

## Comparison of Anthropometric Characteristics of Punjab Male Taekwondo Players across Competitive Levels

Jigyasa Grover<sup>1\*</sup>, Dr. Rajwinder Kaur<sup>2</sup>

<sup>1</sup>Ph.D Scholar, Department of Physical Education, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India.  
Email: groverjigyasa30@gmail.com

<sup>2</sup>Assistant Professor, Department of Physical Education, Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India. Email: [rajwinderkaur0567@gmail.com](mailto:rajwinderkaur0567@gmail.com)

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### Abstract:

Anthropometric characteristics play a critical role in athlete profiling, particularly in combat sports such as Taekwondo, where body composition can influence performance, agility and strength. This study aimed to compare selected anthropometric characteristics and body composition variables of Punjab male Taekwondo players across Inter-College and National competitive levels and to examine trends in these variables with increasing levels of participation. A total of 64 male athletes (32 Inter-College, 32 National) aged 18–25 years were assessed for body weight, height, body mass index (BMI), body fat percentage and skinfold thickness at six sites using standardized protocols and Harpenden skinfold callipers. Independent samples t-tests were employed to evaluate differences between groups and trend analysis was performed to examine patterns associated with competitive level. Results indicated no significant differences in body weight, height or BMI between the two groups. In contrast, body fat percentage and all measured skinfold thickness variables demonstrated a significant progressive decrease from Inter-College to National level players. The findings suggest that body composition, rather than general body size, distinguishes higher-level Taekwondo players and highlights leanness as a defining characteristic of elite performance. These results provide practical guidance for athlete monitoring, training program design, and talent development in regional and national Taekwondo contexts.

**Key Words:** Taekwondo, body composition, skinfold thickness, anthropometry, athlete profiling, competitive level

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### Introduction

Anthropometric characteristics are fundamental indicators of athletic potential, especially in combat sports such as Taekwondo, where physical attributes can directly influence agility, reach, strength and overall performance. Key variables such as height, body weight, body mass index, arm span and chest circumference are not only useful for profiling athletes but also critical for designing tailored training programs, monitoring progress and guiding talent identification initiatives.

Punjab has a long-standing tradition of producing competitive athletes across various sports, including Taekwondo. While the sport has grown in popularity at inter-college and national levels, there is a paucity of systematic research investigating the anthropometric profiles of male Taekwondo players in the region. Understanding how these characteristics vary with competitive level can provide valuable insights into the physical demands of the sport and inform evidence-based strategies for athlete development.

The present study was therefore designed with three primary objectives:

1. To **compare selected anthropometric characteristics** of Punjab male Taekwondo players across inter-college and national levels of competition.

2. To **examine the trend of changes in anthropometric characteristics** with increasing levels of participation.

By addressing these objectives, this study contributes to filling an important gap in sports science research in India. The findings are expected to support coaches, trainers and sports scientists in optimizing training, improving performance, and fostering the systematic development of Taekwondo athletes from regional to national levels.

### Methodology

#### Participants

The participants for the present study comprised Punjab male Taekwondo players competing at two different levels of performance, namely Inter-College and National level. A total of 64 male players were selected using a purposive sampling technique, with 32 players from each competitive level. All participants had a minimum of Two years of formal training experience in Taekwondo and were actively participating in competitions during the period of data collection. The age of the participants ranged from 18 to 25 years. Prior to participation, the purpose and procedures of the study were explained to the players and informed consent was obtained. The study adhered to ethical standards for research involving human subjects.

\*Author for Correspondence: [groverjigyasa30@gmail.com](mailto:groverjigyasa30@gmail.com)

**Procedure**

Standardized anthropometric procedures were followed for the measurement of selected variables. All measurements were taken in the morning hours to minimize diurnal variation and participants were instructed to wear light sports clothing and remain barefoot during measurements.

The selected anthropometric variables included body weight, height, body mass index (BMI) and Skinfold thickness at selected sites.

- Height was measured to the nearest 0.1 cm using a wall-mounted stadiometer.
- Body weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale.
- BMI was calculated using the formula: weight (kg) / height<sup>2</sup> (m<sup>2</sup>)
- Body fat percentage was estimated from the sum of skinfold thickness measurements using a validated regression equation for young adult males and converted to percentage body fat using standard formulas. % body fat = [(4.95 / body density) - 4.50] × 100.
- Skinfold thickness was measured at the following sites: biceps, triceps, subscapular, suprailiac, mid-thigh and calf, using a Harpenden skinfold calliper.

All skinfold measurements were taken on the right side of the body following ISAK standards. Each site was measured twice and if the difference exceeded 1 mm, a third reading was taken, the average of the closest two readings was recorded.

All measurements were taken by the same trained investigator to minimize inter-observer error. The instruments were calibrated before each testing session.

**Data Collection and Analysis**

Data were systematically recorded and organized for statistical analysis. Descriptive statistics, including mean and standard deviation, were computed for all selected anthropometric variables. To compare anthropometric characteristics between Inter-College and National level players, an independent samples t-test was employed, as the data met the assumptions of normality and homogeneity of variance.

The degree of freedom (df), t-values and p-values were calculated to identify statistically significant differences between groups. The level of significance was set at 0.05. Additionally, trend analysis was performed descriptively by examining the direction of change in mean values from the Inter-College level to the National level to assess patterns associated with increasing levels of participation.

All statistical analyses were carried out using standard statistical software and results were presented in tabular form for clarity and interpretation.

**Result**

**Table 1. Anthropometric Means of Punjab Male Taekwondo Players by Competitive Level**

| Variable                  | Inter-College (n-32) Mean±SD | National (n-32) Mean±SD | t-test | df | p-value |
|---------------------------|------------------------------|-------------------------|--------|----|---------|
| Weight (kg)               | 71.49±13.63                  | 70.34±12.71             | 0.35   | 60 | 0.73    |
| Height (cm)               | 177.26±6.89                  | 175.29±5.39             | 1.24   | 56 | 0.21    |
| BMI (kg/m <sup>2</sup> )  | 22.72±4.17                   | 22.59±2.93              | 0.14   | 56 | 0.88    |
| Body Fat (%)              | 16.05±5.15                   | 12.27±2.20              | 3.75   | 42 | <0.001  |
| Biceps Skinfold (mm)      | 6.03±1.01                    | 4.94±0.69               | 4.99   | 54 | <0.001  |
| Triceps Skinfold (mm)     | 8.22±1.12                    | 6.10±0.75               | 8.60   | 53 | <0.001  |
| Subscapular Skinfold (mm) | 9.94±1.60                    | 7.97±1.08               | 5.61   | 52 | <0.001  |
| Suprailiac Skinfold (mm)  | 10.37±0.95                   | 7.38±0.80               | 13.15  | 59 | <0.001  |
| Mid-thigh Skinfold (mm)   | 10.71±1.99                   | 7.31±1.11               | 8.32   | 48 | <0.001  |
| Calf Skinfold (mm)        | 7.32±0.83                    | 5.21±0.75               | 10.29  | 60 | <0.001  |

\* Significant at p < 0.05

**Table 1** presents the mean values, standard deviations, t-ratios, degrees of freedom and probability values for selected anthropometric and body composition variables of Punjab male Taekwondo players at Inter-College and National levels.

No statistically significant differences were observed between Inter-College and National level players for body weight (t = 0.35, df = 60, p = 0.73), height (t = 1.24, df = 56, p = 0.21) and body mass index (t = 0.14, df = 56, p = 0.88). This indicates that both groups were similar with respect to these general anthropometric characteristics.

A statistically significant difference was found in body fat percentage, with Inter-College players showing a higher mean value (16.05 ± 5.15%) compared to

National players (12.27 ± 2.20%) (t = 3.75, df = 42, p < 0.001).

Significant differences were also observed in all measured skinfold variables. Inter-College players exhibited higher mean values than National players for biceps skinfold (6.03 ± 1.01 mm vs. 4.94 ± 0.69 mm; t = 4.99, df = 54, p < 0.001), triceps skinfold (8.22 ± 1.12 mm vs. 6.10 ± 0.75 mm; t = 8.60, df = 53, p < 0.001), subscapular skinfold (9.94 ± 1.60 mm vs. 7.97 ± 1.08 mm; t = 5.61, df = 52, p < 0.001) and suprailiac skinfold (10.37 ± 0.95 mm vs. 7.38 ± 0.80 mm; t = 13.15, df = 59, p < 0.001).

Similarly, significant differences were found for the mid-thigh skinfold (10.71 ± 1.99 mm vs. 7.31 ± 1.11 mm; t = 8.32, df = 48, p < 0.001) and the calf skinfold

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(7.32 ± 0.83 mm vs. 5.21 ± 0.75 mm; t = 10.29, df = 60, p < 0.001), with higher values again recorded for Inter-College players.

Overall, the results show that while general body size measures did not differ significantly between the two groups, significant differences were present in body fat percentage and all skinfold thickness measures.

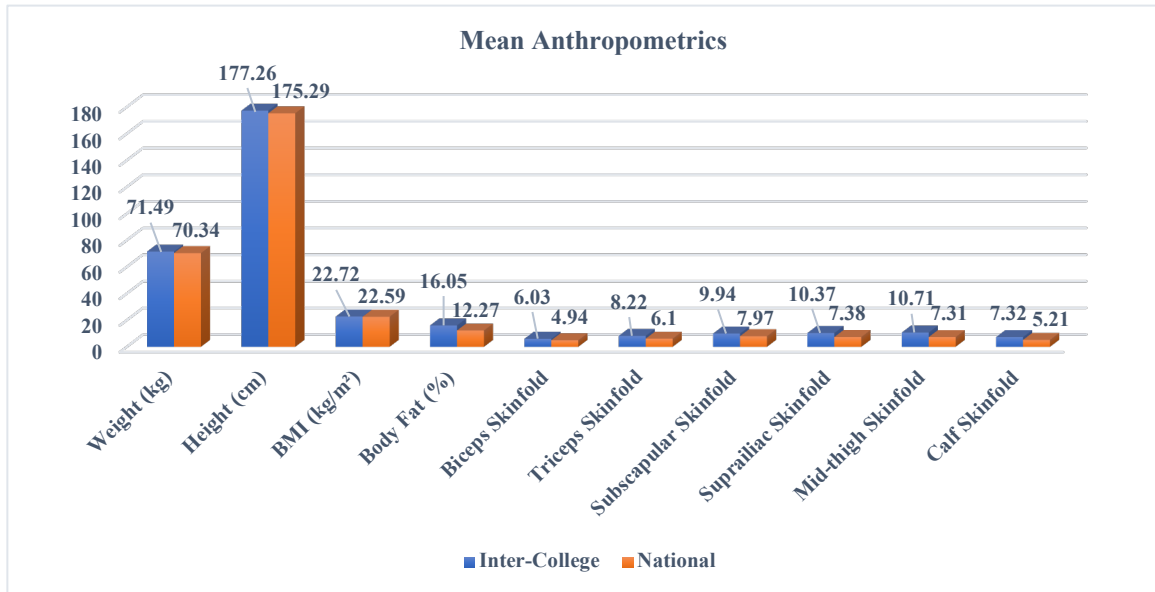


Fig. 1. Anthropometric Profiles of Punjab Male Taekwondo Players Across Competitive Level

Table 2. Trend of Selected Anthropometric Variables of Punjab Male Taekwondo Players Across Competitive Levels

| Variable                  | Inter-College (n-32) Mean±SD | National (n-32) Mean±SD | Trend Direction          |
|---------------------------|------------------------------|-------------------------|--------------------------|
| Weight (kg)               | 71.49±13.63                  | 70.34±12.71             | Stable (→)               |
| Height (cm)               | 177.26±6.89                  | 175.29±5.39             | Stable (→)               |
| BMI (kg/m <sup>2</sup> )  | 22.72±4.17                   | 22.59±2.93              | Stable (→)               |
| Body Fat (%)              | 16.05±5.15                   | 12.27±2.20              | Progressive decrease (↓) |
| Biceps Skinfold (mm)      | 6.03±1.01                    | 4.94±.069               | Progressive decrease (↓) |
| Triceps Skinfold (mm)     | 8.22±1.12                    | 6.10±0.75               | Progressive decrease (↓) |
| Subscapular Skinfold (mm) | 9.94±1.60                    | 7.97±1.08               | Progressive decrease (↓) |
| Suprailiac Skinfold (mm)  | 10.37±0.95                   | 7.38±0.80               | Progressive decrease (↓) |
| Mid-thigh Skinfold (mm)   | 10.71±1.99                   | 7.31±1.11               | Progressive decrease (↓) |
| Calf Skinfold (mm)        | 7.32±0.83                    | 5.21±0.75               | Progressive decrease (↓) |

Table 2 presents the mean values and trend directions of selected anthropometric and body composition variables of Punjab male Taekwondo players across Inter-College and National competitive levels.

The variables **weight**, **height** and **body mass index** showed stable trends across competitive levels, with minimal differences in mean values between Inter-College and National players.

In contrast, **body fat percentage** demonstrated a progressive decreasing trend from Inter-College to National level.

All measured **skinfold thickness variables**, including biceps, triceps, subscapular, suprailiac, mid-thigh and calf, also exhibited progressive decreases with increasing competitive level.

Overall, the trend analysis indicates stability in general body size variables and a consistent reduction in body

fat and subcutaneous fat thickness across higher levels of participation.

**Discussion**

The present study provides clear evidence that differences between Inter-College and National level male Taekwondo players from Punjab are primarily related to body composition rather than overall body size. While general anthropometric measures such as height, body weight and body mass index remained similar across competitive levels, consistent and meaningful differences were observed in body fat percentage and skinfold thickness.

The most important finding of this study is the systematic reduction in body fat percentage and subcutaneous fat thickness with increasing competitive level. This pattern highlights body composition as a key distinguishing feature between sub-elite and elite

Taekwondo players within the same regional and cultural context. The uniform decrease across all skinfold sites suggests that the observed differences are not localized to a specific body region but reflect an overall change in fat distribution.

Another important contribution of this study is the identification of a clear trend of decreasing adiposity with higher participation level, while body size remains stable. This trend-based evidence strengthens the interpretation that physical development in Taekwondo progression is characterized more by qualitative changes in body composition than by quantitative changes in body dimensions.

By focusing on male Taekwondo players from Punjab, this study adds region-specific empirical data that were previously limited. The findings therefore extend existing knowledge by demonstrating that within a relatively homogeneous athletic population, competitive advancement is associated with leaner body composition rather than differences in stature or mass.

### Conclusions

This study concludes that body composition variables, particularly body fat percentage and skinfold thickness, are significantly associated with competitive level in male Taekwondo players from Punjab, whereas general anthropometric measures such as height, weight and BMI are not.

The consistent decrease in body fat and subcutaneous fat across higher levels of participation indicates that leanness is a defining characteristic of National level performance in this sport. Therefore, monitoring and managing body composition should be considered an integral part of athlete development, training evaluation, and talent progression in Taekwondo.

These findings provide practical value for coaches and sports scientists by highlighting which physical attributes are most relevant for competitive advancement. The study also establishes a useful baseline for future research and encourages further investigation into how training, nutrition, and performance interact to influence body composition in combat sport athletes.

Overall, the study contributes to a more precise understanding of the physical profiles associated with higher-level Taekwondo performance and supports a shift in focus from general body size toward targeted body composition assessment in athlete evaluation.

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