

# Anthropometric Characteristics, Body Composition, and Somatotype Profiles of Elite Iranian Kabaddi Players

## Características Antropométricas, Composición Corporal y Perfiles Somatotípicos de Jugadores de Élite de Kabaddi Iraníes

Mahdi Bayati<sup>1</sup>; Mohammadamin Saei<sup>2</sup>; Hamid Agha-Alinejad<sup>3</sup>; Sadegh Amani-Shalamzari<sup>4</sup>;  
Amin Daneshfar<sup>5</sup>; Guillermo Cortés-Roco<sup>6</sup> & Rodrigo Yáñez-Sepúlveda<sup>7,8</sup>

**BAYATI, M.; SAEI, M.; AGHA-ALINEJAD, H.; AMANI-SHALAMZARI, S.; DANESHFAR, A.; CORTÉS-ROCO, G. & YÁÑEZ-SEPÚLVEDA, R.** Anthropometric characteristics, body composition, and somatotype profiles of elite Iranian kabaddi players. *Int. J. Morphol.*, 43(5):1760-1766, 2025.

**SUMMARY:** This study aimed to assess the anthropometric characteristics, body composition, and somatotype profiles of elite male and female Iranian Kabaddi players. A total of 78 players (38 men, 40 women). Measurements taken included standing height, body mass, sitting height, arm span, and eight skinfold thicknesses. Additional measurements included relaxed arm girth, flexed and tensed arm girth, waist, hip, and calf circumferences, as well as humerus and femur bi-epicondylar breadths. Body composition indices, fat mass, body fat percentage, fat-free mass, fat-free mass percentage, body mass index (BMI), waist-to-hip ratio (WHR), and somatotype were calculated using standard equations. The average BMI and body fat percentage were  $23.8 \pm 1.6$  kg/m<sup>2</sup> and  $8.3 \pm 1.4$  % for males and  $21 \pm 2$  kg/m<sup>2</sup> and  $17.3 \pm 2.6$  % for females. Somatotype values indicated endomorphy-mesomorphy-ectomorphy ratings of 2.5–4.3–2.4 for males and 3.7–1.7–3.0 for females. Significant differences were observed between male and female players across all measured characteristics, except for subscapular and iliac skinfolds, hip girth, and WHR ( $P \leq 0.05$ ). The findings suggest that male kabaddi players are generally well-conditioned, while female players, particularly in terms of lean body mass, may require additional conditioning. These results could aid in kabaddi talent identification and training optimization. Given the limited research available on kabaddi players worldwide, further studies are recommended to enhance the understanding and development of this sport.

**KEY WORDS:** Anthropometric measures; Body Fat; Somatotype; Kabaddi; Iran.

## INTRODUCTION

Over the past century, sports science research has focused on identifying factors that influence athletic performance and understanding how these factors interact to shape success in various sports (Carter, 1984; Gomez-Ezeiza *et al.*, 2019). Anthropometric measurements have become integral to understanding how body structure and composition contribute to athletic potential (Ghobadi *et al.*, 2013; Knechtle, 2014; Nikolaidis *et al.*, 2015; Gomez-Ezeiza *et al.*, 2019; Shelke *et al.*, 2024). Body composition is a determinant of physical fitness and sports performance (Yáñez-Sepúlveda *et al.*, 2025). Anthropometry, which includes measurements such as height, body mass, and body

circumferences, offers insights into an athlete's physical capabilities and suitability for specific sports roles (Kumar, 2015). This area of science has advanced talent identification, informed training, and guided player selection based on physiological attributes (Eston & Reilly, 2009; Mahesh *et al.*, 2022).

Sports scientists and physicians use anthropometric methods to assess body composition, monitor physiological abilities, and predict sports potential (Alacid *et al.*, 2015). Somatotype, an important component of anthropometric assessment, categorizes an individual's body shape and

<sup>1</sup> Department of Exercise Physiology, Sport Sciences Research Institute, Tehran, Iran.

<sup>2</sup> Department of Sport Sciences, Faculty of Humanities and Social Sciences, University of Kurdistan, Sanandaj, Iran.

<sup>3</sup> Department of Sport Sciences, Faculty of Humanities, Tarbiat Modares University, Tehran, Iran.

<sup>4</sup> Department of Exercise Physiology, Faculty of Physical Education and Sports Science, Kharazmi University, Tehran, Iran.

<sup>5</sup> School of Health Sciences, University of Canterbury, Christchurch, New Zealand.

<sup>6</sup> Universidad Viña del Mar, Facultad de Ciencias de la Vida, Carrera de Entrenador Deportivo, Magister en Evaluación y Planificación del Entrenamiento Deportivo, Viña del Mar, Chile.

<sup>7</sup> Facultad de Educación y Ciencias Sociales, Universidad Andres Bello, Viña del Mar, Chile.

<sup>8</sup> School of Medicine, Universidad Espíritu Santo, Samborombón, Ecuador.

structure. This system, introduced by Sheldon, identifies three primary body types: endomorphic (fat-prone), mesomorphic (muscular), and ectomorphic (lean). Each body type is recorded on a three-digit scale from 1 to 7, representing the dominance of each type (Eston & Reilly, 2009). Different sports often require specific body shapes for optimal performance, and research consistently finds that successful athletes align with these somatotype profiles (Masanovic *et al.*, 2019; Roy & Sarkar, 2022). Somatotyping is particularly valuable in sports like kabaddi, where athletes need particular physique traits for peak performance (Shelke *et al.*, 2024). In kabaddi, effective players require a mix of strength, agility, and endurance, qualities that correlate with specific body compositions and somatotypes (Ali & Adhikari, 2014; Sardar & Pandey, 2016).

Kabaddi, a traditional contact sport originating in India, demands high physical fitness, mental alertness, and skill. The game involves two teams, where a "raider" enters the opponent's territory to tag players while avoiding tackles. Kabaddi players typically exhibit rapid reaction times, advanced neuromuscular coordination, and strong aerobic capacity, all shown to positively impact performance (Khanna *et al.*, 1996; Sathshivam *et al.*, 2023). Research on elite and sub-elite kabaddi players indicates that success in the sport is linked to specific anthropometric and physiological profiles, such as mesomorphic dominance and low body fat (Majlesi *et al.*, 2012; Sudhakar *et al.*, 2014). Notably, elite players demonstrate high aerobic and anaerobic capacities, essential for sustaining the game's intermittent bursts of effort (Devaraju & Kalidasan, 2012).

Previous studies have highlighted the unique anthropometric and physiological attributes necessary for success in kabaddi. For instance, De *et al.* (1982) studied male college-level kabaddi players, finding that their average body mass, height, and other physical parameters aligned with the sport's demands. Dey *et al.* (1993) also showed that elite Indian national kabaddi players display mesomorphic characteristics and lean body mass well-suited to the sport's intense requirements. Khanna *et al.* (1996) emphasized kabaddi's need for substantial anaerobic capacity and a mesomorphic-endomorphic somatotype with minimal body fat, reflecting its high energy demands.

More recently, Shelke *et al.* (2024) highlighted the significance of anthropometric measurements in distinguishing elite Pro Kabaddi League players, showing that specific body compositions and somatotypes can predict performance potential. Similarly, Roy & Sarkar (2022) identified distinctions in body composition among female kabaddi players, which influence playing efficiency and position suitability. Sathshivam *et al.* (2023) further

emphasized the relationship between somatotype and jump performance, a critical skill for successful raiding in kabaddi.

Although many studies have examined the anthropometric profiles of kabaddi players, research on Iranian players is limited, despite Iran's notable success on the international stage. Currently, the Iranian national team ranks among the world's top teams, with impressive achievements in Asian Games. This success highlights the importance of understanding the physical and morphological characteristics of Iranian kabaddi players to enhance training and talent identification within the country (Gurule & Muley, 2019; Rai & Yadav, 2022). This study aims to assess the anthropometric features, body composition, and somatotype profiles of elite male and female Iranian kabaddi players.

## MATERIAL AND METHOD

This cross-sectional study was conducted in collaboration with the Competition Committee of the Kabaddi Federation. The technical staff including head coaches and assistant coaches from teams participating in the Premier League were briefed on the study's objectives and significance. After obtaining informed consent and holding briefings with the athletes at the competition venue, all measurements were completed over two days.

**Participants.** The study population included all male and female players participating in the Kabaddi Premier League. A sample of athletes who volunteered comprised 38 men (mean age:  $22.8 \pm 3.2$  years) and 40 women (mean age:  $22.3 \pm 5.3$  years). This study was conducted in accordance with the Declaration of Helsinki.

## Data Collection

**Measurement of Anthropometric Features.** All anthropometric measurements were taken according to the standards and equipment approved by the International Society for the Advancement of Kinanthropometry (ISAK) (Marfell-Jones *et al.*, 2001). The anthropometric features measured included standing height, body mass, sitting height, arm span, and skinfolds at the triceps, subscapular, biceps, iliac crest, supraspinale, abdominal, front thigh, and medial calf. Additionally, measurements of relaxed arm girth, flexed and tensed arm girth, waist, hip, and calf circumferences, as well as humerus and femur bi-epicondylar breadths, were recorded.

**Body Composition Measurement.** Body fat percentage was calculated using Carter's six-skinfold equation (Whittingham *et al.*, 1992), which includes the total thickness of the six skinfolds at the triceps, subscapular, supraspinale, abdominal, front thigh, and medial calf. Other indices, such as body fat

mass (calculated as  $\text{body mass} \times \text{body fat \%} / 100$ ), lean body mass (body mass – fat mass), body mass index (BMI, calculated as body mass divided by height squared), and waist-to-hip ratio (WHR), were derived (Eston & Reilly, 2009).

For body fat percentage:

Men:  $\text{body fat \%} = 0.1051 \times (\text{total thickness of the six skinfolds}) + 2.585$

Women:  $\text{body fat \%} = 0.1548 \times (\text{total thickness of the six skinfolds}) + 3.58$

**Calculating Somatotype.** Somatotype was assessed using the Heath–Carter method (Eston & Reilly, 2009). This method involves 10 anthropometric variables: standing height, body mass, four skinfolds (triceps, subscapular, supraspinale, and medial calf), circumferences of the flexed and tensed arm and calf, and humerus and femur breadths. Somatotype calculations were performed using Somatotype software version 1.2.5 (Milic *et al.*, 2017), and the mean somatotype was represented as shown in Figure 1.

**Statistical Analyses.** All results are reported as mean  $\pm$  standard deviation. The Shapiro-Wilk test was used to assess data normality. An independent t-test was applied to compare variables between the two groups (male and female athletes). Statistical analyses were conducted using SPSS software version 20.

Effect sizes were calculated by dividing the mean difference by the pooled standard deviation. The magnitude of effect sizes was interpreted as follows:  $d=0.2$  indicated a 'small' effect size,  $d=0.5$  a 'medium' effect size, and  $d=0.8$  a 'large' effect size (Cohen, 2013).

## RESULTS

Table I presents a comparative analysis of anthropometric variables between elite male and female Iranian kabaddi players, including measures of body length, skinfold thickness, girths, and bone breadths. Male athletes exhibited significantly greater values in stature, arm span, muscle girths, and skeletal breadths ( $p<0.001$ ), accompanied by large effect sizes (Cohen's  $d$  ranging from 1.16 to 2.93), indicating pronounced sex-based differences. In contrast, female players demonstrated significantly higher skinfold measurements across most sites, particularly in the triceps, abdominal, and medial calf regions, reflecting greater subcutaneous fat deposition. Notably, no significant differences were observed in subscapular and iliac crest skinfolds, hip girth, and waist-to-hip ratio. These findings underscore distinct somatic profiles between sexes, which may have implications for performance optimization and sex-specific training strategies in Kabaddi.

Table II summarizes key body composition indices in elite male and female Iranian kabaddi players. Males exhibited significantly higher values for body mass, fat-free mass, fat-free mass percentage, and BMI ( $p<0.001$ ), with large to very large effect sizes (Cohen's  $d = 1.55$  to  $4.37$ ). Conversely, females showed significantly greater fat mass and body fat percentage, along with higher total skinfold sums ( $p<0.001$ ), indicating a higher level of subcutaneous fat. No significant sex-based difference was observed in waist-to-hip ratio ( $p = 0.609$ ). The data highlight distinct differences in body composition profiles between male and female athletes, which may influence physical performance and conditioning strategies in Kabaddi.

Table I. Anthropometric variables by sex in elite Iranian Kabaddi players.

| Variables |                                      | Men       | Women     | p-Value | Cohen's dValue |
|-----------|--------------------------------------|-----------|-----------|---------|----------------|
| Lengths   | Standing Stature (cm)                | 179.3±6.4 | 167.3±6.1 | <0.001* | 1.91           |
|           | Sitting Stature (cm)                 | 95±3.7    | 82.3±4.9  | <0.001* | 2.93           |
|           | Arm Span (cm)                        | 185±7.7   | 167.3±6.9 | <0.001* | 2.42           |
| Skinfolds | Triceps sf (mm)                      | 7.7±2.4   | 14.7±3.4  | <0.001* | 2.38           |
|           | Subscapular sf (mm)                  | 11.1±2.3  | 11±3.3    | 0.854   | 0.04           |
|           | Biceps sf (mm)                       | 4.3±0.8   | 5.6±1.8   | <0.001* | 0.93           |
|           | Iliac Crest sf (mm)                  | 12.5±4.6  | 11.6±3.7  | 0.356   | 0.22           |
|           | Supraspinale sf (mm)                 | 7.2±1.9   | 10.4±3    | <0.001* | 1.27           |
|           | Abdominal sf (mm)                    | 10.9±3.9  | 15.4±4.1  | <0.001* | 1.12           |
|           | Front Thigh sf (mm)                  | 10.6±3.4  | 19.3±3.8  | <0.001* | 2.41           |
|           | Medial Calf sf (mm)                  | 7.1±2     | 17.8±4.1  | <0.001* | 3.32           |
| Girths    | Arm girth relaxed (cm)               | 31.9±2    | 27±3.1    | <0.001* | 1.88           |
|           | Arm girth flexed and tensed (cm)     | 34.1±2.1  | 28.5±3.1  | <0.001* | 2.12           |
|           | Waist girth (cm)                     | 77.6±3.5  | 71±4.8    | <0.001* | 1.57           |
|           | Gluteal girth (cm)                   | 94.9±3.4  | 96.6±4.9  | 0.075   | 0.40           |
|           | Calf girth (cm)                      | 37.9±2    | 34.6±3.5  | <0.001* | 1.16           |
| Breadths  | Humerus breadth (biepicondylar) (cm) | 6.6±0.5   | 5.3±0.5   | <0.001* | 2.60           |
|           | Femur breadth (biepicondylar) (cm)   | 9.7±0.5   | 7.5±1.5   | <0.001* | 1.97           |

Values are given as mean  $\pm$  SD. \* significantly different from women values ( $p\leq0.05$ ).

Table III presents the somatotype components, endomorphy, mesomorphy, and ectomorphy, of elite male and female Iranian kabaddi players. Statistically significant sex differences were observed across all three components ( $p < 0.05$ ). Male athletes exhibited higher mesomorphy ( $4.3 \pm 1.1$ ) and lower endomorphy ( $2.5 \pm 0.6$ ), reflecting greater muscularity and lower fatness compared to females. Female athletes had significantly higher endomorphy ( $3.7 \pm 0.9$ ) and ectomorphy ( $3.0 \pm 1.1$ ), suggesting higher adiposity and linearity. Effect sizes were large for endomorphy ( $d = 1.57$ ) and mesomorphy ( $d = 2.47$ ), and moderate for ectomorphy ( $d = 0.60$ ). These findings indicate distinct somatotype profiles between sexes, with potential implications for role-specific demands and talent identification in kabaddi.

Table II. Body composition variables by sex in elite Iranian kabaddi players.

| Variables                            | Men       | Women      | <i>p</i> -Value | Cohen's d Value |
|--------------------------------------|-----------|------------|-----------------|-----------------|
| Body mass (kg)                       | 76.4±5.4  | 58.9±6.4   | <0.001*         | 2.96            |
| Percentage of body fat (%)           | 8.3±1.4   | 17.3±2.6   | <0.001*         | 4.31            |
| Fat mass (kg)                        | 6.4±1.1   | 10.2±2.3   | <0.001*         | 2.11            |
| Percentage of fat-free mass (%)      | 91.7±1.4  | 82.7±2.6   | <0.001*         | 4.31            |
| Fat-free mass (kg)                   | 70.1±5    | 48.7±4.8   | <0.001*         | 4.37            |
| Body mass index (kg/m <sup>2</sup> ) | 23.8±1.6  | 21±2       | <0.001*         | 1.55            |
| Sum of 6 skinfolds (mm)              | 54.6±13   | 88.8±17    | <0.001*         | 2.26            |
| Sum of 8 skinfolds (mm)              | 71.4±17.5 | 105.2±21.3 | <0.001*         | 1.73            |
| Waist-to-hip ratio                   | 0.8±0.1   | 0.9±1.1    | 0.609           | 0.13            |

Values are given as mean  $\pm$  SD. \* significantly different from women values ( $p \leq 0.05$ ).

Table III. Somatotype variables by sex in elite Iranian kabaddi players.

| Variables           | Men     | Women   | <i>p</i> -Value | Cohen's <i>d</i> Value |
|---------------------|---------|---------|-----------------|------------------------|
| Endomorphy (points) | 2.5±0.6 | 3.7±0.9 | <0.001*         | 1.57                   |
| Mesomorphy (points) | 4.3±1.1 | 1.7±1   | <0.001*         | 2.47                   |
| Ectomorphy (points) | 2.4±0.9 | 3.0±1.1 | 0.016*          | 0.60                   |

Values are given as mean  $\pm$  SD. \* significantly different from women values ( $p \leq 0.05$ ).

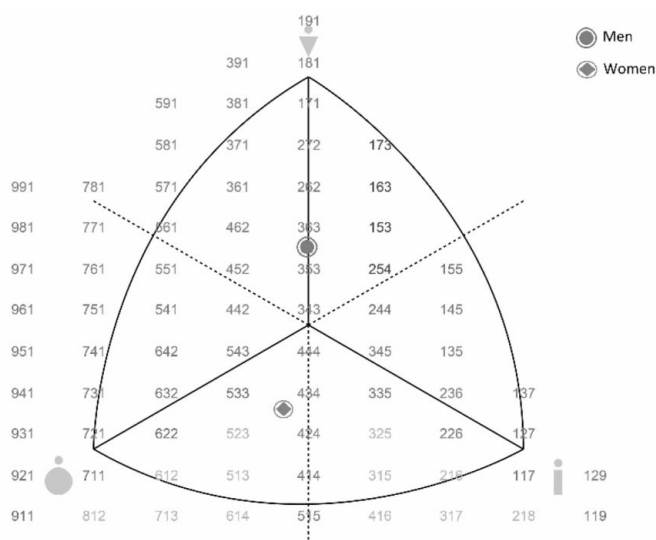


Fig. 1. Somatotype by sex in elite Iranian kabaddi players.

Figure 1 illustrates the mean somatotype distribution of elite Iranian kabaddi players. Male athletes exhibit a balanced mesomorphic somatotype (2.4–4.3–2.5), aligned with the strength and power requirements of the sport. In contrast, female players display an ectomorphic-endomorphic profile (3.7–1.7–3.0), indicating higher adiposity and linearity with lower musculoskeletal robustness.

## DISCUSSION

This study assessed the anthropometric characteristics, body composition, and somatotype profiles of elite male and female Iranian kabaddi players. The findings indicate that male players generally display physical attributes conducive to high-level kabaddi performance, while female players tend to show limitations, particularly in lean body mass. These sex-based differences align with previous research suggesting distinct physiological and body composition requirements for optimal kabaddi performance in male versus female athletes (Roy & Sarkar, 2022; Shelke *et al.*, 2024).

| rs. | Cohen's d Value |
|-----|-----------------|
|     | 1.57            |
|     | 2.47            |
|     | 0.60            |

( $p < 0.05$ ).

Kabaddi is a high-intensity, contact sport combining elements of wrestling, judo, rugby, and gymnastics, demanding both physical robustness and agility (Prasad, 2002). In this study, male players had significantly greater height and body mass compared to females (average height of 179.3 cm vs. 167.3 cm, and body mass of 76.4 kg vs. 58.9 kg). Comparisons with Indian male kabaddi players, who have reported average heights of 174.3 cm and body masses around 75.5 kg, suggest regional and training factors may play a role (De *et al.*, 1982; Dey *et al.*, 1993). The higher values observed in Iranian players may reflect advancements in talent identification and enhanced training protocols in the premier league (Sardar & Pandey, 2016).

A notable finding is the lower body fat percentage in Iranian male players (8.3 %) compared to their Indian counterparts (17.6 %), which could be attributed to differences in training intensity and nutritional practices (Sathshivam *et al.*, 2023). Female players in this study had a body fat percentage of 17.3 %, typical for athletic populations but indicating a need for further lean mass development to enhance performance. Previous research

supports that low lean mass can limit strength and endurance in female players, both of which are critical for kabaddi (Majlesi *et al.*, 2012; Ali & Adhikari, 2014).

Regarding somatotype, Iranian male players exhibited a balanced mesomorphic profile (2.4–4.3–2.5), advantageous for meeting the strength and power demands of kabaddi. This contrasts with the ectomorphic-mesomorphic somatotype (1.7–5.2–3.8) found among Indian male players, likely reflecting regional differences in training focus and selection criteria (Dey *et al.*, 1993; Kumar, 2015). Female players in this study showed an ectomorphic-endomorphic profile (3–1.7–3.7), a combination that could hinder agility and endurance, both essential in kabaddi. This observation aligns with studies advocating for targeted strength training and, if necessary, supplementation to optimize female athletic performance (Sudhakar *et al.*, 2014; Gurule & Muley, 2019).

Comparisons with previous studies suggest that the Iranian Premier League players in this study possess higher levels of anthropometric attributes than those observed in earlier cohorts, likely due to the integration of sports science and anthropometric profiling in athlete development over recent decades (Ghobadi *et al.*, 2013; Nikolaidis *et al.*, 2015). Sex-specific physiological and functional adaptations could also explain the differences in body composition; while male players benefit from enhanced strength and conditioning programs, female players may require tailored interventions to boost lean muscle mass and reduce adiposity (Majlesi *et al.*, 2012; Mahesh *et al.*, 2022). Such approaches mirror findings from other sports, where lean mass and somatotype correlate positively with performance in roles demanding physical strength (Knechtle, 2014; Kumar, 2015).

Significant sex differences emerged across most anthropometric and somatotype variables, with the exceptions of subscapular and iliac crest skinfolds, hip circumference, and waist-to-hip ratio. Higher body fat percentages among female players align with general trends in athletic populations, and competitive weight limits in kabaddi (80 kg for males and 70 kg for females) reflect sport-specific physiological demands (Masanovic *et al.*, 2019; Roy & Sarkar, 2022).

These findings underscore the importance of sex-specific training programs. While male players generally exhibited an optimal physical profile, female players, particularly those with lower lean body mass, could benefit from strength and conditioning interventions. Implementing targeted resistance training could improve muscle mass and performance, as evidenced by research

on similar athletic populations (Devaraju & Kalidasan, 2012; Yallappa, 2020).

Given the limited research on female kabaddi players, this study provides valuable baseline data to guide talent identification and training practices. Future studies should examine the impact of customized training and nutrition programs on performance and anthropometric characteristics in kabaddi players across various skill levels and regions. Broadening research to include diverse populations will improve global understanding of kabaddi's physical demands, supporting the sport's development internationally (Mahesh *et al.*, 2022; Rai & Yadav, 2022).

Despite its contributions, this study has several limitations. First, the sample was restricted to players from the Iranian Kabaddi Premier League, which may limit the generalizability of the findings to players in other countries or competitive levels. Additionally, the cross-sectional design precludes establishing causal relationships between anthropometric and body composition attributes and player performance. Other factors, such as training regimens, dietary habits, and socioeconomic status - which may significantly influence physical characteristics and performance - were not controlled or assessed. Continuous longitudinal studies are recommended to capture changes over time and better evaluate the effects of interventions on kabaddi players' body composition and somatotype.

## CONCLUSIONS

This study provides valuable insights into the anthropometric, body composition, and somatotype characteristics of male and female players in Iran's Kabaddi Premier League. Male players exhibited balanced mesomorphic somatotypes and favorable body composition metrics, supportive of optimal kabaddi performance, which demands speed, strength, and agility. In contrast, female players displayed less advantageous somatotypes (ectomorphic endomorph) and lower lean body mass, which may impact performance and could be improved through strength training and nutrition interventions.

Comparisons with the literature suggest that Iranian Premier League players have achieved more favorable anthropometric profiles than college or national-level teams in other regions, likely due to refined talent identification and the integration of sports science. These findings can inform talent identification, training strategies, and development programs in kabaddi, particularly for female athletes, by emphasizing the need to enhance body composition and muscle mass. Future research involving

larger, more diverse samples and longitudinal tracking is essential for advancing our understanding of kabaddi's physical demands and optimizing training and performance outcomes across sexes and competitive levels.

**ACKNOWLEDGEMENTS.** We sincerely appreciate the study participants for their contribution. Also, we thank the chairman of Iran Kabaddi Federation Dr. Abbas Khajeh Avarseji. AI is used to improve scientific writing and native English.

**BAYATI, M.; SAEI, M.; AGHA-ALINEJAD, H.; AMANI-SHALAMZARI, S.; DANESHFAR, A.; CORTÉS-ROCO, G. & YÁÑEZ-SEPÚLVEDA, R.** Características antropométricas, composición corporal y perfiles somatotípicos de jugadores de élite de kabaddi iraníes. *Int. J. Morphol.*, 43(3):1760-1766, 2025.

**RESUMEN:** El objetivo fue evaluar las características antropométricas, la composición corporal y los perfiles somatotípicos de jugadores iraníes de Kabaddi de élite, tanto hombres como mujeres. Participaron 78 deportistas (38 hombres y 40 mujeres). Se midió la altura de pie, masa corporal, altura sentada, envergadura y ocho pliegues cutáneos. También se midieron perímetros como el brazo relajado, brazo flexionado en tensión, cintura, cadera y pantorrilla, así como los diámetros biepicondilares del húmero y fémur. Se calcularon índices de composición corporal como masa grasa, porcentaje de grasa corporal, masa libre de grasa, porcentaje de masa libre de grasa, índice de masa corporal (IMC), relación cintura-cadera (RCC) y somatotipo, utilizando ecuaciones estándar. El IMC y el porcentaje de grasa corporal fueron, en promedio, de  $23,8 \pm 1,6$  kg/m<sup>2</sup> y  $8,3 \pm 1,4$  % en hombres, y de  $21 \pm 2$  kg/m<sup>2</sup> y  $17,3 \pm 2,6$  % en mujeres. Los valores de somatotipo fueron de 2,5–4,3–2,4 (endomorfia, mesomorfia y ectomorfia) en hombres y 3,7–1,7–3,0 en mujeres. Se encontraron diferencias significativas entre hombres y mujeres en casi todas las variables medidas, excepto en los pliegues subescapular e ilíaco, el perímetro de cadera y la relación cintura-cadera ( $P \leq 0,05$ ). Los resultados sugieren que los jugadores masculinos de kabaddi están generalmente bien acondicionados, mientras que las jugadoras femeninas podrían necesitar un mayor desarrollo de masa corporal magra. Estos hallazgos pueden ser útiles para la detección de talentos y la optimización del entrenamiento en kabaddi. Dado que hay poca investigación disponible sobre jugadores de kabaddi a nivel mundial, se recomienda realizar más estudios para mejorar la comprensión y el desarrollo de este deporte.

**PALABRAS CLAVE:** Medidas antropométricas; Grasa corporal; Somatotipo; Kabaddi; Irán.

## REFERENCES

- Alacid, F.; Marfell-Jones, M.; Muyor, J. M.; López-Miñarro, P. A. & Martínez, I. Kinanthropometric comparison between young elite kayakers and canoeists. *Coll. Antropol.*, 39(1):119-24, 2015.

- Ali, S. & Adhikari, S. Physical and anthropometric characteristics of kabaddi players. *Indian J. Appl. Res.*, 4(1):464-5, 2014.
- Carter, J. E. L. *Physical Structure of Olympic Athletes*. Part II: Kinanthropometry of Olympic Athletes. Basel, Karger, 1984.
- Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*. New York, Routledge, 2013.
- De, A. K.; Dasgupta, P. K.; Panda, B. K. & Bhattacharya, A. K. Physical efficiency tests on Indian male "Kabaddi" inter-university players. *Br. J. Sports Med.*, 16(1):33-6, 1982.
- Devaraju, K. & Kalidasan, R. Prediction of Ksabaddi playing ability from selected anthropometrical and physical variables among college level players. *Asian J. Inf. Technol.*, 11(4):131-4, 2012.
- Dey, S. K.; Khanna, G. L. & Batra, M. Morphological and physiological studies on Indian national kabaddi players. *Br. J. Sports Med.*, 27(4):237-42, 1993.
- Eston, R. & Reilly, T. *Kinanthropometry and Exercise Physiology Laboratory Manual: Tests, Procedures and Data*. Volume One: Anthropometry. 3rd ed. London, Routledge, 2009.
- Ghobadi, H.; Rajabi, H.; Farzad, B.; Bayati, M. & Jeffreys, I. Anthropometry of world-class elite handball players according to the playing position: reports from Men's Handball World Championship 2013. *J. Hum. Kinet.*, 39:213-20, 2013.
- Gomez-Ezeiza, J.; Tam, N.; Torres-Unda, J.; Granados, C. & Santos-Concejero, J. Anthropometric characteristics of top-class Olympic race walkers. *J. Sports Med. Phys. Fitness.*, 59(3):429-33, 2019.
- Gurule, J. & Muley, N. Analysis of success ratio of attacking and defensive skills in Pro Kabaddi League. *Think India J.*, 22(13):471-4, 2019.
- Khanna, G. L.; Majumdar, P.; Malik, V.; Vrinda, T. & Mandal, M. A study of physiological responses during match play in Indian national kabaddi players. *Br. J. Sports Med.*, 30(3):232-5, 1996.
- Knechtel, B. Relationship of anthropometric and training characteristics with race performance in endurance and ultra-endurance athletes. *Asian J. Sports Med.*, 5(2):73-90, 2014.
- Kumar, Y. *A Comparative Study on International Kabaddi Players*. 3rd ed. Saarbrücken, LAP Lambert Academic Publishing, 2015.
- Mahesh, C.; Dileep, N. S. & Sunil Kumar, B. A comparative study of men and women anthropometrics with respect to playing positions in kabaddi. *NeuroQuantology.*, 20(16):1598-601, 2022.
- Majlesi, M.; Azadian, E. & Rashedi, H. Correlation between anthropometric and physical fitness traits: a case study in Hamedan kabaddi team. *World J. Sport Sci.*, 7(4):181-4, 2012.
- Marfell-Jones, M.; Stewart, A. & De Ridder, J. *International Standards for Anthropometric Assessment*. Potchefstroom, ISAK, 2001.
- Masanovic, B.; Popovic, S. & Bjelica, D. Comparative study of anthropometric measurement and body composition between basketball players from different competitive levels: elite and sub-elite. *Pedag. Psychol. Med. Biol. Probl. Phys. Train. Sports*, 23(4):176-81, 2019.
- Milic, M.; Grgantov, Z.; Chamari, K.; Ardigo, L. P.; Bianco, A. & Padulo, J. Anthropometric and physical characteristics allow differentiation of young female volleyball players according to playing position and level of expertise. *Biol. Sport*, 34(1):19-26, 2017.
- Nikolaidis, P. T.; Ingebrigtsen, J.; Povoas, S. C.; Moss, S. & Torres-Luque, G. Physical and physiological characteristics in male team handball players by playing position - Does age matter? *J. Sports Med. Phys. Fitness*, 55(4):297-304, 2015.
- Prasad, R. E. *The Complete Handbook on Kabaddi*. Hyderabad, Jagadamba Publications, 2002.
- Rai, K. G. & Yadav, S. K. S. A comparative study of anthropometric measurements, body composition and cardiovascular efficiency of kho-kho and kabaddi players. *Int. J. Physiol. Nutr. Phys. Educ.*, 7(1):473-4, 2022.
- Roy, M. C. & Sarkar, S. Comparison of body composition among the selected groups of female kabaddi players. *Int. J. Kinanthropom.*, 2(2):58-64, 2022.

- Sathshivam, D.; Adhikari, R.; Ghosh, S. & Pullinger, S. Countermovement jump performance in elite senior male kabaddi players: a cross-sectional study. *J. Adv. Sports Phys. Educ.*, 6(9):153-8, 2023.
- Sardar, S. & Pandey, S. An estimation of kabaddi performance on the basis of selected physical fitness components. *Indian J. Phys. Educ. Sports Appl. Sci.*, 6(4):27-35, 2016.
- Shelke, A.; Bawari, B.; Adhikari, R.; Kamath, S.; Nahak, R. K.; Warrington, C. R. & Pullinger, S. A. Anthropometric characteristics and somatotypes in elite Pro Kabaddi League players. *Int. J. Kinanthropom.*, 4(2):57-66, 2024.
- Sudhakar, H. H.; Majumdar, P.; Umesh, V. & Panda, K. Second to fourth digit ratio is a predictor of sporting ability in elite Indian male kabaddi players. *Asian J. Sports Med.*, 5(3):e23073, 2014.
- Whittingham, N.; Ward, R. & Ross, W. A computer-based physique assessment system. *Aust. J. Sci. Med. Sport.*, 24(2):39-43, 1992.
- Yallappa, M. Relationship of selected physical and anthropometrical variables on the performance of Karnataka state inter-university male kabaddi players. *J. Sports Sci. Nutr.*, 1(2):10-13, 2020.
- Yáñez-Sepúlveda, R.; Herrera-Amante, C. A.; Clemente-Suárez, V. J.; Vasquez-Bonilla, A.; Alacid, F.; Tuesta, M.; Báez-San Martín, E.; Giakoni-Ramírez, F. & Cristi-Montero, C. Anthropometry, body composition, somatotype and asymmetry of canoe sprint world champion: a case study. *Nutr. Health*, 31(1):31-7, 2025.

Corresponding author:

Dr. Mahdi Bayati, Assistant Professor  
Department of Exercise Physiology  
Sport Sciences Research Institute  
Tehran  
IRAN

E-mail: m.bayati@ssrc.ac.ir

ORCID: 0000-0003-4669-4303