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Relationship between Cephalic Anthropometry and Somatotype among Adolescents of Hausa Ethnic Group in Kano Metropolis, Nigeria

Abdulfattah Moisule Ganga[1], Maryam Isa Sharif[2], Lawan Hassan Adamu[3], Rabiu Inuwa Fage[2]

[1]Department of Human Anatomy, Faculty of Basic Medical Sciences, College of Medical Sciences, Yobe State University, Damaturu
[2]Department of Anatomy, Faculty of Basic Medical Sciences, College of Health Sciences, Bayero University, Kano
[3]Department of Human Anatomy, Faculty of Basic Medical Sciences, College of Medicine and Health Sciences, Federal University, Dutse, Nigeria.

Corresponding Author: Rabiu Inuwa Fage

Email: rifage.ana@buk.edu.ng, Tel: 08035558370

ABSTRACT

Anthropometric studies are very important areas for craniofacial surgery and syndromology. Surgeons use these measurements to understand the unique features of a patient's face, head and body, helping them tailor their surgical approaches for optimal results. It aids in achieving aesthetic and functional improvements. Different syndromes often have distinct physical features and body proportions. By analyzing these measurements, healthcare professionals can diagnose and categorize syndromes, enabling appropriate treatment, genetic counselling, and further research. The study aimed to determine the relationship between head anthropometry (cephalic length and breadth) and somatotype among adolescents of Hausa lineage in Kano Metropolis. The design was cross-sectional. The sample size for the study was 391 subjects comprising male (196) and female (195) subjects with a median age of 15.0 from selected secondary schools in the Kano metropolis. Simple random sampling was employed to select the secondary schools and the participants. Anthropometric somatotyping was used and participants were classified into three basic somatotypes; endomorph, mesomorph and ectomorph. Cephalic anthropometry was measured using standard protocol. Spearman's correlation was used to determine the relationship between somatotype dominant components and cephalic anthropometry (cephalic length and breadth), stepwise logistic regression analysis was deployed to predict somatotype components from cephalic parameters. A significant correlation was found between cephalic measurements and somatotype components, somatotype components were significantly predicted from cephalic parameters and cephalic breadth was the best predictor. From the findings, it can be concluded that there is an existence of a relationship between cephalic anthropometry and somatotypes of the ethnicity studied.

Keywords: cephalic anthropometry, adolescents, somatotype, endomorph, mesomorph, ectomorph, regression.

INTRODUCTION

Anthropometric studies are very important area for craniofacial surgery and syndromology[1]. Somatotype is a taxonomy used in describing body physique or shape[2]. The term somatotype and its three components (endomorph, mesomorph and ectomorph) were first described in 1940 by Sheldon and his coworkers. Endomorphy means the relative predominance of soft roundness throughout the various regions of the body, while mesomorphy refers to the relative predominance of muscle, bone and connective tissue and ectomorphy is the relative predominance of linearity and fragility[3]. Later Heath and Carter introduced the simplified method for somatotyping and in the last few decades, anthropometric somatotyping is one of the most used methods which describe the body shape and composition[4]. It has been the most used for studying body physique variations in children, adolescents and adults among populations, age changes and sex differences[5].

Many of the research studies reported sexual dimorphism in somatotypes. Bojadzieva and colleagues reported that Macedonian adolescent males and females are more endomorphic; they also reported that Albanian adolescent males are mesomorphic and females are ectomorphic[6]. Buffa and his colleagues also reported that male Sardinians are mostly mesomorphic; they also reported that female Sardinians are mostly endomorphic[7]. There is a study that showed both male and female Venezuelans to be mesomorphic[8].

Jilani reported that Turkish males have long nose and females have broad type of nose[9]. Pandeya and Atreya worked on Devdaha Medical College students and reported significant sexual dimorphism in facial length and breadth[10]. Mauritanian population recorded significant sexual dimorphism in cephalic length and breadth[11]. A significant sexual dimorphism in nasal length and breadth was recorded among Tiv and Idoma tribes of Nigeria[12]. Facial length and breadth of Malay population were found to be sexually dimorphic with females having higher values[13]. Some researchers reported significant correlation between somatotype and cephalic length and breadth among Igbo tribe of Abakaliki, Nigeria[14].

There have been cases of insurgency around the northern part of Nigeria and Nigeria as a whole, the problem of child abduction and change of identity to another region of the country is also alarming. Studies have been done on somatotypes, cephalic aspects of the body aiming at identification of individuals, ethnic and age differences etc. Data or literature has been scarce on the relationships between somatotypes and cephalic anthropometry in Kano State which is very important in human identification. Somatotypes and cephalic anthropometry can help in identifying individuals by analyzing their body build, cephalic and facial characteristics, especially when only skeletal remains are available. This information can be crucial in solving criminal cases and providing closure to families. In craniofacial surgery, somatotypes and cephalic anthropometry play a significant role in surgical planning and treatment outcomes. Surgeons use these measurements to understand the unique features of a patient's face and body, helping them tailor their surgical approaches for optimal results. It aids in achieving aesthetic and functional improvements. They also contribute to the study and classification of genetic syndromes. Different syndromes often have distinct physical features and body proportions. By analyzing these measurements, healthcare professionals can diagnose and categorize syndromes, enabling appropriate treatment, genetic counselling, and further research. This study aimed to determine the relationship between cephalic anthropometry (cephalic length and breadth) and somatotype among adolescents of the Hausa ethnic group in the Kano metropolis.

MATERIALS AND METHODS

A cross-sectional design was used in the study which was conducted in the eight (8) Local Government Areas (LGAs) of Kano metropolis and sixteen (16) secondary schools (two from each of the LGAs) were randomly selected. The sample size of the study was 391 subjects comprising male and female participants. The participants were adolescent Hausas aged 11-19 years who were also grouped into early (11-14 years), middle (15-17 years) and late (18-19 years) adolescent stages. The study included any student belonging to the selected secondary schools, any student that belongs to Hausa ethnicity and any student without physical deformity on the area of interest of the study.

Ethical Consideration

The protocol involved in the study was approved by the committee on ethics, Kano State Ministry of Health (MOH/Off/797/T. I/1915). Informed consent was also obtained from the participants' guardians.

Methods

Collection of Biodata

A simple proforma was used to collect the bio-data such as sex, age and ethnicity (Hausa) of the participants.

Cephalometry

The cephalic length was measured using a vernier caliper, cephalic breadth was measured using a spreading caliper. The cephalic length was measured as the distance between the glabella and the inion in the midline, the cephalic breadth was measured as the horizontal distance between the two euryons, cephalic index was calculated as the ratio of head breadth to head length multiplied by 100[15].

Determination of Somatotype

Height was measured using a stadiometer, weight was measured using a weight scale, skinfolds (triceps, supraspinale, subscapular and medial calf) were measured using a skinfold caliper, epicondylar breadths (femur and humerus) were measured using a vernier caliper and circumferences (arm and calf) were measured using a measuring tape. Height was measured with the subject standing straight, against an upright wall or stadiometer, touching the wall with the heels, buttocks and back[15]. Body mass (weight) was measured while the subject was wearing minimal clothing, stands in the centre of the scale platform and recorded to the nearest tenth of a kilogram. Skinfold measurement was obtained by raising a fold of skin and subcutaneous tissue firmly between the thumb and forefinger of the left hand and away from the underlying muscle. The edges of the plates on the caliper were placed 1 cm below the fingers of the left hand and was allowed to exert their full pressure before reading at 2 sec the thickness of the fold. All skinfolds were measured on the right side of the body. Triceps skinfold was measured with the subject's arm hanging loosely in the anatomical position, a skinfold was raised at the back of the arm at a level halfway on a line connecting the acromion and the olecranon processes, subscapular skinfold measurement was done when a fold of skin was raised on a line from the inferior angle of the scapula in a direction that is obliquely downwards and laterally at 45 degrees, supraspinale skinfold was measured when a fold of skin was raised above the anterior superior iliac spine on a line to the anterior axillary border and a diagonal line going downwards and medially at 45 degrees. (This skinfold was formerly called suprailiac, or anterior suprailiac. The name has been changed to distinguish it from other skin folds called "suprailiac", but taken at different locations); Medial calf skinfold: A vertical skinfold was raised on the medial side of the leg, at the level of the maximum girth of the calf[16].

The following formulae were used to determine the somatotypes: -

Endomorphy = -0.7182 + 0.1451(X) -0.00068(X^2) + 0.0000014(X^3)

Where X = (sum of triceps, subscapular and supraspinale skinfolds) × (170.18/height)

Mesomorphy = 0.858 × humerus breadth +0.601×femur breadth +0.161× arm girth + 0.161× calf girth height0.131+ 4.5

Ectomorphy: The following are the formulae for ectomorphy depending on the value of Height-weight ratio (HWR): -

Height-weight ratio (HWR) =$\frac{\text{Height}}{3\sqrt{\text{Weight}}}$

- Ectomorphy= 0.732HWR - 28.58 (If HWR is ≥ 40.75)
- Ectomorphy= 0.463HWR-17.63 (If HWR is < 40.75 > 38.25)
- Ectomorphy= 0.1 (If HWR is ≤ 38.25)

An extreme somatotype will be 711, 171 and 117 for Endomorph, Mesomorph and Ectomorph respectively[16].

Measurement Error

Measurement error was determined using intra-class correlation (ICC). The Cronbach's Alpha of the parameters measured ranged from 0.82 to 1, except for cephalic breadth which has 0.72. Where Cronbach's Alpha of > 0.70 indicates a strong reliability[17]. The measurements were carried out on only 30 selected participants.

Statistical Analysis

Data were expressed as median and interquartile range (IQR) for the directly measured variables. Kolmogorov-Smirnov normality test was performed to check the distribution nature of the data. Since the data were not evenly distributed, non-parametric tests were used. Comparisons of cephalic dimensions, dominant somatotype components of the two sexes were made using the Mann-Whiteny U test, a relationship between cephalic variables and somatotypes was made using the Spearman correlation, the stepwise binary logistic regression analysis was performed to predict the somatotypes from cephalic anthropometry. Statistical significance was declared at $P < 0.05$. Data was analyzed using SPSS (IMB, corporation, NY) version 29.

RESULTS

In this study, as demonstrated in Table 1, we observed that the average cephalic length was greater than average cephalic breadth. In somatotype measurements, height recorded a higher median (IQR) value than the rest. In somatotype dominant components, ectomorph recorded a higher median (IQR) value. The negative skewness was observed in height, cephalic breadth and biepicondylar breadth of humerus, only age recorded negative Kurtosis. The variables with maximum and minimum skewness were subscapular skinfold and cephalic breadth respectively, and for kurtosis, cephalic index and age have the maximum and minimum values respectively.

Table 1: Descriptive statistics and normality distribution of selected cephalic anthropometry, somatotype measurements and components

Variables	Min-Max	Median (IQR)	Skewness	Kurtosis
Age (Years)	12-19	15.00 (3.0)	0.13	-0.78
Height (cm)	128.00-184.30	159.00 (12.2)	-0.25	0.13
Weight (kg)	25.00-96.00	45.00 (12.6)	0.75	1.51
Cephalic Breadth (cm)	8.00-19.00	13.50 (1.5)	-0.32	5.13
Cephalic Length (cm)	11.00-24.00	18.50 (1.0)	0.39	6.63
Cephalic Index	44.44-118.18	75.00 (6.3)	0.57	7.60
Biepicondylar B H (mm)	30.09-84.90	61.38 (7.7)	-0.08	1.58
Biepicondylar B F (mm)	54.24-126.91	81.60 (11.3)	0.44	1.34
Triceps S F (mm)	3.30-32.40	8.70 (4.8)	1.70	3.68
Subscapular S F (mm)	2.90-31.50	9.10 (4.0)	2.08	6.66
Supraspinale S F (mm)	2.20-30.60	8.50 (4.3)	1.96	5.46
Medial Calf S F (mm)	3.80-34.50	10.10 (5.6)	1.37	2.86
Arm Circumference (cm)	13.80-39.00	23.00 (3.5)	0.90	2.68
Calf Circumference (cm)	19.50-45.00	29.50 (4.0)	0.64	2.25
Endomorph	0.63-8.04	2.93 (1.3)	1.47	2.86
Mesomorph	-1.77-11.63	3.09 (1.9)	0.60	3.03
Ectomorph	0.10-10.32	3.68 (1.4)	-0.15	0.89

BH= Biepicondylar breadth of humerus, BF= Biepicondylar breadth of femur, SF= Skinfold, IQR= Interquartile range

Table 2 shows sexual dimorphism in selected cephalic anthropometry and somatotype measurements among all adolescents of the Hausa ethnic group in Kano metropolis. A significant sexual dimorphism was observed in age, cephalic length, breadth and index; biepicondylar breadths of humerus and femur; triceps, subscapular, supraspinale and medial calf skin folds; arm and calf circumferences (P<0.001).

Table 2: Sexual dimorphism in selected cephalic anthropometry and somatotype measurements among all adolescents of the Hausa ethnic group in Kano metropolis

	Median (IQR)			
Variables (N=391)	**Female**	**Male**	**Z value**	**P value**
Age (Years)	15.00 (2.0)	16.00 (3.0)	-3.61	<0.001
Height (cm)	158.30 (10.1)	159.50 (14.8)	-1.998	0.046
Weight (kg)	43.50 (11.0)	46.00 (1654)	-1.612	0.107
Cephalic Breadth (cm)	13.00 (1.0)	14.00 (1.5)	-9.751	<0.001
Cephalic Length (cm)	18.00 (1.0)	18.50 (1.5)	-6.681	<0.001
Cephalic Index	73.68 (8.3)	75.68 (5.4)	-3.82	<0.001
Biepicondylar B H (mm)	59.57 (7.3)	63.11 (7.9)	-5.47	<0.001
Biepicondylar B F (mm)	78.46 (8.3)	87.09 (10.7)	-10.807	<0.001
Triceps S F (mm)	11.00 (6.1)	7.30 (2.1)	-12.127	<0.001
Subscapular S F (mm)	10.50 (5.0)	8.20 (2.7)	-7.374	<0.001
Supraspinale S F (mm)	9.50 (4.9)	7.50 (3.7)	-6.07	<0.001
Medial Calf S F (mm)	13.00 (5.6)	8.00 (3.2)	-12.568	<0.001
Arm Circumference (cm)	22.50 (3.5)	23.00 (4.0)	-1.025	0.306
Calf Circumference (cm)	28.60 (4.0)	30.00 (4.0)	-4.204	<0.001

B H=Breadth of Humerus. B F= Breadth of Femur, S F= Skin fold, IQR= Interquartile range

Table 3 shows sexual dimorphism in selected cephalic anthropometry and somatotype measurements among early, middle and late adolescents of Hausa ethnic group in Kano State. In the early adolescent age stage, a significant sexual dimorphism was observed in cephalic breadth, biepicondylar breadth of the femur, triceps skinfold, subscapular skinfold, supraspinale skinfold and medial Calf skinfold (P<0.001). In the middle adolescent age stage, a significant sexual dimorphism was observed in cephalic breadth, cephalic length, biepicondylar breadth of humerus, biepicondylar breath of femur, triceps skinfold, subscapular skinfold, supraspinale skinfold and medial calf skinfold (P<0.001). And in late adolescent age stage, a significant sexual dimorphism was observed in the biepicondylar breadth of the femur and triceps skinfold (P<0.001).

Table 3: Sexual dimorphism in selected cephalic anthropometry and somatotype measurements among early, middle and late adolescents of the Hausa ethnic group in Kano metropolis

	Early (N=128)				**Middle (N=201)**				**Late (N=62)**			
	Median (IQR)				**Median (IQR)**				**Median (IQR)**			
Variables	**Female**	**Male**	**Z value**	**P value**	**Female**	**Male**	**Z value**	**P value**	**Female**	**Male**	**Z value**	**P value**
Age (Years)	13.50 (1.6)	14.00 (1.5)	-0.562	0.574	16.00 (1.3)	16.50 (1.4)	-0.009	0.993	18.50 (2.0)	19.00 (2.2)	-1.707	0.088
Height (cm)	153.00 (10.1)	140.50 (9.5)	-3.013	0.003	159.00 (11.0)	161.00 (11.5)	-1.28	0.201	157.50 (9.0)	166.50 (10.5)	-2.951	0.003
Weight (kg)	39.00 (10.0)	37.00 (9.5)	-2.065	0.039	46.50 (12.0)	46.00 (11.5)	-0.033	0.973	51.50 (13.0)	57.0 (15.0)	-2.006	0.045
Cephalic Breadth (cm)	13.50 (1.5)	14.00 (2.0)	-5.017	<0.001	13.20 (1.0)	14.00 (2.5)	-6.687	<0.001	13.00 (1.0)	14.50 (2.0)	-3.051	0.002
Cephalic Length (cm)	17.50 (3.0)	18.00 (3.5)	-3.206	0.001	18.00 (3.5)	18.50 (4.0)	-4.698	<0.001	20.00 (5.0)	19.00 (4.5)	-0.215	0.829
Cephalic Index	75.00 (8.5)	76.00 (9.0)	-1.488	0.137	73.00 (7.5)	75.00 (8.5)	-2.951	0.003	67.00 (6.7)	76.00 (9.1)	-2.596	0.009
Biepicondylar B H (mm)	57.00 (5.9)	59.10 (6.8)	-1.086	0.277	61.00 (7.0)	62.70 (7.1)	-4.27	<0.001	64.05 (8.0)	67.00 (9.2)	-0.646	0.518
Biepicondylar B F (mm)	77.00 (8.5)	83.00 (9.8)	-4.683	<0.001	79.10 (9.0)	88.00 (10.6)	-7.754	<0.001	78.00 (8.4)	90.00 (10.2)	-3.83	<0.001
Triceps S F (mm)	11.00 (6.0)	8.00 (4.8)	-5.978	<0.001	13.25 (6.4)	7.6 (3.8)	-9.718	<0.001	14.00 (7.0)	8.00 (5.0)	-3.608	<0.001
Subscapular S F (mm)	10.00 (5.2)	8.10 (4.9)	-5.021	<0.001	11.90 (7.0)	9.20 (6.3)	-7.343	<0.001	13.00 (8.4)	11.10 (7.7)	-0.991	0.322
Supraspinale S F (mm)	9.22 (5.0)	7.00 (3.9)	-3.515	<0.001	11.00 (6.0)	8.00 (4.4)	-5.514	<0.001	13.20 (7.8)	9.10 (5.0)	-1.66	0.097
Medial Calf S F (mm)	13.00 (7.6)	8.20 (5.0)	-7.21	<0.001	14.00 (8.0)	8.50 (4.7)	-9.918	<0.001	15.00 (9.0)	9.00 (4.9)	-3.129	0.002
Arm Circumference (cm)	20.90 (10.3)	21.20 (10.5)	-2.482	0.013	24.00 (12.0)	23.10 (11.3)	-0.323	0.747	24.00 (12.0)	26.00 (13.1)	-1.51	0.131
Calf Circumference (cm)	27.00 (14.0)	28.00 (14.3)	-0.311	0.756	29.30 (15.0)	30.00 (15.5)	-2.207	0.027	31.10 (16.0)	32.00 (16.3)	-1.7	0.089

B H=Breadth of Humerus. B F= Breadth of Femur, S F= Skin fold, IQR= Interquartile range

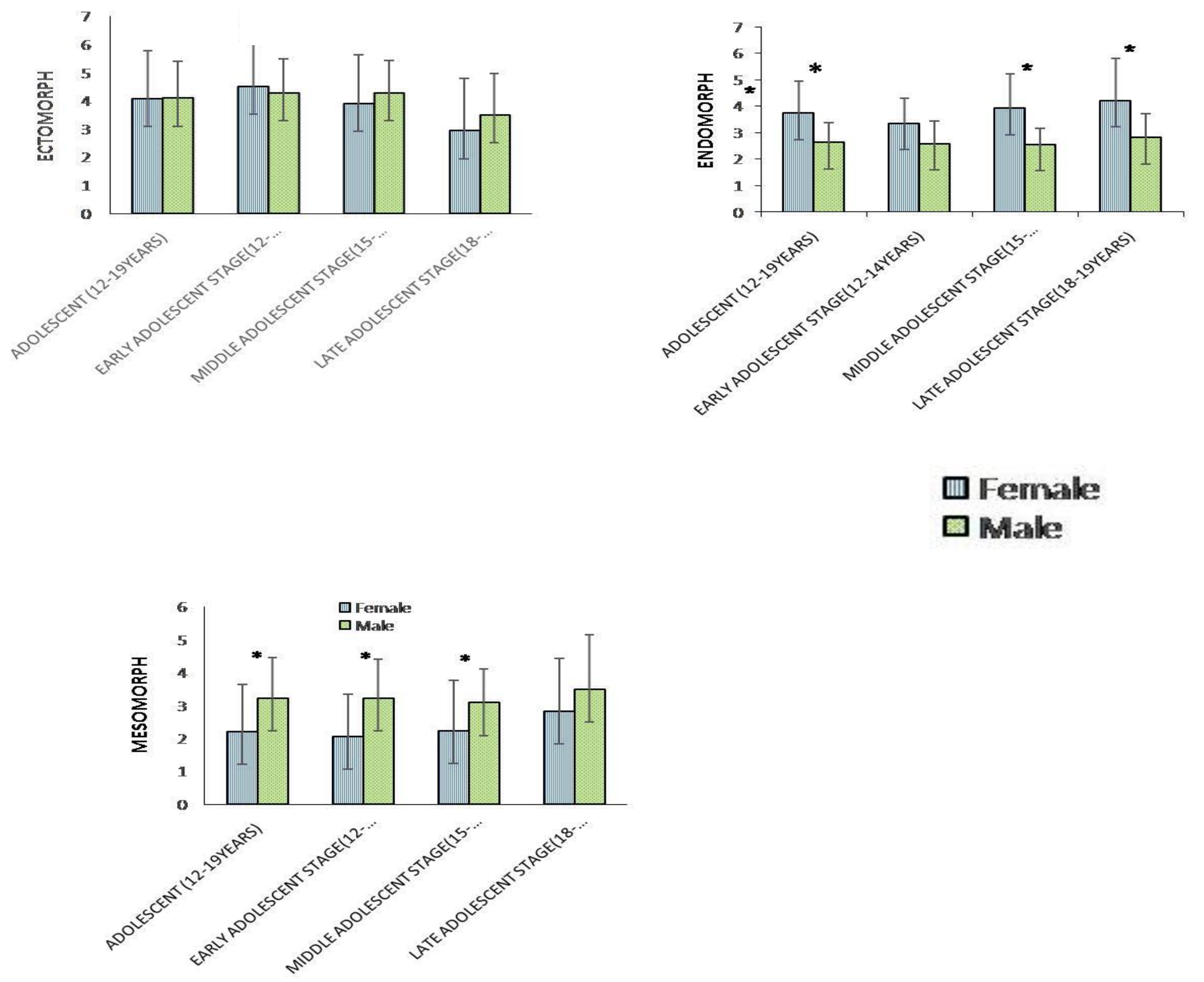

Figure 1: Sexual Dimorphism in Endomorph, Mesomorph and Ectomorph among Adolescent Age Groups of Hausa Ethnic Group in Kano Metropolis (* indicates significant sexual dimorphism at $P<0.05$)

It was documented that endomorph have significant sexual dimorphism in all age groups; mesomorph have significant sexual dimorphism in all age groups except in late adolescence.

Table 4 shows a correlation between selected cephalic anthropometry and somatotype components among three different adolescent age groups of the Hausa ethnic group in Kano metropolis. In early adolescents, cephalic breadth recorded a significant correlation with mesomorphs and ectomorphs; cephalic length recorded a significant correlation only with endomorphs. In middle adolescent, it was observed that cephalic breadth recorded significant correlation with mesomorphs and ectomorphs; cephalic index recorded a significant correlation only with mesomorphs; and cephalic length recorded a positive correlation with endomorphs. In the late adolescent, it was observed that cephalic breadth and cephalic index recorded significant correlation only with mesomorphs.

Table 4: Correlation between Selected Cephalic Anthropometry and Dominant Somatotype components among the three different Adolescent Age Groups of Hausa Ethnic Group in Kano Metropolis

	Early			Middle			Late		
Variables	**Endo**	**Meso**	**Ecto**	**Endo**	**Meso**	**Ecto**	**Endo**	**Meso**	**Ecto**
Cephalic Breadth (cm)	-0.120*	0.310**	-0.187**	0.163*	0.119	-0.217**	0.254**	0.196**	-0.237**
Cephalic Index	0.061	0.266**	-0.299**	0.303**	0.159*	-0.275**	0.129	0.252**	-0.343**
Cephalic Length (cm)	-0.046	0.167**	-0.132**	0.203**	0.003	-0.105	0.132	0.092	-0.176*

Endo=Endomorph, Meso=Mesomorph, Ecto=Ectomorph

Table 5 shows prediction of endomorph, mesomorph and ectomorph from cephalic anthropometry among adolescent stages of Hausa ethnic group in Kano metropolis. In endomorph, it was observed that cephalic length significantly predict endomorph rating only in early adolescent age stage. In male adolescents, it was observed in females that cephalic anthropometry significantly endomorph rating, however endomorph was best predicted using cephalic breadth. The model with the best fitness to predict was observed in late adolescent stage between endomorph and cephalic breadth, the least was observed between endomorph and nasal length with cephalic index. The variance of endomorph explained by cephalic anthropometry was best observed in late adolescent stage between endomorph with cephalic breadth, while the least was in middle adolescent stage between endomorph and cephalic index. In mesomorph, it was observed in female adolescents that cephalic breadth significantly predicted mesomorph rating. And in male adolescents, it was observed that cephalic length significantly predict mesomorph rating in early adolescent age stage. And in ectomorph, was observed in female adolescents that ectomorph was significantly predicted from cephalic breadth in middle adolescent age stage. In male adolescents, it was observed that ectomorph rating was significantly predicted from cephalic breadth.

Table 5: Prediction of Endomorph, Mesomorph and Ectomorph from Cephalic Anthropometry among Adolescent Stages of Hausa Ethnic Group in Kano Metropolis

	Gender	Agestage	Step	Equation (DV=β×IV + Constant)	r^2	SEE	F	P
Endomorph	**Female**	**Early**	**1**	Endo=0.189(CL)+0.020	0.116	0.880	9.541	0.003
	Male	**All**	**1**	Endo=0.309(CB)+(-1.763)	0.110	0.716	24.393	<0.001
		Middle	**1**	Endo=0.035(CI)+(-0.087)	0.064	0.588	7.294	0.008
		Late	**1**	Endo=0.485(CB)+(-4.258)	0.157	0.835	8.979	0.005
Mesomorph	**Female**	**All**	**1**	Meso=(0.188CB)+(-3.123)	0.063	1.490	6.689	0.002
	Male	**Early**	**1**	Meso= (0.337CL)+(-9.838)	0.224	1.113	7.355	0.002
			2	Meso= (0.23CB)+(0.431CL)+ (-9.231)	0.290	1.075	6.795	0.001
Ectomorph	**Female**	**All**	**1**	Ecto=(-0.216CB)+12.324	0.132	1.605	11.637	<0.001
		Middle	**1**	Ecto=(-0.230CB)+11.988	0.090	1.652	5.556	0.005
	Male	**All**	**1**	Ecto=(0.057CB)+10.655	0.132	1.199	28.848	<0.001

DV =dependent variable, β =coefficient of independent variable, IV =independent variable, CB=Cephalic breadth, CL=Cephalic length, Endo=Endomorph, Meso=Mesomorph, Ecto=Ectomorph

DISCUSSION

Sexual dimorphism has been the subject of wonder and scientific studies for centuries, being present in most animal species since pre-historic times. According to Aristotle (fourth century BC), differences in the semen temperature at the time of copulation resulted in sexual dimorphism, with hot semen generating males and cold semen generating females[26].

Bojadzieva and colleagues reported that Macedonian adolescent females are more endomorphic; they also reported that Albanian adolescent males are mesomorphic[6]. Buffa and his colleagues also reported that male Sardinians are mostly mesomorphic; they also reported that female Sardinians are mostly endomorphic[7]; this is in agreement with the present findings in the sense that female individuals tend to have a lot of fats and adipose tissue in their superficial fascia[3, 27] and male have a physical characteristic of being muscular[3].

It's fascinating how researchers have explored the correlation between different body parts and various characteristics[18]. For example, studies have shown that head length and breadth can help differentiate between sexes in certain populations, like the Malays[13]. Other studies have found correlations between head length and stature, as well as between cephalic measurements and stature in different populations, such as the Igbo people of Abakaliki, Nigeria[14]. It's interesting to see how these findings align with the present study, despite differences in age and race. The correlation between height and head length has also been observed in studies on Punjabi and North Indian populations[2]. These research findings contribute to our understanding of human anatomy and variations.

Agnihotri and his team conducted a study on young and healthy students of age group ranging from 20 to 28 years and deduced that stature was significantly correlated with head length. This is in agreement with the present study[11]. Krishan also suggested that cephalic length and breadth are positively and significantly correlated with stature[19]. Ukoha and his team reported significant correlation of head breadth with stature in the females and significant correlation of head length and breadth in males which is in line with the present study despite age and racial difference[20]. Krishan and Kumar also documented a significant correlation between cephalic (length and breadth) and stature in a North Indian population[21]. Trotter and Gleser also reported that stature is significantly correlated to cephalic length and breadth in Kori population of Kanpur[22]. This is also in agreement with the present study. The present study documented the cephalic measurements have significant correlation with stature, stature is among the detrminants of somatotype, therefore it can be logically deduced based on the findings of the present study that somatotype is correlated with cephalic anthropometry independent of racial and age factors.

The estimation of stature from body parts involves specialized anthropometric techniques applied with great precision. For such estimation, regression analysis is the best method as far as the accuracy or reliability of the estimate is concerned[23]. Krishan and Kumar conducted a study on male adolescents for the determination of stature from cephalic measurements and observed that the cephalic measurements (length and breadth) are best predictors of stature[21]. Regression equations were also formulated by Ukoha and his team for estimating stature from cephalic dimensions for the male and female subjects who showed that cephalic length and breadth can be used to estimate stature[20]. In research carried out to predict stature according to some cephalic measurements on Kosovo Albanian population aged 18–35 years old, it was found out that cephalic length significantly correlates with stature and thus significantly predict stature[24]. Krishan also suggested that cephalic measurements (length and breadth) significantly predicted stature[19]. It was also evident that cephalic length and breadth significantly predicts stature among Central Indian population[25]. The present study shows that somatotype dominant components can be predicted significantly using cephalic measurements across the various adolescent age groups, since stature can be estimated from the cephalic parameters[11,20,21] and stature is among the determinants of somatotype, it can be logically said that the cephalic parameters measured are good predictors of somatotype irrespective of age and ethnicity.

CONCLUSION

There are differences between males and females in terms of cephalic parameters, somatotype measurements and its dominant components. Additionally, it appears that somatotypes can be predicted from cephalic measurements among adolescent population of Hausa ethnic origin in Kano metropolis, Nigeria and cephalic breadth is the most accurate predictor of somatotype components.

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Authors Contribution

All authors work as a team to see the completion of this study.

Conflict of Interest

No conflict of interest recorded among the team members.

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