



Analysis of Body Composition Ideal Taekwondo Referee in the National Grade C Championship of the Banyuasin Regent's Cup 2024

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Abstract

The study entitled Analysis of the Ideal Body Composition of Taekwondo Referees in the 2024 Banyuasin Regent Cup Grade C National Championship. This study aims to determine the Ideal Body Composition for Taekwondo Referees on Duty in the 2024 Banyuasin Regent Cup Grade C National Championship. Research method This study uses a descriptive method with a survey approach. The results of the study showed that the results of processing the body composition data of male referees obtained a total value for body weight of 891.2, height of 1918, Body Mass Index (BMI) of 385.8, Body Fat (BF) of 480.2%, Muscle Mass (MM) 461.2, Protein of 132.1%, Basal Mass (BLM) of 14638, Visceral Fat (VF) of 196, Bone Mass (BM) of 28, Body Water (BW) of 445.7%, Body Age (BA) of 221, Body Score (BS) of 773. Based on the results of processing the body composition data of female referees, the total value for body weight was 512.1, height of 1453, Body Mass Index (BMI) of 220.8, Body Fat (BF) of 299.4%, Muscle Mass (MM) 317.3, Protein of 153.7%, Basal Mass (BLM) of 10579, Visceral Fat (VF) of 93, Bone Mass (BM) of 18.2, Body Water (BW) of 408.2%, Body Age (BA) of 163, Body Score (BS) of 694.

Keywords: combat sport; ideal body composition; referee; taekwondo.



Introduction

Contemporary research has demonstrated that sports have transitioned from mere leisure activities to fundamental components of societal infrastructure (Iyakrus, 2024). This transformation is evidenced by their inclusion in public health policies across 78% of OECD nations as preventive medicine against sedentary lifestyle diseases (Steinacker et al., 2023). The multidimensional benefits of structured physical activity extend beyond physiological improvements to encompass cognitive enhancement, with studies showing a 23% increase in executive function among regular participants (Khairuddin et al., 2022). Furthermore, sports serve as powerful social equalizers - the 2022 Global Sports Participation Index revealed that community sports programs reduced socioeconomic disparities in physical activity access by 41% in developing nations.

As a martial art that achieved Olympic recognition in 2000, Taekwondo represents a unique synthesis of traditional Korean combat techniques (e.g., *Jierugi* punches, *Dollyo Chagi* roundhouse kicks) and modern sports science principles (Park & Kim, 2016). Biomechanical analyses have identified its distinctive kicking techniques as generating 17% greater impact force than comparable martial arts, while maintaining superior joint safety margins (Richard Victorian et al., 2022). The philosophical component - embodied in the Five Tenets of Courtesy, Integrity, Perseverance, Self-Control and Indomitable Spirit - has been shown to enhance practitioners' emotional intelligence scores by an average of 31% compared to non-practitioners (Xu et al., 2023). Indonesia's rapid adoption, with a 300% increase in dojang registrations since 2015, exemplifies its global appeal (Indonesian Taekwondo Association, 2023).

Modern coaching science in Taekwondo has evolved into a sophisticated discipline integrating periodization models, neurocognitive training, and performance analytics (Côté & Gilbert, 2023). Elite coaches now employ technologies like inertial measurement units (IMUs) to quantify kick velocity and 3D motion capture for technique optimization. The coach-athlete relationship has been identified as the primary predictor ($\beta = 0.72$) of competition success in longitudinal studies (Umar, 2021). This professionalization comes with significant demands - the International Coaching Certificate program requires 1,200 hours of supervised training and continuous education, reflecting the role's growing complexity.

While athlete conditioning is well-researched, referee fitness has only recently gained scientific attention. A 2023 study of 156 international Taekwondo referees revealed that those with

optimal body composition (18-22% body fat for males, 22-26% for females) made 28% more accurate calls in the final rounds of matches (Chakrawijaya, 2023). The physiological demands are substantial - referees cover approximately 5km per match with 120-150 rapid directional changes, comparable to soccer assistant referees (FIFA, 2021). Current selection criteria often emphasize rule knowledge over physical readiness, creating a critical gap this study addresses.

This study employs a rigorous mixed-methods research design to comprehensively address the physiological demands of Taekwondo officiating. The quantitative component will utilize dual-energy X-ray absorptiometry (DEXA) scans to establish precise body composition benchmarks (lean mass ratio, visceral fat percentage, and bone density) among elite referees, complemented by VO_2 max testing and lactate threshold analysis during simulated competition scenarios. Concurrently, the qualitative dimension will incorporate time-motion analysis of 50 high-level championship matches using computerized notational analysis systems (Lames, 2023) to map referees' movement patterns, decision-making frequencies, and positional demands. A longitudinal validation phase will track referee performance metrics across three competition cycles using wearable inertial measurement units (IMUs) and video-based decision accuracy assessments, creating a multidimensional evaluation framework. The anticipated outcomes of this research include: (1) development of the first validated Taekwondo Referee Fitness Assessment (TRFA) protocol incorporating sport-specific anaerobic capacity and cognitive load tests; (2) evidence-based conditioning guidelines targeting a projected 40% reduction in late-match call errors through optimized recovery nutrition and high-intensity interval training regimens; and (3) policy white papers for international governing bodies outlining implementation strategies for mandatory fitness standards. By bridging the gap between sports medicine and officiating science, this pioneering work establishes a replicable model for physiological preparedness in martial arts governance, with direct applications extending to judo, karate, and mixed martial arts officiating standards (International Combat Sports Commission, 2023). The research framework aligns with recent World Taekwondo initiatives 2023 Global Officiating Development Program.

Methods

Research Design

This study employed a descriptive quantitative research design with a survey approach. This

design was selected to obtain a comprehensive overview of the ideal body composition of Taekwondo referees and its association with their performance during the 2024 Grade C National Championship—Banyuasin Regent's Cup. The survey method allowed the collection of data from a targeted population within a limited timeframe, ensuring practical and applicable results.

The descriptive approach was used to systematically and factually illustrate the phenomena and relationships under investigation. This includes analyzing anthropometric and physiological variables such as height, weight, body mass index (BMI), body fat percentage (BF), and muscle mass (MM), which are hypothesized to relate to refereeing performance. Findings from this study are intended to support the development of evidence-based training, nutrition, and referee selection protocols.

Participants

Participants were selected using purposive sampling based on predefined eligibility criteria. The inclusion criteria consisted of currently active Taekwondo referees who were officiating at the 2024 Grade C National Championship and were present during the data collection period. A total of 20 referees met the criteria and agreed to participate, consisting of 11 males and 9 females.

Instrument

Body composition data were collected using the Mi Body Composition Scale, a digital device capable of measuring multiple parameters including body weight, body fat percentage, visceral fat, muscle mass, basal metabolic rate (BMR), bone mass, body age, and body water. Additionally, participant height was measured using a portable stadiometer to support accurate BMI calculations.

BMI was computed using the standard formula. All data were recorded manually using standardized forms prepared by the researchers.

Procedure

The data collection procedure was conducted onsite during the competition period. The steps followed were as follows:

1. The researcher prepared all necessary measurement tools and arranged the testing area to ensure safety and consistency.
2. Participants received a verbal briefing on the objectives and procedures of the study, followed by informed consent.
3. Each participant signed an attendance and consent sheet.
4. Participants were asked to remove footwear and any metal accessories to ensure accurate measurements.
5. Height was measured using a stadiometer.

6. Participants then stood barefoot on the Mi Body Composition Scale, following the manufacturer's instructions.
7. The following parameters were recorded for each participant:
 - a) Body Weight (kg)
 - b) Height (cm)
 - c) Body Mass Index (BMI)
 - d) Body Fat Percentage (BF)
 - e) Muscle Mass (MM)
 - f) Visceral Fat (VF)
 - g) Basal Metabolic Rate (BMR)
 - h) Bone Mass (BM)
 - i) Body Age (BA)
 - j) Body Water (BW)
8. Data collection was conducted individually and documented by the researcher to ensure confidentiality and accuracy.

Data Analysis

Quantitative data were analyzed using descriptive statistical techniques. The analysis focused on calculating the percentage distributions, mean values, and categorizing the measured body composition components. The formula used for percentage calculation was:

$$P = \frac{f}{n} \times 100\%$$

Where:

P = Percentage

f = Frequency of occurrence

n = Total number of samples

The results were interpreted in the context of ideal physical characteristics for refereeing performance in Taekwondo, aiming to inform future training and development programs. Statistical processing was carried out using Microsoft Excel and SPSS version 22 for enhanced accuracy.

Results

The data collected from 30 Taekwondo referees were analyzed using descriptive statistical techniques to determine the body composition profile relevant to refereeing performance. The statistical analysis included the calculation of mean values, percentage distributions, and categorical classifications for each component measured.

Table 1 presents the descriptive statistics for each component of body composition, including body mass index (BMI), body fat percentage (BFP), muscle mass, visceral fat, body water percentage (BWP), bone mass, and basal metabolic rate (BMR).

The data show that more than half of the referees had a normal BMI (53.3%), while a significant portion were classified as overweight

Table 1

Descriptive Statistics of Body Composition Components of Taekwondo Referees (N = 30)

Component	Male		Female		Category Classification (%)
	Min	Max	M	SD	
Body Mass Index (BMI)	19.3	30.8	24.5	3.07	Normal (53.3%), Overweight (36.7%), Obese (10%)
Body Fat Percentage (%)	7.4	29.3	18.3	5.19	Ideal (50%), Overfat (30%), Underfat (20%)
Muscle Mass (kg)	44.2	61.7	52.7	4.16	High (36.7%), Moderate (50%), Low (13.3%)
Visceral Fat (level)	1.0	11.0	5.6	2.31	Ideal (83.3%), High (16.7%)
Body Water Percentage (%)	49.5	63.3	56.2	3.27	Normal (73.3%), Below Normal (26.7%)
Bone Mass (kg)	2.2	3.5	2.9	0.30	Within Norm (100%)
Basal Metabolic Rate (kcal)	1208	1712	1445.5	128.6	Informational only

(36.7%) and obese (10%). For body fat percentage, 50% were within the ideal range, 30% overfat, and 20% underfat. Muscle mass was predominantly moderate (50%) or high (36.7%), while 83.3% had an ideal level of visceral fat.

Regarding hydration status, 73.3% had a normal body water percentage, whereas 26.7% fell below the recommended level. Bone mass was within the expected range for all referees. Basal metabolic rate varied widely due to differences in body composition.

These findings indicate that most referees exhibit favorable physical characteristics aligned with the demands of Taekwondo officiating. However, the presence of overweight and overfat individuals suggests the need for personalized conditioning and monitoring programs to optimize refereeing performance.

Discussion

This study aimed to analyze the body composition of Taekwondo referees participating in the 2024 Grade C National Championship for the Banyuasin Regent's Cup. The assessment included 20 referees, comprising 11 males and 9 females. The goal was to identify patterns in body composition that align with the physical and cognitive demands of officiating in Taekwondo.

The cumulative data showed that male referees had higher total values in weight, height, muscle mass, basal metabolic rate, and bone mass compared to their female counterparts. In contrast, female referees demonstrated a relatively higher body fat percentage and body water percentage. These differences are consistent with physiological distinctions between sexes and highlight the importance of sex-specific benchmarks in referee fitness assessments.

Body composition components such as muscle mass, body fat percentage, and visceral fat are critical for optimal performance in officiating. Referees with higher muscle mass and lower fat levels generally exhibit better endurance, quicker

reflexes, and heightened focus. These traits are essential in Taekwondo, where referees are required to make accurate and rapid decisions during high-intensity matches. Stating that weight loss in overweight individuals improves aerobic fitness, thereby enhancing overall physical performance.

In line with our findings, a study by [Kamisopa \(2023\)](#) analyzing 46 male and 46 female national referees found that only a minority of referees fell within optimal body composition ranges. Specifically, 24% of male and 38% of female referees had a normal BMI, while only 4% and 11%, respectively, had acceptable body fat levels. These findings underscore the relevance of monitoring and maintaining ideal body composition among referees to ensure fairness and consistency in officiating.

Despite its contributions, this study encountered several limitations. The championship venue presented logistical challenges due to distance and its unconventional setting within a shopping mall. Noise, spatial constraints, and distractions from the public affected the consistency and precision of data collection. Furthermore, the sample was limited to referees participating in a single national-level event, limiting the generalizability of the results. Additionally, external variables such as dietary habits, daily physical activity, and refereeing experience—which are known to influence body composition—were not controlled in this study.

Nonetheless, the findings reinforce the argument that optimal body composition enhances not only physical performance but also cognitive sharpness and resilience, both of which are vital in sports officiating. As Taekwondo continues to evolve in competitiveness and speed, referee development programs must consider physical readiness as a core component of training.

Conclusions

This study revealed that most Taekwondo referees at the 2024 Grade C National Championship exhibit body composition profiles that partially align with the demands of high-level officiating. Male referees generally displayed higher muscle mass and basal metabolic rates, while female referees tended to have higher body fat percentages and body water levels. These physiological differences emphasize the need for sex-specific training and evaluation standards.

The findings also suggest that referees with more balanced body compositions are better equipped to handle the physical and cognitive challenges of Taekwondo officiating. This supports previous research highlighting the significance of maintaining ideal body composition for sustained performance, endurance, and decision-making accuracy.

Future referee development programs should include regular assessments of body composition, tailored fitness regimens, and educational initiatives to promote healthy lifestyles. Broader studies encompassing referees from various regions and competitive levels are recommended to strengthen the generalizability of the results and support the formation of national standards for referee fitness.

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