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**THE REVISED 2 versus 2 SMALL SIDE GAME INCREASES ENDURANCE PERFORMANCE OF FOOTBALL PLAYERS**Mustafa Furkan Ocak<sup>1</sup>, Mehmet Yildiz<sup>1</sup>**ABSTRACT**

The current study aimed to investigate the effect of the 2 vs. 2 small side game (SSG) arranged according to the principle of 90-95% Max HR (3 sets 4x4 min) on the endurance performance and running mechanics of the elite young football players. Sixteen elite young male football players (age:  $18.43 \pm 0.62$  years, height:  $180.68 \pm 4.54$  cm, body weight:  $72.00 \pm 6.40$ ) from the Afjet Spor U-19 team participated in the study. The participants were randomly divided into Revised 2 vs. 2 SSG (experimental group,  $n=8$ ) and Classic 2 vs. 2 SSG (control group,  $n=8$ ) groups. While the experimental group played the Revised 2 vs. 2 SSG for four weeks, two days a week, the control group played the Classic 2 vs. 2 SSG. Before and after the application, the cardiovascular endurance values of the participants were evaluated by considering the Yo-Yo 1 test and the kinematic (distance covered, sprint number, and rates in speed intervals) and physiological (%max HR) values that they exhibited during the matches. It was determined that both SSGs caused improvement Yo-Yo IR1 test (time:  $F=17.72$ ,  $p>0.001$ ), total distance covered (time  $F: 3.62$ ,  $P<0.001$ ), distance covered in the speed zone at 14.00 - 19.99 km/h (group  $F= 10.177$ ,  $p<0.007$ ), and distance covered at the speed zone at 20.00 - 49.99 km/h (time  $F= 19.832$ ,  $p<0.001$ ). However, a greater extent was seen in the revised SSG for the total distance covered (group\*time interaction  $F:0.016$ ,  $P<0.016$ ) and distance covered in the speed zone at 20.00-49.99 km/h (group\* time interaction  $F=11.241$ ,  $p=0.005$ ), without causing a significant change in the physiological values of the football players. It is recommended to use the Revised 2 vs. 2 SSG to improve endurance performance in football training.

**Key words:** Revised 2 versus. 2. Aerobic endurance, Small Side Game. Football.

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**RESUMO**

O pequeno jogo paralelo 2 versus 2 revisado aumenta o desempenho de resistência dos jogadores de futebol

O presente estudo teve como objetivo investigar o efeito do small side game (SSG) 2 vs. 2 organizado de acordo com o princípio de 90-95% da FC máxima (3 séries 4x4 min) sobre o desempenho de resistência e a mecânica de corrida de jovens jogadores de futebol de elite. Dezesesseis jovens jogadores de futebol de elite do sexo masculino (idade:  $18,43 \pm 0,62$  anos, altura:  $180,68 \pm 4,54$  cm, peso corporal:  $72,00 \pm 6,40$ ) da equipe Afjet Spor U-19 participaram do estudo. Os participantes foram divididos aleatoriamente nos grupos Revised 2 vs. 2 SSG (grupo experimental,  $n=8$ ) e Classic 2 versus 2 SSG (grupo de controle,  $n=8$ ). Enquanto o grupo experimental jogou o SSG Revisado 2 versus 2 durante quatro semanas, dois dias por semana, o grupo de controle jogou o SSG Clássico 2 versus 2. Antes e depois da aplicação, os valores de resistência cardiovascular dos participantes foram avaliados considerando-se o teste Yo-Yo 1 e os valores cinemáticos (distância percorrida, número de sprints e taxas em intervalos de velocidade) e fisiológicos (% da FC máxima) que eles exibiram durante as partidas. Foi determinado que ambos os SSGs causaram melhora no teste Yo-Yo IR1 (tempo:  $F=17,72$ ,  $p>0,001$ ), na distância total percorrida (tempo  $F: 3,62$ ,  $p<0,001$ ), na distância percorrida na zona de velocidade de 14,00 a 19,99 km/h (grupo  $F= 10,177$ ,  $p<0,007$ ) e na distância percorrida na zona de velocidade de 20,00 a 49,99 km/h (tempo  $F= 19,832$ ,  $p<0,001$ ). No entanto, uma extensão maior foi observada no SSG revisado para a distância total percorrida (interação grupo\*tempo  $F:0,016$ ,  $p<0,016$ ) e distância percorrida na zona de velocidade de 20,00-49,99 km/h.

**Palavras-chave:** Revisado 2 versus 2. Resistência aeróbica. Jogo paralelo pequeno. Futebol

## INTRODUCTION

Football has a game structure that includes approximately 1000 different motor movements, and the movements can change rapidly one after another. The game, which is played in two 45-minute periods, is based on a basic aerobic structure, with irregular intervals of speed, strength, agility, continuity in speed, continuity in strength, explosiveness, and coordination. It is the display of football in a technical and tactical format, depending on the game structure and skill characteristics. (Deliceoğlu and Müniroğlu 2005).

For success in football, high levels of physical, motor, and physiological performance, as well as talent, are required. The player's lack of technical skills compared to his opponent can be tolerated with his physical superiority (Kamar, 2003).

In this context, all teams have sought new training methods and searches to maximize the motoric performance of their players (Köklü, 2011).

The main goal of these methods is generally to improve aerobic capacity (McMillan et al., 2005).

The average exercise intensity in a football match is very close to the athletes' lactate thresholds or 80-90% maximal heart rate. For this reason, football players are exposed to intense lactate accumulation during the competition.

They cannot sustain higher-than-average loads for a long time. High-intensity loads cause lactate accumulation, which football players cannot tolerate. Since there are many periods in which lactate accumulation is high in a football match, the body eliminates the lactate accumulated in the muscles during lower-intensity periods (Bangsbo, 1994). Additionally, the aerobic energy system contributes approximately 90% of the total energy cost in a football match (Bangsbo, 1994), and aerobic energy capacities are strongly associated with performance-oriented outcomes (Chamari et al., 2005; McMillan et al., 2005).

Traditional endurance training (extensive or interval training without the ball) has become a part of the aerobic training programs of football coaches (Iaia, Rampinini, Bangsbo, 2009).

Among these traditional methods, the 3-4 sets x 3-4 min load and 3-4 recovery intervals at 90-95% at the maximal heart rate (max HR) are the most preferred methods (Iaia, Rampinini, Bangsbo 2009; Hoff, 2005; Harrison et al., 2015; Buchheit, Laursen, 2013).

These methods generally consist of running without the ball by monitoring running speeds or HR. Hoff et al., (2005) reported that it was difficult to control the intensity of the load during training with a ball.

For this reason, they have stated that although running exercises are not liked and preferred by football players, only football-specific training will not be sufficient for max  $\text{VO}_2$  development, and in this context, running without the ball and interval training should be included. However, although such training improves football players'  $\text{VO}_2$  max, running economy, and blood lactate buffering capacity (Iaia, Rampinini, Bangsbo, 2009), they do not include players performing relevant football skills under fatigue during the competition (Harrison et al., 2015).

It is known that fatigue has a negative effect on skill performance, and coaches must take this into account (Russell, Kingsley, 2011).

Additionally, the fact that fitness levels in football have increased to very high levels has made it necessary to use a combination of physical load and technical components in order to use time efficiently.

However, it is considered that football players have a strong desire to train with the ball (Yıldız, 2019). The use of small-side games (SSG) in football, where physical load, technical, and tactical components are trained together, has become mandatory today.

SSG is defined as the use of game-based training in a narrowed area, with a reduced number of players and adapted rules, unlike traditional games, in order to improve technical skills and physical competencies for a purpose (Hill-Haas et al., 2009; Katis, Kellis, 2009).

Coaches achieve physical, physiological, technical, and tactical developments in their athletes through interval loading with SSG, which they perform with different numbers of players, different play areas, and varying playing times.

However, the size of the SSG area, the number of players, the ball going out or going to the goal, and so on change the severity of the

loads. In this respect, SSG formats should be arranged according to the targeted load intensity, duration, and rest intervals. Although many SSGs are used in the literature, there is limited information about SSGs prepared according to the principle of 3 sets of 4X4 minutes at 90-95% maximal load intensity aiming at VO<sub>2</sub> MAX development.

It was stated that SSG prepared in a format in accordance with the three sets of 4X4 min principle revealed an acute loading intensity similar to the loading intensity (HR 90-95%) determined by Hoff et al., (2005). However, the effect of this SSG on the endurance performance of chronic football players has not yet been demonstrated. The aim of the current study was to investigate the effect of the 2 vs. 2 small side game (SSG) arranged according to the principle of 90-95% Max HR (three sets 4x4 min) on the endurance performance and running mechanics of elite young football players. It was hypothesized that the revised 2 vs. 2 SSG would increase endurance performance more than the classic 2 vs. 2 SSG.

## MATERIALS AND METHODS

### Participants

Sixteen elite U-19 football team players participated in the research. The players train four days a week and have one competition. Random distribution of the participants was made online at [www.randomiser.com](http://www.randomiser.com). The criteria for participating in the study were determined as being athletes having at least four years of sports history, not having any chronic or acute illness, participating in training for at least 10 hours a week, playing at least 80

minutes in the last two competitions, and not being a goalkeeper. Failure to participate in at least two trainings is the exclusion criteria.”. Ethical approval for the study was received from the Afyon Kocatepe University Institute of Health Sciences Ethics Committee dated 26.09.2019 and numbered 2019/30. Before the study, the research groups were informed in detail about the procedures. They signed the Informed Volunteer Consent Form.

### Experimental Approach to the Problem

The aim of the current study was to investigate the effect of the 2 vs. 2 SSG arranged according to the principle of 90-95% Max HR (three sets 4x4 min) on the endurance performance and running mechanics of elite young football players.

Therefore, the participants were divided into two groups for classic and revised 2 vs. 2 SSG. As seen in the flow chart, all participants performed the YO-YO 1 tests and two friendly matches one week apart, and their endurance performances were evaluated in their pre-tests. During the application phase, the experimental group played the Revised 2 vs. 2 SSG for four weeks/two days a week, while the control group played the Classic 2 vs. 2 SSG for four weeks/two days a week. After the application phase, post-test measurements were repeated with the same protocol as in the pre-tests. The cardiovascular endurance values of the participants before and after the application were evaluated by taking into account the total distance covered in the Yo-Yo 1 test, the kinematics values they performed during the matches (total distance and distances covered in different speed ranges), and HR data.

**Table 1 - Experimental Flow Chart.**

1st-2nd weeks			2nd-6. weeks	6th-7th weeks		
YO-YO1	1st Friendly Match	2nd Friendly Match	Small Side Games	YO-YO1	1st Friendly Match	2nd Friendly Match
Pre-tests			Two days in a week	Post-tests		

### Procedure

Both SSGs were performed on a 20X15 m artificial grass field at 16:00 o'clock. Forty-eight hours after the first Yo-Yo 1 test, the

participants had a friendly match with the U-17 team of the same club. A second friendly match was held with the same team a week later (Table 1).

All subjects participating in the study were placed the Global Positioning System (GPS) chest bands before the YO-YO 1 test and the matches.

### Measurement Parameters

#### Measurement of the Participants' Cardiovascular Endurance (YO-YO) Values

The cardiovascular endurance performances of the participants were evaluated with the Yo-Yo 1 test. This test consists of repeated 2x20 m back-and-forth movements between the start, return, and finish lines at a gradually increased speed controlled by a beep from a tape recorder (Bangsbo, 1994).

A 10-second rest interval was given after each sit-up. The test track was established on an artificial grass field. Speakers were placed on both sides of the established track. Then, all participants who came to the field were placed the GPS chest bands, and the course was introduced.

Before the test, all participants warmed up, including five minutes of submaximal jogging and five minutes of dynamic stretching. Since the participants had practiced this test before, a familiarization period consisting of only the first four runs of the test was carried out for familiarization.

The test was started on the test track with four observers. The participants were constantly encouraged by the observers. In the later stages of the test, warnings were given to the participants who could not reach the finish line on time.

The tests of the participants who received the third warning were terminated, and the distance covered was recorded. Those who were below 90% of their maximum HR capacity and who wanted to quit the test were warned. Values of those with Max. HR above 90% was taken into consideration.

#### Measurement of Physiological and Kinematic Values Exhibited by the Participants during the Matches

Because the study was carried out during the pandemic period, all participants played two friendly matches as a pre-test before the application and two as a post-test after the

application. The kinematic and physiological values exhibited by the participants in the competition were measured by a GPS system.

The matches were held one week apart. The average values of the two matches in the pre-tests and post-tests were included in the statistical calculation. GPS sensors were placed on the distal part of the sternum in the dressing room before the athletes warmed up with the help of a chest strap. The system was operated by receiving data from three satellites.

The participants' measurements were recorded at the start of the match. The GPS bands of the players who left the game were immediately removed from the sidelines, and the measurement was stopped. Data from these participants were not included in the measurements. The data flow was terminated at the end of the first half with the referee's whistle and with the final whistle. The two-competition average of the players who played 90 minutes during the two competitions was taken and evaluated.

While the total distance covered by the participants and the distances covered in different speed ranges were evaluated as kinematic data in the competitions, maximal heart rate (%Max HR) was evaluated as physiological data. During the competition, kinematic and physiological parameters were measured using the Polar Team Pro system (Polar, 408 Finland). The literature has demonstrated that the Polar Team Pro system is reliable and valid (Akyıldız et al., 2020). Technically, they are systems that can provide both physiological and mechanical real-time data transfer via satellite at 10 Hz. In this system, measurements of players's heart rate, total distance covered, distance covered from different speed zones, acceleration, deceleration, number of sprints, and so on can be obtained.

### Small Side Games

#### The revised 2 vs. 2 SSG

In the current study, the revised 2 vs. 2 SSG was used. The 2 vs. 2 SSG was arranged according to the principle of 90-95% Max HR (3 sets 4x4 min) loading intensity principle. In the revised SSG, eight football players were divided into four groups of two players.

As seen in Figure 1, while two teams (four players) were inside the playing field, four players from the other two teams waited at the edge of the playing field.

The two teams inside were also able to pass the ball with the players waiting on the sidelines. Whichever team passed the ball to those waiting outside, the player outside actively ensured continuity in the game by passing the ball to those on that team. When the ball reaches the players outside, the player has three seconds to pass. He was asked to pass the ball to the team that passed the ball to him.

After the two teams in the playground competed for four minutes, they changed places with the two teams waiting outside. Teams in both groups performed 4 minutes of loading and 4 minutes of active recovery. Goal scores were not requested. Soccer balls were placed on the edges of the playing field so that the game did not stop. The researchers kept the time. The participants were encouraged by coaches and researchers. They were warned to press when they did not have the ball.

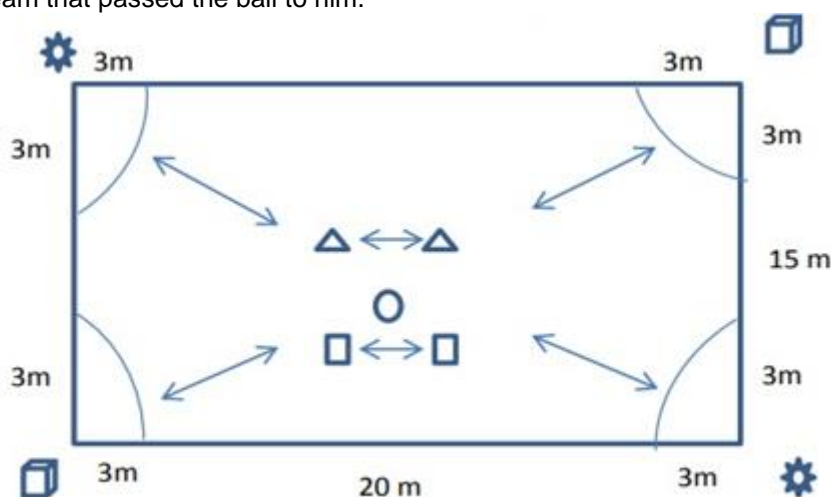


Figure 1 - The revised 2 vs. 2 small-side game graphic.

### The classic 2 vs. 2 Small Side Game

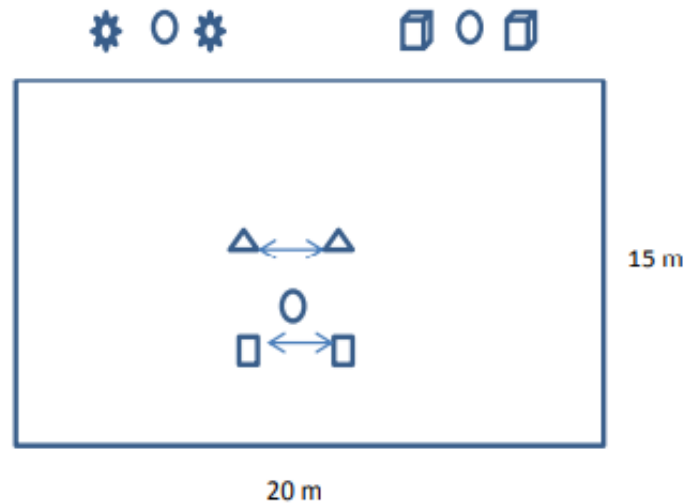
In this SSG, eight football players were divided into four teams of two players. While two teams competed on the field of play, the other two teams waited passively outside (Figure 2).

Football players tried to avoid losing the ball to their opponents by passing it among themselves. Goal scores were not requested in the study. Soccer balls were placed on the edges of the playing field so that the game did

not stop. In the end, while the teams in the game went to passive rest (free) outside, the teams in the rest competed on the field of play.

Football players performed four minutes of play and four minutes of active rest in one set. The game was finished after a total of 3 sets. In the study, athletes were given verbal encouragement to exert maximum performance. Soccer balls were placed on the edges of the playing field to ensure that the game did not stop.





**Figure 2** – The classic 2 vs. 2 small-side game graphic.

### Statistical Analyses

SPSS 22.0 data analysis program was used in the statistical analysis of the data obtained as a result of the research. Before the analysis, the normal distribution of the data was examined with the Kolmogorov-Smirnov test, and it was seen that the data showed a normal distribution. Since the data showed normal distribution, it was decided to use parametric tests. In this context, pre-test and post-test results were evaluated with the paired t-test method. Independent variable t-test was applied to determine the difference between groups, and repeated measures ANOVA tests were applied to determine the group-time interaction. The reliability of the measurements was evaluated with the intraclass correlation

coefficient (ICC). The significance level was accepted as  $p < 0.05$ .

Additionally, effect sizes are shown using the Cohen d method. If Cohen's effect size (d) value is less than 0.2, the effect size is defined as weak; if it is 0.5, it is medium, and if it is greater than 0.8, it is defined as strong. The ICC values are slightly reliable between 0 and 0.20, slightly reliable between 0.20 and 0.40, moderately reliable between 0.40 and 0.60, reliable between 0.60 and 0.80, and reliable between 0.80 and 0.80. Between 1.0 and 1.0, it was evaluated as very reliable. The percentage difference between the pre-test and post-test was calculated using the formula  $(\text{Post-test} - \text{Pre-test} / \text{Pre-test}) \times 100$ . The ICC values ranged between medium and high (0.66-0.94).

### RESULTS

**Table 2** - Demographic Characteristics of the Participants.

Groups	Age (yil)	height (cm)	body mass (kg)
Revised 2 vs. 2 SSG	18,62±0,744	181,12±3,563	72,75±70,50
Classic 2 vs. 2 SSG	18,25±0,354	180,25±5,477	71,25±7,348

Table 2 shows the demographic characteristics of the groups. These data show that the groups are distributed homogeneously, and no significant difference is detected.

As seen in Table 2, significant time effects were found for Yo-Yo IR1, and distance covered in the speed zone at 14.00 - 19.99 km/h

scores, which increased in both groups. However, significant time and group\*time interaction effects were found for total distance covered and distance covered in the speed zone at 20.00 - 49.99 km/h (m), which greater extent in the revised 2 vs. 2 group (respectively, 9323,25±693,91 to 10383,25±1115,31 m., rate

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of change: 11.3% and 587,25±355,77 to 1150,25±486,77 m. rate of change: 95.9%) than classic 2 vs. 2 group (respectively,

9105,50±404,50 to 9317,13±559,94 m. rate of change: 2.3% and 492,75±142,58 to 572,13±140,20 m. rate of change: 10.01%).

**Table 3** - Changes in cardiovascular endurance, kinematic, and physiological values from pre- to post-training for each group.

Measurements		Revised 2 vs. 2 SSG $\bar{x} \pm Sd$	Classic 2 vs. 2 SSG $\bar{x} \pm Sd$	Group	Time	Group* time
HR (%)	Pre-test	80.50±3.50	82.50±2.73	F=0.799 p<0.068	F= 0.12, p<0.730	F=8.629, p<0.110
	Post-test	82.25±4.43	81.13±3.23			
	Rate of change (%)	0.30	-1.66			
Max HR (%)	Pre-test	96.25±4.43	97.87±4.94	F=1.372 p<0.261	F= 3.53, p<0.081	F=0.345, p<0.566
	Post-test	97.63±2.88	100.50±5.18			
	Rate of change (%)	1.43	2.68			
YO-YO IR 1 (m)	Pre-test	3002.50±440.71	2707.50±538.99	F=2.64, p= 0.127	F=17.72 ; p< .001	F=2.14, p=0.165
	Post-test	3312.50±252.97*	2857.50±593.24*			
	Rate of change (%)	10.3	5.54			
Total distance covered (m)	Pre-test	9323.25±693.91	9105.50±404.50	F=3.62 p<0.078	F= 16.99, p<0.001	F=7.5, p<0.016
	Post-test	10383.25±1115.31*	9317.13±559.94			
	Rate of change (%)	11.3	2.33			
Distance covered in the speed zone at 0.00 - 13.99 km/h (m)	Pre-test	7187.00±439.13	7098.88±393.93	F=1.089 p<0.315	F=1.427 p<0.252	F=0.982, p<0.338
	Post-test	7432.88±532.45	7121.75±397.48			
	Rate of change (%)	3.41	0.33			
Distance covered in the speed zone at 14.00 - 19.99 km/h (m)	Pre-test	1552.50±278.88	1515.13±231.68	F=0.51, p<0.486	F=10.17 7, p<0.007	F=1.571, p<0.231
	Post-test	1800.00±443.34*	1623.00±284.49			
	Rate of change (%)	15.94	7.12			
Distance covered in the speed zone at 20.00 - 49.99 km/h (m)	Pre-test	587.25±355.77	492.75±142.58	F=5.65, p<0.032	F= 19.832 p<0.001	F=11.241, p=0.005
	Post-test	1150.25±486.77*	572.13±140.20*			
	Rate of change (%)	95.9	10.01			

p<0.05,  $\bar{x}$ =mean, Sd: Standard Deviation, SSG: Small Side Game.

## DISCUSSION

The current study investigated the effects of the revised 2 vs. 2 SSG arranged according to the principle of 90-95% Max HR (three sets 4x4 min) on elite young football players' endurance performance and running mechanics.

As a result, significant time effects were found for Yo-Yo IR1, and distance covered in the speed zone at 14.00 - 19.99 km/h scores, which increased in both groups. However, significant time and group\*time interaction effects were found for total distance covered and distance covered in the speed zone at 20.00 - 49.99 km/h (m), which was to a greater extent in the revised 2 vs. 2 group than the classic 2 vs. 2 group.

This improvement in aerobic capacity (Yo-Yo 1 test, total distance covered, distance covered in the speed zone at 14.00 - 19.99 km/h, and distance covered in the speed zone at 20.00-49.99 km/h) in both groups is thought to be due to the achievement of high HR values due to the format of the 2 vs. 2 SSGs. Supporting this study, Sarmento et al., (2018) reported in their review study that the physiological load increased more as the number of players decreased in SSG formats.

Similarly, Halouani et al., (2017) reported that comparing 2 vs. 2, 3 vs. 3, and 4 vs. 4 small side games, they found a higher HR value in the 2 vs. 2 SSG. In a study conducted on futsal players, Duarte et al., (2009) compared 4 vs. 4, 3 vs. 3, and 2 vs. 2 SSG and reported that the physiological load increased more with the decrease in the number of players.

Moreover, there are many studies showing that classical running-based endurance training (Helgerud et al., 2001; Eniseler et al., 2017; Hill-Haas et al., 2009; Safania et al., 2011) and SSGs (Fanchini et al., 2011; Hill-Haas et al., 2009; Jastrzebski et al., 2014; Los Arcos, 2015) organized according to the principle of 3-4 min load, and 3-4 min rest lead to an increase in aerobic endurance performance.

Additionally, in both game formats, participants were encouraged to press and keep the tempo high. This situation might have contributed to the higher HR values being observed. In a study using 3 vs. 3, 4 vs. 4, 5 vs. 5, and 6 vs. 6 SSG, the effect of the coach's

verbal encouraging speeches on physiological load was investigated. Researchers have observed that encouraging speeches significantly increase HR, blood lactate concentrations, and perceived exertion (Rampinini et al., 2007).

Additionally, the revised 2 vs. 2 SSG showed proportionally more improvement than the classic 2 vs. 2 SSG for the total distance covered and distance covered in the speed zone at 20.00-49.99 km/h. It is thought that this difference may be due to the game structure of the revised 2 vs. 2 SSG.

Although the revised 2 vs. 2 SSG format is played 2 vs.2, the fact that the team in possession of the ball can pass the ball with four players standing outside turns the game format into 6 vs.2 on behalf of the team in possession.

Players waiting on the sidelines are not included in the game. They only have to pass the ball to the team from which the player passed it within 3 seconds. Thus, increasing the number of players to pass the ball leads to creating many more positions, transforming the game into a much more fluid and fast format.

This might cause much more internal and external load on football players. It seems likely that there will be further development due to this burden. In the literature, it has been reported that rule changes such as increasing the number of players on the team in possession of the ball according to the game format (Halouani et al., 2014) and putting the ball into play in a limited time (Dellal et al., 2008; San Román-Quintana et al., 2013) result in higher HR, blood lactate concentrations, and perceived exertion values compared to free play.

Supporting the current study, Yıldız (2018) compared the revised 2 vs. 2 and classical 2 vs. 2 SSG to investigate the acute effects on physiological responses and running mechanics during the SSGs. He found the higher average HR ( $181.25 \pm 5.05$  bpm vs.  $175.96 \pm 4.23$  bpm,  $p < 0.01$ ), HRmax% ( $90.65 \pm 2.48\%$  vs.  $87.33 \pm 2.17\%$ ,  $p < 0.01$ ), resting HR between sets ( $145.15 \pm 10.92$  bpm vs.  $139.54 \pm 9.39$  bpm), and distance covered ( $601.31 \pm 40.95$  m vs.  $546.60 \pm 51.32$  m), maximal speed ( $22.55 \pm 1.82$  km/h vs.  $20.99 \pm 1.67$  km/h), and average speed ( $8.98 \pm 0.69$  km/h vs.  $8.40 \pm 0.67$  km/h) in the Revised 2 vs. 2 SSG.

As a result, although it was determined that both SSGs developed aerobic endurance



performance, a greater extent was seen in the revised SSG for the total distance covered and distance covered in the speed zone at 20.00-49.99 km/h without causing a significant change in the physiological values of the football players.

When it is considered that SSGs include technical and tactical exercises and their motivational feature, it is recommended to use the revised 2 vs. 2 SSG to improve endurance performance in football training.

## REFERENCES

- 1-Akyildiz, Z.; Yildiz, M.; Clemente, F. M. The reliability and accuracy of Polar Team Pro GPRS units. Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology. 2020. 1754337120976660.
- 2-Bangsbo, J. The physiology of soccer: with special reference to intense intermittent exercise. Acta Physiol Scand Suppl. Num. 619. 1994. p. 1-155.
- 3-Bangsbo, J. Fitness training in football: a scientific approach. August Krogh Inst., University of Copenhagen. 1994.
- 4-Buchheit, M.; Laursen, P.B. High-intensity interval training, solutions to the programming puzzle. Sports medicine. Vol. 43. Num. 5. 2013. p. 313-338.
- 5-Chamari, K.; Hachana, Y.; Kaouech, F.; Jeddi, R.; Moussa-Chamari, I.; Wisløff, U. Endurance training and testing with the ball in young elite soccer players. British journal of sports medicine. Vol. 39. Num. 1. 2005. p. 24-28.
- 6-Deliceoğlu, G.; Müniroğlu, S. The Effects of the speed function on some technical elements in soccer. The Sport Jurnal. Vol. 8. Num. 3. 2005. p. 21-26.
- 7-Dellal, A.; Chamari, K.; Pintus, A. Heart rate responses during smallsided games and short intermittent running: Training in elite soccer players. Journal of Strength and Conditioning Research. Vol. 22. Num. 5. 2008. p. 1449-1457.
- 8-Duarte, C.M.; Conley, D.J.; Carstensen, J.; Sánchez-Camacho, M. Return to Neverland: shifting baselines affect eutrophication restoration targets. Estuar. Coasts. Num. 32. 2009. p. 29-36. doi: 10.1007/s12237-008-9111-2
- 9-Eniseler, N.; Şahan, Ç.; Özcan, I.; Dinler, K. High-intensity small, sided games versus repeated sprint training in junior soccer players. J Hum Kinet. Num. 60. 2017. p.101-111.
- 10-Fanchini, M.; et al. Effect of bout duration on exercise intensity and technical performance of small-sided games in soccer. The Journal of Strength & Conditioning Research. Vol. 25. Num. 2. 2011. p. 453-458.
- 11-Halouani, J.; Chtourou, H.; Gabbett, T.; Chaouachi, A.; Chamari, K. Small-sided games in team sports training: a brief review. The journal of strength & conditioning research. Vol. 28. Num. 12. 2014. p. 3594-3618.
- 12-Harrison, C.B.; Gill, N.D.; Kinugasa, T.; Kilding, A.E. Development of aerobic fitness in young team sport athletes. Sports Med. Num. 45. 2015. p. 969-983.
- 13-Helgerud, J.; Engen, L.C.; Wisloff, U.; Hoff, J. Aerobic endurance training improves soccer performance. Medicine and science in sports and exercise. Vol. 33. Num. 11. 2001. p. 1925-1931.
- 14-Hill-Haas, S.V.; Coutts, A.J.; Rowsell, G.J.; Dawson, B.T. Generic versus small-sided game training in soccer. Int J Sports Med. Num. 30. 2009. p. 636-842.
- 15-Hill-Haas, S.V.; Dawson, B.T.; Coutts, A.J. Physiological responses and time-motion characteristics of various small-sided soccer games in youth players. Journal of Sports Sciences. Vol. 27. Num. 1. 2009. p. 1-8.
- 16-Hoff, J. Training and testing physical capacities for elite soccer players. Journal of sports sciences. Vol. 23. Num. 6. 2005. p. 573-582.
- 17-Hoff, J.; Wisløff, U.; Engen, L.C.; Kemi, O.J.; Helgerud, J. Soccer specific aerobic endurance

training. British journal of sports medicine. Vol. 36. Num. 3. 2002. p. 218- 221

18-Iaia, M.F.; Rampinini, E.; Bangsbo, J. High-intensity training in football. Int J Sports Physiol Perform. Num. 4. 2009. p. 291-306

19-Jastrzebski, Z.; Barnat, W.; Dargiewicz, R.; Jaskulska, E.; Szwarc, A.; Radzimiński, Ł. Effect of in-season generic and soccer-specific high-intensity interval training in young soccer players. Int J Sports Sci Coach. Num. 9. 2014. p. 1169-1179.

20-Kamar, A. Futbol oyuncularına 35 metre maksimal anaerobik sprint ile dikey sıçrama ve durarak uzun atlama skorları arasındaki ilişkinin incelenmesi. İstanbul Üniversitesi Spor Bilimleri Dergisi. Vol. 11. Num. 3. 2003. p. 147-150.

21-Katis, A.; Kellis, E. Effects of Small-Sided Games on Physical Conditioning and Performance In Young Soccer Players. Journal of Sports Science and Medicine. Num. 8. 2009. p. 374- 380.

22-Los Arcos, A.; Vázquez, J.S.; Martin, J.; Lerga, J.; Sánchez, F.; Villagra, F.; et al. Effects of small-sided games vs. interval training in aerobic fitness and physical enjoyment in young elite soccer players. PLoS One. 2015; Vol. 10. Num. 9. 2015. p. e0137224.

23-Mcmillan, K.; Helgerud, J.; Macdonald, R.; Hoff, J. Physiological adaptations to soccer specific endurance training in professional youth soccer players. Br J Sports Med. Num. 39. 2005. p. 273-277.

24-Rampinini, E.; Impellizzeri, F.M.; Castagna, C.; Abt, G.; Chamari, K.; Sassi, A.; Marcora, S.M. Factors influencing physiological responses to small-sided soccer games. Journal of sports sciences. Vol. 25. Num. 6. 2007. p. 659-666.

25-Russell, M.; Kingsley, M. Influence of exercise on skill proficiency in soccer. Sports Med. Num. 41. 2011. p. 523-539.

26-Safania, A.M.; Alizadeh, R.; Nourshahi, M.; Branch, A.A. A comparison of small-side games and interval training on same selected physical

fitness factors in amateur soccer players. Soc Sci. Num. 7. 2011. p. 349-350.

27-San Román-Quintana, J.; Casamichana, D.; Castellano, J.; Calleja-González, J.; Jukić, I.; Ostojić, S. The influence of ball-touches number on physical and physiological demands of large-sided games. International J Fund App Kinesiology. Num. 45. 2013. p. 171-178.

28-Sarmiento, H.; Marcelino, R.; Anguera, M. Match analysis in football: a systematic review. J Sports Sci. Num. 32. 2014. p. 1831-1843.

29-Yıldız, M. Futbolda İki Farklı 2x2 Dar Alan Oyununun Fizyolojik Yanıt, Mekanik Ve Teknik Karakterlerinin Karşılaştırılması. 18. Uluslararası Spor Bilimleri Kongresi. 18. Uluslararası Spor Bilimleri Kongre kitapçığı SB741, 07-09 Kasım. Antalya. 2020.

30-Yıldız, M.; Çandır, B. Futbolcuların Topla ve Topsuz Yapılan Antrenmanlara Yönelik Görüşlerinin Belirlenmesi. Türkiye Spor Bilimleri Dergisi. Vol. 3. Num. 1. 2019. p. 21-25.

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