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Review Article

Relation between body composition and motor abilities of handball players: A systematic review

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Abstract

The aim of this review was to investigate the relationship between body composition and motor abilities in handball players by summarizing, analyzing, and evaluating relevant published studies. A systematic search was conducted in electronic databases including Google Scholar, PubMed, and Web of Science to identify studies published between 2009 and 2022. Fifteen studies that met the inclusion criteria were analyzed in detail. Key information from each study—including first author and year of publication, sample characteristics (number, gender, and age), variables examined, and main findings—was presented in tabular format. The findings indicate that body composition is significantly associated with motor abilities. Specifically, increased body mass, body fat percentage, and body mass index negatively affect speed, agility, endurance, and explosive power, while positively influencing throwing performance. These results suggest that a comprehensive understanding of body composition and motor abilities is essential for optimizing handball player performance. This review expands upon previous knowledge and may serve as a valuable resource for talent identification and player selection in handball.

Keywords: Agility, Anthropometric characteristics, Endurance, Explosive power, Team sport.

Introduction

Handball is a fast-paced team sport played by two teams of seven players, where the goal is to score points by catching, passing, dribbling, and throwing a small ball into the opposing team's goal (Barbero et al., 2014). During the game, handball players engage in various physical activities, such as jumping, throwing, running, and experiencing physical contact with other players (Barbero et al., 2014; Wagner et al., 2014).

Achieving success in handball requires a combination of anthropometric characteristics—such as body height, body mass, and body mass index (BMI)—along with motor abilities, which include speed, strength, agility, explosive strength, and endurance (Ghobadi et al., 2013; Ingebrigtsen et al., 2013; Krüger et al., 2014; Sporiš et al., 2010; Ziv & Lidor, 2009). Agility, speed, jumping ability, handball throwing velocity, endurance, and coordination are essential motor skills required for optimal performance in handball (Šibila & Pori, 2009).

Moreover, physiological and morphological characteristics are critical factors influencing motor abilities. The specific body composition of athletes is crucial for maximizing performance in different sports (Jaworski & Żak, 2015; Mijalković et al., 2023). In handball, understanding the role of body composition—particularly the balance between fat mass and skeletal muscle mass—has become central to both sport science and applied training practices (Cavedon et al., 2018).

Numerous studies have investigated the connection between body composition and motor abilities in handball players (Debanne & Laffaye, 2011; Hammami et al., 2018; Moss et al., 2015; Nikolaidis & Ingebrigtsen, 2013; Sporiš et al., 2010). Some studies suggest that there is a significant relationship between body composition and basic motor abilities in handball players (Ciplak et al., 2019; Moncef et al., 2012; Zapartidis et al., 2016). On the other hand, Sporiš et al. (2010) demonstrated that body fat percentage negatively affects the aerobic endurance of handball players.

Describing the factors influencing performance in team handball is particularly challenging due to the complexity and multifactorial nature of the game, which is characterized by high-intensity explosive movements. Nevertheless, research suggests a clear relationship between body composition and motor skills in handball players. Therefore, monitoring all parameters related to body composition and motor abilities is essential for maximizing performance in the sport.

The evaluation of body composition has become a key issue in sports science, particularly with respect to body fat and skeletal muscle content (Cavedon, Zancanaro, and Milanese, 2018). Given this background, the aim of this review was to explore the relationship between body composition and motor abilities in handball players, based on a thorough summary, analysis, and review of published studies from 2009 to 2022.

Material and Methods

Search Strategy and Databases Used

A systematic search was conducted using the electronic databases Google Scholar, PubMed, and Web of Science to identify relevant literature related to the anthropometric and motor characteristics of handball players. The following keywords were used in various combinations: explosive power, agility, endurance, team sport, handball players, and anthropometric characteristics. Boolean operators (AND/OR) were used to optimize search results. All searches were restricted to original research articles written in English and published between 2009 and 2022.

Eligibility Criteria

Studies were selected based on the following inclusion criteria:

- Research involving male and/or female handball players of any age category and competitive level.
- Articles published in peer-reviewed journals between 2009 and 2022
- Studies published in English.
- Studies comparing both body composition and motor abilities of handball players.

Exclusion criteria included:

- Studies focusing solely on either body composition or motor abilities.
- Non-English language publications.
- Non-original research such as reviews, editorials, or conference abstracts.
- Studies with insufficient methodological or statistical information.

Titles, abstracts, and keywords were first screened for relevance. Then, the full texts of potentially eligible articles were carefully reviewed based on the criteria above.

Study Selection Process

The study selection followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Page et al., 2021). Initially, 1025 articles were identified. After removing duplicates, 969 records remained. Based on title and abstract screening, 867 studies were excluded. Two articles could not be retrieved in full text. Ultimately, 15 articles met the inclusion criteria and were included in the systematic review. The detailed flow of the selection process is presented in Figure 1 (PRISMA diagram).

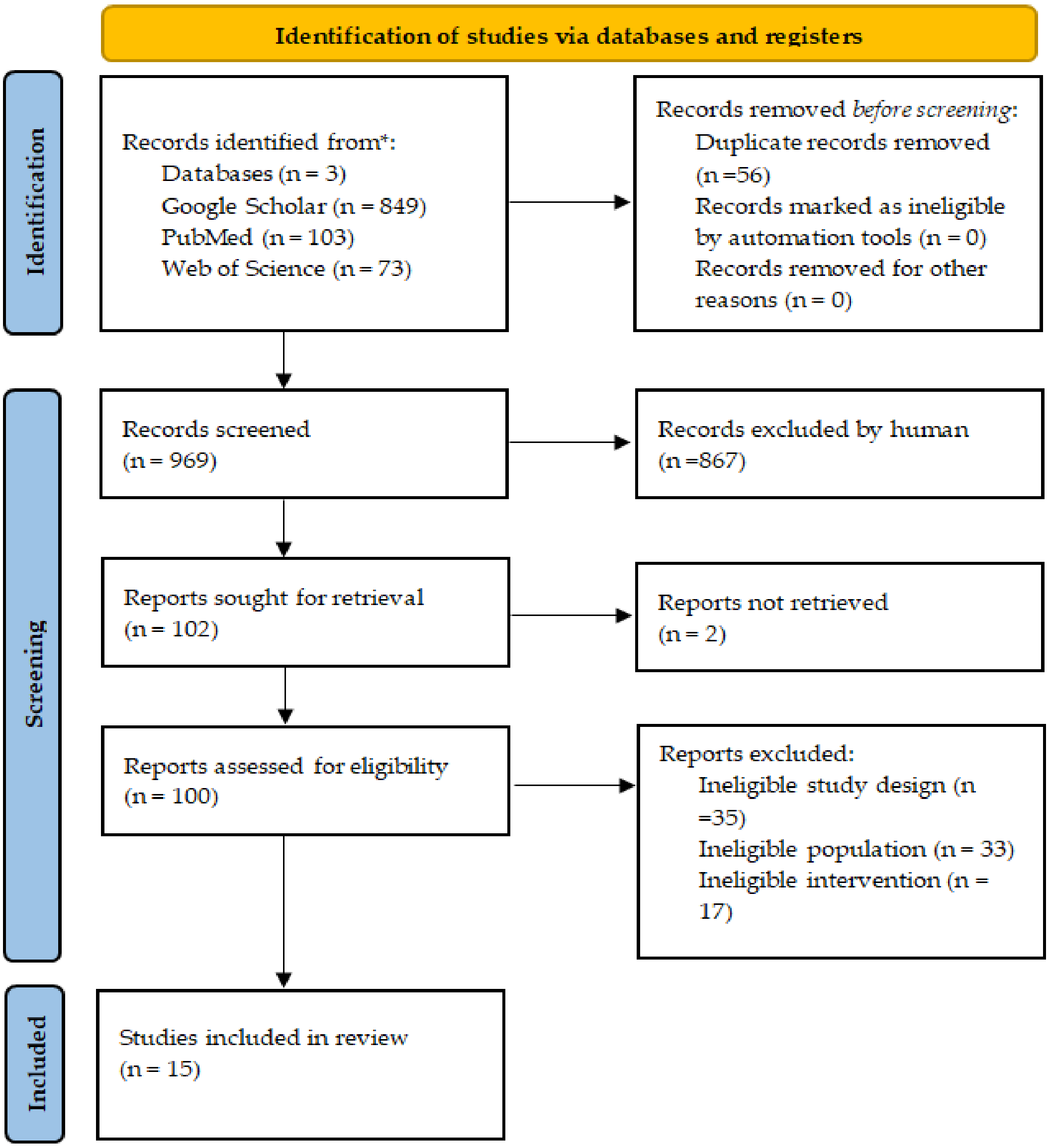

Figure 1. The PRISMA flow diagram.

A descriptive method, systematization, analysis and synthesis and comparison method were used for the purpose of this systematic review. The search strategies yielded a preliminary pool of 1025 possible papers. After removing duplicates, 969 studies remained eligible for inclusion in the study. Based on title and abstract screening, 867 studies were excluded. Additionally, two studies were not retrieved and were therefore excluded. Finally, after a careful review of their full texts the remaining 15 articles were eligible for inclusion in the review.

Data Extraction

Data were extracted using a preformatted spreadsheet. The following variables were recorded from each included study:

- Author(s) and year of publication
- Characteristics of study participants (sample size, age, etc.)
- Monitored anthropometric and motor variables
- Key findings and statistical results
- The extraction process aimed to capture the most relevant information from each study to allow for comparison and synthesis.

Quality Assessment and Review Approach

Each included article was subjected to a critical appraisal to ensure methodological validity. The review focused on verifying whether the study design, population, and measurement tools were appropriate to address the research question. Studies were also examined for potential confounding variables or biases that might affect interpretation of the results. However, a formal risk of bias assessment tool (e.g., ROBIS or JBI checklist) was not applied.

Data Synthesis and Analysis

The selected studies were analyzed using descriptive, comparative, and synthesis methods. The findings were organized and interpreted based on similarities and differences in the studied variables and results.

Results

Studies that met the criteria for the final analysis are shown in Table 1. The following information is provided: first author and year of publication, sample of respondents (number, gender and age), monitored variables and study results.

Table 1. Overview of the studies.

First author and year of publication	Sample of respondents			Monitored variables	Results
	Number	Gender	Age		
Jürimäe et al., (2009)	64	M F	8-11	BH, BM, BMI, HG, SFB, SFT, FC, WC, LWH, LWAR, LWRSR, LWMD, BMD, BMC	HG↔BH,FC, LWAR, LWMD, BMD,BMC
Sporiš et al., (2010)	92	M	26.4 ± 3.8	BF, MRS, VO2max, AE	BF↔MRS
Debanne et al., (2011)	42	M	21 ± 2.9	BH, BM, BMI, FFM, SS	BM↔ SS

Moncef et al., (2012)	42	M	21.9 ± 3.2	BM, BMI, BF, FFM, SJ, CMJ, VJ, Yo-Yo, RS	BM↔SJ BF↔RS
Nikolaidis et al., (2013)	57	M	14.9 ± 1.4	BMI, BM, BH, BF, FFM, WHR, SAR, PWC170, YMCA, CMJ, B30, HG, F-V, WAnT	BMI↔WAnT BMI↔F-V
Vuleta (2013)	18	M	18 ± 1.0	BH, BM, AL, AS, SW, HS, LL, CC, UAG, FC, BMI, ULG, R4M, R6M, R9MRG, R9MJS	R4M, R6M, R9MRG↔ BH, BM, AL, AS, SW, HS, LL, CC, UAG, FC, BMI, ULG
Moss et al., (2015)	113	F	16.1 ± 1.3	SF, BH, BM, S, S20, RS CMJ, SS, Уо-Уо	BM↔CMJ, SS SF↔SS, RS
Šeparović et al., (2015)	26	M	18-36	BH, BM, SKL, PTL, S20, OPBL, BDK, BS	/
Zapartidis et al., (2016)	119	M F	13.4 ± 0.3	BH, BM, BMI, AS, LH, HS, HG, SS, D15m	SS↔BH, BM, BMI, AS, LH, HS
Hammami et al., (2018)	56	M	12-14	BH, BM, BF, TT, CO-DAT, S10, S20, S30, VJ, LJ	BM↔TT BM↔CODAT BF↔CODAT
Saavedra et al., (2018)	80	F	18.2 ± 4.0	BH, BM, BMI, RPI, CMJ, TMB, HG, Yo-Yo, S10, S30, SS	BM↔CMJ, SS
Ciplak et al., (2019)	103	F	15-17	BH, BM, BMI, BF, HG,VJ, LJ, TMB, S30	BM↔ HG,VJ, LJ, TMB, S30 BF↔HG,VJ, LJ, TMB, S30
Hermassi et al., (2019)	22	M	19.1 ± 1.7	BH, BM, BF, PMT, BMI, HSM, SJ, CMJ, RS, TT	BM↔HSM
Kale et al., (2020)	16	F	19.6 ± 2.6	BH, BM, BF, PMT, FFM, SJ, CMJ, WAnT	BH, BM, BF, BM↔CMJ, WAnT

Bakinde, (2021)	14	M	22.85 ± 2.0	BH, BM, WHR, IT, SKL, S50	WHR↔IT, SKL, S50

Legend: ↔ - statistically significant correlation, AE-aerobic endurance, AL - arm length, AS - arm span, B30-Bosco 30s test, BDK-lateral and deep movement, BF - body fat percentage, BH - body height, BM – body mass,BMC-bone mineral content, BMD - total bone mineral density of the body and hand, BMI – body mass idnex, BS-side steps, CC - chest circumference, CMJ-countermovement jump, CODAT-change of direction and acceleration test of agility,D15m-test of dribbling, F – female,FC - forearm circumference, FFM - fat-free mass, F-V-force-velocity test to assess anaerobic power, HG-handgrip, HS - hand span, HSM- semi-squat with maximum load, IT- test of agility, LH - hand length, LL – leg length, LWAR - length and width of the acromiale–radiale, LWH - length and width of the humerus, LWMD - length and width of midstylion–dactylion, LWRSR – length and width of the radiale–stylion–radiale, LJ-long jump, M – male,MRS-maximum running speed, OPBL-defensive triangle movement without the ball, PMT - percentage of muscle tissue, PTL-lying body lift, PWC170- physical activity at 170 heart beats per minute, R4M-4 meter throw from a sitting position, R6M-6m standing throw, R9MJS-9m three-step dash, R9MRG-9m three-step throw, RPI - reciprocal weighted index, RS-repetitive sprints, S - somatotype, S10-10m sprint, S20-20m sprint, S30-30m sprint, S50-50m sprint, SAR-test sit and reach to assess flexibility, SF- skin folds, SFB - skin folds of the biceps, SFT- skin folds of the triceps, SJ-squat jump, SKL-push-ups, SS-shot speed, SW - shoulder width, TMB-medical ball throw, TT-test of agility, UAG - upper arm circumference, ULG - upper leg circumference, VJ-vertical jump,VO2max-maximal oxygen consumption, WAnT- Wingate test to assess anaerobic endurance, WC - wrist circumference, WHR -waist-hip ratio, YMCA-aerobic endurance test, Yo-Yo-yo-yo intermittent recovery test.

Table 1 shows 15 studies that were published in the period from 2009 to 2021. The male sample of respondents was in 9 studies, while the female sample of respondents was in 4 studies (Moss et al., 2015; Saavedra, Kristjánsdóttir, Einarsson, Guðmundsdóttir, Þorgeirsson & Stefansson, 2018; Ciplak et al., 2019; Kale & Akdoğan, 2020). Also, the respondents were members of both genders in two studies (Jürimäe, Hurbo & Jürimäe, 2009; Zapartidis et al., 2016). A total of 864 respondents participated. The largest number of respondents (n=119) was in the study by Zapartidis et al., (2016), and the smallest number of respondents (n=14) was in the study by Bakinde (2021). Šeparović et al. (2015) conducted a study with respondents aged 18 to 36, while the youngest sample of respondents was 8 to 11 years old in the study by Jürimäe et al. (2009).

Discussion

This review aimed to investigate the relationship between body composition and motor abilities in handball players by synthesizing existing literature. The studies reviewed involved athletes at recreational, semi-professional, and professional levels. Frequently examined body composition parameters were body height, body mass, body mass index (BMI), and body fat percentage. The motor abilities assessed included explosive power, static strength, speed, endurance, and agility.

Explosive power was measured through tests such as the countermovement jump (CMJ), squat jump (SJ), long jump (LJ), and medicine ball throw (TMB). Static strength was assessed using handgrip strength (HG), while speed-related tests included the 10, 20, 30, and 50-meter sprints, repeated sprint (RS), maximum running speed (MRS), and shooting speed (SS). Endurance was evaluated using the YMCA step test, the Wingate anaerobic test (WAnT), and the force-velocity (F-V) test. Agility assessments comprised the T-test, Illinois agility test, and the change of direction and acceleration test (CODAT).

A significant relationship between body composition and motor abilities was observed in all but one study (Šeparović et al., 2015). Specifically, higher body fat percentages were negatively associated with performance in explosive power, static strength, speed, agility, and endurance. These findings emphasize the importance of maintaining lower body fat levels to enhance motor performance (Ciplak et al., 2019; Kale & Akdoğan, 2020; Hammami et al., 2018; Moncef et al., 2012; Sporiš et al., 2010).

Body height and body mass were also frequently studied variables. Findings showed that these variables positively affected handball throwing velocity (Debanne & Laffaye, 2011; Jürimäe et al., 2009; Zapartidis et al., 2016), while exhibiting a negative impact on anaerobic endurance and countermovement jump (Kale & Akdoğan, 2020). Furthermore, body mass was inversely related to squat jump, long jump, T-test, CODAT test, and sprint performances across various distances, but positively correlated with handgrip strength, medicine ball throw, and throwing velocity (Bakinde, 2021; Ciplak et al., 2019; Hammami et al., 2018; Moncef et al., 2012; Moss et al., 2015; Saavedra et al., 2018; Vuleta, 2013).

Additionally, body mass index (BMI) was found to significantly influence speed, endurance, and explosive power. Lower BMI values were associated with better outcomes in the medicine ball throw, handball throwing velocity, squat jump, countermovement jump, Wingate test, Illinois test, and force-velocity test (Bakinde, 2021; Hammami et al., 2018; Hermassi et al., 2019; Nikolaidis & Ingebrigtsen, 2013; Zapartidis et al., 2016).

This review also acknowledges certain limitations. Notably, the number of relevant studies published over the past 15 years remains limited. Moreover, female athletes were underrepresented in the sampled populations, leading to a lack of gender-specific insights. These factors restrict the generalizability of the findings. Future research should aim to include more diverse populations and consider reviewing literature in multiple languages to gain broader cultural and regional perspectives. Access to a wider range of academic databases may also contribute to more comprehensive results and enhanced reliability.

Conclusions

The This review revealed that body composition is significantly associated with various motor abilities in handball players. Higher values of body mass, body fat percentage, and body mass index were negatively related to speed, agility, explosive power, and endurance. Conversely, body mass showed a positive relationship with handgrip strength and throwing performance. These findings emphasize the importance of monitoring and optimizing body composition to enhance athletic performance in handball.

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