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Analysis of VO_2 Max Endurance in Untad Volleyball Athletes

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ABSTRACT

This study aims to analyse the level of VO2Max endurance of UNTAD volleyball athletes. This research method uses a quantitative descriptive method. The sample in this study was UNTAD volleyball athletes, whose number was known to be 12. While the data collection technique used a test instrument. The results of this study are based on the results of the analysis of the description of research data from the implementation of the MFT (Multistage Fitness Test). The results of the UNTAD Volleyball Athletes' tests and measurements obtained the highest achievement at level 12 reversal 9, which is predicted to have a VO2max of 56.2, and the lowest at level 8 reversal 2, which is predicted to have a VO2max of 40.5. Overall, the VO2max level of UNTAD Volleyball Athletes shows the following classification: 2 people (17%) are in the very good category, 1 person (8%) is in the Good category, 4 people (33%) are in the moderate or fairly good category, and 5 people (42%) are in the less good category. The average VO2max ability of UNTAD Volleyball Athletes is in the less good classification. From the data that has been obtained, it can be concluded that the Analysis of VO2Max Endurance of UNTAD Volleyball Athletes is still lacking, and training still needs to be improved, so that Physical Condition can be even better.

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INTRODUCTION

VO_2 max is the maximal rate of oxygen consumption during incremental exercise and serves as a gold-standard metric for assessing aerobic capacity and endurance fitness (Wikipedia, 2025). It reflects the efficiency of the cardiovascular, respiratory, and muscular systems working together during sustained activity. In team sports like volleyball—although traditionally viewed as anaerobic—players are required to perform repeated high-intensity actions (jumps, sprints, lateral movements) interspersed with short recovery periods, making aerobic capacity essential for performance and recovery (Stanković et al., 2022; Castagna et al., 2019).

A growing body of research highlights that high VO_2 max supports improved on-court performance, faster recovery between rallies, and resistance to fatigue in volleyball athletes (Enkeleida Lleshi, 2021). Thus, understanding VO_2 max levels among volleyball players is vital for conditioning programs aimed at optimizing performance.

Several studies have reported VO_2 max values in volleyball players. Semi-elite female athletes showed significant improvements in VO_2 max (+3–5%) over a season (Stanković et al., 2022), while elite footballers and volleyballers can reach VO_2 max around 53 mL/kg/min (PMC OMNI, 2015). Among club-level female players, variability is evident: one study noted only 10% classified as "good" and 57.5% "poor" in VO_2 max tests (Rubiyatno et al., 2023). Another investigation employing the Astrand test found that strength training modestly improved VO_2 max in 17-year-old players (Lleshi, 2021). These insights underline the importance of profiling endurance within volleyball programs across all competitive levels.

At Universitas Tadulako (UNTAD), volleyball is a prominent student sport. However, no formal assessment of VO_2 max among UNTAD volleyball athletes has been conducted. Without knowledge of their aerobic fitness levels, coaches cannot design training programs tailored to enhance endurance performance, potentially limiting athletes' conditioning and tournament readiness. Moreover, comparing these athletes' VO_2 max to national and international norms remains unexplored, leaving a gap in understanding UNTAD volleyball's competitive potential.

Despite the recognized role of endurance in volleyball, few studies have systematically evaluated VO_2 max in Indonesian collegiate athletes. While descriptive tracking of VO_2 max in club-level players exists (Rubiyatno et al., 2023), academic programs, especially in universities, have been overlooked. Additionally, mixed training interventions (e.g., strength + aerobic) have shown promise (Lleshi, 2021), yet baseline data among university athletes remains scarce. As UNTAD volleyball players are part of competitive intercollegiate leagues, understanding their aerobic capacity could inform more effective conditioning strategies and improve performance in national competitions.

This study provides original data by analyzing VO_2 max endurance among the UNTAD volleyball team using the Yo-Yo Intermittent Recovery Test Level 1—a field-based and volleyball-relevant test validated in Indonesian athletes (Rubiyatno et al., 2023). This is one of the first studies to: (1) Profile VO_2 max in a university-level volleyball team in Sulawesi, (2) compare results with existing normative data from national and international studies (PMC OMNI, 2015; Rubiyatno et al., 2023; Lleshi, 2021).

Provide practical insights for coaches aiming to improve conditioning using endurance-specific training. This context-specific investigation contributes empirical evidence to inform strength and conditioning programs in university sports settings.

This study aims to analyze the VO_2 max endurance of UNTAD volleyball athletes using a validated endurance test. The central questions are: (1) What is the current VO_2 max range among UNTAD volleyball players? (2) How do these results compare to established benchmarks and peers in Indonesian and global contexts? And (3) What are the conditioning implications of these values for overall performance and training design?

We employ a cross-sectional design involving 20–25 male and female student-athletes, conducting the Yo-Yo Intermittent Recovery Test Level 1. Test outcomes will be classified into VO_2 max categories (poor–excellent) and statistically compared to available norms. The findings will guide coaches in prescribing aerobic training to fill

identified gaps and prepare athletes for competitive demands. Ultimately, this study seeks to elevate the conditioning framework for volleyball at UNTAD and provide a model for similar universities in Indonesia.

METHODS

This type of research is quantitative descriptive. This study aims to provide a systematic, factual, and accurate description of the VO_2Max endurance of UNTAD volleyball athletes.

This research was conducted at the Tadulako University Campus, Palu City, Central Sulawesi, on May 4, 2025. The population of the study was all active volleyball athletes in UNTAD, totalling 12 people. Because the population is small, the entire population was used as a research sample (total sampling). Data Collection Techniques. Data were collected using the Multistage Fitness Test (MFT) or the Bleep Test. Athletes were asked to run back and forth 20 meters following the sound of the "beep". The last level and shuttle achieved were indicators of VO_2Max.

The main instrument is the beep test observation sheet that records each athlete's level and shuttle. The results are converted to a VO_2Max score based on a standard table. Data were analyzed descriptively by calculating the mean value and percentage of VO_2Max classification:

$$P = \frac{F}{N} X\ 100\%$$

RESULTS AND DISCUSSION

Result

This research was conducted in Palu City, precisely at the Tadulako University Campus, Central Sulawesi. Data collection was carried out on May 4, 2025. The subjects in this study were 12 UNTAD Volleyball Athletes. Endurance in this study was measured by a multistage fitness test based on VO2 Max.

The measurement results showed that the highest VO_2Max was at level 12 reversal 9 (56.2 ml/kg/min), while the lowest was at level 8 reversal 2 (40.5 ml/kg/min). The average VO_2Max of athletes was 46.45 ml/kg/min. The classification of the results is:

Table 1.
Percentage Category

Category	Number of Athletes	Percentage
Very good	2	17%
Good	1	8%
Enough	4	33%
Not enough	5	42%
Total	**12**	**100%**

Overall, the VO2max level of UNTAD Volleyball Athletes shows the following classification: 2 people (17%) are in the very good category, 1 person (8%) is in the Good

category, 4 people (33%) are in the moderate or fairly good category, and 5 people (42%) are in the less good category. The average VO2max ability of UNTAD Volleyball Athletes is in the less good classification. For more details, see the following graph:

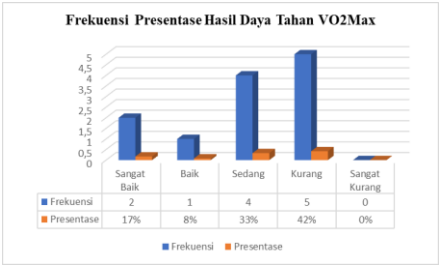

Figure 1.
VO2Max Endurance Analysis Graph for UNTAD Volleyball Athletes

Discussion

The majority of athletes are in the poor to sufficient category, indicating that most UNTAD volleyball athletes have a level of cardiovascular endurance that still needs to be improved through a more structured physical training program. However, there are athletes who are in the very good category, which can be an important asset in the overall team performance.

The average VO_2Max of 46.45 ml/kg/min is still at the lower limit of the fitness standard for men aged 19–29 years. This shows that the aerobic capacity of most athletes is not optimal. High VO_2Max reflects the efficiency of the respiratory and circulatory systems and the ability of muscles to use oxygen during activity (Irianto, 2018). In the context of volleyball, high VO_2Max helps athletes last longer on the field, maintain game intensity, and accelerate recovery between rallies (Matsudo et al., 2021).

Furthermore, according to Santisteban and Lovering (2022), aerobic endurance is the foundation of athlete performance in long matches. Athletes with low VO_2Max experience fatigue more quickly, especially in the final phase of the game. Freire et al. (2023) added that increasing endurance not only affects individual performance but also the overall effectiveness of the team.

Several factors that can cause low VO_2Max include lack of consistent training, low frequency and variety of training, diet that does not support performance, lack of rest, and the possibility of genetic factors or minor medical conditions that have not been detected.

These findings can be used as evaluation material for coaches and coaching teams in developing more individualized physical training programs. Recommended training programs include interval training, fartlek, long-distance running, and moderate to high intensity circuit training. Regular VO_2Max measurements are also highly recommended to determine the development of athlete fitness and assess the effectiveness of the training program.

CONCLUSION

From the results of the study, it can be concluded that the average VO_2Max endurance of UNTAD volleyball athletes is classified as less than good. This indicates that

the athletes' aerobic capacity is still not optimal and requires improvement through a better physical training program. Therefore, it is recommended that coaches and coaching teams design a structured and specific training program to increase VO_2Max, conduct regular evaluations of athlete fitness, and provide education on healthy lifestyles that include nutrition, rest, and stress management.

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