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BODY COMPOSITION AND ANTHROPOMETRY IN FEMALE HANDBALL ATHLETES

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Abstract: This study addresses the issue of body composition and anthropometry in female handball athletes. In view of this, the present study seeks to identify the importance of anthropometry and body composition in female handball athletes that favor better physical performance in this sport. The specific objectives were: a) to describe the sport of handball and its particularities; b) to identify in the literature desirable body composition and anthropometric measures in female handball athletes and c) to analyze aspects related to exercise, nutrition and the care needed in relation to body composition and anthropometry and better performance in handball. The research was carried out using a qualitative and narrative literature review. The results showed that athletes' body composition is a variable that determines the ideal fitness parameters for athletic performance. In order to correlate the body assessment of athletes with their performance in different sports, the percentage of body fat is the most recommended and reliable index to use. It can be concluded that the measurement body composition and the aspects assessed in anthropometry have contributed to the association of various factors that can lead to poor sporting performance in these athletes.
Keywords: Body composition. Anthropometry. Handball. Athletes.

INTRODUCTION

Handball is a very demanding sport that involves a variety of movements, physical skills and full-time cognitive actions to meet the demands of the game (Aires et al. 2023).

The time spent on low-intensity efforts is proportionally greater than on high-intensity efforts, meaning that in relation to the physical condition required and the determination of the path, high-level athletes must be able to intervene a few times per match, with fast action and strength exercises such as jumping, blocking, running and throwing. Thus, in order to achieve a level of performance, they must have an average of values to achieve, a fundamental goal to reach (Caporal, 2015).

Given the characteristics of this team sport, general strength, speed, agility and intermittent efforts, in relation to the aerobic state of recovery, deserve attention in physical preparation in order to maintain the important motor gestures specific to the effectiveness of a team's defense, transition and attack. In terms of anthropometric characteristics, excess body fat can interfere with movement and dexterity. The lean mass of the trunk, upper and lower limbs, as well as the height and height of the arms, can promote the efficiency of the athletes' sports bases and motor skills (Fonseca Junior *et al*., 2022).

In view of this, this study seeks to identify the importance of anthropometry and body composition in female handball athletes that favor better physical performance in this sport. The specific objectives were: a) to describe the sport of handball and its particularities; b) to identify in the literature desirable body composition and anthropometric measures in female handball athletes and c) to analyze aspects related to exercise, nutrition and the care needed in relation to body composition and anthropometry and better performance in handball.

METHODOLOGY

The research was carried out by means of a qualitative and narrative bibliographical review, which according to Lakatos (2002) is a survey of all the bibliography already published, in the form of books, magazines, single publications and the written press.

The material was searched for in the virtual libraries Medline, Scielo, Lilacs, Pubmed and Google Scholar. The following keywords were used as search descriptors: "Body composition" and "anthropometry" and "female handball", "body composition" and "anthropometry" and "handball" and "female", covering the period 2014 - 2024.

Once the material had been collected, an exploratory reading was carried out to see to what extent the work consulted was of interest to the research. After the exploratory reading, the material that was of interest to the research was determined, thus characterizing the selective reading.

Subsequently, an analytical reading was carried out to organize the information contained in the sources in such a way as to provide answers to the research problem. This was followed by an interpretative reading of the selected material with the aim of relating what each study covered.

The inclusion criteria were articles published in the stipulated period, in Portuguese and English, which met the objectives of the study. Studies that did not meet the objectives and that did not address body composition and anthropometry and their relevance to the performance of female handball athletes were excluded. The results were then interpreted and discussed below.

RESULTS AND DISCUSSION

In relation to handball, Caporal (2015) points out that there are versions reporting the practice of games similar to handball since ancient Greece and Rome. However, its origin is attributed to the Danish teacher Holger Nielsen in 1848. At that time it was called handball, emerging as a fusion between soccer and basketball, with some differences that characterize it. In 1919, Karl Schelenz, a German physical education teacher, published the rules which stated that the game would be played on a soccer pitch, with eleven players on each team, and that it would be played with the hands. It became official in 1920 and was renamed Field Handball.

Aries *et al*. (2023) state that all the action in this sport takes place on an area 40 meters long and 20 meters wide, which lasts 60 minutes and can vary according to the category, a relatively long duration. The match is divided into two 30-minute halves in the adult category, with a 10-minute break, according to the official rules of the sport.

Handball is a ball-based team sport, played with the hands, whose objective is to score more goals than the opponent in a 3 x 2 meter goal protected by a goalkeeper. Nowadays, handball can be played in many different venues: on sand courts, in wheelchairs, on grass, for the elderly, mini handball, but today the federation only officially recognizes conventional indoor handball and wheelchair handball, as well as outdoor handball played on sand (Raminelli *et al*., 2023).

The game of handball is played in two teams, with seven players on each side of the pitch and constant physical contact between the players, as well as various physical efforts that are high-intensity and short-lived, especially motor, speed and strength during a match. Sports practice requires well-designed training aimed at achieving excellent levels of physical condition and performance during training and competition. Sports training represents the main structure for putting athlete preparation into practice. It is their basic form of preparation, based on systematic exercises, which in essence constitutes an organized educational process, with the aim of guiding the athlete's evolution (Aries *et al*., 2023).

This sport, like other team sports, includes many activities that require aerobic and anaerobic metabolism, especially the latter (Raminelli *et al*., 2023). According to Peixoto *et al*. (2016), handball is a sport that has characteristics of high intensity and short-term physical effort, which involves all physical abilities and also requires many skills be practiced.

In the practice of handball we see a great evolution of conditioning skills, a development of postural correction, a development of the muscles of the trunk and arms, a rapid development of strength endurance, it is also a factor of energy expenditure and an educational sport (Raminelli *et al*., 2023).

Among the physical skills required in different sports, muscle strength and aerobic/anaerobic capacities are responsible for optimizing performance. The vertical jump is an integral part of basic gestures and is important in more complex motor actions that require greater power from the lower limbs, such as knee flexion and extension movements, which are necessary in offensive and defensive actions in handball (Santos *et al*., 2014)

According to Soares *et al.* (2018), the best sports performance requires not only a physical profile, but also the right morphological characteristics for maximum mobility in the game.

As for anthropometrics, Caporal (2015) points out that the literature describes the importance of some morphological variables for handball athletes. Height is the most cited in scientific literature. It is important for the success of the handball athlete, as it provides an offensive advantage, in the throwing of the ball towards the opponent's goal and defensively with greater effectiveness, avoiding the opponent's throw-in, through blocks and ball steals.

In relation to height, a literature review by Caporal (2015) found an average height of between 162.7cm and 175.7cm in female athletes. Several studies have shown that, among the variations in the physical assessment of athletes, the most commonly used for athletic performance in handball are height and body composition. Thus, as with other team sports, handball requires athletes with specific anthropometric and body composition characteristics for each playing position, which directly affect the technical-tactical actions of this sport. The morphological qualities most visible in the literature for handball athletes are height, body mass, wingspan, palmar diameter, radioulnar diameter, forearm circumference, fat percentage and lean mass (Raminelli *et al*., 2023).

The study by Raminelli et al. (2023) included 15 girls aged between 12 and 21. The aim of this study was to assess the body composition of a female handball team before and after a 12-week training period. After analyzing the data, the mean age of the sample was 16.63±5.12 years before the intervention and 16.75±2.05 years after the intervention. The height variable was 1.66±0 before the intervention and remained at 1.66±0.07 after 12 weeks. Santos et al. (2014) found a height of 1.66±0.42m, a value close to those found in previous studies. In a more recent study, the athletes were slightly taller, with a height of 1.69±0.05 (Gonçalves et al. 2023)

According to Soares et al. (2018), taller players can help with movement and offensive and defensive balance, thus increasing the team's performance in matches and competitions.

A study of Polish athletes found that players from the top leagues were taller than players from lower leagues. The average height of players from the top league was 1.73±6.76 meters, while players from the second division had an average of 1.67±4.49 meters (Sliz et al. 2022).

With regard to wingspan, it can determine the strength and speed of the throw, making it an important morphological characteristic in the handball athlete. With the increase in the practice of handball in recent years, demand for this sport has gradually increased, and with this there is concern about how the process of discovering new talent in teams is developed (Soares *et al*., 2018).

A study of young Spanish athletes showed average wingspan values of 1.70 meters, ranging from 1.63 meters to 1.78 meters. The authors report that a larger wingspan can be an essential anthropometric characteristic for athletes in offensive and defensive actions, due to occupying larger spaces on the court (Camacho-Cardenosa et al., 2018).

As far as body mass is concerned, in a review by Caporal (2015) it varied between 55.8kg and 70.3kg in seven studies carried out between 2000 and 2014. The body mass data for the sample in the study by Raminelli et al.

(2023) was 64.56±22.60kg. These values are similar to those found by Santos et al. (2014) of 62.97±6.83kg.

According to Faccim (2015), body mass is essential for the athlete's performance on the court, due to the great physical contact that handball offers, both in offensive and defensive situations. Knowing that body mass index (BMI) is one of the parameters used to classify nutritional status, the data presented in the study show a prevalence of athletes with normal BMI and waist circumference, where the handball players had an average BMI of 20.63±2.3 kg/m² and a waist measurement of 72±4.5cm.

A study of Brazilian university athletes found that 57.14% had a normal BMI, 33.33% were overweight and 4.76% were obese and underweight. In terms of muscle mass, 52.38% of the athletes had very high muscle mass and 47.62% had high muscle mass. In terms of body fat percentage, 42.86% of people have an average body fat percentage, 28.57% have a lower than average body fat percentage, 4.76% of people are not recommended and only 23.81% of people have a high level of body fat (Aires, 2023).

In addition, BMI is one of the morphological qualities that becomes very important when related to the physical capacities of handball athletes, as it provides indicators of the current state in terms of body composition (Soares *et al*., 2018). Spanish elite athletes had a body mass of 67.3±8.8kg (Carrasco-Fernandes et al., 2023), similar to the 65.79±8.03kg of athletes from different levels of the Polish league (Sliz et al., 2022).

Players who play as winger differ from pivots in terms of body mass, which is lower because they play in attacking situations with less direct contact with rival defenders, unlike pivots. Goalkeepers are fundamentally different from line players (playmakers, winger and pivots). They are the most specific players among their teammates because of their individual performance in a limited space, while focusing on executing quick, explosive split--second movements. Therefore, the goalkeeper usually has a profile with greater longitudinal dimensions compared to the other players on his team, which can contribute significantly to greater coverage of the goal area during shots (Soares *et al*., 2018).

Body composition has been widely studied because it is important for athletic performance, especially the percentage of fat (fat mass) and muscle (lean mass). In most sports, measuring body composition is of fundamental importance, as there is great interest in assessing body composition during exercise, using the differentiation between fat mass and fat-free mass, due to its significant effect on sports performance and biomechanical aspects and physiological abilities. In this sense, body fat is inversely related to motor performance in both sexes (Caporal, 2015).

The body composition of athletes is a variable that determines the ideal fitness parameters for athletic performance. To correlate the body assessment of athletes with performance in different sports, the percentage of body fat is the most recommended and reliable index to use (Peixoto *et al*., 2016).

In the study by Caporal (2015), the average fat percentage varied between 18.6% and 19.6% in the women who took part in the research cited in the review. In the study by Santos et al. (2014), the average fat percentage was 29.71±3.67. In a study by Carrasco-Fernandes et al. (2023), elite Spanish athletes had a fat percentage of 24.7±2.9%.

In the study by Peixoto *et al*. (2016), there were no correlations between lean body mass and power ($p = 0.73$) and lean body mass and agility ($p = 0.14$). However, there was a positive correlation between BMI and longer time in the agility test ($p = 0.01$). There was a negative correlation between BMI and the power variables ($p = 0.02$), i.e. the higher the BMI, the lower the performance in the vertical jump. It can therefore be concluded that there

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is no correlation between lean body mass and power or between lean body mass and agility. However, body weight directly affected performance in physical fitness tests, as athletes with a higher BMI performed less well in both agility and strength tests.

In handball, the lower the fat levels, the greater the athletic performance, since the movement during matches is extremely constant and intense, with high energy demands, so the surplus body mass , referring to the greater accumulation of adipose tissue, called inactive body mass, leads to greater energy expenditure, This makes the post-workout recovery process extremely difficult, since from the perspective of high-performance sport, the periods that should be for recovery and stress generated by intense training or competitions hardly meet the real needs of the athlete's body, due to the large number of competitions in the club calendar (Raminelli *et al*., 2023).

Assessing body composition in athletes is the most recommended and reliable method. Muscle mass levels can be directly associated with explosive strength. To this end, the analysis of vertical jump performance, where great importance is emphasized in assessing performance in different sports, which require jumping skills in many situations and in the case of handball, performance is directly related to the sport modality (Peixoto *et al*., 2016).

These aspects have a direct impact on sports performance. According to Gonçalves *et al*. (2023), some physical abilities can be related to anthropometric variables, such as speed, which is more complex than just running as fast as possible. It also includes muscle strength for running, short sprints, quick movements in all directions, reaction time and ability to stop quickly. Muscle strength capacity, when observed in the lower limbs, through horizontal jumping must take into account the activities they perform in activities that require greater body weight or overloads

All handball players must be in good physical condition and must therefore develop certain physical capacities of aerobic and anaerobic endurance, flexibility, as well as coordination and rhythm, these are skills to be improved with technical training (Peixoto *et al*., 2016).

Physical training with handball has an impact on body composition parameters, influencing the percentage of lean and fat mass, thus becoming a regulator of body mass, so the anabolic effects of physical training with handball will be an increased measure of lean mass (Raminelli *et al*., 2023).

As monitoring the evolution of training is important, assessing body composition is useful to help achieve better results because it combines the specific characteristics of tissue, such as body fat and muscle mass, and can see positive results respectively negative and negative interference in the sports performance of handball players. Body weight can affect athletes' speed, endurance and power, while body composition can affect their strength, agility and appearance (Aries *et al.*, 2023).

Fonseca Junior *et al.* (2022) in their research found the following median values in the two categories analyzed respectively: Cadet (n=23) and Youth (n=16). Body mass (kg): 58.30 and 59.30; height (cm): 167.0 and 166.5; height (cm): 168.0 and 165.25; waist (cm): 68.00 and 70.00 and BMI (kg/m^2): 21.56 21.63.

Studies show that handball teams tend to have relatively high height and body mass, i.e. athletes who are taller and heavier than the average population. However, even if some anthropometric characteristics are favorable for some specific playing positions in a handball team, the results show that the anthropometric characteristics of handball players are relatively heterogeneous, as wingers have, in some cases, lower body mass and height than their peers (Soares *et al*., 2018).

In handball, it's important to know that there isn't necessarily a specific "type" of athlete,

nor a single variable that really determines the conditions of the game, because what we actually have is a combination of physical and cognitive aspects, where the handballer will be used according to the demands of the training or championship situations (Aries *et al*., 2023).

According to Soares *et al*. (2018), each athlete has a different physical structure for each sport and when analyzing a sport separately, more specific differences can be observed between athletes in terms of the functions performed during a match. Some anthropometric characteristics such as length and wingspan, as well as physical characteristics such as body weight and muscle strength, are useful for some specific playing positions in a handball team.

Muscle mass plays a fundamental role in the athlete's good performance, but not only that, as it is key to reducing the risk of injury, especially in a sport that requires a lot of fast movements, with changes of direction, braking and acceleration as appropriate (Aries *et al*., 2018).

Normally, handball players have different anthropometric and morphological characteristics, mainly due to their specific positions on the field, which is why it is essential to have two basic elements when designing training: control and evaluation (Aries *et al*., 2023).

In this sense, Soares et al. (2018) note in their study that, compared to centralized positions, larger longitudinal dimensions and longer levers are important because they provide a more powerful and efficient shot on goal, over and through the opposing defense. Greater body stature is also desirable for more effective cooperation between central and wing players.

Finally, Faccim (2015) contributes by pointing out that the tendency for athletes to be more adipose is due to the short duration and low volume of their training. In addition, not all athletes practice physical activities that complement their training, such as weight training and aerobic activity. This tendency may also be linked to an insufficient and unbalanced diet, rich in sugars and fats and low in essential nutrients.

As handball requires big movements, feints and jumps, it's best for its players to have low body fat and therefore higher lean body mass. The athlete must have the skills to perform certain movements, ball handling, quick and precise feints. And more powerful players, where we see athletes achieving high levels of jumping and increasingly fast throws. Factors that, for many authors, make the difference for a successful team (Aries *et al*., 2023).

FINAL CONSIDERATIONS

The great value of anthropometric and physiological measurements serves to provide a guiding perspective in the analysis prior to team formation. Given the high variability of the data, it presents a broad profile, especially from a physiological point of view, that can be formed. Studies like this provide excellent insights into an area that is little explored and little published. The great importance of anthropometric analysis is the identification of values and their adaptation to the best style of play, training methodology and educational interventions to be carried out. When assessing the elite level, there will certainly be reasons for exclusion through anthropometric measurements, including youngsters.

From the contributions of the studies analyzed, it is clear that the measurement of body composition and the aspects assessed in anthropometry have contributed to linking various factors that can cause poor sports performance in these athletes. These factors may be related to the way in which these athletes' macrocycle was planned. As each athlete has his or her own biological individuality, training sessions should be structured according to each player's collective and specific position.

Another factor that interferes with this BMI x Agility/Strength relationship is, of course, nutrition, which also needs to be worked

on individually and assessed regularly. This highlights the importance of monitoring athletes' nutrition, since an adequate and balanced diet is essential for body composition and the desired anthropometric measurements, especially in female athletes, for better performance in handball.

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