**Journal of Sport Education, Coaching, and Health (JOCCA)**
ISSN (E): 2797-4197 ‖ ISSN (P): 2797-3565
Volume 6 Number 4, Year 2025 ‖ pp.392-401
Email: journal.jocca@gmail.com ‖ Website: http://sainsglobal.com/jk

# The Relationship Between Body Mass Index, Body Composition, And Motor Skills In Physical Education Students In The Basketball Branch: Literature Review

**Tri Angriawan**
Universitas Negeri Makassar, Sulawesi Selatan, Indonesia
tri.angriawan@unm.ac.id

**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

**Received**: 2025-11-24 **Accepted**: 2025-11-30 **Published**: 2025-12-21

## ABSTRACT

This literature review examines the relationship between Body Mass Index (BMI), body composition, and motor skills among Physical Education students in basketball. The background of this study is based on the need to understand how anthropometric and physiological characteristics influence students' basketball-related motor performance. The objective of this review was to synthesize conceptual and empirical evidence regarding the contribution of BMI, fat mass, and lean body mass to agility, speed, vertical jump, coordination, balance, and basketball-specific skills. This study used a literature review method by analyzing peer-reviewed articles published within the last ten years from Scopus- and SINTA-indexed journals. The findings indicate that BMI is useful as an initial screening indicator, but it is less accurate in explaining sport performance because it cannot distinguish fat mass from muscle mass. Empirically, students with normal BMI, lower body fat percentage, and higher lean body mass tend to demonstrate better agility, sprint ability, jumping performance, coordination, dribbling, passing, shooting, and defensive movement. Conversely, excessive fat mass increases mechanical load and reduces movement efficiency. It can be concluded that body composition is a stronger predictor of basketball motor skills than BMI alone. Therefore, basketball learning and training programs should integrate BMI assessment, body composition analysis, physical fitness testing, and sport-specific motor skill evaluation.

**Keywords** : Body Mass Index; Body Composition; Motor Skills; Physical Education Students; Basketball

## INTRODUCTION

Physical Education (PE) plays a strategic role in developing students' physical fitness, motor competence, and sport-specific performance. In higher education settings, particularly among students specializing in basketball, physical characteristics and motor abilities become critical determinants of successful skill acquisition and athletic achievement. Basketball is a complex sport requiring a combination of anthropometric advantages, optimal body composition, neuromuscular coordination, agility, speed, balance, and technical motor proficiency. Consequently, understanding the relationship between Body Mass Index (BMI), body composition, and motor skills has become an important area of inquiry within sports science and physical education.

BMI has long been used as a simple indicator of nutritional status and body weight classification. However, contemporary sports science emphasizes that BMI alone may not adequately describe an individual's physical condition because it cannot distinguish between fat mass and lean muscle mass. Athletes and physically active students often present elevated BMI values due to increased muscle mass rather than excessive adiposity. Therefore, body composition analysis has emerged as a more comprehensive indicator for evaluating physical readiness and athletic performance (Silva et al., 2022; Nikolaidis et al., 2021).

Motor skills are fundamental components of physical education learning outcomes. According to motor development theory, motor competence refers to the proficiency with which individuals perform fundamental and specialized movement patterns that support participation in physical activity and sports. In basketball, motor skills encompass running, jumping, dribbling, passing, shooting, agility, coordination, and balance. Previous studies indicate that students with better motor competence demonstrate higher participation levels, improved sports performance, and enhanced physical fitness (Barnett et al., 2022; Hulteen et al., 2020). Recent empirical evidence suggests that excessive body fat negatively affects motor performance by increasing mechanical load during movement, reducing movement efficiency, and limiting agility and coordination. Conversely, higher lean body mass contributes positively to explosive power, speed, and sport-specific skills. This phenomenon is particularly relevant in basketball, where repeated sprinting, jumping, and rapid directional changes demand optimal body composition (Zaccagni et al., 2020; Mancha-Triguero et al., 2021). Despite growing interest in anthropometric and physiological factors affecting athletic performance, inconsistencies remain regarding how BMI and body composition interact with motor skill development among physical education students. Some studies report significant associations between BMI and motor competence, while others suggest that body composition variables are stronger predictors than BMI alone. These inconsistencies highlight the need for a comprehensive literature review focusing specifically on basketball-oriented physical education students.

Theoretical perspectives from kinesiology, motor learning, and exercise physiology provide a foundation for understanding the relationship between anthropometric characteristics and motor performance. According to Dynamic Systems Theory, motor behavior emerges from interactions among individual constraints, environmental constraints, and task constraints. Body composition and BMI represent individual constraints that influence movement execution and skill acquisition (Logan et al., 2018). Several contemporary studies have demonstrated significant relationships between body composition and motor competence. A systematic review conducted by Hulteen et al. (2020) found that lower adiposity levels were consistently associated with higher motor competence among adolescents and young adults. Similarly, Barnett et al. (2022) reported that individuals possessing healthier body composition profiles exhibited superior locomotor and object-control skills. Research in sports performance further indicates that lean body mass positively contributes to explosive actions. Basketball athletes with greater muscle mass demonstrate higher vertical jump performance, sprint speed, and agility scores than athletes with higher body fat percentages (Stojanović et al., 2018). These findings align with physiological theories suggesting that increased skeletal muscle mass enhances force production and neuromuscular efficiency.

Studies involving university students have also revealed significant associations between body composition indicators and physical performance measures. Nikolaidis et al. (2021) found that body fat percentage was negatively correlated with aerobic capacity, agility, and power output among physically active college students. Similar findings were

reported by Silva et al. (2022), who identified lean mass as a significant predictor of functional movement performance. Within basketball-specific contexts, anthropometric characteristics have been recognized as essential performance determinants. Basketball requires rapid acceleration, multidirectional movement, jumping, and precise technical execution. Research conducted by Mancha-Triguero et al. (2021) demonstrated that athletes possessing lower fat mass and higher lean body mass achieved superior results in sprinting and change-of-direction tests. Furthermore, Zaccagni et al. (2020) highlighted the importance of body composition monitoring in optimizing basketball training programs.

Motor skill theories also support these findings. According to the Motor Competence Framework proposed by Robinson et al. (2018), physical characteristics significantly influence movement proficiency. Individuals with favorable body composition are more likely to engage successfully in complex motor tasks, creating a positive feedback loop that enhances physical activity participation and skill development. Additionally, contemporary educational research indicates that motor competence is a critical predictor of long-term physical activity engagement and sports participation. Physical education students who demonstrate higher motor proficiency tend to exhibit greater confidence, motivation, and performance in sport-specific learning environments (Lopes et al., 2021; Cattuzzo et al., 2020).

Although numerous studies have examined BMI, body composition, and motor competence separately, several gaps remain evident in the literature. First, many studies focus on children and adolescents, whereas research involving university-level physical education students remains relatively limited. College students represent a unique population because they are transitioning toward specialized sports performance and professional physical education competencies (Lopes et al., 2021). Second, previous investigations frequently utilize BMI as the primary anthropometric indicator. However, emerging evidence suggests that BMI may inadequately represent body composition among physically active populations. The inability of BMI to distinguish between fat mass and muscle mass may produce misleading interpretations, particularly in sports-related contexts (Nikolaidis et al., 2021). Third, while relationships between body composition and general physical fitness have been extensively investigated, studies specifically examining motor skills within basketball-oriented physical education programs remain scarce. Most basketball research emphasizes competitive athletes rather than PE students who combine academic learning with practical sport participation (Mancha-Triguero et al., 2021). Fourth, existing findings remain inconsistent regarding the relative contributions of BMI and body composition to motor skill performance. Some studies identify BMI as a significant predictor, whereas others conclude that body fat percentage and lean mass are more influential determinants. Such inconsistencies indicate the need for a comprehensive synthesis of available evidence (Silva et al., 2022; Barnett et al., 2022). Finally, limited literature has integrated conceptual frameworks from motor learning, kinesiology, and exercise physiology to explain how anthropometric characteristics influence basketball-related motor performance. This theoretical integration remains necessary to establish a more comprehensive understanding of the phenomenon.

The objective of this literature review is to analyze and synthesize contemporary evidence regarding the relationship between Body Mass Index, body composition, and motor skills among physical education students involved in basketball activities. Specifically, this review aims to identify the extent to which BMI and body composition influence motor competence, movement efficiency, and basketball-specific skill performance. The novelty of this study lies in three major aspects. First, it integrates BMI, body composition, and motor

skills into a single analytical framework rather than examining them independently. Second, it focuses specifically on physical education students participating in basketball, a population that has received limited attention in previous reviews. Third, it combines perspectives from exercise physiology, motor learning theory, and sports performance science to provide a multidimensional explanation of the observed relationships. By addressing these gaps, this review is expected to contribute to evidence-based physical education practices, athlete development programs, and basketball training strategies within higher education settings.

In summary, BMI, body composition, and motor skills represent interconnected factors influencing performance and learning outcomes among physical education students in basketball. While previous studies generally suggest that favorable body composition contributes positively to motor competence and basketball performance, inconsistencies remain regarding the predictive value of BMI compared with direct body composition measures. Furthermore, limited evidence exists concerning university-level physical education students engaged in basketball activities. Therefore, a comprehensive literature review is warranted to synthesize current knowledge, identify research trends, and establish a clearer theoretical and empirical understanding of the relationship between BMI, body composition, and motor skills in basketball-oriented physical education contexts.

## METHODS

This study employed a Literature Review design to systematically synthesize and critically analyze scientific evidence regarding the relationship between Body Mass Index (BMI), body composition, and motor skills among Physical Education students participating in basketball activities. Literature reviews are widely recognized as effective approaches for integrating theoretical and empirical findings from multiple studies to establish comprehensive scientific understanding and identify future research directions (Al Ghazaly et al., 2025). The review process followed the principles of systematic literature synthesis, emphasizing transparency, reproducibility, and evidence-based analysis. Relevant articles were identified through comprehensive searches of major scientific databases, including Scopus, Web of Science, PubMed, ScienceDirect, Google Scholar, SINTA, and Garuda. The search strategy utilized combinations of keywords such as "Body Mass Index," "BMI," "body composition," "motor skills," "motor competence," "physical education students," "basketball," "anthropometric characteristics," and "physical performance." Boolean operators (AND, OR) were employed to optimize retrieval of relevant studies. The inclusion criteria consisted of: (1) articles published between 2015 and 2025; (2) peer-reviewed journal articles indexed in Scopus or accredited national journals (SINTA); (3) studies investigating BMI, body composition, motor skills, physical fitness, or basketball performance; (4) participants comprising adolescents, university students, athletes, or physical education students; and (5) articles published in English or Indonesian. Exclusion criteria included conference abstracts without full texts, duplicate publications, non-peer-reviewed sources, and studies unrelated to motor performance or anthropometric variables.

The selection process was conducted in four stages: identification, screening, eligibility assessment, and final inclusion. Initially, all retrieved articles were exported into a reference management system. Duplicate records were removed before title and abstract screening. Subsequently, full-text evaluation was conducted to determine the relevance of each study to the research objective. This procedure is consistent with contemporary recommendations for evidence synthesis in sports science and physical education research (Al Ghazaly et al.,

2025). Data extraction focused on several key variables, including study characteristics, sample demographics, BMI indicators, body composition measurements, motor skill assessments, basketball-related performance outcomes, and statistical findings. Special attention was given to studies reporting associations between adiposity, lean body mass, and motor competence. Previous evidence indicates that body composition significantly influences physical fitness, movement efficiency, and sport-specific motor performance, particularly in basketball athletes and physical education students. The extracted findings were analyzed using a narrative synthesis approach, enabling integration of conceptual frameworks from motor learning theory, exercise physiology, and sports performance science. The synthesis emphasized identifying consistent patterns, contradictions, and emerging trends regarding the influence of BMI and body composition on motor skills. Through this approach, the review aimed to provide a comprehensive evidence base for understanding how anthropometric characteristics contribute to motor competence and basketball performance among physical education students.

## RESULTS AND DISCUSSION

### Result

The literature review indicates that Body Mass Index (BMI), body composition, and motor skills are interrelated variables that influence basketball performance among Physical Education students. Conceptually, BMI provides a general classification of body weight status, but it is not sufficient to explain students' functional ability because it cannot differentiate fat mass from lean muscle mass. Empirically, most studies show that students with normal BMI, lower body fat percentage, and higher lean body mass tend to demonstrate better motor performance, especially in agility, vertical jump, sprint speed, balance, coordination, dribbling, passing, and shooting accuracy.

The reviewed literature also confirms that basketball requires complex motor integration. Students with excessive fat mass generally experience reduced movement efficiency because greater body load increases energy expenditure and limits acceleration, jumping, and rapid change of direction. In contrast, students with higher skeletal muscle mass show better explosive power, postural control, and technical skill execution. These findings support the argument that body composition is a stronger predictor of basketball-related motor skills than BMI alone.

**Table 1.**
Synthesis of Empirical Findings on BMI, Body Composition, and Motor Skills in Basketball-Oriented Physical Education

| Variable | Conceptual Meaning | Empirical Finding | Relationship with Motor Skills |
|---|---|---|---|
| Body Mass Index | General indicator of body weight status based on height and weight | Normal BMI is commonly associated with better movement efficiency | Moderate relationship with agility, endurance, and skill performance |
| Body Fat Percentage | Proportion of fat mass in the body | Higher body fat tends to reduce speed, jumping ability, and agility | Negative relationship with motor performance |
| Lean Body Mass | Muscle and non-fat tissue contributing to force production | Higher lean mass supports power, strength, and explosive movement | Positive relationship with basketball motor skills |
| Agility | Ability to change direction quickly and efficiently | Students with lower fat mass perform better in agility tests | Strongly influenced by body composition |

| Variable | Conceptual Meaning | Empirical Finding | Relationship with Motor Skills |
|---|---|---|---|
| Vertical Jump | Indicator of lower-limb explosive power | Higher muscle mass supports better jump performance | Positive relationship with lean mass |
| Sprint Speed | Ability to accelerate over short distances | Excessive fat mass slows acceleration and repeated sprint ability | Negative relationship with fat mass |
| Coordination | Ability to integrate movement patterns efficiently | Better body control improves dribbling, passing, and shooting mechanics | Positive relationship with healthy body composition |
| Basketball Skill Performance | Execution of sport-specific motor skills | Optimal body composition improves dribbling, passing, shooting, and defensive movement | Strong practical relationship |

Overall, the findings reveal three major patterns. First, BMI is useful as an initial screening indicator, but it should not be used as the only measurement in basketball-related physical education research. Second, body composition provides a more accurate explanation of students' physical and motor performance because basketball depends heavily on muscle power, agility, and repeated movement efficiency. Third, motor skills in basketball are not only technical abilities but also products of anthropometric, physiological, and neuromuscular factors.

Thus, the results of this literature review confirm that Physical Education students with proportional BMI, lower fat mass, and higher lean body mass are more likely to achieve better basketball motor performance. These findings strengthen the need for integrated assessment models combining anthropometry, body composition, and motor skill testing in basketball learning and training programs.

## Discussion

The findings of this literature review indicate that the relationship between Body Mass Index (BMI), body composition, and motor skills in Physical Education students involved in basketball is multidimensional, not merely anthropometric. Conceptually, BMI remains useful as an initial screening tool to classify weight status, but its predictive value for basketball motor performance is limited because it does not distinguish between fat mass and lean mass (Nuttall, 2015; Rothman, 2018). This limitation is highly relevant in sport contexts because students with higher muscle mass may be classified as overweight by BMI, although functionally they possess better strength, power, and movement capacity (Silva et al., 2019; Nikolaidis et al., 2021). Therefore, the review supports the argument that body composition provides a more precise explanation of motor performance than BMI alone. Empirically, students with proportional BMI and lower body fat percentage tend to show better agility, speed, endurance, balance, and basketball-specific skill execution. Excessive adiposity increases mechanical load during running, jumping, landing, and change-of-direction actions, thereby reducing movement economy and neuromuscular efficiency (Cattuzzo et al., 2016; Robinson et al., 2015). In basketball, this condition becomes critical because players are required to perform repeated accelerations, decelerations, lateral movements, and explosive jumps in short intervals (Stojanović et al., 2018; Mancha-Triguero et al., 2021). Students with higher fat mass generally require greater energy expenditure to move their body mass, which may reduce their ability to maintain technical quality during dribbling, passing, shooting, and defensive footwork (Zaccagni et al., 2020; Ramos-Campo et al., 2021).

The reviewed evidence also confirms that lean body mass has a positive relationship with basketball motor skills. Higher muscle mass contributes to greater force production, postural stability, and explosive power, which are essential for vertical jumping, sprinting, rebounding, and rapid directional changes (Suchomel et al., 2016; Ferioli et al., 2018). In basketball, lower-limb strength supports jump height and acceleration, while trunk stability improves balance during shooting, pivoting, and body contact situations (Benis et al., 2016; Pojskic et al., 2018). These findings are consistent with exercise physiology theory, which explains that skeletal muscle mass functions as the primary driver of force generation and movement control during high-intensity sport actions (McArdle et al., 2015; Kenney et al., 2020). From a motor learning perspective, motor skills are shaped by the interaction between individual constraints, task demands, and environmental conditions. Dynamic Systems Theory explains that body size, mass distribution, strength, coordination, and perceptual ability interact to determine movement patterns (Newell, 1986; Davids et al., 2015). Thus, Physical Education students with healthier body composition are more likely to perform efficient movement patterns because their bodies provide fewer mechanical constraints during skill execution. This supports the motor competence framework, which states that motor proficiency, physical fitness, perceived competence, and physical activity participation interact reciprocally across development (Robinson et al., 2015; Hulteen et al., 2020).

The relationship between body composition and basketball skill performance is also supported by empirical studies on agility and coordination. Agility requires not only speed but also braking ability, balance, reactive decision-making, and efficient re-acceleration. Students with excess body fat may experience slower deceleration and reduced postural control, making defensive slides, cutting movements, and fast-break transitions less efficient (Scanlan et al., 2019; Conte et al., 2020). Conversely, students with better muscle-to-fat ratio tend to perform superior multidirectional movement because lean mass enhances strength while lower fat mass reduces non-functional load (Gryko et al., 2018; Arede et al., 2019). In terms of basketball technical skills, body composition indirectly affects skill quality through physical fitness components. Dribbling requires coordination between visual control, hand manipulation, rhythm, balance, and lower-limb movement. Passing requires upper-body power, timing, and trunk stability. Shooting requires postural alignment, balance, shoulder–elbow–wrist coordination, and lower-limb force transfer (Okazaki et al., 2015; Rojas et al., 2020). Therefore, students with better body composition profiles are generally more capable of maintaining technical consistency under fatigue or game pressure. This is important because basketball motor skills are not isolated movements but integrated actions performed dynamically in response to opponents, teammates, space, and time (Sampaio et al., 2015; Conte et al., 2018).

Another important finding is that BMI should not be interpreted independently in Physical Education assessment. Several studies emphasize that BMI may misclassify athletic populations because it treats all body mass equally, while sport performance depends more on functional body mass than total body mass (Nevill et al., 2019; Silva et al., 2022). For this reason, assessments should combine BMI with body fat percentage, skeletal muscle mass, waist-to-height ratio, and performance-based motor tests. This integrated model is more appropriate for basketball learning programs because it captures both health status and functional readiness (Tomkinson et al., 2018; Ortega et al., 2018). For Physical Education students, the practical implication is clear: basketball instruction should not only emphasize technical drills but also include body composition monitoring, strength development, agility training, coordination exercises, and nutrition education. Healthy body

composition supports learning efficiency because students can move more freely, tolerate training loads better, and repeat motor tasks with less fatigue (Lopes et al., 2021; Barnett et al., 2022). In the context of higher education, this is especially important because Physical Education students are future teachers, coaches, and movement educators who must demonstrate adequate motor competence and scientific understanding of the body-performance relationship.

Overall, this review confirms that BMI, body composition, and motor skills are interrelated predictors of basketball performance, but body composition offers stronger explanatory power than BMI alone. Lower body fat, higher lean mass, and balanced anthropometric status contribute positively to agility, speed, jumping ability, coordination, and basketball technical performance. Therefore, the most academically and practically defensible conclusion is that basketball-oriented Physical Education programs should adopt an integrated assessment framework combining anthropometry, body composition, physical fitness, and sport-specific motor skill evaluation. This approach strengthens evidence-based teaching, supports student performance development, and provides a more accurate foundation for research in Physical Education and basketball training.

## CONCLUSION

This literature review concludes that Body Mass Index, body composition, and motor skills have a meaningful relationship in Physical Education students participating in basketball. Conceptually, BMI is useful as an initial indicator of weight status, but it is not sufficient to explain basketball motor performance because it cannot differentiate fat mass from lean muscle mass. Empirically, the reviewed findings show that students with normal BMI, lower body fat percentage, and higher lean body mass tend to demonstrate better agility, sprint speed, vertical jump, coordination, balance, dribbling, passing, shooting, and defensive movement. Body composition appears to be a stronger predictor of motor skill performance than BMI alone. Excessive fat mass increases mechanical load, reduces movement economy, and limits explosive actions, while lean body mass supports force production, postural control, and technical execution. Therefore, basketball-oriented Physical Education programs should apply integrated assessment models combining BMI, body fat percentage, skeletal muscle mass, physical fitness tests, and basketball-specific motor skill evaluation. Overall, optimal body composition contributes to more efficient movement patterns and better basketball performance. Future studies should use stronger empirical designs, larger samples, and sport-specific measurement instruments to clarify the causal relationship between anthropometric characteristics and motor skill development in Physical Education students.

## REFERENCES

Barnett, L. M., Webster, E. K., Hulteen, R. M., De Meester, A., Valentini, N. C., Lenoir, M., Pesce, C., Getchell, N., Lopes, V. P., Robinson, L. E., Brian, A., & Rodrigues, L. P. (2022). Through the looking glass: A systematic review of longitudinal evidence, providing new insight for motor competence and health. Sports Medicine, 52, 875–920. https://doi.org/10.1007/s40279-021-01516-8

Benis, R., Bonato, M., & La Torre, A. (2016). Elite female basketball players' body-weight neuromuscular training and performance on the Y-balance test. Journal of Athletic Training, 51(9), 688–695. https://doi.org/10.4085/1062-6050-51.12.03

Cattuzzo, M. T., Henrique, R. S., Ré, A. H. N., Oliveira, I. S., Melo, B. M., Moura, M. S., Araújo, R. C., & Stodden, D. (2016). Motor competence and health-related physical fitness in youth: A systematic review. Journal of Science and Medicine in Sport, 19(2), 123–129. https://doi.org/10.1016/j.jsams.2014.12.004

Conte, D., Favero, T. G., Niederhausen, M., Capranica, L., & Tessitore, A. (2017). Determinants of the effectiveness of fast break actions in elite and sub-elite Italian men's basketball games. Biology of Sport, 34(2), 177–183. https://doi.org/10.5114/biolsport.2017.65337

Ferioli, D., Rampinini, E., Martin, M., Rucco, D., La Torre, A., Petway, A., & Scanlan, A. T. (2018). Influence of ball possession and playing position on the physical demands encountered during professional basketball games. Biology of Sport, 35(1), 79–84. https://doi.org/10.5114/biolsport.2018.70754

Gryko, K., Kopiczko, A., Mikołajec, K., Stasny, P., & Musalek, M. (2018). Anthropometric variables and somatotype of young and professional male basketball players. Sports, 6(1), 9. https://doi.org/10.3390/sports6010009

Hulteen, R. M., Smith, J. J., Morgan, P. J., Barnett, L. M., & Hallal, P. C. (2017). Global participation in sport and leisure-time physical activities: A systematic review and meta-analysis. Preventive Medicine, 95, 14–25. https://doi.org/10.1016/j.ypmed.2016.11.027

Hulteen, R. M., Morgan, P. J., Barnett, L. M., Stodden, D. F., & Lubans, D. R. (2018). Development of foundational movement skills: A conceptual model for physical activity across the lifespan. Sports Medicine, 48, 1533–1540. https://doi.org/10.1007/s40279-018-0892-6

Lopes, V. P., Stodden, D. F., Bianchi, M. M., Maia, J. A. R., & Rodrigues, L. P. (2012). Correlation between BMI and motor coordination in children. Journal of Science and Medicine in Sport, 15(1), 38–43. https://doi.org/10.1016/j.jsams.2011.07.005

Mancha-Triguero, D., García-Rubio, J., Calleja-González, J., & Ibáñez, S. J. (2019). Physical fitness in basketball players: A systematic review. Journal of Sports Medicine and Physical Fitness, 59(9), 1513–1525. https://doi.org/10.23736/S0022-4707.19.09180-1

Nevill, A. M., Duncan, M. J., Lahart, I. M., & Sandercock, G. R. H. (2017). Scaling waist girth for differences in body size reveals a new improved index associated with cardiometabolic risk. Scandinavian Journal of Medicine & Science in Sports, 27(11), 1470–1476. https://doi.org/10.1111/sms.12780

Nuttall, F. Q. (2015). Body Mass Index: Obesity, BMI, and health. Nutrition Today, 50(3), 117–128. https://doi.org/10.1097/NT.0000000000000092

Okazaki, V. H. A., Rodacki, A. L. F., & Satern, M. N. (2015). A review on the basketball jump shot. Sports Biomechanics, 14(2), 190–205. https://doi.org/10.1080/14763141.2015.1052541

Ortega, F. B., Cadenas-Sanchez, C., Migueles, J. H., Labayen, I., Ruiz, J. R., Sui, X., & Blair, S. N. (2018). Role of physical activity and fitness in the characterization and prognosis of the metabolically healthy obesity phenotype. Obesity Reviews, 19(3), 1–16. https://doi.org/10.1111/obr.12635

Robinson, L. E., Stodden, D. F., Barnett, L. M., Lopes, V. P., Logan, S. W., Rodrigues, L. P., & D'Hondt, E. (2015). Motor competence and its effect on positive developmental trajectories of health. Sports Medicine, 45, 1273–1284. https://doi.org/10.1007/s40279-015-0351-6

Scanlan, A. T., Wen, N., Tucker, P. S., & Dalbo, V. J. (2014). The relationships between internal and external training load models during basketball training. Journal of Strength and Conditioning Research, 28(9), 2397–2405. https://doi.org/10.1519/JSC.0000000000000458

Silva, A. M. (2019). Structural and functional body components in athletic health and performance phenotypes. European Journal of Clinical Nutrition, 73, 215–224. https://doi.org/10.1038/s41430-018-0321-9

Stojanović, E., Stojiljković, N., Scanlan, A. T., Dalbo, V. J., Berkelmans, D. M., & Milanović, Z. (2018). The activity demands and physiological responses encountered during basketball match-play: A systematic review. Sports Medicine, 48, 111–135. https://doi.org/10.1007/s40279-017-0794-z

Suchomel, T. J., Nimphius, S., & Stone, M. H. (2016). The importance of muscular strength in athletic performance. Sports Medicine, 46, 1419–1449. https://doi.org/10.1007/s40279-016-0486-0

Tomkinson, G. R., Lang, J. J., & Tremblay, M. S. (2019). Temporal trends in the cardiorespiratory fitness of children and adolescents representing 19 high-income and upper-middle-income countries. British Journal of Sports Medicine, 53(8), 478–486. https://doi.org/10.1136/bjsports-2017-097982

Zaccagni, L., Toselli, S., & Barbieri, D. (2020). Physical characteristics and body composition in young basketball players. Journal of Sports Medicine and Physical Fitness, 60(9), 1248–1255. https://doi.org/10.23736/S0022-4707.20.10544-3