

## Effects of Small-Sided Games Training Program on VO2 max and Football Playing Skills

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### Abstract

Skills disparity in controlling the ball in the soccer pitch are skills that must be constantly improved and owned by every soccer player along with the ideal capacity of oxygen consumption known as VO2max. The small-sided game's training is all about needed. The aim is to reveal the extent to which is the effect of this latter program on VO2max and skills improvement. This study was a quantitative quasi-experimental research of 24 participants as a sample size from SSB schools in Yogyakarta. The instruments used were pretraining and post-training tests designed and implemented by the research after going through validation processes. The data obtained consists of mean, standard deviation based on some antropometric factors along with ANOVA data testing to view the means difference between/within unrelated groups for correlational calculations. Our results were impressive that significant effects were found either on VO2 max increment or players' performances. We concluded that the introduced program has beneficial impacts on our young soccer players related, specific performance, and VO2max indeed. On  $p$ -value  $< 0.05$ . We have realized that the substantial portion of correlated data has sig-value less than 0.05; that means strong effect was found. Shortly, soccer coaches, practitioners should always strive to incorporate deliberate training programs for the sake of their career and novice players.

### Keywords

Training program (SSGs); VO2 max; soccer; skills improvement.



## I. Introduction

Nowadays games in general and soccer, in particular, are characterized by changes and physical demands by a mixture of a variety of both physical and psychological activities. Some of which including standing, walking, running, and sprinting with frequent changes in directions, seeking the ball, or jumping, often with the involvement of the ball and/or opponents (Kunz et al. 2019). Based on the current official competition that follows FIFA's rules, in football matches any player whose age over 16 years old, the normal playing time is twice 45 minutes, between the first and second half where in the meantime there will be a 15-minute recess/break. With this above fact, one may wonder, why this regulation enacted like that? The varying intensity from low to high matches lasting time, that is 90 min depending mostly on age (Mendez-Villanueva et al. 2013), that involves on average superior 80% of peak heart rate and approximately 75% of maximal oxygen uptake in youth soccer players (Kunz et al. 2019; Stølen et al. 2005). Apart from the intensity need for players, in the normal soccer game, for 90 minutes of the normal time as the official time acknowledged by football laws, the body function requires a high VO2 max level in any player. In broad understanding, the VO2 max is an indicator used to measure the level of health, sports performance, monitoring, and measuring the level of success of a given aerobic exercise (Gao et al. 2021). By imposing such considerable demands on both aerobic and anaerobic energy production and need, high-level endurance

performance is also an important prerequisite for success (Vanderford et al. 2004). Thus, players are required to have a good aerobic endurance capacity to support performance while playing since in one single match, it is estimated that players will run about 10-13 km (Bangsbo, Mohr, and Krstrup 2006). Besides that, for a player, the ability to control the ball, the intelligence of the coach to upgrade and apply tactics and game patterns, the exploitation of the players are some of the factors that predict the player performance in the upcoming games (Abarghoueinejad et al. 2021) According to Yani in Syardiansyah (2020) performance is a result of work achieved by a person in carrying out the tasks assigned to him based on skill, experience and sincerity as well as time. However according to Kasmir (2016) that performance is the result of work and work behavior of a person in a period, usually 1 year. Then the performance can be measured by the ability to complete the tasks and responsibilities given. This means that in work contains elements of the standard that achievement must be met, so, for those who reach the standards set means good performance.

To nurture such valuable skills, soccer coaches need then to prepare the physical condition of their players, especially aerobic endurance in the wake of reaching peak performance. For example, it is believed that increasing aerobic endurance capacity would increase the distance and intensity of running while playing soccer and vice versa (Los Arcos et al. 2015). By increasing such assets within players, better achievement is predictable. Thus, to improve such valuable components, proper training methods are needed; that is small-sided games training for the sake of both athletes and trainers/coaches. According to (Halouani et al. 2017), Small-Sided Games (SSGs) exercise is an exercise method that can be used to increase aerobic endurance more effectively and efficiently in soccer players and also to improve techniques and tactics simultaneously. Regarding the plethora of literature and studies on small-sided games in soccer which assess acute responses to exercise in young players along with effective game format configurations, such positive effect has been proved for the effective development of skill and endurance than traditional training (Moran et al. 2019). Besides, high-volume or perpetual low-intensity training has been used successfully to enhance certain staple aspects of endurance performance in soccer players, such as peak oxygen uptake (VO<sub>2</sub> peak) (Helgerud et al. 2007), individual anaerobic threshold, and/or maximal velocity in those young individuals (Aloui et al. 2021; Kunz et al. 2019); (Kunz et al. 2019). With respect to these facts audited above, there are important factors for coaches to consider when aiming to intensify aerobic performance in growing youth players (in age between 14-16 years old) who may be highly susceptible to overtraining and burnout.

Given that small-sided games can serve as a time and skill-efficient solution to meeting the demands of youth soccer players at SBB, such intervention is needed to lift up and improve players' skills. Therefore, this research was conducted to investigate the extent to which is the effect of SSGs training on VO<sub>2</sub>max and also improving VO<sub>2</sub>max toward SSB playing skills.

## **II. Research Method**

### **2.1 Experimental Approach to the Current Issue**

Even though several works of literature have compared the effects of small-side games and other training methods especially on physical performance (Aguiar et al. 2012; Los Arcos et al. 2015). To our better knowledge, this comparative effect has not been carried out yet among SSB soccer players in Yogyakarta. This study was done in three configurations, namely 6 versus 6, 4 vs 4, and 3 vs 3. The three formats of small-sided

games were given to athletes to see how far the three formats affected the VO2 max level and playing skills of soccer players. This study was done over six weeks for 16 meetings. Before and immediately after the 16 meetings of training sessions, anthropometric values, aerobic fitness and countermovement jumps were verified on all the players (Moran et al. 2019). Moreover, heart rate and muscular and respiratory perceived effort were also recorded during training and match (preliminary survey). The eligible participants were players who did not undergo any specific conditioning programs; however, physical fitness was maintained with the usual training sessions.

## 2.2 Reserch Setiting and Time Allocation

This study was done over six weeks for 16 meetings on SSB soccer players in Yogyakarta city. After the 16 meetings of training sessions, anthropometric values, aerobic fitness and countermovement jumps are needed to be verified on all the players (Moran et al. 2019). The eligible participants were players who did not undergo any specific conditioning programs; however, physical fitness was maintained with the usual training sessions.

## 2.3 Participants/Population and Sample Size

Twenty-four young soccer players from SSB School who were members of the Sinar Muda soccer school participated in this study. Players were randomly assigned to skill-based and small-sided games groups, where the demographic information (age, experience, height, and body mass) of the groups were registered as depicted in table 1 below. As the ethical research, all athletes, their parents, and coaches were informed about the research procedures, benefits, requirements, and risks before obtaining written informed consent. All procedures, research instruments of this study were approved by academic experts and supervisors from the campus Universitas Negeri Yogyakarta.

**Table 1.** Distribution of Antropometric data of subjects

No	14 years old		15 years old		16 years old	
	Weight	Height	Weight	Height	Weight	Height
1	46.50	147	46.50	156	48.50	151
2	41.00	151	51.00	151	54.00	153
3	53.50	148	47.00	146	41.50	144
4	39.00	155	41.50	150	43.50	146
5	43.00	161	48.50	157	49.00	152
6	47.00	154	53.00	155	52.00	154
7	49.50	166			48.50	151
8	50.50	145				
9	48.00	137				
10	45.00	142				
11	41.50	149				

## 2.4 Data Collection

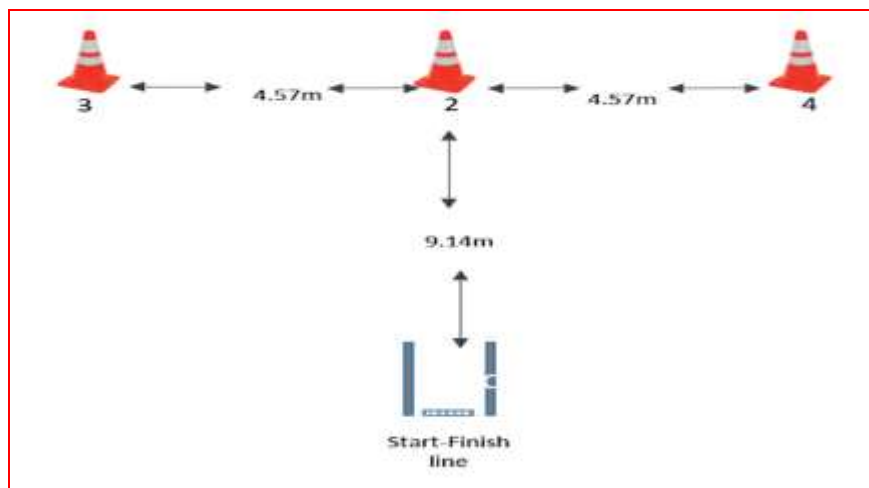
Having the features of experimental research as the type of research that uses a quasi-experimental method, the so-called method tests or examines the potential of the independent variable in the form of small-sided games training program against the dependent variable, namely, VO2max and soccer skills. Thus, to embrace such requirements, instrument tests and measurement were the main means used in this study

during data collection techniques. However, the instrument test employed was in two types; the Beep test (that is for finding out the  $VO_{2max}$  level of soccer players) and the David Lee Development Test; to measure soccer playing skills for young players (Suhadi et al. 2020)

- **Physical Performance Test**

**Estimated  $VO_{2max}$  test:** to determine the aerobic power, a 20-meter shuttle run test was used to predict  $VO_{2max}$  proposed by (Stickland, Petersen, and Bouffard 2003) In the test, these young players were asked to run in a 20-meter straight line to complete a shuttle. The test was terminated for that player when he voluntarily stopped or could not concurrently fail to reach the 20-meter end lines which were synchronized twice.

**Change of Direction Ability Test:**



**Figure 1.** Change of Direction Ability Test

While determining players' change of direction ability, the T-run test was recalled. According to (Karahana 2020), the T-run test consists of the player's speed with directional changes such as forward sprinting, left and right shuffling, and backward to start line. During this treatment, the test was repeated twice with a 2-min active recovery interval and the best of the two performances was recorded using an electronic timing system placed at the starting line.

**Anaerobic Power:** The running anaerobic sprint test (RAST) was another type of test administered while describing the anaerobic capacities of soccer players. The execution of that was performed by placing two electronic timing systems at 35 m apart on an indoor synthetic surface to determine running scores. Players completed 6 x 35 m sprint running with 10 s active recovery periods allowed between each sprint for the turnaround.

- **Training Programs profile: Small-Sided Games**

This small-sided games program was designed and implemented by the research along with coaches. So, the research protocol provided to the coaches by the researcher has matched the playing duration of SSGs. Scores were considered valid only if made with not more than two touches and in all small-sided games, the relative pitch size as standard. All training sessions were conducted on a natural grass field named *Lapangan tempel sari* Kab. Sleman and at two different times of day (mostly from 15.00-16.30 training days, and

14.00-18.00 or 07.00-09.30 pre-test or post-test days) based on the availability of players and coaches. All players underwent the supervision of their coaches, 10 minutes of general warm-up and 10 minutes of specific soccer warm-up such as low-intensity passing, ball control, and dribbling exercises, and 10 minutes of cool-down exercises before and after each training program. During the training program, players were controlled to perform their activities with maximum effort and were instructed verbally by coaches to provide high motivation. Each SSG sessions were mostly conducted three times a week (Tuesday, Thursday, and Saturday) under the supervision of soccer coaches and researcher. As explained in the preceding section, in this study, players were matched as 6 vs 6, 4 vs 4, and 3 v 3 for SSG. Overall, the highest heart rate was (90 %) and found on 3 v 3 formats compared to other SSG game formats. The small-sided games played 4 x 6 min small-sided soccer in the 20 x 25 m pitch dimension, with a 2 min passive recovery (Halouani et al. 2017). During this time of playing, to minimize game downtimes, predicting to reduce the intensity of the games, when the ball moved away from the playing area, the substitute balls which are on the side of the playing area were introduced to the game immediately by the coaches.

## 2.5. Statistical Analysis

Descriptive statistics and statistical differences of findings were calculated using the newest SPSS 26<sup>th</sup> package. The results were presented together with means and standard deviation. However, by verifying whether there are changes or positive-negative effects based on the results of the pre-test, ANOVA and Pearson correlation values/scores were taken as references in SPSS software. Between scores, differences from pre-test and post-test at baseline were assessed using ANOVA test to view whether the mean difference is significant on *p-value* 0.05 between and within groups.

## III. Result and Discussion

**Table 2.** Training Programs, Attributed Values and Mean scores

N0	Anthropometry Measured			Skills Soccer Player Score				VO <sub>2Max</sub> Results			
	Age	Weight	Height	PRE	T1	T2	T3	PRE	T1	T2	T3
1	14	46.50	147	50.50	48.51	45.78	35.15	38.50	39.20	41.45	44.65
2	14	41.00	151	53.70	50.53	45.67	40.55	40.20	40.50	41.45	44.50
3	15	46.50	156	53.10	48.24	40.75	32.77	44.50	45.90	46.20	53.10
4	14	53.50	148	50.80	45.71	40.76	33.95	41.80	42.10	43.30	45.55
5	16	48.50	151	52.50	51.85	48.76	42.35	40.80	41.10	43.30	46.20
6	14	39.00	155	49.90	46.56	38.22	36.29	41.10	42.10	43.32	49.00
7	15	51.00	151	49.80	47.33	45.30	40.75	38.85	39.55	43.30	45.90
8	15	47.00	146	53.70	50.09	48.96	40.66	36.40	37.10	38.50	43.30
9	16	54.00	153	47.70	45.70	42.76	35.88	38.15	39.90	41.10	45.90
10	16	41.50	144	38.09	38.05	35.65	32.76	39.90	42.10	42.70	44.50
11	14	43.00	161	39.75	38.11	35.18	30.85	41.10	42.70	43.60	45.90
12	16	43.50	146	41.37	40.65	38.75	33.41	40.50	40.80	41.45	46.20
13	15	41.50	150	53.90	52.87	48.71	43.15	37.10	38.15	40.50	44.20
14	14	47.00	154	42.37	41.85	38.07	32.65	39.90	40.20	41.45	45.90
15	16	49.00	152	43.05	40.97	36.28	30.51	36.40	37.10	38.85	42.10
16	15	48.50	157	50.34	49.34	45.65	40.34	44.65	45.20	45.90	47.70



17	14	49.50	166	50.50	48.95	43.45	35.12	42.10	42.10	43.90	46.20
18	16	52.00	154	48.75	48.05	45.18	40.25	39.10	39.55	40.20	44.20
19	14	50.50	145	42.75	40.15	37.04	32.55	41.80	42.40	43.00	45.55
20	14	48.00	137	40.12	38.70	36.05	31.85	38.15	39.20	40.20	43.00
21	15	53.00	155	42.35	40.75	36.74	31.20	38.50	39.20	42.70	46.20
22	16	48.50	151	55.76	53.45	50.71	40.35	38.50	38.85	39.55	41.45
23	14	45.00	142	51.76	48.75	45.65	40.77	43.30	43.60	44.65	47.10
24	14	41.50	149	50.50	48.51	45.78	35.15	38.50	39.20	41.45	44.65

**Table 3. Summary of Descriptive Statistics of all Data Collected**

	N	Minimum	Maximum	Mean	Std. Deviation
Statistic	Statistic	Statistic	Statistic	Statistic	
AGE	24	14.00	16.00	148.333	.86811
WEIGHT	24	39.00	54.00	470.417	428.322
HEIGHT	24	137.00	166.00	1.508.750	619.476
PRE_SKILL	24	38.09	55.76	480.442	530.764
T1_SKILL	24	38.05	53.45	459.862	483.349
T2_SKILL	24	35.18	50.71	423.271	491.428
T3_SKILL	24	30.51	43.15	362.192	410.755
PRE_VO2	24	36.40	44.65	399.917	227.776
T1_VO2	24	37.10	45.90	407.417	227.442
T2_VO2	24	38.50	46.20	421.675	201.504
T3_VO2	24	41.45	53.10	455.396	233.922

### 3.1 Output analysis of soccer player's skills during Smal-sided games

It is plainly seen that these data showcased here are the results obtained and extracted from SPSS. It is briefly described that the sample size used as soccer players was 24 individuals. There has been a significant increasing value between the pre-test results on all results yielded after treatments applied. Turn to the fact, ANOVA test was the only scale used and suitable in this research. To our better understanding, before proceeding to ANOVA test or analysing data with ANOVA, there some mandatory assumptions to abide by or to be verified as testing homogeneity of variances indeed of the data. If the *p-value* calculated based on the mean is more than .05, then researchers have met the assumption of homogeneity of variance and can conduct a one-way ANOVA (Jayalath et al. 2017). The one-way analysis of variance shortened ANOVA is employed in analysis to determine whether there are any statistically significant differences between the means of three or more unrelated groups through sig. values. If the sig.value or p-value is less than 0.05 as the threshold standard, then the data or mean difference found are statistically significant. Then, based on the data exhibits in above table, skills soccer player scores in pretraining 1 (6 vs 6), pretraining 2 (4 vs 4) and pretraining 3 (3 vs 3) made a significant difference with p-value ranging from .000 to .047, in other words lower than .05. Likewise, for  $VO_{2max}$  we performed the same calculations as homogeneity of variance test along with ANOVA Test.

**Table 4.** Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
T1	Based on Mean	.150	1	3	.724
	Based on Median	.150	1	3	.724
	Based on Median and with adjusted df	.150	1	2.000	.736
	Based on trimmed mean	.150	1	3	.724
T2	Based on Mean	3.325	1	3	.166
	Based on Median	.750	1	3	.450
	Based on Median and with adjusted df	.750	1	2.000	.478
	Based on trimmed mean	2.822	1	3	.192
T3	Based on Mean	93.750	1	3	.002
	Based on Median	12.150	1	3	.040
	Based on Median and with adjusted df	12.150	1	2.000	.073
	Based on trimmed mean	76.614	1	3	.003

**Table 5.** Outputs for ANOVA testing

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
T1	Between Groups	537.113	20	26.856	356.702	.000
	Within Groups	.226	3	.075		
	Total	537.339	23			
T2	Between Groups	546.423	20	27.321	9.075	.047
	Within Groups	9.031	3	3.010		
	Total	555.454	23			
T3	Between Groups	388.049	20	19.402	8.752.979	.000
	Within Groups	.007	3	.002		
	Total	388.055	23			

### 3.2 Output Analysis of Soccer Players Skills during VO2 Testing

The training sessions showed a positive effect on V02 max within independent groups during pretraing diffent times. As we can see here in table 6; sig. values were under standard p-value score as 0.05. That said, the mean difference between, pretraing 1 (6 vs

6), pretraing 2 (4 vs 4) were statistically significant with .000 and .004 respectively. However, it was not found significant at pretraining 3 (3 vs 3) with the sig.value equal to .104.

**Table 6.** Test of Homogeneity of Variances

		Levene Statistic	df1	df2	Sig.
T1_VO2	Based on Mean	82.667	5	8	.000
	Based on Median	21.714	5	8	.000
	Based on Median and with adjusted df	21.714	5	3.000	.015
	Based on trimmed mean	67.307	5	8	.000
	Based on Mean	1.001	5	8	.474
T2_VO2	Based on Median	.618	5	8	.691
	Based on Median and with adjusted df	.618	5	3.000	.703
	Based on trimmed mean	.949	5	8	.500
	Based on Mean	1.576	5	8	.270
	Based on Median	.827	5	8	.564
T3_VO2	Based on Median and with adjusted df	.827	5	3.000	.603



Based on trimmed mean	1.458	5	8	.302
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**Table 7.** Outputs for ANOVA testing

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
T1_VO2	Between Groups	116.611	15	7.774	26.276	.000
	Within Groups	2.367	8	.296		
	Total	118.978	23			
T2_VO2	Between Groups	86.990	15	5.799	7.251	.004
	Within Groups	6.399	8	.800		
	Total	93.389	23			
T3_VO2	Between Groups	103.183	15	6.879	2.427	.104
	Within Groups	22.672	8	2.834		
	Total	125.855	23			

In addition to these data founds, correlational testing was also performed between the score of skills soccer players, the  $VO_{2max}$  to some antropometric factors used (age, body mass, and hight). Pearson correlation did not reveal any significant results on antropometric factors to skills developed or  $VO_{2max}$ . Then, in our results anthropometric factor such as age, weight and hight data did not show significant impact on  $VO_{2max}$ .

**Table 8.** Correlations Results On antropometric factors vs playing skills

		AGE	WEIGHT	HIGHT	PRE	T1	T2	T3
AGE	Pearson Correlation	1	.242	-.004	-.031	.066	.160	.189
	Sig. (2-tailed)		.255	.985	.887	.761	.454	.376
	N	24	24	24	24	24	24	24
WEIGHT	Pearson Correlation	.242	1	.107	-.021	-.047	.016	-.084
	Sig. (2-tailed)	.255		.620	.922	.826	.942	.696
	N	24	24	24	24	24	24	24
HIGHT	Pearson Correlation	-.004	.107	1	.148	.173	.011	-.039
	Sig. (2-tailed)	.985	.620		.489	.418	.958	.856
	N	24	24	24	24	24	24	24

PRE	Pearson Correlation	-	.031	-.021	.148	1	.971**	.879**	.766**
	Sig. (2-tailed)		.887	.922	.489		.000	.000	.000
	N		24	24	24	24	24	24	24
T1	Pearson Correlation	.066	-.047	.173	.971**	1	.941**	.844**	
	Sig. (2-tailed)		.761	.826	.418	.000		.000	.000
	N		24	24	24	24	24	24	24
T2	Pearson Correlation	.160	.016	.011	.879**	.941**	1	.888**	
	Sig. (2-tailed)		.454	.942	.958	.000	.000		.000
	N		24	24	24	24	24	24	24
T3	Pearson Correlation	.189	-.084	-.039	.766**	.844**	.888**	1	
	Sig. (2-tailed)		.376	.696	.856	.000	.000	.000	
	N		24	24	24	24	24	24	24

\*\* . Correlation is significant at the 0.01 level (2-tailed).

**Table 9.** Correlations Results on antropometric factors vs VO2max

		AGE	WEIGHT	HIGHT	PRE_VO2	T1_VO2	T2_VO2	T3_VO2
		E	T	T	2	2	2	2
AGE	Pearson Correlation	1	.242	-.004	-.289	-.241	-.297	-.199
	Sig. (2-tailed)		.255	.985	.171	.257	.159	.351
	N	24	24	24	24	24	24	24
WEIGHT	Pearson Correlation	.242	1	.107	-.046	-.098	-.024	-.096
	Sig. (2-tailed)		.255	.620	.829	.648	.911	.657
	N	24	24	24	24	24	24	24
HIGHT	Pearson Correlation	.004	.107	1	.274	.257	.338	.355
	Sig. (2-tailed)		.985	.620	.194	.225	.106	.089
	N	24	24	24	24	24	24	24
PRE_VO2 2	Pearson Correlation	-.289	-.046	.274	1	.972**	.904**	.755**
	Sig. (2-tailed)		.171	.829	.194		.000	.000
	N		24	24	24	24	24	24

T1_VO2	N	24	24	24	24	24	24	24
	Pearson Correlation	-.241	-.098	.257	.972**	1	.919**	.791**
	Sig. (2-tailed)	.257	.648	.225	.000	.000	.000	.000
T2_VO2	N	24	24	24	24	24	24	24
	Pearson Correlation	-.297	-.024	.338	.904**	.919**	1	.832**
	Sig. (2-tailed)	.159	.911	.106	.000	.000	.000	.000
T3_VO2	N	24	24	24	24	24	24	24
	Pearson Correlation	-.199	-.096	.355	.755**	.791**	.832**	1
	Sig. (2-tailed)	.351	.657	.089	.000	.000	.000	.000
	N	24	24	24	24	24	24	24

\*\* . Correlation is significant at the 0.01 level (2-tailed).

### 3.3 Discussion

This study aimed to investigate the extent to which is the effect of small-sided games training programs on VO<sub>2</sub> max and soccer playing skills. The protocol used as small-sided games training program to improve the football playing skills in this study increased the mean VO<sub>2</sub>max from 39.99 in the pretest to 40.74 on 6 vs 6 programs; 42.16 on 4 vs 4 programs and at 45.53 on 3 vs 3. In other words, there was an increment of 0.75% in the first programs (6 vs 6); 2.17% in the second programs (4 vs 4) and around 5.54% in the third program otherwise 3 vs 3. Significant changes took place in the ANOVA analysis to identify the mean difference within and between groups with p-value ranging from 0.000 to 0.047. This improvement in VO<sub>2</sub>max from endurance training with small-sided games training programs was in accordance with previous studies (Helgerud et al. 2001). The other main findings were correlational results along with skills developed by players during the training program dimana anthropometric factors such as age, body mass and height did not influence anything on the skills developed and VO<sub>2</sub>max. No differences were found for the quality of passes during a friendly match in the three groups after the training period. However, the average work intensity during a match increased in the 3 vs 3 programs at posttraining, and it enabled them to keep up the quality of passes.

The VO<sub>2</sub>max is simply understood as the body's ability to consume oxygen maximally mainly during physical activity as training indeed (Bahtra et al. 2020; Hoff et al. 2002). The maximum amount of oxygen that can be consumed during intense physical activity until fatigue occurs is calculated in ml/kg/min using specific lab tests or field tests. It is worth mentioning more information about understanding VO<sub>2</sub>max in the human body especially for soccer players. Literature along with theories explain that the VO<sub>2</sub>max needs of a soccer player a varying for different reasons. For example, (Slimani et al. 2019) asserted that the average oxygen up taken for international soccer teams ranges from 55 to 68 ml/kg/min; amateur 55.7 ml/kg/min (Helgerud et al. 2001). However, for football players aged 22-28 years, VO<sub>2</sub>max for men is estimated to be 54 ml/kg/min- 64 ml/kg/min while for girl players is 50 ml/kg/min – 60 ml/kg/min (Bahtra et al. 2020). But in our study, our hub concern was to scrutinize whether VO<sub>2</sub>max before/pretraining will increase in number after or during training sessions. Then as presented in table 1, the VO<sub>2</sub>max of our

players was exponentially changed, which means the training program proposed has significant effects on players.

The need for  $VO_{2max}$  in any athlete and endurance especially during physical activities is quite a lot in the football game. The role of the coach is then to design specific training models or programs that can help to improve the  $VO_2$  max in their students by using a ball (Russell et al. 2016). In addition, types of physical activities to integrate should be also specific exercise/training; that is small-sided games, soccer technique training, and ball-specific position training (Abbott et al. 2018; Kunz et al. 2019). Our findings were corroborated with (Bahtra et al. 2020) who affirmed that high-intensity training in the form of special soccer games such as small-sided games can increase aerobic capacity where any application of training methods for instance for endurance, strength, dribbling must also be specific. As benefits, increasing  $VO_{2max}$  would thereby improve player performance either in matches or during training sessions. Some of the skills developed are distance travelled, intensity, the number of sprints, amount of player involvement with that ball, dribbling skills, jumping, and so forth (Mier and Alexander 2011). Apart from that, it is believed that players with higher  $VO_{2max}$  increase rapidly the distance travelled and enhance their ability in influencing or affecting the final results of the match (Bahtra et al. 2020). The supply and creation of enough energy to move faster and without hindrances, are the signs of players who have large  $VO_{2max}$  that resulting in long hours working without experiencing significant tiredness.

Back to our trainees in this study, even though they were too young, we have realized that the capacity of the lungs was still under the standard line ( $< 50$ , see table 2). However, the effect of our program (small-sided games) was effective since the pretraining test administrated exhibited that the level of their  $VO_{2max}$  mostly was under 40 that means there was increment anyway. Basically, despite the benefits of the program we introduced in the wake of increase the capacity of  $VO_{2max}$  in soccer players along with strengthening their playing skills, some more advantages have been recapped. Integrating  $VO_{2max}$  exercise or small-sided games may increase  $VO_{2max}$  in subjects, eliminating players' boredom in  $VO_2$  training. For trainers, this program may facilitate them in organizing and controlling the behaviours of players during or after the games. That said,  $VO_{2max}$  such as cross country running, intervals and circuits require the trainer to organize and always control the players to keep practicing and running. Last not least,  $VO_{2max}$  exercise enables players to increase motivation because it has an attraction in various forms of training (Ardiansah and Sugiyanto 2019).

To sum up, facts and experiences audited in this study support that  $VO_{2max}$  training using the ball provides an update on the soccer player's  $VO_{2max}$  in tandem to develop some playing skills. And we assume that there are many more benefits and advantages apart from those outlined in this study players may take/gain from physical training with the ball (Stølen et al. 2005). Thus, it is very important for coaches/trainers to design and provide suitable physical training for their players especially activities that may increase their  $VO_{2max}$ . Future studies should properly extend these observations to other age groups, female players, and other skills levels. Also, different load terms (training sessions and times weekly) duration or timeline of training sessions, repetitions should be assessed too.

#### IV. Conclusion

Incorporating/introducing small-sided games training to standard training has improved  $VO_2$ max soccer players, dribbling and jump performance, sprinting, change-of-direction ability, endurance. Increasing  $VO_2$ max for your players used in this study was

found important to execute and having high VO<sub>2</sub>max will support these players in any game. Having good skills but not supported by high VO<sub>2</sub>max is not enough since these players can not readily compete with other players who have both traits. Therefore, through training that applies basic techniques like small-side games can improve such skills and VO<sub>2</sub>max concomitantly. Through ANOVA test and Pearson correlation, results that analysis whether the effect of small-sided games was significant on p-value < 0.05, we have seen that all correlated data has sig-value less than 0.05; that means strong effect was found. Shortly, soccer coaches, practitioners should strive always to incorporate deliberate training programs for the sake of the career and players. In other words, the programs implemented enhanced the maximal oxygen uptake led to improved soccer performance through football playing skills such as level of work intensity, ball control and passes and endurance in running.

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