenditure (Cavanagh and Williams 1982, Dalleau et al 1998).

DISCUSSION AND CONCLUSION

The results, relative at the intensity, fatigue resistance and ability of to cover wide distances, in varied way, by basketball players during matches, can substantially affect basketball theory and practice. In our opinion, the practical value of this and other similar studies is mainly seen in the planning and organization of basketball players' training, particularly during conditioning technical-tactical and the physical preparation. In the field of motor and sports sciences (D'elia et al., 2018), and above all, well as it is possible to notice from analysed studies, the fatigue effects received attention, mainly because fatigue impacts overall athletes'

performance (Faria et al., 2005). The fatigue, as the main parameter for the assessment of physical efficiency, affects muscle strength, coordination, fine motor control, and movement patterns (Enoka & Stuart, 1992); as well as, the maximal oxygen uptake (VO_2max) is an important indicator of the basketball player's aerobic physical condition (Narazaki et al., 2009). In fact, during intermittent exercise, both the VO_2 and the lactate production are greater than what can be found during a continuous type exercise carried out at the same average work load (Bangsbo, 1996); this, further, would underline how the intermittent operation involves, at the same load, a greater energy expenditure compared to continuous operation. This type of commitment in basketball increases the anaerobic alactacid commitment (Gaetano & Rago, 2014), so the training of aerobic capacity is not specific and contraindicated (Katch & Weltman, 1979). The relatively high level of aerobic demand despite the relatively high percent of playing time (about 66%) spent in walking and standing suggests that the role of aerobic metabolism is critical in restoration of phosphocreatine in the sport characterized by high intensity intermittent play (Ainsworth et al, 2000). On the other hand, modern basketball, due to the increasing intensity of the game rhythm, increasingly commits the alactacid anaerobic component; it is above all for this reason that we need more and more powerful athletes (Altavilla et al, 2018c; D'Isanto et al, 2018). The optimization of the various parameters that constitute what for man is one of the most natural activities such as running involves, in the moment in which performance is as extreme as in high-level sports, a deep knowledge of all its aspects biomechanical and energetic. For this reason, it is desirable to have a deep theoretical knowledge of the latter, with the aim of identifying the best training methods for improving performance in the context of high-quality sports performance (Altavilla et al, 2018d). Coaches and anyone involved in training of young player should account for these methodological indications with the aim of program a training specific.

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