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Level Of Physical Fitness (Vo_2Max) In Gresik Wushu Club Athletes Using The Cooper Test (12-Minute Run)

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ABSTRACT

Physical fitness, particularly cardiorespiratory endurance (VO_2max), is an essential component supporting athlete performance in combat sports such as Wushu. Adequate aerobic capacity enables athletes to maintain movement intensity, technical performance, and recovery efficiency during training and competition. However, the aerobic fitness profile of regional-level wushu athletes remains insufficiently documented, especially in club-based athlete development programs. Therefore, this study aimed to evaluate the physical fitness condition, specifically VO_2max levels, of Gresik Wushu Club athletes using the Cooper Test (12-minute run). This study employed a descriptive quantitative method with a cross-sectional design. The participants consisted of 10 wushu athletes aged between 13 and 20 years. Data collection was conducted through the Cooper Test by measuring the total distance covered within 12 minutes. The estimated VO_2max values were subsequently calculated using the Cooper formula and classified according to fitness level categories. The findings revealed that the average running distance achieved by the athletes was approximately 2051.55 meters, with an average VO_2max value of 34.57 ml/kg/minute. Most athletes demonstrated moderate to low physical fitness levels, with VO_2max values below 35 ml/kg/minute indicating insufficient aerobic endurance capacity. Only a small proportion of athletes achieved the good fitness category, while several athletes remained in poor and very poor categories. In conclusion, the cardiovascular endurance level of Gresik Wushu Club athletes generally still requires improvement. Therefore, more structured, systematic, and sustainable aerobic training programs are needed to increase VO_2max capacity and support optimal athletic performance during training and competition.

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INTRODUCTION

Sport has become an essential component of human development because it contributes not only to physical health but also to psychological, social, and cultural well-being. According to the Government of Indonesia through Law No. 11 of 2022 concerning Sports, sport is defined as all systematic and integrated activities involving the body, mind, and spirit to foster physical fitness, character, achievement, and social values. In this context, physical fitness is a fundamental aspect that determines an athlete's ability

to perform training and competition activities without experiencing excessive fatigue. Physical fitness also reflects the body's physiological adaptability to workloads, especially in high-performance sports requiring endurance, speed, agility, and recovery capacity. One sport that demands high physical fitness is Wushu. Wushu is a modern martial art characterized by explosive movements, rapid technical transitions, flexibility, balance, and intermittent high-intensity activity patterns. Athletes are required to maintain technical precision and movement quality during both taolu and sanda performances. Consequently, aerobic endurance becomes an essential component supporting performance sustainability during training and competition (Wang et al., 2024). Previous studies have emphasized that cardiorespiratory endurance strongly influences athlete readiness, fatigue resistance, and recovery ability in martial arts sports (Sanders, 2024).

One of the most widely recognized indicators of cardiorespiratory fitness is maximal oxygen uptake or VO_2max. VO_2max refers to the maximum capacity of the body to transport and utilize oxygen during intense exercise and is considered the gold standard for measuring aerobic fitness (Lee et al., 2025). Athletes with higher VO_2max values generally demonstrate superior endurance, better physiological adaptation, and improved exercise efficiency during prolonged or repeated physical activity. In combat sports, including wushu, aerobic endurance is critically important because athletes must sustain movement intensity while maintaining concentration and technical accuracy throughout the match or performance. Several studies in sports science have confirmed that aerobic capacity contributes significantly to athletic performance. Research on taekwondo, karate, and pencak silat athletes demonstrated that VO_2max is associated with competitive readiness, movement efficiency, and fatigue management during high-intensity performance (Suprianto Kadir et al., 2024). Similarly, Mei and Yuan (2024) explained that wushu athletes require integrated physical qualities consisting of flexibility, coordination, strength, balance, and aerobic endurance to maintain optimal technical execution. However, despite the recognized importance of aerobic fitness in martial arts, many local sports clubs still lack systematic physical fitness evaluations, particularly concerning VO_2max profiling.

The importance of monitoring aerobic fitness is also relevant to athlete development programs in regional sports clubs. The Gresik Wushu Club has shown consistent achievement improvements between 2022 and 2025 through increased medal acquisition in regional and provincial championships. This positive trend indicates that athlete development within the club has progressed considerably. Nevertheless, the club still faces several challenges, including limited athlete numbers, inconsistent training discipline, and inadequate physical conditioning evaluation. These limitations may hinder long-term athlete development and performance sustainability. According to the coach of Gresik Wushu Club, athlete performance improvement must be balanced with optimal physical preparation and aerobic endurance to maintain consistency during training and competition. This statement highlights the urgent need for objective and measurable physical fitness assessments as a basis for designing effective conditioning

programs. Without accurate physiological evaluation, coaches may experience difficulties in determining appropriate training loads and athlete readiness.

Therefore, assessing VO_2max levels among Gresik Wushu Club athletes becomes highly important as an effort to evaluate current physical fitness conditions and support evidence-based coaching programs. One practical approach commonly used to estimate VO_2max is the Cooper Test or 12-minute run test. This test measures the maximum distance covered within 12 minutes to estimate aerobic capacity indirectly (Alvarez Ramirez & Rodriguez, 2021). The Cooper Test has been widely applied because it is simple, economical, efficient, and feasible for field implementation without requiring sophisticated laboratory equipment (Bandyopadhyay, 2020). The measurement of VO_2max has become one of the primary focuses in sports physiology research because aerobic endurance is closely related to athlete performance quality. Numerous studies have investigated the relationship between VO_2max and athletic achievement across different sports disciplines. Research in endurance sports such as running, cycling, and swimming consistently demonstrates that athletes with higher VO_2max levels possess superior performance capabilities due to more efficient oxygen utilization and delayed fatigue onset (Lee et al., 2025).

In martial arts sports, aerobic capacity also plays an essential role because athletes perform repetitive explosive actions combined with rapid recovery demands. Studies involving taekwondo athletes found that aerobic endurance contributes significantly to sustaining attack intensity and maintaining movement coordination during matches. Similar findings were reported in karate and pencak silat athletes, where higher VO_2max levels were associated with better competitive performance and physiological resilience (Suprianto Kadir et al., 2024). Recent studies in wushu have emphasized the multidimensional physical requirements needed to achieve optimal performance. Mei and Yuan (2024) explained that wushu performance depends not only on technical mastery but also on flexibility, muscular strength, coordination, balance, and aerobic endurance. In taolu routines, athletes perform continuous movement sequences requiring sustained energy supply and recovery efficiency. Likewise, sanda competitions demand repeated high-intensity efforts supported by adequate aerobic conditioning.

To evaluate aerobic capacity efficiently, field-based testing methods remain widely utilized in sports science. Among these methods, the Cooper 12-minute run test is considered one of the most practical and valid approaches for estimating VO_2max. According to Alvarez Ramirez and Rodriguez (2021), the Cooper Test provides a reliable estimation of aerobic fitness while remaining cost-effective and accessible for coaches and practitioners. Bandyopadhyay (2020) further explained that the Cooper Test demonstrates acceptable validity and practicality for large-scale athlete fitness evaluations. Several Indonesian studies have also utilized the Cooper Test to assess physical fitness among athletes and students. Research involving football, volleyball, and martial arts athletes reported that the Cooper Test effectively identified variations in aerobic capacity and physical conditioning levels. These findings indicate that field-based VO_2max assessment can provide useful information for designing training programs and monitoring athlete readiness.

Although numerous studies have investigated VO_2max and aerobic fitness in sports, several important gaps remain. First, most previous studies focused on mainstream sports such as football, athletics, cycling, swimming, and general martial arts, while studies specifically examining wushu athletes remain limited, particularly at the regional club level in Indonesia. Existing literature predominantly discusses elite or national-level athletes, leaving local athlete development contexts underexplored. Second, many previous studies employed laboratory-based physiological testing methods that require sophisticated equipment, high operational costs, and controlled environments. Consequently, these approaches are less applicable for regional clubs with limited facilities and financial resources. There is still limited empirical evidence regarding the effectiveness and practicality of simple field-based methods such as the Cooper Test for evaluating VO_2max among local wushu athletes. Third, despite the increasing achievement trend shown by Gresik Wushu Club athletes, no structured scientific evaluation has specifically examined their aerobic fitness profile using standardized VO_2max measurements. This indicates a discrepancy between competitive achievement improvement and the availability of objective physiological evaluation data supporting athlete development programs. Fourth, previous Indonesian studies rarely integrate practical coaching implications into VO_2max assessment research. Many investigations only report descriptive fitness results without connecting findings to athlete development strategies and training program recommendations. Therefore, research that provides both physiological evaluation and practical coaching implications remains necessary.

Based on the identified problems and research gaps, this study aims to determine the level of physical fitness (VO_2max) among Gresik Wushu Club athletes using the Cooper Test (12-Minute Run). Specifically, this research seeks to provide an overview of athletes' aerobic endurance as a basis for evaluating physical fitness conditions and supporting the development of more structured and measurable training programs. The novelty of this study lies in several aspects. First, this research specifically focuses on wushu athletes at the regional club level, an area that has received limited scientific attention in Indonesia. Second, this study applies the Cooper Test as a simple, practical, and field-based method for estimating VO_2max among wushu athletes, offering an applicable alternative for clubs with limited laboratory facilities. Third, this research integrates physiological assessment with practical coaching evaluation, allowing the findings to contribute directly to athlete conditioning strategies and performance improvement programs.

Furthermore, this study is expected to enrich the scientific literature in sports physiology and coaching science, particularly regarding aerobic fitness evaluation in martial arts athletes. The findings may also serve as reference material for coaches, sports practitioners, and researchers in developing evidence-based physical conditioning programs adapted to athlete needs and club conditions. In conclusion, evaluating VO_2max among Gresik Wushu Club athletes is essential to understanding athlete readiness, endurance capacity, and physical conditioning quality. Given the increasing competitive demands in wushu, systematic aerobic fitness assessment becomes necessary to support sustainable athlete development and performance

consistency. Therefore, this study is expected to provide both theoretical contributions to sports science and practical benefits for coaching development through the implementation of accessible and scientifically grounded fitness evaluation methods.

METHODS

This study employed a quantitative descriptive research design using a cross-sectional approach to analyze the level of physical fitness (VO_2max) among Gresik Wushu Club athletes through the Cooper Test (12-minute run). A quantitative descriptive method was selected because it allows researchers to objectively measure and describe athletes' aerobic fitness conditions based on numerical data and physiological performance indicators. According to recent sports science studies, quantitative descriptive approaches are highly effective for profiling athlete fitness levels and evaluating physiological readiness in competitive sports environments (Lee et al., 2025). The cross-sectional design was considered appropriate because data collection was conducted at a single point in time to obtain a comprehensive overview of athletes' current aerobic endurance conditions without implementing experimental treatment (Wang et al., 2024).

The population in this study consisted of 10 active athletes from the Gresik Wushu Club who regularly participated in training and regional competitions. Because the total population was relatively small, the study used a total sampling technique in which all athletes were involved as research participants. Total sampling is frequently recommended in sports science research involving small athlete populations to maximize data representation and minimize sampling bias (Sanders, 2024). The participants included both male and female athletes within productive competitive age categories.

The primary instrument used in this study was the Cooper Test or 12-minute run test, which is widely recognized as a valid and practical field-based method for estimating maximal oxygen uptake (VO_2max). The Cooper Test measures the maximum distance covered by participants within 12 minutes of continuous running and converts the result into an estimated VO_2max value (Alvarez Ramirez & Rodriguez, 2021). This test was selected because it is economical, easy to administer, efficient for large groups, and does not require sophisticated laboratory equipment. Previous studies have demonstrated that the Cooper Test possesses acceptable validity and reliability for evaluating aerobic fitness in athletes and physically active populations (Bandyopadhyay, 2020). In addition to the Cooper Test, supporting instruments included observation sheets, a 30-meter tape measure, chest numbers, cones, and documentation equipment. Observation sheets were used to record athlete attendance, running performance, and test implementation procedures systematically. Cones were utilized to mark running tracks and turning points during the test, while chest numbers facilitated participant identification. Documentation techniques such as photographs and written records were also employed to strengthen research data and support administrative reporting processes.

Data collection was conducted through three primary techniques, namely testing, observation, and documentation. Before the test implementation, all athletes received

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instructions regarding test procedures, warm-up activities, pacing strategies, and safety considerations to ensure standardized implementation. Participants were instructed to run continuously for 12 minutes on a designated track while attempting to achieve maximum possible distance. The total running distance covered by each athlete was measured in meters using a tape measure and recorded immediately after the test. According to recent studies in sports physiology, standardized pre-test preparation and monitoring procedures are important to improve data validity and reduce measurement error during field-based fitness testing (Mei & Yuan, 2024).

The Cooper Test results were subsequently classified according to physical fitness level categories based on age and gender classification standards proposed by Wolters and Edward (2018). These classifications consisted of five categories, namely "Very Good," "Good," "Fair," "Poor," and "Very Poor." The categorization system provides practical interpretation of aerobic fitness conditions and enables coaches to identify athlete readiness levels more effectively. Previous research has emphasized that classification-based fitness evaluation assists coaches in designing individualized conditioning programs and monitoring long-term athlete development (Suprianto Kadir et al., 2024).

Furthermore, the estimated VO_2max values were calculated using the Cooper Test equation:

$$VO2\ MAx = \frac{\mathrm{d} - 504.9}{44.73}$$

where VO_2max represents maximum oxygen consumption (ml/kg/minute), and d refers to the total distance covered during the 12-minute run measured in meters. This formula has been widely applied in sports physiology studies as an indirect estimation of aerobic capacity because it demonstrates strong correlation with laboratory-based VO_2max measurements (Lee et al., 2025).

The data analysis technique used in this study was quantitative descriptive analysis. The collected data were tabulated and analyzed using descriptive statistical procedures, including frequency distribution, percentages, mean scores, and fitness category classification. Descriptive analysis was selected because the primary objective of this study was to provide an overview of athlete aerobic fitness levels rather than examine causal relationships between variables. According to contemporary sports performance research, descriptive statistical approaches remain highly relevant for athlete profiling and physiological monitoring studies, particularly in regional sports development contexts (Wang et al., 2024). Through this analytical approach, the study aimed to provide accurate and practical information regarding the VO_2max levels of Gresik Wushu Club athletes as a scientific basis for developing more structured and evidence-based training programs.

RESULTS AND DISCUSSION

Result

This study aimed to determine the level of physical fitness (VO_2max) among Gresik Wushu Club athletes using the Cooper Test (12-Minute Run). The results obtained provide

an overview of the athletes' aerobic endurance capacity based on the total distance covered during the 12-minute running test and the estimated VO_2max values calculated using the Cooper Test formula. The findings indicate varying levels of aerobic fitness among athletes, ranging from very poor to good categories.

Cooper Test Field Observation Results

The Cooper Test was conducted by measuring the total running distance achieved by each athlete within 12 minutes. The test results included the number of completed laps, additional running distance, total running distance, and test duration.

Table 1.
Cooper Test Field Observation Results

No	BIB	Name	Gender	Age	Round (400 m)	Additional Distance (m)	Total Distance (m)	Time (Minutes)
1	SSM	SSM	M	18	6	169.5	2569.5	12
2	MJM	MJM	M	17	5	258.75	2258.75	12
3	MRP	MRP	M	20	5	236	2236	12
4	ANNA	ANNA	F	13	4	48.5	1648.5	12
5	RSP	RSP	F	13	3	269.3	1468.3	12
6	SPER	SPER	F	16	4	143	1743	12
7	MB	MB	F	13	4	49.4	1649.4	12
8	MHP	MHP	M	20	6	46.9	2446.9	12
9	RCP	RCP	M	18	4	358.2	1958.2	12
10	MBS	MBS	M	16	6	137	2537	12

Based on Table 1, the highest running distance was achieved by athlete SSM with a total distance of 2569.5 meters, while the lowest distance was recorded by athlete RSP with 1468.3 meters. Most male athletes were able to complete between five and six laps, whereas female athletes generally completed three to four laps during the 12-minute running period. These findings indicate differences in aerobic endurance capacity among respondents. The average total running distance achieved by the athletes was approximately 2051.55 meters, indicating a moderate level of aerobic endurance among the athletes. The variation in total distance suggests differences in training adaptation, endurance capacity, and physical readiness among the athletes.

VO_2max Measurement Results and Fitness Categories

The total running distances obtained during the Cooper Test were subsequently converted into estimated VO_2max values using the Cooper Test formula. The results were then classified into fitness categories according to age-and gender-based Cooper Test standards.

Table 2.
Final Results of Cooper Test Measurement

No	Name	Gender	Age	Distance Traveled (m)	VO_2max (ml/kg/min)	Fitness Category	Time (Minutes)
1	SSM	M	18	2569.5	46.15	Good	12
2	MJM	M	17	2258.75	39.15	Fair	12
3	MRP	M	20	2236	38.70	Fair	12
4	ANNA	F	13	1648.5	25.57	Fair	12
5	RSP	F	13	1468.3	21.53	Poor	12
6	SPER	F	16	1743	27.67	Fair	12
7	MB	F	13	1649.4	25.58	Fair	12
8	MHP	M	20	2446.9	43.41	Good	12
9	RCP	M	18	1958.2	32.48	Very Poor	12
10	MBS	M	16	2537	45.43	Good	12
Average			**16.5**	**2051.55**	**34.57**		

Based on Table 2, the average VO_2max value of the athletes was 34.57 ml/kg/minute, indicating that the general aerobic fitness level of Gresik Wushu Club athletes was classified as moderate or adequate. Three athletes (30%) were categorized as having good physical fitness, five athletes (50%) were classified in the fair category, one athlete (10%) was categorized as poor, and one athlete (10%) was categorized as very poor. Athlete SSM achieved the highest VO_2max value of 46.15 ml/kg/minute, indicating strong aerobic endurance and good physiological adaptation to physical activity. Conversely, athlete RSP recorded the lowest VO_2max value of 21.53 ml/kg/minute, suggesting limited aerobic endurance capacity. Similarly, athlete RCP demonstrated a VO_2max value of 32.48 ml/kg/minute, which was classified within the very poor category according to the Cooper Test classification standards.

The findings indicate that although several athletes have reached good aerobic fitness levels, the majority still remain within the fair or moderate category. This condition suggests that improvements in endurance-based training programs are still required to optimize athlete physical fitness and competitive readiness.

Distribution of Athlete Fitness Categories

The percentage distribution of athlete fitness categories based on the Cooper Test classification is presented below.

Table 3.
Percentage Distribution of Wushu Athlete Fitness Categories

Fitness Category	Percentage
Good	30%
Fair	50%
Poor	10%
Very Poor	10%

The distribution results demonstrate that the majority of athletes were classified in the fair category, accounting for 50% of all respondents. This indicates that most athletes possessed moderate aerobic endurance capacity sufficient for general physical activity but still requiring improvement to support optimal competitive performance.

Furthermore, 30% of athletes were categorized as having good physical fitness, suggesting that several athletes had already achieved satisfactory aerobic conditioning levels. However, the presence of athletes in the poor and very poor categories, each representing 10%, indicates that some athletes still require significant improvement in aerobic endurance and overall physical conditioning.

Overall, the results suggest that the aerobic fitness profile of Gresik Wushu Club athletes remains at a moderate level. Although the club has demonstrated increasing competitive achievement, the physical fitness profile indicates the necessity for more structured, consistent, and individualized endurance training programs to improve athlete VO_2max capacity and maintain performance sustainability during training and competition.

Discussion

The results of this study demonstrated that the physical fitness level (VO_2max) of Gresik Wushu Club athletes generally fell within the "Fair" or moderate category based on the

Cooper Test classification. The average running distance achieved by the athletes during the 12-minute run was 2,051.55 meters, with an average VO_2max value of 34.567 ml/kg/minute. These findings indicate that the aerobic endurance capacity of the athletes remains adequate but has not yet reached the optimal level required to support maximal athletic performance in competitive wushu. Aerobic endurance is one of the most important physiological components in martial arts because athletes are required to maintain movement intensity, technical accuracy, and recovery ability during prolonged training and competition situations (Wang et al., 2024).

The variation in running distances and VO_2max values among athletes reflects differences in physiological adaptation, exercise intensity, training consistency, and individual physical condition. This study found that the highest distance covered was 2,569.5 meters by athlete SSM, while the lowest was 1,468.3 meters by athlete RSP. These findings confirm that aerobic endurance among the athletes remains uneven. According to Sanders (2024), variations in VO_2max among athletes are strongly influenced by training frequency, cardiovascular adaptation, muscle oxidative capacity, and exercise experience. Athletes who consistently engage in endurance-oriented conditioning programs generally possess greater aerobic efficiency and delayed fatigue onset during physical activity.

The findings of this study are consistent with previous studies indicating that VO_2max is closely associated with sports performance and endurance capacity. Lee et al. (2025) explained that VO_2max represents the body's maximal ability to transport and utilize oxygen during intense physical activity and serves as a key physiological indicator of cardiorespiratory fitness. Athletes with higher VO_2max values typically demonstrate better endurance performance, faster recovery, and greater tolerance to exercise intensity. In combat sports such as wushu, aerobic endurance becomes increasingly important because athletes repeatedly perform explosive movements combined with technical transitions and recovery periods during taolu and sanda performances (Mei & Yuan, 2024).

The Cooper Test classification results showed that three athletes, namely SSM, MHP, and MBS, were categorized as "Good," with VO_2max values of 46.15 ml/kg/minute, 43.41 ml/kg/minute, and 45.43 ml/kg/minute, respectively. These results indicate that several athletes already possess relatively strong aerobic endurance capacity. Athletes in this category are likely to have more efficient cardiovascular function, greater oxygen delivery capability, and improved muscle endurance during prolonged exercise. Previous research has emphasized that athletes with higher VO_2max values demonstrate superior movement sustainability and physiological resilience during high-intensity sports activities (Suprianto Kadir et al., 2024). The achievement of athletes within the "Good" category may also reflect the positive effects of consistent training exposure and competitive participation. Research in sports physiology has shown that systematic endurance training can increase stroke volume, capillary density, mitochondrial function, and oxygen transport efficiency, all of which contribute to VO_2max improvement (Bompa & Buzzichelli, 2019). Furthermore, athletes who regularly participate in competitions tend to develop stronger physiological adaptation because repeated exposure to competitive stress stimulates cardiovascular and metabolic efficiency (Issurin, 2021).

However, despite the presence of several athletes in the good category, the majority of respondents in this study remained in the "Fair" category. Five athletes MJM, MRP, ANNA, SPER, and MB demonstrated VO_2max values indicating moderate aerobic endurance. This condition suggests that the athletes possess sufficient fitness to perform routine training activities but still require further improvement to compete optimally at higher performance levels. According to McGuigan (2020), athletes classified within moderate aerobic fitness categories often experience limitations in sustaining exercise intensity during prolonged or repeated high-intensity efforts. The moderate VO_2max values observed in this study may be related to several factors, including inconsistent conditioning programs, insufficient aerobic training volume, limited recovery management, and varying training discipline among athletes. Previous studies have explained that aerobic endurance development requires structured, progressive, and continuous training programs involving overload principles and individualized exercise prescription (Kenney et al., 2021). Without systematic endurance training, athletes may fail to achieve optimal cardiovascular adaptation necessary for high-performance sports participation.

The findings also revealed that one female athlete (RSP) fell into the "Poor" category with a VO_2max value of 21.53 ml/kg/minute, while one male athlete (RCP) was classified within the "Very Poor" category with a VO_2max value of 32.48 ml/kg/minute. These results indicate that several athletes still demonstrate insufficient aerobic endurance capacity. Low VO_2max values are commonly associated with rapid fatigue onset, poor exercise tolerance, and limited recovery efficiency during intensive physical activity (Powers & Howley, 2021). In wushu performance, inadequate aerobic endurance may negatively affect movement precision, concentration, and technical consistency, especially during extended training sessions and competitive routines.

The lower aerobic fitness levels observed among some athletes may also be influenced by age, gender, training experience, and physiological maturity. Female athletes generally demonstrated lower running distances and VO_2max values compared to male athletes. This finding aligns with previous physiological studies explaining that males typically possess higher hemoglobin concentrations, larger cardiac output, and greater muscle mass, contributing to superior aerobic capacity compared to females (Wilmore et al., 2020). Nevertheless, aerobic endurance in female athletes can still be substantially improved through appropriate conditioning programs emphasizing cardiovascular adaptation and endurance development. The average VO_2max value obtained in this study (34.567 ml/kg/minute) indicates that the general physical fitness level of Gresik Wushu Club athletes remains within the moderate category. Although this level may still support routine training participation, it is not yet optimal for achieving higher competitive performance. According to Platonov (2022), elite combat sport athletes generally demonstrate VO_2max values exceeding 45–55 ml/kg/minute depending on sport specialization and training status. Therefore, the current VO_2max profile of the athletes suggests the necessity for more intensive and structured aerobic conditioning interventions. The use of the Cooper Test in this study also proved effective in providing practical evaluation of athlete aerobic fitness. The Cooper Test remains one of the most widely utilized field-based assessments because

it is simple, cost-efficient, and applicable in sports club environments lacking sophisticated laboratory equipment (Alvarez Ramirez & Rodriguez, 2021). Bandyopadhyay (2020) further emphasized that the Cooper Test demonstrates acceptable validity and reliability for estimating VO_2max in athletic populations. Consequently, the implementation of the Cooper Test can serve as an important monitoring instrument for coaches in evaluating athlete fitness progression periodically.

Furthermore, the findings of this study reinforce the importance of integrating aerobic conditioning into wushu training programs. Wushu athletes require not only technical skill mastery but also sufficient physical endurance to sustain movement quality and performance consistency. Research by Chaabene et al. (2018) explained that combat sports athletes benefit significantly from combined aerobic and anaerobic conditioning because both energy systems contribute to performance execution during matches and routines. Therefore, training programs emphasizing interval running, circuit training, aerobic endurance exercises, and recovery management may help improve VO_2max capacity among athletes. Another important implication of this study relates to athlete development and long-term coaching strategies. The presence of athletes in poor and very poor categories indicates that physical fitness evaluation should become a regular component of athlete monitoring systems. According to Gamble (2019), systematic fitness monitoring allows coaches to identify weaknesses, individualize training loads, and prevent overtraining or performance decline. Regular VO_2max assessment can therefore assist coaches in designing evidence-based conditioning programs tailored to athlete physiological needs.

In addition, psychological and motivational factors may also contribute to aerobic endurance performance. Athletes with strong motivation and disciplined training habits generally demonstrate better physiological adaptation compared to athletes with inconsistent participation patterns (Weinberg & Gould, 2019). The coach's statement regarding the need for improved athlete discipline supports the assumption that training consistency remains an important issue within the club environment. Consequently, improving athlete motivation, attendance, and training commitment may positively influence aerobic fitness development.

Overall, the findings of this study indicate that the physical fitness level (VO_2max) of Gresik Wushu Club athletes is predominantly categorized as "Fair," with only a limited number of athletes reaching the "Good" category. Although the club has shown increasing competitive achievement in recent years, the aerobic endurance profile suggests that athlete physical conditioning still requires substantial improvement. Therefore, more structured, progressive, and individualized endurance training programs are necessary to increase VO_2max capacity, optimize physiological adaptation, and support sustainable athlete performance during training and competition.

CONCLUSION

Based on the results of this study regarding the level of physical fitness (VO_2max) of Gresik Wushu Club athletes measured using the Cooper Test (12-minute run), it can be concluded that the overall cardiorespiratory fitness level of the athletes is categorized

as fair or moderate. The findings showed that the average distance covered by the athletes during the 12-minute run was 2051.55 meters, while the average VO_2max value reached 34.57 ml/kg/minute. These results indicate that the athletes possess sufficient aerobic endurance to support routine training activities, although their physical fitness levels have not yet reached optimal standards for high-performance competition.

Furthermore, the distribution of fitness categories demonstrated that 50% of the athletes were classified in the fair category, 30% were in the good category, while the poor and very poor categories each accounted for 10% of the total participants. These findings suggest that although several athletes already have relatively good aerobic endurance, there are still athletes with low physical fitness levels who require special attention and more intensive conditioning programs.

Therefore, improving athlete VO_2max capacity through structured, measurable, progressive, and sustainable endurance training programs is necessary to optimize athlete performance during training and competition. Regular physical fitness evaluation is also important to monitor athlete development and support evidence-based coaching programs in wushu achievement development.

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