APPLICATION OF GPS TECHNOLOGY AND ITS INFLUENCE ON IMPROVING PERFORMANCE IN FOOTBALL

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Abstract:
Professional football requires a higher level of physical fitness, more running, strength and versatility. The game of football is evolving rapidly, so the demands of top football are changing. Observing the development of football players, we can notice that there are crucial factors on the way to success in professional football, such as adequate selection, training of coaches, application of innovative training methods, adapted nutrition, but also the use of modern technology, which will be discussed in further work. The biggest driver of setting new demands in football is science, from sports medicine through physiology to diagnostics, of course, with the latest technologies. Undeniably, players must possess exceptional quality to play football at the highest possible level, but quality without adequate training will not bring success. Today, monitoring and supervision of athletes have become an indispensable part of the training process. Coaches, fitness coaches, strength coaches and all people involved in developing players at the highest level must have information and knowledge in the technology field and all innovations that help monitor athletes.

Keywords:
GPS, Catapult, Tracking, Conditioning, Fitness.

INTRODUCTION

Scientists in diagnostics and sports technology have found a way to use technology and enable monitoring of all activities during appointments and matches. By implementing GPS devices in football training, sports scientists have influenced the quality of football players' training processes.

Most of the technological innovations were not made directly for sports or football, they were used in everyday life, but people who care about improving the game of football have found a way to implement the technology in sports. So today we have the use of GPS devices that enable and help us monitor parameters such as the amount of running, running speed, jump height, down to the smallest data such as calorie consumption, heart rate value or the force used for a certain movement in a certain at the moment of training or a match. All this data helps trainers to program training more simply and more accurately.

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DOI: 10.15308/Sinteza-2024-347-351

Football belongs to team sports, but with the application of technology and the easier collection of data from matches and training, the principle of preparation and development of a football team goes towards individualization and setting goals for each player separately, i.e. in the domain of his capabilities. Systems for monitoring various parameters in the development of sports performance are increasingly present and numerous, so that nowadays it is completely unthinkable to program training without them. Trainers are increasingly being asked to collect, understand and analyze data and bring science closer to practice with the help of training tracking technology [1].

2. METHOD

The bibliographic-descriptive method was utilized in this paper. To review the relevant literature, electronic databases such as PubMed, Google and Google Scholar were searched using specific keywords and phrases like microtechnology, GPS, fitness, tracking, wearables.

3. RESULTS AND DISCUSSION

One of the most crucial aspects of monitoring an athlete is to observe their response to stress after a training session. Based on this response, the next training session can be planned. The subsequent training should be a continuation of the previous one, with sufficient intensity and scope to enhance the athlete's abilities. However, it should not be too extensive or intense, as it may lead to excessive fatigue that can negatively impact the player's athletic performance [1].

Perhaps the greatest advantage of using a tracking device is to obtain a large amount of information from a training session or match (or several) and to separate it precisely through parameters in order to further develop the athlete and his performance.

Monitoring a player's training load can be used to assess fitness levels and individual response to a given activity. The amount of work done by an athlete can be described as external or internal load. External load refers to the prescribed activity, in terms of variables such as distance covered, average speed and number of accelerations (within a given period), while internal load describes the athlete's physiological response. Former ways of monitoring external exercise were time-consuming using video analysis, while internal exercise was calculated by monitoring heart rate (HR) or rating of perceived exertion (RPE), where the level of exertion is multiplied by the duration of the exercise.

In the following text, the monitoring of the load with the help of GPS Catapult will be described. Their products empower coaches with 'scientifically validated metrics' to improve athlete performance. This is a device placed behind the athlete between the shoulder blades that is used to track the athlete's movements via GPS. Some of the variables we get with the help of GPS technology (Catapult) and their role in programming and dosage of football training are:

1. Total distance;
2. Total Player Load;
3. Meterage Per Minute);
4. Acceleration (>2 m/s);
5. Deceleration (>2 m/s);
6. High Speed Running;
7. Sprints;
8. Number of sprints; and
9. Maximal velocity.

Total Distance – a parameter that gives us information on how far the players walked or ran in total during the match. Today's players run between 9 and 12 kilometers per game on average. There are players who cover 12 kilometers per game, but there are few of them or they don't do it that often. The difference in how far a player will run, in addition to individual characteristics, is also in the game system, that is, the position the player plays. An important parameter, but football goes in a different direction, it is more important to be more efficient and concrete in running, faster and more dynamic, therefore some parameters that will be further in the text are more important to us than this one [2].

Total Player Load - when we talk about the development of sports performance, we must take care of the dosage of each training session. If the stimulus or training is not sufficient, there will be no development of the player, or progress in the abilities being trained, on the contrary, if the stimulus is often too much leads to injury or an increased possibility of injury. Almost 40% of injuries occur as a result of overtraining of players, therefore this parameter is extremely important to monitor [1].

Intense reactions - Meterage Per Minute – a parameter that gives us a clearer picture of the intensity of the activity itself, specifically the number of meters run per minute at high intensity. If that number is higher, the players played at a higher intensity or are capable of playing high intensity matches.

Acceleration & Deceleration - represent a parameter that refers to the number of accelerations and stops, and is interpreted as the ability to quickly change direction. It is directly related to coordination, agility and starting speed in soccer players. A parameter such as sprint or high-intensity running gives us a lot of information about the football player's activity during a game or training session, but that alone is not enough. Therefore, we also look at these two parameters that refer to an acceleration greater than 2 m/s or a stop occurring at a speed greater than 2 m/s. In this way, we get a clearer picture of the activities of the muscles of the back and front muscles in eccentric work. Based on that, we can more clearly program the recovery training unit as well as supplements if these parameters are not at a satisfactory level [3].

High Speed Running – a parameter that gives us information about how much the player ran at high intensity, expressed in meters, this parameter is equally important as sprinting in football. Since soccer is an explosive activity, we therefore require our players to play fast, that is, to run at a high intensity and spend as much time (meters) as possible in that intensity. In football, we distinguish movements such as walking, low-intensity running, medium-intensity running, high-intensity running and sprinting. Teams spend the least amount of time sprinting, 1-4% of the total duration of the match [4]. The next parameter that indicates the intensity of our team's game is running at a high intensity, and therefore we try to keep that parameter at a high level. The running speed that the Catapult system records as high-intensity running is running at a speed between 19.8 and 25.2 km/h.

Sprint - The time that the teams spend in sprint during the game is 1-4% and that in distances from 10 to 20 meters. Usually, these activities occur during the key actions of scoring a goal or defending a goal [5]. Catapult is a device that directly gives us information on how many meters our players ran in a sprint, but the downside of this parameter is that Catapult in its system has standardized speeds over 25.2 km/h and records everything over that as a sprint. Individual differences in speed between the players give us the right to take this information with a caution.

Number of total sprints - The number of total sprints is also an important data for us in order to see the intensity or ability of the player to repeat sprint runs. Sometimes it happens that a player runs 50 meters in a sprint, and it happens from one sprint running in attack or in defense.

With the exact number of sprints, we can directly see how many repetitions he got to his 50 m sprint, which is much more important to us. It's better if he did it in multiple reps than one, for the simple reason that it shows us the power of repetition in a player.

Maximal Velocity - Represents the maximum recorded speed of a player in a certain activity, expressed in km/h. In this way, we can obtain a player's speed parameter that can later be used to calculate MAS (English maximal aerobic speed) or MSS (English maximal sprinting speed) during individual running programming for players [6].

The ratio of external to internal load can be used to give some indication of mechanical efficiency. Increasing efficiency can be achieved by reducing the internal load in cooperation with maintaining the external load (performance). Similarly, a decrease in external load or an increase in internal load may indicate increased effort.

Thus we have an example of monitoring the training load through the concept of acute and chronic workload (ACWR) [7]. Of course, the workload is easier to monitor with the help of technology, in several ways: individually, as a team, by position in the team. ACWR is a mathematical calculation that consists of dividing the current week's training load by the average training load or averages for the previous 4 weeks [7, 8].

Therefore, it is recommended to avoid progressive training (high-intensity training) in increasing the load in order to avoid the risk of injury. In this sense, it has been proposed that there is a "danger zone" for increased risk of injury when the ACWR is between 0.8 and 1.5 [7]. This means that when the acute load is < 0.8 times or > 1.5 times the chronic load during training, the risk of injury increases during the following week. In this situation, it appears that the risk of injury can be modified by a high level of aerobic fitness, greater lower body strength, reduced injury history and younger age of the soccer player [9, 10].

The most commonly used method to analyze performance is through post-session analysis. This method involves reviewing the data collected on a device after the training session has ended. It allows athletes and coaches to reflect on the data at their leisure and plan for the next training session. However, with the advancement of technology, it is likely that real-time data analysis will become more common in the future [11].

During a training session, it can be quite useful to evaluate one's performance by viewing real-time data. This data can offer immediate feedback and help individuals adjust their approach accordingly. Although real-time data feedback is still a relatively new concept, it's quickly gaining traction, thanks in part to the rising popularity of the 'quantified self' movement. As people become more interested in tracking their own behaviors and habits, it will become increasingly important to have easily available analysis of this nature. By offering real-time data feedback, individuals can gain valuable insights into their performance and make informed decisions about how to improve their performance moving forward [12].

GPS devices have proven to be reliable and valid in collecting data both for internal and external loads. However, in order to achieve significant results in improving the sports performance of players, there are a large number of factors that must work in order to achieve the goals.

The impression is that with proper dosing and the use of microtechnology when planning and programming the training program, we can significantly influence the improvement of parameters such as explosive power, speed and maximum aerobic consumption. The problem with this load programming method is that it requires individualization in monitoring parameters. The path exists, but a high level of player diagnostics is required.

In the future, GPS technology is expected to be utilized in three main areas: Firstly, there will be a greater integration of movement data with fitness, physiological, tactical, or strategic data. Secondly, GPS and inertial sensor data will be integrated. Lastly, further miniaturization is expected with a possible increase in sample rate [13].

As we mentioned earlier, football is moving in the direction of increasing demands and burdens. The matches are more numerous, and therefore more frequent. The teams are becoming more uniform, so it is more difficult to win.

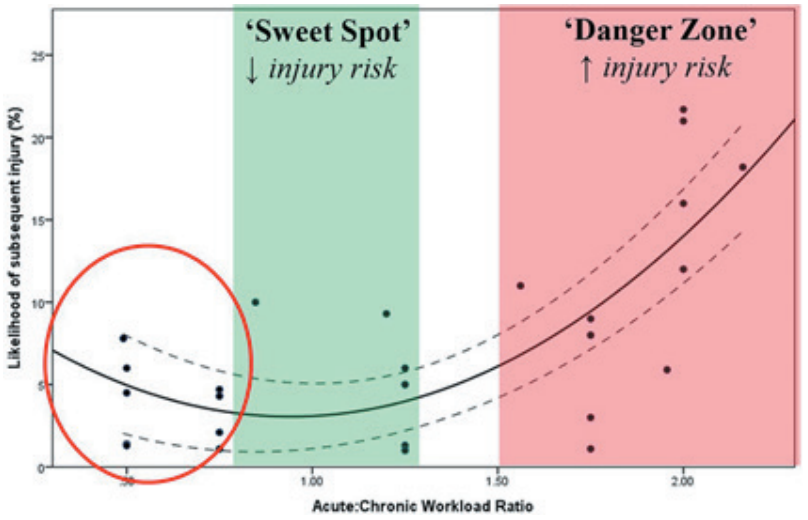

Figure 1. Relationship between acute and chronic workload [10].

Figure 2. Real-time data analysis [12].

Financial, marketing and infrastructural football as we know it today is at the very top. Details make the difference. It is they who play an increasingly important role, and the possibility of coaches and people leading the team to make a mistake is decreasing [2]. That's why there are innovations in sports, different scientific fields are involved in different fields with the aim of further improving sports and athletes.

4. CONCLUSION

The use of GPS technology together with training programs should balance developing the individual for the specific and positional demands of team sports and the maximum load that the individual can withstand before a significant increase in the probability of injury [14]. Without a healthy athlete, we cannot maintain or further develop his performance.

It is certain that innovation, education and the most up-to-date approach to training planning and programming are needed [15]. If we unreservedly trust technology and what it tells us, we can get into trouble because sport is a living thing, it differs from person to person and each athlete needs to be approached in an individual way. Also, if we accept technology as an aid and a tool that will make it easier for us to improve our sports abilities, then we are on the right track [16].

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