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Futbolculara uygulanan fonksiyonel antrenmanın anaerobik performans üzerine etkisi

Sadettin EROL[1], Ayşegül YAPICI[2], Hayrettin GÜMÜŞDAĞ[3]

[1]Bursa Uludağ Üniversitesi, Spor Bilimleri Fakültesi, Antrenörlük Eğitimi Anabilim Dalı
[2]Denizli Pamukkale Üniversitesi, Spor Bilimleri Fakültesi Antrenörlük Eğitimi Anabilim Dalı
[3]Yozgat Bozok Üniversitesi, Spor Bilimleri Fakültesi, Antrenörlük Eğitimi Anabilim Dalı

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Özet

Fonksiyonel hareketler atletik yeterliliği geliştirmek için çok önemli bir faktördür. Günlük yaşamdaki aktiviteleri ve atletik performansı sürdürmek için yapılan hareketlerin enerji tüketimi açısından ekonomik ve sağlık açısından güvenli olması hayati önem taşımaktadır. Bu çalışmanın amacı futbolcularda fonksiyonel antrenmanın anaerobik performansa etkilerini araştırmaktır. Bu çalışmaya profesyonel bir futbol takımının U-19 kategorisinde oynayan toplam 22 sağlıklı erkek gönüllü futbolcusu (yaş, 18,29 ± 0,52 yıl; boy, 175,18 ± 3,12 cm; vücut ağırlığı, 68,84 ± 2,44 kg) katılmıştır. Katılımcılar rastgele olarak antrenman (n=11) ve kontrol gruplarına (n=11) ayrıldı. Katılımcılara dikey sıçrama, 10m sprint, 30m sprint ve zig-zag testleri uygulanmıştır. Araştırmada elde edilen verilerin analizinde ise grup arası karşılaştırmalar için bağımlı örneklem t-testi (paired sample t test) ve gruplar arası karşılaştırmalarda ANOVA ve post hoc testleri kullanılmıştır. Etki büyüklükleri regresyon analizi ile değerlendirilmiştir ve değerler Cohen's d kullanılarak belirlenmiştir. Antrenman grubundaki tüm skorlarda grup içi karşılaştırmalarda anlamlı artışlar vardı. Fakat kontrol grubunda sadece dikey sıçrama performansında anlamlı bir fark bulunurken, diğer parametrelerde bulunmamıştır. Fonksiyonel antrenmanın sporcularda anaerobik performansı artırdığı belirlenmiştir. Antrenörlerin, sporcularının optimal performansları için antrenman programlarında fonksiyonel antrenmanlara daha fazla yer vermeleri tavsiye edilmektedir.

Anahtar Kelimeler: Futbol, fonksiyonel antrenman, anaerobik performans

The effect of functional training applied to soccer players on anaerobic performance

Abstract

Functional movements are a crucial factor for improving athletic competence. In order to sustain activities in daily life and athletic performance, it is vital that the movements performed are economically and health-safe in terms of energy consumption. The aim of this study is to investigate the effects of functional training on anaerobic performance in soccer players. A total of 22 healthy male volunteer soccer playing in the U-19 category of a professional soccer players (age, 18.29 ± 0.52 years; height, 175.18 ± 3.12 cm; body weight, 68.84 ± 2.44 kg) participated in this study. The participants were randomly divided into the training group (N=11) and control group (N=11). In the analysis of the data obtained in the study, dependent sample t-test (paired sample t test) for intragroup comparisons and ANOVA and post hoc tests were used for comparisons between groups. Effect sizes were determined using Cohen's d. There were significant increases in intra-group comparisons in all scores in training group. While a significant difference was found only in vertical jump performance in control group, do not found in other parameters. It has been determined that functional training improves anaerobic performance in athletes. It is recommended that trainers include more functional training in their training programs for the optimal performance of their athletes.

Keywords: *Soccer, functional training, anaerobic performance*

Sorumlu Yazar/ Corresponded Author: Ayşegül YAPICI, **E-posta/ e-mail:** ayapici@msn.com

Genişletilmiş Türkçe Özet, makalenin sonunda yer almaktadır.

INTRODUCTION

Functional training is a training system done with free weights and alternative special equipment, imitating some of the movements we do in daily life (Liebenson, 2014). In this training system, in which the spine muscles and, accordingly, all the muscle groups of our body are exercised with a movement, multiple muscle groups are activated rather than single muscle exercises with exercises focused on balance, strength and condition, and the whole muscle-nervous system is exercised at a high heart rate (Oliver & Di Brezzo, 2009).

Soccer is played with high intensity and a contact sport where contacts are very common during the game (Gümüşdağ et al., 2011). Well-designed functional training program is needed to reduce the injury risks and improve their performance in soccer players. It is often performed using equipment such as crossfit, resistance band, kettlebells, powerbag, suspended fitness cables and battling ropes. The use of these equipments will contribute to the improvement of performance and the prevention of injuries in athletes (Dominski et al., 2022; Wang and Zhang, 2023). In the literature some studies have discovered positive effects of functional training on performance in soccer players (Kotzamanidis et al., 2005; Christou et al., 2006; Baron et al., 2020; Keiner et al., 2020; Xiao et al., 2021; Gümüşdağ et al., 2021; Wang & Zhang, 2023). Christou et al., (2006) found that, in their study on the physical capacity of male soccer players, in addition to soccer training, a combination of progressive resistance training (functional strength training) can be used for the overall improvement of the physical capacity of the players. Kotzamanidis et al. (2005), in their study to determine the effects of a combined high-intensity strength and speed training program on the sprint and jump performances of soccer players, stated that the applied program provided a better improvement on the strength performance of the athletes compared to the traditional resistance training group. In a study conducted by Gümüşdağ et al. (2021) on young soccer players, it was reported that functional training caused significant improvements in athletes' body fat percentage, vertical jump, anaerobic power, 10m-30m speed performances. Wang and Zhang, (2023) reported that there was a very significant difference in the scores of physical fitness indexes of football players after functional training for 10 weeks.

There is evidence that functional training is beneficial for the performance of athletes (Xiao et al., 2021; Wang and Zhang, 2023). A new exercise training method that has recently received much attention to developing athletes' performance is functional training (Egesoy et al., 2018).

Functional movement is a crucial factor for improving athletic performance (Shaikh & Mondal, 2012; Wang & Zhang, 2023). In order to sustain activities in daily life and athletic performance, it is vital that the movements performed are economically and health-safe in terms of energy consumption. These requirements include motor skills such as strength, endurance, speed, flexibility, coordination, and deep sense in the world of movements consisting of pushing, pulling, rotation and level shifting required by the movements of the human body (Tomljanović et al., 2011). Performing the movements in one axis or with local muscle groups makes the functionality of our movements difficult (Cook et al., 2012; Collins, 2012). While many muscles in the body work at the same time and in harmony in sports activities or activities in daily life, the fact that they do not work in this way in training reveals some problems (Boyle, 2004; Tomljanović et al., 2011; Xiao et al., 2021). The muscular imbalances that occur in the bodies of the athletes due to unilateral loads, uniaxial exercises, the exercise of only some parts of the body (only upper extremity, only the lower extremity, only the right side, etc.) adversely affect the daily quality of life and sportive performance of the athletes (Kollock et al., 2019). In some cases, serious injuries or the termination of sports activities can be seen. This is mostly due to the weakness of some links of the kinetic chain (Cook et al., 2012). Some problems can be seen for muscles in their neural communication (coordination), in the intensity of contraction (strength), in the speed of contraction (speed), in the contraction system (balance, mobility, flexibility), and during the spread of all these over a long period of time (endurance). These problems also lead to the inability to perform the movement required by the skill. For this reason, it is important to use a program of movements that complement the kinetic chain, engage almost the entire body, and mimic the target skill (Cook et al., 2012). At this point, the importance of functional training in exercise planning emerges.

The most important element in functional training allows the person to work by using the limits of his own body, not depending on any machine. The person can reach her goal by applying four basic movements in this training. These movements are: stopping/switching, pushing/pulling, level shifting and rotation (Cook et al., 2012; Marsh, 2014; Egesoy et al., 2018; Xiao et al., 2021). As the records and training methods in sports are renewed with the help of scientific researches and methods developed and with the help of science and technology that are advancing day by day, success in sports increases in parallel.

It is important to implement a well-designed functional training program in a long-term and systematic way in order to reduce the risk of injury and improve the performance of the

athlete. It is main point to apply correct and appropriate training and working methods for trainers to train athletes who can be successful in the international area (Kollock et al., 2019).

The purpose of our study is to examine the effects of functional training on anaerobic performance in soccer players. It is thought that the findings obtained in this study are important in terms of making evaluations about the performance of the athletes and contributing to the coaches.

MATERIAL AND METHODS

Participants

A total of 22 healthy male volunteer soccer playing in the U-19 category in a professional soccer team (age, 18.29 ± 0.52 years; height, 175.18 ± 3.12 cm; body weight, 68.84 ± 2.44 kg) participated in this study. Athletes who do not smoke, do not have a known history of cardiovascular disease, have a body mass index <30 kg/m^2, do not use any medication, and have no disease/infection status were included in the study. Before the study, each of the participants was given related information about the risks in the study. In order to carry out the study, the ethics committee approval of Pamukkale University, Faculty of Medicine "Non-Invasive Clinical Research Ethics Committee" was obtained (Decision no: E-60116787-020-338942).

Experimental design

The subjects were then randomly divided into the training group (N=11) and control group (N=11). A pre-test post-test control group design with a 6-week intervention period was used. Firstly, a standard 10-minute warm-up protocol was performed to the subjects. Later, counter movement jump, 10-30 sprint and zig-zag tests were used respectively. These tests were made while the players were out of the competition period. The training group practiced functional exercises twice a week for 6 weeks additional routine football training. But control group did not use these exercises. The training group practiced functional exercises, while the control group played foot tennis.

Table 1 shows the physical characteristics of the athletes.

Table 1. Characteristics of participants

Variable	Training Group (N=11)	Control Group (N=11)
Age (year)	18.1±0.40	18.5±0.20
Height (cm)	175.1± 0.12	175.4 ± 0.06
Body weight (kg)	68.6 ± 12.30	69.3 ± 9.88

Functional training program

The functional training program included the movements that will support the kinetic chain of the athletes (Willardson, 2007) (Table 2). This program has been implemented two times in a week.

Table 2. Functional training program for 6 weeks

Exercises	1-3 th weeks	4-6th weeks
	Exercise Time / Rest Time / Sets	Exercise Time / Rest Time / Sets
Deep squat	20 sec / 20 sec x 2	30 sec / 30 sec x 2
Russion Twist	20 sec / 20 sec x 2	30 sec / 30 sec x 2
Leg Raise (up and down)	20 sec / 20 sec x 2	30 sec / 30 sec x 2
Plank Leg Extension	20 sec / 20 sec x 2	30 sec / 30 sec x 2
Push up	20 sec / 20 sec x 2	30 sec / 30 sec x 2
Forward Lunge	20 sec / 20 sec x 2	30 sec / 30 sec x 2

Data collection tools

In this study, the counter movement jump (CMJ), 10-30m sprint and zig-zag tests were used respectively to evaluate the anaerobic performance of the athletes.

Counter movement jump test

Vertical jump performance was evaluated with the Smart Speed mat. Participants were inqured to stand on the mat with their feet, placing their hands at hip level, and jumping to the highest point they could jump whenever they wanted. 2 attempts were given and the best was recorded.

10-30 m sprint test

10-30 meter sprint was measured by Newtest Powertimer (Finland). Photocell gates are installed at the starting line, at distances of 10 m and 30 m. Each football player tried to cover the 10 m and 30 m distances by running in the shortest time. 2 attempts were given and 5 minutes of rest was given between repetitions and the best value was saved.

Zig-zag test

The zig-zag test was measured by Newtest Powertimer (Finland). This test includes three 100-degree turns between the start and end point. In the test protocol, the distance traveled after each turn is 5 m and the total distance traveled is 20 m. Soccer players repeated the test 2 times during the 2 minutes rest interval and the best grade was evaluated.

Statistical analysis

Descriptive statistics (mean ± standard deviation) were used in the analysis of the obtained data. In the analysis of the data obtained in the study, dependent sample t-test (paired sample t test) for intragroup comparisons and ANOVA and post hoc tests were used for comparisons between groups. The significance level was taken as $p<0.05$. Effect sizes were

evaluated by regression analysis and values were determined using Cohen's d. Effect sizes were interpreted using these criteria: <0.2 = trivial, 0.2–0.6 = small,>0.6–1.2 = moderate,>1.2–2.0 = large, and>2.0 very large differences (Hopkins, 2014).

RESULTS

The findings obtained in this research have been given in the following tables

Table 3. The comparison of training and control groups intra-group

	Training group (N=11)				**Control group (N=11)**			
	Pre	**Post**			**Pre**	**Post**		
	Mean± s.d.	**Mean± s.d.**	**p**	**E.S.**	**Mean± s.d.**	**Mean± s.d.**	**p**	**E.S.**
Vertical jump (cm)	31.66 ± 2.05	33.83 ± 2.03	**0.000***	**0.642 (moderate)**	30.5 ± 2.77	32.25 ± 2.41	**0.000***	**0.624 (moderate)**
10 m sprint (sec)	1.7 ± 0.41	1.68 ± 0.03	**0.025***	**0.234 (small)**	1.71 ± 0.21	1.71 ± 0.20	1.000	0.000 (trivial)
30 m sprint (sec)	4.27 ± 0.07	4.25 ± 0.06	**0.002***	**0.417 (small)**	4.25 ± 0.04	4.25 ± 0.05	0.777	0.003 (trivial)
Zig zag test (sec)	5.4 ± 0.21	5.36 ± 0.21	**0.000***	**0.648 (moderate)**	5.51 ± 0.13	5.51 ± 0.14	0.678	0.008 (trivial)

***p<0,05; E.S.: Effect Size, s.d.: standart deviation**

When the pre-test and post-test values of the groups were considered, there was a significant increase in vertical jump, 10m, 30m sprint and zigzag test values (ES=0.64; p = 0.000; ES = 0.23; p=0.025; ES=0.42; p =0.002; ES = 0.65; p= 0.000, respectively) in intra-group comparisons in training group.

While a meaningful difference was detected only in vertical jump performance (ES=0.62; p = 0,00) in control group, do not found in other variables (ES = 0.00; p= 1.00; ES=0.00; p = 0.78; ES = 0.00; p= 0.68).

Table 4. The comparison of training and control groups between-groups

	Pre test				**Post test**			
	Training	**Control**			**Training**	**Control**		
	Mean± s.d.	**Mean± s.d.**	**p**	**E.S.**	**Mean ± s.d.**	**Mean ± s.d.**	**p**	**E.S.**
Vertical jump (cm)	31.66 ± 2.05	30.5 ± 2.77	0.255	0.058 (trivial)	33.83 ± 2.03	32.25 ± 2.41	0.097	0.124 (trivial)
10 m sprint (sec)	1.7 ± 0.41	1.71 ± 0.21	0.396	0.032 (trivial)	1.68 ± 0.03	1.71 ± 0.20	**0.013***	**0.249 (small)**
30 m sprint (sec)	4.27 ± 0.07	4.25 ± 0.04	0.446	0.026 (trivial)	4.25 ± 0.06	4.25 ± 0.05	0.890	0.000 (trivial)
Zig zag test (sec)	5.4 ± 0.21	5.51 ± 0.13	0.149	0.026 (trivial)	5.36 ± 0.21	5.51 ± 0.14	0.055	0.157 (trivial)

***p<0,05; ES: effect size, Sd: standart deviation**

When looking at the comparisons between groups, there was no meaningful difference in vertical jump, 10m- 30m sprint and zig zag test values (ES=0.06; p = 0.026; ES = 0.03; p= 0.396; ES =0.03; p = 0.446; ES = 0.09; p= 0.149, respectively) between training and control groups in pre-test.

And also, a significant difference was no found in vertical jump, 30m sprint and zig zag test values (ES=0.12; p = 0.097; ES=0,00; p = 0.890; ES = 0.16; p= 0.055, respectively) between training and control groups in post-test. But there was a meaningful difference only in 10m sprint values (ES=0.25; p = 0.013) between groups in post-test.

DISCUSSION AND CONCLUSION

The purpose of the current research is to examine the effects of functional training on anaerobic performance in soccer athletes. The main findings from the study were that functional training improved the anaerobic parameters in soccer players. When the athletic performance was examined in light of the data, it was found that all values were significantly improved in TG ($p < 0.05$); there were significant increases only in the vertical jump in CG ($p < 0.05$). No significant difference was found in any athletic performance values of CG ($p > 0.05$).

In literature studies, it has been stated that functional training applied to athletes can contribute to the performance development of athletes. Several studies have confirmed that functional training can enhance muscular endurance (Oliver & Brezzo, 2009; Wang & Zhang, 2023), muscular strength (Weiss et al., 2010; Tomljanović et al., 2011), agility (Miller et al., 2006; power (Keiner et al., 2020) and speed (Anuranjan, 2015; Baron et al., 2020; Jakub et al., 2020; Kovac, et al., 2022).

In a study conducted by Song et al. (2014) on elite high school baseball players, a 16-week FT program was implemented and reported an increase in strength and flexibility performance of athletes. Shaikh and Mondal (2012), in their study on male students aged 19-25, stated that 8-week functional training improved students' speed, endurance, muscular endurance, strength, explosive strength, flexibility and agility. Tomljanovic et al. (2011) compared the effects of functional and traditional resistance training applied to young people aged 22-25 for 5 weeks on anthropometric and motor performance variables. It was observed that agility and muscle strength increased in both training programs. In a study conducted by Yıldız et al. (2019) on tennis players, it was reported that the applied functional training program showed significant improvements in the flexibility, vertical jump, speed, balance and agility performances of training group athletes. Kenta et al (2021) reported some improvements in strength, agility and speed values of baseball players.

The findings of these studies show similarities with the findings of our study. in these studies, the reason for the performance improvement as a result of functional training can be explained as the improvement in the strength performance of athletes.

In addition, when looking at other studies in the literature, Cerrah et al., (2016) reported that functional balance training performed three times a week improves the balance abilities and hitting performance of adolescent football players positively. It has been reported by Atabaş (2017) that at the end of the functional training program applied to swimmers in the 14-16 age group, there was a significant increase in the maximum repetition strength performance of the athletes. Goss et al. (2009) reported that after six weeks of functional training, functional movement score increased by 2.5 points, agility performance (T-test) improved by 0.5 seconds, single leg jump time improved by 10%, jump performance for distance increased by approximately 10%, kick.

Weiss et al. (2010) examined the effects of functional training and traditional training methods on agility, flexibility, balance, endurance, muscular strength performances of the athletes. A significant increase was found only in the flexibility performance of the TG; unlike there were no significant differences were found in other features. Yıldız (2018) reported that a significant relationship was found between Functional Movement Screen (FMS) scores and flexibility, squat jump, core stabilization values of elite karate athletes.

Along with the functional training, some improvements can be observed in the motor skills of the muscles However, it is extremely important that the exercises are performed in

accordance with the principles of functional movement. If the exercises are mostly performed in single joints and on a single plane, the quality of the movements performed may decrease

Also, single joint and single-plane exercises that do not communicate and cooperate with each other so, joint range of motion problems will occur in the muscles. These situations will lead to restriction of optimal performance in athletes (Kollock et al., 2019).

As a result of this study, it has been determined that functional training improves anaerobic performance in athletes. The performance of targeted functional training is relevant and should be applied to soccer training.

Suggestions

The training protocol should focus on the specific capabilities required for improve the anaerobic performance. As in soccer the positions on which the player is playing different position, the training protocol should be specified accordingly. It is thought that it would be beneficial to pay more attention to functional training in order to have an improved athletic performance in athletes. It is recommended that the athletes and coaches perform the exercises according to the functional training principles.

Conflict of interest

There were no conflicts of interest

Funding

No external funding was received for this study.

GENİŞLETİLMİŞ ÖZET

GİRİŞ

Fonksiyonel antrenman, günlük hayatta yaptığımız bazı hareketleri taklit eden serbest ağırlıklar ve alternatif özel ekipmanlarla yapılan bir antrenman sistemidir (Liebenson, 2014). Omurga kaslarının ve buna bağlı olarak vücudumuzun tüm kas gruplarının bir hareketle çalıştırıldığı bu antrenman sisteminde denge, güç ve kondisyon odaklı egzersizlerle tek kas egzersizleri yerine birden fazla kas grubu harekete geçirilir ve tüm kas-sinir sistemi yüksek şiddette çalıştırılır (Oliver & Di Brezzo, 2009).

Fonksiyonel hareket, atletik performansı geliştirmek için çok önemli bir faktördür. Günlük yaşamdaki aktiviteleri ve atletik performansı sürdürmek için yapılan hareketlerin enerji tüketimi açısından ekonomik ve sağlık açısından güvenli olması hayati önem taşımaktadır. Bu gereksinimler insan vücudunun hareketlerinin gerektirdiği itme, çekme, kaldırma, taşıma, rotasyon ve seviye değiştirme hareketlerinden oluşan kuvvet, dayanıklılık, sürat, esneklik, koordinasyon ve derin duyu gibi motorik becerileri kapsar (Boyle, 2004; Cook ve ark., 2010; Tomljanović ve ark., 2011).

Fonksiyonel antrenman; kişilerde daha fazla kas hakimiyeti, daha fazla denge, daha fazla güç artışı meydana getirmektedir. Ayrıca, kasların daha farklı açılarda ve çeşitli olarak çalıştırılması, büyük ve küçük kas gruplarında güç dağılımında değişiklikler göstererek daha kısa sürede daha fazla verim almayı sağlamaktadır (Cook ve ark., 2010; Dominski et al., 2022; Francesco & Inesta, 2010; Xiao et al., 2021; Wang & Zhang, 2023).

Bu nedenle bu çalışma, futbolcularda fonksiyonel antrenmanın anaerobik performans üzerindeki etkilerini araştırmak için yapılmıştır.

YÖNTEM

Çalışma tasarımı

Bu çalışma, deneysel çalışma (Ön test ve son-test) olarak yapılmıştır.

Araştırma grubu

Araştırmaya profesyonel bir futbol takımının U-19 takımında oynayan sağlıklı 22 erkek gönüllü sporcu katılmıştır. Çalışma öncesinde deneklerin her birine çalışma ile ilgili ve karşılaşılabilecek risk ve rahatsızlıkları içeren ayrıntılı bilgi verilmiştir. Katılımcılar, araştırmanın amacı ve uygulanacak değerlendirme yöntemleri hakkında bilgilendirilecek ve tüm katılımcılardan 'Bilgilendirilmiş Gönüllü Olur Formu' alınmıştır.

Araştırmanın planlanması

Bu çalışma 6 hafta devam etmiştir. Araştırmaya katılan tüm katılımcıların sırasıyla, yaş, boy uzunluğu, vücut ağırlığı ve vücut kütle indeksi değerleri kaydedilmiştir. Katılımcılara, her test öncesi 10 dk'lık düşük şiddetli koşu ve dinamik egzersizlerinden oluşan standart bir ısınma protokolü uygulanmıştır. Daha sonra katılımcılara sırasıyla dikey sıçrama, 10-30 m sprint ve zig-zag testleri uygulanmıştır. Ölçümler öğleden sonra antrenman saati dışında, öncesinde herhangi bir egzersiz yapmadıkları gün gerçekleştirilmiştir

Katılımcılara düşük şiddette 1 deneme hakkı verilmiştir. Her denek testi iki kez tekrar etmiş ve en iyi dereceleri cm ve sn cinsinden kaydedilmiştir.

Katılımcılar rasgele olacak şekilde iki gruba ayrılmışlardır. Birinci grup antrenman grubu olarak (n=11) önce haftada iki gün olacak şekilde fonksiyonel kuvvet antrenmanını uygulamış, daha sonra rutin günlük programına katılmışlardır. İkinci grup kontrol grubu olarak (n=11) fonksiyonel kuvvet antrenmanlarına katılmamış, onlar sadece günlük programdaki futbol antrenmanlarında yer almışlardır.

Fonksiyonel kuvvet antrenmanı

Fonksiyonel antrenman programı, sporcuların kinetik zincirini tamamlayacak deep squat, russion twist, leg raise, plank leg extension, push up ve forward lunge gibi egzersizlerinden oluşmaktadır. Bu

program, antrenman grubuna haftada iki kez ve 48 saat ara ile ısınmadan hemen sonra uygulanmıştır. Kontrol grubu fonksiyonel antrenman programını uygulamamıştır.

İstatistiksel analiz

Araştırmada elde edilen verilerin analizinde ise grup arası karşılaştırmalar için bağımlı örneklem t-testi (paired sample t test) ve gruplar arası karşılaştırmalarda ANOVA ve post hoc testleri kullanılmıştır. Etki büyüklükleri regresyon analizi ile değerlendirilmiştir ve değerler Cohen's d kullanılarak belirlenmiştir. Hopkins ve arkadaşlarına (2009)s göre, etki büyüklükleri önemsiz (0,0–0,2), küçük (0,2–0,6), orta (0,6–1,2), büyük (1,2–2,0) ve çok büyük (>4,0) olarak sınıflandırılmıştır (Hopkins ve ark., 2009).

BULGULAR

Katılımcıların ön-test ve son test değerlerinin grup içi değerlendirilmesinde, antrenman grubunun tüm skorlarında anlamlı bir artış bulunmuştur ($p<0,05$). Kontrol grubunda ise sadece dikey sıçrama performansında anlamlı fark bulunurken ($p<0,05$), diğer parametrelerde bulunmamıştır ($p>0,05$).

Gruplar arasındaki karşılaştırmalara bakıldığında, katılımcıların ön test değerlerinde antrenman ve kontrol gruplarının tüm parametreleri arasında anlamlı bir fark olmadığı tespit edildi ($p >0,05$). Ancak katılımcıların son test değerleri karşılaştırıldığında, gruplar arasında 10m sprint değerleri arasında anlamlı bir fark bulunmuştur ($p<0,05$).

TARTIŞMA ve SONUÇ

Bu çalışmanın amacı, futbolcularda fonksiyonel antrenmanın anaerobik performans üzerindeki etkilerini araştırmaktır. Çalışmanın ana bulguları, fonksiyonel antrenmanın futbolcularda anaerobik performansta anlamlı iyileşmeler olduğunu ortaya koymaktadır. Katılımcıların ön test ve son test değerlerinin grup içi karşılaştırılmasında, antrenman grubunun tüm parametrelerinde anlamlı bir artış olduğu tespit edilmiştir.

Shaikh ve Mondal (2012) tarafından 19-25 yaş arası erkek öğrenciler üzerinde yapılan bir çalışmada, 8 haftalık fonksiyonel antrenmanın öğrencilerin sprint, dayanıklılık, kas kuvveti, patlayıcı güç, esneklik ve çeviklik değerlerinde önemli gelişmeler olduğu rapor edilmiştir. Tomljanoviç ve arkadaşları (2011) tarafından yapılan bir başka çalışmada, 5 hafta boyunca 22-25 yaş arası genç bireylere uygulanan fonksiyonel ve geleneksel direnç antrenmanının antropometrik ve motor performans değişkenleri üzerindeki etkileri karşılaştırılmıştır. Her iki antrenman programında da katılımcıların çeviklik ve kas gücü değerlerinde anlamlı gelişmeler olduğu belirlenmiştir. Cerrah ve arkadaşları (2016) yaptıkları çalışmalarında, ergen futbolculara haftada üç kez fonksiyonel denge antrenmanları yaptırmışlardır. Yapılan uygulamalar sonucunda, sporcuların denge ve topa vuruş performanslarında önemli iyileşmeler gözlemlenmiştir. Weiss ve arkadaşlar (2010) fonksiyonel antrenman ve geleneksel antrenman yöntemlerinin sporcuların çeviklik, esneklik, denge, dayanıklılık, kas gücü performansları

üzerindeki etkilerini incelemişler ve sadece antrenman grubunun esneklik performanslarında anlamlı bir artış tespit etmişlerdir. Yıldız (2018) tarafından yapılan bir başka çalışmada, elit karate sporcularının Fonksiyonel Hareket Taraması (FMS) skorları ile esneklik, skuat sıçrama ve kor stabilizasyon değerleri arasında anlamlı bir ilişki olduğu bildirilmiştir. Wang ve Zhang, (2023) yaptıkları çalışmalarında, 10 hafta süresince uygulanan fonksiyonel antrenmanlardan sonra futbolcuların fiziksel uygunluk indeks puanlarında çok anlamlı bir fark olduğunu bildirmişlerdir.

Sonuç olarak, mevcut çalışmada, uygulanan fonksiyonel antrenmanın futbolcuların anaerobik performansları üzerinde anlamlı gelişimler gösterdiği belirlenmiştir. Sporcuların ve antrenörlerin egzersizleri fonksiyonel antrenman ilkelerine göre yapmaları önerilmektedir.

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KATKI ORANI *CONTRIBUTION RATE*	**AÇIKLAMA** *EXPLANATION*	**KATKIDA BULUNANLAR** *CONTRIBUTORS*
Fikir ve Kavramsal Örgü *Idea or Notion*	Araştırma hipotezini veya fikrini oluşturmak *Form the research hypothesis or idea*	Ayşegül YAPICI
Tasarım *Design*	Yöntem ve araştırma desenini tasarlamak *To design the method and research design.*	Ayşegül YAPICI Hayrettin GÜMÜŞDAĞ
Literatür Tarama *Literature Review*	Çalışma için gerekli literatürü taramak *Review the literature required for the study*	Sadettin EROL
Veri Toplama ve İşleme *Data Collecting and Processing*	Verileri toplamak, düzenlemek ve raporlaştırmak *Collecting, organizing and reporting data*	Sadettin EROL Hayrettin GÜMÜŞDAĞ
Tartışma ve Yorum *Discussion and Commentary*	Elde edilen bulguların Değerlendirilmesi *Evaluation of the obtained finding*	Sadettin EROL Ayşegül YAPICI

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Etik Kurul Beyanı/ *Statement of Ethics Committee*

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