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The Effect of Different Training Methods on Aerobic Performance and Some Respiratory Parameters in Young Soccer Players

Veysel BÖGE[1A], Süleyman PATLAR[1B]

[1]*Selcuk University, Sports Sciences Faculty, 42130, Konya-Turkey*
Address Correspondence to V. Böge: e-mail: veyselboge@gmail.com
**This study was produced from the doctoral thesis titled " The effect of the different training methods on aerobic and anaerobic performance and some respiratory parameters in young soccer players" published in 2021.*
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A:Orcid ID: 0000-0002-7466-1173 B:Orcid ID: 0000-0003-3817-3575

Abstract

The aim of this study is to examine the effects of different training methods on aerobic performance and respiratory parameters in young soccer players. For this purpose, fourty healthy young male soccer players participated in the study. The mean age of the participants was 16.72± 1.09 years, their average height was 172.45± 5.56 cm and their body weight average was 62.79± 8.91 kg. The study protocol was approved by the Selcuk University Faculty of Sport Sciences Ethics Committee. Different training methods applied in the study were applied in addition to routine training programs 3 times a week for 8 weeks. Fourty soccer players who participated in the study were divided into 5 groups as the control group (CG), small sided games (SSG), transition in SSG (TSSG), high intensity interval training (HIIT) and low intensity continuous training (LICT) groups. Three measurements were made for aerobic performance (VO2max), lactate levels and rating of perceived exertion (RPE). And also, two measurements were applied for respiratory parameters. As a result, significantly increased the VO2max levels of the other groups except the SSG group. LICT significantly decreased lactate levels. RPE were found to be significantly higher in the HIIT in all three measures. It provided significant increases in force vital capacity (FVC) and the forced expiratory volume in 1 second (FEV1) levels of LICT and HIIT groups. There was a significant decrease in the FEV1/FVC levels of the LICT and the peak expiratory flow (PEF) levels of the HIIT. As a result, different trainings applied for eight weeks significantly improved aerobic performance and decreased lactate levels. It resulted in different changes in RPE levels and respiratory parameters.

Keywords: Aerobic performance, respiratory system, soccer.

Genç Futbolcularda Farklı Antrenman Yöntemlerinin Aerobik Performans ve Bazı Solunum Parametrelerine Etkisi

Özet

Bu çalışmanın amacı genç futbolcularda farklı antrenman yöntemlerinin aerobik performans ve solunum parametreleri üzerine etkilerini incelemektir. Bu amaçla, çalışmaya sağlıklı 40 genç erkek futbolcu katılmıştır. Katılımcıların yaş ortalamaları 16.72± 1.09 yıl, boy ortalamaları 172.45± 5.56 cm ve vücut ağırlığı ortalamaları 62.79± 8.91 kg olarak tespit edilmiştir. Çalışma protokolü Selçuk Üniversitesi Spor Bilimleri Fakültesi girişimsel olmayan etik kurulu tarafından onaylanmıştır. Çalışmada uygulanan farklı antrenman yöntemleri, 8 hafta boyunca haftada 3 kez rutin antrenman programlarına ek olarak uygulanmıştır. Çalışmaya katılan 40 futbolcu, kontrol grubu, sınırlı alan oyunları (SAO), sınırlandırılmış alanlarda geçiş oyunu (SAGO), yüksek şiddetli interval antrenman (YŞİA) ve

düşük şiddette sürekli antrenman (DŞSA) grubu olmak üzere 5 gruba ayrılmıştır. Aerobik güç (maksVO2), laktat ve algılanan zorluk düzeyi (AZD) için üç ölçüm yapılmıştır. Solunum parametreleri içinse iki ölçüm uygulanmıştır. SAO grubu dışındaki diğer grupların maksVO2 seviyelerini önemli ölçüde artırmştır (P<0.05). DŞSA laktat seviyelerini önemli ölçüde azaltmıştır (P<0.05). Her üç ölçümde de AZD'nin YŞİA'da önemli ölçüde daha yüksek olduğu bulunmuştur (P<0.05). DŞSA ve YŞİA gruplarının FVC ve FEV1 düzeylerinde anlamlı artışlar sağlamıştır (P<0.05). DŞSA'nın FEV1/FVC seviyelerinde ve YŞİA'nın PEF seviyelerinde önemli bir düşüş gözlemlenmiştir (P<0.05). Sonuç olarak, 8 hafta boyunca uygulanan farklı antrenmanlar aerobik performansı önemli ölçüde iyileştirirken ve laktat düzeylerini düşürmüştür. AZD seviyelerinde ve solunum parametrelerinde ise farklı değişiklikler meydana getirmiştir.

Anahtar Kelimeler: Aerobik güç, futbol, solunum parametreleri,

INTRODUCTION

''Citius, Altius, Fortius'' were coined by Pierre de Coubertin in 1894 as an Olympic slogan after the formation of the International Olympic Committee. The spirit of the motto faster, higher, stronger encompasses the holistic aspirations of the Olympic movement as well as the importance of an athlete's physical prowess. The slogan calls for designing training methods designed to prepare all competitors, including the youngest, to be the best in the world (17). As a reflection of this spirit, today's success is determined by very small details, while in some moments faster contraction of a motor unit or degrees in less than a second make a big difference (31). Soccer which is one of the branches that attract the most attention in today's sports, where such details are of great importance, and which drags the masses after it, is followed with great excitement.

Soccer is the world's most popular sport, played daily by millions of people at different levels of expertise, both professionally and for fun (42). Soccer which is constantly developing and where competition reaches high levels; technical, tactical, physical, psychological and physiological factors. In addition, it is stated that in parallel with the developments in soccer, the technical, tactical skills and physical capacities of soccer players increase day by day (1,9).

When a soccer match is analyzed; running parameter stands out as the dominant activity. Soocer players cover a distance of approximately 8-12 km at or near the anaerobic threshold (approximately 90% of maximal heart rate). This activity is exhibited at 75% of the average maximal oxygen consumption (maxVO2) of soccer players (37,13). In addition, the aerobic and anaerobic capacity of soccer players can affect the outcome of a match. Therefore, it is also important to determine the aerobic and anaerobic capacities of the athletes (3).

Considering the situations mentioned above, with this study; In addition to the training routines applied in the preparation period, different training methods on young soccer players; It is aimed to examine the changes in aerobic performance and some respiratory parameters.

MATERIAL & METHOD

Participants

Forty healthy young male soccer players who actively playing soccer participated in the study. The measurements of the participants were carried out in the Performance Laboratory of the Faculty of Sport Sciences of Selcuk University and grass field of Cumra Municipality. Descriptive information of the participants is given in Table 1. The protocol of the study was approved by Selcuk University Faculty of Sport Sciences non-interventional clinical research ethics committee with the decision numbered 40990478-050.99 and dated 28.01.2020.

Table 1. Descriptive statistics table showing participants' age, height, body weight, body mass index and MaxHR (n= 40).

Variables	Mean	Standart Deviation (SD)
Age (years)	16,72	1,09
Height (cm)	172,45	5,56
Body weight (kg)	62,79	8,91
Body mass index(kg/m^2)	20,78	2,31
MaxHR (beats/min)	203,30	1,07

Experimental design

Table 2. The Yo-yo level 1 test applied for the training of the participants.

Variables	Groups	Mean	SD	MIN	MAX
YO-YO (m)	CG	1605	610,83	940	2440
	TSSG	1612,50	573,305	900	2480
	SSG	1657,50	768,482	600	2680
	HIIT	1665	474,823	1040	2300
	LICT	1607,50	258,554	1000	1780

CG: Control Group, **TSSG:** Transition game group in SSG's, **SSG:** Small sided games, **HIIT:** High intensity interval training group, **LICT:** Low intensity continuous training

Yo-yo level 1 test (as a pre-test) was applied, and study groups were determined according to the Yo-yo level 1 test data in order to provide clearer results and a homogeneous distribution of the training loads performed. Participants were divided into 5 groups and each group consisted of 8 people.

Control group (CG)

Participants in the control group (CG) only continued soccer training in the pre-season period and did not do any additional training.

Low intensity continuous training (LICT)

In addition to the pre-season soccer training, a continuous running protocol was applied for 45 minutes at 70% of the maximum heart rate (maxHR) of the players immediately after the end of the unit training (24). In long-term jogs applied as additional training, the participants' HR was kept at the desired levels by means of polar watches worn by the participants.

High intensity interval training group (HIIT)

In addition to the pre-season period soccer training in the high-intensity interval training (HIIT) group, a running protocol was applied for 90-95% of the maximum heart rate (maxHR) of the athletes for 15 seconds immediately after the end of the unit training. In 70% of maxHR, a high-intensity interval running protocol was applied with a rest period of 15 seconds, with a total of 8 repetitions, 3 sets and 3 minutes of rest between sets (24). In high-intensity interval runs applied as additional training, the participants' HR was kept at the desired levels by means of polar watches worn by the participants.

Small sided games (SSG)

In addition to the pre-season soccer training for small sided games (SSG) group athletes, 4x4 small sided games in a 30x30 m (112.5 m2 per person) field immediately after the end of the unit training (38) 3 sets for 4 minutes and 3 minutes rest between sets applied with.

Transition game group in SSG's (TSSG)

In addition to the pre-season soccer training in the limited areas, after the completion of the unit training, 4x4 SSG (38) is applied in the first limited area, which is 30x 30m (112.5m2 per person), in addition to the preparation period football training, with the whistle of the enforcer at the 50th second. The athletes were allowed to pass in the second area, which is 35 meters ahead of the same dimensions. Transition games were applied for 4 minutes with 3 sets and 3 minutes rest between sets. At the end of the training of all groups, 10 minutes of jog and stretching movements were applied to the participants. Exercises were applied 3 days a week (Monday-Wednesday-Friday) for 8 weeks in addition to football training (41).

Collection of data

In this test, which is similar to the running and movement examples of a soccer match, the intermittent endurance performance of soocer players and their ability to recover after vigorous exercises were evaluated. Yo-yo test 1st measurement was done before the 8-week training program, 2nd measurement was done on the day following the last training of the 4th week (Saturday), and the 3rd measurement was done at the end of the 8-week training.

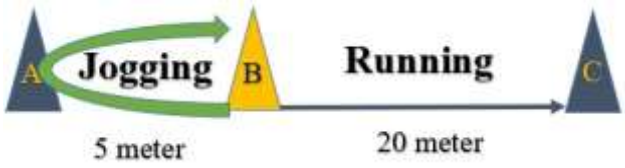

Figure 1. Yo-Yo Intermittent Recovery Level 1 Test

Yo-Yo level 1 test protocol: The running area for the test is shown in the figure above. During the test, the participants start running from B and run to C,

and as soon as they press or after pressing the line at that point, the signal sounds and the subject runs to B again and must reach the line before or during the beep. At points B and A, the participants jog towards the starting point and this cycle is repeated with the signal tone. While the initial speed is 10km/h, this cycle is applied with 10s rest intervals at speeds that increase over time. Try to do as many repetitions as possible. The beep sound sent by the CD player enabled the participants to adjust their speed accordingly during the test. If the participants came later than the two-time sound, the test was completed and the distance covered (including the last run that was not completed) was calculated as the test result (10) and the estimated maxVO2 values were determined (3).

Yo-Yo ATS1 test: maxVO2 (ml/min/kg) = ATS1 distance (m) X 0.0084 + 36.4 (3).

Determination of blood lactate

Lactate determinations of the participants in the 1st week, after the first training day (1st training day-Monday), after the last training of the 4th week (12th day-Friday) and at the end of their 8-week training (24th training day-Friday). A sufficient amount of blood taken from the fingertip using strips was taken to the lactate measurement sensor and measured in mmol/L with a Lactate Scout brand lactate analyzer.

Rating of perceived exertion

The rating of perceived exertion (RPE) is a psycho-physical measure of effort and is traditionally obtained on a 6-20 or 10 scale (5). RPE uses a modified Borg scale of 10 after the first training day (1st training), after the last training of week 4 (12th training) and at the end of 8 weeks of training (24th training). The question "What is the fatigue you perceive during training?" was asked to calculate the training load of each athlete, right after the end of the training. The values were recorded as a result of the answers given by the participants.

Table 3. Received Perceived Exertion (18,26).

0	Rest
1	Really Easy
2	Easy
3	Mooderate
4	Sort of Hard
5	Hard
6	
7	Really Hard
8	
9	Really, Really, Hard
10	Maximal

Respiratory Parameters

Measurements were made before the studies and at the end of the 8-week study period. Cosmed Ponny Fx model device was used during the measurements. During the measurement, the participants were asked to wear comfortable clothes and sports clothes. It was stated to the participants that maximal effort was mandatory. Different measuring nozzles were used for all participants. In addition, the use of mouthpieces was ensured so that there was no gap at the corners of the mouth of the participants. During the measurement, the participants were verbally motivated.

FVC measurement

For the pulmonary function tests, the soccer players were asked to breathe normally three times, then the test was performed with a deep and rapid expiration maneuver after a deep maximal inspiration. Upon completion of the test, FVC, FEV1, PEF and FEV1/FVC (%) values were obtained. Pulmonary function test was repeated 2 times and the best value was recorded.

MVV measurement

It is the maximum amount of volume that can be inhaled as a result of voluntary effort in one minute. In the measurement, the participants were asked to breathe quickly for 12 seconds. The pulmonary function test was repeated 2 times and the best value was recorded in liters.

Statistics

The data obtained as a result of the studies were evaluated in the package program called SPSS (IBM SPSS Statistics 25). The mean and standard deviations of the data for all variables were calculated. According to the results of the normality test (Shapiro Wilk, Histogram, Skewness and Kurtoris), it was seen that the data fulfilled the parametric assumptions. The ''Repeated Measures Anova'' test was applied to determine the difference within the group for Yo-Yo, lactate and rating of perceived exertion, which were taken at three different times as pre-test, mid-test and post-test. ''One Way ANOVA'' was used to determine the difference between the groups for each period (pre-test, mid-test and post-test). "Duncan" test, one of the Post-hoc tests, was used to determine which group caused the difference. In addition, with the pairwise comparisons of Yo-Yo, lactate, RPE parameters between the pretest and the 4th and 8th weeks. In the pre-test and post-test comparisons of parameters

FVC, FEV, FEV1/ FVC, PEF, MVV were used ''Paired-Samples T Test''. In the evaluation of statistical analyzes, cases with P<0.05 were accepted as significant values.

RESULTS

Table 4. Comparison of Yo-Yo IR level 1 test data.

Variables	Pre Test (ml/kg/min)	Mid Test (ml/kg/min)	Post Test (ml/kg/min)	n_p^2	p
CG (n=8)	49,88± 5,13**y**	52,28± 4,91**x**	51,60± 5,45**x**	**0,68**	**0,00***
TSSG (n=8)	49,95± 4,82**y**	52,40± 5,36**x**	52,49± 6,06**x**	**0,45**	**0,02***
SSG (n=8)	50,32± 6,46	51,21± 6,86	51,14± 7,42	**0,11**	**0,39**
HITT (n=8)	50,39± 3,99**y**	52,36± 3,22**x**	52,89± 3,38**x**	**0,48**	**0,01***
LICT (n=8)	49,90± 2,17**y**	50,79± 1,36**xy**	51,84± 2,33**x**	**0,49**	**0,01***
f	**0,02**	**0,20**	**0,14**		
p	**0,99**	**0,93**	**0,97**		

x,y,z: Different letters on the same line are significant for the difference between the within-group means (p<0.05).

When the pre-test results of the Yo-yo AT-1 test were examined in the study, no significant difference was found between the groups (p>0.05). These results were used before the study as an indicator for the homogeneous distribution of the groups. When the inter-group and post-test results of the Yo-yo AT-1 test data were evaluated, no significant difference was found between the groups (p>0.05).

Table 5. Comparison of blood lactate test data.

Variables	Pre Test (ml/kg/min)	Mid Test (ml/kg/min)	Post Test (ml/kg/min)	n_p^2	p
CG (n=8)	3,73± 0,41**b**	3,88± 0,38b	3,93± 0,37**d**	**0,20**	**0,22**
TSSG (n=8)	11,33± 2,59**a**	9,29± 2,04**a**	8,74± 1,00**b**	**0,32**	**0,07**
SSG (n=8)	10,61± 5,90**a**	8,26± 3,48**a**	6,51± 3,05**c**	**0,30**	**0,11**
HITT (n=8)	13,26± 4,79**a**	14,23± 3,80**a**	10,75± 2,39**a**	**0,32**	**0,06**
LICT (n=8)	5,46± 2,89**bx**	4,56± 2,28**x**	2,34± 0,44**dy**	**0,56**	**0,03***
f	**9,10**	**19,28**	**28,70**		
p	**0,00***	**0,00***	**0,00***		

a,b,c: The difference between the means between groups with different letters in the same column is significant (p<0.05).
x,y,z: Intra-group means with different letters on the same line, the difference is significant (p<0.05).

According to Table 5, it was determined that the lactate levels of the groups were significantly different after the pre-intermediate and post-tests (p<0.05). Accordingly, lactate levels of CG and LICT groups were similar after the pre-test (p>0.05), but significantly lower than the other groups (p<0.05). The lactate levels of TSSG, SSG and HIIT groups after the pre-test were not different from each other (p>0.05). When the lactate levels were compared between the groups after the interim test, the intermediate test results of all groups showed a decrease compared to the pretest data. A significant difference was determined between TSSG and CG groups, between HIIT and CG groups, and also between HIIT and USC groups (p<0.05).

Table 6. Comparison of rating of perceived exertion data.

Variables	Pre Test (ml/kg/min)	Mid Test (ml/kg/min)	Post Test (ml/kg/min)	n_p^2	p
CG (n=8)	2,13± 0,35**b**	2,25± 0,46**b**	2,25± 0,46**b**	**0,03**	**0,80**
TSSG (n=8)	3,13± 0,35**b**	3,38± 1,06**b**	2,75± 0,46**b**	**0,24**	**0,15**
SSG (n=8)	2,13± 0,84**b**	2,13± 0,83**b**	1,88± 0,64**b**	**0,10**	**0,48**
HITT (n=8)	6,00± 0,93**a**	6,38± 1,60**a**	5,63± 1,92**a**	**0,07**	**0,61**
LICT (n=8)	2,50± 0,76**b**	2,75± 1,58**b**	2,00± 1,31**b**	**0,21**	**0,20**
f	**9,10**	**19,28**	**28,70**		
p	**0,00***	**0,00***	**0,00***		

a,b,c: The difference between the means between groups with different letters in the same column is significant (p<0.05).

When the rating of perceived exertion (RPE) test data in the pre-test measurement of the groups were evaluated, there was a significant difference between the groups (p<0.05). A significant difference was found between TSSG and CG groups in the pre-test data of RPE measurements (p<0.005). As a result of the pre-test, the highest perceived difficulty level occurred in the HIIT group (P<0.05). According to this; A significant difference was found between HIIT and CG, HIIT and TSSG, HIIT and SSG, and HIIT and LICT groups (p<0.005). When the intermediate test data, in which perceived difficulty level measurements were made, were analyzed on the basis of groups, a significant difference was found between the groups (p<0.05).

Table 7. Comparison of FVC, FEV1, FEV1/ FVC %, PEF, MVV parameters of the groups participating in the study.

Variables	CG n=8	TSSG n=8	SSG n=8	HIIT n=8	LICT n=8	f	p
	Mean+SD	Mean+SD	Mean+SD	Mean+SD	Mean+SD		
FVC/ Pre Test	3,01±**0,60**	3,82±**0,76**	3,61±**0,67**	3,34±**0,80**	3,25±**0,30**	**1,89**	**0,14**
FVC/ Post Test	3,58±**0,43**	3,83±**0,64**	3,71±**0,52**	3,68±**0,75**	3,67±**0,28**	**0,21**	**0,93**
FEV1/ Pre Test	2,80±**0,63**	3,51±**0,62**	3,43±**0,57**	2,97±**0,80**	3,10±**0,29**	**2,03**	**0,11**
FEV1/ Post Test	3,41±**0,42**	3,66±**0,59**	3,61±**0,52**	3,25±**0,72**	3,45±**0,26**	**0,79**	**0,54**
FEV1/ FVC % Pre Test	92,13± **3,60ab**	92,13± **5,28ab**	95,25± **5,75a**	88,25± **4,23**	95,63± **1,06a**	**3,82**	**0,01***
FEV1/ FVC % Post Test	95,25± **4,06a**	95,50± **3,21a**	96,75± **2,60a**	87,88± **6,88**	93,75± **1,49a**	**5,88**	**0,00***
PEF/ Pre Test	6,97±**1,36**	6,47±**1,12**	6,90±**1,44**	7,31±**0,57**	8,14±**1,32**	**2,15**	**0,09**
PEF/ PostTest	6,89±**1,89**	7,04±**1,33**	7,13±**1,89**	6,09±**1,80**	7,96±**1,86**	**1,14**	**0,36**
MVV/ Pre Test	139,55± **23,76**	151,90± **15,64**	140,90± **29,08**	149,85± **26,95**	132,16± **17,21**	**0,97**	**0,44**
MVV/ Post Test	155,86± **20,11**	142,28± **23,54**	149,15± **32,04**	143,05± **13,71**	135,78± **16,33**	**0,95**	**0,45**

a,b,c: The difference between the means between groups with different letters on the same line is significant (p<0.05).
* : Indicates that there is a significant difference between and/or within the groups (P<0.05).

Only significant difference was found between the groups FEV1/FVC Pre test and FEV1/FVC Post test (p>0.05).

DISCUSSION

In this study, it was aimed to examine the effects of different training methods applied to young soccer players on aerobic and anaerobic performance and some respiratory parameters.

When we observe soccer training, it is possible to evaluate both internal and external loads with several methods. Internal load; It creates physiological responses that occur with training stimuli (26) and is typically possible by examining and evaluating oxygen consumption (7), blood lactate concentration (6) or rating of perceived exertion (26). In this direction, as a result of the statistical evaluations made in the light of the data obtained in the study; When the pre-test results of the Yo-yo AT-1 test data of the groups were examined, no significant difference was detected (p>0.05). These results show us that the groups were formed homogeneously. There is a common view that there is an increase in VO2max values with high-intensity aerobic training (16, 20, 24). While Mcmillan et al (30) revealed that the increase in VO2max value in each training unit was 0.56% with high-intensity training, Helgerud et al (23) found this rate to be 0.67% in their study. In another study; It has been observed that both continuous running training and high-intensity interval training applied 3-4 days a week and for 6 weeks lead to a similar increase in VO2max values (4). In this study, there was a significant increase in VO2max values in both the LICT group and the HIIT group, in line with the literature (p<0.05). In the study of Salah et al (36), in which they compared high-intensity training and continuous training protocols, they did not find a significant difference in VO2max values, unlike our study. In addition to these, there are some other studies showing that interval training increases aerobic performance more than continuous running training (11,35). Contrary to this finding, when the difference between the groups in the study was examined, it was seen that the difference was insignificant (p>0.05).

Some researchers have found that the average blood lactate concentrations are between 2 and 10 mmol during a soccer match (2, 28,43). In a review in which many variables of small sided games were

examined, it was observed that the lactate concentrations stated in this study showed parallelism with the lactate concentrations (6-12 mmol/L) obtained during the 4x4 SSG applied in a study (29). In the study carried out, it was determined that the lactate concentrations in the 4x4 SSG and TSSG games were in the range of 6.51-11.33 mmol/L and were similar to the literature. In their study, Selmi et al (39) revealed that LICT and SSG are studies with similar intensity (86% of maxHR) and stated that both types of training increase aerobic capacity. In a recent study, no significant difference was found in lactate concentrations between the groups after LICT and SSG (39) which is the same with our study.

In addition to blood lactate accumulations in soccer, data obtained from indicators such as rating of perceived exertion have also shown that high intensity can be achieved using the ball (25,34). Contrary to this information, in the study carried out, RPE levels of the HIIT group were found to be significantly higher in all three measures (pre-test, mid-test and post-test) compared to the SSG and TSSG groups applied with the ball. This finding; It can be explained as the increasing training load and the increasing contribution in the anaerobic system, leading to an increasing rating of perceived exertion (26). Similarly, Drust et al (14) reported an increase in RPE, although there was no change in heart rate and VO2 values of intermittent exercises compared to exercises performed in stable-state, in both groups. In addition, it is seen that the RPE values of soccer players after SSG applied in 4x4 format are approximately between 5-8.9 (12, 21, 27). Contrary to these findings, RPE values of the 4x4 SSG and TSSG groups in our study were lower than these values is considered as a result of the fact that the players can rest more easily in the parts where the game is not actively played during SSG and can reduce the intensity of the game by playing the ball more slowly.

In this study, in which different training methods were applied, one of the observed situations of soccer players is the changes in the respiratory system. Patlar (32) in his study, in which he examined the effect of long-term running and game format on the respiratory system, found significant increases in the vital capacities of soccer players who practiced LICT compared to the game form group. While the FVC data was 3.25 ± 0.30 in the pre-test results for the LICT group, it was 3.67± 0.28 in the post-test results, and these findings of the FVC data showed that 8-week LICT led to an increase. Similarly, in the continuous running method applied 3 days a week for 8 weeks, the FVC data of the participants was 4.10± 0.26 in the pre-test results, while it was 5.14± 0.29 in the post-test results and a significant increase was observed (44). This increase in FVC data as a result of training has been observed in some studies in the literature (15, 19, 22, 32). Contrary to these findings, in a study, it was revealed that there was no significant difference between the pre-test and post-test data in the FVC values of the soccer players with the different training methods applied for 8 weeks to the soccer players whose age groups were similar to our study (45). In the study, an increase was observed in the post-test data compared to the pre-test data in the FEV1 data of all groups. Similarly, Hazar and Ibis (2010) found an increase in FEV1 data in their study on amateur football players. On the contrary, Zerin et al (45) found that FEV1 data did not lead to an increase as a result of the applied training in their study. In both pre and post-test measurements of FEV1/ FVC parameters of all groups; A significant difference was found between the groups, unlike the other parameters in which the respiratory test was performed. Soykan et al (40) no significant change was found in the PEF values of soccer players s a result of LICT performed for 4 weeks. However, in our study, interestingly, according to the pre- and post-test data of all groups, it was determined that the PEF levels of the HIIT group decreased significantly. It is thought that this decrease may be due to expiratory flow limitation that may occur during submaximal or maximal exercises (8, 33). There was no statistically significant difference between the groups in the pre-test and post-test results of the MVV data, and in all groups as a result of pairwise comparisons ($p>0.05$). Similarly, Erkmen et al (15) and Soykan et al (40) did not find a significant difference in MVV data after training applied to both professional and amateur soccer players. However, Zerin et al (45) reported that MVV data showed a significant increase as a result of the training applied to amateur soccer players for eight weeks.

As a result; 8-week different trainings applied to the soccer players showed the same effect in all groups except the SSG group and increased the VO2max levels significantly. While different training methods applied to the groups we observed that significantly decreased the lactate levels of only the LICT group. RPE levels reduced with training. Significant increases in the FVC and FEV1 levels of the LICT and HIIT groups, it caused a significant

decrease in the FEV1/FVC levels of the LICT group and in the PEF levels of the HIIT group.

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