



The Body Mass Index and Physical Performance of U-14 and U-15 Futsal Athletes

Dava Aldi Santoso^{1A-E*}, Aprilyan Bimantoro^{2B-D}, Pudjianto^{3B-D}, Heri Wahyudi^{4B-D}

^{1,2} Universitas Negeri Surabaya, Jawa Timur, Indonesia

dava.22124@mhs.unesa.ac.id^{1*}, priliyanbimantoro@unesa.ac.id², pudjiuniarto@unesa.ac.id³,
heriwahyudi@unesa.ac.id⁴

ABSTRACT

Futsal is a high-intensity sport that requires optimal physical condition to support technical and tactical performance during matches. However, many school-based extracurricular programs still lack structured physical assessments, resulting in training programs that are not fully tailored to athletes' needs. This study aimed to analyze the Body Mass Index (BMI) and physical condition profiles of U-14 and U-15 futsal athletes participating in the extracurricular program at SMP Negeri 50 Surabaya. The study employed a descriptive quantitative method using tests and measurements involving 15 athletes aged 14–15 years. The research instruments included BMI measurement, the Multistage Fitness Test (MFT) to assess aerobic endurance, the 20-meter sprint test to measure speed, the Illinois Agility Test to evaluate agility, and the Sit and Reach Test to assess flexibility. The findings revealed that the athletes had an average BMI score of 20.51, which was categorized as normal. Aerobic endurance assessment showed an average $VO_2\text{Max}$ value of 34.85 ± 4.52 ml/kg/min, categorized as deficient. The 20-meter sprint test produced an average score of 3.97 ± 1.1 seconds, also classified as deficient. In contrast, agility assessment using the Illinois Agility Test demonstrated an average score of 14.32 ± 1.0 seconds, categorized as very good. Flexibility assessment through the Sit and Reach Test resulted in an average score of 42.06 ± 6.81 cm, which fell into the good category. In conclusion, the athletes demonstrated relatively better agility and flexibility compared to aerobic endurance and speed. Therefore, more structured and sport-specific conditioning programs are required to improve endurance and speed performance among adolescent futsal athletes.

ARTICLE HISTORY

Received: 2026/05/10
Accepted: 2026/05/12
Published: 2026/05/25

KEYWORDS

Futsal;
Body Mass Index;
Physical Performance;
Aerobic Endurance;
Adolescent Athletes.

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

Cites this Article : Santoso, D.A.; Bimantoro, A.; Pudjianto, P.; Wahyudi, H. (2026). The Body Mass Index and Physical Performance of U-14 and U-15 Futsal Athletes in the Extracurricular Program at SMP Negeri 50 Surabaya. **Competitor: Jurnal Pendidikan Kepeleatihan Olahraga**. 18 (2), p.3468-3484

INTRODUCTION

Sport has become an inseparable component of human life because it contributes significantly to physical fitness, health maintenance, psychological well-being, and social development. Participation in sports activities also supports the formation of discipline, responsibility, teamwork, and achievement-oriented behavior among adolescents. In the



educational context, extracurricular sports programs provide students with opportunities to develop athletic potential through systematic coaching and competitive experiences. One of the sports that has experienced rapid growth among junior high school students is futsal, which is widely recognized as a high-intensity intermittent sport requiring technical mastery, tactical understanding, and optimal physical condition. Futsal has become increasingly popular because the game is dynamic, fast-paced, and suitable for school environments with limited playing areas. Previous studies have emphasized that futsal participation contributes positively to students' physical development and social character formation (Santoso, 2023; Pitaloka, 2024).

The achievement of optimal performance in futsal cannot be separated from the quality of athletes' physical conditions. Futsal players are required to perform repeated sprinting, rapid acceleration and deceleration, quick directional changes, and continuous movement throughout the game. Consequently, physical components such as aerobic endurance, speed, agility, and flexibility are considered fundamental determinants of performance (Harsono, 2018). Athletes who possess adequate physical fitness are generally more capable of maintaining game intensity, executing tactical instructions effectively, and minimizing fatigue-related performance decline during matches. Conversely, inadequate physical condition may negatively affect technical execution, decision-making, and overall competitive performance.

One important factor associated with physical performance is anthropometric condition, particularly Body Mass Index (BMI). BMI represents the proportion between body weight and height and is commonly used as an indicator of nutritional and body composition status in athletes. Although BMI does not directly measure body fat percentage, it remains a practical and widely applied anthropometric parameter for evaluating athletes' physical profiles (Norton & Olds, 2018). Appropriate body composition is associated with movement efficiency, balance, and physiological effectiveness during exercise. Athletes with excessive body weight may experience decreased agility and endurance, whereas underweight athletes may demonstrate insufficient muscle strength and power (Ismaryati, 2020). Therefore, maintaining proportional BMI is essential for supporting optimal athletic performance in futsal.

Adolescent athletes aged 14–15 years experience significant physical growth and developmental changes that may influence sports performance. During this stage, variations in height, body weight, muscle development, and motor coordination become increasingly evident. These physiological transitions may affect athletes differently depending on training exposure, nutritional status, and biological maturation. Consequently, evaluating BMI and physical performance among adolescent futsal players is necessary to identify physical readiness and to provide evidence-based recommendations for training programs. Several studies have shown that physical fitness characteristics among youth athletes vary according to age category, training intensity, and environmental factors (Malina et al., 2015; Lloyd & Oliver, 2019).

Preliminary observations conducted during futsal extracurricular activities at SMP Negeri 50 Surabaya indicated that approximately 60–70% of players experienced decreased

movement intensity after 10–15 minutes of play. The indicators observed included reduced sprint frequency, slower transition speed, delayed recovery between movements, and slower responses during one-on-one situations. These findings suggest limitations in aerobic endurance and speed capacity. Furthermore, the absence of structured physical assessments has caused training programs to rely primarily on subjective observations rather than objective performance data. According to Bompa and Buzzichelli (2019), systematic physical testing is essential for designing training programs that correspond to athletes' physiological needs and developmental stages. Therefore, scientific evaluation through standardized testing instruments is urgently required to provide accurate information regarding the physical profiles of adolescent futsal athletes.

Recent studies in sports science have increasingly focused on the relationship between anthropometric characteristics and athletic performance among youth athletes. BMI has frequently been used as an accessible anthropometric indicator to evaluate nutritional status and body proportionality in adolescent sports participants. Research conducted by Nikolaidis et al. (2019) demonstrated that athletes with normal BMI categories generally exhibit better aerobic endurance and movement efficiency compared to overweight athletes. Similar findings were reported by Silva et al. (2020), who found that excessive body mass negatively affected agility and sprint performance among adolescent futsal players.

In futsal, physical demands are characterized by repeated high-intensity actions involving sprinting, acceleration, rapid directional changes, and recovery periods performed within limited spaces (Reilly et al., 2020). Consequently, aerobic endurance is considered essential for maintaining game intensity throughout matches. The Multistage Fitness Test (MFT) has been widely utilized to estimate aerobic capacity because it provides practical and reliable measurements of VO_2 max among team sport athletes (Thomas Reilly, 2005). Studies conducted by Castagna et al. (2018) revealed that futsal athletes with higher aerobic capacity were capable of sustaining high-intensity activity for longer durations.

Speed is another critical component in futsal performance because players frequently perform explosive movements over short distances. Haugen et al. (2019) explained that sprint performance is closely associated with neuromuscular coordination and lower-body power. The 20-meter sprint test has therefore become a common instrument for assessing speed performance in futsal athletes (Thomas et al., 2019). Additionally, agility is indispensable in futsal because players continuously change direction during attacking and defensive situations. Turner et al. (2022) reported that agility contributes significantly to successful dribbling, defensive coverage, and tactical transitions. The Illinois Agility Test has been widely recognized as a valid measurement for evaluating rapid directional change ability in limited-space sports activities (N. et al., 2022).

Flexibility also plays a crucial role in movement efficiency and injury prevention. According to ACSM (2022), flexibility contributes to optimal joint mobility and reduces musculoskeletal injury risks among adolescent athletes. The Sit and Reach Test is commonly used to measure lower back and hamstring flexibility because of its

practicality and reliability. Sukadiyanto (2019) emphasized that adequate flexibility supports biomechanical efficiency during sports performance.

Several studies in Indonesia have investigated physical condition profiles among student athletes; however, most have focused only on isolated physical components rather than integrating anthropometric and performance variables simultaneously. Research on futsal extracurricular athletes remains relatively limited, especially within junior high school settings. Existing studies have generally emphasized training interventions rather than descriptive analyses of BMI and physical performance characteristics. Therefore, comprehensive evaluations combining anthropometric measurements and multiple physical fitness components are still needed to provide broader insights into adolescent futsal athlete development.

Despite the increasing number of studies related to futsal performance and youth athlete development, several important gaps remain evident in the literature. First, previous research has predominantly concentrated on professional or elite athletes, whereas investigations involving junior high school extracurricular athletes remain limited. Adolescent athletes participating in school-based extracurricular programs possess different developmental characteristics, training intensities, and environmental conditions compared to elite players. Consequently, findings from professional athlete populations cannot be generalized directly to school-level athletes.

Second, many previous studies have analyzed physical performance variables independently without integrating anthropometric indicators such as BMI. In reality, anthropometric condition and physical fitness are closely interconnected because body composition influences movement efficiency, endurance capacity, agility, and speed performance. Studies examining the combined relationship between BMI and multiple physical performance components among adolescent futsal players are still scarce, particularly within Indonesian educational contexts. Third, previous research frequently focused on single physical components such as endurance or agility alone. Comprehensive assessments involving aerobic endurance, speed, agility, and flexibility simultaneously remain relatively uncommon. Considering that futsal performance depends on the integration of multiple physical abilities, multidimensional evaluations are necessary to obtain more accurate descriptions of athletes' physical readiness. Fourth, limited empirical data are available regarding the physical profiles of U-14 and U-15 futsal athletes participating in extracurricular programs at Indonesian junior high schools. Most available studies have been conducted in sports academies or professional youth clubs rather than school-based sports programs. Consequently, coaches and physical education teachers often lack objective references for designing age-appropriate and evidence-based training programs for adolescent futsal athletes.

Based on the identified problems and research gaps, this study aims to analyze the Body Mass Index and physical performance profiles of U-14 and U-15 futsal athletes participating in the extracurricular program at SMP Negeri 50 Surabaya. Specifically, this research evaluates aerobic endurance using the Multistage Fitness Test (MFT), speed using the 20-meter sprint test, agility using the Illinois Agility Test, and flexibility using

the Sit and Reach Test. In addition, the study seeks to describe the relationship between BMI conditions and athletes' physical performance characteristics.

The novelty of this research lies in its comprehensive approach integrating anthropometric assessment and multiple physical fitness components simultaneously among adolescent school-based futsal athletes. Unlike previous studies that focused only on isolated variables or elite athlete populations, this study specifically examines extracurricular athletes within the U-14 and U-15 age categories in a junior high school context. Furthermore, this research provides empirical evidence that may serve as a scientific reference for coaches, teachers, and sports practitioners in developing more structured, objective, and data-driven training programs for adolescent futsal athletes.

In conclusion, the analysis of BMI and physical performance among adolescent futsal athletes is essential for understanding athletes' physical readiness and supporting evidence-based training development. Comprehensive physical assessments can help coaches identify strengths and weaknesses in athletes' physical conditions while contributing to more effective and systematic coaching strategies. Therefore, this study is expected to provide meaningful contributions to sports science literature, particularly in the field of youth futsal development within school extracurricular programs.

METHODS

This study employed a descriptive quantitative approach with a survey design to analyze the Body Mass Index (BMI) and physical performance profiles of U-14 and U-15 futsal athletes participating in the extracurricular program at SMP Negeri 50 Surabaya. A descriptive quantitative method is considered appropriate for identifying and describing the characteristics of physical condition variables objectively through systematic measurement and numerical analysis (Sugiyono, 2019). This approach allows researchers to provide empirical descriptions regarding the anthropometric and physical fitness conditions of adolescent athletes without manipulating variables or implementing experimental treatment. Descriptive survey research has frequently been applied in sports science studies to evaluate athletes' physical readiness and performance characteristics in educational and training settings (Thomas et al., 2020).

The study was conducted at the futsal court of SMP Negeri 50 Surabaya in December 2025. The participants consisted of all members of the school futsal extracurricular team, totaling 15 athletes aged 14–15 years. The selection of adolescent athletes in this age category was based on the consideration that the age of 14–15 years represents a critical developmental phase characterized by rapid physiological growth, motor development, and physical adaptation to exercise (Lloyd & Oliver, 2019). Prior to data collection, approval and permission were obtained from the school authorities, coaches, and respondents to ensure ethical compliance during the research process. The sampling technique used in this study was total sampling, in which all members of the population were selected as research participants to ensure that the collected data accurately represented the overall physical condition of the athletes (Sugiyono, 2019). Total sampling is widely recommended in small

population sports studies because it minimizes sampling bias and increases the representativeness of findings (Creswell & Creswell, 2018).

The research instruments consisted of anthropometric measurements and physical condition tests. Anthropometric assessment included measurements of body height and body weight to calculate Body Mass Index (BMI). BMI was determined by dividing body weight in kilograms by height in meters squared (kg/m^2). BMI is recognized as a practical anthropometric indicator for evaluating proportional body composition and nutritional status in adolescent athletes (Norton & Olds, 2018). Previous studies have shown that BMI is associated with movement efficiency, aerobic performance, and agility among youth athletes (Nikolaidis et al., 2019). Height was measured using a stadiometer, while body weight was measured using a calibrated digital weighing scale to ensure measurement accuracy. The physical condition variables measured in this study included aerobic endurance, speed, agility, and flexibility. These components were selected because they represent the primary physical demands of futsal performance, which requires continuous movement, rapid acceleration, directional changes, and dynamic body control during matches (Reilly et al., 2020). Aerobic endurance was measured using the Multistage Fitness Test (MFT), commonly known as the beep test. The MFT was administered using standardized audio signals played through loudspeakers, where athletes were instructed to run repeatedly over a 20-meter distance according to progressively increasing beep intervals. The final level achieved by each athlete was used to estimate VO_2Max values. The MFT is considered a valid and reliable instrument for assessing aerobic endurance in team sports athletes because it practically estimates cardiorespiratory fitness under field conditions (Mutista, 2022; Tomkinson et al., 2019).

Speed performance was measured using the 20-meter sprint test with digital stopwatch recording. Athletes were instructed to sprint maximally over a 20-meter distance, and the fastest recorded time was used as the final result. Sprint performance is highly relevant in futsal because players frequently perform explosive movements over short distances during offensive and defensive transitions (Haugen et al., 2019). Agility was assessed using the Illinois Agility Test, which involved eight cones arranged according to standardized testing procedures. Athletes were required to complete directional changes as quickly as possible, while completion time was recorded using a stopwatch. The Illinois Agility Test has been widely utilized in sports performance research because of its ability to evaluate rapid directional change ability effectively (N. et al., 2022; Turner et al., 2022).

Flexibility was measured using the Sit and Reach Test with a standardized sit-and-reach box. Participants performed forward-reaching movements while seated with extended legs, and the furthest reach distance was recorded in centimeters. This test primarily evaluates hamstring and lower back flexibility, which are essential for maintaining movement efficiency and reducing injury risk among athletes (ACSM, 2022). Adequate flexibility contributes to biomechanical effectiveness and supports optimal movement execution during futsal activities (Sukadiyanto, 2019).

The collected data were analyzed descriptively using percentage distributions, mean scores, standard deviations, minimum values, and maximum values. The descriptive

analysis was intended to provide comprehensive information regarding the anthropometric and physical performance characteristics of the athletes. Data interpretation was subsequently categorized according to established physical fitness classification standards commonly used in sports science research (Bompa & Buzzichelli, 2019).

RESULTS AND DISCUSSION

Result

The data obtained from this study were analyzed using descriptive statistical methods, including the calculation of mean values, highest and lowest scores, as well as the classification of results into specific categories. This analysis was conducted to present the data in a simple and comprehensible manner, thereby providing a clear description of the physical condition of U-15 extracurricular futsal athletes at SMP Negeri 50 Surabaya for the purposes of evaluation and the development of future training programs.

Table 1.
Descriptive results IMT

Old	Min	Max	Mean	Standart Deviation
14	144	165	155,29	7,064
15	148	162	156,38	5,097

Table 2.
Presentation Result IMT

Number	Note	Total	Percentage
1.	Deficient	0	0%
2.	Normal	12	80%
3.	Excessive	3	20%
4.	Obesity	0	0%
Total		15	100%

Based on the results of the height and body weight measurements above, the anthropometric condition of the U-15 futsal players at SMP Negeri 50 Surabaya showed a lowest value of 18.2 and a highest value of 23.8, with a mean score of 20.51.

Table 3.
Aerobic Endurance Percentage Results

No	Note	Result	Percentage
1.	Very Good	0	0%
2.	Good	0	0%
3.	Fair	6	40%
4.	Poor	9	60%
Total		15	100

The results of the Multistage Fitness Test (MFT) showed that the futsal players achieved a highest test score of 43.9 ml/kg/min and a lowest score of 29.1 ml/kg/min, with an average endurance value of 34.85 ml/kg/min.

Table 4.
Descriptive Result Fast Test

Old	Min	Max	Mean	Standart Deviation
14	3.28	4.53	4.0871	44105
15	3.26	4.93	3.8637	60373

Table 5.
Speed test percentage results

No	Note	Result	Percentage
1.	Very Good	0	0%
2.	Good	6	40%
3.	Enough	2	13%
4.	Deficient	7	47%
5.	Very Deficient	0	0%
Total		15	100%

Based on the results of the speed test above for the 20 meter running test, the futsal player had the fastest time of 3.26 seconds and the slowest was 4.93 seconds, with an average (mean) speed value for the futsal player of 3.97.

Table 6.
Descriptive Result Test Kelincahan (Illinois Test)

Old	Min	Max	Mean	Standart Deviation
14	11.39	15.66	13.9800	1.38838
15	13.21	15.66	14.6300	.72575

Table 7.
Percentage test agility (Illinois Test)

No	Note	Result	Percentage
1.	Very Good	15	100%
2.	Good	0	0%
3.	Moderate	0	0%
4.	Deficient	0	0%
5.	Very Deficient	0	0%
Total		15	100%

Based on the results of the agility test, the players' physical condition showed a fastest completion time of 11.39 seconds and a slowest time of 15.66 seconds, with a mean agility score of 14.32 seconds.

Table 8.
Descriptive Result Test Flexibility

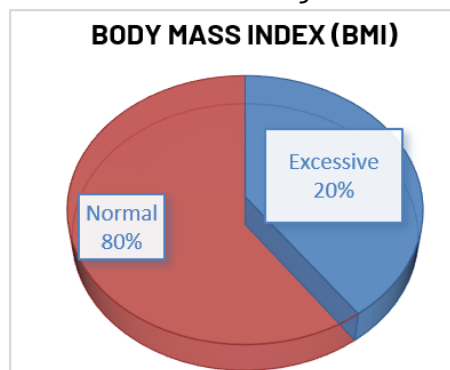
Old	Min	Max	Mean	Standart Deviation
14	35	53	42.71	6.824
15	34	52	42.75	7.265

Table 9.
Result Percentage Flexibility Test

Number	Note	Total	Percentage
1.	Very Good	7	47%
2.	Good	8	53%
3.	Moderate	0	0%
4.	Deficient	0	0%
5.	Very Deficient	0	0%
Total		15	100%

Based on the results of the flexibility assessment using the Sit and Reach Test, the U-15 futsal players obtained a lowest score of 34 cm and a highest score of 53 cm, with a mean flexibility score of 42.06 cm.

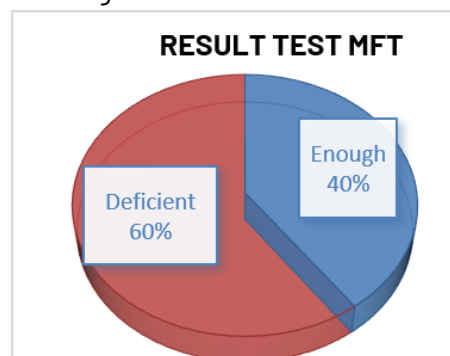
Validity testing was also conducted in this study, revealing that not all variables demonstrated significant relationships. In the U-14 group, a very strong relationship was found between height and waist circumference, with a significance value of 0.002, indicating that taller athletes tended to have larger waist circumferences. In the U-15 group, significant relationships were identified between body weight and height, with a significance value of 0.021, and between body weight and Body Mass Index (BMI), with a significance value of 0.027. In addition, a negative relationship with a significance value of 0.002 was found between agility and MFT results, indicating that better athlete agility was associated with shorter MFT completion times. The reliability test results showed a Cronbach's Alpha value of 0.704, which was categorized as reliable.



Picture 1.

Body Mass Indeks (BMI) Percentage Result

Based on the diagram above, the percentage distribution of Body Mass Index (BMI) among the U-15 futsal players showed that 12 players (80%) were classified in the "Normal" category, while 3 players (20%) were classified in the "Overweight" category. Overall, the average Body Mass Index (BMI) of the U-15 extracurricular futsal players at SMP Negeri 50 Surabaya was categorized as "Normal."

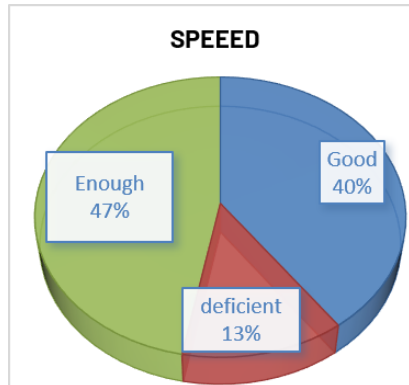


Picture 2.

Result Percentage Test MFT

Based on the diagram above, the percentage distribution of VO₂Max endurance among the U-15 futsal players showed that six players (40%) were categorized as

"Enough," while nine players (60%) were categorized as "Deficient." Overall, the average aerobic endurance of the U-15 futsal players was classified in the "Deficient" category.



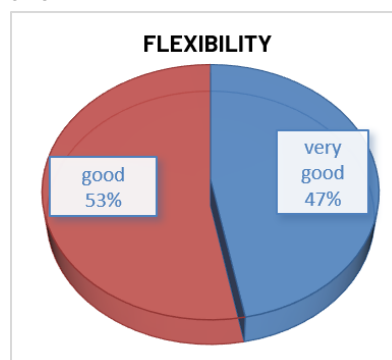
Picture 2.
Speed Test Percentage Results

Based on the diagram above, the calculation results of the speed test in the "Good" category are 6 players with 40% and the "Enough" category with 2 players at 13%, then the players in the "Deficient" category are 7 players with a percentage of 47%. The average speed of U15 futsal players falls into the "Deficient" category.



Picture 3.
Agility Test Percentage Results

Based on the diagram above, the results of the agility test showed that one player (6%) was categorized as "Good," while 11 players (73%) were classified in the "Moderate" category. Furthermore, three players (21%) were categorized as "Deficient." Therefore, the agility level of the U-15 extracurricular futsal players at SMP Negeri 50 Surabaya was generally classified as "Moderate."



Picture 4.
Flexibility Test Percentage Results

Based on the diagram above, the results of the calculation in terms of flexibility of futsal players at SMP NEGERI 50 Surabaya show that endurance is "Good" in 8 players with a percentage of 53% and the category of "Very Good" in 7 players at 47%. The average flexibility of U-15 futsal players at SMP NEGERI 50 Surabaya is included in the "Good" category.

Discussion

The findings of this study indicate that the physical condition and anthropometric profile of U-14 and U-15 futsal athletes participating in the extracurricular program at SMP Negeri 50 Surabaya still require systematic improvement, particularly in aerobic endurance and speed components. The absence of structured physical condition assessments in previous training programs resulted in non-individualized exercise loads and limited monitoring of athletes' physical development. Consequently, the players' physical improvements were inconsistent, and the team demonstrated suboptimal competitive achievement, reaching only the round of 16 in tournaments without securing championship titles. These findings emphasize the importance of objective physical evaluation in youth sports development programs. According to , the lack of baseline anthropometric and physical performance data made it difficult for coaches to design evidence-based training programs that corresponded to athletes' physiological needs.

From an anthropometric perspective, the average Body Mass Index (BMI) of the athletes was categorized as normal, with a mean score of 20.5. This finding suggests that, generally, the players possessed proportional body composition relative to their age category. However, several athletes were classified as overweight and underweight, indicating variability in nutritional and physical conditions among the participants. BMI is recognized as an important anthropometric indicator associated with athletic performance because body composition influences movement efficiency, energy expenditure, and physiological adaptation during exercise (Norton & Olds, 2018). Athletes with excessive body weight often experience decreased agility and reduced acceleration ability because additional body mass increases biomechanical load during movement (Nikolaidis et al., 2019). Conversely, athletes with deficient BMI frequently demonstrate lower muscle strength and inadequate balance, which negatively affects movement stability and physical resilience (Ismaryati, 2020). These findings support previous research by Silva et al. (2020), which reported that adolescent futsal players with non-ideal BMI profiles generally exhibit lower physical performance capacities compared to athletes with proportional body composition.

The aerobic endurance assessment revealed that the athletes' average VO_2 Max value was 34.85 ml/kg/min, categorized as relatively low for active adolescent athletes. This finding indicates that the players had limited cardiorespiratory endurance to sustain high-intensity activity throughout futsal matches. Aerobic endurance is one of the most essential physical components in futsal because the game requires repeated intermittent movements, continuous transitions, and rapid recovery between high-intensity actions (Reilly et al., 2020). Players with inadequate aerobic capacity tend to

experience premature fatigue, decreased movement quality, slower reaction times, and reduced tactical decision-making ability during the final stages of matches (Castagna et al., 2018). Field observations during this study demonstrated that players experienced decreased sprint frequency and slower responses after 10–15 minutes of play, which is consistent with the physiological effects of insufficient aerobic endurance.

The results of this study align with the findings of Yudi Nugraha and Sri Hartono (2022), who stated that low aerobic capacity significantly reduces gameplay effectiveness in futsal athletes. Similar studies by Barbero-Alvarez et al. (2016) and Makaje et al. (2018) also reported that VO_2 Max is strongly associated with match intensity and movement productivity in futsal players. Athletes with higher aerobic endurance are generally more capable of maintaining repeated sprint performance and tactical consistency during competition. Furthermore, Bompa and Buzzichelli (2019) emphasized that endurance training programs should be developed progressively and systematically to improve athletes' physiological adaptation. Therefore, the low VO_2 Max values identified in this study indicate that the current training program has not yet optimally addressed cardiorespiratory conditioning needs.

The speed assessment showed that approximately 47% of the players were categorized as "Deficient" in the 20-meter sprint test. Speed represents a fundamental component in futsal because players frequently perform explosive movements, rapid transitions, and short-distance accelerations during both offensive and defensive situations (Haugen et al., 2019). The inability to achieve optimal sprint performance negatively affects players' responsiveness to opponents' movements and reduces effectiveness during game transitions. According to , several athletes demonstrated delayed responses and slower sprint performance during actual match situations, indicating limitations in acceleration capacity and neuromuscular readiness.

These findings are consistent with research conducted by Andi Wicaksana and Budi Raharjo (2023), who found that sprint speed contributes significantly to successful positional transitions and tactical execution in futsal. Additionally, Jamalul Insan (2022) reported that improvements in sprint ability positively influence dribbling speed and movement effectiveness among youth futsal athletes. From a physiological perspective, sprint performance is influenced by neuromuscular coordination, lower-body explosive power, and fast-twitch muscle fiber activation (Cormie et al., 2016). Therefore, insufficient sprint ability among the athletes in this study may indicate inadequate exposure to structured speed and acceleration training. Previous literature has suggested that plyometric exercises, resisted sprinting, and repeated acceleration drills can significantly improve sprint performance in adolescent athletes (Ramirez-Campillo et al., 2020; Turner et al., 2022). Consequently, speed training should become a priority component in future extracurricular conditioning programs.

In contrast to the endurance and speed results, the agility assessment demonstrated relatively positive outcomes. All players were categorized as "Very Good," with an average Illinois Agility Test completion time of 14.32 seconds. Agility is crucial in futsal because players continuously perform rapid directional changes, body

adjustments, and reactive movements within limited playing spaces (Chaabene et al., 2020). Good agility enables players to execute dribbling maneuvers, evade opponents, and maintain defensive positioning effectively. The results suggest that the athletes possessed adequate movement coordination and lower-body control despite limitations in endurance and speed.

However, although categorized as “Very Good,” field observations revealed that agility performance declined under fatigue conditions. Several athletes demonstrated slower directional changes and delayed movement responses during prolonged gameplay. This finding indicates that laboratory or field-test agility scores do not always fully represent movement effectiveness during competitive situations. Similar findings were reported by Paul et al. (2016), who stated that fatigue significantly affects reactive agility and movement precision among team sport athletes. Therefore, agility training should not only emphasize directional change speed but also integrate fatigue-resistance and reactive decision-making components. The flexibility assessment also demonstrated favorable results, with most players categorized as “Good” to “Very Good” and an average Sit and Reach Test score of 42.06 cm. Flexibility contributes significantly to joint mobility, biomechanical efficiency, and injury prevention in adolescent athletes (ACSM, 2022). Adequate flexibility supports the execution of kicking techniques, ball control, and body balance during dynamic movement. The results indicate that regular stretching exercises implemented during extracurricular activities positively contributed to muscle elasticity and movement range.

These findings support the study conducted by Rizky Pratama and Dedi Setiawan (2021), which reported that consistent stretching programs significantly improve muscle flexibility and reduce musculoskeletal injury risk among adolescent athletes. Sukadiyanto (2019) further explained that flexibility contributes to movement efficiency and supports the biomechanical effectiveness of sports performance. Moreover, flexibility training has been associated with improved recovery and decreased muscle stiffness following high-intensity exercise (Behm et al., 2016). Therefore, the relatively good flexibility profile identified in this study may reflect the positive adaptation resulting from regular warm-up and stretching routines implemented during futsal practice sessions.

Overall, the findings of this study indicate that greater attention should be directed toward improving aerobic endurance and speed because these components remain below the expected standards for adolescent futsal athletes. Meanwhile, agility and flexibility demonstrated relatively better profiles, although both components still possess potential for further optimization. According to , these findings provide important baseline information for coaches and physical education practitioners in developing more structured, evidence-based, and individualized training programs. Future conditioning programs should integrate endurance training, sprint acceleration exercises, agility drills under fatigue conditions, and continued flexibility maintenance to improve the overall physical readiness and competitive performance of adolescent futsal athletes.

CONCLUSION

Based on the results of this study, it can be concluded that the physical condition of the U-15 extracurricular futsal players at SMP Negeri 50 Surabaya varied across each physical component. Anthropometric measurements calculated using Body Mass Index (BMI) showed an average value of 20.51, indicating that the majority of athletes were within the normal body composition category. The physical condition assessments revealed that agility was categorized as "Moderate" and flexibility as "Good," indicating that the players' coordination and body flexibility were supportive of game performance, with an average agility score of 14.32 seconds and an average flexibility score of 42.06 cm. Meanwhile, aerobic endurance and speed were categorized as "Deficient" and therefore require further improvement, with an average aerobic endurance value of 34.85 ml/kg/min and an average speed score of 3.97 seconds. Therefore, more specific training programs are needed to improve endurance and speed performance optimally, such as interval training and repeated sprint exercises.

ACKNOWLEDGMENTS

The author expresses sincere gratitude to Allah SWT for His blessings and mercy, which enabled the completion of this research and scientific article. This article was prepared as part of the academic requirements of the Undergraduate Program in Sports Science at Universitas Negeri Surabaya. Throughout the research and writing process, the author received valuable guidance, feedback, and evaluation from the academic supervisor to ensure the accuracy of the writing and data presentation.

The author also extends gratitude to the Head of the Undergraduate Program in Sports Science and all lecturers for their knowledge and academic support during the study period. Appreciation is further expressed to the author's parents for their prayers, motivation, and continuous support, as well as to colleagues who contributed through discussions, collaboration, and assistance throughout the research and writing process.

REFERENCES

- American College of Sports Medicine. (2022). ACSM's guidelines for exercise testing and prescription (11th ed.). Wolters Kluwer ACSM Guidelines
- Andi Wicaksana, A., & Budi Raharjo, B. (2023). Pengaruh kecepatan terhadap efektivitas transisi permainan futsal. *Jurnal Pendidikan Jasmani Indonesia*, 19(1), 45-53.
- Azis, P. A., Gustiawati, R., & Kurniawan, F. (2024). Peran fisiologi olahraga dalam meningkatkan kebugaran fisik dan kesehatan mental. *Multilateral: Jurnal Pendidikan Jasmani Dan Olahraga*, 23(4), 197-203. <https://doi.org/https://doi.org/10.20527/multilateral.v23i4.20992>
- Barbero-Alvarez, J. C., Castagna, C., Soto, V. M., Vega, C., & Granda-Vera, J. (2016). Physiological demands of futsal. *Journal of Strength and Conditioning Research*, 22(5), 1379-1385. <https://doi.org/10.1519/JSC.0b013e3181731c24>

- Behm, D. G., Blazevich, A. J., Kay, A. D., & McHugh, M. (2016). Acute effects of muscle stretching on physical performance. *Applied Physiology, Nutrition, and Metabolism*, 41(1), 1-11. <https://doi.org/10.1139/apnm-2015-0235>
- Bompa, T. O., & Buzzichelli, C. (2019). *Periodization: Theory and methodology of training* (6th ed.). Human Kinetics.
- Castagna, C., D'Ottavio, S., Vera, J. G., & Álvarez, J. C. B. (2018). Match demands of professional futsal: A case study. *Journal of Science and Medicine in Sport*, 12(4), 490-494. <https://doi.org/10.1016/j.jsams.2008.02.001>
- Chaabene, H., Prieske, O., Negra, Y., & Granacher, U. (2020). Change of direction speed: Toward a strength training approach with accentuated eccentric muscle actions. *Sports Medicine*, 48(8), 1773-1779. <https://doi.org/10.1007/s40279-018-0907-3>
- Cormie, P., McGuigan, M. R., & Newton, R. U. (2016). Developing maximal neuromuscular power. *Sports Medicine*, 41(1), 17-38. <https://doi.org/10.2165/11538500-000000000-00000>
- Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
- Darmawan, G. E. B., Hidayat, S., & Arijaya, K. S. (2024). Analisis kondisi fisik terhadap performa atlet futsal. *Jurnal Ilmiah Spirit*, 24(2), 101-110.
- Febrianti, R. (2019). Pengaruh kondisi fisik terhadap performa atlet dalam pertandingan. *Jurnal Pendidikan Jasmani Dan Olahraga*, 8(2), 120-128.
- Hamdi Chaabene, H., Prieske, O., Negra, Y., & Granacher, U. (2020). Change of direction speed: Toward a strength training approach. *Strength and Conditioning Journal*, 42(1), 36-44. <https://doi.org/https://doi.org/10.1519/SSC.0000000000000505>
- Haugen, T., Tønnessen, E., & Seiler, S. (2019). Speed and sprint mechanics in team sports athletes. *Sports Medicine*, 49(4), 497-510. <https://doi.org/10.1007/s40279-019-01056-7>
- Harsono. (2018). *Kepelatihan olahraga: Teori dan metodologi*. PT Remaja Rosdakarya. Remaja Rosdakarya
- Ismaryati. (2020). *Tes dan pengukuran olahraga*. UNS Press. UNS Press
- Jamalul Insan, I. H. (2022). Pengaruh Latihan Lari (Sprint) 20 Meter Terhadap Kecepatan Menggiring Bola (Dribbling). *Jendela Olahraga*, 7(1), 132-139.
- Kevin Norton, K., & Timothy Olds, T. (2018). *Anthropometrica: A textbook of body measurement for sports and health courses* (reprint ed.). UNSW Press.
- Lloyd, R. S., & Oliver, J. L. (2019). *Strength and conditioning for young athletes: Science and application*. Routledge. <https://doi.org/10.4324/9781315545257>
- Makaje, N., Ruangthai, R., Arkarapanthu, A., & Yoopat, P. (2018). Physiological demands and activity profiles during futsal match play according to competitive level. *Journal of Sports Medicine and Physical Fitness*, 52(3), 366-374. *Journal of Sports Medicine and Physical Fitness*
- Medicine., A. C. of S. (2022). *ACSM's guidelines for exercise testing and prescription* (11th ed.). Wolters Kluwer

- Mutista, F. (2022). Application of multistage fitness tests in youth sports performance evaluation. *Journal of Physical Education and Sport*, 22(4), 921–928. <https://doi.org/10.7752/jpes.2022.04116>
- Nikolaidis, P. T., Knechtle, B., Clemente, F., & Torres-Luque, G. (2019). Reference values for body mass index in young athletes. *Sustainability*, 11(20), 5807. <https://doi.org/10.3390/su11205807>
- N., A., Turner, A. N., Bishop, C., & Chavda, S. (2022). Strength and conditioning for agility in sport: A systematic review. *Strength and Conditioning Journal*, 44(1), 1–15
- Norton, K., & Olds, T. (2018). *Anthropometrica: A textbook of body measurement for sports and health courses*. UNSW Press. Anthropometrica Book
- Paul, D. J., Gabbett, T. J., & Nassis, G. P. (2016). Agility in team sports: Testing, training and factors affecting performance. *Sports Medicine*, 46(3), 421–442. <https://doi.org/10.1007/s40279-015-0428-2>
- Pitaloka, A. (2024). Sports participation and physical health development among adolescents. *Journal of Physical Education Research*, 15(2), 101–110. Google Scholar Search Pitaloka 2024
- Ramirez-Campillo, R., Moran, J., Chaabene, H., & Granacher, U. (2020). Effects of plyometric training on physical fitness in team sport athletes. *International Journal of Sports Physiology and Performance*, 15(6), 1–10. <https://doi.org/10.1123/ijsp.2019-0350>
- Reilly, T., Bangsbo, J., & Franks, A. (2020). Anthropometric and physiological predispositions for elite soccer and futsal. *Journal of Sports Sciences*, 18(9), 669–683. <https://doi.org/10.1080/02640410050120050>
- Rizky Pratama, R., & Dedi Setiawan, D. (2021). Pengaruh latihan peregangan terhadap fleksibilitas otot pada siswa. *Jurnal Ilmu Keolahragaan*, 9(2), 88–95
- Santoso, D. (2023). The role of extracurricular futsal activities in character development among junior high school students. *Jurnal Pendidikan Jasmani Indonesia*, 19(1), 44–53. *Jurnal Pendidikan Jasmani Indonesia*
- Silva, A. F., Clemente, F. M., Lima, R., & Nikolaidis, P. T. (2020). Associations between body composition and physical performance in futsal players. *Frontiers in Psychology*, 11, 1519. <https://doi.org/10.3389/fpsyg.2020.01519>
- Sugiyono. (2019). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta. Penerbit Alfabeta
- Sukadiyanto. (2019). *Pengantar teori dan metodologi melatih fisik*. UNY Press. UNY Press
- Thomas, A., Dawson, B., & Goodman, C. (2019). The Yo-Yo test and sprint performance in team sports athletes. *Journal of Science and Medicine in Sport*, 9(5), 483–494. [https://doi.org/10.1016/S1440-2440\(06\)70062-2](https://doi.org/10.1016/S1440-2440(06)70062-2)
- Thomas, J. R., Nelson, J. K., & Silverman, S. J. (2020). *Research methods in physical activity* (8th ed.). Human Kinetics. Human Kinetics Research Methods Book
- Tomkinson, G. R., Carver, K. D., Atkinson, F., et al. (2019). European normative values for physical fitness in children and adolescents. *British Journal of Sports Medicine*, 52(22), 1445–1456. <https://doi.org/10.1136/bjsports-2017-098253>

- Turner, A. N., Brazier, J., Bishop, C., Chavda, S., Cree, J., & Read, P. (2022). Data analysis for strength and conditioning coaches: Using velocity-based training and agility performance. *Strength and Conditioning Journal*, 44(2), 45–56. <https://doi.org/10.1519/SSC.0000000000000660>
- Wicaksana, A., & Raharjo, B. (2023). Sprint performance and transition effectiveness in futsal athletes. *Jurnal Keolahragaan*, 11(2), 120–129. *Jurnal Keolahragaan*
- Yudi Nugraha, & Sri Hartono. (2022). Aerobic endurance contribution toward futsal performance among adolescent athletes. *Jurnal SPORTIF*, 8(3), 210–220. *Jurnal SPORTIF*