

TYPES OF AEROBIC TRAINING FOR IMPROVING VO₂ MAX

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Abstract. *Through its programs, aerobic training has now assumed the characteristics of a societal phenomenon related to sports, physical activity, and health. The goal of the study is to critically evaluate previous studies that have looked at how aerobic exercise affects a soccer players VO₂ max quality. Within this framework, maintaining control over the degree of a chosen physical ability is a fundamental problem, particularly during sporting events. We looked through Google Scholar, Pub Med, CrossRef, Scopus, and other databases to find all pertinent papers. In this search, the following keywords had been typed in: "aerobic training", "aerobic dance", "soccer", "VO₂ max", "soccer performance". Articles were searched using their titles, abstracts, and full contents in order to eliminate those that did not fit the previously given criteria. For aerobic training in natural forms of movement or in its naturally stimulated forms, a considerable number of studies were found recently published. These researches studied the effects and changes brought about by aerobic training of different forms in young soccer players. The effects of modern aerobic regimens have been widely researched and examined in relation to population health. Soccer players of all skill levels are finding aerobic training to be an effective training technique, and that the program, in all of its versions, has effectively addressed the unique demands of the game. In summary, aerobic training improves soccer player indicators.*

Keywords: *aerobic training; aerobic dance; soccer; VO₂ max; soccer performance.*

Introduction

Hard physical work hundreds of years ago was the main way our ancestors survived. Technical progress freed modern man from heavy physical work leaving him many free hours for other activities. Dr. Kenneth Cooper first used the word "gymnastics" in the 60s to refer to all activities performed under aerobic working conditions. The research that Dr. Cooper did for several members of the US Air Force found that these very direct training exercises, such as walking, running, dancing, swimming and playing certain sports, were effective in improving cardiorespiratory fitness. Dancer and choreographer Jackie Sorenson introduced this kind of practice to the general public in the late 70s. These, together with a few fresh concepts around the necessity of develop and make it better cardiorespiratory fitness; she did so by creating exercises dynamic with music. "Any form of physical activity that is performed by activating large groups of muscles, in a relatively long period of time (over 20 min), with a basic "cyclic" character is how gymnastics (aerobics) is defined. The work intensity for this type of exercise ranges from 50 to 85% of maximum oxygen uptake (VO₂ max) and/or 60 to 90% of maximum heart rate. Today, aerobic activity can be divided into several different types of work (modes):

1. Natural forms of movement (walking, running, cycling, driving, etc.), during which the exerciser maintains a continuous or slightly interrupted form of work;
2. Simulated natural forms of movement realized using the so-called cardio fitness equipment, (eg exercising with a bicycle, stepper, cycle ergometer, rowing ergometer, etc.);

3. Modern, all forms of movement that are made with music, because of its rhythm and tempo, intimately combine movement. The effect was to create a separate entity, which was referred to as modern gymnastics. This type of exercise is known as "gymnastics" or "aerobic dance" because it is performed to music and followed by choreography.

In particular, it is believed that contemporary gymnastics (aerobic dance) is now more popular than any other type of exercise activity. This is also a consequence of the studies done, the effectiveness of the training that has been shown and the motivational basis that it has. In our study, we do not aim at the positive effects of aerobic programs in terms of sports for everyone, but in terms of competitive sports with a focus on increasing the aerobic capacity of the lungs (VO_2 max) and improving performance, to soccer players.

Methodology

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: "aerobic training", "aerobic dance", "soccer", " VO_2 max", "soccer performance", along with adjectives such as "effect", "change" and "impact". Papers focused on the effects of aerobic exercise training on young soccer players, published in the last 10 years, and written in English and Italian. To filter articles that did not meet the aforementioned criteria, articles were searched based on their titles, abstracts, and finally the entire content. Subjects in each study were divided into the following categories: 1. Subjects by age; 2. Subjects according to the type of exercise; 3. Subjects according to the variables analyzed in the study (performance and VO_2 max).

Aerobic training

Aerobic exercise is one type of physical activity that requires the body's metabolic system to use oxygen to produce energy. It improves the ability of the circulatory system to receive and transport oxygen during aerobic activity. It can be performed in a variety of ways, with the common feature being achieved at a heart rate between 70-80% of an individual's age-appropriate maximum. It is also considered the cornerstone of endurance training, characterized by moderate energy expenditure over an extended period of time. Any action that is rhythmic in character and involves big muscle groups that can be done repeatedly is regarded as aerobic activity. The muscles involved in this type of activity rely on aerobic metabolism, which uses oxygen to extract energy in the form of adenosine triphosphate (ATP) from amino acids, carbohydrates, and fats. Walking, cycling, swimming, jogging, jumping, and long-distance jogging are some examples (Millstein, 2020). These characteristics make it possible that regardless of the age, weight, or athletic ability of soccer players, aerobic activity is very good for them, as the health benefits are numerous. As their bodies adapt to regular aerobic exercise, they will become stronger and in better physical shape. Aerobic training will help them not only in reducing the cardiac frequency but also in reducing the level of stress caused in the cardiac muscle at a certain level of exertion. In turn, cardiac output and maximal aerobic capacity or maximal oxygen uptake (VO_2 max) will increase.

Aerobic exercise will also reduce arterial and arteriolar tone, thereby decreasing cardiac “afterload” and peripheral vascular resistance (Garber et al., 2011).

Aerobic training is important for soccer players

Soccer is played around the world and has been an Olympic sport since 1900. The game lasts two 45-minute halves, with a 15-minute rest period in between. However, a team sport such as soccer has an activity profile that is intermittent due to the demands for frequent changes in the type of movements (such as walking, running, jumping, and kicking), in speed (such as accelerations, slowdowns), as well as in the change of direction and technical tasks (Stølen et al., 2005). Moreover, it is a high-level skill sport that requires aerobic and anaerobic strength (Afyon et al., 2017), on the other hand, aerobic exercise, additionally referred to as cardio, enhances the capacity of an athlete to use oxygen to continue the assignment for different time frames. The biological process of aerobic power uses lipids, sugars, and occasionally proteins to resynthesize using adenosine triphosphate (ATP) as fuel. In everything that lives, ATP serves as the main energy transporter. More ATP is generated by the aerobic system than by the other two energy systems (ATP-PC and lactic acid), although it generates ATP much less quickly (Garber et al., 2011). When it comes to sports, the aerobic system is the most important way of generating energy for ongoing workouts (Millstein, 2020), this will help soccer players build a greater aerobic base and increase anaerobic thresholds making it possible to improve their energy efficiency, which plays an important role in the game of soccer. Our muscles adjust to aerobic activity in the same way as they react to anaerobic exercise by generating fast-twitch muscle fibers. Persisted exercise of minimal to medium intensity degrees improves the capacity of the body for breathing and utilizing oxygen. As a result, the capacity of muscles to burn fat for fuel improves in cells that derive energy from oxygen increases, higher lung function is achieved, we have an improvement in hormonal variations levels and blood pressure that are needed to finally, redistribute fat around the body to burn as fuel and decrease the amount of fat (Garber et al., 2011). Of course, such changes bring benefits to soccer players, translating into higher endurance during intense physical activity due to increased blood volume, increased lung volume, strengthening of the heart muscle, and decreased total cholesterol, therefore, reducing the risk of arteriosclerosis, improving mental and emotional well-being and increasing bone density (Garber et al., 2011; Niu et al., 2018). These benefits enable the young soccer player to complete certain activities, as players need a specialized skill set as well as excellent physical condition.

Proper stretching, relaxation techniques, and healthy nutrition are important to accompany a cardiovascular exercise routine (Garber et al., 2011). Before designing and implementing an aerobic training program in athletes, we must measure their endurance. This will serve us to determine the intensity of the load that we will give. To maximize training benefits, players ought to train within the heart rate range. In the first session, good achievement is considered 50% of maximum HR, and over time this can increase to 85% (Garber et al., 2011).

Interval training

HIT is by far the most used training in the field of sports. Intensity (frequency), the amount of time, and repetition are the important factors to take into account while trying to enhance an athlete's capacity for cardiovascular exercise. In serious studies, it is emphasized that HIIT is defined by seasons of severe physical activity with max heart rate (HR max) > 90% alternating with periods of low-intensity activities (Gibala et al., 2012). According to findings, HIIT is a quick way to trigger certain muscle changes that are similar to those seen during regular endurance activities. Soccer is characterized by continuous variations in activity intensity, encompassing standing, walking, running, jogging, frequent changes of direction and speed, as well as jumping, often involving ball interaction with or without opponents (Stølen et al., 2005). These fluctuations in intensity, coupled with the 90-minute duration of a match, typically lead to heart rates exceeding 80% of maximal heart rate and approximately 75% of maximal oxygen uptake, imposing significant demands on both aerobic and anaerobic energy systems in young soccer players (Mendez-Villanueva et al., 2012).

Achieving high-level sustainability performance is crucial for success in soccer, and the aerobic energy system can be developed through various training methods, including interval training, continuous training, and Fartlek. Interval training for the long-term aerobic energy system typically involves a work/rest ratio of 1:1 or 1:2, with work periods lasting several minutes and active rest periods at a lower intensity. Continuous exercise maintains a constant intensity for an extended duration, while high-volume or continuous low-intensity training in soccer has been successful in improving endurance performance aspects such as peak oxygen uptake, individual anaerobic threshold, and maximal speed in young players (Meckel et al., 2014).

Fartlek training, Swedish for "speed play," involves varying speed and effort levels during a session based on individual feelings, without specific rest intervals. This type of training combines elements of both interval and continuous training, making it adaptable and effective for soccer players. Research indicates that Fartlek training is effective in developing cardiovascular endurance, including maximal oxygen uptake (VO₂ max), among soccer players (Pratama & Kushartanti, 2018).

Aerobic dance workout (with music)

To enhance all aspects of fitness (coordination, flexibility, muscular strength, and cardiovascular fitness), aerobic dance training blends rhythmic aerobic exercise with stretching and strength training regimens. It is done in a group under the direction of a teacher (a fitness expert) and executed to music. Formal aerobic dance classes are divided into different levels of intensity and complexity and have five components: warm-up (5-10 minutes), cardiovascular conditioning (25-30 minutes), strength and muscle conditioning (10-15 minutes), relaxation (5-8 minutes) and flexibility (5-8 minutes). Athletes can choose classes according to their level of physical fitness. Also, Garber et al. have concluded that an aerobic dance program is an effective alternative to a traditional interval training regimen (Garber et al., 1992). They reached this conclusion by comparing the physiological effects of an 8-week aerobic dance program with those

of a walking-running interval training program. The results showed a significant increase in maximal oxygen uptake, both in the "aerobic dance" group (+3.9 ml/kg/min) and in the "walking-running" group (+3.4 ml/kg/min). Also, the heart rate peak decreased significantly, in the "aerobic dance" (-4 b/min) and "walking-running" (-3 b/min) groups. So, an improvement in maximum oxygen uptake (VO₂ max) and heart rate was found. In one of the papers, 4 forms of aerobic dance that were used for the study are clearly described (Viskić-Štalec et al., 2007).

- Aerobic LO (low intensity), is a 5 to 30-minute aerobic exercise that consists of choreographic forms of lower intensity, executed without jumping or jumping, with one leg constantly in contact with the ground. The music is 130-145 beats per minute (bpm);

- HI-LO aerobics (high intensity, low intensity), involves the gradually interrupted distribution of these loads, to alternately place low and high-intensity loads on the entire locomotors, vascular and respiratory system. In addition to typical LO aerobic movement patterns, this program also includes more pushing variations, as well as jumping and running (traditional high-impact (HI) movement patterns, as well as plyometric features. The music is 136-155 bpm;

- STEP aerobics, is performed in front of a platform, on which we have to get on and off to complete a sequence of exercises. The height of the platform is different (15, 20, or 25 cm). Along with the kind and degree of difficulty of the steps performed, several other factors contribute to providing the right load, such as the appropriate number of repetitions and the pace. The music is 124-68 bpm;

- Aerobics (new body). Most important feature of the training is the simultaneous implementation of an aerobic dance program with lower-intensity leg movements and the use of small weights in the hands (0.5-1 kg), to increase the work of the body's upper part. For realizing this method are used; simple choreographic patterns, a methodical sequence of stimulation of small muscle groups, and the right number of repetitions are used to ensure the required workload. The music is 124–132 bpm.

The effective competitive performance of professional football teams relies heavily on the physical, psychological, and functional conditions of football players (Kokštejn & Musálek, 2019; Petrovska et al., 2020). Notably, the acquisition of functional skills at the anaerobic metabolism threshold, anaerobic power, and anaerobic capacity levels is a complex process. Enhancing the functional readiness of elite soccer players throughout the annual macro cycle necessitates efficient strategies and modern training tools and methods, including aerobics, step aerobics, CrossFit, stretching, and bodybuilding (Kumahara et al., 2021).

Innovative fitness technologies, particularly High-Intensity Interval Training (HIIT), are central to enhancing football players' physical and functional abilities (Gibala et al., 2012). HIIT, characterized by alternating short, intense bursts of anaerobic activity with brief aerobic recovery periods, aligns well with the demands of high-intensity aerobic-anaerobic soccer. Consequently, the widespread adoption of these modern fitness training techniques aims to elevate the performance and rehabilitation of young football players.

The hypothesis of the experiment posits that innovative training methods significantly impact sports performance and the physical and functional rehabilitation of young football players. This

approach aims to improve athletes' competitive performance following high muscle loads, thereby sustaining optimal performance across competitive periods. While various methods, including aerobics, CrossFit, and bodybuilding, contribute to improving physical training regimes, the focus should be on efficient recovery techniques (Nassis et al., 2020; Irtyshcheva et al., 2022).

Despite the acknowledged benefits of certain training tools, such as HIIT, and recovery strategies, there remains a scarcity of methodological recommendations for different high-intensity interval training techniques and strategies for rapid post-exertion recovery in scientific literature (Bangsbo et al., 2005; Owen et al., 2012; Kunz et al., 2019). Therefore, further research and practical implementation of these approaches are essential to optimize the physical and functional fitness of elite and amateur soccer players.

Conclusions

A number of academic publications, journals and scientific papers were examined before concluding that the choice of a motor fitness component would be influenced by aerobic exercise. A detailed review of some of the references revealed that there are many ways to improve the format and content of soccer players' regimens, partly as a result of doing aerobic exercise. It turns out that the most used exercise so far in the field of sports is the one with intervals. It can help build stamina in young soccer players. In soccer, the different intensity as well as the duration of the match, requires both aerobic and anaerobic energy production in young soccer players. The best possible method to achieve this is via short, intensive workouts then less intense workout. From this we understand that HIIT training corresponds to the intensity of the soccer game. On the other hand, Strength and endurance are increased when interval exercise is performed. At this period, one can enhance productivity on high-intensity intermittent workouts by utilizing both cardiovascular and velocity resistance training. Because interval exercise is an effective training method for maintaining high levels of aerobic power, athletes with strong aerobic capacity see improvements in their VO_2 max, but on the other hand there is a need for further studies regarding athletes with poor aerobic capacity. Also, continuous training and fartlek can be used successfully in football. The first serves to intensify some factors that affect ability to endure like the VO_2 peak, personal anaerobic threshold and maximum speed, especially in young players, and the second develops heart and lung endurance. Aerobic training with music is thought to be an effective alternative to a traditional interval training regimen, but studies should be conducted in this direction. Modern techniques of aerobics should be used, since the functional preparation of elite soccer players refers to looking for strategies which ensure the training system by using modern equipment and training methods. This will give coaches different opportunities to improve the structure and content of programs for the physical development of young soccer players. For this reason, innovative fitness technology should be highlighted in particular. This trend requires continuous improvement of further training methods. Findings showed that aerobic dance training increases motor fitness metrics, including flexibility, agility, and dribbling ability. There are numerous methods to improve these structures and refer to the use of different types of aerobics

and other variants mentioned above. The correct term that refers to these methods is "the most effective functional training techniques". However, there are only few researchers who provide methodical suggestions for the variability of different high-intensity interval training techniques as well as strategies for athletes to recover quickly from high muscle loads.

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