RESEARCH ARTICLE

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Somatotype Characteristics of U-17 Badminton Players of Tripura

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Abstract: Individual characteristics and physical composition are important determinants of physical attributes such as speed, endurance, agility, and power in badminton. The aim of the study is to investigate the somatotype characteristics of U-17 badminton players in the state of Tripura. A cross-sectional study was conducted on 40 male players (aged 8.9–16.7 years) from the Netaji Subhas Regional Coaching Centre, Agartala, including state, national, and club badminton players. Anthropometric data were taken and somatotypes were calculated based on the Heath–Carter method. Result indicates that national players are statistically significantly older and taller among the rest of their peers ($p<0.01$). Within the club category, players were assigned a mesomorphic endomorph profile (6.2–4.0–3.0), state players an ectomorphic endomorph profile (4.7–2.9–3.4), and national players endomorphic–ectomorph profile (3.4–2.9–3.8). There were statistically significant differences in endomorphy with national players exhibiting advanced traits as opposed to club players ($p<0.01$). The higher Mesomorphy observed in club players was probably attributed to natural growth rather than functional adaptation. The group averages for ectomorphy did not differ significantly, although national players exhibited slightly higher linearity. The somatochart demonstrated a shift progressively from endomorphic to balance meso-ectomorphic at the higher levels of play. For optimal badminton performance, youth players in Tripura seem to be taller, have lesser endomorphy, and possess meso-ectomorphic physique greater balance. As the study and data sets suggest, more structured training and nutrition to control fat levels and help international participation would be of regional significance for talent identification.

Keywords: Anthropometry, Somatotype, Badminton, U-17, Body composition

1. Introduction

Badminton is a rapidly played racket sport that requires an individual to be highly skilled in physical fitness and efficient in various physiological components. Out of all sports, badminton is arguably the most popular sport in the world, with an estimated 700 million followers, 300 million playing actively, and third in the world after football and basketball. The game is played with a great deal of explosive nature, which requires the player to engage in sprinting, agility, and explosive power. In the sport of badminton, a player must have aerobic endurance as a single match can take 40-50 minutes and have long sustained rallies. On the other hand, anaerobic power is needed to smash the birdie, as well as perform rapid directional changes and quick movements on the court (Phomsoupha and Laffaye, 2015). The combined physical and physiological demands of the sport require comprehensive skill work and the right body composition to function optimally.

In badminton, certain aspects of an individual's physical makeup, such as height, limb length, body composition, and body composition (somatotype), affect performance potential (Campos *et al.,* 2009; Afsal *et al.,* 2025). Anthropometric traits, particularly height, body mass, and limb length, play an important role in an athlete's ability to tolerate and sustain training loads. The integration of individualized anthropometric assessments into load monitoring supports evidence-based training strategies that can enhance performance while reducing the risk of injury in youth badminton players (Germic *et al., 2*025). Players of greater stature and longer arms can reach more and thus can perform offensive and defensive strokes more effectively. Moreover, athletes with lower body fat and more lean muscle mass can perform

more high-intensity movements, lessening fatigue during vital rallies and moving more quickly. The need for more anthropometric information for profiling is critical is for talent identification, designing appropriate training and nutrition, injury risk, and advancement in development in the various stages of training (Raschka and Schmidt, 2013, Angga, 2019).

Research in various populations shows similar findings in anthropometric characteristics and the ability to play badminton. Raschka and Schmidt (2013) reported that males players in the sample tend to be taller and have longer limbs, this gives an advantage to males with greater reach of court coverage and is a potential advantage for playing. The body composition (somatotype) of male players is typically described as mesomorphic–ectomorphic, combining muscularity and leanness, while female players tend toward meso-ectomorphic profiles.

According to findings of *Israj et al., (2025)* flexibility and agility are foremost determinants of badminton performance. Speed and agility are primarily associated with ectomorphic body types, while mesomorphic body types are linked to muscular strength and power, and endomorphic body types to higher aerobic capacity (Rithika et al., 2025). The interplay of these components determines physical efficiency as it relates to badminton players.

For junior players in South Kalimantan, Angga (2019) found evidence of a gap in training and physical readiness, as lower scores were noted for the region's international counterparts in both motor performance and anthropometric measures. Similarly, Kavanashri *et al.* (2023) found Indian players to have a modest height compare to international players. Hussain (2013) examined adolescent male badminton players from Kerala and reported that they predominantly exhibited a balanced mesomorphic body type. These findings indicate morphological characteristics might be an important marker to understand performance disparity at international competitions. These results highlight the need for regional anthropometric assessments to better inform training, nutrition, and conditioning regimens suited to specific populations. Studies beyond national and international metrics also remain scarce in Indian regional populations, particularly the north-eastern states. Till date no systematic investigation has been conducted to evaluate the anthropometric characteristics of under-17 badminton players in Tripura. This absence of regionally specific information inhibits the formulation of sports training tailored to the athletes' physiology for coaches and sports specialists in the area.

From this point of view, there is a gap of understanding about anthropometric characteristics of under-17 badminton players in Tripura. Hence, this current study attempts to assess the anthropometric parameters, body composition, and somatotype of under-17 badminton players in Tripura. This research seeks to document these characteristics to pursue scientific talent identification, improve performance, and strengthen player badminton infrastructure in the region.

2. Materials and Methods

2.1 Research design

To assess the body composition, anthropometric characteristics, and somatotype of the under-17 participants of badminton from Tripura, a cross-sectional descriptive research design was considered for this study. One of the objectives was to put together a regional profile for the consideration of talent identification and developing performances for young athletes, which could then be matched with national and international benchmarks.

2.2 Participants

At the Netaji Subhas Regional Coaching Centre, Agartala, 40 male badminton players (aged 8.9-16.7 years) volunteered for this study, with participants distributed into club (n=13), state (n=17), and national (n=6) competitive categories. Participants for the study were competitors of club (within district), state (within Tripura) and national (represent Tripura) level tournaments in several age-groups. All participants trained for four sessions per week, with each session lasting approximately 2.5 to 3 hours. However, the intensity, volume, and overall training structure varied according to their competitive level. For this study, the players were required to meet the following conditions; (i) under 17 years of age, (ii) actively training and competing for a minimum of one year, and (iii) not injured during the time of data collection. Ethical research involving minors was followed. Because of this, written informed consent was taken from the parent/guardian. However, four volunteers had to be excluded from the study because of improperly completed data and consent forms.

2.3 Anthropometric measurements

All anthropometric data were collected by a level one anthropometrist following the standardized protocols of the International Society for the Advancement of Kinanthropometry (ISAK). Measurements were recorded to the nearest 0.1 cm for lengths and girths, 0.1 mm for skinfolds, and 0.1 kg for body mass.

2.4 Measuring procedures

Basic characteristics of the subjects were recorded (age in years, body mass in kilograms, and height in centimeters). Skinfold thickness in millimeters was recorded at the five sites of the biceps, triceps, subscapular, supraspinale, and medial calf. Breadths were recorded in centimeters at the bi-epicondylar humerus and bi-epicondylar femur. Girths included in the measurements were the arm girth (flexed) and calf girth. Each measurement was made a second time, and an additional measurement was made in the cases where the difference exceeded 0.5 cm for lengths and girths or 0.1 mm for skinfolds. For median value, accuracy and reliability were used for analysis.

Individual body composition analysis was performed using standard anthropometric equations. The Heath-Carter method which incorporates skinfolds, breadths, girths, height, and body mass was used to calculate endomorphy (relative fatness), mesomorphy (musculoskeletal robustness), ectomorphy (linearity relative to mass). With these values, the somatotype components were calculated and somatocharts were constructed to show the distribution of athletes at different competitive levels (Carter, 2002).

2.5 Statistical analysis

The collected data was organized and analyzed on Microsoft Excel 2021 and the free statistical software Jamovi (version 2.6.19). According to distribution pattern descriptive (mean ± standard deviation) and inferential statistics (one-way ANOVA followed by Tukey post-hoc test) were conducted to describe and assess the statistical significance. One-way ANOVA was used because purpose of the study was to compare the differences in anthropometric and somatotype variables across these competitive levels, which is suitable for identifying significant differences among more than two groups while maintaining control over the Type I error rate. A p-value of 0.05 was used to assess statistical significance.

3. Results

The above note table (table 1) expresses the comparison of anthropometric characteristics across different levels of participation. National-level players were found to be significantly older than the club and state level players. Similarly, they were also considerably taller, showing a clear physical advantage associated with higher levels of play. Although, no meaningful differences were observed in body mass and body mass index across the groups.

The figure 1 illustrates that club-level players were predominantly clustered toward the endomorphic side, indicating higher body fat and less lean composition. State-level players were more dispersed toward the mesomorphic–ectomorphic axis, reflecting leaner and more athletic body types with lower fat accumulation. National-level players were positioned centrally with balanced mesomorphic and ectomorphic tendencies, showing an optimal physique.

The table 2 express that club level players of the study were mesomorphic endomorph (6.2-4.0-3.0), National level players were endomorphic-ectomorph (3.4-2.9-3.8) and state level players found to be ectomorphic endomorph (4.7-2.9-3.4).

Table 1. Comparison of Anthropometric Characteristics among the groups

Parameters	Club	National	State	p
Age (y)	11.6±1.53	15.0±2.24$^{a\wedge}$	12.3±1.99$^{b\#}$	0.003
Body Mass (kg)	42.5±8.99	50.9±9.46	45.0±10.2	0.232
Height (cm)	147.6±6.01	163.1±9.47$^{a\#}$	153.6±9.13^{b*}	0.002
BMI (kg/m2)	19.6±4.76	19.0±1.92	19.0±3.49	0.883

Note. * p < .05, # p < .01, ^ p < .001; a= compared to club level, b= compered to National level

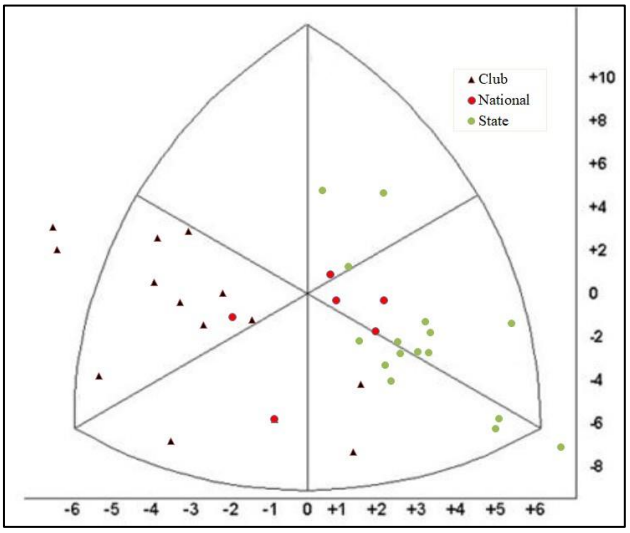

Figure 1. Somatotype characteristics of the group volunteers

Table 2. Comparison of Somatotype Components and Body Fat Percentage among the groups

Parameters	Club	National	State	p
Endomorphy	6.15±1.30	3.41±1.70$^{a\wedge}$	4.74±1.73$^{a\#}$	0.004
Mesomorphy	4.02±1.21	2.9±0.41^{a*}	2.91±1.25^{a*}	0.031
Ectomorphy	2.96±2.06	3.82±1.03	3.4±2.14	0.664
Body fat (%)	22.28±3.58	14.83±5.10$^{a\#}$	18.59±5.02	0.007

Note. * p < .05, # p < .01, ^ p < .001; a= compared to club, b= compered to National level

A significant difference was observed in endomorphy and mesomorphy components, indicating that higher-level players tend to have leaner body profiles with lower fat accumulation. National players exhibited significantly lower endomorphy and body fat percentage compared to club players, suggesting superior body composition and reduced adiposity at the elite level. Mesomorphy values were also lower among national and state players compared to club players, might be sign of over or excessive training. However, ectomorphy did not show a statistically significant variation across groups, indicating that linearity remained relatively consistent.

4. Discussions

The study conducted among Tripura's U-17 badminton players at different levels, revealed notable differences in physical and performance development that align with biological maturation and the nature of the sport. Improvements in body profiles and somatotypes indicate positive physical adaptations associated with the level of competition. The older players at the national level, compared to those at the club and state levels, reflect the outcomes of growth and several years of structured training. These players generally exhibit better neuromuscular coordination, refined motor control, and superior tactical understanding, all of which contribute to enhanced performance (Phomsoupha and Laffaye, 2015). This pattern corresponds with national selection standards in racquet sports, where physical maturity is a key factor for advancement to higher levels of competition.

Height also emerged as a distinguishing feature, with national-level players being significantly taller than their counterparts at the club and state levels. Greater height in badminton provides biomechanical advantages, including more effective execution of overhead strokes, wider court coverage, and steeper attacking trajectories (Angga, 2019). Similar patterns have been observed among Indian players, who are often found to be shorter than international athletes, suggesting that height plays an important role in achieving success at the global level (Kavanashri *et al.*, 2023). However, Campos *et al.* (2009) noted that variations in body mass and BMI were not statistically significant among individuals engaged in badminton, indicating that qualitative body composition may play a more vital role than overall body size.

There was clear differentiation in somatotype across competition levels. The players at the club level were classified as mesomorphic endomorphs (6.2–4.0–3.0) were noted to possess more body fat and moderation in muscle. This corresponds with their early stage of development, where players may not yet benefit from rigorous training and nutrition control (Hussain, 2013). The players at the National level were described as an endomorphic–ectomorph (3.4–2.9–3.8), suggesting an increase in body leanness as well as linearity more fitting to the demands of agility, speed, and endurance. In comparison to the club and national level players, the state level players were described as ectomorphic endomorph (4.7–2.9–3.4) indicating an intermediate status. These shifts in somatotype reflect the refinement of physique through training and competition. The higher mesomorphy observed in club-level players can be attributed to natural growth and biological maturation rather than sport-specific muscular adaptation. During early adolescence, increases in muscle mass often occur independent of structured training, whereas players at higher competitive levels tend to develop leaner and more functionally optimized physiques through specialized training.

Prior studies have substantiated the tendency for elite badminton players to exhibit meso-ectomorphic or ecto-mesomorphic traits. Rithika Shree and colleagues (2025) noted that morphosocial traits also pertain to individual physical qualities and characteristics needed to perform badminton. In the same regard, Kumer and Vincent (2020) reported that the male badminton players are usually in the endomorph-mesomorph spectrum, while the females are in the endomorph-ectomorph spectrum, having body fat distribution that will affect the performance potential.

The players from the club attained the largest part of the endomorph body type and also the largest percentage of fat, both of which are associated with inefficient movement, decreased agility, and poor endurance (Paswan, 2020). The available body type and fat percentage of players from the national levels are in the necessary lower end of the spectrum, emphasizing the need of leanness in the upper levels performance in the same literature. Lieshout & Rooyen (2004) also reported the same with South African juniors, where to improve the competitive readiness, the focus should be on improving aerobic power in addition to losing body fat and also as of greater importance (14). The state-level players have intermediate parts of the body composition which indicates the fat in the body which in other literature suggested stated of structured training directly associated with leading efforts in fat loss, while without advancing the necessary performance body composition that is seen from players at the national level. The findings of the study when compared with South African junior badminton players, the players of U-17 Tripura showed a higher body fat percentage and shorter stature than their South Australian counterparts. At the same time, they were found to be taller and heavier than Indonesian youth badminton players (van Lieshout and Lombard, 2004; Rahmawati *et al.*, 2007).

In regard to the expectation, the players from the club had the greatest measurements in mesomorphy as opposed to players from the state and national levels. It is possible that growing and developing players will possess more massive muscle structure even if there is not a sport-related functional adaptation. As a player improves and attains higher levels, the relative mesomorphy will reduce since the musculature will be optimized for more agility, explosive power, and endurance as opposed to sheer hypertrophy. This aligns with the results of Raschka and Schmidt (2013), who described badminton players as having more robust builds, yet unlike tennis players, their musculature was considerably leaner, suggesting that functional rather than muscle bulk is more beneficial. There were no significant differences in ectomorphy values in the different groups which suggest the skeletal linearity does not change with the level of competition. However, national players did have a slightly higher ectomorphy value which suggests leanness. This coincides with the international literature stating that badminton players described as tall and lean with ecto-mesomorphic profiles (Phomsoupha and Laffaye, 2015). This type of physique affords rapid changes of direction, efficient energy use, and high-intensity intermittent movements.

The results also align with the distribution of somatochart. Club level players were found in the endomorphic area which suggests that they have increased fat accumulation. State level players had more dispersion and were found in the mesomorphic-ectomorphic region suggesting a transitional stage with body composition that is more improved.

National-level players positioned themselves at the center as they showed balanced mesomorphic-ectomorphic tendencies with lesser endomorphy,

indicating an ideal body type for badminton. Similarly, Yasin *et al.* (2010) reported badminton players with wider hips and calves because of the repeated jump and rapid multidirectional movements, characteristics that are adapted for greater performance efficiency in the sport with lean somatotypes . Somatotype changes across the levels in the sport have practical implications (Rithika *et al.,* 2025). It is essential that youth training in Tripura focuses on reducing endomorphy while keeping mesomorphic and ectomorphic traits in balance. To achieve international standards, young players should have their nutrition and conditioning plans and body compositions set and monitored.

5. Conclusion

The anthropometric and somatotype characterizations of U-17 badminton players in Tripura show the progressive physical changes that develop with improved competitive level. The national-level players' advantages in height, age, somatotype, and body composition set them apart from players in clubs and state badminton, proving the impact of training, physiological maturity, and an appropriately structured physique. Athletic performance at this level is governed by the physical attributes of height and leanness owing to the demands of the sport on reach, movement agility, and efficiency. Observing the shifts in somatotype from mesomorphic-endomorphic tendencies in the club level, to now, endomorphic–ectomorphic in the national level shows the changes in more performance based physiques, in which a reduction in endomorphy and lower body fat % assist with speed, endurance and agility. The higher mesomorphy in club level players is probably a result of natural growth as opposed to sport-specific muscularity. Athletes at the national level, in contrast, displayed more balanced meso-ectomorphic builds which are suited for explosive power as well as the ability to make rapid directional changes, and without excessive bulk. State-level players, who are occupying an intermediate stage, are a reflection of the developmental role structured training assists in bridging the recreational and elite performance gaps through improvements in conditioning, nutrition and technical refinement which are interwoven.

References

Afzal, S., Raj, N. B., Musa, R. M., Rahim, M. B., & Khan, M. I. (2025). Multivariate analysis of anthropometric determinants of training load in youth badminton. *Retos*, 71, 988-997. [DOI]

Angga, P. D. (2019, February). Anthropometric and motor performance of junior badminton athlete. In *2nd International Conference on Sports Sciences and Health 2018 (2nd ICSSH 2018)* , *Atlantis Press.*

Campos, F.A.D., Daros, L.B., Mastrascusa, V., Dourado, A.C., Stanganelli, L.C.R. (2009) Anthropometric profile and motor performance of junior badminton players. *Brazilian journal of biomotricity,* 3(2), 146-151.

Carter J.E.L. (2002) Part 1: The Heath-Carter anthropometric somatotype-instruction manual. *Surrey,* Canada.

Germic, A., Filipcic, T., Filipcic, A. (2025). Anthropometric Characteristics and Somatotype of Young Slovenian Tennis Players. *Applied Sciences*, 15(15), 8584. [DOI]

Hussain, S. (2013). Somatotype and body composition of adolescent badminton players in Kerala. *International Journal of Advanced Scientific and Technical Research*, 6(3), 105-111.

Israj M.F.M., Ibrahim N.S, Madarsa N.I., Kassim M., Latif R.A., Maliki A.B.H.M. (2025) A Multivariate Recognition Profiling and Classifying for Youth Elite Badminton Players Based on Anthropometric and Fitness Indicators. *Research Square.* [DOI]

Kavanashri, N.M., Cherian, K.S., Ghosh, S., Yagnambhat, V.R. (2023). Anthropometry and Physical Characteristics of Indian Badminton Players. *International Journal of Kinanthropometry*, 3(2), 78-83. [DOI]

Kumar, M.S., Vincent, T.V. (2020). Physical Characteristics and Somato Type of Trained Badminton Players. Indian Journal of Public Health Research & Development, 11(2), 263. [DOI]

Lieshout, K.A.V., Van Rooyen, J.H. (2004). Fitness profile of elite junior South African badminton players. *South African Journal for Research in Sport, Physical Education and Recreation*, 26(1), 59–72.

Paswan, D. (2020) An analysis of selected kinanthropometric variables between badminton and tennis players: A detailed comparative approach. *International Journal of Physical Education, Sports and Health,* 7(4), 211-213.

Phomsoupha, M., Laffaye, G. (2015). The science of badminton: game characteristics, anthropometry, physiology, visual fitness and biomechanics. *Sports medicine*, 45(4), 473-495. [DOI] [PubMed]

Rahmawati, N.T., Budiharjo, S., Ashizawa, K. (2007) Somatotypes of young male athletes and non-athlete students in Yogyakarta, Indonesia. *Anthropological Science,* 115(1), 1-7. [DOI]

Raschka, C., Schmidt, K. (2013). Sports anthropological and somatotypical comparison

between higher class male and female badminton and tennis players. *Papers on Anthropology*, 22, 153-161. [DOI]

Rithika, J.S., Jothilingam, M., Dhanusia S., ,Raziya Mehar S., ,Sameena S.,, Jilna James R., Bharathi Krishnan S. (2025). Kinanthropometric Profile of Women Badminton Players. *International Journal of Scientific Research in Engineering and Management*, 9(4), 1–9. [DOI]

Van Lieshout, K.A., Lombard, A.J. (2004). Fitness profile of elite junior South African badminton players. *African Journal for Physical Activity and Health Sciences*, 9(3), 114–120. [DOI]

Yasin, A., Omer, S., Ibrahim, Y., Akif, B. M., & Cengiz. (2010). *Comparison of some anthropometric characteristics of elite badminton and tennis players.* Science of Movement and Health, 2, 400S–405S.

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Ethics approval statement
The study protocol was reviewed and approved by the Institutional Ethics Committee of The ICFAI University, Tripura.

Additional materials
All raw data, somatotype calculations, and anthropometric records supporting the findings of this study are available from the corresponding author upon reasonable request.

Author's contribution & statement:
Anmol Saha: Conceptualization, data collection, writing the original manuscript. Madhab Chandra Ghosh: Conceptualization, statistical analysis, writing, review and editing. Subhashis Biswas: Conceptualization, statistical analysis, writing, review and editing. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work, ensuring its accuracy and integrity.

Does this article pass screening for similarity?
Yes

Informed Consent
The consent form was signed by the participants before the commencement of the study.

Conflict of Interest
The authors declare that there was no conflict of interest.