

**Analysis of Maximal Volume of Oxygen for Gorontalo Contingent Martial Arts Athletes****Suprianto Kadir¹, Arief Ibnu Haryanto^{2✉}, I Kadek Suardika³, Nur Rohmah Muktiani⁴**Program Studi Pendidikan Kepelatihan Olahraga, Fakultas Olahraga dan Kesehatan, Universitas Negeri Gorontalo, Indonesia¹²³Program Studi Pendidikan jasmani, Fakultas Ilmu Keolahragaan dan Kesehatan, Universitas Negeri Yogyakarta, Indonesia⁴**Article History**

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Abstract

This research analyzes Maximal Volume of Oxygen (VO2 Max) as the main variable to measure the aerobic capacity of martial arts athletes from the Gorontalo Contingent. This variable is important for understanding the level of cardiovascular fitness and physical endurance capabilities of athletes in facing training and competition. This research uses descriptive analytical research methods. The total number of subjects was nine athletes including four Taekwondo athletes, two Wushu athletes, one athlete Kickboxing, one athlete Karate and one athlete Muaythai. The instrument used in this research is the Bleep Test with classification norms using a bleep test calculator. Meanwhile, descriptive data analysis used SPSS 25 software. The results of this research for Taekwondo athletes were two above average, two were good. Wushu one average, one below average. Average kickboxing. Good karate. Muay Thai is average. In conclusion, Taekwondo athletes show a VO2 max that is generally higher compared to athletes from other disciplines. These results demonstrate the importance of personalized training programs to optimize cardiovascular fitness and performance in athletes. Further research with a more comprehensive approach is needed to strengthen and expand understanding of the influence of VO2 max on the performance of martial arts athletes.

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INTRODUCTION

Maximal Volume of Oxygen Level (VO₂ max) is a measure of a person's body's maximum capacity to use oxygen during physical activity (Hidayat et al., 2023; Hidayat & Haryanto, 2021, 2022). For athletes, VO₂ max is an important parameter that can influence their performance in various sports (Jurov et al., 2023; Matias et al., 2022; Mazaheri et al., 2021). A high VO₂ max level indicates that the body can process oxygen more efficiently, thereby increasing the athlete's ability to endure activities that require high levels of strength and endurance (Ahmad et al., 2019; Irianto et al., 2020). In aerobic sports such as long-distance running, cycling and swimming, a high VO₂ max level is essential because these activities require a continuous supply of oxygen to the muscles to produce energy (Haryanto et al., 2022; McGinn et al., 2014; Wondem & Tegegne, 2023). The higher a person's VO₂ max level, the better their ability to overcome physical strain and maintain optimal performance over longer periods of time. This can be a significant competitive advantage for athletes, especially in situations where strength and endurance are determining factors in success. In addition, a high VO₂ max level is also closely related to the ability to recover quickly between training sessions or competitions. By processing oxygen efficiently, athletes' bodies can speed up the recovery process, allowing them to face the next workout more prepared and improve adaptation to strenuous training. This is the key to maximizing an athlete's overall fitness and performance development potential.

The importance of VO₂ max levels in the world of sports also includes health aspects (Guerra et al., 2022; Nyberg et al., 2020). These indicators can help coaches and medical professionals to assess athletes' health conditions, detect potential risks, and design appropriate training programs. With a better understanding of VO₂ max, athletes and coaches can optimize the training and strategies needed to improve aerobic capacity and overall sports performance. Therefore, the VO₂ max level is not just a number, but is also an important tool in helping athletes reach their full potential on the field and in competition. In martial arts sports, such as karate, taekwondo or judo, the Maximum Oxygen Volume level (VO₂ max) remains an important parameter, although in a slightly different context. Although not completely dependent on aerobic endurance like traditional aerobic sports, VO₂ max levels still have a significant role in improving an athlete's performance in martial arts. Behind

a series of fast and powerful movements in martial arts, there is the body's need for an adequate oxygen supply to support muscle activity effectively. A high VO₂ max level will help athletes to provide sufficient oxygen to their muscles during fights or intense training. Thus, they are able to maintain strength and concentration over longer periods of time, which is an important aspect in achieving an edge in a fight or competition. Apart from that, martial arts also require high anaerobic endurance, which relies on metabolic processes that do not require oxygen. However, a high VO₂ max level still provides benefits by speeding up recovery between bouts of exercise or intense movement. This way, the athlete can return to a strong position more quickly and maintain optimal performance throughout the fight.

The importance of VO₂ max in martial arts also lies in the aspect of the athlete's health and fitness. Although martial arts often emphasize strength and speed, the long-term health aspect should not be ignored. A high VO₂ max level reflects good cardiorespiratory health, which is an important indicator of overall physical fitness. Thus, increasing VO₂ max levels can be an integral part of a martial arts athlete's training program. Through specific exercises designed to increase aerobic and anaerobic endurance, athletes can improve their fighting abilities, speed recovery and ensure optimal health. In this way, VO₂ max remains an important factor in helping martial arts athletes reach their full potential on and off the tatami. In the context of National Sports Week, the importance of Maximum Oxygen Volume Levels (VO₂ max) for martial arts athletes becomes increasingly prominent. National Sports Week is often a very competitive event where athletes from various regions compete to achieve the best achievements for their country. In this kind of competition, the level of physical fitness is the main key in determining the final result.

Martial arts athletes participating in National Sports Week need to have a high VO₂ max level to maintain their optimal performance during competitions (Nugroho, 2020). Combat in the martial arts field is often intense and requires extraordinary strength, speed and endurance. A high VO₂ max level ensures that they have an adequate supply of oxygen to their muscles, so they can produce power efficiently during competition. Apart from that, National Sports Week can also be a platform to measure athletes' progress in terms of physical fitness levels (Simanjuntak et al., 2022). Increasing the VO₂ max level can be one of the goals pursued by athletes and their coaches in preparing for the competition

(Rahadiani, 2023). By having a good understanding of the importance of VO2 max and how to increase it through proper training, athletes can adapt their training programs to achieve the best performance at National Sports Week.

Moreover, in the context of National Sports Week, the importance of VO2 max can also be seen from the perspective of the athlete's overall health and fitness. Increasing VO2 max levels not only has a positive impact on an athlete's performance in competition, but can also improve their long-term health and physical fitness. Thus, National Sports Week can be an additional motivation for athletes to improve their overall physical fitness level, including increasing their VO2 max level. In order to achieve success at National Sports Week, martial arts athletes need to pay attention to and increase their VO2 max levels through structured and effective training. Thus, VO2 max is not only an important performance parameter for martial arts athletes, but also an integral part of their preparation in achieving the best performance on the national sports stage.

METHODS

This type of research is quantitative research with a research design using descriptive analytical methods. The results obtained, namely the athlete's VO2 max level, will then be described and compared with the ideal VO2 max standard for athletes. The sampling technique in this study used a total sampling method, all of which were taken from athletes from the Gorontalo contingent who will compete in the 2024 National Sports Week (usually abbreviated as PON XXI/PON ACEH-SUMUT 2024), a total of nine athletes including four Taekwondo athletes, Wushu two athletes, one athlete in Kickboxing, one athlete in Karate, and one athlete in Muaythai. The descriptive data analysis used SPSS 25 software.

The instrument used in this research is the Bleep Test. The bleep test instrument, also known as the multistage fitness test, is a physical fitness evaluation tool used to measure a person's aerobic capacity and cardiorespiratory endurance. This test is carried out by running back and forth between two points 20 meters apart, according to a bleep or beep rhythm that gets faster as time goes by. Participants must reach the line before the next beep sounds. The initial speed was relatively slow, but the intervals between beeps would become shorter, forcing participants to increase their running speed. The test continues until the participant is unable to reach the line within the time determined by two consecutive beeps, and

the final level reached becomes an indicator of their aerobic capacity. The classification norms use the bleep test calculator developed by Topend Sports (Wood, 2010).

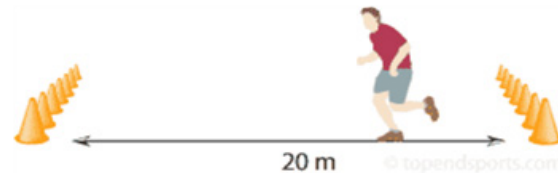


Figure 1. Bleep Test (Sepdanius et al., 2019).

RESULTS AND DISCUSSION

From the VO2 max data collection that has been carried out, the results obtained are SM (SCORE Maximum) = 54.3 and minimum score = 40.2, mean = 45.033, and standard deviation = 5.3181. Thus the data is normally distributed, because the difference between the mean value and the median value is no more than one standard deviation. For more clarity, the VO2 Max data can be seen in **Table 1.**

Table 1. VO2 max results

Sport	Gender	Age (Year)	Level	Reverse	VO2 max	Classification
Taekwondo	Male	17	12	2	54.3	Good
Kickboxing	Male	30	8	1	40.2	Average
Wushu	Female	20	8	1	40.2	Average
Karate	Female	22	11	1	50.6	Good
Taekwondo	Female	20	10	8	49.2	Good
Taekwondo	Female	22	9	11	46.8	Above Average
Wushu	Male	23	8	3	40.9	Below Average
Muaythai	Female	21	8	3	40.9	Average
Taekwondo	Male	18	8	7	42.2	Above Average

The results showed significant variations in maximal oxygen volume (VO2 max) among martial arts athletes from various different disciplines in the Gorontalo contingent. Of the four Taekwondo athletes, two of them had a good VO2 max classification, while the other two were

above average. Past research suggests that Taekwondo athletes have relatively high levels of cardiovascular fitness, which likely contributes to their ability to endure intense, long-duration matches (Bayzid, 2019). The high VO₂ max of most Taekwondo athletes may reflect the effective and consistent training programs they undertake, which include intensive cardio training designed to increase aerobic capacity.

In contrast, the results for Wushu athletes showed a disparity in cardiovascular fitness, with one athlete in the average classification and one below average. This may indicate differences in the intensity and quality of the training program each athlete follows or perhaps individual factors such as genetics and level of commitment to training. In accordance with previous research which states that low VO₂ max can affect the performance of Wushu athletes, especially in terms of endurance and the ability to maintain high intensity during matches (Sarkar et al., 2018). A more structured training program focused on increasing aerobic capacity may be necessary to increase Wushu athletes' VO₂ max.

Kickboxing and Muaythay athletes each have an average VO₂ Max classification. Kickboxing and Muaythay are martial arts disciplines that require a combination of strength, speed and endurance. Previous research shows that a training program that includes high-intensity interval (HIIT) and continuous cardio training can help increase their VO₂ Max, giving them additional advantages in endurance and performance during competitions (Bhumipol et al., 2023; Eken et al., 2022). A VO₂ Max that is at an average level indicates that while they may have adequate cardiovascular capacity to compete, there is potential for further improvement.

A Karate athlete with a good VO₂ Max classification indicates high cardiovascular fitness, which is important in Karate to maintain speed, strength and technique during competition. This is the same as previously, Karate athletes in Gorontalo Province did have a good average in VO₂ Max (Kadir et al., 2022). Good cardiovascular fitness allows athletes to be more efficient in energy use and recover more quickly between attack and defense, which can provide a significant competitive advantage.

Overall, the results of this study underscore the importance of aerobic capacity in the performance of martial arts athletes. Different martial arts disciplines may have slightly different fitness requirements, but increasing VO₂ max can generally improve an athlete's endurance, speed, and recovery abilities. Tailored training programs

with a focus on increasing aerobic capacity can provide great benefits to athletes, helping them achieve peak performance in competition.

The results of research on the analysis of maximum oxygen volume (VO₂ max) in Gorontalo contingent martial arts athletes have significant implications for the development of more effective and targeted training programs. These findings suggest that there is variation in aerobic capacity among athletes from different martial arts disciplines, indicating the need for a personalized approach in training programs to optimize cardiovascular fitness and performance.

Overall, the implications of the results of this study emphasize the importance of regularly evaluating cardiovascular fitness and personalizing training programs to the specific needs of martial arts athletes. By making appropriate adjustments in the training program based on the results of the VO₂ max analysis, coaches can help athletes achieve peak performance and increase their competitiveness in competitions.

CONCLUSION

The study "Analysis of the Maximal Volume of Oxygen of Gorontalo Contingent Martial Arts Athletes" revealed significant variations in aerobic capacity among athletes from various martial arts disciplines, with Taekwondo athletes showing generally higher VO₂ max compared to athletes from other disciplines. These results demonstrate the importance of personalized training programs to optimize cardiovascular fitness and performance in athletes. Although these results provide valuable insights, this study has limitations in terms of sample size, individual variability, measurement methods, and research design, which need to be considered in the interpretation of the findings. Further research with a more comprehensive approach is needed to strengthen and expand understanding of the influence of VO₂ max on the performance of martial arts athletes.

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