

## THE USE OF GPS TRACKING IN 3x3 BASKETBALL TRAINING FOR MONITORING AND IMPROVING ATHLETES PERFORMANCE

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### Abstract

*The paper aim is to show a novel technique for tracking and monitoring the physical activity of the players in 3x3 basketball sport using a GPS system, due to the fact this particular sport is considered nowadays is one of the most spreaded urban team activity. In order to establish the best way for basketball players to improve their endurance and thus obtain better performance during the game we used for the first time in Romania a Polar monitor chest for measurement heartbeat. The results showed that 3x3 basketball game is significantly more anaerobic than the traditional 5v5 one, and even if the first one is shorter in terms of time the relative intensity is twice higher than of traditional 5v5 basketball.*

**Keywords:** *gps, statistics, performance, basketball.*

### INTRODUCTION

Nowadays, this basketball discipline is considered the number one urban team sport. From the first official event at the 2010 Youth Olympics Games to the Olympic inclusion starting from the Tokyo 2020 Games, FIBA has had an ambitious vision for the game. This was possible because as in 1932, when Romania was part of the eight founding members of FIBA and now we can say without mistaking that Romania has struggled for 3x3 basketball to become Olympic sport, being the only country that has promoted basketball 3x3, a discipline with a great impact among young people, attracting thousands of athletes annually on the streets.

The research is to develop basketball 3x3 specific preparation recommendations and training plans based on the findings of this study. The objective of this paper was to scientifically prove the physical and physiological characteristics of 3x3 versus the traditional 5v5 basketball as well as to lay a scientific ground for training recommendations.

For that purpose the players were subjected to a series of basketball specific performance tests

being equipped with heart rate monitors and GPS units in-game during the competition.

### MATERIALS AND METHODS

Basketball is an intermittent, court-based team sport comprised of repeated high intensity movements such as change of direction, accelerations and decelerations interspersed with periods of low to moderate intensity activity. Athletes also perform regular maximal efforts during competition including extensive high intensity shuffling, sprinting and jumping (Edwards et al., 2018).

During the practice, players were asked to wear a personal Global Positioning System (GPS) Garmin Vivo sport device, for registering the standard variables of distance (m) and meters covered per minute of game time (m/min). Heart rate was measured continuously during play through personal chest transmitters using a Belt Polar Heart Rate h10 system. The data was analyzed for peaks and average heart rate during the effort (b/min).

We have tested the technology on 8 male athletes and 8 female athletes during the practice and games on a official court. The

official court size is 15 meters in width and 11 in length long with 1.5 meter boundaries.

## RESULTS AND DISCUSSIONS

The player movement information is used by teams for training purposes, to get a better understanding of players movements and therefore maximize training results.

The first suggestion that GPS could be used to assess the physical activity of humans followed some 40 years later. There was a rapid uptake of GPS technology, with the literature concentrating on validation studies and the measurement of steady-state movement. The first attempts were made to validate GPS for field sport applications in 2006 (Aughey, 2011).

While GPS has been validated for applications for team sports, some doubts continue to exist on the appropriateness of GPS for measuring short high-velocity movements. There is extensive information on the activity profile of athletes from field sports in the literature stemming from GPS, and this includes total distance covered by players and distance in velocity bands. Global positioning systems have also been applied to detect fatigue in matches, identify periods of most intense play, different activity profiles by position, competition level, and sport. More recent research has integrated GPS data with the physical capacity or fitness test score of athletes, game-specific tasks, or tactical or strategic information.

The future of GPS analysis will involve further miniaturization of devices, longer battery life, and integration of other inertial sensor data to more effectively quantify the effort of athletes.

A recent report of traditional basketball describes average heart rates of ~171 beat/min, which was 91% of the maximal heart rate recorded during play. Additionally, during on-court playing periods, 75% of playing time was at or above 85% of maximal heart rate. The average heart rate response during play for 3x3 is 83% of the average peak heart rate obtained from players during competition or testing (Figure 1, Figure 2).

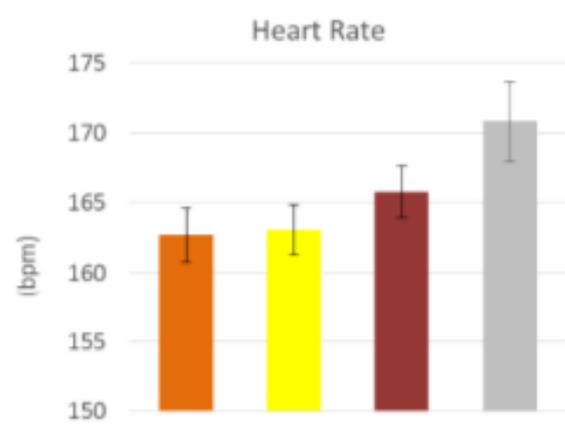


Figure 1. Heart rate during the practice

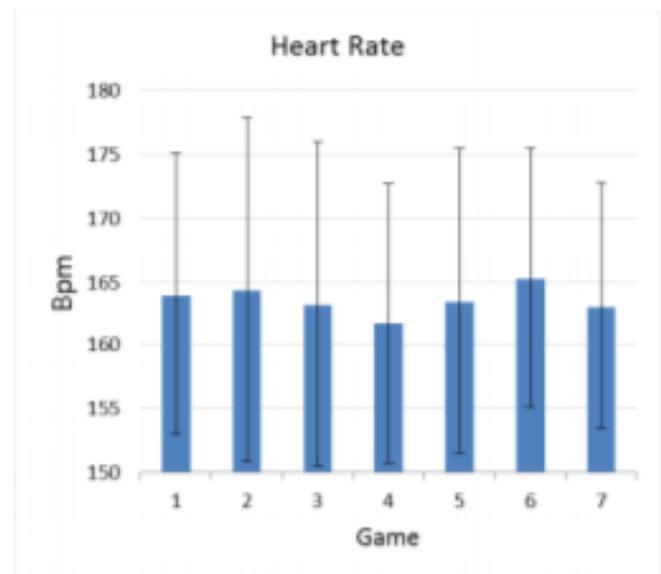


Figure 2. Heart rate during the game

Therefore, although the absolute heart rate response from 3x3 players is lower than that of traditional basketball, given that there is less distance travelled during play the relative intensity as a proportion of maximal is similar to that of traditional basketball. This is a unique characteristic as it demonstrates that the requirement to meet the game demands of fast changes in direction, in a small competition space is high.

The average heart rate response during male 3x3 was not different at our practices levels, and only marginally higher at professional competitions. Compared to the heart rate responses recorded from literature, heart rate during all levels of 3x3 are significantly lower. No differences were observed for heart rate response over increased number of games, and this may be due to the wide variation in responses to game demands. This indicates that

as the number of games increases, that heart rate may not provide a clear indication of fatigue.

For female players, the average heart rate responses from the games were significantly higher than those from the practices, and those published from literature. Similar to male responses, there were no differences in heart rate as the number of games increased, and both show wide variation.

Male 3x3 players are generally shorter and heavier and more closely resemble forwards from traditional basketball, while female players are similar to the characteristics of guards at national and international level.

There was a significant difference in the change of direction profile for male players. Males tend to make a greater number of fast changes in direction to the left. The reasons for this are not achievable in this analysis. For female players, the volume of fast changes of direction is lower than males, and it appears the main change of direction is to the right, but not only for practice. This coincides with the other physical and physiological data, in that the female game is less explosive than males.

The acceleration and deceleration profile for females is similar to that of males, displaying that there are a greater number declaration events, particularly in the low and medium range, with no difference for high speed accelerations and decelerations. Surprisingly, the volume of high speed accelerations and decelerations are similar between males and females, which appears to be a unique aspect of 3x3.



Figure 3. An illustration representing athletes during the game

As 3x3 can be considered as predominantly anaerobic exercise, players compete in a confined court area increasing the relative movement intensity compared to traditional basketball. Increased high intensity accelerations and decelerations from change of direction movements contribute to this difference. This also demonstrates a dissociation between displacement (distance covered) and intensity in the demands to play 3x3 i.e. although there is less total distance covered and the metres covered per minute of game time is low, the actions described drive a high physiological response.

The ability to perform short, repeat efforts comprising multiple changes in direction in a confined court space is complex and multifactorial. The importance of both aerobic and anaerobic energy pathways has been shown in traditional basketball, and likewise in our analysis of 3x3. Additionally, lower body strength and neuromuscular power are key contributors to performance in repeat effort and change of direction activities.

Acceleration and deceleration profiles during male and female 3x3 are gender specific, with females lower in volume and speed, while both genders complete more deceleration activities during a game. The relative intensity of male competition is twice that of traditional basketball (Montgomery, 2016).

## CONCLUSIONS

Our work can be extended in many directions. We can include performance features extracted from official games, where the player is exposed to the highest physical and psychological stress or we can investigate the “transferability” of our approach from a club to another.

The majority 3x3 players have differing physical and physiological characteristics compared to players from traditional basketball.

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