

Physical Condition of Indonesian Nusantara League Female Futsal Athletes: A Gender Perspective Review

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Abstract

Physical ability is an important component in athlete performance, which includes aspects such as strength, speed, agility, and aerobic endurance (VO₂max). In the context of futsal, the low understanding and measurement of physical abilities among Liga Nusantara female athletes may hinder the development of their potential. This study aims to measure and analyse the physical abilities of Liga Nusantara female futsal athletes, as well as explore the relationship between these physical variables. The method used was quantitative with a descriptive correlational design, involving 16 athletes taken with a total sampling technique. The instruments used include physical tests which are processed by descriptive analysis. The results showed that the physical condition of the Nusantara League female futsal athletes was generally adequate, there were variations in the ability of strength, speed, agility, and aerobic endurance. The average strength test shows good results, but some athletes are still below average, especially in sit-ups and back-ups. Speed and agility also needed to be improved in some athletes whose results were lower than others, although in general the speed performance was quite good. Aerobic endurance, measured through VO₂max, showed good capacity, but inter-athlete differences indicated the need for more intensive cardio training for some individuals. It was concluded that physical ability varies between athletes, with some athletes having strength and endurance that need to be improved. Thus, this study provides valuable insights for designing more effective training programmes to improve the performance of female futsal athletes.

Keywords: *Physical Condition, Women's Futsal, Nusantara League.*

Introduction

Futsal is one of the more popular sports, both among men and women (Spyrou et al., 2020). First introduced by Juan Carlos Ceriani in Uruguay in 1930 (EIRD, 2016), The sport has undergone rapid development and is now widely played around the world, including in Indonesia (Doewes *et al.*, 2022). Futsal is a variation of football played indoors on a smaller pitch and teams of five players (Saryono et al., 2022). The speed of the game, technical skills, and high physical intensity make futsal a challenging and exciting sport (Silva et al., 2022; Suryadi, 2022; Suryadi et al., 2023).

In Indonesia, futsal was first recognised in 1989 and began to grow significantly in the late 1990 (Prabowo *et al.*, 2023). Since 2008, the National Futsal Board (BFN) started organising official national competitions, which triggered the increasing popularity of the sport (Andrianto et al., 2023). Futsal is considered a more accessible sport than football as it does not require a large field, and the relatively simple rules allow anyone to play it without the need for specialised equipment (Nurjaya & Supriadi, 2021). In fact, futsal is often played in schools, universities, and communities (Suryadi & Rubiyanto, 2022).

One of the interesting developments in the world of futsal is the increasing participation of women in the sport (Siwi & Dunan, 2022). For many years, the sport of futsal has been dominated by men. However, along with the changing views of society and the advancement of gender equality in the field of sport (Da'i et al., 2024), more and more women are interested in entering the world of futsal (Ni'mah & Melisa, 2022;

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Rubiyatno et al., 2023). Many schools, universities and communities now provide specialized facilities and training for women's futsal. This allows women to express their interest and talent in the sport (Fetru, 2020).

Along with the increasing popularity of futsal among women, there are various assumptions and stereotypes that associate the sport with masculinity (Barreira et al., 2024; Sumantri et al., 2023). Some people argue that women who play futsal will lose their femininity and not have the same physical abilities as men (Bartoluci & Baršić, 2020). In futsal, physical condition is one of the key factors to achieve optimal performance (Athaya et al., 2023; Nawawi & Fatoni, 2023; Rozi et al., 2023). Physical condition is an important aspect of futsal, especially since the sport demands high levels of endurance, speed, and agility (Doewes *et al.*, 2023).

In general, physical conditions can be divided into two categories, namely general physical conditions and special physical conditions (Amaliya & Pudjijuniarto, 2022; Haidar et al., 2024; Suryadi, Nasrulloh, et al., 2024; Suryadi, Susanto, et al., 2024). General physical condition includes cardiovascular endurance, muscular strength, agility, flexibility, and body coordination (Gutierrez & Porqueres, 2021). Meanwhile, special physical conditions are physical abilities that are more specific and needed in futsal sports, such as reaction speed, acceleration of movement in a narrow space, and body control when dribbling or making a quick pass (Saputra, 2020).

Especially among female futsal athletes, the importance of physical training that suits their characteristics is becoming increasingly recognized (Amaliya & Pudjijuniarto, 2022). In futsal, player movement takes place at a fast tempo with sudden changes in direction (Perdana et al., 2022). This requires players to have good endurance to keep moving during the 2x20 minutes of game time, as well as agility to overcome tight spaces (Phitaloka *et al.*, 2020). Although women generally have different physical capacities than men, with the right training program, they can develop the strength, endurance, and speed necessary to perform optimally on the field (Litardiansyah & Hariyanto, 2022).

Therefore, research on the physical condition of female futsal athletes is very relevant, especially to understand how the gender perspective affects training approaches and athlete performance at various levels of competition. This study aims to review the physical condition of female futsal athletes in the Nusantara League by considering gender factors. This study is expected to provide insight into the importance of the role of proper physical training for female athletes, as well as encourage more women to participate and excel in the world of futsal.

Materials and Methods

Study Participants

The target population in this study were female futsal players in the goalkeeper position who participated in the Nusantara League. The research subjects used in the physical test totaled 16 people, and tested various physical aspects such as strength (push-ups, sit-ups, back-ups), speed, agility, and Vo₂max through the yo-yo test. Data from these tests will be analyzed to see the relationship between physical condition and the performance of futsal athletes in the context of their training.

Organization Studies

This type of research is quantitative research using a descriptive correlational method design, which aims to find whether or not there is a relationship between certain variables and measure the extent to which the relationship occurs. Descriptive research seeks to describe, interpret, and analyze data through correlation tests. According to Pratama *et al.*, (2023), Correlation research is used to measure the level of relationship between variables in the form of a correlation coefficient. Thus, this research is clearly included in descriptive correlational research, where the aim is to see if there is a relationship between one variable and another and how strong the relationship is (D. Pratama, 2021).

According to Balaka, (2022), Quantitative research is a form of research that uses numerical data and statistical analysis to test hypotheses and understand the relationship between the variables studied. Quantitative research is considered an objective and systematic scientific methodology in collecting measurable data, processing it statistically, and drawing conclusions based on the results of data analysis (Kusumastuti *et al.*, 2020).

In this study, the physical tests used to measure the condition of female futsal athletes involved tests of strength (push-ups, sit-ups, back-ups), speed, agility, and aerobic endurance, as suggested by (Hulfian, 2022) in the physical tests for Indonesian professional futsal goalkeepers. These tests are designed to evaluate upper and lower body muscle strength, as well as endurance and agility which are important for futsal players.

Data Collection Technique

The sampling technique used was total sampling, so that the total sample in the study was 16 Nusantara League Female Futsal athletes. The instrument in this study is a physical test that measures the ability of push-ups, sit-ups, and back-ups. This measurement is carried out to assess the physical condition of athletes which includes their strength, endurance and agility. Data collection procedures are carried out through the implementation of physical tests. The data obtained will be analyzed using a correlation test to determine if there is a relationship between the athletes' physical abilities and their performance in futsal games. This data processing follows a quantitative research methodology that is systematic and objective, as described by Balaka, (2022)

Instruments

This research instrument is based on physical measurements which include tests of strength, speed, agility, and aerobic endurance of Nusantara League female futsal athletes. The strength test consists of three components: push-ups to measure arm muscle strength, sit-ups to measure abdominal muscle strength, and back-ups to measure back muscle strength. Each athlete will perform as many repetitions as possible in one minute for each test. To measure speed, a sprint test will be conducted which records the time taken to complete a certain distance, while agility is measured through a zig-zag test which calculates the time taken to complete a zig-zag course. In addition, Vo2max is measured through the yo-yo test, which will give an indication of the athlete's aerobic endurance. All results from these tests were recorded and analyzed to determine the relationship between physical strength and athlete performance.

Table 1. Physical Condition Test Instrument Grid

No	Tes Item	Assessed Elements
1.	Push-Up	Arm muscle strength
2.	Sit-Up	Abdominal muscle strength
3.	Back-Up	Back muscle strength
4.	Lari Sprint	Measuring speed
5.	Lari Zig-Zag	Measuring agility
6.	Yoyo test	Aerobic endurance

Analysis Statistics

Descriptive and inferential analysis to evaluate data collected from physical tests of Nusantara League female futsal athletes. Descriptive analysis was conducted to describe the characteristics of the sample by calculating the mean, median, mode, and standard deviation of each variable measured, namely push-ups, sit-ups, back-ups, speed, agility, and aerobic endurance (Vo2max). Furthermore, to examine the relationship between the variables, Pearson correlation analysis was used, which allows researchers to determine the strength and direction of the relationship between the independent and dependent variables. If a significant relationship is found, simple linear regression analysis can be used to determine how much each

independent variable contributes to the dependent variable. The significance level used in this analysis was $p < 0.05$. All analyses were conducted using relevant statistical software to ensure the accuracy of the results.

Results

Based on the results of physical testing conducted on 16 Nusantara League female futsal athletes, a thorough analysis can be conducted to evaluate the physical condition of these athletes. Testing consists of several tests, namely push-ups, sit-ups, back-ups, speed, agility, and Vo2max, all of which are important indicators in determining the physical performance of a futsal athlete.

Table 2. Physical Test Results

No	Name	Strength Test			Speed	Agility	Vo2max yo-yo test
		Push-Up	Sit-Up	Back-Up			
1	FAS	27	45	90	8.54	15.78	16.1
2	AKN	36	40	105	8.84	17.91	14.6
3	GWD	35	43	89	9.88	19.5	14.3
4	TAF	32	40	100	8.41	15.63	14.8
5	IA	37	33	117	8.78	16.75	15.1
6	GA	33	41	113	8.72	15.97	16.7
7	SNR	30	27	80	9.92	18.12	15.2
8	NPU	34	42	93	8.76	17.77	16.3
9	JBG	36	40	105	8.84	17.91	14.6
10	WDS	35	43	89	9.88	19.5	14.3
11	ELF	37	33	117	8.78	16.75	15.1
12	DMN	33	41	113	8.72	15.97	16.7
13	JKY	32	42	100	8.84	15.63	14.8
14	HBE	30	27	80	9.92	18.12	15.2
15	CLM	35	44	98	8.41	16.75	14.8
16	BSL	32	40	100	8.72	15.63	14.8
	Average	33.375	38.8125	99.3125	8.9975	17.10563	15.2125

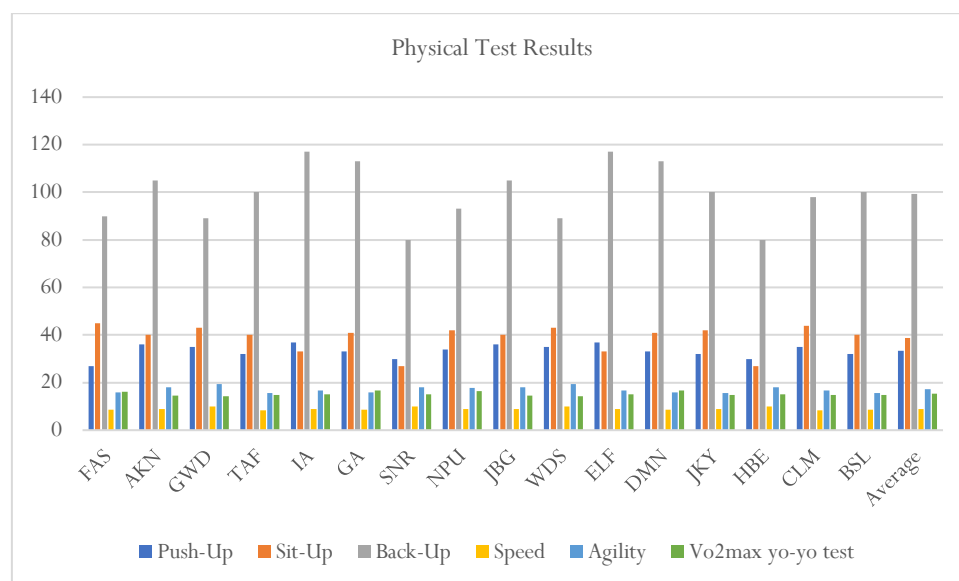


Figure 1. Graph of Physical Test Results

The physical test results of the Nusantara League female futsal athletes showed diverse physical performance in various aspects. In the strength test, which includes push-ups, sit-ups, and back-ups, the average push-up achieved was 33.37 times, with the highest achievement being 37 times by some athletes (IA and ELF) and the lowest being 27 times (FAS). For sit-ups, the average reached 38.81 times, with a high of 45 times (FAS) and a low of 27 times (SNR and HBE). The back-up test recorded an average of 99.31 times, with the best achievement being 117 times (IA and ELF), while the lowest value was 80 times (SNR and HBE).

In the speed test, the average time recorded was 8.9975 seconds, with the fastest athletes finishing in 8.41 seconds (TAF and CLM), while the longest time was 9.92 seconds (SNR and HBE). The agility test showed an average of 17.10 seconds, with the best result of 15.63 seconds (TAF, JKY, and BSL), and the worst result of 19.5 seconds (GWD and WDS).

In the VO₂max test using the yo-yo method, the average value achieved was 15.21, with the highest result of 16.7 (GA and DMN) and the lowest value of 14.3 (GWD and WDS). These results provide an overview of the athletes' strength, speed, agility and aerobic endurance, which can be the basis for developing a more specific and targeted training program.

The results of the physical tests conducted on 16 female futsal athletes from Liga Nusantara provide a comprehensive view of their current fitness levels. These tests measured key physical attributes including strength, speed, agility, and aerobic endurance, which are essential components of athletic performance in futsal. The athletes were assessed through standardized methods such as push-ups, sit-ups, back-ups, sprint tests, zig-zag tests, and the Yo-Yo test. The data collected not only highlight the overall fitness of the athletes but also reveal individual strengths and areas that require improvement, allowing for a tailored approach to training and development. In the push-up test, which measures arm muscle strength, the athletes achieved an average of 33.375 repetitions in one minute. The highest score was recorded at 37 repetitions, while the lowest was 27. This range indicates variability in upper body strength among the athletes, with some demonstrating a robust level of arm strength and others requiring further development. Arm strength is crucial in futsal, particularly for maintaining balance during rapid changes in direction and for executing powerful passes or defensive maneuvers. Athletes with lower scores may benefit from targeted resistance training to enhance their upper body capabilities.

The sit-up test assessed the abdominal muscle strength of the athletes, with an average score of 38.8125 repetitions in one minute. The best-performing athlete completed 45 sit-ups, while the lowest score was 27. Core strength, as measured by this test, is vital for maintaining stability and control during dynamic movements. A strong core reduces the risk of injury and enhances overall performance by improving posture, balance, and rotational power. Athletes with below-average scores may require additional core-focused exercises such as planks and rotational drills to improve their performance. Back muscle strength was evaluated using the back-up test, where the athletes achieved an average of 99.3125 repetitions in one minute. The highest score recorded was 117 repetitions, while the lowest was 80. This test highlights the athletes' ability to maintain spinal stability and support during gameplay. Strong back muscles are essential for absorbing impact during physical contact and for maintaining endurance over the course of a match. The wide range of scores suggests that while some athletes possess excellent back strength, others may need more specialized training to address weaknesses in this area.

Speed was measured through sprint tests, with the athletes achieving an average time of 8.9975 seconds. The fastest time recorded was 8.41 seconds, while the slowest was 9.92 seconds. Speed is a critical attribute in futsal, enabling athletes to outpace opponents and capitalize on scoring opportunities. The results indicate that most athletes have a competitive level of speed, although those with slower times may require additional sprint training. Exercises focusing on explosive power, such as plyometrics, can help improve acceleration and top-end speed. Agility was assessed using zig-zag tests, which measure the time taken to complete a course designed to simulate the quick changes in direction required in futsal. The athletes achieved an average time of 17.1056 seconds, with the fastest time recorded at 15.63 seconds and the slowest at 19.5 seconds. Agility is essential for evading opponents and executing precise movements in tight spaces. Athletes with slower times may benefit from drills that enhance coordination, reaction time, and

lower-body strength. Improving agility can significantly impact an athlete's ability to adapt to the fast-paced nature of futsal.

The Yo-Yo test evaluated the athletes' aerobic endurance, yielding an average Vo2max score of 15.2125. The highest score was 16.7, and the lowest was 14.3. Aerobic endurance is a key determinant of an athlete's ability to sustain high-intensity activity over the duration of a match. Athletes with lower Vo2max scores may experience fatigue more quickly, affecting their performance in the later stages of gameplay. Incorporating aerobic conditioning programs such as interval training and continuous running into their regimen can help improve cardiovascular fitness. The analysis of these results reveals that the athletes, on average, possess a well-rounded physical condition suitable for futsal. However, the variation in scores across different tests indicates that some athletes excel in specific areas while others require targeted improvement. For instance, athletes with strong performances in push-ups and sit-ups may need to focus on speed and agility, while those with slower sprint times might prioritize explosive power and quickness. This variability underscores the importance of individualized training programs that address each athlete's unique strengths and weaknesses.

Discussion

Based on the results of the physical tests that have been conducted on 16 Nusantara League female futsal athletes, it can be concluded that the physical condition of the athletes is quite good, but there are some variations in abilities that need further attention. This test covers various important physical aspects, namely strength, speed, agility, and aerobic endurance, all of which are very relevant for optimal performance in the sport of futsal.

On the strength aspect, measured through push-ups, sit-ups, and back-ups, it was seen that the majority of athletes had good muscle strength, especially in the core muscles such as the arms, abdomen, and back muscles. An average of 33 push-ups indicates that arm muscle strength is at a fairly competitive level. Similarly, the average of 38.8 sit-ups and 98.3 back-ups showed the strength of the abdominal and back muscles. However, the variation in results between athletes suggests that there are some athletes whose strength still needs to be improved, especially for those whose results are below average. In the context of training, it is important for coaches to give more attention to athletes with below-standard abilities so that they can catch up in terms of muscle strength.

Speed is an important factor in the game of futsal, where players must move quickly in a short period of time to keep up with the fast pace of the game (Costa Miranda et al., 2020). From the speed test results, the average time of 8.98 seconds shows that the athletes' speed is quite good. However, there was a noticeable difference between the fastest athlete who recorded a time of 8.20 seconds and the slowest athlete with 9.82 seconds. This indicates the need for a more intensive speed training program for some athletes so that this difference is not too significant, considering that speed is very important in a dynamic futsal game and requires a fast reaction (Aktas, 2023).

Agility was also an important aspect tested, with an average result of 17.17 seconds. This result adequately illustrates the athletes' ability to move agilely and quickly in response to changing situations on the field. However, some athletes showed slightly lower results than others. To improve agility, a training program that focuses more on quick movement drills, changes of direction, as well as footwork drills can be implemented to reduce inter-athlete differences (Neto et al., 2014).

Aerobic endurance, measured through the VO2max test, gives an idea of the athletes' stamina capacity to maintain performance during long matches. The average VO2max of 15.38 indicates that most athletes have fairly good aerobic endurance, although there is a difference between the highest value of 16.7 and the lowest of 15.2. Aerobic endurance is very important in a futsal game, especially when entering the final minutes of the match when players' stamina usually decreases (Wenly et al., 2021). Therefore, increasing aerobic capacity through structured cardio training can be done to strengthen the endurance of athletes, especially for those whose VO2max values are below average (Allsabab et al., 2021).

The analysis of the physical test results provides critical insights into the current physical condition of the 16 female futsal athletes from Liga Nusantara. These athletes were evaluated using a range of tests designed to measure arm, abdominal, and back strength, as well as speed, agility, and aerobic endurance. Such tests are essential in understanding the physical fitness level of players and their potential impact on game performance. The comprehensive data collected allows for targeted training interventions to optimize the athletes' performance.

The push-up test, which measures arm muscle strength, revealed an average performance of 33.375 repetitions per minute, with a range of 27 to 37 repetitions. The higher scores suggest that some athletes possess excellent arm strength, which is critical for maintaining balance during rapid changes of direction and physical challenges in the game. However, athletes with lower scores may need additional resistance training to improve this attribute, as arm strength plays a key role in stability and defensive movements.

In the sit-up test, which evaluates abdominal strength, the athletes scored an average of 38.8125 repetitions per minute. The scores ranged from 27 to 45 repetitions, reflecting variability in core strength among the team. Core strength is pivotal for stabilizing the body during quick, multidirectional movements on the field. Players with higher sit-up scores are likely better equipped to maintain balance during these movements, while those with lower scores might benefit from specific core-strengthening exercises.

The back-up test, which assesses back muscle strength, showed an average of 99.3125 repetitions per minute, with scores ranging from 80 to 117 repetitions. A strong back is essential for maintaining posture and absorbing physical impacts during gameplay. Athletes with higher back-up scores are likely to endure the physical demands of futsal more effectively. However, the lower-performing athletes may need focused training to strengthen their back muscles and enhance their ability to cope with repetitive physical stress.

Speed was measured through a sprint test, with athletes averaging a time of 8.9975 seconds. The fastest recorded time was 8.41 seconds, while the slowest was 9.92 seconds. Speed is a crucial attribute in futsal, enabling players to quickly close gaps, outpace opponents, and create scoring opportunities. While most athletes demonstrated a competitive level of speed, those with slower times might benefit from plyometric and sprint-specific training to improve acceleration and peak speed.

Agility, a critical component of futsal performance, was assessed using a zig-zag test. The athletes recorded an average time of 17.1056 seconds, with scores ranging from 15.63 to 19.5 seconds. Agility is essential for quick directional changes during gameplay, such as evading opponents or executing sharp turns. Athletes with slower times could focus on coordination and reaction drills to enhance this attribute, as improved agility directly translates to better performance in tight and dynamic game scenarios.

Aerobic endurance was evaluated using the Yo-Yo test, which measures Vo₂max. The average Vo₂max score among the athletes was 15.2125, with a range of 14.3 to 16.7. Aerobic endurance is fundamental in futsal, where continuous high-intensity activity is required throughout the match. Athletes with lower Vo₂max scores are more likely to experience fatigue during prolonged gameplay, highlighting the need for aerobic conditioning programs such as interval running or endurance drills.

The variability observed in the scores across all tests suggests differences in the physical conditioning levels among the athletes. While some athletes excelled in specific tests, others showed areas that require improvement. This variability underscores the importance of individualized training plans that address each athlete's unique needs, thereby fostering balanced development across all physical attributes essential for futsal.

Descriptive analysis of the test data provides valuable insights into the central tendencies and dispersion of scores. The average scores represent the overall performance level of the team, while the range and standard deviation highlight the differences among individual athletes. Such analysis enables coaches to identify outliers—athletes who significantly outperform or underperform—and focus training resources accordingly.

Inferential analysis can further enhance understanding by exploring relationships between different physical attributes and game performance. For instance, Pearson correlation analysis could reveal whether stronger core muscles (sit-up scores) are linked to better agility (zig-zag test scores) or whether higher Vo2max scores correlate with longer sustained performance during matches. Such insights could guide training priorities and resource allocation.

The relationship between physical fitness and futsal performance is well-documented, with each attribute contributing uniquely to gameplay. For instance, strength in the arms, abdomen, and back supports stability, power, and endurance, while speed and agility facilitate quick transitions and maneuverability on the field. Aerobic endurance ensures sustained performance, allowing athletes to maintain high intensity throughout the game.

Coaches can use these findings to design training regimens that address the specific needs of the team and individual players. For instance, athletes with lower agility scores could benefit from ladder drills and quick-step exercises, while those with lower aerobic endurance might focus on interval training. Such targeted interventions ensure that training time is used effectively, maximizing improvements in critical performance areas.

From these results, it can be concluded that the physical condition of the Nusantara League female futsal athletes is generally at an adequate level, but still requires some improvement in specific areas. The variation in ability between athletes in each physical aspect indicates that training programs need to be designed individually or at least grouped based on the physical needs of each athlete. As in the results of research conducted by (Ariko *et al.*, 2021) athletes lacking in strength need to be given additional weight training, while those lacking in speed and agility can be given more intensive sprint or agility drills. By optimizing training programs that focus on improving individual weaknesses, it is hoped that the overall performance of the team can improve, and athletes can achieve the ideal physical condition to compete at a higher level.

Conclusions

The conclusion of this study shows that the physical condition of Nusantara League female futsal athletes is generally adequate, there are variations in the ability of strength, speed, agility, and aerobic endurance. The average strength test showed good results, but some athletes were still below average, especially in sit-ups and back-ups. Speed and agility also needed to be improved in some athletes whose results were lower than others, although in general the speed performance was quite good. Aerobic endurance, measured through VO2max, showed good capacity, but inter-athlete differences indicated the need for more intensive cardio training for some individuals. The weakness of this study lies in the small sample size (16 athletes), so the results are less representative for the wider population. In addition, this study did not consider other factors such as diet, rest, or psychological conditions that can also affect athletes' physical performance. Recommendations for future research are to expand the sample size, as well as include other variables such as nutrition and mental health to provide a more comprehensive picture of the factors that affect athletes' physical performance.

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Conflict of Interests

No conflict of interest

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