Indian Journal of Modern Research and Reviews

This Journal is a member of the *'Committee on Publication Ethics'*

Online ISSN:2584-184X

Research Paper

Age-Related Changes in Somtotype Among Bengali Boys in Tripura

Dr. Sandeep Roy Sarkar

Asst. Professor of Human Physiology Holy Cross College, Agartala, Tripura, India

Corresponding Author: *Dr. Sandeep Roy Sarkar

DOI: https://doi.org/10.5281/zenodo.15390249

ABSTRACT

A cross-sectional study employing multistage cluster sampling was conducted on 558 Bengali schoolboys (aged 8 to 16 years) from rural Tripura to analyze how their somatotypes change during adolescence. Using the Heath-Carter method based on ten anthropometric measurements, the Bengali boys' body physiques were assessed and plotted on a somatotype chart. The findings indicated a slight overall increase in endomorph (0.1 units) and ectomorph (0.5 units), coupled with a minor decrease in mesomorph (0.4 units) over the nine years. The dominant physique shifted from mesomorph-ectomorph in younger boys (8 to 12 years) to mesomorphic-ectomorph in older adolescents (13 years onwards). While mesomorph generally declined with age, endomorph increased until age 11 and ectomorph until age 13, after which these trends showed some reversal. The average somatotype of these boys was mesomorph-ectomorph (2.09-3.78-4.33), suggesting a predominantly ectomorphic build. As compared to other populations of India, the Bengali boys are less endomorphic and more mesomorphic.

Manuscript Info.

✓ **ISSN No:** 2584- 184X
✓ **Received:** 29-03-2025
✓ **Accepted:** 17-04-2025
✓ **Published:** 12-05-2025
✓ **MRR:3(5):**2025;17-22

✓ **Peer Review Process:** Yes
✓ **Plagiarism Checked:** Yes

How To Cite

Sarkar SR. Age-Related Changes in Somtotype Among Bengali Boys in Tripura. *Indian J Mod Res Rev.* 2025;3(5):17–22.

KEYWORDS: Bengali boys, Ectomorphic, Heath Carter's method, Somatotype, Tripura.

1. INTRODUCTION

The study of human physique, or somatotype, provides a valuable framework for understanding the morphological characteristics of different populations and how these characteristics evolve during growth and development [1]. Somatotyping, a quantitative method pioneered by Sheldon and later refined by Heath and Carter, classifies individuals based on three fundamental components: endomorph (relative fatness), mesomorph (relative musculoskeletal development), and ectomorph (relative linearity) [2]. These components offer a holistic view of body composition and shape, reflecting the interplay of genetic predispositions, environmental factors, and developmental processes [3].

Adolescence, a period of rapid and significant biological changes, is marked by substantial alterations in body size, shape, and composition. These transformations are influenced by hormonal fluctuations, growth spurts, and varying levels of physical activity and nutritional intake [4]. Understanding the trajectory of somatotype during this critical developmental window is crucial for establishing normative data, identifying potential deviations, and providing insights into the health and physical capabilities of adolescents [5].

Regional and ethnic variations in body physique during adolescence have been documented across the globe, highlighting the influence of genetic background and socio-environmental factors. Studies examining the somatotypes of adolescent populations in different parts of India have revealed diverse patterns, reflecting the country's rich anthropological and geographical diversity. However, specific data on the somatotype characteristics and their age-related changes among adolescent boys in the northeastern state of Tripura remain relatively limited.

Tripura, a state with a distinct socio-cultural and ethnic composition, is home to a significant Bengali population [6,7]. Understanding the anthropometric profile, particularly the somatotype, of adolescent boys within this community is essential for establishing population-specific reference data. Such data can be valuable for health assessments, nutritional interventions, and comparisons with other regional and national groups. Investigating how somatotype evolves with age within this population can also shed light on the typical growth patterns and potential influences of their specific environment and lifestyle [8-11].

Therefore, this study aims to investigate the age-related changes in anthropometric somatotypes among a sample of Bengali adolescent boys from rural Tripura, India. By employing the Heath-Carter method, this research will provide a detailed analysis of the three somatotype components across different age groups within adolescence. The findings will contribute to a better understanding of the physical development of this specific population and establish baseline data for future studies. Ultimately, this research seeks to enhance our knowledge of human growth variation within the diverse Indian context.

2. MATERIALS AND METHODS

To collect various anthropometric measurements, a cross-sectional sample of five hundred and fifty-eight (558) Bengali boys between the ages of 8 and 16 was carefully chosen. Data were collected from Government schools placed in 30 villages, covering six districts of Tripura. The sampling strategy applied here was the multistage cluster sampling method. The date of birth of the subjects was taken from the school registers and confirmed by the subjects. In case of an anomaly, the subject was requested to get the date confirmed by his parents. Age was recorded in complete years [12].

Before commencing the study, the required permission from the school administration was secured. The procedures followed were by the ethical standards of the responsible committee on human experimentation (Institutional) and the Helsinki Declaration of 1964, as revised in 2000 [13]. This study attained consent from every member. Parents filled out a questionnaire to determine socioeconomic status based on their education, occupation, income, family size, additional income sources, healthcare quality, and access to medical services. Information regarding dietary patterns and physical activities performed by the students was also collected.

In accordance with the aims and objectives of the study, ten body measurements were taken following the internationally accepted standards [14]. Standing height, weight, bicondylar humerus and femur breadths, flexed upper arm and calf girths, and skinfolds at triceps, subscapular, suprailia, medial calf sites were obtained for each subject. Using a GPM Swiss-made anthropometer, barefoot height to the closest millimeter was measured. Body weight, with subjects wearing minimal clothing, was recorded to the nearest 0.5 kg using a Libra weighing scale, and skinfolds were measured in triplicate using a Holtan skinfold calliper (UK-made) having a constant pressure of 10 g/mm2 to the nearest 0.1 mm on the left side of the body. Bone diameters were recorded to the nearest 1 mm after measuring in duplicate with a sliding calliper. Upper arm fully flexed girth was measured in duplicate to the nearest 1 mm with a flexible steel tape, while the calf girth was measured in duplicate at the extreme circumference while the subject sat with his feet on the floor and relaxed calf. All the measurements were taken in well-lit and well-ventilated rooms within the school during regular school hours by the author. The technical error of measurement (TEM) for intra-observer measurements was calculated and was found below the maximum acceptable TEM reference values [15].

Anthropometric somatotyping was done with the help of all the measured anthropometric variables using Heath and Carter's anthropometric somatotype method (Heath and Carter, 1967). Descriptive statistics were computed for somatotype components, height, weight, and height-weight ratio (height/3√weight), and the Somatotype Attitudinal Distance (SAD).

3. RESULTS

All the rural Bengali boys fell under the upper-lower to lower-middle socioeconomic class as determined by Kuppuswamy's socioeconomic scale [16]. An analysis of somatotype variables across different ages revealed that endomorph, mesomorph, and ectomorph ratings evolve with age in Bengali boys from Tripura between the ages of 8 and 16. (Table 1). The mean somatotypes were found to be 1.94-4.0-3.94 and 2.01-3.64-4.47 at ages 8 and 16 years, respectively. Over these eight years, endomorph showed a slight overall increase of 0.1 units, while ectomorph increased by 0.53 units. In contrast, mesomorphs exhibited an overall decrease of 0.36 units. The mean height-weight ratio (HWR) shows an irregular pattern and, by and large, shows a general increasing trend from 44.42 at 8 years to 45.15 at 16 years. The distance between any two somatopoints is called the somatotype attitudinal distance (SAD), showing an increasing trend from 1.14 at 8 years to 1.55 at 16 years.

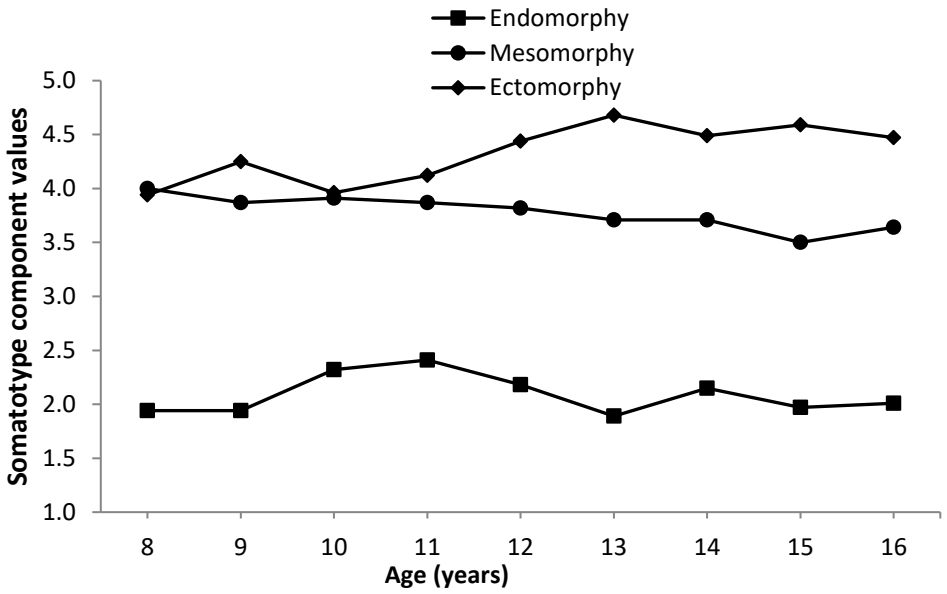

Figure 1: Mean somatotype components of Bengali boys of Tripura

Mean stomatopods of various age groups of Bengali boys of Tripura are shown in Figure 1 on a two-dimensional somatochart. The mean mesomorph decreased with age. Average endomorph gradually rose until the age of 11, after which this trend showed a slight reversal. An increase up to the age of 13 years was observed in the mean ectomorph, and then the trend was reversed. Among the Bengali boys, the maximum and minimum mean values of endomorphic components have been seen at 11 years (2.41) and 8 and 9 years (1.94), respectively. The highest average mesomorph rating, 4.0, was observed at age 8, while the lowest, 3.50, occurred at age 15. The Bengali boys have shown ectomorphic values ranging from 3.94 to 4.68, represented by the age of 8 years (the minimum) and 13 years (the maximum), respectively. It was noticed that the somatoplots of mean somatotypes fell in the mesomorph-ectomorph region at age 8 to 12 years, and from 13 years onwards, the somatoplots were distributed in the mesomorphic ectomorph region of the somatochart (Figure 2). The average somatotype for Bengali boys was 2.09-3.78-4.33 and fell in the mesomorph-ectomorph region of the somatochart. Most of the somatotype classifications on the somatochart fall into the area where ectomorphy is the most prominent component, indicating a tendency towards linearity or slenderness in their physique.

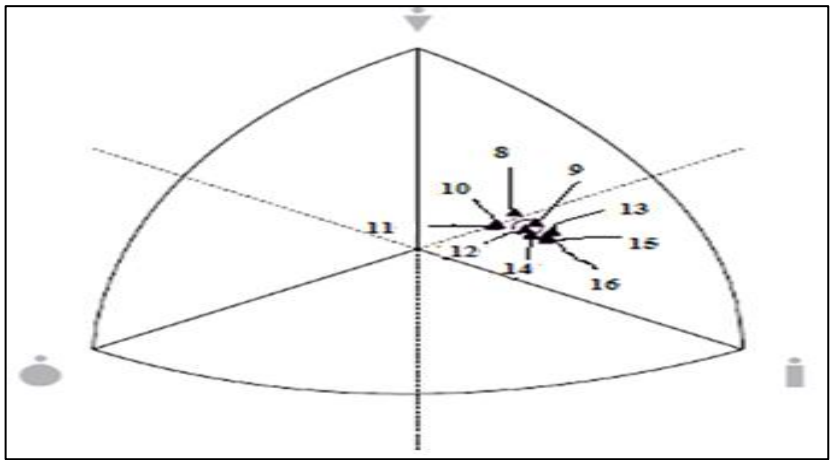

Figure 2: Somatotype distribution of the Bengali boys of Tripura, ranging in age from 8 to 16 years

In addition to gross body typing, the somatotypes were grouped according to component dominance into different somatotype categories and are presented in Table 2. Four of the somatotype categories, viz., endomorph-ectomorph, ectomorphic endomorph, balanced endomorph, and endomorphic ectomorph, have, however, been excluded from the tables due to the non-

availability of any individual belonging to these categories. Sixty-seven per cent of the Bengali boys were either mesomorph-ectomorph or mesomorphic ectomorph, but the single highest category was the mesomorphic ectomorph, in which 50.54% of the Bengali boys fell. The study identified five somatotype categories—endomorphic mesomorph, balanced mesomorph, ectomorphic mesomorph, mesomorph-ectomorph, and mesomorphic ectomorph—present across all age groups of the Bengali boys.

Table 1: Mean and standard deviation (SD) of height, weight, height-weight ratio (HWR), somatotype attitudinal distance (SAD), and somatotype variables of Bengali boys of Tripura.

Age (years)	n	Statistics	Height (cm)	Weight (kg)	HWR	Endomorph	Mesomorph	Ectomorph	SAD
8	63	Mean	125.64	22.90	44.42	1.94	4.00	3.94	1.14
		SD	5.23	3.82	1.42	0.49	0.71	1.04	0.71
9	64	Mean	128.48	23.67	44.85	1.94	3.87	4.25	1.14
		SD	4.00	2.84	1.33	0.56	0.62	0.98	0.58
10	64	Mean	132.98	27.03	44.45	2.32	3.91	3.96	1.46
		SD	4.43	3.63	1.71	1.00	0.76	1.24	0.96
11	61	Mean	137.49	29.71	44.67	2.41	3.87	4.12	1.44
		SD	7.53	6.31	1.55	0.96	0.76	1.14	0.83
12	62	Mean	144.94	33.96	45.10	2.18	3.82	4.44	1.50
		SD	8.48	8.10	1.82	1.06	0.82	1.30	1.10
13	60	Mean	149.98	36.73	45.44	1.89	3.71	4.68	1.33
		SD	8.50	8.26	1.65	0.70	0.81	1.20	0.89
14	62	Mean	157.81	43.45	45.17	2.15	3.71	4.49	1.72
		SD	8.92	8.52	1.93	1.12	0.98	1.41	1.09
15	60	Mean	161.56	46.17	45.30	1.97	3.50	4.59	1.65
		SD	7.23	8.94	2.11	0.98	0.99	1.53	1.23
16	62	Mean	163.02	47.52	45.15	2.01	3.64	4.47	1.55
		SD	5.99	6.42	1.84	0.82	0.94	1.34	0.95
Total	T=558	Mean	144.66	34.57	44.95	2.09	3.78	4.33	1.44
		SD	6.70	6.31	1.71	0.85	0.82	1.24	0.93

Table 2: Distribution of somatotype categories of the Bengali boys of Tripura.

Somatotype categories		Age (years)									
		8	9	10	11	12	13	14	15	16	8 - 16
1	F	0	0	1	0	1	0	0	0	0	2
	%	0	0	1.56	0	1.61	0	0	0	0	0.36
2	F	0	0	4	6	4	0	3	2	1	20
	%	0	0	6.25	9.84	6.45	0	4.84	3.33	1.61	3.58
3	F	4	2	4	4	3	4	6	6	3	36
	%	6.35	3.13	6.25	6.56	4.84	6.67	9.68	10	4.84	6.45
4	F	7	5	5	5	1	2	2	2	4	33
	%	11.1	7.81	7.81	8.2	1.61	3.33	3.23	3.33	6.45	5.91
5	F	12	12	9	4	7	5	3	5	7	64
	%	19.1	18.8	14.1	6.56	11.29	8.33	4.84	8.33	11.29	11.47
6	F	10	14	10	13	13	12	7	5	10	94
	%	15.9	21.9	15.6	21.31	20.97	20	11.29	8.33	16.13	16.85
7	F	30	30	27	25	30	35	36	37	32	282
	%	47.6	46.9	42.2	40.98	48.39	58.33	58.06	61.67	51.61	50.54
8	F	0	0	1	2	3	1	2	3	3	15
	%	0	0	1.56	3.28	4.84	1.67	3.23	5	4.84	2.69
9	F	0	1	3	2	0	1	3	0	2	12
	%	0	1.56	4.69	3.28	0	1.67	4.84	0	3.23	2.15
Total	F	63	64	64	61	62	60	62	60	62	558
	%	100	100	99.9	100	100	100	100	100	100	100

1= Mesomorphic endomorph, 2 = Mesomorph-endomorph, 3 = Endomorphic mesomorph, 4 = Balanced mesomorph, 5= Ectomorphic mesomorph, 6 = Mesomorph-ectomorph, 7 = Mesomorphic ectomorph, 8 = Balanced ectomorph, 9 = Central. Underlined values indicated the highest incidence of occurrence.

4. DISCUSSION

This cross-sectional study provides a comprehensive analysis of the age-related changes in somatotype among 558 Bengali adolescent boys aged 8 to 16 years from rural Tripura. The findings, derived from anthropometric measurements and the Heath-Carter method, reveal a dynamic shift in body physique during this critical developmental period, ultimately characterizing this population as predominantly ectomorphic.

The observed overall increase in ectomorph (0.5 units) across the nine years highlights a tendency towards increasing linearity and slenderness as these boys progress through adolescence. This trend aligns with the typical adolescent growth spurt, often characterized by a disproportionate increase in height relative to weight in the early stages. The concomitant slight increase in endomorphy (0.1 units) suggests a modest accumulation of relative fatness, although this increase is less pronounced than the change in linearity. Interestingly, the minor decrease in mesomorph (0.4 units) indicates a relatively slower rate of increase in musculoskeletal development compared to the other two components during this period. The trajectory of mean somatotypes on the somatochart further elucidates these developmental shifts. The transition from the mesomorph-ectomorph region in younger boys (8 to 12 years) to the mesomorphic ectomorph region in older adolescents (13 years onwards) signifies a clear shift in the dominant physique. In the early adolescent years, a balance between moderate muscularity and linearity is evident, with a slight inclination towards ectomorph. However, as the boys mature, the ectomorphic component becomes more dominant, indicating a leaner and more slender build with relatively less pronounced muscularity. The age-specific trends in the individual somatotype components offer a more nuanced understanding of these changes. The initial increase in endomorphy up to 11 years might reflect the early stages of pubertal development and associated hormonal changes influencing fat deposition. The subsequent slight reversal could be attributed to increased physical activity or changes in metabolic demands during later adolescence. Similarly, the increase in ectomorph up to 13 years likely corresponds to the peak height velocity of the adolescent growth spurt, leading to increased linearity. The subsequent plateau or slight decrease might indicate a relative increase in other body tissues as growth in height decelerates. The consistent decrease in mesomorphy with age, albeit with a slight levelling off towards the later years, suggests that the development of muscularity, while present, does not keep pace with the increase in linearity during this specific period in this population. The average somatotype of 2.09-3.78-4.33 firmly places these Bengali adolescent boys in the mesomorph-ectomorph category, with a notable emphasis on the ectomorphic component. This finding underscores the predominantly lean and slender physique characteristic of this population during adolescence. The relatively low endomorphy rating suggests that these boys, on average, do not exhibit high levels of relative fatness. The moderate mesomorphy rating indicates a degree of muscularity that is present but not the dominant feature of their body build. However, the predominantly ectomorphic profile observed in this study might reflect genetic predispositions, nutritional patterns, and physical activity levels prevalent in this specific socio-cultural and geographical context. This study's results, when looked at alongside information from other adolescent groups in India and elsewhere, highlight possible differences in how body types develop across regions and ethnicities. For instance, compared to rural tribal boys from Tripura [17], the rural Bengali boys in this study showed more endomorphy and ectomorphy but less muscularity. The Bengali boys also exhibited less endomorphy and more muscularity than students in western Maharashtra [18], urban adolescents in Howrah [19], Polish youths [20], and boys from Bulgaria and Turkey [21]. Conversely, they were endomorphic and less muscular than college students in urban Kolkata [22] and Mising boys from Assam [23]. Furthermore, the study suggests that the three aspects of body type (endomorphy, mesomorphy, and ectomorphy) do not change predictably with age; they might increase at certain ages and decrease at others. This aligns with findings from studies on Konyak Naga males in Nagaland [24], Bodhs and Baltis in Ladakh and J&K [25], and Bengali Kayastha boys born in Delhi [26]. These variations between populations could stem from differences in ethnicity, the timing of their adolescent growth spurts, their diets, and how physically active they are. The use of a multistage cluster sampling method strengthens the representativeness of the sample for rural Bengali boys in Tripura. However, the cross-sectional nature of the study limits the ability to track individual developmental trajectories. This study will contribute to the limited existing data on adolescent growth patterns in this region and provide a foundation for future research exploring the factors influencing somatotype development and for comparisons with other populations. Understanding these anthropometric characteristics is crucial for developing population-specific health and development strategies.

5. CONCLUSION

This cross-sectional study effectively described the body types based on anthropometric measurements and how these body types change with age in 558 Bengali adolescent boys, aged 8 to 16 years, from rural Tripura. Employing the Heath-Carter method on ten anthropometric measurements, the findings revealed a discernible developmental trajectory in body physique throughout adolescence. During the nine-year study, observed a small general rise in endomorphy and a more significant rise in ectomorphy, along with a minor decline in mesomorphy. The average somatotype charts showed a transition from the mesomorph-ectomorph area in younger boys (8 to 12 years old) to the mesomorphic ectomorph area in older adolescents (13 to 16 years old), indicating an increasing dominance of linearity with age. While mesomorphy generally declined, the trends for endomorphy and ectomorphy showed initial increases followed by a slight reversal in later adolescence, highlighting the complex dynamics of growth. The average somatotype of the studied population was identified as mesomorph-ectomorph (2.09-3.78-4.33), firmly establishing that Bengali adolescent boys in rural Tripura are predominantly ectomorphic in their body physique. These findings provide valuable baseline data on the physical development of this specific population, contributing to a better understanding of their anthropometric characteristics during a critical growth phase and laying the groundwork for future comparative studies with other adolescent groups.

ACKNOWLEDGEMENT

I sincerely acknowledge all participants and their parents of this study and the school authorities for their cooperation during data collection.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Carter JEL. The Heath-Carter anthropometric somatotype instruction manual. San Diego (USA): San Diego State University; 2002.
2. Heath B, Carter JEL. A modified somatotype method. Am J Phys Anthropol. 1967;27:57–74.
3. Singh SP, Singh P, Malhotra P, Sidhu LS. Somatotypes of high altitude Spitian boys. J Hum Ecol. 2007;22:129–33.
4. Widiyani T, Suryobroto B, Budiarti S, Hartana A. The growth of body size and somatotype of Javanese children age 4 to 20 years. Hayati J Biosci. 2011; 18:182–92.
5. Wardle J, Brodersen NH, Cole TJ, Jarvis MJ, Boniface DR. Development of adiposity in adolescence: five-year longitudinal study of an ethnically and socioeconomically diverse sample of young people in Britain. BMJ. 2006;332:1130–5.
6. Miller FP, Vandome AF, McBrewster J. Bengali People. Saarbrücken (Germany): Alphascript Publishing; 2010. p. 1–64.
7. Sarkar SR. Malnutrition frequency among Tripuri boys. In: Indigenous Knowledge & Practices. New Delhi: Akansha Publishing House; 2024. ISBN:978-93-48001-29-0.
8. Gakhar I, Malik SL. Age changes and sex differences in somatotypes among Jats of Delhi. Anthropologist. 2002;1:115–25.
9. Ghosh S, Malik SL. A comparative study of age changes in somatotypes of Brahmin and Rajput boys of Sundarnagar, Himachal Pradesh. Anthropologist. 2004;6:19–23.
10. Longkumer T. Physical activity and somatotype among Ao Naga boys. J Anthropol. 2014;17:669–75.
11. Sarkar SR, Sil SK. Somatotype of non-athlete tribal school boys of West Tripura District, Tripura. Biolife. 2014;2(4):1365–70.
12. Eveleth PB, Tanner JM. Worldwide variation in human growth. Cambridge: Cambridge University Press; 1990.
13. Touitou Y, Portaluppi F, Smolensky MH, Rensing L. Ethical principles and standards for the conduct of human and animal biological rhythm research. Chronobiol Int. 2004;21:161–70.
14. Lohman TG, Roche AF, Martorell R. Anthropometric standardization reference manual. Champaign (IL): Human Kinetics; 1988.
15. Ulijaszek SA, Kerr DA. Anthropometric measurement error and the assessment of nutritional status. Br J Nutr. 1999;82:165–77.
16. Kumar N, Gupta N, Kishore J. Kuppuswamy's socioeconomic scale: updating income ranges for the year 2012. Indian J Public Health. 2012;56(1):103–4.
17. Sarkar SR, Sil SK. Somatotype of non-athlete tribal school boys of West Tripura District, Tripura. Biolife. 2014;2(4):1365–70.
18. Ughade MN, Ughade JM, Kardile PB. Study of somatotypes in students of western Maharashtra population by anthropometric method. Sch J App Med Sci. 2016;4(10A):3593–6.
19. Roy S, Roy J, Ghosh JR. A study on the relationship of somatotype and anthropometric variables with blood pressure levels among urban adolescents in Howrah district, West Bengal, India. Malays J Med Res. 2023;7(4):10–20.
20. Krzykała M, Karpowicz M, Strzelczyk R, Pluta B, Podciechowska K, Karpowicz K. Morphological asymmetry, sex and dominant somatotype among Polish youth. PLoS One. 2020;15(9):1–11.
21. Baltadjiev A, Merdzhanova E, Boyadjiev N, Angelova P, Raycheva R, Lalova V, et al. Children somatotype study of different ethnic groups from Plovdiv Region, Bulgaria. J IMAB. 2024;30(1):5381–6.
22. Chakrabarti D, Kundu S, Biswas S, Adhikari A. Somatotype traits of college students of urban areas near Kolkata, West Bengal, India. Hum Biol Rev. 2020;9(4):334–43.
23. Lohe N, Nagi T, Marei N, Tsukru V. Anthropometric somatotype among the adolescent boys of a tribal population in India. Antrocom Online J Anthropol. 2021;17(2):271–80.
24. Soni S, Gautam RK. Somatotypes among Konyak Naga males aged 11–20 years: a cross-sectional study in the District Mon, Nagaland, India. Int J Kinanthrop. 2024;4(3):24–31.
25. Bhasin MK, Singh LP. A study of anthropometric somatotype in two high altitude populations – Bodhs and Baltis of Ladakh, J & K, India. J Hum Ecol. 1992;3:35–8.
26. Kumar V, Kapoor AK, Tiwari SC. Physical activity and somatotype evaluation of the Bengali Kayastha boys of Delhi. Indian J Sport Sci Phys Educ. 1997;9:41–51.