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Relationship Between Jogging Habit and Freestyle Swimming Speed

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ABSTRACT

This study aimed to examine the relationship between jogging habits and freestyle (crawl) swimming speed, as freestyle speed is a key indicator of swimming performance influenced by both technical mastery and physical conditioning. Jogging is a commonly practiced aerobic exercise that has the potential to enhance cardiorespiratory endurance, lower limb muscular endurance, and overall energy efficiency, which theoretically may support swimming performance. However, empirical evidence regarding the relationship between habitual jogging and freestyle swimming speed remains limited and inconclusive. This study employed a quantitative method with a correlational approach. The population consisted of students at a State University of Education in Indonesia, with a sample of 169 students selected based on predetermined inclusion criteria. Jogging habits were measured using a questionnaire adapted from the International Physical Activity Questionnaire (IPAQ), while freestyle swimming speed was assessed using a 25-meter freestyle swimming test recorded in seconds. Data analysis was conducted using SPSS version 25. After normality testing indicated non-normal data distribution, the Spearman's rank correlation test was applied to examine the relationship between variables. The results revealed a significant relationship between jogging habits and freestyle swimming speed ($r = -0.316$; $p < 0.01$). The negative correlation indicates that higher levels of jogging habits were not consistently associated with faster swimming speed. This finding suggests that while jogging contributes to general physical fitness, excessive reliance on jogging without adequate swimming-specific training may not optimally support freestyle swimming performance. In conclusion, jogging habits are significantly related to freestyle swimming speed but are not a dominant determinant of performance. Jogging should therefore be positioned as a supplementary or cross-training activity, integrated with technical and sport-specific swimming training. This study contributes empirical evidence to sports science literature and provides practical insight for athletes, coaches, and educators in designing balanced and evidence-based training programs.

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A. Conception and design of the study;
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INTRODUCTION

Physical activity is a fundamental component in maintaining health and improving athletic performance, both in the general population and athletes. Regular physical exercise has been shown to improve heart function, accelerate the regeneration of

physiological structures, and support the efficiency of the cardiovascular and musculoskeletal systems (Physical & Sports, 2020; Warburton et al., 2017). In addition to its health-oriented nature, exercise also has recreational and psychological dimensions that contribute to the continued participation of individuals in physical activity. One example is swimming, known as a fun, safe, and low-risk activity (Muhammad Nur Alif, 2021; Barbosa et al., 2019).

In the context of competitive sports, athlete performance is determined not only by technical mastery but also by the complex interactions between physical, psychological, and physiological conditions (Ilham, 2021; Mujika et al., 2018). Swimming, particularly freestyle, is a sport that demands high physical capacity, precise motor coordination, and optimal biomechanical efficiency. Freestyle is known as the fastest and most dominant stroke used in competitions, so freestyle swimming speed is often used as a primary indicator in assessing swimmer performance (Morais et al., 2021; Rezeky et al., 2025).

In coaching practice, improving freestyle swimming speed is generally focused on training in water techniques, such as arm coordination, leg movement, and breathing control. However, various empirical reports indicate that even though athletes or swimming students regularly participate in technique training, swimming speed improvements are often suboptimal (Hendra et al., 2022; Ashwad, 2022). This condition indicates that general physical condition factors, particularly cardiorespiratory endurance and leg muscle strength, have not been fully developed in a planned and integrated manner.

Jogging is a form of land-based aerobic exercise that is easy to perform, economical, and commonly practiced by students and athletes as a habit. Theoretically, jogging has the potential to increase VO_2max, cardiovascular efficiency, and leg muscle strength and endurance, which play a crucial role in swimming propulsion (Midgley et al., 2018; Saunders et al., 2020). However, there is currently no empirical evidence to support the relationship between regular jogging and freestyle swimming speed. This lack of scientific evidence raises doubts about the use of jogging as an evidence-based supplementary training for swimming.

Research into the factors influencing freestyle swimming speed has advanced rapidly over the past decade. Several studies emphasize the importance of physiological capacities, such as aerobic endurance, muscle strength, and neuromuscular efficiency, in determining swimming performance (Barbosa et al., 2019; Morais et al., 2021). Biomechanical studies indicate that leg muscles contribute significantly to body speed and stability in the water during freestyle swimming (Figueiredo et al., 2016).

Land-based studies (dry-land training) have also shown positive results. Boik et al. (2025) reported that programmed 20-meter back-and-forth sprint training significantly increased freestyle swimming speed. These findings confirm that land training has a positive transfer to swimming performance. However, this approach is a structured intervention with a specific dosage and intensity, and therefore does not represent everyday aerobic activities such as jogging.

Another study by Ashwad (2022) highlighted the relationship between arm and leg muscle endurance and freestyle swimming speed. The results showed a significant correlation between muscle strength components and swimming performance. This finding is supported by research by Girold et al. (2017) and Amaro et al. (2019), which emphasized the role of strength and endurance training in improving swimming speed. However, most of these studies focused on specific physical components, rather than habit-based physical activity patterns.

On the other hand, numerous studies have also been conducted on anthropometric factors. Hendra et al. (2022) found that height and weight were associated with freestyle swimming speed, demonstrating the importance of morphological characteristics in swimming performance. However, anthropometric factors are relatively static and difficult to modify through short-term training, thus insufficient to address the need for easily implemented intervention-based performance development.

In general, the state of the art indicates that increasing freestyle swimming speed has been studied through technical approaches, specific physical training, and anthropometric characteristics. However, studies that prioritize land aerobic activity habits, such as jogging, are still very limited.

Based on a review of the current literature, several significant research gaps remain. First, the majority of studies place land training in the form of structured programs with specific intensities and durations, while habitual physical activity has not been widely explored in the context of swimming performance. Second, although jogging is known to be effective in improving cardiorespiratory endurance and leg strength, there is no empirical evidence specifically examining the relationship between jogging habits and freestyle swimming speed.

Third, most studies use experimental or correlational approaches, focusing on physiological or biomechanical variables, but rarely combine the measurement of physical activity habits using survey instruments with direct measurements of swimming performance. Fourth, the context of university students or beginner-intermediate swimmers as research subjects has received relatively little attention, even though this group has different training characteristics and physical habits than elite athletes (Mujika et al., 2018; Pyne & Sharp, 2019).

These limitations demonstrate the urgent need for research examining the relationship between jogging as a land aerobic activity and freestyle swimming speed, using a systematic, empirical approach that is relevant to daily coaching practice.

Based on the identified research problems and gaps, the objective of this study is to analyze the relationship between jogging and freestyle swimming speed in college students. Jogging habits were measured systematically using a standardized questionnaire, while freestyle swimming speed was measured using a 25-meter swim test as an objective performance indicator.

The novelty of this study lies in: (1) the use of jogging as the primary variable, rather than a structured training program; (2) the integration of a physical activity habit survey approach with direct swimming performance measurements; and (3) its empirical

contribution to the development of a simple, inexpensive, and easy-to-implement training model for supporting swimming. Therefore, the results of this study are expected to enrich the scientific literature in the field of sports science and provide a scientific basis for the evidence-based use of jogging as a land exercise to support freestyle swimming speed improvement.

METHODS

Research Design

This study employed a quantitative research method with a descriptive correlational design. This approach was selected because it is appropriate for examining the degree and direction of relationships between variables using numerical data and statistical procedures (Creswell & Creswell, 2018; Field, 2018). Correlational designs are widely used in sports science to explore associations between habitual physical activity and performance outcomes without manipulating the independent variable (Thomas, Nelson, & Silverman, 2015; Hopkins et al., 2019).

The descriptive correlational approach allowed the researchers to (1) describe the characteristics of jogging habits among students and (2) determine the relationship between jogging habits as the independent variable and freestyle swimming speed as the dependent variable. This design is considered suitable for investigating habitual behaviors, such as jogging, that naturally occur in daily life and may influence physiological and performance-related outcomes (Sallis et al., 2016; Bauman et al., 2017). Moreover, correlational analysis has been frequently applied in swimming research to examine the contribution of physical activity patterns, fitness components, and anthropometric factors to swimming performance (Morais et al., 2021; Barbosa et al., 2019).

Population and Sample

The population of this study consisted of students enrolled at a State University of Education in Indonesia, particularly those participating in aquatic-related courses. The sample comprised 169 students who were actively enrolled in swimming or aquatic learning courses during the academic period of data collection. This sample size meets the minimum requirements for correlational research, ensuring adequate statistical power to detect meaningful relationships between variables (Hair et al., 2019; Pallant, 2020).

Participants were selected using a total sampling approach, as all students who met the inclusion criteria were involved in the study. The inclusion criteria included: (1) active participation in aquatic courses, (2) physical readiness to perform a 25-meter freestyle swimming test, and (3) willingness to participate voluntarily. The use of student samples is consistent with previous sports science studies examining the relationship between physical activity habits and performance-related variables (Girold et al., 2017; Pyne & Sharp, 2019).

Instruments and Data Collection

Data were collected using two primary instruments: a jogging habit questionnaire and a freestyle swimming speed test.

Jogging Habit Questionnaire

Jogging habits were assessed using a questionnaire adapted from the International Physical Activity Questionnaire (IPAQ) framework (Schuhl, 2019; Craig et al., 2017). The IPAQ has been widely validated and used internationally to measure habitual physical activity, including aerobic activities such as jogging, across different populations (Bauman et al., 2017; Lee et al., 2021). In this study, the questionnaire was modified and translated into Indonesian to ensure cultural and linguistic appropriateness.

The questionnaire measured several dimensions of jogging habits, including frequency, duration, intensity, and consistency, as well as exercise frequency related to lower limb strength development. Prior to data collection, the instrument underwent content validity testing through expert judgment, involving experts in sports science and physical education, to ensure alignment with the construct of jogging habits (Haynes et al., 2016). Reliability testing was conducted using Cronbach's Alpha, with coefficients meeting acceptable thresholds for internal consistency ($\alpha \geq 0.70$), consistent with methodological standards in behavioral and sports research (Taber, 2018; Pallant, 2020).

Freestyle Swimming Speed Test

Freestyle swimming speed was measured using a 25-meter freestyle swimming test, which is commonly used to assess short-distance swimming performance and speed capacity (Garrido et al., 2018; Morais et al., 2021). Performance was recorded in seconds, with shorter times indicating higher swimming speed. A digital stopwatch with precision to the hundredth of a second was used to ensure measurement accuracy, as recommended in swimming performance assessment protocols (Figueiredo et al., 2016; Barbosa et al., 2019).

Prior to testing, participants performed a standardized warm-up to minimize injury risk and ensure optimal physiological readiness (McGowan et al., 2015). Attendance was checked to ensure consistency between questionnaire data and performance test data. At the start of the test, participants assume a water-start position with one hand holding the pool wall. The test commenced upon the sound of a whistle, simultaneously triggering the stopwatch when the participant released the wall.

Participants were instructed to perform pure freestyle (front crawl) swimming, without assistance from the pool floor or the use of non-freestyle movements. Timing was stopped when one of the participant's hands touched the pool wall at the 25-meter mark. This standardized procedure aligns with established swimming test protocols to enhance reliability and reduce measurement error (Hopkins et al., 2019; Amaro et al., 2019).

Data Analysis

Data from the jogging habit questionnaire were processed to obtain a total jogging habit score for each participant, while swimming performance data were obtained from the 25-meter freestyle swimming time (seconds). Prior to hypothesis testing, descriptive statistics were calculated to summarize participant characteristics and variable distributions. Assumption testing, including normality and linearity, was conducted to ensure the appropriateness of parametric statistical analysis (Field, 2018; Hair et al., 2019).

The relationship between jogging habits and freestyle swimming speed was analyzed using correlation analysis. All statistical analyzes were performed using SPSS

version 25, which is widely used in sports science research for quantitative data analysis (Pallant, 2020). The level of statistical significance was set at $p < 0.05$. This analytical approach enables valid interpretation of the strength and direction of the relationship between habitual jogging behavior and swimming speed performance.

RESULTS AND DISCUSSION

Result

Next, the data is described first to find the minimum, maximum, mean and standard deviation values using descriptive statistical tests, the results of which are presented in table 1.

Table 1.
Descriptive Statistcs

	N	Minimum	Maximum	Mean	Std. Deviation
Kebiasaan Jogging	121	1.60	3.60	2.7124	.43562
Kecepatan Renang	121	20.10	55.80	34.6653	5.87704
Valid N (listwise)	121				

Based on the Descriptive Statistics table, the number of respondents analyzed in this study was 121, and all data were declared valid. For the jogging habit variable, the minimum value was 1.60 and the maximum value was 3.60, with a mean of 2.7124 and a standard deviation of 0.43562. These results indicate that respondents' jogging habits were moderate, with a relatively homogeneous distribution. Furthermore, the swimming speed variable had a minimum value of 20.10 and a maximum of 55.80, with a mean of 34.6653 and a standard deviation of 5.87704. These values indicate that respondents' swimming speeds were moderate, with considerable variation in ability among respondents.

Based on these descriptive statistics, it can be concluded that respondents in this study had relatively uniform levels of jogging habits, while swimming speeds showed greater variation. Thus, the data obtained met sufficient characteristics for further analysis to further understand the relationship between jogging habits and swimming speed.

Next, prerequisite tests were conducted to ensure that the research data met the necessary assumptions before further statistical analysis. Meeting these prerequisites is crucial to ensure the test results are valid and scientifically accountable. In this study, the prerequisite test used was the normality test to determine whether the data were normally distributed.

Table 2.
Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Kebiasaan Jogging	.096	121	.008	.967	121	.005
Kecepatan Renang	.081	121	.050	.977	121	.036

Based on the table above, a normality test was conducted on two research variables: jogging habits and swimming speed, with a sample size of 121 respondents. The normality test used two methods: the Kolmogorov-Smirnov and the Shapiro-Wilk test, each of which aims to determine whether the data is normally distributed based on

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its significance value (Sig.). For the jogging habits variable, the Kolmogorov-Smirnov test showed a significance value of 0.008, while the Shapiro-Wilk test showed a significance value of 0.005. Both values are lower than the 0.05 significance level, thus concluding that the jogging habits data are not normally distributed. Furthermore, for the swimming speed variable, the Kolmogorov-Smirnov test showed a significance value of 0.050, which is within the 0.05 significance level, while the Shapiro-Wilk test showed a significance value of 0.036. Because the Shapiro-Wilk significance value is less than 0.05, the swimming speed data are also considered non-normally distributed.

A correlation test was then conducted to determine whether there was a relationship between freestyle swimming speed and jogging habits. The results are presented in Table 3.

Table 3.
Correlations Test

			Jogging Habits	Swimming Speed
Spearman's rho	Jogging Habits	Correlation Coefficient	1.000	-.316**
		Sig. (2-tailed)	.	.000
		N	121	121
	Swimming Speed	Correlation Coefficient	-.316**	1.000
		Sig. (2-tailed)	.000	.
		N	121	121

Based on the Correlations table, the analysis of the relationship between jogging habits and swimming speed was conducted using the Spearman's rank correlation test with 121 respondents. The Spearman's rank test was chosen because the previous data did not meet the assumption of normality. The analysis results showed a correlation coefficient of -0.316 between jogging habits and swimming speed, with a significance value (Sig. 2-tailed) of 0.000.

The correlation coefficient of -0.316 indicates a negative relationship between jogging habits and swimming speed, with a low to moderate level of closeness. This negative relationship indicates that as respondents' jogging habits increase, their swimming speed tends to decrease, and vice versa. Furthermore, a significance value of less than 0.01 indicates that the relationship is statistically significant at the 99% confidence level.

Therefore, it can be concluded that there is a significant relationship between jogging habits and swimming speed, but the relationship is negative. These results confirm that jogging habits are related to swimming speed, although the direction of the relationship is not consistent. Therefore, this finding requires further analysis in the discussion to determine the influencing factors.

Table titles should be at the top, while the titles of figures, photographs, or graphs should be placed below them. For English writing, thousands are indicated by a comma; for example, 1200300 is written as 1,200,300. The decimal point is indicated by a period followed by two digits, for example, 12.34. For numbers below 1, zeros are not required, for example, 0.12. Alphabetic letters are italicized for mathematical symbols or notation, but Greek letters are written in upright form using the correct symbols. The equals sign

is spaced before and after it; for example (English format): r = 0.456; p = 0.008. For statistical values with degrees of freedom, such as t, F, or Z, the degrees of freedom are enclosed in curly brackets, such as t(52) = 1.234; F(1, 34) = 4.567.

Discussion

Relationship Between Jogging Habit and Freestyle Swimming Speed

The findings of this study demonstrate that jogging habits are significantly associated with freestyle swimming speed, confirming that land-based physical activity is not isolated from aquatic performance. This result supports the broader perspective in sports science that general physical conditioning contributes to sport-specific performance through physiological transfer mechanisms (Mujika et al., 2018; Pyne & Sharp, 2019). Jogging, classified as a light-to-moderate intensity aerobic exercise, is widely recognized for its role in improving cardiorespiratory endurance and overall aerobic fitness (Lamusu, 2018; Midgley et al., 2018). Enhanced aerobic capacity improves the efficiency of oxygen uptake, transport, and utilization, which is essential for sustaining high-intensity activity over time (Iskandar, 2023; Saunders et al., 2020).

In freestyle swimming, cardiorespiratory endurance plays a critical role, as swimmers are required to maintain rhythmic, continuous movement while resisting water drag (Morais et al., 2021; Rezeky et al., 2025). A well-developed aerobic system allows swimmers to delay fatigue, maintain stroke efficiency, and preserve swimming speed throughout the distance. Therefore, from a theoretical standpoint, jogging contributes to the development of basic physiological fitness that underpins swimming performance, particularly in short- to middle-distance freestyle events (Barbosa et al., 2019; Garrido et al., 2018).

Beyond cardiorespiratory adaptations, jogging also induces neuromuscular benefits, particularly in the lower limbs and core musculature. Repetitive running movements stimulate muscular endurance, strength, and postural stability, which are relevant to swimming mechanics (Dharma & Boy, 2020; Kusmita et al., 2022). In freestyle swimming, leg propulsion generated through the flutter kick contributes to forward momentum and body stabilization, while core strength supports streamlined body alignment and efficient coordination between upper and lower extremities (Niartiningsih et al., 2023; Figueiredo et al., 2016). Consequently, jogging can be conceptualized as a cross-training modality that enhances general physical preparedness before or alongside specific water-based training (Girold et al., 2017; Amaro et al., 2019).

However, an important finding of this study is that the relationship between jogging habits and freestyle swimming speed was negative, indicating that increased jogging frequency or intensity was not consistently accompanied by improved swimming speed. This phenomenon can be explained through the principle of training specificity, which emphasizes that performance adaptations are most effective when training closely matches the movement patterns, muscle recruitment, and environmental demands of the sport (Renang & Bebas, 2022; Issurin, 2016). Jogging primarily involves cyclical lower-limb movements on land, whereas freestyle swimming relies heavily on upper-body

propulsion, breathing coordination, and hydrodynamic adaptation in a water medium. As a result, the transfer of jogging-induced adaptations to swimming speed may be limited if not balanced with sufficient sport-specific training.

These findings align with previous research indicating that technical proficiency and sport-specific conditioning exert a more direct influence on freestyle swimming speed than general physical activity alone (Ashwad, 2022; Morais et al., 2021). Excessive jogging may also lead to accumulated fatigue in the lower limbs, potentially compromising the quality or volume of swimming training sessions (McGowan et al., 2015; Mujika et al., 2018). Furthermore, time allocation to jogging may inadvertently reduce time spent on technical drills in the pool, which are critical for refining stroke mechanics and efficiency (Pyne & Sharp, 2019).

Factors Contributing to the Relationship Between Jogging and Freestyle Swimming Speed

The association between jogging habits and freestyle swimming speed can be primarily attributed to improvements in cardiorespiratory capacity resulting from regular aerobic exercise. Jogging effectively stimulates central and peripheral cardiovascular adaptations, including increased stroke volume, capillary density, and mitochondrial efficiency, which enhance aerobic metabolism (Dharma & Boy, 2020; Midgley et al., 2018). These adaptations support sustained energy production and delay the onset of fatigue during high-intensity swimming tasks (Palar et al., 2015; Saunders et al., 2020).

Additionally, jogging contributes to muscular endurance and stability, particularly in the lower extremities and core. Stronger and more fatigue-resistant leg muscles enhance the effectiveness of the flutter kick, while improved core stability facilitates a streamlined body position that minimizes drag and energy loss in the water (Kusmita et al., 2022; Niartiningsih et al., 2023). This interaction between general muscular conditioning and swimming biomechanics helps explain why jogging habits show a measurable relationship with freestyle swimming performance. Empirical evidence from Ashwad (2022) further supports this interpretation, demonstrating a significant correlation between leg muscle endurance and freestyle swimming speed.

Nevertheless, swimming performance remains a multifactorial construct influenced by technique, coordination, anthropometry, and specific physiological adaptations to the aquatic environment (Barbosa et al., 2019; Hendra et al., 2022). Therefore, jogging should not be viewed as a substitute for swimming-specific training. Instead, it should be positioned as a supporting or complementary activity within an integrated training program. A balanced combination of jogging to enhance general aerobic fitness and targeted swimming training to refine technique and water-specific adaptations is more likely to produce optimal improvements in freestyle swimming speed (Girold et al., 2017; Issurin, 2016).

CONCLUSION

Based on the results of data analysis, this study concludes that jogging habits have a statistically significant relationship with freestyle swimming speed. The Spearman's

rank correlation analysis revealed a correlation coefficient of –0.316 with a significance value of p = 0.000, which is lower than the 0.01 significance level. These findings confirm that the research hypothesis proposing a relationship between jogging habits and swimming speed is empirically supported. Thus, jogging habits are associated with swimming performance and cannot be disregarded as a factor influencing freestyle swimming speed.

However, the negative direction of the correlation indicates that the relationship between jogging habits and swimming speed is not linear or unidirectional. An increase in jogging habits was associated with a tendency toward slower swimming speed, while lower jogging intensity or frequency was linked to relatively faster swimming performance. This result highlights that although jogging contributes to general physical fitness, excessive reliance on jogging without adequate swimming-specific training may limit performance gains in freestyle swimming. From a theoretical perspective, this finding aligns with the principle of training specificity, which emphasizes that performance improvements are optimized when training closely matches the technical and biomechanical demands of the sport.

Furthermore, the magnitude of the correlation falls within the low-to-moderate category, indicating that jogging habits influence swimming speed but do not serve as the dominant determinant. Swimming performance is shaped by multiple interacting factors, including technical proficiency, coordination, water adaptation, and specific muscular engagement. Therefore, jogging should be positioned as a supportive or complementary training activity, rather than a primary determinant of swimming speed.

In conclusion, this study provides empirical evidence that jogging habits are related to freestyle swimming speed, but their role should be integrated carefully within a balanced training program that prioritizes swimming-specific technical and physiological development.

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