Influence of Kinanthopometric Profile of National Level Male Judo Players of Tamil Nadu on Performance

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Resumen

Introducción: Los aspectos antropométricos y la composición corporal son factores cruciales para explicar el estado físico humano. La ventaja antropométrica, un factor no modificable, contribuyó significativamente al éxito de los atletas en los deportes. Cada persona tiene unas características morfológicas que la definen, lo que podría resultar beneficioso para la práctica de determinado deporte. El presente estudio se estudió para descubrir la relación entre los perfiles cineantométricos y el nivel de rendimiento de jugadores masculinos de judo a nivel nacional de Tamil Nadu, India. **Métodos:** Se midieron los parámetros antropométricos de 30 jugadores masculinos de Judo. Se midieron la altura, el peso, las circunferencias y el espesor de los pliegues cutáneos en varios sitios. Se calculó la densidad corporal y se determinó el porcentaje de grasa corporal utilizando la ecuación de Siri. Una prueba especial de condición física de Judo involucró a los compañeros de lanzamiento utilizando la técnica ippon-seoi-nage en tres períodos con controles de frecuencia cardíaca, y se calculó un índice basado en los lanzamientos totales y los valores de frecuencia cardíaca. **Resultados:** En el presente estudio se observó una altura promedio de 158.1 (± 8.5) cm mientras que el peso fue de 63,7 (± 7.3) kg. Los jugadores de judo se clasificaron en tipos de cuerpo endomórficos (30%), mesomórficos (36.7%) y ectomórficos (33.4%). Los jugadores mesomorfos mostraron un buen rendimiento, los jugadores ectomorfos mostraron un rendimiento medio y los jugadores endomórficos mostraron un rendimiento pobre cuando el rendimiento se analizó mediante la prueba especial de aptitud física de judo. Esto subrayó un vínculo potencial entre el tipo de cuerpo y el rendimiento en Judo. **Conclusión:** El estudio concluyó que la composición corporal tiene un alto impacto en la condición física y el rendimiento deportivo. Los tipos de cuerpo de los jugadores de judo variaban según el tipo de actividades deportivas que practicaban. Junto con las habilidades deportivas, el entrenamiento, el tipo de cuerpo y el nivel de condición física tienen una correlación positiva con el rendimiento deportivo.

Palabras Clave: Jugadores de Judo, Composición corporal, Altura, Peso, Rendimiento.

Abstract

Introduction: Anthropometric Aspects and Body composition are the crucial factors in explaining human physical status. Anthropometric advantage, a non-modifiable factor, significantly contributed to athletes' success in sports. The present study was studied to find out the relationship between the Kinanthopometric profiles and performance level of National-level male Judo players from Tamil Nadu, India. **Method:** 30 male Judo players were measured for their anthropometric parameters. Height, weight, circumferences, and skinfold thickness at various sites were measured. Body density was calculated, and body fat % was determined using Siri's Equation. A special Judo fitness test involved throwing partners using the ippon-seoi-nage technique in three periods with heart rate checks, and an index was calculated based on total throws and heart rate values. **Results:** An average height of 158.1 (± 8.5) cm was observed in the present study whereas that of weight was 63.7 (± 7.3) kg. Judo players were categorized into Endomorphic (30%), Mesomorphic (36.7 %) and Ectomorphic (33.4 %) body type. Mesomorphic players showed good performance, Ectomorphic players showed average performance, and Endomorphic players displayed poor performance when performances were analyzed using the Special Judo Fitness Test. This underscored a potential link between body type and Judo performance. **Conclusion:** The study concluded that body composition has a high impact on physical fitness and sports performance.

Introduction

Judo is an Olympic sport as well as a Japanese art form. In addition to tactical strategy and technical proficiency, conditioned (physical and physiological) traits are essential for both training and competitive success. Judo is a dynamic, high-intensity, sporadic sport where success demands mastery of intricate techniques (Degoutte et al., 2003). It is a sporadic combat sport with quick muscular movements that depends on both anaerobic and aerobic metabolism (Franchini et al., 2015). In particular, aerobic metabolism is necessary for a successful recovery in between games (Franchini et al., 2009).

Athletes in competitive judo strive to control their opponent during groundwork battle or toss him onto his back in this combative, high-intensity sport. Both endeavors rely on certain methods and tactical abilities in addition to strong physical conditioning (Ali et al., 2010). In order to compete in a lower category, quick weight loss techniques are frequently used by judo athletes in the days leading up to competition (Artioli et al., 2010). Top Judo practitioners should have a minimal amount of body fat because the sport is weight classified. There have been suggestions that body fat percentage could serve as a success discriminant (Ali et al.,2010).

Judo is a martial art where strong strikes are performed quickly and often against an opponent's might. It's a variable-effort sport. There are longer or shorter intervals in between the continuous bursts of maximum or sub-maximum intensity during the competition (Drapsin et al.,2009). Judokas' fitness levels are assessed with the Special Judo Fitness Test (SJFT), it helps to measure their level of effort tolerance. This test involves a particular type of throw from the game ippon-seoi-nage and is intermittent in nature, with intervals in between tests (Sterkowicz ., 1995). The World Health Organization states that anthropometry is an accessible and affordable science that doesn't involve any invasive or uncomfortable procedures. Obtaining a variety of body measurements enables evaluation of the human body's composition and physical characteristics (Çıkmaz et al., 2005).

Our understanding of Kinanthopometry enables us to measure a variety of body parts which includes height, weight, circumferences and skin folds measurements. Kinanthopometry is a branch of sports science that focuses on measuring and analyzing aspects of the human body's composition, size, and shape. It offers critical information about athletic performance, injury avoidance, and general health. Kinanthopometry is derived from the Greek words "kinein" (to move), "anthropos" (human), and "metron" (measure). It refers to the systematic measurement and analysis of human body dimensions, proportions, and composition in relation to movement and physical activity. As a scientific discipline, Kinanthopometry emerged in the mid-20th century with the high interest in understanding the connection between human body characteristics and athletic performance. These metrics are used to choose athletes. Existing studies on the physical characteristics of the human body suggest that, in terms of somatic qualities, the morphological characteristics of elite athletes are different from those of the general population. In Kinanthopometry, anthropometric measurements are used to inform training programs, monitor growth and development, and evaluate injury risk and rehabilitation progress. Our ability to measure various bodily components, such as height, weight, diameters, circumferences, and skin folds, is made possible by our knowledge of Kinanthopometry.

The ISAK [International Society for the Advancement of Kinanthopometry] oversees measurements of human body composition. ISAK recommends the approach that is now most commonly used for gathering and analyzing anthropometric and Kinanthopometric data (Çıkmaz et al., 2005). Everybody has distinctive physical characteristics that make them unique and are advantageous while participating in a certain activity. Because of this, scientific study focusing on professional athletes or certain sports has increased in recent years (Khan et al.,2016). Kinanthopometric measurements were taken to assess key variables, such as body mass, height, body composition [including fat and muscle mass distribution], limb lengths, and other relevant anthropometric features. In addition, physical performance tests were conducted to evaluate different aspects of athletes' running abilities, including speed, endurance, and power (Masanovic et. al, 2019). A primary goal on Kinanthopometric is to take precise measures of each athlete's body composition across a variety of sports fields. It is important in sports because sports coaches select adults based on how well they can move and perform in a variety of settings after taking measurements of their bodies. The selection of athletes and monitoring of the athletes wouldn't be effective without an awareness of each individual's growth and structural status. For anthropometric measurements to yield useful data, measurements must be accurate and repeatable.

As a result, clinicians should guarantee the use of high-quality, accurately calibrated equipment. Equipment such as a weight scale, calibration weights, a stadiometer, knee and skin fold calipers, a non-stretchable tape measure, and a stadiometer to gauge recumbent length are typically needed to produce anthropometric measures. Evaluations of physical characteristics are an essential part of training since they reveal areas that need to be

improved and the effectiveness of a certain training plan. In order to identify and analyze the unique Judo fitness levels among Judo practitioners as well as potential anthropological causes, this study was conducted. The study of the size, shape, and proportions of the human body is known as anthropometry. It provides valuable insights into individual and population differences, as well as the relationship between dimensions and various aspects of physical performance and health (Ackland et al., 2012).

Materials and Methods

Anthropometric measurements for 30 male Judo players from Tamil Nadu included height and weight, recorded using a stadiometer and digital scale. BMI was calculated using Quetelet's Equation. Body circumferences and skinfold thickness at various sites were measured. Body density was calculated, and body fat % was determined using Siri's Equation. A special Judo fitness test involved throwing partners using the ippon-seoi-nage technique in three periods with heart rate checks, and an index was calculated based on total throws and heart rate values.

Procedure

For the 30 National level male Judo players from Tamil Nadu Anthropometric measurements included: Weight (kg) was recorded by calibrated scale, Height (m) was measured by a commercial stadiometer and BMI (body mass index) were calculated from height and weight using QUETELET'S EQUATION. BMI = body weight in Kg / (height in meters)2 Body circumferences (cm) were measured using a measuring tape at seven different sites (chest, thigh, wrist, relaxed arm, flexed arm, forearm, and calf) in accordance with normal procedure (Tremblay et al.,2012). Body density will be computed based on skin fold thickness (mm) measured at seven sites on the right side of the body (triceps, subscapular, mid axillary, belly, suprailiac, medial calf, and proximal thigh) using skin fold calipers. Body fat % was calculated using SIRI'S EQUATION [4.95/Body density– 4.500] × 100 (Campa, 2015). SPECIAL JUDO FITNESS TEST: The test performer was positioned three meters away from the Judokas who were to be thrown, while two Judokas with comparable stature and body mass were placed six meters apart. The test comprised three sections: 15 seconds (A), 30 seconds (B), and 30 seconds (C), with intervals of 10 seconds. In each phase, the performer utilized the ippon-seoi-nage technique to throw the partners as much as possible. The performer's heart rate was recorded immediately after the test and one minute later. After tallying all the throws completed during this period, an index was determined to assess the overall performance. [7] Index=final HR (bpm) +HR 1min after the end of the test (bpm) / total number of throws. By using the SJFT classificatory table, we classified the Judo players' performance level and their physical fitness.

Results

A total of 30 Judo players were assessed, and their data were calculated and tabulated. The body composition of the Judo players was presented in Table-1. Mean and SD of height and weight of the Judo players were presented in Table-2. Mean and SD of skinfold measurements of the Judo players were presented in Table-3. Mean and SD of Mid-Arm circumference and Mid-Calf circumference of the Judo players were presented in Table-4. Mean and SD of Humeral Intercondylar width and Femoral Intercondylar width of the Judo players were presented in Table-5. From the Judo players' anthropometric data, we calculated the physical fitness of the Judo players, which was found to be mesomorphic- 36.67%, ectomorphic33.34%, and endomorphic- 30%. The sports performance of the Judo players was analyzed by the Special Judo Fitness Test, and the result showed that Judo players with mesomorphic body type had a good performance level, Judo players with ectomorphic body type had an average performance level, and Judo players with endomorphic body type had a poor performance level. By correlating the Kinanthopometric, physical fitness, and their sports performance in the game, we came to know that players with a higher body fat percentage had a low impact on their sports performance, and players with a lower body fat percentage had a high impact on their sports performance.

Table 1. Body composition of Judo players based on their performance.

Subject	Body type	Classification based on Judo Performance
1	Endomorphic Mesomorph	Good
2	Mesomorphic Mesomorph	Good
3	Mesomorphic Ectomorph	Average
4	Endomorphic Ectomorph	Good

5	Mesomorphic Endomorph	Good
6	Mesomorphic Ectomorph	Average
7	Endomorphic Mesomorph	Poor
8	Mesomorphic Mesomorph	Good
9	Mesomorphic Ectomorph	Average
10	Endomorphic Mesomorph	Good
11	Endomorphic Endomorph	Poor
12	Mesomorphic Ectomorph	Average
13	Endomorphic Mesomorph	Good
14	Endomorphic Mesomorph	Poor
15	Mesomorphic Ectomorph	Average
16	Endomorphic Mesomorph	Poor
17	Mesomorphic Mesomorph	Good
18	Endomorphic Mesomorph	Poor
19	Endomorphic Mesomorph	Good
20	Endomorphic Mesomorph	Poor
21	Mesomorphic Ectomorph	Average
22	Endomorphic Mesomorph	Good
23	Endomorphic Mesomorph	Poor
24	Mesomorphic Ectomorph	Average
25	Endomorphic Mesomorph	Good
26	Endomorphic Mesomorph	Poor
27	Mesomorphic Ectomorph	Average
28	Mesomorphic Ectomorph	Average
29	Endomorphic Mesomorph	Poor
30	Mesomorphic Ectomorph	Average

Table 2. Mean and Standard Deviation of height and weight of all Judo players

Variables	Height (cm)	Weight (kg)
Mean	158.1	63.7
SD	8.5	7.3

Table 3. Mean and Standard Deviation of skin fold [mm] measurements of the judo players

Variables	Biceps Skin Fold Thickness (mm)	Triceps Skin Fold Thickness(mm)	Subscapularis Skin Fold Thickness(mm)	Supraspinale Skin Fold Thickness(mm)	Mid-calf Skin Fold Thickness(mm)
Mean	7.0	21.5	18.9	28.5	13.5
SD	1.7	2.4	3.4	2.8	2.9

Table 4. Mean and Standard Deviation of Mid-Arm circumference and Mid-Calf circumference of the Judo players.

Variables	Mid-Arm circumference (cm)	Mid-Calf circumference (cm)
Mean	36.9	35.1
SD	1.7	1.0

Table 5. Mean and Standard Deviation of Humeral Inter condylar width and Femoral Inter condylar width of the Judo players.

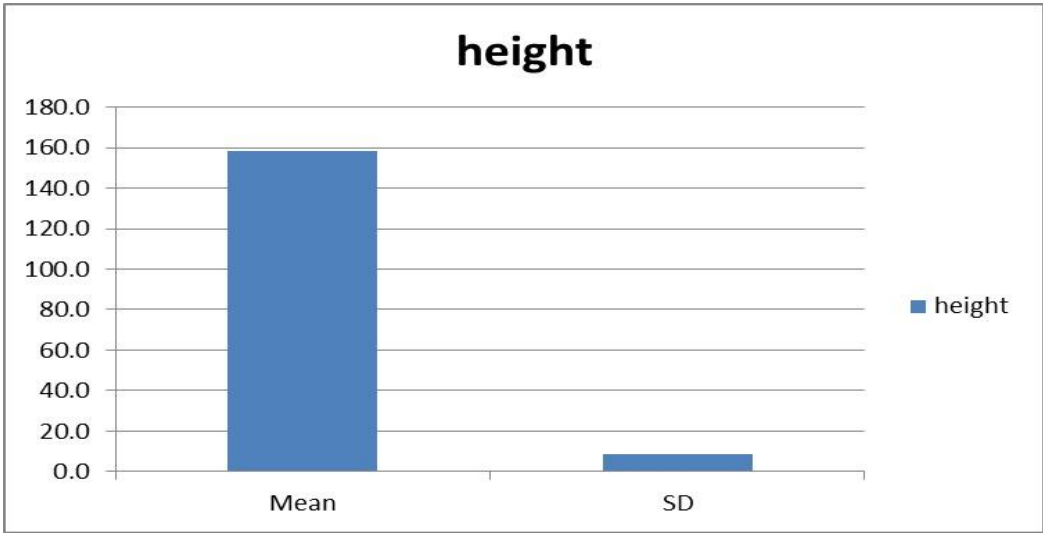| Variables	Humeral Inter condylar width (cm)	Femoral Inter condylar width(cm)
Mean	7.4	10.1
SD	0.6	0.4

Figure 1. Mean and Standard Deviation of height
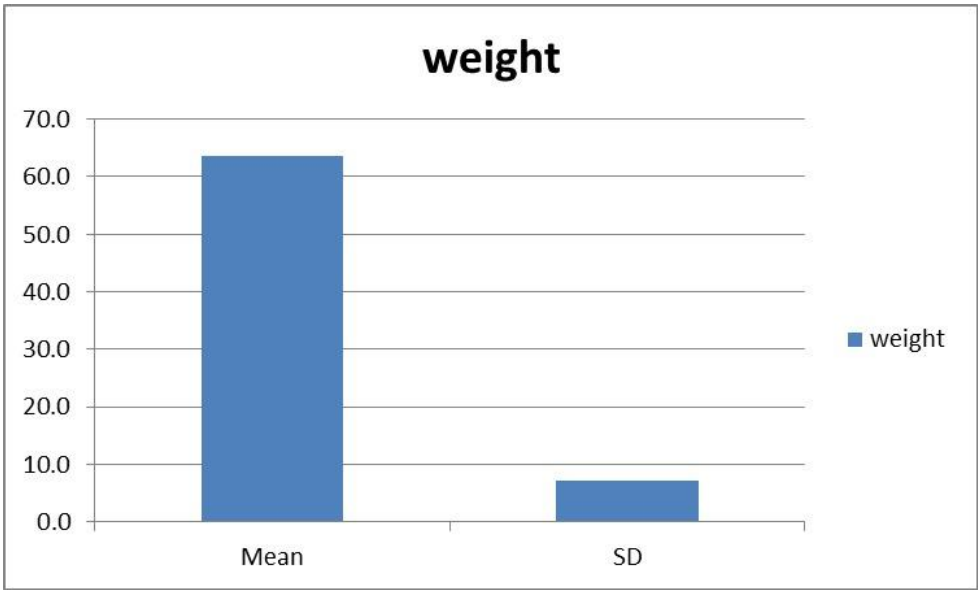
Figure 2. Mean and Standard Deviation of weight
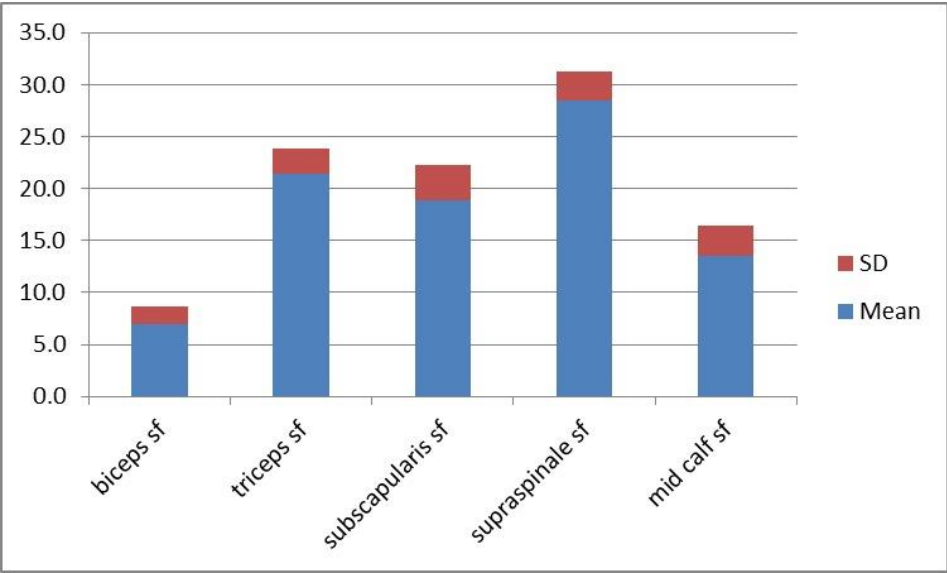
Figure 3. Mean and Standard Deviation of skin fold [mm] measurements
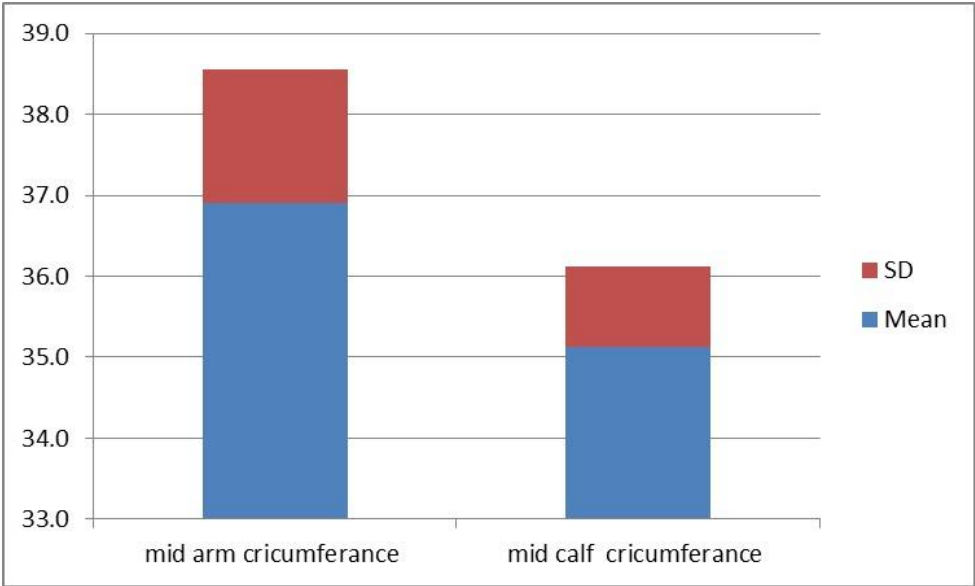
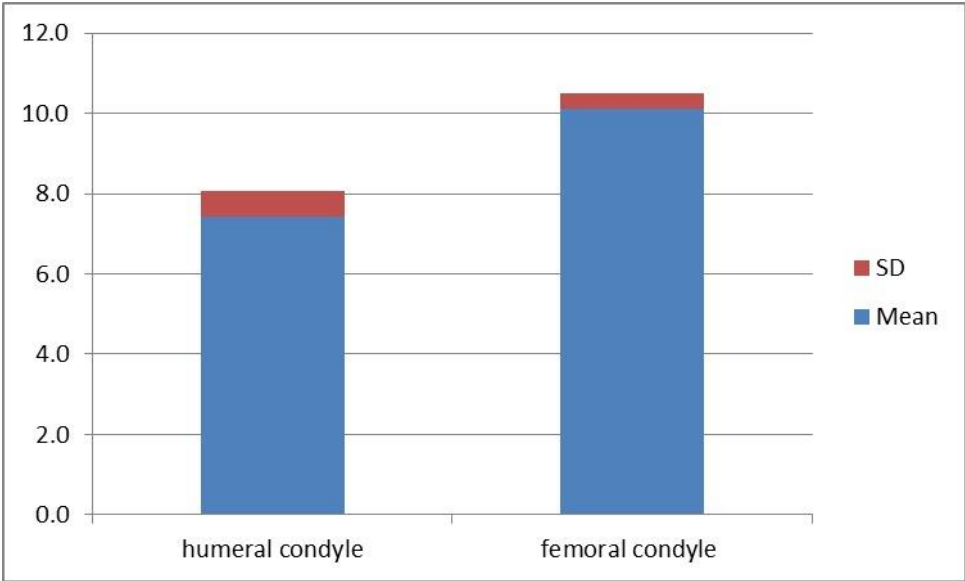**Figure 4**. Mean and Standard Deviation of Mid-Arm circumference and Mid-Calf circumference

Figure 5. Mean and Standard Deviation of Humeral Inter condylar width and Femoral Inter condylar width

Discussion

The Special Judo fitness test involved a carefully orchestrated scenario where two Judokas, matched in stature and body mass, stood 6 meters apart, forming a challenging distance for the performer positioned 3 meters away. The objective was to evaluate the performer's proficiency in executing the ippon-seoi-nage technique during three distinct periods: A (15 sec), B (30 sec), and C (30 sec), interspersed with ten-second intervals. Throughout each period, the performer aimed to maximize the execution of the ippon-seoi-nage technique, emphasizing its effectiveness in throwing the partner Judokas. This not only required precision in the application of the technique but also demanded strategic timing and control.

Crucially, the physiological impact on the performer was monitored through heart rate measurements taken immediately after each period and again 1 minute after the entire test concluded. These measurements served as valuable indicators of the cardiovascular demands and recovery aspects associated with the sustained execution of the ippon-seoi-nage technique.

The total sum of successful throws accomplished during the entire test duration was then tallied. This cumulative count formed the basis for calculating an index, providing a quantitative measure of the performer's overall performance in applying the ippon-seoi-nage technique under the specified conditions.

This methodical approach not only assessed the technical proficiency of the performer but also shed light on the physiological stressors encountered during the repeated execution of the ippon-seoi-nage. The inclusion of heart rate data added a dimension of understanding regarding the cardiovascular demands and post-exertion recovery, contributing to a comprehensive evaluation of the Special Judo fitness test (SJFT).

Coaches using the SJFT to categorize their athletes and track their progress in physical fitness could benefit from the results. Since the current classification table was based on male data across all weight categories combined, it is crucial to keep in mind that classificatory norms for each weight category must be established for both male and female athletes. The rehabilitation process is another potential use for this table. Coaches can use it to compare an athlete's performance on the SJFT before and after an injury to determine when to advance an athlete to more difficult Judo-specific exercises based on their physical condition.

Accurate measurement is crucial for constructing a precise Kinanthopometric profile. Adhering strictly to standardized protocols is essential to ensure reproducibility. Careful attention to technique, particularly under field test conditions, was required to minimize errors. Prior to measurement, anthropometrists developed appropriate techniques to reduce error levels. Reproducibility was established through repeated measures on at least twenty subjects, and comparison with experienced anthropometrists helped ensure accuracy. Under ISAK protocol, unilateral measurements were usually taken on the right side, but the left side could be used when impractical to use the right side.

Variations obtained from standard procedures were documented on the proforma. Each measurement was taken at least twice, with a third measurement if the difference between the first two exceeded 5% for skinfolds or 1% for other measurements. The mean or median value was used based on the number of measurements. The anthropometrist and recorder worked as a team, with the recorder entering data into the proforma. It was crucial to follow the recommended sequence of actions, and measurements were not taken consecutively to avoid increased measurement error. Errors in data recording were minimized through careful pronunciation and immediate verification by the recorder.

Judo player anthropometric characteristics were summarized as follows: The mean height of the cohort was recorded at 158.1 cm, with a standard deviation of 8.5 cm, denoting a degree of variability in height distribution. This indicated that the typical height was 158.1 cm, while individual heights exhibited a spread within approximately one standard deviation below or above the mean. Concurrently, the mean weight of Judo players was reported as 63.7 kgs, with a standard deviation of 7.3 kgs, suggesting a level of variability in weight distribution. The standard deviation implied that the majority of players were anticipated to possess weights within one standard deviation of the mean.

These statistics served as a professional and quantitative representation of the central tendency and dispersion in both height and weight among Judo players, providing valuable insights into the nuanced physical attributes within this athletic demographic.

The anthropometric measurements for individuals, encompassing Biceps Skin Fold Thickness, Triceps Skin Fold Thickness, Subscapularis Skin Fold Thickness, Supraspinale Skin Fold Thickness, and Mid-calf Skin Fold Thickness, revealed distinctive characteristics. The mean Biceps Skin Fold Thickness was 7.0 mm, with a standard deviation of 1.7 mm, indicating a relatively limited variability around the average measurement. Triceps Skin Fold Thickness demonstrated an average of 21.5 mm, with a standard deviation of 2.4 mm, reflecting moderate dispersion in the dataset. Subscapularis Skin Fold Thickness exhibited a mean of 18.9 mm and a standard deviation of 3.4 mm,

suggesting a notable range of values. Supraspinale Skin Fold Thickness recorded a mean of 28.5 mm, with a standard deviation 2.8mm.

After examining the relationship between Kinanthopometric data, physical fitness, and sports performance, we found that athletes with higher body fat percentages exhibited reduced impact on their sports performance, whereas those with lower body fat percentages demonstrated a stronger influence on their performance in the game.

Conclusion

From the results, it was found that Judo players with mesomorphic somatotyping had good Judo sports performance, followed by ectomorphic and endomorphic somatotypes. Therefore, sports skills, training body type, and physical fitness level have a positive correlation with sports performance. It is concluded that body composition has a high impact on physical fitness and sports performance.

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Conflicts of Interest

The authors have no conflicts of interest to declare that they are relevant to the content of this article.

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