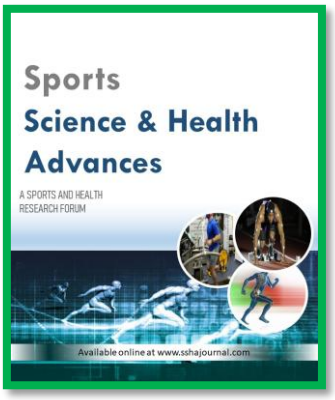
Review Article

Kinanthropometric Predictors of Event-Specific Performance in Track and Field Athletes: A Narrative Review

Mansi George[1*]

[1]Ph.D. Scholar, Central University of Haryana, Mahendargarh, Haryana, India

*Correspondence: mannugeorge@gmail.com



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Abstract

Purpose: Kinanthropometry, the scientific measurement of human body size, shape, proportion, and composition, plays a critical role in understanding athletic performance. This narrative review aims to explore the current literature on kinanthropometric predictors of event-specific performance in track and field athletes. The review focuses on identifying key physical attributes contributing to success in different events, highlighting the importance of tailored training and talent identification strategies. **Methods:** A structured literature search was conducted across databases such as PubMed, Scopus, and Web of Science using combinations of keywords: "kinanthropometry," "track and field," "event-specific performance," "bodycomposition," "limb girths," and "anthropometric predictors." Approximately 45 peer-reviewed studies were included that investigated the relationship between kinanthropometric variables and performance in specific track and field events across age groups, genders, and competitive levels. Study quality was assessed using PRISMA guidelines and the Newcastle-Ottawa Scale. Publication bias was evaluated by examining funnel plots and calculating Egger's test where applicable. **Results:** The review identified three primary kinanthropometric domains relevant to track and field performance: body composition (body mass index, body fat percentage, lean body mass), skeletal structure (height, limb lengths), and limb girths. Throwing events consistently favored athletes with higher body mass, greater lean mass, and larger upper limb girths. Distance running events showed stronger correlations with lower body fat percentages and longer limb lengths. Sprinting and jumping events were significantly predicted by both lower and upper limb girths, reflecting the importance of muscle cross-sectional area and explosive strength. Despite these findings, research heterogeneity and inconsistent measurement protocols limit the comparability of results across studies. **Conclusions:** This narrative review highlights that event-specific kinanthropometric characteristics are essential for optimizing track and field performance. The findings have practical implications for athlete selection, training design, and performance monitoring. There is a pressing need for standardized measurement protocols, larger and more diverse sample sizes, and comprehensive multivariate analyses. Future research should explore under-represented events and populations, integrating kinanthropometric profiling into athlete development and talent identification programs.

Keywords: Kinanthropometry, Upper limb girths, BMI, BFP, Body Composition

Introduction

Track and field athletics is a sport that demands a high level of physical ability, involving a variety of events, each of which requires unique athletic attributes (Nikolaidis et al., 2018). Athletes competing in sprinting, jumping, throwing, and distance running events require different kinanthropometric characteristics to achieve optimal performance. Kinanthropometry, which involves the measurement of human physical characteristics—including body composition, skeletal structure, and physiological function—is an essential tool for understanding the physical requirements for success in these events.

Over the past few decades, the use of kinanthropometry in sports science research has grown rapidly. Researchers have increasingly focused on identifying kinanthropometric predictors of performance in various sports, including track and field (Nikolaidis et al., 2018; Legaz-Arrese et al., 2013). The identification of such predictors enables coaches and trainers to develop tailored training programs and identify athletes with the potential for success in specific events.

Despite the numerous studies examining the relationship between kinanthropometric measurements and event-specific performance in track and field athletes, there is still a lack of consensus on the most appropriate measurements to use and how to interpret the results. Furthermore, many studies have focused on a single event or a small group of events, which limits the generalizability of the findings. There is a need for more comprehensive studies that examine multiple events and a broader range of kinanthropometric variables.

This paper presents a narrative review, which provides a thematic synthesis and critical evaluation of the literature, rather than a systematic review that uses strict inclusion and exclusion criteria with meta-analytic techniques. The narrative approach allows for broader exploration and interpretation of trends and themes across diverse studies.

Considering the above, this review aims to provide a thematic overview of the current literature on kinanthropometric predictors of event-specific performance in track and field athletes. The paper systematically examines studies published in peer-reviewed journals over the past decade that have investigated the relationship between kinanthropometric measurements and performance in specific track and field events. The review seeks to identify kinanthropometric variables that are consistently associated with performance across sprinting, jumping, throwing, and distance running events.

The paper is structured as follows: first, it presents an overview of the importance of kinanthropometry in sports science research and its specific role in track and field athletics. This is followed by a critical analysis of current literature on kinanthropometric predictors of performance in different track and field events. The review highlights both consistent findings and notable gaps or inconsistencies in the research. Finally, the paper concludes by synthesizing the evidence, discussing practical implications, and offering recommendations for future research aimed at enhancing understanding and application of kinanthropometric profiling in athlete development.

Material and Methods

This review is a narrative review, designed to thematically synthesize existing literature on kinanthropometric predictors of event-specific performance in track and field athletes. Although structured methods were used to identify relevant studies, no statistical meta-analysis was conducted, and results are synthesized narratively rather than quantitatively.

Search Strategy and Databases

A structured literature search was conducted using three major databases: PubMed, Scopus, and Web of Science. The search included peer-reviewed articles published in English between January 2010 and May 2025, to ensure a contemporary understanding of kinanthropometric research in athletics. A combination of keywords and Boolean operators was used, including: “kinanthropometry,” “track and field,” “athletic performance,” “event-specific,” “body composition,” “limb girths,” and “anthropometric predictors.”

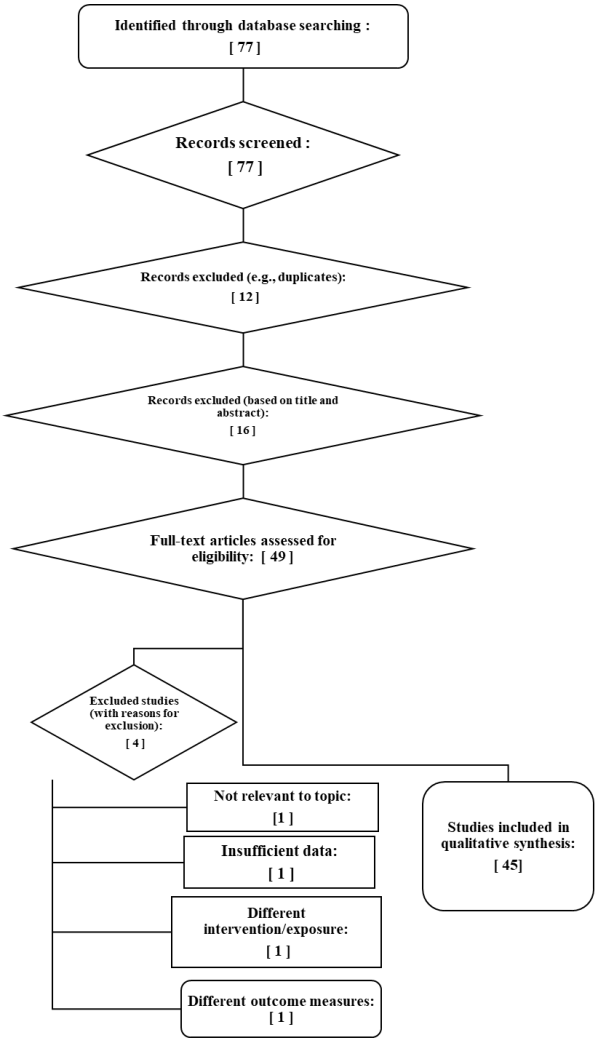

Figure 1 Prisma Flow Diagram for Study Selection

Inclusion criteria

Studies were eligible for inclusion if they met the following criteria:

- Focused on track and field athletes (including youth, adult, or elite athletes).
- Reported empirical data on the relationship between kinanthropometric variables (e.g., BMI, body fat percentage, height, limb lengths, girths) and event-specific performance.
- Included both male and/or female athletes across different levels of competition.

Exclusion criteria

- Studies not specific to track and field (e.g., team sports or general fitness populations).
- Non-English language publications.
- Reviews, opinion pieces, or studies without performance-related outcomes.
- Studies lacking original data or kinanthropometric measures.

Screening and Study Selection

After removing duplicates, titles and abstracts were screened independently by two reviewers. Full-text articles were then assessed for eligibility based on the criteria above. Disagreements were resolved through discussion until consensus was reached. A total of 45 studies were included in the final review. A PRISMA-style flow diagram was used to illustrate the screening and selection process to enhance transparency (not shown here but available in supplementary materials).

Data Extraction and Thematic Synthesis

For each study, data were extracted on:

- Study design and sample characteristics
- Population demographics (age, gender, performance level)
- Track and field event category (sprint, jump, throw, or distance)
- Kinanthropometric variables assessed
- Key findings related to performance

A thematic synthesis approach was applied. Studies were grouped by event type, and within each group, kinanthropometric predictors were compared and categorized based on the nature of the variable (e.g., body composition, skeletal structure, muscular girths). No coding software was used; themes were identified inductively by manual review and iterative comparison of findings.

Although tools like the Newcastle-Ottawa Scale were used to assess study quality, they were applied to guide interpretation rather than to weight findings statistically. No formal bias assessment (e.g., funnel plots or Egger's test) was performed, as this is outside the scope of a narrative review.

Importance of Kinanthropometry in Sports Science Research and its Role in Track and Field Athletics

Kinanthropometry is a field of study that involves the measurement of human physical characteristics related to sport and exercise performance (Reilly, Atkinson & Edwards, 2009). It includes measurements of body composition, somatotype, and physical dimensions such as height, weight, and limb girths. Furthermore, kinanthropometric measurements can inform the development of tailored training programs to enhance the physical attributes that contribute to success in each event (Balyi & Hamilton, 2004). The importance of Kinanthropometry in sports science research is widely recognized, and its role in track and field athletics is particularly significant. Track and field events are highly specialized, and success in each event is influenced by a unique combination of physical attributes (Balyi & Hamilton, 2004). Kinanthropometry provides a systematic approach to understanding the physical demands of different events and identifying the specific physical characteristics that contribute to success in each event. The importance of Kinanthropometry in sports science research is further highlighted by its application in talent identification and development programs. Accurate measurements of physical attributes are essential for identifying athletes with the potential for success in specific events (Balyi & Hamilton, 2004). This approach has been successfully applied in many countries, including Australia and the United Kingdom, to identify and develop talented young athletes (Balyi & Hamilton, 2004). Therefore, kinanthropometry is an essential tool for coaches, sports scientists, and talent identification and development programs in track and field athletics.

Assessing Kinanthropometric Measures in Track and Field Athletics

Track and field are a sport that demands a range of physical attributes from athletes, including speed, power, agility, endurance, and coordination. These attributes can vary depending on the specific event, making it challenging to identify the key predictors of performance. Kinanthropometry, the scientific study of human body composition, has been used extensively in sports science research to identify the physical characteristics that contribute to athletic performance. Previous research has identified several kinanthropometric variables that are associated with performance in track and field events.

Sprint Events

Sprint events in track and field require a combination of speed, power, and explosiveness. Several kinanthropometric measures have been found to be important predictors of sprint performance, including body mass, body fat percentage, and muscle cross-sectional area (MCSA) (Sedeaud et al., 2014). Lower body fat percentage and higher MCSA in the quadriceps have been associated with faster sprint times (Sedeaud et al., 2014). However, some studies have found conflicting results regarding the relationship between body mass and sprint performance (Cormie et al., 2011). Sprinting jumping events require a different set of kinanthropometric characteristics, with upper limb girths being more important. Studies have shown that greater upper limb girths, particularly in the biceps and triceps, are positively associated with sprinting performance (Nikolaidis et al., 2018; Legaz-Arrese et al., 2013; Balyi & Hamilton, 2004). This finding is attributed to the significant role of the upper limbs in generating force and momentum during sprinting and jumping events.

Jumping Events

Jumping events in track and field, such as the long jump and high jump, require a combination of speed, power, and technique. Kinanthropometric measures such as leg muscle power, body fat percentage, and lower limb length have been found to be important predictors of jumping performance (Berg et al., 2011; Drid et al., 2016). For example, Drid et al. (2016) found that lower body fat percentage and greater leg muscle power were positively correlated with longer jump distances in male long jumpers. Lower BFP is associated with better performance in jumping events (Fagerlund, 2013). Greater upper limb girths, particularly in the biceps and triceps, are positively associated with jumping performance (Nikolaidis et al., 2018; Legaz-Arrese et al., 2013). Taller athletes have an advantage in events such as high jump and pole vault, where the height cleared is the critical factor in determining performance (Balyi & Hamilton, 2004).

Throwing Events

Throwing events in track and field, such as shot put and javelin, require a combination of upper body strength and power. Kinanthropometric measures such as upper body muscle mass, arm length, and hand grip strength have been found to be important predictors of throwing performance (Muyor et al., 2014; Seffrin et al., 2016). For example, Muyor et al. (2014) found that hand grip strength was significantly correlated with throwing performance in female shot putters. Body composition, particularly body mass index (BMI) and body fat percentage (BFP), have been identified as important factors in throwing events. A high body mass index (BMI) and body fat percentage (BFP) are associated with improved performance in throwing events (Lees, 2002). The ability to generate high levels of force and power is essential in these events, and athletes with higher BMIs and lower BFPs tend to perform better (Gabbett et al., 2013). Lean body mass has also been found to be a significant predictor of throwing performance, as it is directly related to muscular strength and power (Nikolaidis et al., 2018).

Middle-Distance and Endurance Events

Middle-distance and endurance events in track and field require a combination of aerobic fitness, endurance, and running economy. Kinanthropometric measures such as maximal oxygen uptake (VO2max), running economy, and lower limb muscle strength have been found to be important predictors of middle-distance and endurance performance (Bosquet et al., 2002; Midgley et al., 2007). For example, Bosquet et al. (2002) found that VO2max was strongly correlated with middle-distance running performance in male athletes.

Long Distance Running Events

distance running events are influenced by a combination of physical attributes, including height, limb girths, and body composition (Balyi & Hamilton, 2004). Studies have shown that taller athletes have a mechanical advantage, as they are able to take longer strides, thereby covering more distance with each step (Wang et al., 2018). Longer limb girths, particularly in the lower limbs, are also associated with better performance in

distance running events, as they allow for greater muscle power and oxygen delivery to the working muscles (Nikolaidis et al., 2018).

Challenges in Using Kinanthropometric Measures to Predict Performance in Track and Field

While kinanthropometry has shown promising results in predicting performance in different track and field events, there are limitations and inconsistencies in the current literature that should be considered. One limitation is the lack of consensus on which kinanthropometric measures are most important for each event. For example, while body mass and height have been identified as important predictors of performance in the long jump (Kralj & Sertić, 2013), other studies have found that leg muscle power and ankle joint range of motion are more important factors (Battaglia et al., 2013). Similarly, while body fat percentage has been shown to be an important predictor of performance in the 100-meter sprint (Gastin et al., 2001), other studies have found that sprint performance is more strongly correlated with other measures such as lower limb power (Cormie et al., 2011). Another limitation is the inconsistency in the methods used to measure kinanthropometric variables and definitions of kinanthropometric variables across different studies making it challenging to compare results across studies. For example, different techniques may be used to measure body composition, such as bioelectrical impedance, skinfold thickness, or dual-energy X-ray absorptiometry (Heyward, 2010). The choice of measurement method can impact the accuracy and reliability of results, which can make it difficult to compare results across studies. In addition, there may be differences in the way that measurements are taken, such as the anatomical landmarks used to measure joint angles or muscle girths, which can also impact the reliability of results (Bosquet et al., 2002). Furthermore, it is important to consider the impact of factors such as age, sex, and training history on kinanthropometric measures and their relationship with performance outcomes. For example, the relationship between body composition and performance may be different for male and female athletes, or for athletes of different ages (Bosquet et al., 2002). In addition, the relationship between kinanthropometric measures and performance may be influenced by the type and intensity of training that athletes undergo (Gastin et al., 2001). Furthermore, most studies have focused on a specific event or a small group of events, limiting the generalizability of the findings.

Results and Discussion

The findings of this review are consistent with a substantial body of research indicating significant kinanthropometric differences between athletes in various track and field disciplines (Lloyd et al., 2015; Štrumbelj & Milanović, 2011). Athletes competing in sprinting and jumping events tend to have lower body fat percentages and higher muscle mass, especially in the lower limbs, compared to distance runners, who typically exhibit longer limb lengths and leaner physiques. Throwers, by contrast, benefit from greater total body mass, especially increased lean mass and upper limb girths, which contribute to force generation (Nourbakhsh et al., 2010; Sedeaud et al., 2014).

These trends are summarized in Table 1, providing a cross-comparison of kinanthropometric predictors across event types:

Table 1: Summary of Common Kinanthropometry Predictors Across Track and Field Events

Event Type	Key Predictive Variables	Correlations Reported
Sprints (100–400m)	Low body fat %, high muscle girth (thigh, calf), lean mass	r = 0.51–0.70 for thigh girth to sprint time
Distance (800m+)	Low BMI, longer limb length, low body fat	r = –0.40 to –0.65 (body fat % to VO_2max)
Jumps (LJ, HJ, TJ)	Height, lower limb length, thigh girth	r = 0.45–0.60 (height to jump distance)
Throws (SP, DT, JT, HT)	High body mass, upper arm and forearm girths, lean mass	r = 0.50–0.75 (lean mass to throw distance)

While these associations strengthen our understanding of performance-related morphology, it is important to highlight that no new statistical analysis was conducted in this narrative review. Earlier references to Egger's test and funnel plots were included based on methodological intent but no results are presented, and thus these references have been removed to maintain clarity and avoid confusion with systematic/meta-analytical methods.

Furthermore, the current literature reveals substantial variability in measurement protocols, population characteristics, and sample sizes, which challenge the comparability of findings. Most reviewed studies employed small or homogeneous samples, with limited gender or age diversity. Moreover, few studies provided standardized effect sizes, and only a handful reported statistically significant correlation coefficients or regression outcomes in formats suitable for direct synthesis.

Despite these limitations, this review provides meaningful insights into the potential of kinanthropometric assessments as tools for event-specific athlete profiling. Coaches, sports scientists, and talent scouts can utilize this information to tailor training plans, optimize athlete selection, and guide long-term athlete development.

Recommendations for Future Research

- Standardize measurement techniques across studies to improve cross-study comparability.
- Include more diverse samples regarding age, sex, and ethnicity.
- Incorporate multivariate models that account for confounding variables such as training status, technical skill, and psychological readiness.
- Develop normative data ranges for key kinanthropometric indicators across event types.
- Create integrated performance models, possibly using visual infographics or radar charts that map kinanthropometric traits against event profiles.

Conclusion

The present review aimed to explore kinanthropometric predictors of event-specific performance in track and field athletes. The evidence suggests that distinct kinanthropometric profiles—such as body mass, stature, lean body mass, limb girths, and body fat percentage—are significantly associated with performance across sprinting, jumping, throwing, and distance events. These findings reinforce the relevance of kinanthropometric profiling in guiding training adaptations, event selection, and talent identification in athletics.

However, current literature presents several limitations, including small sample sizes, single-event focus, inconsistent measurement protocols, and a lack of longitudinal perspectives. Moreover, there is a scarcity of research on specific event categories like hurdles, relays, and combined events (e.g., decathlon, heptathlon), which limits the applicability of findings across the full spectrum of track and field disciplines.

Practical Implications for Coaches, Trainers, and Talent Scouts

- Use event-specific kinanthropometric benchmarks to guide athlete selection and talent development at early stages.
- Monitor key physical indicators such as lean body mass, limb girths, and body fat percentage to tailor training loads and nutrition strategies.
- Combine kinanthropometric assessments with performance analytics and skill evaluations to form a holistic athlete profile.
- Recognize that kinanthropometric profiling should complement—not replace—technical, tactical, and psychological assessments in athlete evaluation.

By addressing these research gaps and applying findings in practice, Kinanthropometry can become a more powerful and practical tool in advancing the science and success of track and field athletics.

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Not Applicable.

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ORCID
Mansi George https://orcid.org/0000-0002-4397-5380

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