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Anthropometric Assessment of Nutritional Status among Young Football Athletes

Bonifasius Alfadika Hartanto[1,A,D,E], Galang Eka Putra Matadi[1,A,B,D] Muhammad Rosyiful Annas[1,A,C,D], Wahyu Daud Zulkarnain[1,A,C,D,E,F]

[1]Department of Sport Coaching Education, Faculty of Sport Science, Universitas Negeri Malang
Corresponding author: Wahyu Daud Zulkarnain; Department of Sport Coaching Education, Faculty of Sport Science, Universitas Negeri Malang, Indonesia, email: wahyu.daud.2306316@students.um.ac.id

Abstract

Background: Nutritional status is an important component of growth and development in young football athletes. Differences in growth and maturation may result in variations in nutritional status among athletes of similar age. **Objective:** This study aimed to describe the nutritional status of early-age football athletes at SSB Jaguar Muda Malang. **Methods:** This descriptive study involved 21 male football athletes aged 10–13 years at SSB Jaguar Muda Malang, selected using total sampling. Body weight and height were measured to calculate body mass index (BMI), and nutritional status was determined using BMI-for-age Z-scores based on the WHO 2007 reference. **Results:** Of the 21 athletes assessed, 13 athletes (61.9%) had normal nutritional status, 7 athletes (33.3%) were classified as overweight, and 1 athlete (4.8%) was classified as obese. Thus, 8 athletes (38.1%) had excess nutritional status. These findings indicate that although most athletes had normal nutritional status, a considerable proportion had excess nutritional status. **Conclusion:** Most early-age football athletes at SSB Jaguar Muda Malang had normal nutritional status. However, the presence of overweight and obese athletes highlights the importance of regular anthropometric and nutritional monitoring to support healthy growth and sustainable athlete development.

Keywords: Nutritional Status; BMI-For-Age; Young Football Athletes; Anthropometry; Youth Football

Authors' Contribution: A – Research concept and design; B – Collection and/or assembly of data; C – Data analysis and interpretation; D – Writing the article; E – Critical revision of the article; F – Final approval of article

INTRODUCTION

Nutritional status is a fundamental component of healthy growth, physical development, and overall well-being during childhood and adolescence. This developmental period is characterized by substantial changes in body size, body composition, physiological function, and biological maturation. Adequate nutritional intake is therefore essential to support normal growth and maturation as well as the physiological demands associated with regular physical activity. For young athletes, these nutritional requirements may be further increased by systematic training and competition, making appropriate nutritional status an important consideration in both health maintenance and athletic development (Desbrow, 2021; Norris et al., 2022).

Youth football places considerable physical demands on children and adolescents through activities involving repeated running, acceleration, deceleration, changes of direction, and intermittent high-intensity exercise. Consequently, appropriate growth and nutritional status are important components of a sustainable athlete development pathway. Evidence from youth football research indicates that regular football participation may be associated with favorable changes in body composition and physical fitness; however, individual responses vary according to age, training exposure, dietary intake, and biological maturation (Hernandez-Martin et al., 2021). Anthropometric characteristics and biological maturity are also relevant to the physical performance and development of young football players, highlighting the importance of monitoring growth-related characteristics alongside technical and physical training (Dut et al., 2023; Toselli et al., 2024).

The nutritional management of young football athletes requires particular attention because training takes place concurrently with ongoing growth and maturation. Unlike adult athletes, young athletes must meet nutritional requirements for both physiological development and exercise. Inadequate dietary intake or inappropriate timing of food consumption may affect energy availability, recovery, training adaptation, and potentially long-term health. Research involving academy football players has identified suboptimal fuelling and recovery practices among some young athletes, suggesting that nutritional support should be incorporated into youth athlete development rather than considered only as a component of elite-level sport (Stables et al., 2024). Recent evidence from youth team sports likewise emphasizes the importance of nutrition knowledge, dietary behavior, and appropriate nutritional practices in supporting the health and performance of young athletes (Irwin et al., 2026).

At the same time, excessive nutritional status should not be overlooked in physically active children. Childhood overweight and obesity are associated with adverse health outcomes and an increased risk of obesity and non-communicable diseases later in life (World Health Organization [WHO], 2025). Participation in organized sport does not necessarily eliminate the possibility of overweight or obesity because nutritional status is influenced by multiple

factors, including dietary intake, physical activity, training volume, growth, and biological maturation. Evidence from Indonesian schoolchildren has also demonstrated a substantial prevalence of overweight and obesity, indicating that excessive body weight remains an important public health concern among children in Indonesia (Widyahening et al., 2023). Thus, young athletes should also be included in systematic nutritional monitoring, even when they participate regularly in organized physical activity.

Anthropometric assessment offers a practical and relatively simple approach for monitoring growth and nutritional status in children and adolescents. Measurements of body weight and height can be used to calculate Body Mass Index (BMI), while BMI-for-age provides an age- and sex-specific indicator for interpreting nutritional status during growth. For children and adolescents aged 5–19 years, the WHO 2007 Growth Reference provides standardized BMI-for-age Z-score (BAZ) classifications for assessing nutritional status (World Health Organization, 2007). According to WHO criteria, overweight is defined as BMI-for-age greater than +1 standard deviation (SD), obesity as greater than +2 SD, thinness as below −2 SD, and severe thinness as below −3 SD (World Health Organization, 2007, 2025). The WHO 2007 reference was specifically developed for school-aged children and adolescents and remains an important standard for monitoring growth and nutritional status in this age group (World Health Organization, 2007).

The use of BMI-for-age is particularly relevant for young football players because body size changes substantially throughout childhood and adolescence. However, BMI should be interpreted as an indicator of nutritional status rather than a direct measure of body fat or body composition. Children of the same chronological age may differ considerably in height, body mass, muscular development, and biological maturity. Therefore, age- and sex-specific interpretation is essential when assessing overweight and obesity among individuals aged 5–19 years (World Health Organization, 2025). In youth football, this consideration is particularly important because differences in biological maturation may influence anthropometric characteristics and physical performance (Dut et al., 2023; Toselli et al., 2024). Standardized anthropometric monitoring can therefore provide useful baseline information

for identifying nutritional patterns while recognizing the developmental characteristics of young athletes.

Despite increasing interest in youth sports nutrition and athlete development, context-specific evidence concerning the nutritional status of young football athletes in grassroots football-school environments remains limited. Existing research has largely focused on general school populations, academy or elite football players, or associations between dietary intake, body composition, and physical performance (Hernandez-Martin et al., 2021; Mardiana et al., 2023; Toselli et al., 2024). Such evidence is valuable but may not fully represent young athletes participating in local football schools, where access to sports nutrition support, monitoring systems, and professional resources may differ from those available in elite academies. In Indonesia, research examining the nutritional profile of young football athletes within grassroots development environments is still relatively limited. This gap is important because early identification of nutritional problems may provide coaches, parents, and sports practitioners with information that can be used to support appropriate growth and athlete development.

Jaguar Muda Malang Football School represents a relevant grassroots football setting in which young athletes undergo systematic football training during an important period of growth and maturation. Athletes aged 10–13 years are particularly relevant for nutritional monitoring because this age range encompasses substantial changes in body size and the transition toward adolescence. Establishing an anthropometric profile at this stage may help identify athletes who require closer nutritional attention and provide baseline information for integrating health monitoring into football development programs.

Therefore, this study aims to assess the nutritional status of male football athletes aged 10–13 years at Jaguar Muda Malang Football School using anthropometric measurements and BMI-for-age Z-scores (BAZ) based on the WHO 2007 Growth Reference. The study is expected to provide context-specific empirical evidence regarding the nutritional profile of young football athletes in a grassroots football-school setting and to support the implementation of systematic nutritional monitoring as part of youth athlete

development. Because the study involves a relatively small sample from a single football school, the findings are intended primarily to describe the characteristics of this specific population and should not be generalized to all young football athletes without further research involving larger and more diverse samples.

METHOD

Community Service Program and Participants

This anthropometric assessment was conducted as part of a community service program (Pengabdian kepada Masyarakat/PkM) at Jaguar Muda Malang Football School. The program included anthropometric assessment and nutritional-status screening intended to provide information regarding the nutritional condition of young football athletes and to support awareness of nutritional monitoring in youth football development.

The participants consisted of 21 male football athletes aged 10–13 years who were actively involved in the football school's regular training activities. All eligible athletes participating in the community service program were included in the anthropometric assessment. Thus, the assessment involved the entire accessible group of athletes participating in the program rather than a sample selected for inferential research purposes.

Because the assessment was conducted in a single football school and involved only male athletes aged 10–13 years, the findings describe the nutritional-status profile of the participating group. The results should therefore not be generalized to young football athletes from other football schools, regions, age groups, or populations.

Anthropometric Assessment

Anthropometric assessment was performed to obtain body weight and standing height as indicators for nutritional-status screening. Body weight was measured using a digital weighing scale, while standing height was measured using a microtoise. Measurements were performed without shoes using standardized anthropometric procedures.

Body mass index (BMI) was calculated from body weight and standing height using the following formula:

$$\text{BMI} = \text{body weight (kg)} / \text{height}^2 (\text{m}^2) \quad (1)$$

BMI was used as an anthropometric screening indicator of nutritional status and not as a direct measure of body composition. BMI cannot distinguish between fat mass and lean mass. This limitation is particularly relevant among young football athletes because differences in muscular development and biological maturation may influence body weight and BMI. Accordingly, the results were interpreted as indicators of nutritional status rather than direct measures of body composition.

Nutritional-Status Classification

Nutritional status was assessed using the BMI-for-age Z-score (BAZ) based on the WHO 2007 Growth Reference for children and adolescents aged 5–19 years (World Health Organization, 2007). BAZ was determined according to the participant's age and sex.

Table 1. The nutritional-status classification

BAZ	**Nutritional Status**
< −3 SD	Severe thinness
≥ −3 SD to < −2 SD	Thinness
≥ −2 SD to ≤ +1 SD	Normal
> +1 SD to ≤ +2 SD	Overweight
> +2 SD	Obesity

The complete WHO classification was retained in the assessment framework. Categories with no participants were reported as zero or omitted from the descriptive presentation when appropriate. Therefore, if no participants were classified as severe thinness or thinness, the observed results may be presented only for the categories identified in the participating group, such as normal, overweight, and obesity.

Data Analysis

The anthropometric data obtained through the community service program were analyzed descriptively to describe the nutritional-status profile of the participating athletes. Continuous variables, including age, height, weight, BMI, and BAZ, were summarized using mean ± standard deviation (SD), together with minimum and maximum values. Nutritional-status categories were presented as frequencies (n) and percentages (%).

BMI was calculated from measured body weight and height, while BAZ was determined according to the WHO 2007 Growth Reference for children and adolescents aged 5–19 years. The analysis was limited to descriptive

statistics and did not involve hypothesis testing, association analysis, or causal inference.

Ethical and Participant Protection Considerations

The anthropometric assessment was conducted as part of a community service program and was not originally designed or conducted as a formally ethics-reviewed research study. Accordingly, the activity did not receive prior approval from an institutional research ethics committee, and no ethical approval number is reported.

Because the participants were children aged 10–13 years, participant protection and appropriate permission were considered during the implementation of the program. Participation in the anthropometric assessment was voluntary and was coordinated with the football school's management. Information obtained from individual participants was treated confidentially, and no personally identifiable anthropometric information was disclosed in the presentation of the results.

The authors acknowledge that the absence of formal prior ethical review is an important limitation when the activity's data are subsequently presented in a scientific publication. The findings should therefore be understood as descriptive results obtained from a community service-based anthropometric assessment rather than as evidence generated from a prospectively ethics-approved research study. Future community service activities involving systematic data collection and publication, particularly those involving children, should incorporate appropriate ethical review and documented parental or legal-guardian permission before data collection.

RESULT

Participant Characteristics

The community service-based anthropometric assessment involved 21 male young football athletes aged 10–13 years from Jaguar Muda Malang Football School. The participants had a mean age of 141.14 ± 9.86 months, with ages ranging from 121 to 157 months. The mean standing height was 146.10 ± 9.71 cm (range: 125.50–172.80 cm), while the mean body weight was 39.87 ± 9.07 kg (range: 24.45–64.15 kg).

Anthropometric Characteristics

The anthropometric characteristics of the participating athletes are presented in Table 1. The mean BMI was 18.44 ± 2.22 kg/m², with individual values ranging from 15.33 to 22.41 kg/m². The mean BMI-for-age Z-score (BAZ) was 0.89 ± 0.61 SD, with values ranging from 0.00 to 2.10 SD.

Overall, the descriptive anthropometric data indicated variation in body size among the participating athletes. The BAZ values also showed variation in nutritional status, with most participants falling within the normal range, while several participants were classified as overweight and one participant as obese according to the WHO 2007 Growth Reference.

Table 2. Descriptive Anthropometric Characteristics of Young Football Athletes

Variable	Mean ± SD	Minimum	Maximum
Age (months)	141.14 ± 9.86	121	157
Height (cm)	146.10 ± 9.71	125.50	172.80
Weight (kg)	39.87 ± 9.07	24.45	64.15
BMI (kg/m²)	18.44 ± 2.22	15.33	22.41
BMI-for-Age Z-score (BAZ)	0.89 ± 0.61	0.00	2.10

Nutritional Status

The distribution of nutritional status based on BMI-for-age Z-score (BAZ) is presented in Table 2. Of the 21 participants, 13 athletes (61.9%) were classified as having normal nutritional status (BAZ ≥ −2 SD to ≤ +1 SD). Seven athletes (33.3%) were classified as overweight (BAZ > +1 SD to ≤ +2 SD), while one athlete (4.8%) was classified as obese (BAZ > +2 SD).

No participants were classified as having thinness (BAZ ≥ −3 SD to < −2 SD) or severe thinness (BAZ < −3 SD). Thus, although the complete WHO classification was applied, the observed nutritional-status categories in this group were limited to normal, overweight, and obesity.

Table 3. Distribution of Nutritional Status Based on BMI-for-Age Z-score

Nutritional Status	BAZ Classification	n	%
Severe thinness	< −3 SD	0	0.0
Thinness	≥ −3 SD to < −2 SD	0	0.0
Normal	≥ −2 SD to ≤ +1 SD	13	61.9
Overweight	> +1 SD to ≤ +2 SD	7	33.3
Obesity	> +2 SD	1	4.8
Total		**21**	**100.0**

The findings indicate that 8 of the 21 athletes (38.1%) were above the normal nutritional-status range, consisting of seven athletes classified as overweight and one classified as obese. The highest individual BAZ value was 2.10 SD, corresponding to the participant classified as obese.

DISCUSSION

The variations in nutritional status observed among the young football athletes indicate substantial inter-individual differences in growth, body composition, and nutritional characteristics. Such variation is expected during childhood and early adolescence because chronological age does not necessarily correspond to biological maturation. Differences in maturation may affect height, body mass, body composition, and physical performance, even among athletes participating in similar training environments. Recent research involving young football players has demonstrated that anthropometric characteristics and body composition vary according to age and maturation status, emphasizing the importance of considering developmental characteristics when interpreting the physical profiles of youth athletes (Portella et al., 2023; Toselli et al., 2024). In particular, Toselli et al. (2024) reported differences in anthropometric and maturation characteristics among selected and unselected young football players, suggesting that growth and maturation should be considered alongside conventional physical-performance measures in youth football development.

The predominance of normal nutritional status in the present study is consistent with recent evidence indicating that many young football athletes maintain generally favorable nutritional and body-composition profiles. For example, Staśkiewicz et al. (2023) reported differences in body composition and nutritional awareness among football players across age groups, while Solichah and Putriana (2026) found that most adolescent football athletes had good nutritional status, although a proportion presented with excess nutritional status. These findings suggest that participation in organized football training may coexist with generally adequate nutritional status, but does not eliminate the possibility of overweight or other unfavorable body-composition profiles. Nutritional status among young athletes should therefore be understood as the result of multiple interacting factors, including

dietary intake, training load, habitual physical activity, sedentary behavior, and individual growth requirements rather than participation in sport alone.

The presence of athletes with overweight in the present sample is particularly relevant from a developmental perspective. Young football players experience changing energy requirements associated with both growth and physical training. Consequently, an apparent excess in body mass should not automatically be interpreted as excessive adiposity or poor nutritional behavior. BMI is a useful screening indicator but does not distinguish fat mass from fat-free mass and can be influenced by growth and maturation. Recent research has therefore emphasized the value of assessing body composition using complementary anthropometric or body-composition methods when evaluating young football players (Tornero-Aguilera et al., 2022; Portella et al., 2023). This consideration is important because youth athletes may develop substantial lean mass while simultaneously undergoing normal changes in body size and maturation.

The relationship between nutritional status, body composition, and physical performance also appears to be multidimensional. In youth football, body composition is associated with aspects of physical fitness, although the magnitude and direction of these relationships may vary according to age, maturation, playing level, and the specific performance variable assessed. Leão et al. (2022) demonstrated interactions between body composition and physical fitness among youth soccer players, while França et al. (2024) reported associations between body composition and lower-body power, speed, and agility in youth soccer players. Similarly, Toselli et al. (2024) found that anthropometric and maturation-related characteristics contributed to differences between selected and unselected young football players. These findings support the interpretation that an appropriate physical profile may contribute to the demands of football, but that no single anthropometric indicator can adequately explain athletic performance in developing players.

Recent evidence also supports the importance of football participation for maintaining favorable body-composition characteristics. A systematic review and meta-analysis published in 2026, involving 20 studies and 2,906 children and adolescents aged 8–17 years, found that recreational football was

associated with reductions in BMI, body-fat percentage, and waist circumference, together with a small increase in lean mass. Although the certainty of evidence was limited by methodological heterogeneity, these findings provide quantitative support for the potential role of football participation in promoting favorable body-composition outcomes among children and adolescents (Lei et al., 2026). Thus, the generally favorable nutritional status observed in the present study may partly reflect the physical activity demands associated with regular football participation, although the cross-sectional nature of the present data does not allow a causal relationship to be established.

Nutrition is another important component of youth football development. Young football athletes have nutritional requirements that must simultaneously support normal growth, physiological development, training, recovery, and sport performance. A systematic review by North et al. (2022) emphasized that high-performance youth soccer players experience nutritional demands associated with both growth and intensive training, requiring appropriate dietary strategies throughout the developmental process. More recent research further indicates that nutrition-related knowledge and dietary practices remain important considerations among young football players. Vicente et al. (2025), for example, demonstrated that a nutrition education program improved nutrition knowledge among young football players, even though changes in overall dietary adherence were not statistically significant. This finding suggests that nutrition education may be a feasible component of athlete-development programs, but education alone may not necessarily produce immediate changes in dietary behavior.

The importance of nutrition education is further supported by recent evidence linking nutrition knowledge, body composition, and performance-related characteristics in adolescent football players. Tomljanovic et al. (2025) highlighted the importance of sports-nutrition knowledge and carbohydrate intake among young elite football players, whereas Dumitrescu et al. (2026) examined the associations among nutrition knowledge, body composition, and cardiopulmonary exercise performance in adolescent football players. Collectively, these studies indicate that nutritional management should

extend beyond simply classifying athletes according to BMI or body mass. Young athletes require practical guidance regarding energy intake, carbohydrate availability, protein consumption, hydration, food quality, and recovery nutrition, while recommendations should remain appropriate to their age and stage of development.

Body-composition monitoring should consequently be integrated into youth football development, but it should be conducted carefully and longitudinally. Repeated assessment can provide more meaningful information than a single measurement because growth and maturation continuously modify body size and composition. Zaccagni et al. (2025), for example, demonstrated changes in body composition among adolescent soccer players across pre-season and in-season periods, highlighting the dynamic nature of body composition during training. Similarly, recent research in youth soccer has examined body-composition characteristics across playing positions, indicating that physical profiles may also vary according to positional demands (Łuszczki et al., 2025). Therefore, monitoring programs should focus on individual developmental trajectories rather than applying rigid performance-oriented body-composition targets to all young athletes.

These findings have practical implications for youth football development programs. Anthropometric monitoring can provide coaches and support staff with an initial overview of athletes' growth and nutritional status and can help identify individuals who may require additional assessment or guidance. However, BMI or body mass should not be used as a standalone indicator of athlete health or performance. A more comprehensive approach should combine age- and sex-specific anthropometric assessment with information on biological maturation, body composition, physical fitness, dietary intake, training load, and health status. Such an approach is consistent with contemporary youth-sport nutrition frameworks that emphasize the need to balance sport-specific demands with the physiological requirements of growth and development (North et al., 2022; Victoria-Montesinos et al., 2026).

The findings also highlight the importance of collaboration among coaches, parents, athletes, and qualified nutrition or health professionals.

Recent evidence indicates that nutrition education can improve knowledge among young football players (Vicente et al., 2025), while broader evidence from youth team-sport settings suggests that nutrition education and behavioral interventions may influence nutrition knowledge, dietary behaviors, hydration practices, body composition, and aspects of performance (Victoria-Montesinos et al., 2026). Therefore, nutritional management should not be restricted to competition periods or individual athletes with visible weight-related concerns. Instead, it should become part of a preventive and developmental strategy implemented throughout the athlete pathway.

Overall, the present findings reinforce the importance of considering nutritional status and anthropometric characteristics as integral components of long-term youth football development. The predominance of normal nutritional status is encouraging; however, the identification of athletes with excess nutritional status indicates the need for continuous monitoring rather than assuming that football participation alone guarantees optimal nutritional health. The most appropriate strategy is therefore a longitudinal, individualized, and developmentally sensitive approach that integrates anthropometric assessment, body-composition monitoring, nutrition education, appropriate training loads, and healthy lifestyle practices. Such an approach may support not only football-specific performance but also healthy growth, recovery, and sustainable athlete development.

CONCLUSIONS

The findings of this study indicate that most early-age football athletes at SSB Jaguar Muda Malang have a normal nutritional status. However, a small proportion of athletes were classified as overweight or obese, indicating that variations in nutritional status remain among the participants. These variations may be related to differences in growth and maturation, dietary habits, and physical activity.

Overall, the athletes' mean BMI and BMI-for-age Z-score indicate a generally normal nutritional status. Nevertheless, the presence of overweight and obese athletes highlights the importance of regular nutritional monitoring and appropriate dietary guidance during the growth and development of young football athletes.

Future research should examine additional factors related to nutritional status, particularly dietary intake, physical activity outside training, and eating-related behaviors. Longitudinal studies are also recommended to monitor changes in nutritional status throughout growth and development. Collaboration among coaches, parents, and sports nutrition professionals may further support healthy and sustainable development of young football athletes.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with any party in the implementation of this research.

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