Body Composition Variation Among The Adult Tai Ahom Female Across Age Group Of Lakhimpur District, Assam

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Abstract
Body composition is important as it reflects overall health and fitness by indicating the percentage of body fat relative to lean mass. The measurements of size and body composition can be used to mark the ability of the system to function. The body composition characteristics are examined to understand the health status among 429 adult Tai Ahom women of Lakhimpur district, Assam. The measurements, like stature, weight, waist circumference and hip circumference are collected with the help of anthropometric method. Anthropometric indices like Conicity Index (CI), Waist Hip Ratio (WHR), Waist Stature Ratio (WSR) are calculated for the present study. Anthropometric indices serve as strong indicators of environmental influences and the adaptability of the human body. The present study concluded that the adult Tai Ahom women fall in the high risk category, indicating the presence of higher visceral fat and showing a health risk.
Keywords: Body composition, Tai Ahom, Lakhimpur Assam

INTRODUCTION

Body composition is a crucial factor in assessing and maintaining health. In healthy adults, body composition is maintained over the short term within narrow limits. Illness may significantly affect body composition, and malnutrition is a major complication. Body composition assessment involves quantifying the amount and relative proportion of fat, muscle, bone, and their chemical components. Significant changes in body composition occur during growth and development, especially during infancy and puberty. Therefore, assessing body composition in children is more complex than in adults and serves multiple important purposes. In India, most body composition studies are concerned with the problem of under-nutrition, although there is evidence of socio-economic and nutrition transition that is likely to increase the epidemic of chronic diseases and obesity, particularly in urban areas (Shetty, 2002). Body composition is highly varied and widely recognized in relation to age, sex, race, diet, physical activity levels, hormones, genetics, and disease conditions. Body compositional changes, including the regional distribution of body fat, are especially larger during the pubertal transition and are marked in a sexually dimorphic manner (Rogel *et al.,* 2002). Chakraborty and Bose (2009) tested the relative efficiency of Waist Circumference (WC), Hip Circumference (HC), Waist-Hip Ratio (WHR), and Conicity Index (CI) to predict BMI and PBF among Bengalee Hindu male slum dwellers. In this study, WC showed the strongest significant (p<0.001) partial correlation with BMI and PBF. Milanovic *et al.,* (2011) studied the basic anthropometric characteristics and body composition of elderly individuals between 60 to 80 years of age on the basis of collected data and analyzed papers published between the years of 1990 and 2011. The study stated that aging is associated with a higher percentage of body fat and body fat redistribution. The redistribution of fat predominantly from the lower body to subcutaneous fat in the abdominal and visceral sections is quite frequent despite an apparent decrease in BMI. Das *et al.,* (2012) undertook a cross-sectional study of 246 (18-76 years) rural Bauri women of West Bengal to understand the difference in prevalence of under-nutrition and body composition between 3 age groups: Group I (18-33), Group II (34-66) & Group III (>66 yrs). This indicates that with increasing age, the values of anthropometric measurements rise significantly, with a subsequent fall among older rural Bauri women. Many studies on age-related changes and body composition have been conducted on different ethnic groups in India, and a few have been conducted in the northeastern region. The Tai Ahom of Lakhimpur district is one such population among whom the age

changes from childhood to adulthood, and body composition has not been done till now. Therefore, the present study was undertaken on this section of the population living in the district of Lakhimpur in Assam to highlight the body composition characteristics such as waist circumference, waist–hip ratio, waist–stature ratio, and conicity index.

METHODS AND MATERIALS
The present study was conducted on 429 Tai Ahom females from North Lakhimpur, Assam. Their ages ranged from 20 years and above to study the changes from young adults to old adults. The subjects were grouped into nine groups with five-year intervals. Anthropometry is extremely useful for identifying changes in body size and composition. In view of the importance of age changes in anthropometric characteristics, it helps to understand the process of change in physical growth and body composition, ultimately sufficing the knowledge. The anthropometric measurements provide an indirect assessment of body composition which is easy, and it is essential to undertake them for research. Anthropometric measurements included height, weight, waist circumference, abdominal circumference, and hip circumference.

The Tai Population in India is mostly confined to the states of Assam and Arunachal Pradesh. The Tais, as a highly assimilative people, accepted the best of others wherever they went. The Shan was a group of this great family, and a section of it intruded into Assam in the early part of the 13th century AD. Today, they are known as Ahoms. Their racial brethren are the Khamtis, Phakes, Aitons, Kamyangs, and Turungs, whose forefathers filtered into this land following the Ahoms. The Tais belong to the great Mongolian race. The Tai Ahoms, the largest Tai community in Assam, were selected for this study.

Results

Table 1: Abdominal Obesity among Adult Tai Ahom Females as per Waist Circumference

Age Groups Years	Sample Size	Low <80cm	High≥80cm	Very high≥88cm
20 - 25	53	42(77.36%)	12(22.64%)	0 (0%)
25 - 30	45	42(93.34%)	2(4.44%)	1(2.22%)
30 - 35	58	44(75.87%)	12(20.68%)	2(3.45%)
35 - 40	47	8(17.02%)	27(57.45%)	12(25.53%)
40 - 45	41	19(46.34%)	19(46.54%)	3(7.32%)
45 - 50	45	22(55.12%)	11(24.44%)	11(24.44%)
50 - 55	39	13(33.34%)	13(33.33%)	13(33.33%)
55 - 60	46	2(4.35%)	15(32.61%)	29(63.04%)
60 & above	55	24(43.65%)	25(45.45%)	6(10.90)
Total	**429**	**216(50.35%)**	**136(31.70%)**	**77(17.95%)**

Cut –off points recommended by WHO, 2008

Table 1 presents the distribution of abdominal obesity among adult Tai Ahom females across different age groups, based on Waist Circumference (WC) cut-off points recommended by the WHO (2008). Waist circumference was categorized into three risk levels: low risk (<80 cm), high risk (≥80 cm but <88 cm), and very high risk (≥88 cm).

Of the 429 adult female participants, 50.35% (n=216) fell under the low-risk category, 31.70% (n=136) were in the high-risk category, and 17.95% (n=77) were classified under the very high-risk category, indicating a substantial proportion of women at elevated risk for central obesity-related health complications.

The age-wise distribution reveals a progressive increase in abdominal obesity with advancing age.

- In the youngest age group (20–25 years), a large majority (77.36%) were in the low-risk category, and none were in the very high-risk group.
- A similar trend of low risk continued in the 25–30 and 30–35 age groups, where over 75% remained in the low-risk range.

- From the 35–40 years age group onward, there was a notable shift, with only 17.02% in the low-risk category and a significant 25.53% reaching the very high-risk level.
- The peak prevalence of very high risk was observed in the 55–60 years group, where 63.04% of women were in the very high-risk category. This was the highest among all age groups, indicating that more than half of the women in this group had a WC ≥88 cm.
- In the ≥ 60 years group, although the very high-risk percentage slightly declined to 10.90%, nearly 45.45% were still in the high-risk range, suggesting sustained central fat accumulation even in older age.

These findings indicate that aging is associated with an increase in abdominal fat accumulation, likely influenced by physiological and hormonal changes, such as menopausal estrogen deficiency, reduction in growth hormone, and alterations in fat metabolism. These changes make older women more prone to visceral fat deposition, thereby increasing the risk for metabolic disorders such as type 2 diabetes, hypertension, and cardiovascular diseases.

Table 2: Abdominal Obesity among Adult Tai Ahom Females as per Waist Hip Ratio

Age Group (Years)	Sample Size	Low Risk ≤0.80	Moderate Risk 0.81-0.85	High Risk ≥0.86
20 - 25	53	12(22.64%)	33(62.26%)	8(15.09%)
25 - 30	45	28(62.22%)	14(31.11%)	3(6.66%)
30 - 35	58	27(46.55%)	25(43.10%)	6(10.34%)
35 - 40	47	7(14.89%)	25(53.19%)	15(31.90%)
40 - 45	41	17(41.46%)	18(43.90%)	6(14.63%)
45 - 50	45	17(37.78%)	20(44.44%)	8(17.78%)
50 - 55	39	9(33.07%)	13(33.33%)	17(43.59%)
55 - 60	46	1(2.17%)	8(17.39%)	37(80.43%)
60 & above	55	19(34.55%)	15(27.27%)	21(38.18%)
Total	429	137(31.94%)	171(39.86%)	121(28.21%)

Cut-off points recommended by WHO (2008)

Table 2 presents the classification of abdominal obesity among adult Tai Ahom females based on Waist-Hip Ratio (WHR), using the WHO (2008) recommended cut-off points. WHR is a widely used anthropometric measure to assess fat distribution and is a significant indicator of central obesity and associated health risks.

Among the total sample of 429 women, 31.94% were in the low-risk category (WHR ≤ 0.80), 39.86% in the moderate-risk category (WHR 0.81–0.85), and 28.21% in the high-risk category (WHR ≥ 0.86). The data indicates that a considerable proportion of the adult female population is already at moderate to high risk for health complications linked to central obesity.

The age-wise distribution reveals notable patterns:

- In the younger age groups (20–30 years), a majority were classified under low to moderate risk, with 62.26% of those aged 20–25 falling into the moderate category and only 15.09% at high risk.
- A significant shift occurs after the age of 35, where the percentage of women in the high-risk category rises. In the 35–40 age group, 31.90% were already in the high-risk category.
- The most concerning finding is in the 55–60 age group, where a substantial 80.43% of women were in the high-risk category, reflecting a sharp rise in central fat deposition during this life stage.
- Even among women aged 60 and above, 38.18% were still in the high-risk category, though a portion also fell back into the low-risk category, possibly due to age-related weight loss or changes in body composition.

This progression in WHR with advancing age may be linked to hormonal and metabolic changes, especially postmenopausal estrogen decline, increased insulin resistance, and decreased physical activity, which together promote central fat accumulation. These physiological changes increase susceptibility to non-communicable diseases such as cardiovascular diseases, type 2 diabetes, and metabolic syndrome.

Table 3: Distribution of Waist-Stature-Ratio among Adult Tai Ahom Females

Age Group (Years)	Sample Size	Normal <0.50	High / Obese ≥0.50
20 – 25	53	30(56.70%)	23(43.40%)
25 – 30	45	35(77.78%)	10(22.22%)
30 – 35	58	36(62.07%)	22(37.93%)
35 – 40	47	7(14.89%)	40(85.11%)
40 – 45	41	18(43.90%)	23(56.10%)
45 - 50	45	20(44.44%)	25(55.56%)
50 – 55	39	11(28.21%)	28(71.79%)
55 – 60	46	2(4.35%)	44(95.65%)
60 & above	55	20(36.36%)	35(63.64%)
Total	429	179(41.72%)	250(58.28%)

Cut –off points as recommended by Browning *et al.*, 2010

Table 3 shows the distribution of waist-to-stature ratio (WSR) among adult Tai Ahom females across different age groups, using the cut-off point of 0.50 as recommended by Browning et al. (2010). A Waist-to-Stature Ratio (WSR) of ≥0.50 is considered a reliable indicator of central obesity and increased cardiometabolic risk, regardless of an individual's height. Among the 429 participants, 250 (58.28%) had a WSR of ≥0.50, classifying them as centrally obese, while 179 (41.72%) were in the normal category (WSR <0.50). This clearly suggests that more than half of the female population studied is at an elevated risk for non-communicable diseases due to central fat accumulation.

Age-wise analysis reveals a clear and consistent trend of increasing WSR with age:

• In the youngest age group (20–25 years), 56.70% had normal WSR, but 43.40% were already in the high-risk category, suggesting early onset of central adiposity in some individuals.

• The 25–30 age group exhibited the highest percentage of normal WSR (77.78%), suggesting better control of central adiposity in early adulthood.

• From age 35 onwards, a rapid shift is observed. In the 35–40 age group, 85.11% had high WSR, and this proportion further increases in older groups.

• The highest prevalence of central obesity is observed in the 55–60 age group, where 95.65% of women had WSR ≥0.50–an alarming figure that signifies critical health risks.

• Even in the 60 & above group, 63.64% were categorized as obese by WSR.

These findings reflect the progressive accumulation of abdominal fat with advancing age, which is consistent with hormonal and metabolic changes such as menopause-related estrogen deficiency, reduced physical activity, and slowed metabolic rate. Central obesity, as measured by WSR, is strongly associated with increased risk of cardiovascular diseases, type 2 diabetes, hypertension, and insulin resistance.

Table 4: Distribution of Conicity Index among adult Tai Ahom Females

Age Group (Years)	Sample Size	Normal <1.18 for Female	High / Obese ≥1.18 for Female
20 – 25	53	24(45.28%)	29(54.72%)
25 – 30	45	28(62.22%)	17(37.78%)
30 – 35	58	26(44.83%)	32(55.17%)
35 – 40	47	25(53.19%)	22(46.81%)
40 – 45	41	20(48.78%)	21(51.22%)
45 - 50	45	18(40.00%)	27(60.00%)
50 - 55	39	10(25.64%)	29(74.36%)
55 - 60	46	4(8.70%)	42(91.30%)
60 & above	55	15(27.27%)	40(72.73%)

Total	429	170 (40.09%)	259(60.37%)

Cut- off points as recommended by Pitanga *et al.*, 2011

Table 4 presents the distribution of Conicity Index (CI) among adult Tai Ahom females across various age groups, using the cut-off value of 1.18 for females as recommended by Pitanga et al. (2011). The Conicity Index is a refined anthropometric indicator that considers waist circumference, weight, and height to estimate the degree of abdominal fat distribution and central obesity.

Among the 429 participants, 259 females (60.37%) had a Conicity Index ≥1.18, placing them in the high/obese category, while 170 females (40.09%) were within the normal range. This indicates that a majority of the population exhibits central adiposity, which is a significant risk factor for cardiovascular and metabolic disorders.

Analyzing the age-wise distribution:
- In the 20–30 year age group, results show a mixed trend. While 62.22% of women in the 25–30 age group had a normal CI, over 54.72% of the 20–25 group were already in the high-risk category, suggesting early onset of central obesity in some individuals.
- The 30–45 age range shows a nearly balanced distribution of normal and high CI values, reflecting a transitional stage in fat accumulation.
- A sharp increase in obesity risk is evident from the age of 45 onwards, with 60.00% of the 45–50 group, 74.36% of the 50–55 group, and a critical 91.30% of the 55–60 group falling into the high Conicity Index category.
- In the 60 & above group, 72.73% remained at high risk category, indicating persistent central fat concentration into older age.

This rising trend of elevated CI with age can be attributed to hormonal changes (e.g., estrogen decline during menopause), reduced lean body mass, decreased physical activity, and age-related metabolic slowdown. The Conicity Index, by incorporating multiple body measurements, provides a more comprehensive estimation of visceral fat accumulation compared to single measures like waist circumference alone.

DISCUSSION OF FINDINGS

Waist Circumference (WC) is recognized as a reliable anthropometric indicator of central obesity, affected by both visceral and subcutaneous fat deposition. It is considered a more accurate indirect measure of visceral fat compared to other indicators and is relatively less influenced by age, sex, height, or overall obesity status (Han et al., 1997; Janssen, Heymsfield, & Ross, 2002). In the present study (Table 1), 17.95% of Tai Ahom females were classified under the high health risk category based on WC, with the highest proportion (63.04%) in the 55–60 years age group. In contrast, 50.35% were categorized under the low-risk level. The increasing trend of very high-risk abdominal obesity with age may be attributed to hormonal changes, including reduced secretion of growth hormone (Corpas, Harman, & Blackman, 1993), menopausal estrogen deficiency, and diminished levels of total and bioavailable testosterone in women (Harman & Blackman, 2004; Harman et al., 2001).

The Waist-Hip Ratio (WHR), presented in Table 2, further supports the prevalence of abdominal obesity among the study population. WHR is widely acknowledged for its ability to indicate central fat accumulation and related metabolic risk (WHO, 2008). In this study, 28.21% of Tai Ahom females were classified as high health risk based on a WHR of ≥ 0.85, while 39.86% fell into the moderate risk category and 31.94% were at low risk. Previous research has found WHR to be associated with hormonal and metabolic dysfunction. Derby et al. (2006) reported an inverse association between testosterone levels and WHR, while Lear et al. (2007) highlighted that South Asians and Chinese exhibit higher levels of visceral fat at a given WC than Caucasians. Further supporting this trend, Molarius et al. (1999) It was observed that both waist circumference (WC) and waist-to-hip ratio (WHR) tend to increase with age. Similarly, Hughes et al. (2004) observed a significant increase in WC among elderly women, accompanied by a decline in hip circumference in men. Misra and Vikram (2004) and Banerji et al. (1997) noted that Asian Indians have higher truncal and abdominal fat compared to other ethnic groups, even at lower WC values.

Table 3 illustrates the Waist-to-Stature Ratio (WSR), or Waist-to-Height Ratio (WHtR), which is a stable and reliable indicator of abdominal obesity and cardiovascular risk (Browning, Hsieh, & Ashwell, 2010). A waist-to-height ratio (WHtR) exceeding 0.50 is deemed critical, as it is strongly associated with elevated metabolic risk. In the current study, 58.28% of Tai Ahom females were above this threshold, with 95.65% of females aged 55–60 years falling in the obese category. This further affirms the trend of increasing central adiposity with age. WHtR remains relatively stable across age, sex, and ethnicity, making it a robust screening tool (Ashwell & Hsieh, 2005). Height plays a critical role in interpreting abdominal fat, as taller individuals may show lower WHtR even with higher WC.

Table 4 presents the Conicity Index (CI), which estimates trunk fat distribution and is a useful predictor of cardiovascular disease (CVD) risk (Pitanga, 2011). The findings reveal that 60.37% of adult Tai Ahom females were in the high-risk category (CI ≥ 1.18), particularly in the 55–60 age group, where 91.30% were at risk. Conversely, the lowest risk (37.78%) was observed in the 25–30 age group. A similar age-related increase in CI values has been documented in studies among other ethnic groups, including Bauri females in West Bengal, where females aged 34–66 years exhibited higher mean CI scores, indicating increased adiposity with advancing age (Das, Chowdhury, & Bose, 2012).

Collectively, these findings highlight a clear age-associated trend in central obesity and related health risks among adult Tai Ahom females. The convergence of data from multiple anthropometric indicators — WC, WHR, WHtR, and CI — underscores the importance of age-sensitive screening and targeted health interventions in this ethnic group.

CONCLUSION

In the present endeavour the age-related changes have been studied in anthropometric and body composition characteristics among the adult Tai Ahom females of Lakhimpur, Assam. Since body composition is directly related to health, maintaining a healthy proportion of body fat is associated with better health and a longer lifespan. Excess fat in relation to lean body mass can greatly increase the risk of cardiovascular disease, diabetes and more. Central obesity parameters reflect adiposity and serve as primary indicators of overall obesity. The Tai Ahom women fall in the high-risk category, indicating the presence of higher visceral fat as indicated by the waist circumference. Waist-to-stature ratio indicating risk of obesity related to cardio-vascular diseases has been found to be maximum among the 55-60 years age category of women. Trunk adiposity measure of Conicity index has also detected the higher age groups to be more at health risk than the younger age categories.

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