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Interaction Between VO_2max and Sportspersonship: A Study on Middle-Distance Athletes of the Sportyjoy Club

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ABSTRACT

This study aims to identify the relationship between VO_2max, as an indicator of aerobic capacity, and sportspersonship, as a measure of sports participation orientation, among middle-distance runners of the Sportyjoy Club. The method used was a quantitative correlational approach with 10 study subjects selected through purposive sampling. VO_2max was measured using the Cooper 2.4 km run test, while sportspersonship was assessed using the Sports Participation Model Questionnaire (SPMQ). Data analysis employed descriptive statistics and Pearson correlation tests. The results showed that the average VO_2max of male participants (44.24 ± 6.59 ml/kg/min) was higher than that of female participants (41.92 ± 5.64 ml/kg/min). However, no significant linear relationship was found between VO_2max and sportspersonship ($r = -0.076$, $p = 0.836$). These findings indicate that VO_2max is not a primary predictor of sportspersonship among middle-distance athletes. It is recommended that training programs adopt a holistic approach encompassing both physical and mental aspects of athletes to comprehensively develop sportspersonship.

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A. Conception and design of the study;
B. Acquisition of data;
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D. Manuscript preparation;
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INTRODUCTION

As a primary parameter of cardiorespiratory fitness, aerobic function, and health status, VO_2max plays an essential role in assessing an individual's physical fitness level (Astorino et al., 2019). VO_2max reflects the efficiency of the body's oxygen transport and utilization system during intense activity, making it a key factor in measuring athletic performance (Casado et al., 2022a; Midgley et al., 2006; Vuorimaa et al., 2000). In the context of middle-distance running, VO_2max is one of the main determinants of an athlete's success (Dwitama & Wibowo, 2022).

VO_2max is a critical indicator of aerobic capacity and athletic performance, particularly in middle-distance sports. Study shows that VO_2max has a significant correlation with middle-distance running performance, as seen in studies linking

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increased VO_2max with improved critical speed and running performance (Jones et al., 2019; Rabadán et al., 2011). Additionally, VO_2max is used to differentiate between middle-distance and long-distance runners, highlighting its important role in determining athletic specialization (Rabadán et al., 2011) Higher VO_2max values enable middle-distance runners to sustain high-intensity efforts with greater energy efficiency, thus supporting optimal performance achievement (Millah & Priana, 2020).

In the context of middle-distance running, sportspersonship plays an important role in creating a healthy competitive atmosphere in sports. Sportspersonship includes elements such as fairness, equality, good conduct, and the desire to win—all of which must be balanced to maintain the integrity of competition (Abad, 2010). Sportspersonship helps athletes focus on self-improvement and achieving personal goals rather than solely pursuing victory (Malanov & Subaeva, 2021).

The motivation and goals of athletes in middle-distance sports can be significantly influenced by sportspersonship. Athletes with intrinsic motivation, such as enhancing self-esteem and mastering tasks, tend to demonstrate higher levels of sportspersonship. Conversely, extrinsic motivation, such as seeking social status, can lower sportspersonship levels (Ryska, 2003). Good sportspersonship not only enhances positive experiences in sports but also reduces negative behaviors and encourages sustained participation (Wells et al., 2008).

This study aims to identify the relationship between VO_2max and sportspersonship in middle-distance athletes at the Sportyjoy Club. By understanding this relationship, it is hoped to provide insights into how aerobic capacity and sportspersonship attitudes can influence each other in improving athletic performance.

METHODS

This study employs a quantitative correlational method to identify the relationship between the variables VO_2max (aerobic capacity) and sportspersonship (orientation in sports participation). A quantitative correlational study is a type of study aimed at determining the extent of the relationship between two or more quantitative variables without manipulating those variables (Fraenkel et al., 2023).

The study involved 10 middle-distance athletes from the Sportyjoy Club, consisting of 8 males and 2 females aged 10-14 years. The sampling technique used was purposive sampling based on specific criteria, namely active athletes participating in regular training programs. Purposive sampling was chosen because this technique is effective in focusing on populations with specific characteristics relevant to the study's objectives (Fraenkel et al., 2023). The study was conducted on the Pajajaran athletic track in Bandung in December 2024.

Instruments

VO_2max Test

VO_2max was measured using the Cooper 2.4 km run test to estimate the athletes' aerobic capacity. The Cooper test has proven effective in assessing VO_2max in large

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populations and is more practical as it does not require laboratory equipment (Syafrina et al., 2022). The Cooper test has been validated as a reliable method for predicting VO_2max in recreational runners and college students. Studies have shown a significant correlation between the distance covered in the Cooper test and VO_2max, making it a dependable testing tool (Alvero-Cruz et al., 2019; Bandyopadhyay, 2014). In 2013, the Singapore Football Association replaced the bleep test with a 2.4 km fitness run as a mandatory requirement. A similar approach is used by the United States Navy, which includes a 1.5-mile run as part of its physical fitness evaluation (Millah & Priana, 2020).

For recreational runners, the Cooper test has demonstrated better accuracy in predicting half-marathon race times compared to laboratory methods, with distance covered being the best predictor of running performance (Alvero-Cruz et al., 2019). Another study found that although differences in Maximal Aerobic Speed (MAS) exist between middle-distance runners and endurance athletes in non-running sports, VO_2max values measured remained comparable. This indicates that the Cooper test can be broadly applied across different athlete groups (Casado et al., 2022).

Implementation of the 2.4 Km Run Test (Bushman, 2017)

Test Administration

1. Objective: The test aims to measure an individual's aerobic capacity.
2. Required Equipment: A 400-meter running track and a stopwatch.
3. Execution Procedure:
   - The test involves completing six laps of a 400-meter track as quickly as possible.
   - Participants start from the starting line, and the stopwatch begins when the command "Go" is given.
   - Participants may choose their pace based on their abilities. Walking is permitted but discouraged as it may affect test results.
4. Scoring: The time taken to complete the 2.4 km run is recorded as the test score.
5. Norms: The running time results are used to classify participants' VO_2max levels according to the table provided below:

Table 1.

VO_2max Classification (ml/kg/min) Using the Cooper 2.4 Km Test for Ages 11 to 14.

Category	Female	Male
Very Weak	< 33,0	< 38,7
Weak	33,0-36,4	38,7-43,3
Regular	36,5-38,7	43,4-47,9
Good	38,8-42,4	48,0-52,2
Very Good	≥ 42,5	≥ 52,3

Source: (Rodrigues et al., 2006).

Survey

The instrument used is the Sports Participation Model Questionnaire (SPMQ), designed to evaluate sports participation orientation. The SPMQ is a tool developed to assess sports participation orientation based on two main paradigms: Pleasure and Participation and Power and Performance (Aicinena, 2018).

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Data analysis in this study was conducted descriptively, consisting of: Descriptive Analysis of VO_2max, Descriptive Analysis of Sportspersonship, and using correlation testing with JASP software to measure the relationship between the VO_2max variable and sportspersonship scores. The descriptive approach is often used to present data in an informative and easily understandable way, making it very suitable for studies aimed at providing a general or specific overview of certain variables (Fraenkel et al., 2023). This methodology allows the study to provide a clear picture of data patterns and helps in identifying significant differences between sample groups.

The following formulas were used in this study:
The formula used to calculate VO_2max in this study is as follows:
VO_2max = (483 ÷ ____ time in minutes) + 3.5
Source: (Bushman, 2017).
The formula used to calculate standard deviation in this study is:

$$\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{N}}$$

Description:
σ = standard deviation
N = number of participants
x_i = individual value of each participant
μ = mean
Source: (Setiawan, 2018).
The mean score (mean) was calculated using the following formula:

$$\bar{x} = \frac{\sum fix}{n}$$

Description:
$\bar{x}$ = calculated mean value
x = midpoint of scores for each class with a value of c = 0
$\sum$ = summation symbol
fi = frequency
n = total sample size
Sumber: (Sugiyono (2013).

RESULTS AND DISCUSSION

Table 2.
VO_2max Results Based on Category and Average

Group	Participants	VO_2Max	Category	Mean	Standard Deviation VO_2max
Female	P1	43,60	Very Good	41,92	5,64
	P2	40,24	Good		
Male	P3	55,29	Very Good	44,24	6,59
	P4	50,46	Good		
	P5	48,72	Good		
	P6	48,28	Good		
	P7	43,62	Regular		
	P8	34,70	Very Weak		
	P9	41,40	Weak		
	P10	37,45	Very Weak		

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The VO_2max measurement results for the middle-distance runners of the Sportyjoy Club are presented in Table 2. In the female group, the average VO_2max is 41.92 ± 5.64 ml/kg/min, categorized as good to very good. The highest recorded VO_2max for females was 43.60 ml/kg/min (very good category), and the lowest was 40.24 ml/kg/min (good category).

The male group had a higher average VO_2max of 44.24 ± 6.59 ml/kg/min, with a broader range of categories. The highest VO_2max in the male group was 55.29 ml/kg/min (very good category), while the lowest was 34.70 ml/kg/min (very weak category). The VO_2max categories in the male group ranged from very weak to very good, indicating cardiovascular fitness variation among participants. These results align with previous studies on VO_2max, which found that males tend to have higher VO_2max compared to females due to differences in heart size, lung volume, haemoglobin mass, and body composition. Males have a higher oxygen capacity due to greater oxygen transport ability (Santisteban et al., 2022)

VO_2max is influenced by physiological factors such as body size, biomechanical efficiency, and cardiovascular adaptations. Males tend to have higher VO_2max values compared to females due to larger haemoglobin mass, higher lung capacity, and more efficient skeletal muscles in oxygen transport (Jones et al., 2019).

Table 3.
Sportspersonship Scores Based on VO_2max Categories

Category	Participants	Mean	Standard Deviation
Very Weak	P8, P10	79, 5	6,5
Weak	P9	78	0
Regular	P7	89	0
Good	P2, P4, P5, P6	86,75	4,82
Very Good	P1, P3	80	6

Table 3 presents the sportspersonship scores grouped according to VO_2max categories. In the very poor VO_2max category, consisting of participants P8 and P10, the average sportspersonship score was recorded at 79.5 with a standard deviation of 6.5. This score is relatively lower compared to other categories, indicating that athletes with very poor aerobic capacity tend to have a lower level of sportspersonship. The high variation in sportspersonship scores is also reflected in the fairly large standard deviation. Meanwhile, in the poor VO_2max category, there is only one participant, P9, with a sportspersonship score of 78, which is also one of the lowest scores among all categories. Since there is only one participant, there is no variation in this score.

In the regular VO_2max category, represented solely by participant P7, the recorded sportspersonship score is 89, with a standard deviation of 0, indicating no variation since there is only one participant in this category. This score is relatively higher compared to the previous categories, suggesting that athletes with regular VO_2max tend to have better sportspersonship. The good VO_2max category, consisting of participants P2, P4, P5, and P6, recorded an average sportspersonship score of 86.75 with a standard deviation of 4.82. Although the average score in this category is relatively high, the larger

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standard deviation indicates variation in sportspersonship levels among participants despite having similar fitness levels.

In the very good VO_2max category, represented by participants P1 and P3, the recorded sportspersonship score is 80, with a standard deviation of 6. Despite the athletes in this category having very good VO_2max, their sportspersonship scores are lower compared to the good or regular VO_2max categories. The fairly large variation in sportspersonship scores in this category is also seen with the high standard deviation, indicating differences between participants, even though they belong to the very good VO_2max category.

Overall, the sportspersonship scores based on VO_2max categories show that there is no clear relationship between cardiovascular fitness levels and sportspersonship. While athletes with better VO_2max tend to have higher sportspersonship scores, some exceptions, such as in the very good VO_2max category, suggest that other factors may also play a role. This indicates that sportspersonship is not solely influenced by physical fitness but also by other factors, such as experience, values acquired from training, and mental aspects. Therefore, the development of sportspersonship should not only rely on physical fitness improvement but also on a holistic approach that considers the mental aspects and experiences of the athletes.

Table 4.

Correlation Analysis of VO_2max and Sportspersonship

Variable		VO2Max	Sportspersonship Score
1. VO2Max	Pearson's r	-	
	p-value	-	
2. Sportspersonship Score	Pearson's r	-0.076	-
	p-value	0.836	-

Table 4 presents the results of the correlation analysis between VO_2max and sportspersonship scores using Pearson's r test. In this table, the Pearson correlation value for the relationship between the two variables is -0.076, indicating a very weak negative correlation. This means that although there is a slight relationship between VO_2max and sportspersonship, the strength of this relationship is very low and tends to be insignificant.

It is important to note that the correlation value very close to zero (in this case, -0.076) suggests that there is no strong linear relationship between VO_2max (aerobic capacity or cardiovascular fitness) and sportspersonship (attitudes and orientation towards sports). This implies that while a person's physical fitness, as measured by VO_2max, may influence athletic performance, it is not directly related to the sportspersonship attitudes displayed by the athlete.

Additionally, the p-value recorded in this analysis is 0.836, which is much greater than the commonly used significance level in research, which is 0.05. This p-value indicates that the relationship between VO_2max and sportspersonship scores is not statistically significant. In other words, there is not enough evidence in the data to state that VO_2max and sportspersonship influence each other within the context of this study.

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Results indicated that VO_2max is not the primary predictor of sportspersonship in middle-distance athletes of the Sportyjoy Club. Although athletes with higher VO_2max tend to have better fitness levels, these results suggest that other factors, such as experience, mental training, or values taught within the team, may play a more significant role in shaping the athletes' sportspersonship.

These correlation results indicate that, although there is variation in VO_2max and sportspersonship levels among athletes, there is no significant relationship between the two. Therefore, effective training programs should not only focus on improving physical fitness but also on the development of mental, social, and sportsmanship aspects in sports.

CONCLUSION

The analysis results of this study reveal that, while there is observable variation in both VO_2max and sportspersonship scores among the participants, no significant correlation was found between cardiovascular fitness levels (as measured through VO_2max) and sportspersonship. Specifically, the data shows that the variation in VO_2max levels, which reflect the participants' aerobic capacity, does not correspond to a clear trend in sportspersonship scores. This lack of a significant relationship suggests that VO_2max, despite being a crucial indicator of physical fitness, does not serve as the primary predictor of sportspersonship in middle-distance athletes at the Sportyjoy Club.

Sportspersonship, defined as the ethical and moral behaviour demonstrated by athletes during competition, encompasses traits such as fairness, respect, and the desire to perform well while maintaining a sense of integrity. The findings of this study imply that sportspersonship is influenced by factors beyond just physical fitness. While a high VO_2max may indicate better cardiovascular endurance, it does not automatically translate to higher levels of sportspersonship. It is more likely that sportspersonship in these athletes is shaped by a variety of other components. These may include the athlete's previous experience in sports, their mental resilience, and the values instilled in them through their coaching and training environments. For example, an athlete with extensive experience may have a more developed sense of sportspersonship simply due to exposure to various competitive scenarios where they have learned to manage emotions, respect opponents, and handle victory or defeat with grace.

Moreover, mental training could play a critical role in fostering sportspersonship. Techniques such as visualization, mindfulness, and psychological resilience exercises can encourage athletes to focus on personal growth and fair play rather than solely on physical performance. Additionally, the values promoted during coaching, such as teamwork, respect, and empathy, may have a profound impact on an athlete's approach to competition, irrespective of their physical fitness levels.

The findings of this research provide valuable insights into sports programs and coaching practices. They highlight that the development of sportspersonship is not solely dependent on an athlete's physical capabilities or cardiovascular fitness but is

instead shaped by a more complex interplay of physical, mental, and emotional factors. Therefore, coaching programs should adopt a holistic approach that balances the physical training needed to enhance cardiovascular fitness with mental and emotional development. Such an approach would involve teaching athletes the psychological and moral aspects of sports, promoting positive attitudes toward competition, and encouraging personal growth in both physical and ethical dimensions. By incorporating this broader focus, coaching programs can foster well-rounded athletes who not only excel physically but also demonstrate exemplary behaviour both on and off the field.

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