

## Improved Fitness and VO2Max: Implementation of Traditional “Massallo” Games Mejora del fitness y VO2Max: implementación de los tradicionales juegos “Massallo”

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**Abstract.** Students' health needs are one of the priorities in learning. Therefore, physical education, sports and health have a very significant role. Physical education, sports and health are not only a means of improving physical fitness, but also play a role in maintaining body health and understanding the local wisdom contained in traditional sports such as Massallo. Therefore, the aim of this research is how Massallo games can shape students' fitness and Vo2max. This research is a quantitative pre-experimental design research using a Pretest-Posttest one group design. With a total of 42 students participating, they used exercises with the Massallo game. All data obtained were searched for mean, min, max, and standard deviation values as well as differences in applying exercises and Massallo games using independent sample t-test and simple regression. There are differences in results in implementing training with Massallo games in increasing students' fitness and VO2Max. It was found that using the Massallo game training method had a difference of 11,421 in increasing students' fitness and VO2Max and had a significant influence of 0.610, which indicated that the Massallo game had a good role in students' fitness and VO2Max.

**Key Words:** *Fitness, Massallo Games, Physical Education, VO<sub>2</sub>Max*

**Resumen.** Las necesidades de salud de los estudiantes son una de las prioridades en el aprendizaje. Por ello, la educación física, el deporte y la salud tienen un papel muy significativo. La educación física, el deporte y la salud no son sólo medios para mejorar la condición física, sino que también desempeñan un papel en el mantenimiento de la salud corporal y en la comprensión de la sabiduría local contenida en deportes tradicionales como el Massallo. Por lo tanto, el objetivo de esta investigación es cómo los juegos Massallo pueden moldear la condición física y el Vo2max de los estudiantes. Esta investigación es una investigación de diseño cuantitativo preexperimental que utiliza un diseño de un grupo Pretest-Posttest. Con la participación de un total de 42 alumnos, utilizaron ejercicios con el juego Massallo. En todos los datos obtenidos se buscaron valores medios, mínimos, máximos y de desviación estándar, así como diferencias en la aplicación de ejercicios y juegos de Massallo utilizando la prueba t de muestra independiente y regresión simple. Existen diferencias en los resultados al implementar el entrenamiento con juegos Massallo en el aumento de la condición física y el VO2Max de los estudiantes. Se encontró que el uso del método de entrenamiento del juego Massallo tuvo una diferencia de 11,421 en el aumento de la condición física y el VO2Max de los estudiantes y tuvo una influencia significativa de 0.610, lo que indicó que el juego Massallo tuvo un buen papel en la condición física y el VO2Max de los estudiantes.

**Palabras Clave:** *Fitness, Juegos Massallo, Educación Física, VO2Max*

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### Introduction

Students' health needs are one of the priorities in learning. Therefore, physical education, sports and health have a very significant role. Physical education, sports and health are not only a means of improving physical fitness, but also play a role in maintaining body condition and understanding local wisdom contained in traditional sports such as Massallo (Cocca et al., 2020; Udomtaku & Konharn, 2020; Zhang & Li, 2023; Alvisari, Lah, & Tun, 2024). Health aspects are important in physical education, sports and health, especially in the context of this research which involves analyzing students' VO<sub>2</sub>Max (Junger et al., 2019; Irmansyah et al., 2020; DiFrancisco-Donoghue et al., 2022). Physical education, sports, and health programs can provide a better understanding of a student's fitness management and VO<sub>2</sub>Max.

Physical education, sports and health can align health education with local wisdom contained in the Massallo playing culture. This involves understanding local values that support bodily health and implementing these practices in everyday life (Capio et al., 2023; Jamo, 2023; Supriadi, Friskawati, & Karisman, 2023; Iqbal et al., 2023; Ramadhanti et al., 2023). It is important to recognize that local wisdom plays an important role in maintaining the cultural

identity of a community (Ratana-Ubol, and J. A. Henschke, 2015; Syahril et al., 2019; Sandoval-Rivera, 2020; Wayan et al., 2023; Wiajanarko et al., 2023). By understanding and preserving local wisdom, a society can enrich its traditions, respect the heritage of its ancestors, and maintain a balance between modernity and tradition (Intem et al., 2019; Yanti et al., 2020; Phongphio, 2021).

Indonesia, as a country with rich cultural diversity, has a traditional sports heritage that reflects the local wisdom of its people (Akbar, 2023). One example is the sport of Massallo, which has become an integral part of Indonesia's cultural identity. In the context of globalization and modernization, the existence of traditional sports is often overlooked, even though it has great potential as a form of local wisdom that includes cultural and physical aspects (He, Zheng, & Gong, 2021; Azmi et al., 2023; Wulan et al., 2023). Along with the flow of modernization and changes in lifestyle, traditional sports often face challenges in maintaining their sustainability (Lefevre et al., 2022; Alkasasbeh, 2023; Tsang, 2023). However, there are not many studies that thoroughly examine the contribution of physical fitness and body health in the context of massao sports, especially when seen as a manifestation of local wisdom (Ho, & Devi, 2020; Gaesser, & Angadi, 2021; Peng, & Jiang, 2023). In this case, the research tries to combine

cultural and physical aspects, making Massallo not only a sporting activity, but also a part of local wisdom that needs to be understood and appreciated.

Previous research, which is in line with the current research, states that traditional games can be used as an alternative in physical education in junior high schools (Hendry et al., 2021; Park, & Kim, 2023). Because, traditional games contain elements of play, they are not bound by many rules such as competency which will improve students' physical fitness. Because students' physical fitness will be formed if physical activity is carried out continuously over a long and continuous period of time and will affect the student's VO<sub>2</sub>Max level.

Good maximum oxygen consumption or VO<sub>2</sub>Max clearly shows that a person's physical fitness level also has VO<sub>2</sub>Max and good physical fitness in a student can prevent or minimize the possibility of injury. For this reason, apart from having excellent physical fitness, a football player should have a high aerobic capacity (Baxter-Jones., Goldstein., & Helms, 1993; Baquet et al., 2002; Castagna, 2010; Le Gall et al., 2010; Francisco, Martí'n., & Gallego, 2011; Markovic., & Mikulic, 2011; Hammami et al., 2013). In connection with this indicator, the KONI Sports Science Center (PIO) sets a minimum standard of 39-42/kg/min maximum aerobic ability.

According to Kent maximum aerobic capacity or VO<sub>2</sub>Max is the maximum amount of oxygen that a person can inhale from the air and then transport and use in the tissues (Kent, 1994; Jatmiko et al, 2024). The maximum aerobic power is determined by factors: a) the function of the heart, lungs and blood vessels; b) the process of delivering oxygen to tissues by erythrocytes which involves heart function, blood volume and the number of red blood cells in terms of diverting blood from inactive tissue to active muscle (Edward, 1984; Edward et al, 1993). So, the maximum oxygen volume is an important factor to support athlete performance, especially sports that include endurance. The criteria for achieving maximum aerobic capacity applied in measuring maximum aerobic capacity are: a) the occurrence of fatigue; b) pulse rate greater than 190 beats per minute; c) the respiratory exchange ratio is greater than 1, and d) the level of lactic acid in the blood exceeds 100 mg percent (Nikoladis, & Karidis, 2011; Azcárate et al., 2019). This criterion is used as a basis for assessing the objectivity of measurements and the requirements of a test. The maximum aerobic ability (VO<sub>2</sub>Max) of a soccer player will support more intensive work and the ability to execute skills.

VO<sub>2</sub>Max is the body's ability to consume oxygen optimally during activity and training (Hoff et al., 2002; Bompa, & Haff, 2009; Sidik, Pesurnay, & Afari, 2019). The maximum volume of oxygen that can be consumed during continuous and gradually increasing intensive exercise, mainly using the aerobic process. It is calculated in ml/kg/min using specific laboratory tests or field tests (Turnley, n.d; Hoff, 2007; Slimani et al., 2019). The maximum amount of oxygen that can be consumed during

intense physical activity until fatigue occurs (Wells et al., 2012).

The need for VO<sub>2</sub>Max and fitness is very necessary for teenage students, therefore, how can teachers at school provide treatment to be able to increase the fitness and VO<sub>2</sub>Max of the students they teach? Previous research results found that there is a relationship between high physical activity and VO<sub>2</sub>Max requirements (Cleven et al., 2020; Kusuma et al., 2021). This shows that physical activity is very necessary to increase VO<sub>2</sub>Max (Lukodono, & Lin, 2023). Physical activity is necessary and can be trained through education at school. Through physical education, sports and health at school, students will be trained in maintaining their physical activity (Tang, Cui, & Kim, 2023). Recognition of Massallo as a form of local wisdom also opens up opportunities to reflect on how cultural values influence physical and health aspects in the context of sporting activities.

Based on all of this, the aim of this research is to see the effectiveness of the Massallo game in improving students' fitness and VO<sub>2</sub>Max. With the following research questions: 1) How is the student's fitness in the masalao game? 2) How is the student's VO<sub>2</sub>Max in the masalao game? 3) Is there a significant difference in Massallo play for students' fitness and VO<sub>2</sub>Max and its impact?

## Material & methods

### Research Design

This research is real experimental research with a pre-experimental design using a Pretest-Posttest one-group design. This is done to investigate causal hypotheses about causes that can be manipulated by comparing one or more experimental groups that were treated with a comparison group that was not treated (Cohen., Manion., & Morrison, 2007). This research design was carried out because it was in accordance with the research objectives, where the aim was to find out whether there were differences and impacts between the implementation of the traditional massalo game on students' fitness and VO<sub>2</sub>Max. This research uses descriptive statistics in the form of mean, min, max, and standard deviation and uses inferential statistics. The inferential statistics used are the Independent Sample T-test and simple regression.

Table 1.  
Pretest-Posttest one group design

Group	Pretest	Treatment	Posttest
Experimental	O <sub>1</sub>	Implementation traditional games "Massallo"	O <sub>2</sub>

### Research Subject

The subjects in this research were 42 junior high school students. By implementing treatment in the form of Massallo game practice. The sample collection technique uses a purposive sampling method. Purposive sampling is a sampling technique based on researcher criteria (Kerlinger, 2014). The criteria for this study were students under 15 years of age. The data collection procedure to refer to

Creswell (2012), is explained in the figure 1.

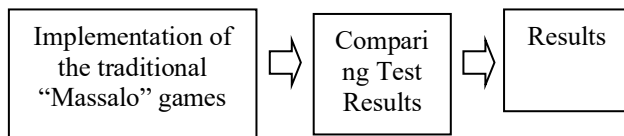


Figure 1. Data Collection

### Research Instrument

Based on Figure 1, it can be seen that the first activity carried out was implementing the Massallo game to increase the player's VO2Max fitness. After the exercise is complete, the Yo – Yo IR test Bangsbo, & Mohr, (2015) is given to see whether there is a difference in the students' VO2Max.

Meanwhile, to measure student fitness, the test results of each of the five physical fitness test items are first given a

Table 3. Physical Fitness Test Criteria are based on the T-Score of the student's physical fitness test results

Nilai	50 Meter run	Hanging Body Lift 60 Seconds	Lying Sitting 60 Seconds	Upright Jump	Run 1000 Meters
1	30.82 – 40.58	60.96 – 69.99	54.63 – 61.90	57.14 – 64.87	36.70 – 44.01
2	40.59 – 50.35	51.92 – 60.95	47.35 – 54.62	49.40 – 57.13	44.02 – 52.33
3	50.34 – 60.10	42.88 – 51.91	40.07 – 47.34	41.66 – 49.39	52.34 – 60.65
4	60.11 – 69.87	33.84 – 42.87	32.79 – 40.06	33.92 – 41.65	60.66 – 68.97
5	69.88 – etc	24.80 – 33.83	25.51 – 32.78	26.18 – 33.91	68.98 – 77.29

After the five test items have been carried out, the scores obtained are totaled, then an assessment is carried out by referring to the physical fitness score norm table to determine the level of physical fitness possessed by each sample. Table of Indonesian Physical Fitness Test Norms for Boys Aged 13 - 15 years can be found. seen in the following table.

Table 4. Physical Fitness Test Category for students aged 13 – 15 years

Interval	Classification
22 – 25	Very well
18 – 21	Good
13 – 17	Currently
10 – 13	Not enough
5 – 9	Very less

### Analyze Data

Data analysis in this study used descriptive statistics to detail students' physical fitness and VO2Max profiles. Then proceed with carrying out difference analysis and simple linear regression to evaluate the differences and impacts between physical fitness variables and VO2Max.

Table 5. Description of students' physical fitness levels in traditional "Massallo" games

	Interval	F	%	Category	Mean	Med	Min	Max
PostTest	22 – 25	2	4.8	Very well	19.8	20.5	13	23
	18 – 21	34	80.9	Good				
	13 – 17	6	14.3	Currently				
	10 – 13	0	0	Not enough				
	5 – 9	0	0	Very less				
PreTest	22 – 25	0	0	Very well	15.2	15	11	20
	18 – 21	10	23.8	Good				
	13 – 17	28	66.7	Currently				
	10 – 13	4	9.5	Not enough				
	5 – 9	0	0	Very less				

t-score, then converted into a table of physical fitness norm values, after which they are added up to become a physical fitness score on table 2.

Table 2. Criteria for Physical Fitness Test Results for Boys Aged 13 – 15 years

50 Meter run	Hanging Body Lift 60 Seconds	Lying Sitting 60 Seconds	Upright Jump	Run 1000 Meters
Sd – 6.7"	16 Up	38 Up	86 Up	Sd – 3.04"
6.8" – 7.6"	11 – 15	28 – 37	53 – 65	3'05" – 3'53"
7.7" – 8.7"	6 – 10	19 – 27	42 – 52	3'54" – 4'46"
8.8" – 10.3"	2 – 5	8 – 18	31 – 41	4'47" – 6'04"
10.4" – etc	0 – 1	0 – 7	Sd – 30	6'05" – etc

" = Seconds , ' = Minutes

The physical fitness assessment criteria used to assign grades in this study were based on the t-score results from the physical fitness test. These criteria can be seen in the following table 3.

### Results

The research findings are described in this section. The results of the Mean, Min, Max, and Standard Deviation, posttest to show the impact of Massallo game practice on students are presented in tables 5 and 6 below.

Based on the results of the descriptive statistical tests above, it can be described that the physical fitness level of junior high school students in the Massallo game is dominant in the good category and there is one student who is categorized as very good with percentages of 80.9% and 4.8%. Then there were 14.3% of students whose physical fitness level was categorized as moderate in the experimental class, while for the control class the dominant class was in the good category at 23.8% and poor at 9.5%.

Table 6. Discrepancies in students' VO2Max scores with traditional game practice "Massallo"

Group	Max (ml/kg/min)	Min (ml/kg/min)	Mean	SD
Post-test	38.54	35.8	36.64	2.11
Pre-test	34.53	31.8	33.28	1.63

From table 6, we can see that the student's post-test score has the highest VO<sub>2</sub>Max value of 38.54 and the lowest is 35.8, while the pre-test score has the highest VO<sub>2</sub>Max value of 34.53, and the lowest is 31.8. From this we can see that the use of training with the traditional "Massallo" game is more effective in increasing students' VO<sub>2</sub>Max. Although the standard for VO<sub>2</sub>Max under 15 is 39-42ml/kg/min (Cramer, 2003). However, this could not confirm the

existence of differences in the use of training methods, so inferential testing was carried out using the independent sample t-test and simple regression, which can be seen in table 7-9.

Table 7.  
Results of the Independent sample t-test for VO<sub>2</sub>Max and student fitness using the traditional training game "Massallo"

	T	df	Mean	Std. Deviation	95% confidence interval	
					Lower	Upper
VO <sub>2</sub> Max	11.421	42	42.64	2.11	12.136	.4010
	11.421	91.321	41.24	1.63	11.435	.5205
Fitness	11.223	42	42.24	2.08	12.124	.4814
	11.120	91.321	41.10	1.53	11.445	.5125

From table 7 you can see the value obtained (t count) with the t table value. The t table value can be seen in the t table with a significance value of 0.05 (2-sided test) with a degree of freedom (df) of 42. In this study, the t table result was 1.36515. Meanwhile, the calculated t value can be seen in table 2 (column t), namely 11.421. The hypothesis testing criterion is if the t table value is greater than the calculated t then there is no difference [55]. So, it can be concluded that there is a significant difference in VO<sub>2</sub>Max and fitness of students under 15 years in the students' posttest and pretest scores when using traditional games. It can be seen from table 7 that the average VO<sub>2</sub>Max value of players is 2.11 and 2.08, which means that traditional games are capable and effective in increasing VO<sub>2</sub>Max and fitness for students under 15 years old.

Table 8.  
Simplified regression test results; The influence of traditional games on student fitness

Variable	R	R Square	Sig.
Traditional Games*Fitness	0.785	0.616	0.04

Based on table 8 above, it is known that there is a relationship between training using the traditional Massallo game and physical fitness of 0.785 which is categorized as having a very strong relationship. The magnitude of the influence of training using the traditional Massallo game on students' physical fitness is 61.6%. Based on the significance value obtained, namely 0.04, namely <0.05, fatigue from using the traditional game Massallo significantly affects the physical fitness of students in junior high school. So H1 is accepted, H0 is rejected.

Table 9.  
Simplified regression test results; the influence of traditional games on students' VO<sub>2</sub>Max

Variable	R	R Square	Sig.
Traditional Games*VO <sub>2</sub> Max	0.782	0.611	0.038

Based on table 9 above, it is known that there is a relationship between training using the traditional Massallo game and VO<sub>2</sub>Max of 0.782 which is categorized as having a very strong relationship. The effect of students' body mass index on students' physical fitness is 61.1%. Based on the significance value obtained, namely 0.038, namely <0.05, training using the traditional game Massallo significantly

influences the VO<sub>2</sub>Max of students in junior high school. So H1 is accepted, H0 is rejected.

## Dicussion

Based on the results (see Table 5-6), traditional "Massallo" game training is more effective. This is because training using the traditional game Massallo contains elements of education and sport, namely training skills, agility, physical endurance, and discipline, apart from training children to compete in a healthy manner. Table 2-3 shows that a pre-test score can increase a player's VO<sub>2</sub>Max by 34.53 ml/kg/min. It is very different from the post-test score, which can increase students' VO<sub>2</sub>Max by 38.54 ml/kg/min, and that has already entered the VO<sub>2</sub>Max standard for ages 13-19. Because the standard VO<sub>2</sub>Max for young players is 39-42 ml/kg/min (Lynch, Wharton, & Johnston, 2016). And the fitness of students who are in the good category in the post-test score is 80.9%, with a mean value of 19.8, when compared to the pre-test score, which has a dominant category in the medium category of 66.7% and a mean value of 15.2, this indicates that training using Traditional massallo games are more practical exercises.

The findings of this research show the effectiveness and positive impact of students' fitness and VO<sub>2</sub>Max in using the traditional game massallo as a means of exercise to improve students' fitness and VO<sub>2</sub>Max. This will have implications for students' VO<sub>2</sub>Max needs, impacting student performance in sports and activities, such as student performance in competitions, distance covered, intensity, number of sprints, and student involvement in games or competitions and daily activities. day. This research can highlight the role of traditional sports such as massallo in supporting students' health. The study results could provide a strong argument for including local sports in school policies regarding health and fitness. The results of this research show that there is a positive relationship between physical fitness variables and VO<sub>2</sub>Max, this can provide a basis for developing more effective and relevant physical fitness programs for junior high school students, including exercises inspired by traditional sports such as the traditional game of Massallo.

This is in line with previous research, which found that including traditional "Massallo" games in the physical education curriculum for students could be a breakthrough in maintaining student fitness. Additionally, the development of traditional games in physical education also impacts students' character (Astalini et al, 2022; Ospankulov, Zhumabayeva, & Nurgaliyeva, 2023; Kogoya et al., 2023; Mustakim et al, 2024). Various games and exercises help improve children's physiological system, physical development, and physical fitness and foster positive moral and volitional qualities. Traditional games are part of the local cultural heritage, and by implementing these games, you can help preserve the cultural values and traditions that exist in society.

Traditional games and sports training have similar effectiveness in improving children's fitness and health (Graha,

2023). Therefore, traditional games can be used with or as a substitute for more rigorous exercise routines to improve students' physical fitness. The results of this research support the research results found by current researchers. Previous and current research differ in the sample used, time, and place. The research results highlight the importance of physical education and sports programs in junior high schools. This can help in preparing a curriculum that is more related to local wisdom and the physical needs of students, which are the implications of this research.

Apart from the fitness that students must have, they must at least have a good VO<sub>2</sub>Max to support all their activities. VO<sub>2</sub>Max is the body's ability to consume oxygen optimally during activity and training (Buttar, Saboo, & Kacker, 2019; Potosí-Moya, Paredes-Gómez, & Durango-Sánchez, 2024). The maximum volume of oxygen can be consumed during continuous and gradually increasing intensive exercise, mainly using the aerobic process. It is calculated in ml/kg/min using specific laboratory or field tests (Bjelica et al., 2020; Panenggak et al., 2022; Victoria, 2024). The maximum amount of oxygen can be consumed during intense physical activity until fatigue occurs (Gomez-Cabrera et al., 2021; Vigriawan et al., 2024; Yudi et al., 2024). The need for a lot of VO<sub>2</sub>Max and endurance in an activity requires students to do exercises that can increase VO<sub>2</sub>Max. This will impact student performance in sports and activities, such as student performance in competitions, distance covered, intensity, number of sprints, and student involvement in games or competitions and daily activities.

The physical activity involved in traditional "Massallo" games can increase the capacity of the lungs and respiratory system. Good breathing exercises can help improve respiratory health and ensure adequate oxygen supply throughout the body. Playing massallo can help improve fitness and VO<sub>2</sub>Max and increase physical activity levels. Additionally, these games can provide a fun and exciting alternative to a less active lifestyle. This research has limitations, namely the limitation of using samples in the age range 13-15, and only looking at aspects of students' fitness and VO<sub>2</sub>Max, perhaps it can also be seen in terms of body index or muscle endurance of students or something else. Researchers can recommend that future research consider the influence of environmental factors, such as accessibility of sports facilities or support from schools and the community, on student participation in Massallo sports.

## Conclusions

The conclusion from the research that has been carried out is that massallo sports are not just physical activities but are also recognized as local wisdom that has cultural and historical value that needs to be preserved. Student participation in mass sports can be an effective way to preserve local wisdom and student body fitness. In this research, the results were obtained that using the traditional game massallo can increase the fitness and VO<sub>2</sub>Max of students aged 13-15 years, with the results obtained in the good category

for students' fitness and VO<sub>2</sub>Max. There is a significant difference in the application of traditional Massallo games in training on students' physical fitness and VO<sub>2</sub>Max, and has a significant influence, as evidenced by the influence of training using traditional Massallo games on students' physical fitness, namely 61.6%. Training using the traditional Massallo game on students' VO<sub>2</sub>Max was 61.1%. This proves that the traditional game of massallo has a significant influence on students' fitness and VO<sub>2</sub>Max. This has implications for students' VO<sub>2</sub>Max and fitness needs, which will impact student performance in sports and activities, such as student performance in competitions, distance covered, intensity, number of sprints, and student involvement in games or competitions and daily activities. This also proves that traditional sports such as massallo support student achievement performance in sports and activities, especially in VO<sub>2</sub>Max and student fitness.

## Conflicts of interest

The author has no conflict of interest.

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