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The Importance Of Vo2 Max In Young Soccer Players

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Abstract

Soccer is a high-level skill sport that requires aerobic and anaerobic strength, as well as physical skills related to speed, agility, strength, and power. To meet these physical needs of soccer players, coaches now offer a variety of aerobic exercises that essentially use the lower and upper extremities, as well as large muscle groups. Correct technical performance of exercises protects not only from various injuries but also saves unnecessary energy consumption. For this reason, the purpose of this research is to critically analyze research that has examined the importance of aerobic endurance in young soccer players. The following databases were searched: Pub Med, Scopus, Google Scholar, CrossRef, etc. to find all relevant publications. The following keywords were used in this search: "soccer", "young soccer players", "VO_2 max", and "soccer performance", along with adjectives such as "effect", "change" and "impact". It was found that the aerobic demands of soccer players are crucial and strategic for the game.

Keywords: "soccer", "young soccer players", "VO2 max", "soccer performance", "effect", "change" and "impact".

Introduction

Soccer is the most popular global sport millions of men and women train and participate in this magical game. The line of creation of young footballers works without interruption with every individual who has dreams and aspirations to "reach the top" and emulate their superheroes. Many young people have bedroom walls full of posters of their heroes and live with the expectation of success at all levels of competitive sport. Moreover, the greatest emphasis is placed on discovering talents and training them from childhood until they appear in the top-level teams. The focus on youth soccer has increased since the huge financial investment in 'building a future star' together with the increase in professional levels of training and education which has encouraged coaches, parents, and administrators to support development programs of soccer. These approaches have emerged since the early 80s and the development of programs and structures in the new millennium are very sophisticated and well-funded. Over the years, there have been various studies and texts that have addressed the principles of youth soccer training. These books cover the principles and practices of the game with an almost endless number of soccer activities, skill practice, and strategic approaches. Today, there are thousands of dedicated soccer training sites on the web that reflect the global demand for the most attractive sport for every young man or woman. Facing the fact that there are few or no texts dedicated to the science of youth soccer in our country, there is a need to fill this gap with literature but also with contemporary studies that will serve to give an impulse and push scientific theories on soccer at young ages. Since its inception in 1987, the World Congress of Science and Soccer has been held once every four years. The first congress included a theme entitled "Facilities for young soccer players" which reflected the concerns of youth soccer at the time.

VO_2 MAX

Soccer is a very dynamic sport. As a result, the tension and effort during the game vary depending on the player's actions on the field, the essence of biomechanics, and quick movements (D'Elia et al., 2020). For this reason, aerobic power is a key element for a soccer player, as it allows for improving recovery capacity, especially after very intense efforts. As we have mentioned before, aerobic power is defined as the amount of oxygen that can be used by our body in the unit of time during progressively increasing physical activity, until it is exhausted. It is closely related to the heart rate, which can be obtained from the heart beats per minute. The aerobic and anaerobic capacity of an athlete can determine the outcome of the competition, precisely for this reason, it is important to evaluate the ability of athletes within this capacity. The player in the game undergoes periods of low intensity interspersed with periods of high intensity, including standing, walking, running, and sprinting with frequent changes in direction (Stølen et al., 2005). During these peaks of intensity, the aerobic mechanism alone is not sufficient to cover the energy demand, so anaerobic mechanisms must intervene, which creates immediate energy to meet the demand and immediately make the necessary amount of energy available to the muscle's ATP. The body at this point is in oxygen debt that needs to be replenished as quickly as possible, so improving aerobic power is key to achieving this. Even the study done by Di Salvo, emphasizes that the aerobic base $\dot{V}O_2$ max is

crucial in football. It serves to cope with high-intensity interplay activities, including accelerations, sprints, changes of direction, jumps, lateral steps, touches, and technical skills specific to the game, all associated with sufficient muscle strength, flexibility, and dexterity (Di Salvo et al., 2007). Contemporary soccer compared to previous decades is more intense, and nowadays players cover approximately 30% more distance at high intensity, this requires at the same time, faster recovery (Barnes et al., 2014). Aerobic fitness, on the other hand, is also associated with a lower risk of illness and injury throughout the preseason and competitive season, which is another crucial factor for soccer players (Watson et al., 2017). It is widely recognized that athletes with better aerobic capacity have a higher body capacity to recover from intermittent anaerobic activity such as that involved in soccer. Thus, one of the most important physiological mechanisms for the soccer player is the ability to recover through increased capillarization caused by aerobic exercise. This is achieved by improving the transport of oxygen to the muscles, consequently increasing the density of the mitochondrial muscles and removing the metabolic bi-products produced during the match, all this being based on aerobic training, that is, on the aerobic system as a whole. Therefore, as already proven, the player with higher $\dot{V}O_2$ max can run at higher intensity and longer distances, before glycogen depletion causes a decrease in intensity. Researchers have stated that in terms of team selection, individual responsibilities of players within the team, and tactical decision-making, coaches knowing the VO_2 max of the players will be able to make the right decisions (Jemni et al., 2018).

As a result, the aerobic demands of soccer are crucial and strategic. For this reason, aerobic exercise, also known as cardio, is widely used by trainers to improve the athlete's ability to use oxygen and continue activity for different periods of time. Another extremely beneficial effect of aerobic exercise is the modulation of parasympathetic-sympathetic activity. Self-restoration during the match is another extremely useful physiological feature provided by this exercise. Vagal reactivation is also associated with better aerobic performance. And bradycardia is a hemodynamic benefit for a soccer player who wants to make quick transitions, as it means that active muscles will receive more oxygen (De Araújo et al., 2018). Recently, it has been argued that aerobic exercise involves qualities such as speed, power, agility, coordination, strength, and game-specific skills in response to perturbations and adverse remarks. One could argue that these training techniques are ineffective and only energize distance runners. But do they understand the need to develop every muscle fiber and energy system, which most team sports frankly don't? However, research has not revealed any negative relationship between strength, jumping ability, and sprinting in soccer players after aerobic training, which challenges these erroneous and contradictory impressions (McMillan et al., 2005). One of the theories presented is that VO_2 max affects the agility of the soccer player. According to the findings of data analysis, VO_2 max contributed 39.24% to dribbling agility in the sport of soccer (Subrata, 2020). This implies that the dribbling skill of soccer players will increase as the VO_2 max increases. On the other hand, players need a high level of fitness to cope with the energy demands of the game. Training brings about changes and adaptations in the body and in the case of interval training, favors improved endurance and strength. Aerobic and speed resistance training can be used during the season to improve high-intensity interval exercise performance. Interval training is successful in improving VO_2 max in athletes who

already have good aerobic capacity, as it is a good training tool to maintain high levels of aerobic power (Raiola & D'Isanto, 2016). Since it is considered an efficient training method to improve the aerobic capacity of players during the competitive season (Belegišanin, 2017), players should develop their ability to perform maximal, or near maximal, repeated efforts, which can be achieved through aerobic training. high intensity, with resistance to speed. For this reason, the ability to play the ball with great skill becomes more and more important in today's soccer game. When the player is in control of the ball, these qualities relate to the pace with which the opposing player applies pressure. The one who controls the ball is under a lot of pressure and thus has little space to play the ball freely. In these conditions, the player must be able to escape from the opponent's control, guard the ball so that the ball is in his possession and coordinate the attack through quick passes ensuring that the ball is under his team's control (possession of the ball). Soccer is a sport that requires a specific set of skills, "ball technique" skills known as functional movement patterns in the game of soccer. These soccer playing skills must be supported by: 1) possession of the ball; 2) control; 3) deceptive skills; 4) speed variability; and 5) perceptual and cognitive skills (Galli et al., 2016). If not supported by these factors, the skills cannot be realized quickly and thus the ball will be easily possessed by the opponent. Therefore, to compete internationally in soccer requires not only talent but also a high VO_2 max level, because these players will not be able to compete internationally and professionally if they simply have the talent or skills to manage a good ball. The soccer player must run an average of eight to thirteen kilometers (km) during two 45-minute halves of soccer matches, running short distances and running at a moderate pace alternately (intermittently). If a talented soccer player is physically unable to constantly maintain his physical condition, he may not be able to play a good and fulfilling game (Azcárate et al., 2020). One of the current arguments used by physical training coaches in our country is that because soccer is a sport characterized by intermittent activities and short intense training, longer activities would not take into account these characteristics and aerobic training would slow athletes down. This line of reasoning turns out to be contrary to the findings of several important researchers (Tønnessen et al., 2013; McMillan et al., 2005; Helgerud et al., 2001) etc. With a 4-minute stimulus, one of the most reliable studies on soccer players found expressive physiological effects of long-interval training, including substantial improvements in VO_2 max of 11%, anaerobic threshold of 16%, and running economy of 6.7%. In addition, the amount of time spent interacting with the ball throughout the game increased by 24%, the number of sprints by 100%, and the distance traveled on the court by 20%. The improvement in cardiovascular capacity during submaximal activity, which went from 82% to 86%, was another important factor. As a result, the central and peripheral capacity of the players was strengthened by long-term interval training. In addition to all the benefits of extended interval training, this training program can be predicted to increase VO_2 max by 0.5% each training session, which is a very economical method (Helgerud et al., 2001). Consistent with this idea, a different study found that prolonged exercise in soccer players did not slow them down (McMillan et al., 2005). Without a doubt, VO_2 max is a crucial factor in how well soccer players perform during a match (Tønnessen et al., 2013; Helgerud et al., 2001; Ekblom, 1986). As a result, it is clear that the soccer players in the present study did not receive sufficient aerobic load to increase VO_2 max at the end of the preseason, and most likely not throughout the competitive season. Older research already concluded that

60-65 ml/1-min/1-kg was sufficient to compete internationally in men's soccer (Ekblom, 1986). Ten years later, (Reilly et al., 2000) made the statement, which is still relevant today, that mean VO_2 max values greater than 60 ml/1-min/1-kg in elite teams, which expected to be verified in the players we will take into the study, suggest the existence of a threshold below which an individual player is unlikely to be physically successful in modern first-class soccer. Another research that used the time frame found that a well-developed soccer player can maintain a good aerobic condition throughout the season (Tønnessen et al., 2013). Consequently, an interval training protocol with dedicated testing has been proposed to assess and improve players' ability to perform high-intensity activities during the game (Raiola & Altavilla, 2020). The aim is to test whether a training protocol can improve aerobic power in an elite or amateur soccer team. For both a coach and an athlete, it is very important to periodically monitor the results of training programs (Ceruso et al., 2019). For this, evaluation tests are used to analyze the initial situation and to plan and verify the results.

Conclusions

Research has shown that the aerobic demands of soccer are crucial and strategic to the game.

$\dot{V}O_2$ max: - serves to cope with high-intensity combined activities, - affects the agility of the soccer player, - favors the improvement of endurance and strength, - promotes parasympathetic-sympathetic activity, i.e. restoration during the match.

Bradycardia is a hemodynamic benefit for a soccer player who wants to make quick transitions, as it means that the active muscles will receive more oxygen (De Araújo et al., 2018).

The aerobic and anaerobic capacity of an athlete can determine the outcome of the competition, precisely for this reason, it is important to evaluate the ability of athletes within this capacity.

The researchers point out that to compete at the international level in soccer, not only talent is required but also a high level of VO_2 max. Soccer players, in addition to being talented, must also be able to continuously maintain good physical condition, in order to play well. Older research has already concluded that VO_2 = 60–65 ml/1–min/1–kg is sufficient to compete internationally in men's soccer. However, regardless of these values, it is suggested to take into account the positions that the player has in the field.

An important aspect is evidenced by the extensive use of aerobic training by coaches, with the aim of improving the athlete's ability to use oxygen.

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