International Journal of Arts and Social Science
ISSN: 2581-7922,
Volume 9 Issue 10, October 2026

Anthropometric Characteristics and Their Association With Age, Sibling Composition, and Parity: A Cross-Sectional Study of North 24 Parganas, West Bengal, India

Sarnali Sarkar[1], Puja Das[2], Ashish Mukhopadhyay[3], Mithu Bhadra[4]

[1]*UGC-NET SRF, Department of Anthropology, West Bengal State University, Barasat, West Bengal-700126,*
[2]*Former Research Scholar, Department of Anthropology, Acharya Prafulla Chandra College, New Barrackpore, West Bengal-700131,*
[3]*Associate Professor, Department of Anthropology, Acharya Prafulla Chandra College, New Barrackpore, West Bengal-700131,*
[4]*Associate Professor, Department of Anthropology, Dinabandhu Mahavidyalaya, Bongaon, West Bengal743235, India,*

Corresponding Author: **Sarnali Sarkar**

ABSTRACT: Childhood growth is an important indicator of nutritional and developmental status. The present study examined anthropometric characteristics and their associations with age and family composition among 431 children. Height, weight, mid-upper arm circumference (MUAC), and head circumference were assessed using descriptive statistics, correlation analysis, and multiple linear regression. The results revealed significant positive correlations between age and all four anthropometric measurements. Height showed the strongest correlation ($r = 0.666$, $p < 0.001$), followed by weight ($r = 0.509$, $p < 0.001$), MUAC ($r = 0.372$, $p < 0.001$), and head circumference ($r = 0.271$, $p < 0.001$). Regression analyses identified age as a significant positive predictor of all four anthropometric outcomes. However, the number of brothers, number of sisters, and parity showed no statistically significant independent associations with these measurements. The findings highlight age as an important correlate of childhood anthropometric variation and indicate the need for further research incorporating socioeconomic, nutritional, and environmental factors to better understand childhood growth patterns.

KEYWORDS: Height, Weight, MUAC, Head Circumference

I. INTRODUCTION

Growth during childhood is a key sign of overall health, nutritional status, and biological development. Anthropometric measurements are frequently employed in biological anthropology, pediatrics, and public health studies to evaluate physical growth. Complementary data regarding children's physical development can be obtained from measurements including height, body weight, head circumference, and mid-upper arm circumference (MUAC). However, how they are interpreted depends on a number of variables, including age, sex, developmental stage, and the population reference. Using information from its Multicentre Growth Reference Study, the World Health Organization (WHO) developed child growth standards that offer a methodical framework for evaluating children's physical development (WHO 2006,2007).

Because body proportions alter throughout childhood, age has a significant role in anthropometric variation. While changes in MUAC and head circumference reflect various elements of somatic growth and development, height and weight typically rise as children grow. Researchers can better understand patterns of physical growth within a group by looking at the relationship between age and these metrics. However, rather than being direct indicators of an individual's development over time, age-related variances found in a cross-sectional study reflect disparities between individuals of various ages.

Biological, socioeconomic, and family-level factors also affect anthropometric variation. Through variations in the distribution of household resources, caregiving, nutrition, and parental attention, family composition—including birth order, the number of siblings, and parental reproductive history—may be linked to children's development. These connections could change depending on the social and cultural setting. Birth order and sibling gender may have a significant role in explaining variations in children's height, according to research done in India. Using information from around 168,000 children, Jayachandran and Pandi (2017) found that sibling gender had an impact on the relationship between height and birth order.

The importance of population-specific evidence is also reflected in recent research on Indian children's growth. Majumder et al. (2024) developed anthropometric growth references for Indian children and adolescents using data from national surveys. Their findings highlighted differences between the proposed Indian growth references and WHO standards, emphasizing the need to consider the reference population when interpreting growth patterns. Chandna and Bhagowalia (2024) examined the relationship between birth order and children's height using nationally representative data from the India Human Development Survey for 2005 and 2011. They reported a negative association between birth order and height-for-age z-scores, with the relationship varying according to son preference and sibling gender. The study also examined educational outcomes, illustrating that early-life disadvantages may have implications beyond physical growth. West Bengali research has also investigated the connection between anthropometry and familial traits. Ghosh and Bandyopadhyay (2006) examined the number of siblings, birth order, and home income in a sample of 171 adult Bengali women from Kolkata. They found strong correlations between these factors and a number of body composition and size measurements. This study offers pertinent regional evidence that family and socioeconomic factors may be related to anthropometric variation, even though it focused on adults rather than children. However, its conclusions shouldn't be seen as immediately applicable to kids.

The associations between age, family composition, and numerous anthropometric measurements need more research in particular communities, even though earlier studies have looked at child growth, nutritional status, and family-level impacts. A more comprehensive knowledge of anthropometric variance can be obtained by analyzing height, weight, MUAC, and head circumference within the same analytical framework as opposed to focusing only on one measurement.

Therefore, the current study looks at the anthropometric traits of 431 Child and looks at the connections between certain anthropometric measurements and age. It also assesses whether children's height, weight, MUAC, and head circumference are independently correlated with age, the number of brothers and sisters, and parity. The study attempts to provide population-specific data on childhood anthropometric variance and its relationship with particular demographic and family-composition characteristics by combining descriptive statistics, correlation analysis, and multiple linear regression.

II. OBJECTIVES

1. To assess the anthropometric characteristics of the study participants in terms of height, weight, midupper arm circumference (MUAC), and head circumference.
2. To examine the correlation between age and selected anthropometric measurements, including height, weight, MUAC, and head circumference.
3. To investigate the associations of age, number of brothers, number of sisters, and parity with all anthropometric characteristics of the children

III. METHODOLOGY

This was a cross-sectional study conducted among 431 children aged 6-9 years of North 24 Parganas, West Bengal. Used a quantitative anthropometric technique to examine the association between age, family composition, and specific anthropometric measurements using a sample of 431 children. Height, body weight, mid-upper arm circumference (MUAC), and head circumference were the main variables analyzed. Every participant's

measurements were taken at one time, a cross-sectional design would be suitable; the data-collection technique should validate the actual study design.
Height (cm), body weight (kg), MUAC (cm), and head circumference (cm) were the four dependent variables in the anthropometric evaluation. Years of age were regarded as an explanatory variable. The number of brothers, sisters, and parity served as indicators of family composition. These factors were examined to see if variations in children's anthropometric measurements were related to age and family structure.

For statistical analysis SPSS version 13 was used. Statistical significance was assessed using the reported p-values, with ($p<0.05$) conventionally considered statistically significant.

IV. RESULTS

Table 1 reveals average height and body weight of the 431 study participants were 124.11 ± 8.71 cm and 25.77 ± 7.19 kg, respectively, according to the descriptive analysis. The average head circumference was 49.64 ± 2.24 cm, and the average mid-upper arm circumference (MUAC) was 18.38 ± 2.98 cm. An overview of the anthropometric traits of the study population is given by these results. Compared to head circumference, weight and MUAC showed comparatively higher variability among the measurements, suggesting variations in the distribution of these values among subjects. Nevertheless, the children's nutritional status cannot be ascertained using these descriptive statistics alone.

Table 2 shows that age and all four anthropometric parameters showed statistically significant positive correlations, according to correlation analysis. The strongest association was found between height and age ($r=0.666$, $p<0.001$), followed by weight ($r=0.509$, $p<0.001$), MUAC ($r=0.372$, $p<0.001$), and head circumference ($r=0.271$, $p<0.001$). According to these findings, older participants' anthropometric measurements were often higher than those of younger participants. Compared to the other measurements in this sample, height appears to have fluctuated more closely with age, as indicated by the somewhat greater correlation between age and height. The least significant relationship between head circumference and age was found. Overall, the results show that anthropometric variation among study participants is correlated with age.

Table 3 represents independent relationships between children's height and age, number of brothers, number of sisters, and parity were investigated using multiple linear regression analysis. Height was shown to be significantly positively correlated with age ($B=5.388$, standardized beta=0.670, $p<0.001$). Each extra year of age was linked to an estimated 5.388 cm increase in height after controlling for the other factors. On the other hand, parity, the number of sisters, and the number of brothers were found to be statistically insignificant predictors. The overall regression model was found to be statistically significant ($F=86.206$, $p<0.001$), indicating that the predictors as a whole had a substantial correlation with height.

In Table 4 regression analysis, children's weight was significantly positively predicted by age ($B=3.392$, standardized beta=0.511, $p<0.001$). Every extra year of age was linked to an estimated 3.392 kg rise in body weight, all other things being equal. There were no statistically significant predictors for the number of brothers ($B=0.004$, $p=0.967$)), number of sisters ($B=0.092$, $p=0.340$), or parity ($B=0.335$, $p=0.484$)). The model as a whole was statistically significant ($F=37.606$, $p<0.001$). The included predictors explained about 26.1% of the variation in children's weight, with an adjusted estimate of 25.4%, according to the model's R^2 of 0.261 and adjusted R^2 of 0.254. These results imply that age had a stronger correlation with weight than the model's family-composition factors.

Table 5 depicts age and mid-upper arm circumference had a substantial positive correlation, according to the regression results ($B=1.024$, standardized beta=0.372, $p<0.001$). A one-year increase in age was linked to an estimated 1.024 cm rise in MUAC after adjusting for parity, the number of brothers, and the number of sisters. Nevertheless, there were no statistically significant independent relationships between MUAC and the number of brothers ($B=0.037$, $p=0.373$\)), number of sisters ($B=0.051$, $p=0.239$), or parity ($B=0.059$, $p=0.782$).Overall, the regression model was significant ($F=17.667$, $p<0.001$). The predictors explained 14.2% of the observed variation in MUAC, which dropped to 13.4% following adjustment, according to the 0.142 and 0.134 adjusted R^2 values.

The results show that, although the majority of its variation remained unexplained, age was a significant predictor of MUAC within the given model.

In Table 6 age was found to be a significant positive predictor of head circumference (B=0.570, standardized beta=0.275, p<0.001) in the multiple linear regression analysis. Each extra year of age was linked to an estimated 0.570 cm increase in head circumference after controlling for the other factors. The number of sisters (B=0.022, p=0.507), number of brothers (B=-0.016, p=0.615), and parity (B=0.212, p=0.203) were not statistically significant predictors. The model as a whole was statistically significant (F=9.219, p<0.001). The predictors accounted for 8.0% of the variation in head circumference, or 7.1% after adjustment, according to the calculated R^2 value of 0.080 and the corrected R^2 value of 0.071. This implies that while there was a substantial correlation between age and head circumference, the model's predictors only accounted for a small percentage of the total variation.

V. DISCUSSION

Age had a positive correlation with height (r=0.666), weight (r=0.509), MUAC (r=0.372), and head circumference (r=0.271); all of these correlations were statistically significant at (p<0.001). In the provided regression models, age continued to be a significant predictor of every outcome. According to these findings, the study sample's older children often had higher anthropometric measurements. Age heterogeneities in child growth and the sociodemographic parameters that are linked to them: A cross-sectional study conducted in India examined agerelated trends in height-for-age and weight-for-age using data from the country's 2015–2016 National Family Health Survey. Although the degree varied, the researchers found that growth faltered during the first two years of life across socioeconomic categories. Their research shows that age-related variations in children's growth can be complicated and can alter depending on developmental stages and socioeconomic conditions (Yadav et al.2022). This research is supplemented by the current study, which looks at head circumference, MUAC, and raw height and weight measures. The current study offers raw anthropometric measures and correlations with age, while the Indian national survey evaluated normalized height-for-age and weight-for-age indicators. As a result, while agerelated disparities within the sample are established by the current data, it is unclear if the children were growing appropriately in relation to age-specific norms.

The number of brothers, sisters, and parity were not shown to be statistically significant independent predictors of height, weight, MUAC, or head circumference, which is a major finding of the current study. In contrast, other research indicates that children's anthropometric and nutritional traits may be related to the makeup of their siblings.

Magvanjav et al. (2013) investigated sibling composition and children's anthropometric indicators among the Tsimane population of Bolivia. Their longitudinal analysis included approximately 337 children aged 2–9 years. Among girls, an additional older brother was associated with a 1.4% decrease in MUAC and a 4.3% decrease in arm muscle area; an additional younger sister was associated with a 6.3% decrease in triceps skinfold thickness. These findings indicate that the relationship between sibling composition and anthropometry may depend on the particular sibling category and anthropometric outcome examined. In comparison, the present study did not identify statistically significant independent associations between the number of brothers or sisters and MUAC. One possible explanation for this difference is the variation in population characteristics and analytical design. Magvanjav et al. examined the effects of specific older and younger siblings in a longitudinal dataset, whereas the present study used broader sibling-count variables in multiple linear regression. Therefore, the two studies are not directly equivalent, and the findings suggest that sibling composition should be investigated using appropriately detailed family variables rather than interpreted solely through total sibling counts.

A larger study by Yu et al. (2020), conducted among 84,075 children aged 3–12 years in Shanghai, China, examined the associations between sibling number, birth order, and childhood thinness. The researchers reported that the associations varied according to sex, sibling number, and birth-order position. For example, boys with two or more siblings had higher odds of more severe thinness than boys without siblings, while different patterns were observed among girls. These findings differ from the present study, in which the number of brothers and sisters was not reported as a significant independent predictor of the continuous anthropometric measurements. However, the difference should be interpreted cautiously. Yu et al. investigated categorical thinness based on BMI

cut-offs, whereas the present study analysed height, weight, MUAC, and head circumference as continuous outcomes. A family variable may be associated with the probability of falling into a nutritional category without demonstrating a statistically significant association with every continuous anthropometric measurements

The present study showed a significant positive correlation between age and MUAC ($r=0.372$, $p<0.001$). In the adjusted regression model, age remained a significant predictor ($B=1.024$, standardized beta$=0.372$, $p<0.001$), while the family-composition variables were not statistically significant. The model explained 14.2% of the observed variation in MUAC. Ashtekar et al. (2020) studied the use of MUAC as a growth parameter among schoolchildren aged 6–18 years in Nashik district, Maharashtra, India. Their sample included 2,270 children, and they examined MUAC in relation to BMI, height, age, sex, and social categories. They reported strong correlations between MUAC and BMI in both boys and girls. This study supports the usefulness of MUAC as an anthropometric measurement in school-aged populations. The present study extends this line of investigation by examining age and family composition as predictors of MUAC. Nevertheless, the two studies addressed different research questions: Ashtekar et al. primarily evaluated MUAC in relation to BMI and other growth characteristics, while the present study examined its independent association with age and family variables. Since BMI and nutritional-status classifications were not included in the supplied tables, the current findings cannot establish the nutritional status of the participants.

The present study's non-significant regression coefficients for sibling counts and parity indicate that these variables did not show clear independent associations with the four anthropometric outcomes after adjustment for the other included predictors. This result is important because the relationship between family size and children's growth is not necessarily straightforward. A study by Endogenous inclusion in the Demographic and Health Survey anthropometric sample: Implications for studying height within households examined data from India and sub-Saharan Africa and demonstrated that estimated relationships between fertility, sibling number, and children's height can depend on sample selection and the age restrictions of the available anthropometric data. In the Indian sample, children born to higher-fertility mothers were shorter on average than children born to lower-fertility mothers, yet later-born children were taller than earlier-born children when comparisons were made among children with the same sibling-group size and age adjustment.

This research highlights an important distinction between the number of children in a family and a child's position within that family. It also illustrates why the non-significant sibling-count coefficients in the present study should not be interpreted as evidence that family structure is universally unrelated to growth. The results indicate only that the particular family variables, as measured and modelled in this sample, did not show statistically significant independent associations.

VI. CONCLUSION

The present study examined the anthropometric characteristics of 431 children and investigated the associations of age and family composition with height, weight, mid-upper arm circumference (MUAC), and head circumference. The findings revealed significant positive correlations between age and all four anthropometric measurements, with height showing the strongest association, followed by weight, MUAC, and head circumference. Multiple linear regression analyses further demonstrated that age was a significant positive predictor of all four anthropometric outcomes, indicating that older children generally had larger anthropometric measurements within the study population.

In contrast, the number of brothers, number of sisters, and parity did not demonstrate statistically significant independent associations with the anthropometric outcomes in the reported regression models. The explanatory power of the models varied across measurements, with the weight model explaining a greater proportion of the observed variation than the MUAC and head-circumference models. These findings suggest that although age is an important correlate of childhood anthropometric variation, the family-composition variables included in the analysis provide limited evidence of independent associations within this sample.

Overall, the study highlights the importance of considering age when examining anthropometric variation among children and demonstrates the value of assessing multiple anthropometric indicators within a common analytical

framework. Future research incorporating age- and sex-standardized growth indicators, socioeconomic characteristics, nutritional factors, and more detailed measures of family structure may provide a more comprehensive understanding of the determinants of childhood growth.

References:

[1.] Chandna, A., & Bhagowalia, P. (2024). Birth order and children's health and learning outcomes in India. Economics & Human Biology, 52, 101348. https://doi.org/10.1016/j.ehb.2023.101348

[2.] Ghosh, J. R., & Bandyopadhyay, A. R. (2006). Income, birth order, siblings, and anthropometry. Human Biology, 78(6), 733–741. https://doi.org/10.1353/hub.2007.0012

[3.] Jayachandran, S., & Pandi, R. (2017). Why are Indian children so short? The role of birth order and son preference. American Economic Review, 107(9), 2600–2629. https://doi.org/10.1257/aer.20151282

[4.] Majumder, R., Kurpad, A. V., Sachdev, H. S., Thomas, T., & Ghosh, S. (2024). Anthropometric growth reference for Indian children and adolescents. Indian Pediatrics, 61(5), 425–434. https://doi.org/10.1007/s13312024-3128-x

[5.] World Health Organization. (2006). WHO child growth standards: Length/height-for-age, weight-forage, weight-for-length, weight-for-height and body mass index-for-age: Methods and development. World Health Organization. https://www.who.int/publications/i/item/924154693X

[6.] World Health Organization. (2007). WHO child growth standards: Head circumference-for-age, arm circumference-for-age, triceps skinfold-for-age and subscapular skinfold-for-age: Methods and development. World Health Organization. https://www.who.int/publications/i/item/9789241547185

[7.] Ashtekar, S. V., Padhyegurjar, M. S., Powar, J. D., & Padhyegurjar, S. B. (2020). Mid-upperarmcircumference as a growth parameter and its correlation with body mass index and heights in Ashram school students in Nashik District in Maharashtra, India. Indian Journal of Community Medicine, 45(4), 419–424. https://doi.org/10.4103/ijcm.IJCM_446_19

[8.] Magvanjav, O., Undurraga, E. A., Eisenberg, D. T. A., Zeng, W., Dorjgochoo, T., Leonard, W. R., TAPS Bolivian Study Team, & Godoy, R. A. (2013). Sibling composition and children's anthropometric indicators of nutritional status: Evidence from native Amazonians in Bolivia. Annals of Human Biology, 40(1), 23–34. https://doi.org/10.3109/03014460.2012.728621

[9.] Yu, T., Chen, C., Jin, Z., Yang, Y., Jiang, Y., Hong, L., Yu, X., Mei, H., Jiang, F., Huang, H., Liu, S., & Jin, X. (2020). Association of number of siblings, birth order, and thinness in 3- to 12-year-old children: A population-based cross-sectional study in Shanghai, China. BMC Pediatrics, 20, 367. https://doi.org/10.1186/s12887-020-02261-z

[10.] Endogenous inclusion in the Demographic and Health Survey anthropometric sample: Implications for studying height within households. (2022). Journal of Development Economics. https://doi.org/10.1016/j.jdeveco.2021.102783

[11.] Yadav, S., & Bhandari, P. (2022). Age heterogeneities in child growth and its associated socio-demographic factors: a cross-sectional study in India. BMC Pediatrics, 22(1), 384.

Table 1: Descriptive Statistics of Anthropometric measurements among the Study participants (n=431)

Anthropometric measures	Mean	SD
Height (cm)	124.11	8.71
Weight (kg)	25.77	7.19
MUAC (cm)	18.38	2.98
Head circumference (cm)	49.64	2.24

Table 2: Correlation between Age and Anthropometric measurements among the Study participants (n=431)

Anthropometric measures	Age in y ears	
	r-value	p-value
Height	0.666	<0.001***
Weight	0.509	<0.001***
MUAC	0.372	<0.001***
Head circumference	0.271	<0.001***

Table 3: Multiple Linear Regression analysis of Age and Family composition as predictors of Children's Height

Predictors	B	SE	Standardized beta	t-value	p-value
Age	5.388	0.290	0.670	18.561	<0.001***
No. of brothers	-0.119	0.097	-0.049	-1.228	0.967
No. of sisters	0.033	0.101	0.013	0.328	0.340
Parity	0.193	0.501	0.016	0.385	0.484
R^2= 0.261, Adjusted R^2= 0.442, F-statistic= 86.206, Overall model p-value= <0.001***					

Table 4: Multiple Linear Regression analysis of Age and Family composition as predictors of Children's Weight

Predictors	B	SE	Standardized beta	t-value	p-value
Age	3.392	0.277	0.511	12.338	<0.001***
No. of brothers	0.004	0.092	0.002	0.041	0.967
No. of sisters	0.092	0.096	0.045	0.954	0.340
Parity	0.335	0.478	0.033	0.701	0.484
R^2= 0.261, Adjusted R^2= 0.254, F-statistic= 37.606, Overall model p-value= <0.001***					

Table 5: Multiple Linear Regression analysis of Age and Family composition as predictors of Children's MUAC

Predictors	B	SE	Standardized beta	t-value	p-value
Age	1.024	0.124	0.372	8.275	<0.001***
No. of brothers	0.037	0.041	0.044	0.891	0.373
No. of sisters	0.051	0.043	0.060	1.180	0.239
Parity	0.059	0.213	0.014	0.278	0.782
R^2= 0.142, Adjusted R^2= 0.134, F-statistic= 17.667, Overall model p-value= <0.001***					

Table 6: Multiple Linear Regression analysis of Age and Family composition as predictors of Children's Head circumference

Predictors	B	SE	Standardized beta	t-value	p-value
Age	0.570	0.097	0.275	5.904	<0.001***
No. of brothers	-0.016	0.032	-0.026	-0.503	0.615
No. of sisters	0.022	0.034	0.035	0.664	0.507
Parity	0.212	0.167	0.067	1.275	0.203
R^2= 0.080, Adjusted R^2= 0.071, F-statistic= 9.219, Overall model p-value= <0.001***					