



The effect of Futsal Training on the Speed, Agility, and Anaerobic Power of Male Children Aged 12-14 Years Old

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Abstract

The present study aimed to investigate the effect of 6-week futsal training on the speed, agility, and anaerobic power of male children aged 12-14 years old. A total of 20 male students from Ayşe Fitnat Middle School voluntarily participated in this study. Their mean age was 13.50 ± 0.51 years, the mean length was 1.61 ± 0.06 meters, the mean weight was 50.23 ± 8.43 kg, and the mean body-mass index was 19.42 ± 2.74 kg/m². 10 participants were assigned to participate in futsal training, and the other 10 formed a control group. The research was designed as an experiment that included a pre-test and post-test within the control and experimental groups. The experimental group (Futsal) participated in a 6-week futsal training with 3 days a week and an hour a day of practice. To evaluate both groups' physical and motor capacities, length, weight, body-mass index, 20m-sprint test, agility test, vertical jump test, and anaerobic power tests were applied. All statistical analyses were performed by IBM SPSS 23.0 computer program. The level of significance was set as $p < 0.05$. There was a statistically significant difference in the experimental group's pre-test and post-test values in the 20 m sprint test, agility, vertical jump, and anaerobic power measurements ($p < 0.05$). However, no statistical significance was determined in the control group. Post-test results between the experimental and control groups revealed that the experimental group significantly had better 20 m sprint, agility, and vertical jump scores than the control group ($p < 0.05$). Even though there was no significant difference in anaerobic power between the two groups, the experimental group had substantially higher values compared to the control group. As a result, it can be concluded that 6-week futsal training three days a week and an hour a day can improve the speed, agility, and anaerobic power among male children aged between 12 and 14 years old.

Keywords: Futsal, Speed, Agility, Anaerobic power

Futsal Antrenmanlarının 12-14 Yaş Erkek Çocuklarda Sürat, Çeviklik ve Anaerobik Güce Etkisi

Özet

Bu çalışmanın amacı, 12-14 yaş erkek çocuklarda 6 haftalık futsal antrenmanlarının sürat, çeviklik ve anaerobik güce etkisini araştırmaktır. Araştırmaya Ayşe Fitnat Ortaokulunda okuyan yaş ortalamaları 13.50 ± 0.51 yıl, boy ortalamaları 1.61 ± 0.06 m, vücut ağırlığı ortalamaları 50.23 ± 8.43 kg ve beden kitle indeksi (BKİ) ortalamaları 19.42 ± 2.74 kg/m² olan 10 futsal ve 10 kontrol grubu olmak üzere rastgele seçilmiş toplam 20 gönüllü erkek öğrenci katılmıştır. Araştırma ön-son test kontrol gruplu model olarak tasarlanmıştır. Futsal grubuna 6 hafta boyunca haftada 3 gün 1 saat futsal maçı yaptırılırken kontrol grubuna herhangi bir aktivite yaptırılmamıştır. Grupların fiziksel ve motorik kapasitelerini değerlendirmek için boy uzunluğu, vücut ağırlığı, BKİ, 20 m sprint testi, çeviklik testi, dikey sıçrama testi ve anaerobik güç ölçümleri alınmıştır. Çalışmada tüm istatistiksel işlemler IBM SPSS İstatistik 23.0 programı ile gerçekleştirilmiştir. Araştırmada anlamlılık seviyesi $p < 0.05$ olarak kabul edilmiştir. Futsal grubunun ön-son test ölçüm verileri karşılaştırıldığında 20 m sprint, çeviklik, dikey sıçrama ve anaerobik

güç değerlerinde istatistiksel olarak anlamlı bir fark elde edilmiştir ($p<0.05$). Buna karşın kontrol grubunda herhangi bir istatistiksel anlamlılık söz konusu değildir. Futsal grubu ile kontrol grubunun son testleri karşılaştırıldığında 20 m sprint, çeviklik, dikey sıçrama değerlerinde futsal grubu lehine istatistiksel olarak anlamlı bir fark bulunmuştur ($p<0.05$). Anaerobik güç değerleri açısından iki grup arasında istatistiksel olarak anlamlı bir fark bulunmamasına rağmen futsal grubunun anaerobik değerleri daha yüksektir. Bu çalışmanın bulgularına göre 6 hafta boyunca haftada 3 gün 1 saatlik futsal antrenmanlarının 12-14 yaş erkek çocuklarda sürat, çeviklik ve anaerobik gücü olumlu yönde geliştirdiği söylenebilir.

Anahtar sözcükler: Futsal, Sürat, Çeviklik, Anaerobik güç.

INTRODUCTION

Futsal is the internationally recognized and supported version of indoor football by FIFA (Federation de Football Association). FUTSAL, which originated from Futebol De Salao in Portuguese or Football De Sala in Spanish, is the shining new face of FIFA and UEFA's five-person indoor football. It is a high-intensity and intermittent sport distributed over a short recovery period, in which accelerations and short sprints are exhibited at or near-maximal levels during a short period, played by over one million players worldwide and growing in many countries (11).

One of the most critical factors that bring success in sports is the motor skills required for that branch. Basic motoric features of humans are the elements that determine the person's body, power and ability, and the degree of complex motorsports power. These features are the basis and primary condition of every motoric sports movement performed during the training process (2).

Agility is very essential for many sports (41) including this sport as the players have to change their directions very fast with respect the opponents' movements and to save the ball (37). Thus, players should need high decision-making process and speed (36), which can be developed through long-term the center of gravity of speed training (40).

A futsal player is a player who moves quickly on the field of play throughout the match and increases in offense and defense, plays well one-on-one, shrinks in defense, and is not easily deceived, and covers the distance with and without the ball in the attack, shoots well, and achieves all of these with a tempo close to 80-100%. Therefore, it needs good anaerobic power and capacity (34). Anaerobic performance has been reported to be affected by muscle type, gender, age, genetic, muscle mass, cross-sectional muscle area, training, and body composition (35). Anaerobic performance causes

some morphological, physiological, and biochemical changes in the organism, changes in the process from childhood to maturity (27). Physical activity, which has a crucial place in developing, protecting, and continuing public health, has vital importance in children's growth and development process. Because physical activity has many positive effects in childhood and adulthood in terms of psychological, physiological, and physical aspects, it is essential to gain the level of physical fitness necessary for maintaining life at optimum efficiency. In addition to performance sports, in today's life concepts, the primary purpose of the child to do regular sports in a balanced and healthy development should be to increase cardiovascular endurance, neuromuscular coordination, strength, and flexibility. These features should be gained through practices made with a pedagogical approach under the forms of play in preschool and primary school children (31). From this point of view, this study aimed to investigate the effects of Futsal training on Speed, Agility, and Anaerobic power in 12-14-year-old boys.

MATERIAL AND METHOD

Research Group: This research was carried out in the 2nd semester of the 2016-2017 academic year (March-April). 20 healthy male students, randomly selected among the students studying at Ayşe Fitnat Secondary School affiliated with the Ministry of National Education and who filled in and brought the necessary participant information form from their families, participated in this research. The descriptive physical characteristics of the students participating in the research are presented in Table 1. Before the study, a detailed information meeting was held with the students and their parents about the research. For the research, permission was obtained from the clinical research ethics committee of Mustafa Kemal University Tayfur Ata Sökmen Medical Faculty (Decree No: 2017/38, 24.02.2017).

Table 1. Physical descriptive characteristics of male students participating in the research.

PARAMETER	N	Mean	SD
Age (years)	20	13.50	0.51
Height (m)	20	1.61	0.06
Body Weight (kg)	20	50.23	8.43
BMI (kg/m ²)	20	19.42	2.74

SD: Standard deviation

Study Design: Three days before the initiation, two groups of 10 each, each Futsal (FG) and Control group (CG), were formed randomly from the participants, and the pre-test measurements of the groups were obtained. Futsal training is organized according to the competition method. According to this method, the futsal group played a futsal match for 1 hour a day (5 min warm-up – 20 min 1st half – 10 min break – 20 min 2nd half – 5 min cooldown and stretching), 3 days a week (Monday-Wednesday-Friday) for 6 weeks. Futsal matches were played in the 34x18 m indoor. No planned activity was performed in the control group during the 6 weeks. Post-test measurements of all participants were made 3 days after the last training.

Height, Body Weight, and Body Mass Index (BMI): The height (± 0.1 cm) and body weight (± 0.1 kg) measurements of the students participating in the study were made with a stadiometer (Seca 217, UK). The following formula was used to determine the body mass index (39,42).

Body Mass Index (BMI) = Body Weight / Height (m)²

Agility Test (Illinois Agility Test): The test consists of a 40 m straight, and 20 m slalom run between the cones, consisting of three cones with a width of 5 m, a length of 10 m, and three cones with 3.3 m intervals in the middle and 180° turn every 10 m. After the test track was prepared, a two-door photocell electronic chronometer (Seven Electronics, Turkey) system was installed at the beginning and the end, measuring with an accuracy of 0.01 seconds. Before the test, the participants were allowed to make 3-4 attempts at low tempo after introducing the track and necessary explanations. After that, the participants were given warm-up and stretching exercises at a low tempo for 5-6 minutes. Participants were made to exit from the starting line of the test track in the prone position with their hands in contact with the ground at shoulder level. The time to finish the track was recorded in seconds. The test was repeated 2 times with complete rest, the better value was recorded (21,24,33).

Speed Test (20 m Sprint Test): The speed performances of the participants were determined by the 20-meter sprint test (6). A two-door photocell electronic chronometer (Seven Electronics, Turkey) system was installed at the beginning and end of the 20 m track with an accuracy of 0.01 seconds. Participants started the sprint run with a high start of 50 cm behind the starting line. Two attempts were made, and the best grade was recorded in seconds and evaluated.

Vertical Jump Test and Calculation of Anaerobic Power: Vertical jump measurements of the participants in the study were taken with shorts, t-shirts, sneakers, and a jump meter (Seven Electronics, Turkey) jump measurement device. Care was taken to ensure that the participant's position during the jump and landing on the platform remained the same, that the knees were not drawn to the chest, and not bent backward. The vertical jump was performed twice, and the best grade was recorded in cm (39, 42). Anaerobic power was calculated in kg-m/sec according to the Lewis formula (18).

$P = (\sqrt{4.9} \times (\text{Body Weight}) \times \sqrt{D})$, P = Anaerobic Power (kg. m/sec.), D = Vertical Jump (m)

Analysis of Data: Mean and Standard Deviation (SD) were used as descriptive statistics. Since the number of people participating in the research was less than 30 and it was determined that the distribution was not normal with tests for the normality of the distribution [statistical (Shapiro-Wilk, Skewness, Kurtosis) and graphical (Histogram, Box plot, Q-Q plot)], non-parametric tests were used for comparisons. Wilcoxon test was used for within group pretest-posttest comparison, and the Mann-Whitney U test was used for between group comparison. $p < 0.05$ was determined as a statistical significance level in this study. Statistical data analysis was done using IBM SPSS for the Windows (V 23. New York, USA) package program.

RESULTS

When the data obtained with the pre-tests were examined, no statistically significant difference was determined between the control and futsal groups in terms of all variables. This result is critical in demonstrating that the groups are at a similar level before futsal training.

At the end of the 6-week study, no statistically significant difference was observed in all variables of

the control group from pre-test to post-test. However, when the mean values were examined, a positive and

statistically significant improvement was determined in all parameters of the futsal playing group (Table 2).

Table 2. Comparison of groups in terms of parameters

PARAMETER	GROUP	PRE-TEST		POST-TEST		z	p	U
		mean	SD	mean	SD			
Bodyweight (kg)	CG	50.99	8.00	50.93	7.95	-1.73	0.08	36.00
	FG	49.47	9.21	49.26	9.02	-2.21	0.03*	0.29
BMI (kg/m ²)	CG	20.15	3.01	20.13	2.99	-1.68	0.09	32.00
	FG	18.68	2.36	18.60	2.28	-2.20	0.03*	0.17
20 m Sprint (sec)	CG	3.80	0.18	3.86	0.23	-1.27	0.20	1.50
	FG	3.77	0.18	3.44	0.09	-2.81	0.01*	0.01 [#]
Agility (sec)	CG	19.89	0.41	20.07	0.28	-0.76	0.45	16.00
	FG	19.58	0.35	18.51	1.03	-2.40	0.02*	0.01 [#]
Vertical J. (cm)	CG	27.43	1.81	27.28	2.73	-0.26	0.80	17.00
	FG	27.77	1.37	30.94	3.42	-2.70	0.01*	0.01 [#]
Anaerobic Power (kg,m/sec)	CG	82.43	6.83	82.13	7.57	-0.36	0.72	39.00
	FG	81.75	7.80	86.06	9.22	-2.70	0.01*	0.41

* pre-test - post-test comparison $p < 0.05$, # groups (CG-FG) comparison in terms of post-test $p < 0.05$.

When the groups were compared in terms of post-test, the futsal group's speed, agility, and vertical jump values were statistically significantly better than the control group (Figure 1). However, although not statistically significant, the futsal group was better than the control group in terms of other variables (body weight, BMI, and anaerobic power).

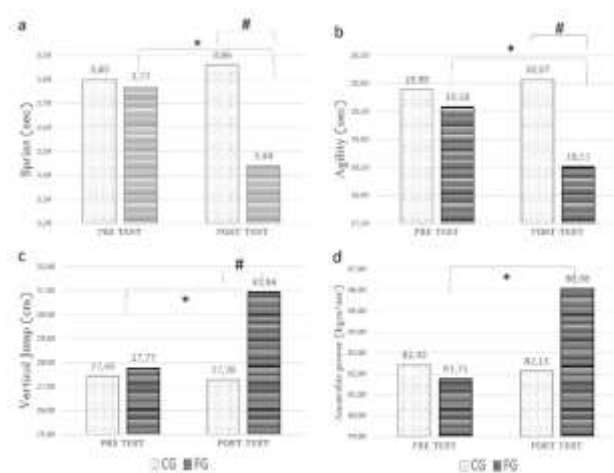


Figure 1. Comparison of groups: a: Sprint, b: Agility, c: Vertical Jump, d: Anaerobic power * pre-test - post-test comparison $p < 0.05$, # groups (CG-FG) comparison in terms of post-test $p < 0.05$,

DISCUSSION

The present study revealed significant differences in the data on speed, agility, and anaerobic power of boys aged 12-14 who did regular futsal training for 6 weeks compared to boys who did not do a regular physical activity outside of physical education class (Figure 1).

Although the ability to speed is innate, it can be developed to a certain extent with training. This development is especially dependent on motoric, physiological, and anthropometric characteristics that affect speed (4). Since players take an active role in both defense and offense in a small area, and the game has a high intensity, fast-playing character, futsal requires players to sprint more and be active. As a matter of fact, in comparisons made on the speed and acceleration of futsal and football players, significant differences were found in favor of futsal players (30,25,20). Besides, the reduced playing field constantly causes pressure from the opposing player, and futsal players are constantly under the mark and in one-on-one situations with the opponent. Also, the small size of the field and frequent turnovers necessitates the players to make quick decisions and have a high sprint capacity in the sections where the teams are attacking or defending (32). It was stated that, as in basketball and handball, a large part of the futsal game includes high-intensity sprint activities, and 8.9% of the distances covered during a futsal match are sprints (8). Kicking the ball requires speed, endurance, strength, and power for turns, tackles, and changes in speed (19). In our study, mass movements, changes of direction, running, sprints, sudden stops, and jumps applied during futsal training created a load on the leg muscles. While performing these movements, the eccentric and concentric contraction of the leg muscles ensures that the elastic and contractile components are activated together. This situation causes the muscle to release force quickly (29). Armstrong et al. (5) indicate that Type IIa fibers may be more common than Type IIx

fibers in children and adolescents. It was suggested that the increase in motor unit activation, together with neurological development, may contribute to the short-term increase in power output independent of the growth in muscle mass (13,5). It is thought that the significant difference in speed in this study may be due to the development of leg muscles and neurological adaptations to training.

While agility is defined as the speed of change of direction, it is stated that acceleration, deceleration, and change of direction speed should be improved for performance (15). Futsal includes movements with and without the ball, jumps, and rapid direction changes. Offensive sports with a high level of speed, such as futsal, are placed in the category of sports that require fast running (acceleration and maximum speed) and agility (23). In a study in which the match analysis of the national futsal teams of Turkey, Italy, and Russia, it was found that Turkey met the ball 297 times and ran 34 times without the ball, and was able to control the ball for an average of 8 seconds in each attack, Italy met the ball 731 times, ran 176 times without the ball and held the ball for an average of 11 seconds, Russia met the ball 628 times, managed to control the ball for an average of 15 seconds by running 150 times without the ball. Another study reported that English Premier League football players made 609 turns within 0-90 degrees angles to the right-left in a match, and they made 95 turns above 90 degrees (12). A different study indicated that futsal players make locomotor movement changes every 3.3 seconds in a match (17). A study performed with football players states that jumping, changing direction, and accelerations between 1000-1400 for a short period of 4-6 seconds often occur during the game (38). As the analyzes in the studies clarify, futsal is a game that is played very quickly, and there are constant turnovers. In this context, to develop the ability to change direction at the highest level, athletes have to train the movements they perform in practice (14). Agility performance increases with age and is further improved with repetitions and physical activities. Activities such as physical competitions and games have an important place in developing agility (16,10). It is thought that the 5.46% significant improvement in agility at the end of the 6 weeks is due to the futsal training, as can be understood from the basic motoric features it contains depending on the general characteristics of the futsal game and from the studies in the literature.

Anaerobic power values of the group participating in futsal training increased significantly at the end of the 6 weeks. When the groups were compared in terms of post-tests, although there was no statistically significant difference, it was observed that the anaerobic power averages of the futsal group were higher than the control group (Figure 1d). All movements performed at a very high tempo during the competition require futsal players to use a high level of anaerobic power (34). A study including futsal players noted that the average heart rate was 170-190 beats/min, and the maximum heart rate reached 85-90% during the match, which was due to high anaerobic metabolism (8). In futsal, movements related to anaerobic energy, performed at high intensity and in a short period, frequently occur (34). Dođramacı and Watsford (17) revealed that futsal players performed high-intensity activities in 26% of the playing time during a match. Another study stated that 13.7% of the distances covered during the game during the Futsal match were in the form of high-intensity running (8). Also, it was reported that while running at a moderate intensity every 37 seconds and a high intensity every 43 seconds, a maximum intensity effort occurs every 56 seconds (7). In high-intensity, short-term loads, anaerobic power is based on the use of the phosphagen system (ATP-PC system), depending on the re-synthesis process of ATP, while anaerobic capacity is predominantly based on the use of the lactic acid energy system (anaerobic glycolysis) (9). Krusturp et al. reported that glycogen and creatine phosphate stores were depleted in type II fibers at the end of the Yo-Yo intermittent recovery 1 test they applied to football players, but there was no significant decrease in Type I fibers. (28). During futsal training, movements related to anaerobic energy occur at high intensity in a short time, such as changing direction, short-distance sprints, sudden stops, headshots, jumping, and the frequency of use of these movements may have increased and improved energy use. Therefore, it is thought that the increase in anaerobic power is due to futsal training, depending on the explanations above. The literature supports the findings of this study in that it shows that the anaerobic power values of children who participate in sports activities and have a high level of physical activity are higher than their inactive peers (27,22,26,1).

In conclusion, futsal training 3 days a week, 1 hour a day for 6 weeks, is considered to positively

improve speed, agility, and anaerobic power in 12-14-year-old boys. However, in similar studies to be performed in the future, different dimensions may be added to the subject depending on the sample size, age range to be studied, gender differences, and longitudinal or cross-sectional research design.

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