



The Effects of L-Arginine Supplementation on Oxygen Saturation and Blood Lactic Acid Levels on the Physical Fitness Level of Muaythai Athletes in West Kalimantan

Ibrah Fastabiqi Bawana Mukti^{1✉}, Jayadi², Heri Purnama Pribadi³, Dhoni Akbar Ghozali⁴, Agam Akhmad Syaukani⁵, Muh. Isna Nurdin Wibisana⁶, Herdianty Kusuma Handari⁷

Pendidikan Jasmani Kesehatan dan Rekreasi, Universitas Katolik Santo Agustinus Hippo, Indonesia¹²

Ilmu Keolahragaan, Universitas Negeri Malang, Indonesia³

Kedokteran, Universitas Sebelas Maret, Indonesia⁴

Department of Physical Education and Sport, Universiti Teknologi Malaysia, Malaysia⁵

Pendidikan Jasmani Kesehatan dan Rekreasi, Universitas PGRI Semarang, Indonesia⁶

Fisioterapi, Politeknik Kesehatan Kementerian Kesehatan Surakarta, Indonesia⁷

History Article

Received Desember 2024

Approved Desember 2024

Published vol 11 no 2 2024

Keywords

L-Arginine; Oxygen Saturation; Blood Lactic Acid; Physical Fitness; Muaythai Athletes

Abstract

This study aims to determine the extent of the effect of L-Arginine amino acid supplementation on oxygen saturation and lactic acid levels at the fitness level (VO2Max) of West Kalimantan muaythai athletes. High lactic acid levels can be an indicator of fatigue in athletes after undergoing a physical fitness test. This type of quantitative descriptive research used a randomized group pretest-posttest group design sampling method. The subjects in the study used were male athletes on the West Kalimantan muaythai team who will be prepared for the 2024 International Student Muaythai Championship. In this study, the subjects were divided into two groups, the first group was given a placebo and the second group was given the amino acid L-arginine. Each group was given the same treatment, namely a physical fitness test to determine the VO2Max level using a bleep test. Before and after carrying out the physical fitness test, the subjects were checked for oxygen saturation, and blood lactic acid samples were taken. The results showed that L-Arginine supplementation had a positive effect in helping to maintain optimal oxygen saturation in the body and reducing the accumulation of blood lactic acid levels that can cause fatigue in Muay Thai athletes. This shows the significant role of L-arginine supplementation in helping to enhance physical endurance performance and speed up recovery during and after physical activity.

How to Cite

Mukti, I. F. B., Jayadi., Pribadi, H. P., Ghazali, D. A., Syaukani, A. A., Wibisana, M. I. N., & Handari, H. K. (2024). The Effects of L-Arginine Supplementation on Oxygen Saturation and Blood Lactic Acid Levels on the Physical Fitness Level of Muaythai Athletes in West Kalimantan. *Journal of Physical Education, Health and Sport*, 11 (2), 60-64.

INTRODUCTION

Nowadays, the development of supplements in the world of sports is increasingly used because supplements are one of the supports in enhancing athlete performance. In preparing for a tournament, athletes usually train according to the specified target, but during preparation athletes often experience excessive fatigue, which will have an impact on decreasing athlete performance when competing. When athletes do too much activity, oxygen saturation will decrease and blood lactic acid levels will accumulate so that athletes will experience fatigue.

Several sports science experts have recommended supplements as support (Meirelles et al. 2019, Hiratsu et al. 2022) in improving athlete performance. It has been proven that prolonged exercise can cause a decrease in blood glucose, which causes increased fatigue (Grego et al. 2004), and carbohydrate replacement supplementation can delay fatigue during exercise by maintaining blood glucose levels. One of the glucocorticoid hormones, cortisol, which increases rapidly during exercise is reported to be significantly correlated with fatigue during exercise. It is also explained that the supplements produced will accelerate muscle protein catabolism when energy is depleted during prolonged exercise, this is what can cause fatigue due to the accumulation of lactic acid. Various amino acids can be used as supplements to support athlete performance (Botchlett, Lawler, and Wu 2014). One supplement that can be used to improve performance is the amino acid L-arginine.

The amino acid L-arginine is one of the supplements often used by athletes to improve performance. L-Arginine functions as a precursor to Nitric Oxide which can cause vasodilation or widening of blood vessels and muscle hypertrophy during physical activity. When vasodilation of blood vessels widens, blood flow will bring oxygen supply into the body (Speer et al. 2020; Takeda and Takemasa 2018) thereby increasing oxygen saturation. One of the main indicators in assessing the efficiency of oxygen use is VO2 max.

VO2 Max is the maximum amount of O2 that can be processed by the human body when doing intense activities (Hutajulu et al. 2017). In addition, VO2Max is what measures the body's maximum capacity to absorb and use oxygen. When someone has poor fitness or cardiovascular endurance (VO2Max), it will greatly affect physical activity (Mukti 2024), especially for

athletes. An athlete's performance in performing activities usually lasts for 5 minutes or more and requires an intensity approximately equal to the VO2max capacity, this is related to the capacity of the circulatory and respiratory systems to supply fuel and resynthesize adenosine triphosphate (ATP) through oxidative metabolism (Bassett and Howley 2000; Joyner and Coyle 2008). Therefore, endurance performance is determined by the level of maximum oxygen volume (VO2max).

Previous studies (Bassett and Howley 2000; Joyner and Coyle 2008; Pasa et al. 2022; Rizal and Segalita 2018; Arimbi, Usman, and Wahid 2022; Nyawose et al. 2022; Mukti et al. 2021) have examined the effect of supplement use on athlete fitness levels tend to focus on energy metabolism indicators of aerobic athletes, water polo players, and increased physical activity and use the Citrulline variable. However, research examining L-Arginine Supplementation in West Kalimantan Muaythai Athletes can be considered an important step to explore the potential for activities or fitness levels that have not been studied before. Previous studies (Gambardella et al. 2021; Viribay et al. 2020; Jahani, Nabilpour, and Campillo 2019) which discussed the use of L-Arginine only reached developed areas where athletes were familiar with the use of sports supplements, while research on L-Arginine has not reached the West Kalimantan Province which still has minimal insight into the use of these supplements in improving performance. This study reached rural areas that have the potential to produce quality athletes in West Kalimantan where there is still minimal insight into sports supplements.

Given the importance of supplements in improving athlete performance, research is expected to contribute to increasing insight into the importance of supplements in improving physical performance and provide a better understanding of how supplements can improve athlete performance. Therefore, this study aims to determine the effect of L-Arginine supplementation on Oxygen Saturation and blood lactic acid levels at the level of physical fitness of West Kalimantan Muaythai athletes.

METHOD

This study aims to determine the extent of the effect of L-Arginine amino acid supplementation on oxygen saturation and lactic acid levels at the fitness level (VO2Max) of West Kalimantan Muaythai athletes. The type of this research was quantitative research. The purpose of this design

was to determine whether the effect of an experimental variable can be generalized through all levels of a control variable or whether the effect of an experimental variable is specific to a particular level of the control variable (Mustafa et al. 2015). This study used a laboratory experimental approach with a pretest and posttest control group design involving treatment in the experimental group (L-Arginine) and the control group (placebo). This aims to analyze and evaluate the use of L-Arginine supplements in improving athlete performance. The study sample consisted of 16 Muaythai athletes who were preparing for the International Student Muaythai Championship. Eight athletes were given a placebo, while the other eight athletes were given L-arginine supplements. This experimental laboratory study was conducted using a pretest and posttest experimental design with a control group (Ali, 2012). Initial observations were made to determine the use of supplement as a performance support in sports. The supplement given was 3 grams. Furthermore, data was collected through the results of the bleep test to determine the extent to which L-Arginine supplementation improved the performance of Muaythai athletes. The quantitative data collected were analyzed using statistical analysis. The data were analyzed using statistical tests, including paired sample t-tests to compare pretest and posttest results within groups, and independent sample t-tests to compare differences between groups.

Randomized pretest and posttest control group design

(O1) : pretest experimental group

(O2) : posttest experimental group

(O3) : pretest control group

(O4) : posttest control group

(X1) : Treatment (with L-Arginine) experimental group

(X2) : Treatment (placebo) control group

Picture 1. Research Design



RESULTS AND DISCUSSION

This study aims to determine the effect of L-Arginine supplementation on Oxygen Saturation and blood lactic acid levels on the physical fitness level of West Kalimantan Muaythai athletes. After collecting data, the researchers found the following **Table 1**.

Table 1. Mean and standard deviation data of

lactic acid and oxygen saturation

Variable	N	Mean $\pm$ SD	
		Control	Treatment
Lactic Acid Level Pre-test	8	2.005 $\pm$ 0.348	1.801 $\pm$ 0.290
Lactic Acid Level Post-test	8	10.086 $\pm$ 0.953	8.805 $\pm$ 0.831
Oxygen Saturation Pre-test	8	97.500 $\pm$ 1.927	97.500 $\pm$ 2.449
Oxygen Saturation Post-test	8	97.125 $\pm$ 1.552	97.625 $\pm$ 1.995

The results **Table 1** showed that in the Lactate Acid Level variable, the control group had a higher average than the treatment group, both in the pre-test and post-test. The increase in lactic acid levels after the bleep test was greater in the control group, indicating that the treatment group experienced a slower increase than the control group. In the Oxygen Saturation variable, the average pre-test oxygen saturation was almost the same in both groups, both in the control and treatment groups. However, after the bleep test, the control group experienced a slight decrease in oxygen saturation, while the treatment group showed an increase although not very significant. These results indicate that treatment in the treatment group can help slow the increase in lactate acid levels and maintain more stable oxygen saturation compared to the control group.

Table 2. Sample of VO2 Max

Variable	N	Mean	SD	Sig
VO2 Max Control Group	8	39.4625	4.19317	0.824
VO2max Treatment Group	8	43.8250	3.84104	0.407

Based on **Table 2**, the average VO2max in the Control Group was 39.46 with a standard deviation of 4.19, while in the Treatment Group, it was 43.83 with a standard deviation of 3.84. The significance value (Sig) for both groups was 0.824 for the Control Group and 0.407 for the Treatment Group, both of which were greater than 0.05. This means that there was no significant difference between the two groups in terms of VO2max. So, it can be concluded that the treatment given did not have a significant effect on oxygen saturation and lactic acid levels..

This study aims to determine the effect of L-Arginine supplementation on oxygen saturation and blood lactic acid levels in Muaythai athletes in West Kalimantan. Based on the results obtained, it can be seen that L-Arginine supple-

mentation has a positive impact on both variables tested, namely oxygen saturation and blood lactic acid. This finding is in line with the findings of Mukti et al., (2021); where the use of amino acid supplements has a positive impact (Viribay et al., 2020) where the supplement can increase oxygen saturation and inhibit the accumulation of lactic acid, thereby reducing fatigue (Tsuda et al., 2019) and can improve performance in athletes.

In the results of lactic acid levels, pre-test data showed that the control group had a higher average value compared to the treatment group given L-Arginine supplements, both before and after the bleep test. On the other hand, after the treatment group was given supplements, the research data showed a lower increase in lactic acid levels compared to the control group which experienced a higher increase. It can be concluded that L-arginine supplementation can help reduce the accumulation of lactic acid levels in the body. The lactic acid that accumulates during physical activity or exercise can cause fatigue, and a decrease in lactic acid levels through greater oxygen entering the body is very likely to contribute to a faster decrease in fatigue levels so that it can improve athlete performance.

At the oxygen saturation level, the pre-test data results showed that both groups had the same oxygen saturation level values. However, after the supplementation treatment, the data showed a slight increase in oxygen saturation levels in the treatment group, while the control group experienced a slight decrease in oxygen saturation levels. These results support the hypothesis that L-Arginine, which functions as a precursor to Nitric Oxide (NO), which functions to increase vasodilation or widen blood vessels, which is useful for increasing oxygen flow to body tissues (Speer et al., 2020; Takeda & Takemasa, 2018; Botchlett et al., 2014). This process can help increase the efficiency of oxygen use by the body during intense physical activity, thereby accelerating the energy formation process improving athlete performance, and reducing fatigue. On the other hand, in the VO₂ Max results, although there is a difference in the average VO₂ max between the Control Group and the Treatment Group, the test results show that the difference is not significant. This means that the level of treatment given to the control and treatment groups is the same. This will affect the results of oxygen saturation and blood lactic acid levels of the control and treatment groups fairly.

The results of this study revealed that L-arginine supplementation can help athletes maintain or improve their performance by suppressing

the accumulation of lactic acid levels in the body and increasing the supply of oxygen saturation to the body. This supplementation is very appropriate for Muaythai athletes who require high physical endurance and optimally control fatigue levels during the competition.

CONCLUSION

Based on the results of this study, it can be concluded that L-Arginine has a positive effect on oxygen saturation levels and blood lactic acid levels, which can help improve athletes' performance and physical endurance. The findings of this study provide an important contribution to the development of supplements to improve physical endurance and good athlete fitness levels, especially for Muaythai athletes in West Kalimantan who do not know much about the use of this supplement. Further research with a larger sample size and long-term testing and administration of larger supplement doses will provide a positive impact and a deeper understanding of the potential of L-Arginine as a supplement to support athlete performance.

REFERENCES

- Arimbi, Arimbi, Arifuddin Usman, and Wahyana Mujari Wahid. 2022. "Pengaruh Pemberian L-Citrulline Dalam Memperlambat Kelelahan Otot Pada Atlet." *Indonesian Journal of Fundamental Sciences* 8(1):61. doi: 10.26858/ijfs.v8i1.33169.
- Bassett, D. R., and E. T. Howley. 2000. "Limiting Factors for Maximum Oxygen Uptake and Determinants of Endurance Performance. / Facteurs Limitants de La Consommation Maximale d'oxygene et Determinants de La Performance d'endurance." *Medicine & Science in Sports & Exercise* 32(1):70-84.
- Botchlett, Rachel, John M. Lawler, and Guoyao Wu. 2014. *L-Arginine and L-Citrulline in Sports Nutrition and Health*. Elsevier Inc.
- Gambardella, Jessica, Antonella Fiordelisi, Luca Spigno, Lorenzo Boldrini, Giulia Lungonelli, Eugenio Di Vaia, Gaetano Santulli, Daniela Sorrento, Federica Andrea Cerasuolo, Valentina Trimarco, and Guido Iaccarino. 2021. "Effects of Chronic Supplementation of L-Arginine on Physical Fitness in Water Polo Players." *Oxidative Medicine and Cellular Longevity* 2021. doi: 10.1155/2021/6684568.
- Grego, Fabien, Jean Marc Vallier, Maya Collardeau, Stéphane Bermon, Patricia Ferrari, Mirande Candito, Pascale Bayer, Marie Noëlle Magnié, and Jeanick Brisswalter. 2004. "Effects of Long Duration Exercise on Cognitive Function, Blood Glucose, and Counterregulatory Hormones in Male Cyclists." *Neuroscience*

- Letters 364(2):76–80. doi: 10.1016/j.neulet.2004.03.085.
- Hiratsu, Ayano, Yusei Tataka, Saki Namura, Chihiro Nagayama, Yuka Hamada, and Masashi Miyashita. 2022. “The Effects of Acute and Chronic Oral L-Arginine Supplementation on Exercise-Induced Ammonia Accumulation and Exercise Performance in Healthy Young Men: A Randomised, Double-Blind, Cross-over, Placebo-Controlled Trial.” *Journal of Exercise Science and Fitness* 20(2):140–47. doi: 10.1016/j.jesf.2022.02.003.
- Hutajulu, Pahala Tua, Wahida Y. Mapandin, and Yohanis Manfred Mandosir. 2017. “Impact Aerobic Toward Body Physiology and Vo2Max.” *Journal of Physical Education Health and Sport* 7(2):25–30.
- Jahani, Majid, Maghsoud Nabilpour, and Rodrigo Ramirez Campillo. 2019. “Effects of L-Arginine Supplementation and Aerobic Training on Hemodynamic Indices of Obese Men.” *International Journal of Sport Studies for Health In Press(In Press)*:1–6. doi: 10.5812/intjssh.88017.
- Joyner, Michael J., and Edward F. Coyle. 2008. “Endurance Exercise Performance: The Physiology of Champions.” *Journal of Physiology* 586(1):35–44. doi: 10.1113/jphysiol.2007.143834.
- Meirelles, Claudia Mello, Cristiane Matsuura, Roberto Souza Silva, Felipe Frances Guimarães, and Paulo Sergio Chagas Gomes. 2019. “Acute Effects of L-Arginine Supplementation on Oxygen Consumption Kinetics and Muscle Oxyhemoglobin and Deoxyhemoglobin during Treadmill Running in Male Adults.” *International Journal of Exercise Science* 12(2):444–55.
- Mukti, Ibrah Fastabiqi Bawana. 2024. “Profil Daya Tahan Kardiovaskular Mahasiswa.” 6(2):195–202.
- Mukti, Ibrah Fastabiqi Bawana, Elyana Asnar, and Harlina Harlina. 2021. “The Effect of Citrulline Supplementation on Lactic Acid Blood Level and Oxygen Saturation (SaO2) in Submaximal Physical Activity.” *Folia Medica Indonesiana* 56(4):245. doi: 10.20473/fmi.v56i4.24553.
- Mustafa, Pinton Setya, Hafids Gusdiyanto, Andif Victoria, and Ndaru Kuku Masgumelar. 2015. *Metode Penelitian Kuantitatif, Kualitatif Dan Tindakan Kelas Dalam Pendidikan Olahraga*.
- Nyawose, Siphamandla, Rowena Naidoo, Nenad Naumovski, and Andrew J. McKune. 2022. “The Effects of Consuming Amino Acids L-Arginine, L-Citrulline (and Their Combination) as a Beverage or Powder, on Athletic and Physical Performance: A Systematic Review.” *Beverages* 8(3). doi: 10.3390/beverages8030048.
- Pasa, Camila, Ruberlei Godinho de Oliveira, Thiago da Rosa Lima, Michelle Jalousie Kommers, Karla Régia Ferreira Viana Figueiredo, Waléria Christiane Rezende Fett, and Carlos Alexandre Fett. 2022. “Effectiveness of Acute L-Arginine Supplementation on Physical Performance in Strength Training: A Systematic Review and Meta-Analysis.” *F1000Research* 10:1072. doi: 10.12688/f1000research.73905.2.
- Rizal, Mochammad, and Calista Segalita. 2018. “Peran Asam Amino Sitrulin Dalam Meningkatkan Performa Olahraga Pada Atlet The Role of Amino Acid Citrulline in Improving Sports Performance Among Athletes.” *Literatur Riview* 299–306. doi: 10.20473/amnt.v2.i4.2018.299-306.
- Speer, Hollie, Nathan M. D’cunha, Michael J. Davies, Andrew J. McKune, and Nenad Naumovski. 2020. “The Physiological Effects of Amino Acids Arginine and Citrulline: Is There a Basis for Development of a Beverage to Promote Endurance Performance? A Narrative Review of Orally Administered Supplements.” *Beverages* 6(1):1–11. doi: 10.3390/beverages6010011.
- Takeda, Kohei, and Tohru Takemasa. 2018. *An Overview of Ornithine, Arginine, and Citrulline in Exercise and Sports Nutrition*. Second Edi. Elsevier Inc.
- Viribay, Aitor, José Burgos, Julen Fernández-Landa, Jesús Seco-Calvo, and Juan Mielgo-Ayuso. 2020. “Effects of Arginine Supplementation on Athletic Performance Based on Energy Metabolism: A Systematic Review and Meta-Analysis.” *Nutrients* 12(5):1–20. doi: 10.3390/nu12051300.