



Article

Continuous Running vs. Interval Training on VO₂Max Increase in 16-17-Year-Old Football Athletes at Bintang Kejora Football School Deli Serdang Regency

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Abstract

This study compares the Vo₂Max effects of continuous running and interval training on 16-17-year-old football participants at Bintang Kejora football school in Deli Serdang Regency in 2022. The research method is experimental quantitative research. This study used purposive sampling to pick Bintang Kejora football school athletes under certain conditions. The study lasted six weeks with three training sessions per week. The statistical analysis of Vo₂Max increase in the continuous running group showed a tcount of 6.56 and a ttable of 2.75, with $\alpha = 0.05$. We reject H₀ and accept H_a since the tcount is bigger than the ttable ($6.56 > 2.75$). In 2022, the continuous running exercise group improved the Vo₂Max results of 16-17-year-old football participants at Bintang Kejora football school (SSB), Deli Serdang Regency. Hypothesis II on interval training's Vo₂Max rise had a tcount value of 6.11, higher than the crucial ttable value of 2.75. This means H₀ is rejected and H_a is accepted. Thus, the interval training group affects the Vo₂Max results of 16-17-year-old football participants at Bintang Kejora in Deli Serdang Regency. Upon assessing hypothesis III, the average standard deviation tcount value was 1.32, while the ttable value was 2.23, with $\alpha = 0.05$. Low tcount values (tcount < ttable) support the null hypothesis (H₀) and reject the alternative hypothesis (H_a). This analysis suggests that continuous running or interval training have similar effects on Vo₂Max outcomes for 16-17-year-old football players at the Bintang Kejora football school in Deli Serdang Regency.

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INTRODUCTION

In the football game, good physical conditions are needed to support playing skills, such as speed, agility, endurance, and so on. An average football player in 90 minutes covers 10 km per game but this distance varies according to the player's position in the team. A midfielder generally has the highest mileage compared to strikers, defenders, or goalkeepers. Of the total mileage, generally 75% is walking and jogging, 20% is sprinting, and 5% is sprinting. Such demands make a player must have good endurance in order to perform optimally.

Football is classified as an aerobic sport where athletes really need oxygen to distribute it to the muscles during the match. As said by Giriwijoyo (2012) that if the aerobic capacity is large, fatigue will come slowly, whereas, if the aerobic capacity is small, fatigue will come quickly. Aerobics really needs oxygen, so if we want to have good aerobic endurance, we also must have good lung capacity to accommodate as much oxygen as possible and distribute it throughout the body. If we experience fatigue, it will cause lactic acid to form in the muscles. Lactic acid itself is dangerous if it occurs, because the athlete does not have enough oxygen to be distributed to the muscles so that it can cause injury to the athlete due to the fatigue they experience.

The endurance of a football player must always be in good condition in order to be able to play consistently for 2x45 minutes and properly carry out instructions from the coach. Seeing this fact, VO_{2max} endurance needs special attention from the coach so that the club's performance does not decrease. The coach must know the factors that affect endurance ability, so that in preparing the training program, there are no mistakes. Many factors affect the endurance ability of a soccer player. There are internal factors and external factors. Internal factors that affect endurance include the lungs as the organ that provides oxygen, the quality of blood (hemoglobin) which binds oxygen and carries it throughout the body, the heart as the organ that pumps blood throughout the body, the blood vessels (circulation) distributes blood throughout the body, and skeletal muscle as one of the organs of the body that will use oxygen for the oxidation process of food ingredients to produce energy. If one of these components has a low capacity, it will affect the VO_{2Max} level because each of these components mutually support one another. Meanwhile, external factors include the quality of the coaches in making training

programs to increase the endurance abilities of their players, facilities and infrastructures to influence the training process in an effort to improve endurance abilities, and the training methods used in the training process to increase player endurance.

Based on observations at the Bintang Kejora football school in Deli Serdang Regency, most of the players have poor endurance. This was also stated by the coach where the average player was only able to play optimally well in the first 45 minutes, whereas, in the second half, it was seen that the players were getting tired and playing less optimally in the remaining time. As a result, many players experienced excessive fatigue and a few players had injury. As it is known, football is a game that is done quickly in a wide field with a length of 110 meters and a width of 75 meters. The size of the field requires players to run fast and move actively around every corner of the field during the game, in order to create opportunities that can result in goals. Excellent physical condition and strong endurance are needed in soccer, because the duration of a soccer game is around and even more than 90 minutes.

Table 1. Preliminary VO₂Max Test Results Using the Bleep Test

No.	Name	Level and Reverse	VO ₂ Max	Category
1	Alif Alfarezi Riswan	8/2	40.5	Moderate
2	Anelka Pandiangan	9/5	44.9	Moderate
3	Pasha Safezi Nst	9/3	44.2	Moderate
4	Akbar Syabani	7/5	38.2	Poor
5	Fauzan Saleh	8/11	43.3	Moderate
6	Fajar Ramadhan	6/7	35.4	Poor
7	Hakim Dira	6/5	34.7	Very Poor
8	Roman Badawi	9/5	44.9	Moderate
9	Mezio Putra Daeeno	6/4	34.4	Very Poor
10	Steven Simbolon	9/4	44.5	Moderate
11	Revan Fadillah	7/7	38.9	Moderate
12	Rifki Dwi	7/5	38.2	Poor

Table 2. Normative Table of Bleep Test

Umur	Kurang sekali	Kurang	Sedang	Baik	Baik sekali	Sangat baik sekali
13-19	<35.0	35.0 – 38.3	38.4 – 45.1	45.2 – 50.9	51.0 – 55.9	>55.9
20-29	<33.0	33.0 – 36.4	36.5 – 42.4	42.5 – 46.4	46.5 – 52.4	>52.4
30-39	<31.5	31.5 – 35.4	35.5 – 40.9	41.0 – 44.9	45.0 – 49.4	>49.4
40-49	<30.2	30.2 – 33.5	33.6 – 38.9	39.0 – 43.7	43.8 – 48.0	>48.0
50-59	<26.1	26.1 – 30.9	31.0 – 35.7	35.8 – 40.9	41.0 – 45.3	>45.3
60+	<20.5	20.5 – 26.0	26.1 – 32.2	32.3 – 36.4	36.5 – 44.2	>44.2

(Source: Harsuki, 2003, *Perkembangan Olahraga Terkini*, Jakarta: PT. Raja Grafindo Persada)

Endurance training in soccer has two types, namely aerobic and anaerobic. Aerobic is athletes supplying oxygen directly, while anaerobic activity is fast, dynamic, and short-term, so there is no time for the heart to pump oxygen and the muscles to work to expend energy. This sport is a complex type of energy exercise. According to my calculations and experience in a soccer game, a player involves an average of 70% using aerobic and 30% anaerobic energy. Therefore, the endurance training that will be used in this study is continuous running and interval training which focuses on training to increase the vo2max of Bintang Kejora football players.

Based on the background above, the author will raise a research entitled "Differences in the Effect of Continuous Running Training with Interval Training on the Increase in VO₂Max of Football Athletes Aged 16-17 Years Old at Bintang Kejora Football School (SSB) Deli Serdang Regency in 2022".

METHODS

This research is classified as an experimental research (Arikunto, 2010) in which the researcher wants to know the differences in the effect of continuous running and interval training on increasing VO₂Max athletes at the Bintang Kejora football school Deli Serdang (Sugiyono, 2009). The research design used was a two group pre-test and post-test design. The location of this research is at Bintang Kejora football school field on Jalan Purwo, North Sumatra, which was conducted for 6 weeks with a frequency of 3 times each week. The total population in this place is 21 athletes for age 16-17 years old and only 12 athletes meet the requirements to be the research sample in which the determination uses a purposive sampling technique. There are three requirements to become a sample, including (1) one-year training experience, (2) actively participating in training, (3) able to follow the exercise program for 18 times, and (4) 16-17 years old. The instrument test in this research was bleep test as a VO₂Max test tools. The data that has been collected from the results of the pre-test and post-test were analyzed using the t-test by comparing the score of Mean (Sudjana, 2005).

RESULTS & DISCUSSION**Description of Research Data**

The data analyzed were obtained through tests and measurements with a sample of 12 athletes of which six athletes were in the experimental group with continuous running and the other 6 athletes were in the experimental group with interval training. From the two groups, the samples were examined regarding the effect of the trainings given to each group on the increase and results of Vo₂Max. To find out the effect of the exercise given, both groups carried out the training treatment for 6 (six) weeks. Both groups were also tested before and after doing the treatment. The results of tests and measurements that have been processed through statistical formulas are shown in the data description table below.

Table 3. Pre-Test and Post-Test Results of Continuous Running and Interval Training Groups

Data Description	VO ₂ Max Result			
	Continuous Running Group		Interval Training Group	
	<i>Pre-Test</i>	<i>Post-Test</i>	<i>Pre-Test</i>	<i>Post-Test</i>
Range	44.9	48.7	44.9	49.0
Mean	40.53	44.45	39.82	42.78
Standard Deviation	4.21	4.21	4.35	5.33
Difference of Mean	3.92		2.97	
Difference of Standard Deviation	1.42		1.18	
t-count	6.56		6.11	
t-table	2.75		2.75	
Combined Standard Deviation	2.18			
t-combined count	1.32			
t-table	2.23			

Table 4. Post-Test Results of Vo₂Max of Football Athletes Aged 16-17 Years Old at Bintang Kejora Football School (SSB)

No.	Continuous Running Group		Interval Training Group	
	Name	VO ₂ Max Result	Name	VO ₂ Max Result
1	Anelka Pandiangan	48	Roman Badawi	48,4
2	Pasha Safezi Nst	46,8	Steven Simbolon	49
3	Fauzan Saleh	48,7	Alif Alfarezi Riswan	44,5
4	Akbar Syabani	44,2	Revan Fadillah	40,5
5	Rifki Dwi	40,8	Fajar Ramadhan	37,5
6	Mezio Putra Daeeno	38,2	Hakim Dira	36,8

Normality Test

The result of the normality test using the Lilifors test for VO₂Max Pre-Test data of continuous running group is shown in the table below where L_o is equal to 0.210. Meanwhile, L_{table} at the α level of 0.05 is obtained 0.319. Thus, $L_o < L_{table}$ ($0.210 < 0.319$) means that H_o is accepted and the conclusion is that the sample comes from a normally distributed population.

Table 5. Normality Test Results of VO₂Max Pre-Test Data for the Continuous Running Group

No.	X	F	Zi	f(zi)	s(zi)	If(zi) – s(zi)I
1	34.4	1	-1.456	0.073	0.167	0.094
2	38.2	1	-0.554	0.290	0.333	0.044
3	38.2	1	-0.554	0.290	0.500	0.210
4	43.3	1	0.657	0.744	0.667	0.078
5	44.2	1	0.871	0.808	0.833	0.025
6	44.9	1	1.037	0.850	1.000	0.150
Σ		6				
\bar{X}	40.53					
S	4.21					
S^2	17.73					

$L_{table} = 0.319$

Meanwhile, the normality test result for the VO₂Max Pre-Test data for the interval training group is shown in the table below where L_o is equal to 0.178 and L_{table} at the α level of 0.05 is 0.319. Thus, $L_o < L_{table}$ ($0.178 < 0.319$) means that H_o is accepted and in conclusion, the sample comes from a normally distributed population.

Table 6. Normality Test Results of VO₂Max Pre-Test Data for the Interval Training Group

No.	X	F	Zi	f(zi)	s(zi)	If(zi) – s(zi)I
1	34.7	1	-1.175	0.120	0.167	0.047
2	35.4	1	-1.014	0.155	0.333	0.178
3	38.9	1	-0.211	0.417	0.500	0.083
4	40.5	1	0.157	0.562	0.667	0.104
5	44.5	1	1.076	0.859	0.833	0.026
6	44.9	1	1.168	0.879	1.000	0.121
Σ		6				
\bar{X}	39.82					
S	4.354					
S^2	18.95					

$L_{table} = 0.319$

Furthermore, the normality test result for the VO₂Max Post-Test data for the continuous running group is shown in the table below where L_o is equal to 0.156 and L_{table} at the α level of 0.05 is 0.319. Thus, $L_o < L_{table}$ ($0.156 < 0.319$) means that H_o is accepted and in conclusion, the sample comes from a normally distributed population.

Table 7. Normality Test Results of VO₂Max Post-Test Data for the Continuous Running Group

No.	X	F	Zi	f(zi)	s(zi)	If(zi) – s(zi)I
1	38.2	1	-1.484	0.069	0.167	0.098
2	40.8	1	-0.867	0.193	0.333	0.140
3	44.2	1	-0.059	0.476	0.500	0.024
4	46.8	1	0.558	0.712	0.667	0.045
5	48	1	0.843	0.800	0.833	0.033
6	48.7	1	1.009	0.844	1.000	0.156
Σ		6				
\bar{X}	44.45					
S	4.21					
S^2	17.73					

$L_{table} = 0.319$

Finally, the normality test result for the VO₂Max Post-Test data for the interval training group is shown in the table below where L_o is equal to 0.173 and L_{table} at the α level of 0.05 is 0.319. Thus, $L_o < L_{table}$ ($0.173 < 0.319$) means that H_o is accepted and in conclusion, the sample comes from a normally distributed population.

Table 8. Normality Test Results of VO₂Max Post-Test Data for the Interval Training Group

No.	X	F	Zi	f(zi)	s(zi)	If(zi) – s(zi)I
1	36.8	1	-1.122	0.131	0.167	0.036
2	37.5	1	-0.991	0.161	0.333	0.173
3	40.5	1	-0.428	0.334	0.500	0.166
4	44.5	1	0.322	0.626	0.667	0.040
5	48.4	1	1.054	0.854	0.833	0.021
6	49	1	1.166	0.878	1.000	0.122
Σ		6				
\bar{X}	42.78					
S	5.33					
S^2	28.41					

$L_{table} = 0.319$

Homogeneity Test

Based on Tables 5 and 7 above, the variance scores from the pre-test and post-test data of continuous running group are equal to 17.73 so that F_{count} is equal to 1. At the α level of 0.05, $F_{\text{table}} (5,5)$ is equal to 5.05. Thus, $F_{\text{count}} < F_{\text{table}} (1 < 5.05)$ means that H_0 is accepted and the conclusion is that the data comes from a homogeneous variance. Meanwhile, based on Tables 6 and 8 above, the variance scores from the pre-test and post-test data of interval training group are equal to 18.95 and 28.41 so that F_{count} is equal to 1.50. At the α level of 0.05, $F_{\text{table}} (5,5)$ is equal to 5.05. Thus, $F_{\text{count}} < F_{\text{table}} (1.50 < 5.05)$ means that H_0 is accepted and the conclusion is that the data comes from a homogeneous variance. Furthermore, based on Tables 7 and 8 above, the variance scores from the post-test data of continuous running and interval training groups are equal to 17.73 and 28.41 so that F_{count} is equal to 1.60. At the α level of 0.05, $F_{\text{table}} (5,5)$ is equal to 5.05. Thus, $F_{\text{count}} < F_{\text{table}} (1.60 < 5.05)$ means that H_0 is accepted and the conclusion is that the data comes from a homogeneous variance.

Hypothesis Test

Based on the t distribution table, dk (n-1) 6-1 is equal to 5 at a significant level α 0.05 equals 2.75, which means $t_{\text{count}} > t_{\text{table}} (6.56 > 2.75)$. Thus, H_a is accepted and H_0 is rejected. In this case, it can be concluded that continuous running training has a significant effect on increasing the $VO_2\text{Max}$ results of football athletes aged 16-17 years at the Bintang Kejora football school (SSB), Deli Serdang Regency in 2022. Meanwhile, hypothesis test for another independent variable is obtained dk (n-1) 6-1 equals to 5 at a significant level α 0.05 equals 2.75, which means $t_{\text{count}} > t_{\text{table}} (6.11 > 2.75)$. Thus, H_a is accepted and H_0 is rejected. In this case, it can be concluded that interval training has a significant effect on increasing the $VO_2\text{Max}$ results of football athletes aged 16-17 years at the Bintang Kejora football school (SSB), Deli Serdang Regency in 2022. Furthermore, the last hypothesis test for both independent variables with dependent variable is obtained dk (n1 + n2 - 2) 6+6-2 equals to 10 at a significant level α 0.05 equals 2.23, which means $t_{\text{count}} < t_{\text{table}} (1.23 < 2.23)$. Thus, H_0 is accepted and H_a is rejected. In this case, it can be concluded that there is no difference in a significant effect between continuous running and interval training on increasing the $VO_2\text{Max}$ results of football

athletes aged 16-17 years at the Bintang Kejora football school (SSB), Deli Serdang Regency in 2022.

The result of the first hypothesis test shows that there is a significant effect in the continuous running group on the VO₂Max results of football athletes aged 16-17 years old at the Bintang Kejora football school (SSB) Deli Serdang Regency in 2022. This is because the form of continuous running has characteristics for increasing endurance, more precisely cardiovascular endurance (heart and lungs) (Alfian, 2016). The training form of continuous running is running around the field as far as 1200 meters. Continuous running is a moderate-intensity activity or we can say with a training tempo of the constant intensity and the duration of 15-25 minutes per training session. The explanation of the hypothesis above is in line with the results of research in a journal written by Badruzzaman Busyairi (2018) entitled Comparison of Interval Training and Continuous Run Methods to Increasing VO₂Max. The article explains that continuous running exercise has a significant effect on increasing VO₂Max, but the difference here is in the exercise program section where the researcher used 50%-80% intensity with a distance of 1200 meters while that journal researcher made the exercise intensity 70% with a distance of 2 -5 Miles.

Then, the result of the second hypothesis test shows that there is a significant effect in the interval training group on the VO₂Max results of soccer athletes aged 16-17 years old at the Bintang Kejora football school (SSB), Deli Serdang Regency in 2022. This exercise is required to increase aerobic and anaerobic endurance (Putra & Dinata, 2019). This training method is different from other methods, even though the type of activity may be the same, such as running, swimming or cycling. The difference is in the setting between training and resting time. The explanation of the second hypothesis above is in line with the results of research in a journal written by Badruzzaman Busyairi (2018) entitled Comparison of Interval Training and Continuous Run Methods to Increasing VO₂Max. The article explains that interval training has a significant effect on increasing VO₂Max, but the difference here is in the exercise program section where the researcher used 50%-80% intensity with the 30 meter sprint and 30 meter jogging method, while

that journal researcher made the exercise intensity 70% running interspersed with 2-3 minute breaks.

Finally, the result of the third hypothesis test shows that continuous running has a greater effect than interval training on the VO₂Max results of football athletes aged 16-17 years old at the Bintang Kejora football school (SSB), Deli Serdang Regency in 2022 (Hasibuan & Damanik, 2019). Basically, these two forms of training have the same characteristics to increase VO₂Max results (Busyairi & Ray, 2018). These are due to the form of these two trainings where the sample must really focus on their maximum aerobic capacity. In addition, VO₂Max is related to the capacity or ability of the body to inhale, transport, distribute and use oxygen optimally, as well as this is a reliable indicator of the physical fitness of someone who does work for a long time or work that requires endurance.

CONCLUSION

Based on the results of hypothesis test and research results, it can be concluded that there is an effect of either the continuous running or interval training method on increasing the VO₂Max capacity of the Bintang Kejora football athletes in Deli Serdang Regency in 2022. In addition, the continuous running method has a greater impact than the interval training method even though the difference between the two is not significant enough to VO₂Max. This research is expected to be useful for coaches regarding training methods to increase the endurance of their athletes. On the other hand, researchers argue that there is a need for research on training methods, components of physical fitness, and other age groups to improve the performance of soccer athletes.

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