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THE INFLUENCE OF PARENTS' EDUCATION ON GROWTH PATTERN OF CHILDREN AGED 5-12 YEARS FROM KAZAURE EMIRATE, JIGAWA STATE, NIGERIA

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ABSTRACT
Anthropometry is defined as the measurements of different parts of the body and is widely used in surveys as an indicator of nutritional and health status. Studies revealed that large number of socio-economic variables are associated with the physical development of children. These variables consist of parental profession, income, education, birth order, family size, and urbanization. Materials used for the study were Stadiometer, non-elastic measuring tape, Skin fold caliper. The study involved a cross-sectional survey comprising of 863 pupils randomly selected from public primary schools in Kazaure emirate. The subjects were noted for sex and age. A stadiometer was used to measure height to the nearest 0.1 cm and weight to the nearest 0.5 kg. A non-elastic measuring tape was used for the measurement of head, neck, chest, mid upper arm, hip, waist and calf circumferences to the nearest 0.1cm respectively. A Harpenden skin fold caliper was used for the measurement of biceps and triceps skin fold thicknesses to the nearest 0.1 mm respectively. The study participants were apparently healthy public primary school pupils aged between 5 - 12years, from Kazaure Emirate and ofHausa ethnic group (parents and grandparents are Hausa). Based on lack of parents' formal education, males had higher values of neck circumference (NC) and chest circumference (CTC) than females with statistical difference at p<0.05. However,females had higher values ofcephalic index (CI) than males with statistical difference at p<0.05.Based on the level of education of parents (primary, secondary and tertiary education), males had higher values of height (HT), weight (WT), BMI, head circumference (HDC), NC, CTC, waist circumference (WC) and calf circumference (CC) than females with statistical difference at p<0.05. However, females showed higher mean values of triceps skinfold thickness (TSF) and hip circumference (HC) than males with statistical difference at p<0.05. Males had higher values ofhead length (HDL), head breadth (HDB), facial length (FL) and facial breadth (FB) than females with statistical difference at p<0.05. Conversely, females showed higher mean value ofcephalic index (CI) than males with statistical difference at p<0.05.
Males had higher values of right humerus length (RHML), left humerus length LHML), right ulna length (RUL), left ulna length (LUL), right radial length (RRL), left radial length (LRL), right hand length (RHNL), left hand length (LHNL), right hand breadth (RHNB) and left hand breadth (LHNB) than females with statistical difference at p<0.05. Males had higher values of right tibial length (RTBL), left tibial length (LTBL), right fibula length (RFBL), left fibula length (LFBL), right foot length (RFTL), left foot length (LFTL), right foot breadth (RFTB) and left foot breadth (LFTB) than females with statistical difference at p<0.05.
Keywords: Age, Education, Growth, Kazaure emirate, Nigeria

INTRODUCTION

Anthropometry which is defined as the measurements of different parts of the body, and is widely used in surveys as an indicator of nutritional and health status (Khalid *et al*., 1997; Al-Sendi *et al*., 2003). The normality of human growth and development is internationally recognized as the most sensitive indicator of child health and well-being (Cameron *et al*., 1998). Nigeria being one of the developing countries, the characteristic pattern of poverty, poor maternal education, high rates of morbidity, and inadequate nutritional intake of the mother and her child combine to produce a pattern of growth characterized by an increased risk of low birth weight, poor growth velocities, and a growth status that gradually falls away from the norms of children in developed countries (Cameron, 1991).

The most important criteria for healthiness and well-being of children are growth status and growth pattern. The analysis of growth patterns and the detection of aberrant growth patterns provide crucial information for the detection of pathologic condition (Kean, 2007). So growth and maturation of children are sensitive indices of health (Eiben and Panto, 1988; Tanner, 1994) and is influenced by many factors. Socio-economic state (SES) is a concept devised to measure some aspects of education, occupation, and social prestige of a person or a social group (Roche and Sun, 2003; Eiben and Mascie-Taylor, 2004) observed urban children were taller and grow faster than their rural peers. Studies revealed that large number of social-economic variables are associated with the physical development of children. These variables include parental profession, income, education (Doughlas and Simpson, 1964; Belmont *et al.*, 1975), birth order (Eiben *et al.*, 1996), family size (Peck and Vagero, 1987), and urbanization (Silva *et al.*, 1985). Growth is not only accompanied by an increase in size, but also by changes in body proportions and form. The changes are especially marked during puberty and sexual dimorphism is heightened. Changes in segment lengths and breadths are useful to understand differential growth and variation in human size and proportions (Kromeyer and Jaeger, 2000).Anthropometric characteristics have direct relationship with sex, shape and form of an individual and these factors are intimately linked with each other and are manifestation of the internal structure and tissue components which in turn, are influenced by environmental and genetic factors (Krishan, 2007).It is known that body segments exhibit consistent ratios among themselves and relative to the total body height. The ratios between body segments are age, sex and race dependant (Jantz and Jantz, 1999; Williams *et al.*,2000).Growth - the vital process is measured by measuring the height of a person, which itself is a sum of length of certain bones and appendages of the body represent certain relationship with form of proportion to the total stature (Patel *et al.* 2007). Height-for-age is considered to be an indicator of long-term nutritional status because an individual's present height is the result of many years' growth (WHO Working Group, 1986). Although, there is a report that, weight-for-height is frequently considered to be a better indicator of current nutritional status than is height-for-age since weight can be quickly gained or lost (Waterlow *et al.*, 1977; WHO Working Group, 1986).Little is known about the role of individual socio-economic factors and whether socio-economic differences within countries can help in explaining the differences in children's height between countries (Drachler *et al.*, 2002).It is well documented that children belonging to high and middle socio-economic groups are larger in body size than those in lower socio-economic groups (Goldstein, 1971; Prasad *et al.*, 1971; Banik *et al.*, 1972; Eleveth and Tanner, 1991).Children with less educated parents are generally more likely to be overweight or obese (Vignerova *et al.*, 2004; Due *et al.*, 2009). However, a recent study in 35 countries found that among adolescents those from more affluent backgrounds in Croatia, Estonia and Latvia were more likely to be overweight/obese (Due *et al.*, 2009). Among adults, lower socio-economic position has been associated with a greater prevalence of obesity, particularly among women (Pomerleau *et al.*, 2000; Klumbiene *et al.*, 2004). Most of these studies involved either children or adults and few simultaneously examined the socio-economic patterning of obesity in both children and their parents (Vignerova *et al.*, 2004). Increase in anthropometric measurements is associated with the families with the higher educational and income levels (Rona and Chinn, 1986; Berdasco, 1994; Naidu and Rao, 1994). It is well known that differences in growth and body composition of the children in relation to mother's education levels occur between urban and rural populations (Bolzan *et al.*, 1999). In terms of anthropometric indicators of growth, however, rural populations must not always be considered as homogeneous social groups. As in the studied community, the differences in the access to education of parents play an important role (Bolzan *et al.*, 1999).In all age groups, mean triceps and subscapular skinfold were higher in girls than in boys and they increase with age. A similar trend was noted in the means of mid-upper arm, waist and hip circumferences (Al-Sendi *et al.*, 2003).Similarly, in other areas of the developing world, the effects of broad socio-economic changes on growth have not been equally distributed throughout a population (Leatherman *et al.*, 1995). It is well known that responses to modernization are dependent on the socio-economic characteristics of a population, including income, wealth, education, and land distribution, proximity to urban centres, population density, and changes in traditional subsistence patterns. These local factors interact with increased exposure to national and international influences, resulting in various outcomes from relative and absolute impoverishment to varying states of enrichment (McGarvey, 1992).

MATERIALS AND METHODS

Materials

The following materials were used for the study:

i. Stadiometer (Holtain Ltd., Crymych, Dyfed, UK)
ii. Non-elastic measuring tape (Seca 201 Ergonomic Circumference measuring Tape, Amazon, UK)
iii. Harpenden skin folds Caliper (Harpenden Skin Fold Caliper, Amazon, UK)

Design and Study Population

The study was carried out in four (4) Local Government Areas (LGAs) of Jigawa State. Namely: Kazaure, Roni, Gwiwa and Yankwashi Local Governments Areas respectively. Of the four (4) LGA's, three towns and related primary schools were randomly selected and the participants were measured and the values recorded.

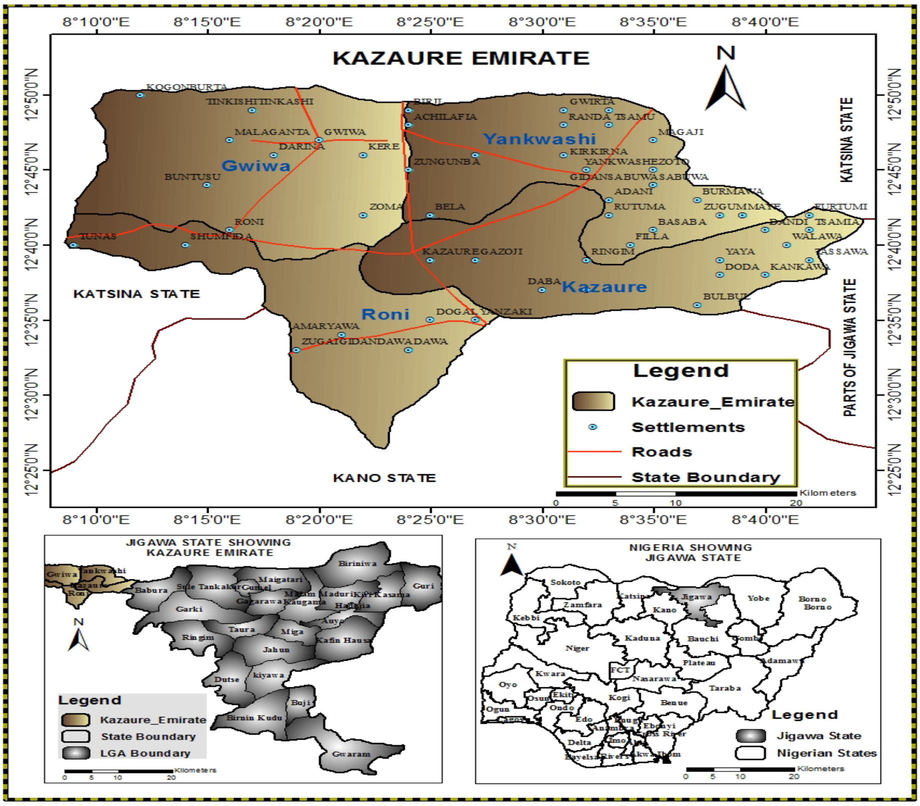

Fig. 1: Map of Kazaure emirate. Modified from the Administrative Map of Nigeria
Figure 1: Map of Kazaure emirate

Study Area

Kazaure is located in the Northern part of Jigawa State, one of the 27 local governments in Jigawa State. It lies between longitude 12^0 30′ to 12^0 45′ and latitude 8^0 15′ to 8^0 30 North and East respectively. It covers a land area of about 1780 kilometers square. It is bordered to the north by Daura (Katsina State), West by Ingawa (Katsina State), and to the South by Dambatta (Kano state) (Olofin, 1987; Ayodele, 2000). The area belongs to the Sudan Savanna Vegetation. Rainfall begins between May and June and ends around September and October. The main annual rainfall is about 600mm with the highest input during the months of July and August. Mean annual temperature is about 26 ^{0} C but mean monthly value ranges between 22^0 C in the coldest months (December and January) and 31^0C in the hottest months of April and May (Olofin, 1987).

Inclusion criteria

Participant must be:
i. public primary school pupil
ii. between 5-12 years of age
iii. apparently physically/mentally fit
iv. from Kazaure Emirate
v. Hausa ethnic group (parents and grandparents are Hausa)

Exclusion criteria

Participant must not be:
i. private primary school pupil
ii. below 5 years or above 12 years, of age
iii. physically/ mentally unfit or deformed
iv. from any Emirate other than Kazaure Emirate
v. of any ethnic group other than Hausa

Methods of Anthropometric Assessment

A stadiometer (Holtain Ltd., Crymych, Dyfed, UK) was used to measure height to the nearest 0.1 cm and weight to the nearest 0.5 kg, a non-elastic measuring tape was used for the measurement of head, neck, chest, mid upper arm, hip, waist and calf circumferences respectively to the nearest 0.1cm, a Harpenden skin fold caliper was used for the measurement of biceps and triceps skin fold thicknesses respectively to the nearest 0.1 mm (Lohman *et al.*, 1988; Fidanza, 1991).

i. **Height/ Stature (HT)**: The subjects stood up perfectly upright with arms relaxed by the side, and ankles and knees placed together. The subjects were encouraged to stand as upright as possible and bare footed before measurements were taken. The stadiometer was positioned behind the subjects and the measurement taken to the nearest 0.1cm.
ii. **Body weight**: This was taken with subjects wearing light clothes and barefooted to the nearest 0.5kg.
iii. **Mid upper arm circumference (MUAC)**: This was measured using the tailor's plastic measuring tape at the midpoint of the upper non-dominant arm, between the acromial process and the tip of the olecranon and recorded to the nearest 0.1cm.
iv. **Head/occipitofrontal circumference (HDC)**: This was measured using plastic tape from the occiput of the skull, to the most anterior portion of the frontal bone and recorded to the nearest 0.1cm.
v. **Hip circumference (HC)**: This was measured with the subject in standing position. The tailor's plastic tape was placed on the tip of the buttock's curvature posteriorly and pubis anteriorly. The measurement was to the nearest 0.1cm.
vi. **Waist circumference (WC)**: This was taken while subject in standing position. The tape was placed between the lowest lumbar region and the sacral region posteriorly and pubic region anteriorly. The measurement was to the nearest 0.1cm.
vii. **Calf circumference(**CC**)**: This was taken with the subject in standing position. The tape was placed on the gastrocnemius muscle posteriorly and the tibial bone anteriorly. The measurement was to the nearest 0.1cm.
viii. **Neck circumference (NC)**: The tape was placed around the neck measurement recorded to the nearest 0.1 cm.
ix. **Chest circumference (CTC)**: The tape was placed around the chest with the tape meeting on the sternum and measurement recorded to the nearest 0.1 cm.
x. **Biceps skin fold thickness (BSF)**: This was measured on the left side using the Harpenden caliper. The measurement was to the nearest 0.1 mm at the upper non-dominant arm anteriorly.
xi. **Triceps skin fold thickness (TSF)**: This was measured using the Harpenden skin fold caliper at the midpoint of the upper non-dominant arm posteriorly to the nearest 0.1mm. All skin fold measurements were taken twice and the average recorded.
xii. **Humeral length (HL)**: This was measured using sliding caliper from the lateral border of the acromion to the inferior extent of the olecranon (elbow flexed at 90 degrees) and recorded to the nearest 0.1cm.
xiii. **Ulna length (UL)**: This was measured from the olecranon to the head of the styloid process, using sliding caliper and recorded to the nearest 0.1cm.
xiv. **Radius length (RL)**: This was measured from the base of the wrist to the fold in elbow, using sliding caliper and recorded to the nearest 0.1cm.
xv. **Hand length (HL)**: This was measured as the distance from the mid-point of the distal wrist crease to the tip of the middle finger using sliding caliper (position: palmar surface of the hand) and recorded to the nearest 0.1cm.
xvi. **Hand breadth (HB)**: This was measured as the distance from the head of 5^{th} to 2^{nd} metacarpal using a sliding caliper (position: palmar surface of the hand) and recorded to the nearest 0.1cm.
xvii. **Head length (HL)**: This was measured as a straight distance between glabella and opisthocranion (occipital bone) using sliding caliper and be recorded to the nearest 0.1cm.
xviii. **Head breath (HB)**: It is the maximum biparietal diameter and this was measured as the distance between the most lateral points on the parietal bones using sliding caliper and recorded to the nearest 0.1cm.
xix. **Facial height (FH)**: This was measured as a direct distance between nasion and gnathion, using sliding caliper and recorded to the nearest 0.1cm.
xx. **Facial breath (FB)**: This was measured as the distance between the right and left

zygomatic bones using sliding calipers and recorded to the nearest 0.1cm.

xxi. **Nasal height (NH)**: This was measured as a direct distance between nasion and sub-nasion, using sliding caliper and recorded to the nearest 0.1cm.

xxii. **Tibial length (TL)**: The subject sat with left knee placed in the semi flexed position and the left foot partly inverted to relax the soft tissues and render bony landmarks prominent. The length of tibia was measured using sliding caliper from the medial condyle (as it becomes palpable and diverges anteriorly from the articulating femoral condyle) to the tip of the medial malleolus, and recorded to the nearest 0.1 cm.

xxiii. **Fibular length (FIBL)**: The subject sat with left knee placed in the semi flexed position and the left foot partly inverted to relax the soft tissue and render bony landmarks prominent. The distance between the upper most point palpable on fibular head, (little below the lateral margin of the knee) and the tip of the lateral malleolus, and was measured, using sliding caliper and recorded to the nearest 0.1 cm.

xxiv. **Foot length(FL)**: This was measured as the straight distance between the most posterior projecting point of the heel and anterior projecting point (the end of the 1^{st} or 2^{nd} toe) using sliding caliper (position: plantar view of the sole of the foot) and recorded to the nearest 0.1 cm.

xxv. **Foot breadth (FB)**: This was measured as the widest point of the sole which is from the metatarso-phalangeal joint of the 1^{st} metatarsal and that of the 5^{th} metatarsal of the foot using a sliding caliper (position: plantar view of the sole of the foot) and recorded to the nearest 0.1 cm.

Statistical Analyses

Data were expressed as mean ± standard deviation (SD). Differences between boys and girls were tested using the Student's t– test. One-way analysis of variance (followed by Benferoni Post Hoc test) was used to investigate the effect of socio-economic factor (birth order) on the different anthropometric parameters. Statistical significant difference was deemed acceptable at P<0.05. The data were analyzed using Statistical Package for Service Solutions (SPSS) version 20 (IBM Corporation, Armonk, New York, USA).

RESULTS

Table1 shows the descriptive statistics of male and female pupils who participated in the study. The results showed the Mean±SD, minimum and maximum values of height, weight, body mass index, biceps and triceps skinfold thicknesses; mid-upper arm, head, neck, chest, waist, hip and calf circumferences of the pupils.

Table 2 shows the influence of lack of parents' formal education on height, weight, BMI, biceps and triceps skin fold thicknesses, mid-upper arm, head, neck, chest, waist, hip and calf circumferences on male and female pupils of Kazaure emirate with male having higher values than females with statistical difference (p<0.05) in neck circumference and chest circumference.

Table 3 shows the influence of lack of parents' formal education on head length, head breadth, facial length, facial breadth, cephalic index, facial index, nasal height on male and female pupils of Kazaure emirate with females having statistical difference (p<0.05) incephalic index.

Table 4 shows the influence of primary, secondary and tertiary education of parents on height, weight, BMI, biceps and triceps skin fold thicknesses, mid-upper arm, head, neck, chest, waist, hip and calf circumferences on male and female pupils from Kazaure emirate with males having higher values than females with statistical difference (p<0.05) in height, weight, BMI, head circumference, neck circumference, chest circumference, waist circumference and calf circumference. However, females showed higher mean values than males with statistical difference (p<0.05) in triceps skinfold thickness and hip circumference.

Table 5 shows the influence of primary, secondary and tertiary education of parents on head length, head breadth, facial length, facial breadth, cephalic index, facial index, nasal height on male and female pupils from Kazaure emirate with males having higher values than females with statistical difference (p<0.05) in head length, head breadth, facial length, facial breadth. Conversely, females showed higher mean values than males with statistical difference (p<0.05) in cephalic index.

Table 6 shows the influence of primary, secondary and tertiary education of parents on right humerus length, left humerus length, right ulna length, left ulna length, right radial length, left radial length, right hand length, left hand length, right hand breadth and left hand breadthon male and female pupils of Kazaure emirate with males having higher values than females with statistical difference (p<0.05) inright humerus length, left humerus length, right ulna length, left ulna length, right radial length, left radial length, right hand length, left hand length, right hand breadth and left hand breadth.

Table 7 shows the influence of primary, secondary and tertiary education of parents on right tibial length, left tibial length, right fibular length, left fibular length, right foot length, left foot length, right foot breadth and left foot breadthon male and female pupils of Kazaure emirate with males having higher values than females with statistical difference ($p<0.05$) in right tibial length, left tibial length, right fibula length, left fibula length, right foot length, left foot length, right foot breadth and left foot breadth.

Table 1: Descriptive statistics of male and female pupils from Kazaure emirate (n=863)

	Male (n= 432)		Female (n= 431)	
Variables	Mean ± SD	Min - Max	Mean ±SD	Min-Max
Age (years)	8.56 ± 2.27	5.00-12.00	8.43 ± 2.34	5.00-12.00
Height (cm)	124.00 ± 14.00	99.00 -150.00	121.00 ± 14.00	96.00-148.00
Weight (kg)	25.14 ± 4.07	10.9 0-40.30	23.60 ±4.83	13.30-37.30
Body Mass Index (kg/m^2)	15.64 ± 1.52	12.27-21.44	14.24 ±1.41	11.54-20.08
Biceps Skinfold Thickness (mm)	1.17 ± 0.26	1.00-2.00	1.46 ±0.21	1.00-2.54
Triceps Skinfold Thickness (mm)	1.12 ± 0.33	1.00-2.00	1.41 ±0.22	1.00-2.50
Mid-upper arm Circumference (cm)	16.80 ± 1.39	12.50-22.00	15.72 ±1.62	11.50-20.00
Head Circumference (cm)	50.73 ±2.41	48.00-56.30	49.26 ±2.67	47.00-54.00
Neck Circumference (cm)	24.89 ± 1.34	20.50-32.50	23.33 ±1.66	19.00-30.00
Chest Circumference (cm)	57.62 ± 4.37	44.50-68.50	55.73 ±4.20	42.60-67.00
Waist Circumference (cm)	56.14 ± 3.94	46.00-69.50	54.82 ±4.57	42.50-66.00
Hip Circumference (cm)	59.50 ± 5.53	44.20-72.00	62.80 ±4.94	48.20-75.00
Calf Circumference (cm)	22.55 ± 1.98	12.80-28.00	21.83 ±2.51	12.00-27.00

Table 2: Influence of lack of parents' formal education on height, weight, BMI, skinfold thicknesses and body circumferences on pupils aged 5-12 years from Kazaure emirate

	Male (n=60)	Female (n=67)		
Variable	Mean±SD	Mean±SD	F	p-value
HT (cm)	122.05±14.32	121.43±13.97	0.246	0.806
WT (kg)	24.46±1.46	24.08±1.78	0.397	0.701
BMI (kg/m^2)	15.43±1.23	15.07±1.39	0.958	0.340
BSF (mm)	1.10±0.19	1.15±0.27	1.288	0.200
TSF (mm)	1.34±0.38	1.45±0.38	0.717	0.425
MUAC (cm)	16.73±1.40	16.56±1.45	0.670	0.504
HDC (cm)	50.72±2.64	50.51±2.10	0.858	0.405
NC (cm)	24.80±1.31	24.19±1.45	2.635	0.01
CTC (cm)	57.20±2.09	55.69±2.91	2.125	0.01
WC (cm)	54.95±2.02	54.73±2.27	0.677	0.439
HC (cm)	59.01±2.56	59.69±2.73	1.380	0.170
CC (cm)	22.27±1.93	22.13±1.84	0.130	0.897

HT=height, WT= Weight, BMI= Body mass index, BSF=Biceps skinfold thickness, TSF= Triceps skinfold thickness, MUAC= Mid-upper arm circumference, HDC= Head circumference, NC= Neck circumference, CTC= Chest circumference, WC= Waist circumference, HC= Hip circumference, CC= Calf circumference

Table 3: Influence of lack of parents' formal education on craniofacial dimensions of pupils aged 5-12 years from Kazaure emirate

	Male (n=60)	Female (n=67)		
Variable	Mean±SD	Mean±SD	F	p- value
HDL (cm)	17.61±1.53	17.38±1.68	0.541	0.562
HDB (cm)	12.82±1.56	12.78±1.74	0.982	0.345
FL (cm)	9.29±0.50	9.23±0.58	0.537	0.592
FB (cm)	10.30±1.62	10.22±1.57	0.726	0.469
NH (cm)	3.66±0.29	3.59±0.36	1.134	0.259
CI	72.36±3.78	72.81±3.69	1.779	<0.05
FI	90.35±4.49	90.32±4.56	0.027	0.978

HDL= head length, HDB= head breadth, FL= facial length, FB= facial breadth, CI= cephalic index, FI= facial index, NH= nasal height

Table 4: Influence of different levels of education of parents on height, weight, BMI, skinfold thicknesses and body circumferences of school children aged 5-12 years from Kazaure emirate

Variable	Primaryeducation		Secondaryeducation		Tertiary education		F	p- value
	Male (n=231) Mean±SD	Female(n=180) Mean±SD	Male (n=117) Mean±SD	Female(n=96) Mean±SD	Male(n=63) Mean±SD	Female(n=49) Mean±SD		
HT(cm)	123.49±13.90[a]	121.61±13.59[b]	125.19±13.92[c]	123.86±14.24[d]	128.74±13.40[e]	126.94±13.55[f]	2.940	0.001
WT (kg)	25.37±1.35[g]	23.25±1.78[h]	27.97±1.43[i]	25.94±1.78[j]	29.75±1.43[k]	27.62±1.55[l]	3.151	0.001
BMI (kg/m^2)	15.60±1.63	15.31±1.23	16.86±1.56	16.49±1.63	17.50±1.49[m]	16.87±1.53[n]	2.867	0.01
BSF (mm)	1.16±0.30	1.18±0.28	1.17±0.35	1.18±0.24	1.19±0.26	1.21±0.21	0.291	0.765
TSF (mm)	1.42±0.43	1.55±0.40	1.58±0.58	1.64±0.45	1.66±0.32[o]	1.73±0.31[p]	1.962	<0.05
MUAC (cm)	16.84±1.45	16.67±1.56	16.93±1.66	16.89±1.54	17.07±1.37	16.98±1.54	1.132	0.302
HDC (cm)	50.90±2.28[q]	50.38±2.40[r]	51.68±2.22[s]	50.87±2.43t	52.55±2.24[u]	51.33±2.39[v]	3.044	0.001
NC (cm)	24.88±1.48	24.23±1.75	25.95±1.52	24.91±1.71	25.98±1.34	24.92±1.65	3.429	0.001
CTC (cm)	57.56±2.78[w]	55.50±2.85[x]	58.70±2.83[y]	57.63±2.91[z]	59.64±2.45[a1]	57.86±2.57[b1]	4.615	<0.001
WC (cm)	55.16±2.56[c1]	54.25±2.70[d1]	56.61±2.62[e1]	55.54±2.76[f1]	57.68±2.61[g1]	56.62±2.70[h1]	1.875	<0.05
HC (cm)	59.48±2.76[i1]	60.59±2.57[j1]	60.60±2.72[k1]	61.96±2.56[l1]	61.36±2.66[m1]	62.41±2.74[n1]	2.850	0.01
CC (cm)	22.55±1.15[o1]	21.56±1.33[p1]	23.69±1.19[q1]	22.57±1.30[r1]	23.73±1.14[s1]	22.70±1.32[t1]	3.102	0.001

Superscript indicates difference in means with statistical significant difference, where there is no superscript shows no difference
HT=height, WT= Weight, BMI= Body mass index, BSF=Biceps skinfold thickness, TSF= Triceps skinfold thickness, MUAC= Mid-upper arm circumference, HDC= Head circumference, NC= Neck circumference, CTC= Chest circumference, WC= Waist circumference, HC= Hip circumference, CC= Calf circumference

Table 5: Distribution of craniofacial dimensions of school children aged 5-12 years from Kazaure emirate according to age and parental level of education

Variable	Primary education		Secondary education		Tertiary education		F	p- value
	Male(n=231) Mean±SD	Female(n=180) Mean±SD	Male(n=117) Mean±SD	Female(n=96) Mean±SD	Male(n=63) Mean±SD	Female(n=49) Mean±SD		
HDL (cm)	17.90±1.56[a]	17.49±2.61[a]	17.97±2.56[a]	17.53±2.56[a]	18.49±2.50[b]	17.54±2.56[c]	3.725	0.001
HDB (cm)	12.75±1.53	12.58±2.70	12.79±2.54	12.61±2.74	13.32±2.48[d]	12.81±2.34[e]	2.218	0.01
FL (cm)	9.38±0.56	9.26±1.68	9.45±1.61	9.34±1.58	10.40±0.54[f]	9.56±0.56[g]	2.573	0.01
FB (cm)	9.41±1.56	9.22±1.67	9.45±1.60	9.26±1.62	10.28±1.41[h]	9.50±1.45[i]	2.107	0.01
NH (cm)	3.64±0.29	3.66±0.33	3.63±0.29	3.67±0.33	3.65±0.25	3.68±0.33	1.148	0.248
CI	72.43±3.38[a1]	73.38±3.69[b1]	72.47±3.38[c1]	73.31±3.69[d1]	72.53±3.32[e1]	73.42±3.61[f1]	2.576	0.01
FI	90.45±4.49	90.42±4.56	90.50±4.49	90.44±4.56	90.54±4.44	90.50±4.40	1.661	0.106

Superscript indicates difference in means with statistical significant difference, where there is no superscript shows no difference
HDL= head length, HDB= head breadth, FL= facial length, FB= facial breadth, CI= cephalic index, FI= facial index, NH= nasal height.

Table 6: Influence of different levels of education of parents on bones of upper extremities of school children aged 5-12 years from Kazaure emirate

Variable	Primary education		Secondary education		Tertiary education		F	p- value
	Male(n=231) Mean±SD	Female(n=180) Mean±SD	Male(n=117) Mean±SD	Female(n=96) Mean±SD	Male(n=63) Mean±SD	Female(n=49) Mean±SD		
RHML (cm)	26.46±1.66^{a}	25.90±1.27^{b}	26.70±2.66	26.43±1.27	27.55±1.63^{c}	26.48±1.88^{d}	2.010	0.01
LHML (cm)	26.41±1.43^{e}	25.92±1.62^{f}	26.71±1.83	26.42±1.20	27.77±1.80^{g}	26.76±1.86^{h}	2.003	0.01
RUL (cm)	21.39±1.67	20.99±1.81	21.63±1.67	21.60±1.78	22.74±1.69^{i}	21.68±1.70^{j}	1.826	<0.05
LUL (cm)	21.37±1.70	20.99±1.74	21.62±1.67	21.58±1.71	22.73±1.65^{k}	21.66±1.68^{l}	1.998	0.01
RRL (cm)	18.11±1.67^{m}	17.78±1.71^{n}	19.23±1.66^{m1}	19.18±1.71^{n1}	19.30±1.62^{m1}	19.25±1.67^{n1}	1.838	<0.05
LRL (cm)	18.10±1.61^{o}	17.80±1.73^{p}	19.26±1.60^{o1}	19.18±1.68^{p1}	19.29±1.58^{o1}	19.22±1.63^{p1}	1.994	0.01
RHNL (cm)	13.12±1.34^{q}	12.10±1.50^{r}	14.20±1.34^{s}	13.18±1.50^{t}	14.28±1.38	14.22±1.47	2.001	0.01
LHNL (cm)	13.14±1.31^{u}	12.12±1.48^{v}	14.21±1.31^{w}	13.16±1.48^{x}	14.29±1.35	14.21±1.49	1.829	<0.05
RHNB (cm)	6.11±0.65^{y}	5.19±0.69^{z}	6.17±0.65	6.15±0.69	6.20±0.57	6.18±0.69	1.844	<0.05
LHNB (cm)	6.12±0.62^{a1}	5.20±0.66^{b1}	6.16±0.62	6.15±0.66	6.21±0.59	6.17±0.66	1.843	<0.05

Superscript indicates difference in means with statistical significant difference, where there is no superscript shows no differenceRHML=right humerus length, LHML= left humerus length, RUL= right ulna length, LUL= left ulna length, RRL= right radius length, LRL= left radius length, RHNL= right hand length, LHNL= left hand length, RHNB= right hand breadth, LHNB= left hand breadth

Table 7: Influence of different levels of education of parents on the bones of lower extremities of school children aged 5-12 years from Kazaure emirate

Variable	Primary education		Secondary education		Tertiary education		F	p- value
	Male(n=231) Mean±SD	Female(n=180) Mean±SD	Male(n=117) Mean±SD	Female(n=96) Mean±SD	Male(n=63) Mean±SD	Female(n=49) Mean±SD		
RTBL(cm)	29.79±1.30	29.71±1.65	30.86±1.43^{a}	30.01±1.65^{b}	30.88±1.46^{c}	30.03±1.68^{d}	2.055	0.01
LTBL(cm)	29.79±1.39	29.68±1.58	29.82±1.43	29.82±1.58	30.92±1.47^{e}	29.99±1.59^{f}	2.275	0.01
RFBL(cm)	28.63±1.87^{g}	27.58±1.55^{h}	28.68±1.89	28.59±1.55^{h1}	29.75±1.69^{i}	29.68±1.73^{i}	1.868	<0.05
LFBL(cm)	28.73±1.72^{j}	27.67±1.60^{k}	28.75±1.67	28.69±1.73	28.76±1.67	28.71±1.73	1.987	<0.05
RFTL(cm)	19.81±1.19^{l}	19.74±1.25^{l}	20.83±1.24^{m}	20.72±1.37^{m}	20.86±1.27^{m}	20.77±1.39^{m}	2.019	0.01
LFTL(cm)	19.75±1.29^{n}	19.66±1.20^{n}	20.81±1.32^{o}	20.69±1.43^{o}	20.80±1.36^{o}	20.75±1.47^{o}	2.020	0.01
RFTB(cm)	6.80±0.65^{p}	6.78±0.68^{p}	6.86±0.68^{p}	6.81±0.76^{p}	7.66±0.68^{q}	7.62±0.77^{q}	1.946	<0.05
LFTB(cm)	6.81±0.69^{p}	6.78±0.71^{p}	6.87±0.65^{p}	6.83±0.73^{p}	7.64±0.67^{q}	7.61±0.72^{q}	1.937	<0.05

Superscript indicates difference in means with statistical significant difference, where there is no superscript shows no differenceRTBL= right tibia length, LTBL= left tibia length, RFBL= right fibula length, LFBL= left fibula length, RFTL= right foot length, LFTL= left foot length, RFTB= right foot breadth, LFTB= left foot breadth

DISCUSSION

The anthropometric parameters of growth examined in this study population showed that the males had higher height, weight and BMI than females. Studies by Pena Reyes *et al*. (2002), Donald, (2002), Al-Sendi *et al*. (2003) showed thatmales had higher height, weight and BMI than the females. Additionally, studies byIlayperuma, (2010); Kharyal and Nath, (2008); Ezekie *et al*.(2015), reported that males had higher height than the females respectively. However, studies by Bolzan *et al*. (1999) showed that the females were found to be taller, heavier and had higher BMI than the males. This differs from the result of this study whereby the males were taller, heavier and had higher BMI. Study by Bhavna and Nath, (2009) showed that males had higher values for lower limb bones length. This agrees with the findings of this study, and is the reason why the males had higher height than the females. Similarly, females had higher values for biceps and triceps skin folds thicknesses than the males, and this agrees with findings by Al-Sendi *et al*. (2003) whereby the females had higher values for triceps and subscapular skin folds than the males at all ages (12 – 17 years). The males had higher values than the females in the body circumferences except hip circumference respectively This is supported by Al-Sendi *et al*.(2003) whereby the males had higher waist circumference than the females while the females had higher mid-upper arm and hip circumferences than the males. Studies by Ezekie *et al*. (2015) reported Igbo males had higher head circumference than the Igbo females. Likewise, males had higher waist and neck circumferences than the females and this is similarly in accordance with the findings of Mozaffer *et al*. (2012). This study showed that males had larger head length, head breadth, facial height and facial breadth than the females respectively. Studies by Kharyal and Nath, (2008), Olotu *et al*. (2009), Ilayperuma, (2010); Omotoso *et al*. (2011), Bugaighis *et al*. (2013); Ezekie *et al*. (2015); Shah *et al*. (2015); Kpela *et al.* (2016) showed that males had higher head length, head breadth, facial height and facial breadth than the females. These are in line with the findings of this present study. Studies by Shah *et al*. (2015) on assessment of cephalic and facial indices as a proof for ethnic and sexual dimorphism showed that females had higher cephalic and facial indices than the males in non-Gujurat ethnic group while in Gujurat ethnic group males had higher facial index while females had higher cephalic index. This study showed that females had higher cephalic and facial indices than the males, and therefore agrees with the findings of Shah *et al*. (2015). Furthermore, females showed higher nasal height than the males in this study, however, this contradicts the findings of Kharyal and Nath, (2008) that says males had higher nasal height than the females.

Studies by Goldstein, (1971), Prasad *et al*. (1971), Banik *et al*. (1972), Eleveth and Tanner, (1991) concluded that children belonging to higher and middle socioeconomic groups are larger in body size than those in lower socio-economic groups. Kim *et al.* (2002) also suggested that presumably, amenities that contribute to "quality of life" are, on average, more accessible to urban than to rural children. Studies by Rona and Chinn (1986), Berdasco (1994), Naidu and Rao (1994) showed that increase in anthropometric measurements is associated with the families with the higher educational and income levels. This agrees with the findings of this study that showed children of small household size and low birth order showed better growth pattern than those of larger household size and higher birth order.

Studies by Bolzan *et al*. (1999) showed that differences in growth and body composition of the children in relation to mother's education level occur between urban and rural populations. This agrees with the findings in this present study that showed children of educated mothers had better growth than those of none educated mothers. In terms of anthropometric indicators of growth, however, rural populations must not always be considered as homogeneous social groups. As in the studied community, the differences in the access to education of parents play an important role (Bolzan *et al*., 1999).

Study by Thompson *et al*. (2002) showed that there is a wide variation among children in growth parameters at any given age and in the velocity of these parameters from one age to the next. This agrees with the findings of this study that showed variation in growth at different ages in different anthropometric parameters.

Belmont *et al*. (1975) in their study found that maternal education is associated with higher weight and height of children. The other significant factor which was observed in our children was economic status. The result indicated that weight and height of children are directly influenced by economic status. More welfare is a fertile field for growth. Eiben *et al*. (1996) evaluated the effect of socio-economic status on weight and height of children. Their results showed that people of high economic status had more height than low economic status. They also observed that sons of senior salaried employee were taller than unskilled worker about 2.9 cm (Eiben *et al*., 1996). Moreover, this study is in accord with other studies that have shown those of lower economic status have lower weight and height (Belmont *et al*., 1975).

CONCLUSION

The anthropometric parameters of growth examined in this study population showed that the males had higher height, weight, BMI, body circumferences than females. Conversely, females had higher values for biceps and triceps skin fold thickness than their male counterparts. Moreover, males had larger head length, head breadth, facial height and facial breadth than the females. However, females showed higher nasal height than the males in this study, indicating cosmetic value that they are beautiful.

In general, children of educated parents showed better growth than those of non-educated parents.

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