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The Effect of Aerobic Endurance on Agility and Speed in Amateur Soccer Players

İbrahim Halil ŞAHİN [1A], Ömer KAHRAMAN [2B],

Maya BUDAK [3C], Turgut KAPLAN [1D]

[1] *Selcuk University Institute of Health Sciences, Konya, Türkey.*
[2] *Ministry of Youth and Sports, Ardahan, Türkey.*
[3] *Ministry of Education, Erzincan, Türkey.*

Address Correspondence to İ. H. ŞAHİN: e-mail: ibrahim.h.sahin27@gmail.com

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A: Orcid ID: 0000-0002-8455-4574 B: Orcid ID: 0000-0001-5958-2592
C: Orcid ID: 0000-0001-6209-0935 D: Orcid ID: 0000-0002-6150-5235

Abstract

The aim of this study is to examine the effect of aerobic endurance on speed and agility performance in amateur soccer players. 18 male soccer players at the Türkiye regional amateur league voluntarily participated in the research. The means age of the soccer players participating in the research; 24.61 ± 4.434 years, means height; 181.50 ± 0.041 cm and means body weight; 73.17 ± 6.364 kg. In the study, the yo-yo test was used to determine VO2Max levels, the 30-meter sprint test to determine sprint performance, and the pro-agility test to determine agility performance. The results of this study were that high VO2max levels in soccer players had a significant effect on agility and speed performance. Additionally, when the effect size was examined, it was seen that VO2max level was more effective in speed performance than agility. Also, it was found that the VO2max level explained the speed performance by 37% and a 1-unit change in the VO2max level affected the speed by 0.16, while the VO2max level explained the agility performance by 40.2% and a 1-unit change in the VO2max level affected the agility performance by 0.11. In conclusion, It has been observed that aerobic endurance affects sprint performance more than agility. Considering the distances related to agility (18.28 m) and sprint test (30 m), it is thought that the effect level of aerobic endurance increases as the running distance increases. Therefore, aerobic endurance levels should also be considered when applying agility and speed exercises.

Keywords: Aerobic, agility, endurance, soccer, speed

Amatör Futbolcularda Aerobik Dayanıklılığın Çeviklik ve Sürat Üzerine Etkisi

Özet

Bu araştırmanın amacı amatör futbolcularda aerobik dayanıklılık seviyesinin sürat ve çeviklik performansı üzerindeki etkisini incelemektir. Araştırmaya Türkiye Bölgesel Amatör Ligi seviyesinde 18 erkek futbolcu gönüllü olarak katılmıştır. Araştırmaya katılan futbolcuların yaş ortalamaları; 24.61 ± 4.434 yıl, boyları; 181.50 ± 0.041 cm,

vücut ağırlığı ortalamaları; 73.17 ± 6.364 kg'dir. Araştırmada VO2max seviyelerinin belirlenmesi için yo-yo testi, sürat performansının belirlenmesi için 30 metre sürat testi ve çeviklik performansının belirlenmesi için pro-agility testi kullanıldı. Bu araştırmanın bulgularında, futbolcuların VO2max seviyesinin yüksek olmasının çeviklik ve sürat performansı üzerinde önemli bir etkisinin olduğu görülmüştür. Ayrıca etki boyutu incelendiğinde VO2max seviyesinin çevikliğe göre sürat performansında daha etkili olduğu tespit edilmiştir. VO2max seviyesinin sürat performansını % 37 oranında açıkladığı ve VO2max seviyesindeki 1 birimlik değişimin sürati 0,16 oranında etkilediği bulunurken, VO2max seviyesinin çeviklik performansını % 40.2 oranında açıkladığı ve VO2max seviyesindeki 1 birimlik değişimin çeviklik performansını 0,11 oranında etkilediği bulunmuştur. Sonuç olarak, aerobik dayanıklılığın çeviklikten çok sprint performansını etkilediği görülmüştür. Çeviklik (18,28 m) ve sprint testi (30 m) ile ilgili mesafeler dikkate alındığında, koşu mesafesi arttıkça aerobik dayanıklılığın etki düzeyinin arttığı düşünülmektedir. Bu nedenle çeviklik ve sürat çalışmaları uygulanırken aerobik dayanıklılık seviyeleri de dikkate alınmalıdır.

Anahtar Kelimeler: Futbol, aerobik dayanıklılık, çeviklik, sürat

INTRODUCTION

While both aerobic and anaerobic energy systems are usually used in soccer, it is considered as a sport prone to aerobic endurance due to the long duration of competitions. Soccer players travel an mean of 9-10 km during a match. Based on the reality , the endurance levels of the players should be at an advanced level. It is stated that the level of endurance specific to soccer affects the level of performance in soccer more than aerobic endurance. Therefore, it is necessary to focus more on soccer-specific endurance in soccer training. In other words, it is stated that classical aerobic endurance exercises do not have a sufficient effect on performance in a competition (5, 17). Soccer is a team sport in which anaerobic components such as speed and agility are important as well as the development of soccer-specific aerobic endurance in order to resist physiological violence for a long time during a competition (28, 15, 37, 10). Soccer is a sport characterized by sudden acceleration, deceleration, change of direction, short sprints, jumps and double struggles (1, 6, 24, 22). Multi-faceted players influencing each other, fast and continuous actions, unpredictable game models are unique features of soccer (38). In soccer competitions, athletes perform many movements such as sudden changes of direction, double combat and speed for 90 minutes (8, 7). It is stated that high levels of many motoric features such as aerobic capacity, anaerobic capacity, agility, speed and flexibility in soccer are important for success (40). Speed is defined as the ability to move the body at maximum fast. Speed is very important in soccer since speed runs cover a maximum of 25-30 meters (9, 36). The fact that the speed feature is developed allows to turn what they perceive into reality, to reach the result or to prevent the opponent from going to the result. In other words, it allows the actions that will affect the outcome of the match. The game structure of soccer requires players not only to have speed but also to have good agility (34). Agility can be expressed as the ability of the athlete to control and maintain body position during sudden changes in direction. It has a very important place in soccer, as in many sports branches. A soccer player exhibits sudden changes in direction, sudden accelerations, decelerations and stopping movements in the flow of the game. Since agility includes all these components, the agility of the soccer player is important for high performance (33, 2). Although the contribution of features such as speed and agility to the performance in soccer is below 15%, these features constitute important moments of the match such as possession of the ball, scoring or conceding a goal (31). Furthermore, these features differ according to the position of the players and the game strategy of the team (20). Therefore, in this study, it was aimed to examine the effect of aerobic endurance performance on agility and speed.

METHODS

Experimental Approach

This study includes section design to evaluate agility and speed abilities of amateur soccer players according to their aerobic endurance. A total of 18 amateur soccer players were participated. These soccerers have played in Türkiye regional league. F-MARC test battery designed by FIFA was used for warm-up of soccer players.

Subjects

The aerobic endurance of 18 soccer players were examined. Before conducting the experiment, all subjects were informed of the risks of the study and gave an informed consent. The study was approved by a local ethics board and met the conditions of the Helsinki Declaration.

Procedures

In this study, the F-MARC test battery designed by FIFA was used for warm-up. The test battery should inform about the warm-up procedure, about endurance, and about agility, power and speed (35).

All of the soccer players participating to the study had the same physical fitness because they attended the preparatory period. The tests were applied in the contest season, and the aims of all tests were explained to the players before the tests were conducted. The tests were started with a 20-minute warm-up session. The tests were performed on different days. While the tests were conducted, the same weather conditions were taken into consideration. This was followed by the administration of yo-yo, 30-m sprint, and pro-agility tests.

Each test was applied twice, with a 3-minute interval, and the best result was recorded. Photocell, cone, and tape measure for distance were used. The methodology employed during the tests is summarized in the following paragraphs.

30-m Sprint

This test allows the assessment of sprinting ability. The player waits for the signal at the starting point. On the signal, he runs at maximum speed. When he reaches the finish point, the time between the starting and finish lines is measured with photocell in terms of seconds.

Yo-Yo IRT-1 Test

The subject runs from cone B to cone C. During the runs, when one comes from cone B to cone C, a signal sounds and the line is stepped on and back to cone B is run. When the subject comes to cone B, the signal is heard again and it is jogged from cone B to cone A and it has waited until the starting point cone B is heard again. Running speed increases according to the test protocol. If the athlete cannot catch the signal for the first time when he comes to cone B, he or she receives an error and the second time in a row, if the signal is heard and, the subject is not on the point of B, the test is ended. Each time the subject arrives at cone B, the test distance is marked on the sheet and recorded. The test conditions to be performed should always be in the same field and weather conditions (such as not hot or cold, the ground not being wet to prevent the subjects from slipping). The subjects participating in the test should be asked to wear the same type of soccer shoes (crampons) so that they do not fall during running, and the running area should be made on the natural grass area. Test running speed will start at 10 km / h. At the end of every 40 meters, the running speed will increase by 0.5 km / h or 1 km / h depending on the test protocol (5).

VO2max = 36,4+(0,0084 x running distance) (5).

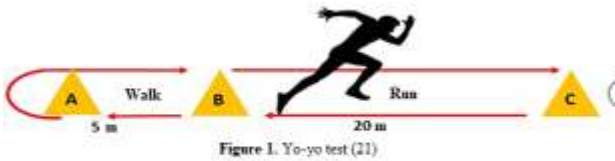

Figure 1. Yo-yo test (21)

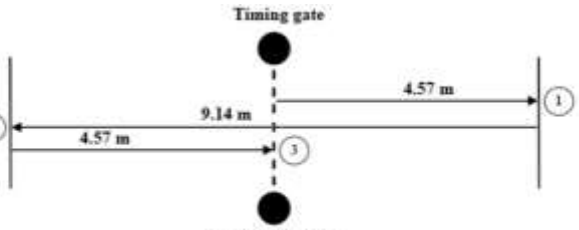

Figure 2. Pro-agility test (27)

Pro-Agility Test

For the pro-agility run, the participants started on a centreline facing the researcher. The participants sprinted 4.57 m (5 yards) to the left, then 9.14 m (10 yards) to the right, and 4.57 m (5 yards) back to finish the test as they crossed the centreline. Three trials within each testing session were used to gather mean performance data. Three minutes of passive rest was provided between trials to limit performance fluctuations resultant from fatigue and decrease risk of injury. The instructions were provided to, stand in a 3-point stance with their left foot 30 cm behind the start/finish line. Once the participant was stable, a "go" command was

given. Timing started when the turned 90 degrees to the left and ran through timing gate 1. Touched the change of direction (COD) line with their left hand, the participant then turned and ran to the other side and touched the COD line with their right hand, the test was then finished by turning and running back through the middle line. To ensure the athletes touched the line, the researchers observed each trial. In the case, the athlete did not touch the line, slipped, or had a mistrial, they were given a retrial after three minutes of passive rest (27).

Statistical Analyses

Descriptive statistics were calculated for all test variables. Linear Regression tests, according to the results of the test of normality, were conducted to determine if there were any significant differences between the test scores of amateur soccer players. Data were analyzed using the SPSS IBM 22 for Statistical Package. Significance was set at $p \leq 0.05$, and results were presented as mean ± SD.

RESULTS

Table 1. Physical characteristic and performance data for the test subjects.

Variables	Mean (N=18)	SD
Age (y)	24,61	4,434
Height (cm)	181,50	0,041
Weight (kg)	73,17	6,364
30 m sprint (sec)	4,663	0,501
Pro-agility (sec)	5,713	0,322
VO_{2max} (ml/kg/min)	44,163	1,911

When Table 1 is examined, the mean age of the participants is 24.61 ± 4.434 years, their mean height is 181.50 ± 0.041 cm, their body weight is 73.17 ± 6.364 kg, their 30 m mean speed rating is 4.663 ± 0.501 sec, their mean agility time is 5.713 ± 0.322 sec. and VO2max mean was found to be 44,163 ± 1.911 (ml/kg/min).

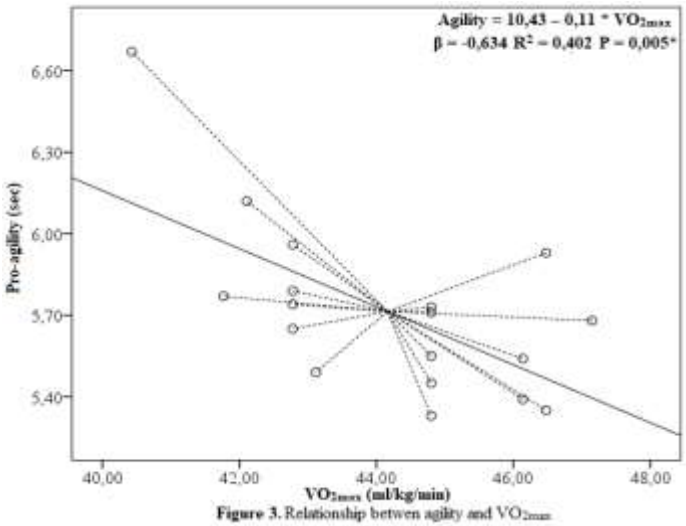

Figure 3. Relationship between agility and VO_{2max}

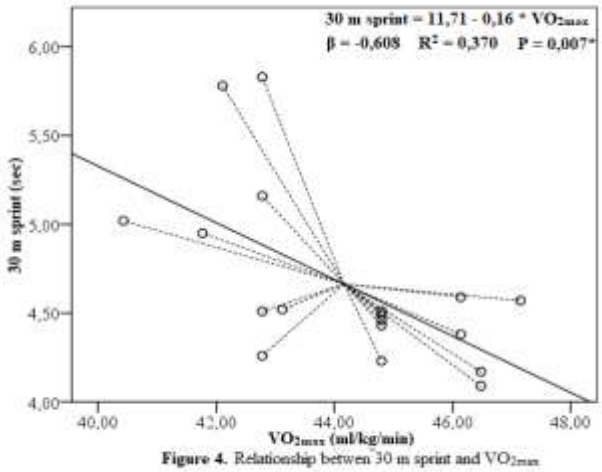

Figure 4. Relationship between 30 m sprint and VO_{2max}

When Figure 3 was examined, it was determined that there was a significant correlation in the same direction between VO2max and agility performances of soccer players. It was observed that VO2max explained agility by 40.2%. A one-unit change in VO2max affects agility by 0.11. A unit decrease in VO2max worsens agility by 0.11, while an increase by one unit improves agility by 0.11.

When Figure 4 was examined, it was determined that there was a significant correlation in the same direction between VO2max and 30 m sprint performances of soccer players. It was observed that VO2max explained the 30 m speed by 37 %. A one-unit change in VO2max affects 30 speed by 0.16. One unit reduction in VO2max worsens the 30-meter speed by 0.16. On the other hand, an increase in VO2max by one unit improves the 30-meter speed by 0.16.

DISCUSSION

In the current study, the VO2max level of 18 soccer players at the same competitive level was determined and its effect on agility and speed performance was examined. The primary finding of this study was that high VO2max levels in soccer players had a significant effect on agility and speed performance. Additionally, when the effect size was examined, it was seen that VO2max level was more effective in speed performance than agility.

There are many studies in the literature in which the VO2max, speed and agility values of soccer players were determined, and in addition to the studies showing similarity with the VO2max, speed and agility values we obtained in our study, lower and higher VO2max, speed and agility values were also found. In a study, it has been emphasized that the maximum speed distance is 20-30 meters on mean and 40 meters at the most (25). Aslan and Koç (3) found the 30 m sprint value of 70 soccer players to be 4.30 ± 0.18 seconds in their study. Cerrah et al. (14) in their study with 89 amateur soccer players measured the 30 m speed values for soccer players as 4.31 seconds, 4.17 seconds, 4.25 seconds and 4.15 seconds. Duyul et al. (16) determined the aerobic capacity value of athletes as 49.91 ml/kg/min in their study. Erkmen et al. (18), in their study, reported that the aerobic capacity value they obtained from the 20 m shuttle run was 44.60 ml/kg/min. In another study, the mean VO2max value of young soccer players (n=14) was found to be 51.84 ± 7.56 ml/kg/min, and the 30 m sprint value was found to be 4.21 ± 0.17 sec (30). Kayhan et al. (23) determined the pro-agility test means as 4.96±0.17 seconds in their study on soccer players. Canlı (11) reported pro-agility test means as 5.73±0.36 sec in their study. In the literature, it is emphasized that aerobic training improves an athlete's endurance performance and also affects an athlete's ability to repeatedly apply maximal efforts (7). In a study evaluating aerobic endurance and 40 m sprint performance in soccer, it was determined that there was a slight relationship between 40 m sprint performance and VO2max, but this situation was not statistically significant (4). In another study, it was observed that there was a decrease in the performance levels of elite soccer players in the second half of the competition, and it was stated that continuity in sprints could be ensured by increasing the aerobic level (39). Önürme (30) reported that speed, mean speed, jump and maximum heart rate values were effective in the change in VO2max value by approximately 50%. In a study, it was stated that high VO2max levels increase post-exercise recovery, and it was stated that soccer players with higher VO2max levels can run longer distances during a match and sprint more than those with lower VO2max levels (29). Raymundo et al. (32) in their study examining the relationship between VO2max and agility, reported a stronger correlation between agility and VO2max performance, especially in attacking players. When the literature is examined, it is seen that there is a significant relationship between aerobic endurance and anaerobic characteristics such as speed and agility. Studies have found that there is a highly significant relationship between the total running distance covered in the Yo-yo level 1 test, and the high-intensity running distance and high-intensity movements covered in the competition (26, 12, 13). In another study, Francini et al. (19) stated that there is a moderate to high relationship between the total running distance covered in the yo-yo test in 68 young male soccer players, and the high-intensity running distance and high-intensity movements, as well as the sprint distance.

This study has a limitation due to the methodological differences that may exist in evaluating the speed, agility and aerobic capacity. Therefore, caution is needed when comparing the results of the present study with other studies. Besides the relevance of the variables evaluated in this study, it is also important to add more variables in future studies based on the specific characteristics needed by soccer players during a match.

In conclusion; It has been observed that aerobic endurance affects sprint performance more than agility. Considering the distances related to agility (18.28 m) and sprint test (30 m), it is thought that the effect level of aerobic endurance increases as the running distance increases. Therefore, aerobic endurance levels should also be considered when applying agility and speed exercises.

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