Wisdom Journal of Science and Technology 1(1), 36-43, June 2025
https://doi.org/10.64848/WJST.1.1.2025.36-43

WISDOM JOURNAL of Science & Technology

RESEARCH ARTICLE

Comparative assessment of anthropometric and body composition parameters among tribal adults in northeast India

Subhashree Das* and Puja Chatterjee
Department of Anthropology, University of Calcutta (Ballygunge Campus)
35, Ballygunge Circular Road, Kolkata 700 019, West Bengal, India

Abstract: This research examines and compares the height, weight and body composition of Hrangkhawl and Tripuri tribal adults living in Tripura, Northeast India. The OMRON HBF-362 body composition monitor was used to measure the participants, and the Bioelectrical Impedance Analysis (BIA) method was employed to determine the amounts of fat mass, fat-free mass, body fat percentage, visceral fat, subcutaneous fat, and skeletal muscle mass. Standard anthropometric techniques were used to measure height, and an anthropometric rod was used for this purpose. To measure weight, a body composition monitor was employed. More body fat was found in Tripuri participants than in the Hrangkhawl group; conversely, more muscle was found in the Hrangkhawl group than in the Tripuri group. The analysis demonstrated strong relations between body fat percentage, subcutaneous fat and skeletal muscle. The study highlights that focusing health assessments on each population within tribal communities supports more effective nutritional and public health initiatives.

Keywords: *Body composition, Anthropometric measurements, Tribal communities, Fat mass, Fat-free mass, Subcutaneous fat, Skeletal mass*

Introduction

Body composition is the relationship between the body's fat, bone, muscle and water [1]. Health is influenced by the body's proportions, which also greatly affect physical activity and movement. Body composition shows how much fat, muscle and bone are in someone's body. People commonly describe body composition using percentages and lean body mass (LBM) or as a ratio of lean mass to fat mass [2]. Lean mass consists of muscle, bone, skin, internal organs and body water. Fatty mass is comprised mainly of subcutaneous body fat and, inside the abdomen, essential visceral fat. People can have the same height and weight, yet their body composition can be significantly different, which may impact their health outcomes. Moreover, Fat Mass (FM) refers to the overall body fat, yet separate fat depots exhibit diverse metabolic and health implications [3]. Visceral adipose tissue (VAT), situated around internal organs, is intensely associated with metabolic difficulties. In contrast, subcutaneous adipose tissue (SAT), found beneath the skin, also has a more benign or protective role.

Body composition assessment delivers a critical understanding of both nutritional situation and functional measurements [4]. It is extensively applied to screen for growth, disease progression, and response to nutritional or therapeutic interventions. Measuring human body composition is key in identifying health and nutritional issues, illness effects, and outcomes related to dietary, medicinal, or behavioural changes [5]. The physical body composition examination is beneficial as it supports the detection and attention to several health problems [5], [6]. They quantify the state of somebody's nutritional condition, screen disease

*Corresponding author: Department of Anthropology, University of Calcutta (Ballygunge Campus)
35, Ballygunge Circular Road, Kolkata 700 019, West Bengal, India E-mail: subhashree.mithu@gmail.com
Received: 28/04/25, Accepted: 28/05/25, Published Online: 04/06/25

consequences and evaluate the achievement of any diet or exercise strategies to develop health. Inspection of body composition is crucial for determining the distribution of fat, muscle, and bone mass, as well as water weight, to assess an individual's overall health condition.

Body composition is an improved method for measuring the quantity of body fat an individual contains. Anthropometry and epidemiologic studies are still usually used to estimate body composition in various fields [7]. An individual's body fat condition can be influenced by their sex, age, genetic factors, and environmental conditions, which help assess their health condition and nutritional status [8] . Measuring an individual's body composition benefits to correctly assess their physical health [9]. Moreover, body composition condition supports the estimate of a person's health ailment by measuring the weight, percentages of fat, fat-free mass, muscle along with water weight in the body, as well as the allotment of subcutaneous fat and skeletal mass in the body [3],[10]. Furthermore, the percentage of body fat (PBF) procedures the extra adiposity or obesity as well.

In India, many communities are suffering because of their poor health condition, poor eating habits and poor nutritional status; similarly, the tribal groups are considered as affected [9]. Based on the viewpoint of Khadilkar & Khadilkar [9] and Saha & Sil [10], India has several diverse tribal communities, which also account for 8.6% of the nation's population. Nevertheless, there is inadequate data about dietary conditions and anthropometric measurements among several Indian tribal communities [11]. Experts are now deliberating how to measure the nutritional requirements of Indian tribal societies speedily. Reviewing body fat and nutrition is significant because research demonstrates that extreme abdominal fat, along with malnutrition, is becoming increasingly common [3],[12]. Hansdah et al. [12] conducted a comparative study on Santhal tribal people with other populations, demonstrating variations in body mass index (BMI), percentage of body fat (PBF), and several dietary intake behaviours. These results underscore the importance of considering and appreciating geographical and ethnic diversity when assessing body composition and related health risks [10],[12].

While evidence on development, growth, and nutritional condition for numerous parts of India is extensively available, very few studies have focused on the North-eastern part of the country [13]. Although several national nutritional programmes and their implementation have been announced, undernourishment remains unresolved in various parts of India [14]. Additionally, very limited research is available on fat mass (FM), fat-free mass (FFM), and the FM index in India [10]. However, there is very limited work conducted in Tripura. Therefore, published data from Tripura remains limited, specifically on Hrangkhal and Tripuri tribes. These two tribal communities were selected due to their distinct socio-cultural practices, different dietary practices and geographic isolation from the main city, which may contribute to unique anthropometric and health profiles. Moreover, they were involved in the study due to the limited representation of previous work on anthropometric and body composition research on tribal communities. No previous studies have particularly assessed segmental body composition, including skeletal muscle and subcutaneous fat distribution, by applying Bioelectrical impedance analysis (BIA) in these tribal communities. Besides, these tribes remain underrepresented in National Health Surveys and peer-reviewed journals, resulting in a serious data gap. The limitation of such data restricts our understanding of their situation regarding metabolic health risks and hinders the development of advanced nutritional development. From this perspective, the study aims to assess and compare the anthropometric and body composition parameters of adult Hrangkhal and Tripuri tribal communities in Tripura, one of the northeastern state of India, which is also a part of 'Seven Sister State' of India. Moreover, it also aims to examine the correlations between subcutaneous fat, skeletal muscle mass and anthropometric measurements within these tribal groups.

Materials and Methods

Study Design and Participants

The study employed cross-sectional methods to investigate the anthropometric status and body composition of individuals from the Hrangkhawl and Tripuri tribes in Tripura, Northeast India. The study included 118 adult participants. A total of 27 males and 41 females belonged to the Hrangkhawl Tribe (n=68), and 17 males and 33 females belonged to the Tripuri Tribe group (n=50). Participants were aged 18 years or older and were selected using purposive sampling in tribal communities. People were included in this study if they were, well, permanent inhabitants where the study was conducted and had no disease at the time of the study.

Anthropometric Measurements and Body Composition

The World Health Organisation (WHO) recommendations were comprehended while taking the anthropometric measurements. All required measurements in the study were only taken with recommended calibrated instruments. Moreover, using the portable anthropometer rod in an accurate way, when the subjects stood totally barefoot with their heads position was stable in the Frankfort horizontal plane while height measurement [15]. Additionally, while taking the measurement of Waist Circumference, mainly need to focus on the midpoint between the rib and the highest point of the iliac crest. To quantify the circumferences in this study, the anthropometric tape was used. According to Hansdah et al. [12], the waist-hip ratio (WHR) is considered by dividing the waist and hip measurements. To observe the waist-hip ratio (WHR), it is essential to divide the waist circumference values by hip circumference values.

Weight in kilograms in this study was measured with the help of the OMRON HBF-362 Body Composition Monitor [16]. It was essential that members not wear shoes, as well as select lightweight clothing throughout their time on the body composition monitor. The body monitor was operated to assess values of the body fat or percentage of body fat (PBF), visceral fat (VF), fat mass (FM) and fat-free mass (FFM). The monitor was again used to quantify both the subcutaneous fat percentage and skeletal mass percentage of various body regions, including the arms, body, trunk, and legs. The body composition monitor was also utilised to understand and calculate the body mass index (BMI) and again validate the resting metabolic rate (RMR) of the studied population. Body composition was assessed using the BIA method. Before starting the process, it was necessary to enter the subject's age, sex, and height in centimetres. All members were suggested not to consume alcohol and only drink water, avoid heavy eating along avoid heavy work for two hours before body composition and anthropometric measurement. Correspondingly, the outcomes were calculated by applying the ensuing formulations such as FM (kg) = (PBF/100) × Weight (kg) and FFM (kg) = Weight (kg) – FM (kg)[8], [12].

Statistical Analysis

SPSS (version 18) was used in this study to analyse the data collected during the study. Moreover, descriptive statistics are used to analyse the body composition and anthropometric data. Mean and standard deviation (mean ± SD) were calculated for height, weight, BMI, WHR, FM, FFM, PBF, VF and Muscle fat (MF), as well as subcutaneous fat (arm, trunk, body and legs) which were represented by SUB A, SUB T, SUB B, SUB L and the same applied to skeletal fat mass (SKL A, SKL T, SKL B, SKL L). Additionally, correlation (r) was used to determine the relationship between anthropometric measurements and body composition measurements.

Ethical Considerations

All participants were aware of the study purpose and provided their consent prior to data collection. It was confirmed that the ethics board granted the required approval for this study. No tests caused physical harm and all participants were concerned about the study.

Results

Researchers in this study analysed anthropometry and body composition to identify variations across tribes and between men and women. Information about fat mass (FM), fat-free mass (FFM), percentage body fat (PBF), visceral fat (VF), skeletal muscle (SKL) and subcutaneous fat (SUB) was obtained for each person using BIA. Results described the distinctions among groups and related the anthropometric data to body fat and lean mass. The results suggest ways to enhance health assessments for specific tribal groups.

The anthropometric analysis reveals that Hrangkhawl and Tripuri men differed in body composition measures. The average height and weight of the males in the Tripuri group (163.4 ± 6.82 cm and 58.94 ± 11.00 kg) were both higher than for those from the Hrangkhawl group (160.18 ± 6.34 cm and 55.84 ± 7.99 kg). Although Tripuri males were generally weightier, their BMI was lower (21.64 ± 3.49 kg/m2) (Table 1). This indicates that they have more proportionate heels-to-weight ratios and are likely healthier. The measurement of waist-hip ratio was not significantly different between the two groups (0.90 ± 0.65 in Tripuri, 0.875 ± 0.056 in Hrangkhawl). Moreover, body composition analysis found that the fat distribution in the two sample groups differed significantly. Tripuri males had significantly higher fat mass indices (66.87 ± 83.53 compared to 36 ± 6.69), a larger percentage of body fat (21.01 ± 5.55% versus 17.77 ± 7.42%), and a higher accumulation of visceral fat (6.70 ± 4.28 cm versus 4 ± 1.41 cm). In comparison, Hrangkhawl men had a higher range of muscle fat (35.78 ± 4.39) than women (34.68 ± 4.27) and an overall higher amount of subcutaneous fat around the arms (20.17 ± 11.42), trunk (14.21 ± 9.81), and legs (20.15 ± 5.17). When comparing Tripuri and Hrangkhawl males, skeletal fats showed consistent results, with males from Tripuri having more fat measured in the arms (38.49 ± 2.66 vs. 36.82 ± 6.11), trunk (24.95 ± 4.14 vs. 27.17 ± 4.22), body (31.54 ± 2.53 vs. 30.57 ± 7.75) and legs measurements (48.35 ± 2.67 vs 45.81 ± 13.13) (Table 1).

Observations made between Hrangkhawl and Tripuri females revealed significant differences in body shape. Women of the Hrangkhawl group were shorter (150.16 ± 3.83 cm) and substantially lighter weight (41.75 ± 0.778 kg) than women of the Tripuri group. In this comparison, the BMI was lower for Hrangkhawl females (19.45 ± 2.166 kg/m²) compared to Tripuri females (22.04 ± 3.21 kg/m²) and there was no major difference in the waist-to-hip ratios (WHR) between the two groups (0.879±0.067) in Hrangkhawl females and (0.903±3.21) in Tripuri females (Table 1). The analysis revealed clear patterns when sorting through body composition. The Tripuri females showed a greater amount of fat mass (15.033 ± 4.730 kg) and fat-free mass (37.84 ± 7.92 kg) and the Hrangkhawl females had lower body fat percentage (23.15 ± 6.43%). Tripuri women had higher visceral fat levels (4.66 ± 2.80) than women from the study (2.0 ± 1.414). Tripuri females had more subcutaneous fat in all body regions but also had greater muscle measurements, while Hrangkhawl females had less muscle fat (30.3 ± 1.555 vs. 28.07 ± 3.408).

Table 1 Comparison of anthropometric and body composition parameters between Hrangkhawl and Tripuri tribal people

Variables	Hrangkhawl Male (Mean±SD)	Tripuri Male (Mean±SD)	Hrangkhawl Female (Mean±SD)	Tripuri Female (Mean±SD)
Age (year)	39.77 ± 17.42	43.05 ±16.35	44.63 ± 13.95	40.48 ± 14.25
Height (cm)	160.18 ± 6.34	163.4 ±6.82	150.16 ± 3.83	152.56 ± 6.14
Weight (kg)	55.84 ± 7.99	58.94 ±11.00	41.75 ± 0.778	52.90 ± 11.60
BMI (kg/m2)	24.74 ± 15.08	21.64 ± 3.49	19.45 ± 2.166	22.04 ± 3.21
WHR (waist-hip ratio)	0.875 ± 0.056	0.90 ± 0.65	0.879 ± 0.067	0.903 ± 3.21
FM(fat mass)	10.07 ± 4.87	19.01± 26.26	11.08 ± 4.39	15.033 ± 4.730
FFM (fat-free mass)	36 ± 6.69	66.87 ± 83.53	32.174 ± 11.967	37.84 ± 7.92
PBF (% of body fat)	17.77 ± 7.42	21.01 ± 5.55	23.15 ± 6.43	28.08 ± 4.78
Visceral fat	4 ± 1.41	6.70 ± 4.28	2 ± 1.414	4.66 ± 2.80
Muscle fat	35.78 ± 4.39	34.68 ±4.27	30.3 ± 1.555	28.07 ± 3.408
RM (kcal)	1255.7± 46.12	1419 ± 1170.8	1018.5 ± 2.121	1126.90 ± 217.62
Subcutaneous fat (arm)	20.13 ± 9.81	19.61 ± 4.13	32.2 ± 3.394	38.69 ± 6.22

Variables	Hrangkhawl Male (Mean±SD)	Tripuri Male (Mean±SD)	Hrangkhawl Female (Mean±SD)	Tripuri Female (Mean±SD)
Subcutaneous fat(trunk)	14.21 ± 9.81	12.38 ± 4.47	15.65 ± 5.72	22.53 ± 13.017
Subcutaneous fat(Body)	14.55 ± 7.84	15.08 ± 5.29	19.95 ± 5.30	24.29 ± 13.017
Subcutaneous fat (leg)	20.17 ± 11.42	20.30 ± 5.170	31.1 ± 5.30	34.45 ± 5.683
Skeletal fat (arm)	36.82 ± 6.11	38.49 ± 2.66	32.85 ± 4.17	29.00 ± 3.65
Skeletal fat (trunk)	27.17 ± 4.22	24.95 ± 4.14	22.8 ±3.39	20.24 ± 2.61
Skeletal fat (body)	30.57 ± 7.75	31.54 ± 2.53	27 ± 3.25	25.57 ± 2.52
Skeletal fat(leg)	45.81 ± 13.13	48.35 ± 2.67	36.6 ± 1.697	37.84 ± 3.55

Within the Tripuri population, significant differences exist in anthropometric and body composition parameters between men and women. Tripuri males were taller (163.46 ± 6.82 cm) and heavier (58.94 ± 11.00 kg) than females (152.56 ± 6.14 cm and 52.90 ± 11.60 kg). Both male and female patients had almost similar BMI (21.64 ± 3.49 kg/m² for males and 22.04 ± 3.21 kg/m² for females). Males had greater fat mass (19.01 ± 26.26 kg) and fat-free mass (66.87 ± 83.53 kg) than females, while females displayed a greater percentage of body fat (28.08 ± 4.78%) (Table 1). Subcutaneous fat was found to be higher in women in all parts of their body, but men had higher skeletal muscle everywhere.

In the Hrangkhawl tribe, males and females were found to have very different body compositions. Compared to females, males measured higher for height (160.2 cm vs. 150.2 cm), weight (55.9 kg vs. 41.8 kg) and BMI values (24.8 kg/m² vs. 19.5 kg/m²). Interestingly, males had a lower body fat percentage (PBF) (23.15 ± 6.43% vs. 17.77 ± 7.42%), but this was offset by a higher total weight in kg (11.08 ± 4.39 vs. 10.07 ± 4.87). Males overall had greater fat-free mass (36 ± 6.7 kg) and a higher percentage of muscle fat (35.78 ± 4.3 kg) than females (29 ± 1.4 kg and 30.3 ± 1.6 kg) (Table 1). Women had greater subcutaneous fat in their outer arms and legs, whereas men had more skeletal muscle in all body parts.

There was a noticeable relationship among Hrangkhawl males, where a high WHR indicated more subcutaneous fat and less skeletal muscle mass in the different body parts ($p < 0.05$). In addition, body fat percentage (PBF) was linked strongly to both subcutaneous fat ($r = 0.511$ to 0.735, $p < 0.01$) and lower levels of skeletal muscle ($r = -0.349$ to -0.866, $p < 0.05$) (Table 2). An increase in muscle fat was associated with a decrease in subcutaneous fat and the parallel rise in skeletal muscle mass.

Table 2 The correlation between anthropometric variables and subcutaneous fat and skeletal muscle in Hrangkhawl male

	SUB A	SUB T	SUB B	SUB L	SKL A	SKL T	SKL B	SKL L
BMI	-.019	.168	-.057	-.040	.102	.068	.083	.070
WHR	.735**	.645**	.604**	.537**	-.609**	-.657**	-.473*	-.379
FM	.705**	.546**	.595**	.466*	-.592**	-.809**	-.307	-.229
FFM	-.262	-.043	-.224	-.221	.396*	.358	.415*	.358
PBF	.735**	.516**	.627**	.511**	-.682**	-.866**	-.438*	-.349
VF	.432*	.657**	.442*	.367	-.336	-.346	-.175	-.167
MF	-.582**	-.671**	-.564**	-.481*	.656**	.734**	.534**	.457*

In Hrangkhawl females, body mass index was strongly related to subcutaneous fat in all regions ($r = 0.657$ to 0.796, $p < 0.01$) and there were also correlations of negative values with skeletal muscles ($r = -0.195$ to -0.573, $p < 0.05$) (Table 3). Visceral fat was strongly linked to having more subcutaneous fat ($r = 0.662$ to 0.726, $p < 0.01$). There was a consistent correlation between PBF and subcutaneous fat (ranging from 0.435 to 0.679, $p < 0.01$) and a negative correlation with the main skeletal muscle measures, highlighting the typical change between body fat and muscle among females.

Table 3 The correlation between anthropometric variables and subcutaneous fat and skeletal muscle in Hrangkhawl females

	SUB A	SUB T	SUB B	SUB L	SKL A	SKL T	SKL B	SKL L
BMI	.657**	.775**	.796**	.761**	-.573**	-.479**	-.021	.195
WHR	.421**	.523**	.490**	.443**	-.473**	-.467**	-.362*	-.200
FM	.756**	.734**	.588**	.595**	-.512**	-.625**	.058	.257
FFM	.343*	.314*	.418**	.301	-.092	-.108	.379*	.440**

	SUB A	SUB T	SUB B	SUB L	SKL A	SKL T	SKL B	SKL L
PBF	.679**	.667**	.435**	.494**	-.596**	-.692**	-.194	.015
VF	.668**	.711**	.726**	.662**	-.510**	-.539**	-.023	.184
MF	-.397*	-.411**	-.402**	-.270	.319*	.396*	-.043	-.161

PBF was found to be the best predictor in Tripuri males, correlating strongly with arm and leg fat (r = 0.887 to 0.910, $p < 0.01$) while negatively associating with skeletal muscle mass (r = -0.548 to -0.690, $p < 0.05$) (Table 4). A moderate correlation was between BMI and subcutaneous fat in arms and body regions (0.489 to 0.594, $p < 0.05$). Muscle fat was negatively linked to subcutaneous fat and positively associated with skeletal muscle features, suggesting ongoing muscle-fat balance in the studied groups.

Table 4 The correlation between anthropometric variables and subcutaneous fat and skeletal muscle in Tripuri males

	SUB A	SUB T	SUB B	SUB L	SKL A	SKL T	SKL B	SKL L
BMI	.594*	.285	.489*	.404	-.210	-.440	-.022	-.095
WHR	.369	.025	.239	.568*	-.186	-.446	-.345	-.289
FM	.226	.152	.119	.169	-.202	-.235	-.296	-.237
FFM	.092	.049	.044	.031	-.183	-.138	-.209	-.164
PBF	.910**	.658**	.553*	.887**	-.187	-.690**	-.632**	-.548*
VF	.449	.241	.437	.283	-.312	-.585*	-.262	-.288
MF	-.619**	-.395	-.529*	-.529*	.467	.639**	.576*	.553*

For Tripuri women, there were strong correlations between PBF and subcutaneous fat, mainly in the arms and body areas (r = 0.880 to 0.894, $p < 0.01$), along with strong correlations that showed lower skeletal muscle mass (r = -0.398 to -0.795, $p < 0.05$). Fat mass closely correlated with having more subcutaneous fat (r = 0.602 to 0.759, $p < 0.01$). Visceral fat showed a strong association with subcutaneous fat in the body and legs (r = 0.531 to 0.675, $p < 0.01$), pointing to the same adipose tissue patterns seen in females (Table 5).

Table 5 The correlation between anthropometric variables and subcutaneous fat and skeletal muscle in Tripuri females

	SUB A	SUB T	SUB B	SUB L	SKL A	SKL T	SKL B	SKL L
BMI	.351*	.264	.651**	.502**	-.524**	-.214	-.030	.277
WHR	.415*	.328	.346*	.299	-.337	-.548**	-.534**	-.400*
FM	.602**	.232	.759**	.609**	-.628**	-.419*	-.261	-.015
FFM	-.086	.073	.113	.024	-.049	.210	.327	.422*
PBF	.880**	.256	.894**	.768**	-.795**	-.747**	-.643**	-.398*
VF	.404*	.242	.675**	.531**	-.583**	-.348*	-.174	.135
MF	-.390*	-.259	-.590**	-.413*	.557**	.471**	.315	.074

Discussion

In this study, Hrangkhawl and Tripuri tribal communities living in Tripura were investigated to determine their differences in anthropometric and body composition parameters and to establish their connection with skeletal muscle and subcutaneous fat distributions. Clear differences were found between the two tribes when examining fat mass, fat-free mass, BMI, visceral fat, and subcutaneous fat distribution. According to Saha and Sil [10], the Chakma people in Tripura appear to have more subcutaneous fat than people in other regions.

The present research revealed that Tripuri males had a higher percentage of body fat and visceral fat, as well as a greater total body weight, compared to Hrangkhawl males. However, the study group had more skeletal muscle tissue in their trunks and legs. While Tripuri females had much more fat and visceral fat than the Hrangkhawl group in each part of the body, the latter had less fat but also less skeletal muscle. Consistent with the study done by Hansdah et al. [12] on the Santal Tribes, all variables except MUAC, waist and hip circumference differed significantly ($p < 0.05$). There were differences in height and weight among adults of different ages. The study found a significant difference between men and women in their waist-to-hip ratios but not in their BMI categories. Sengupta [17] noted that 50% of Toto men have mild weight loss, lower body fat, thinner waists and a lower tendency to store fat. Furthermore, this study reveals that most Toto men are underweight due to their poor diet; however, their strength from hard work has not yet compromised their overall fitness.

The relationships between anthropometric variables (BMI, WHR, PBF) and body composition indicators, mainly subcutaneous fat and skeletal muscle mass, were studied in individuals from the Hrangkhawl and Tripuri tribes. In all groups, the results showed that higher PBF had a positive correlation with subcutaneous fat in all body regions while showing a negative correlation with skeletal muscle mass. There is a negative correlation between how fat accumulates and muscle distribution. Toskic et al. [1] also found that all types of physical activity benefit body composition and noted that the most important factor for enhancing body composition is the frequency of exercise. Maken and Varte [18] found that urban men and women had higher values than rural men and women for height, weight, sitting height, mid-upper arm circumference (MUAC), chest circumference, hip circumference, and fat mass ($p < 0.05$). According to Bose et al. [8], females had a significantly higher prevalence of Fat-Free Mass Index (FFMI), and more than 60% of individuals over 60 years of age were affected by low FFMI. Likewise, low PBF was reported in a greater percentage of females, and this rate was higher among participants aged 60 years or older. On the other hand, significant negative correlations were found between age and BMI and positive correlations between WHR, age, and conicity index (CI) among the Oraons and Munda tribes [14].

Conclusion

In this study, measurements of anthropometric and body composition were made and compared among Hrangkhawl and Tripuri tribal adults. Based on the study, tribal groups differ in their body fat, muscle mass and various ways of measuring their composition. The results clearly showed that more fat accumulated in Tripuri women and Hrangkhawl males tended to have higher muscle mass. Higher fat levels were connected to an increase in subcutaneous fat and a decrease in skeletal muscle within all the study subgroups.

The findings of the study have many important implications. The results of this study suggest that tribal community-wise health screening, along with intervention strategies on their dietary practices, is essential to analyse their health conditions, as sometimes general public health measures may overlook the tribal population who live in extremely rural areas. Moreover, findings on high visceral and subcutaneous fat levels in Tripuri females highlight the requirement for targeted nutritional assessment and dietary intervention programs in this subgroup. Furthermore, regulatory monitoring and evaluation of intervention programs may assist tribal communities in achieving better development in community engagement and improving health conditions.

Results suggest that different community characteristics should be considered when assessing body composition in tribal groups. Because the study involved only a small number of people, the findings should not be used to represent all tribal communities in this context. Because the data is collected at a particular time, fundamental relationships cannot be investigated in this study. In future research, other tribes in various regions can be studied, and their success can be tracked over time. For the health condition assessment of other tribal groups, researchers should consider their daily activities, eating habits, physical activity and energy requirements.

Acknowledgement

We are very grateful to Professor Dr. Arup Ratan Bandyopadhyay from the University of Calcutta, who provided us with valuable advice, encouragement, and support. I am indebted to Professor Dr. Diptendu Chatterjee for providing valuable knowledge and leading ideas throughout my research. We also appreciate Research Scholar Dr. Pronobesh Sarkar for helping us to support in fieldwork and data collection.

References

[1] L. Toskic, M. Markovic, J. Simenko, V. Vidic, N. Cikiriz, and M. Dopsaj, "Analysis of Body Composition in Men and Women with Diverse Training Profiles: A Cross-Sectional Study," *Int. J. Morphol.*, vol. 42, no. 5, pp. 1278–1287, 2024.

[2] S. Messiah, "Body composition," *Essent. Meas. Pediatr. Musculoskelet. Imaging*, pp. 247–261, 2020.

[3] M. Galasso, L. Verde, L. Barrea, S. Savastano, and A. Colao, "The Impact of Different Nutritional Approaches on Body Composition in People Living with Obesity," *Curr. Obes. Rep.*, 2025.

[4] R. Kuriyan, "Body composition techniques," no. May, pp. 517–520, 2018.

[5] C. M. Toomey, A. Cremona, K. Hughes, C. Norton, and P. Jakeman, "A review of body composition measurement in the assessment of health," *Top. Clin. Nutr.*, vol. 30, no. 1, pp. 16–32, 2015.

[6] G. Mazzoccoli, "Body composition: Where and when," *Eur. J. Radiol.*, vol. 85, no. 8, pp. 1456–1460, 2018.

[7] S. Debnath, N. Mondal, and J. Sen, "Socio-economic and Demographic Correlates of Stunting and Thinness among Rural School-going Children (Aged 5-12 Years) of North Bengal, Eastern India," *J. Life Sci.*, vol. 10, no. 01, 2018.

[8] K. Bose, M. Ghosh, S. Bhandari, and B. K. Kuiti, "Mid-Upper Arm Based Nutritional Status and Body Fat Pattern Among Adult Mahalis of Bankura District, West Bengal, India," vol. 99, pp. 201–215, 2019.

[9] V. V. Khadilkar and A. V. Khadilkar, "Body Composition in Tribal Indian Girls from the North-East India," *Indian J. Pediatr.*, vol. 86, no. 6, pp. 492–493, 2019.

[10] S. Saha and S. K. Sil, "A Comparative Study on Fat Pattern between Tribal and Non-tribal Girls of Tripura, North-East India," *Indian J. Pediatr.*, vol. 86, no. 6, pp. 508–514, 2019.

[11] A. M. Majee and D. Roy, "Anthropometric Characteristics, Body Composition, and Nutritional Status of Sabar Tribal People of Jhargram District of West Bengal, India," *Int. J. Med. Sci. Dent. Res.*, vol. 06, no. 03, pp. 19–38, 2023.

[12] S. Hansdah, S. Baral, S. Majhi, R. R. Singh, R. Maharana, and M. Goswami, "Anthropometric Characteristics and Body Composition measures among the Santal tribal population of Mayurbhanj ," vol. 20, pp. 299–306, 2024.

[13] S. Saha and S. K. Sil, "A Comparative Study of Anthropometric Measurements between Tribal and Non-Tribal Girls of Tripura," *Stud. Tribes Tribals*, vol. 16, no. 1–2, pp. 40–48, 2018.

[14] S. Das, B. Debsharma, and K. Bose, "Adiposity and Health Status among Adult Male Mundas and Oraons of Paschim Medinipur, West Bengal, India," *J. Anthropol.*, vol. 2013, pp. 1–6, 2013.

[15] T. Capon, "Standardised anatomical alignment of the head in a clinical photography studio. A comparison between the Frankfort Horizontal and the natural head position," *J. Vis. Commun. Med.*, vol. 39, no. 3–4, pp. 105–111, 2018.

[16] D. Kar and S. Roy, "Factors associated with the CVD risk factors and body fat pattern of postmenopausal Hindu caste and Lodha tribal populations living in India: An exploratory study," *Women's Midlife Heal.*, vol. 9, no. 1, pp. 1–13, 2023.

[17] P. Sengupta, "A report on body composition and fitness profile of young men of Toto community: An endangered tribe of India," *Indian J. Med. Spec.*, vol. 7, no. 3, pp. 95–99, 2016.

[18] T. Maken and L. R. Varte, "Anthropometric and Body Composition Differences among Rural and Urban Ao Naga Tribes: Correlation between Hypertension, Haemoglobin and Obesity. ," *Antrocom Online J. Anthr.*, vol. 12, no. 2, 2016.