



DETERMINATION OF SEX USING DEMARKING POINTS OF THE CALF AND SKINFOLD THICKNESS AMONG BAUCHI STATE STUDENTS IN UNIVERSITY OF MAIDUGURI, NIGERIA.

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ABSTRACT

The aim of the study was to estimate sex using demarking points and index of sexual dimorphism of the calf and skinfold thickness among Bauchi State students in University of Maiduguri, Nigeria. The study was carried out using 194 subjects (100 males and 94 females) with age ranged from 18 to 39 and 18 to 35 years respectively with no structural deformity or fracture. The following parameters were measured (standing height, weight, calf height, upper one-third calf circumference, medial and lateral calf skinfolds). The results showed that standing height, weight, calf height, upper one-third calf circumference, medial and lateral calf skinfolds in males were 1.70m, 62.08kg, 43.68cm, 32.15cm, 4.70mm and 6.15mm respectively, while female counterparts had 1.58m, 60.22kg, 35.98cm, 35.23cm, 10.33mm and 13.46mm respectively. There were significant differences between males and females standing height, calf height, upper one-third calf circumference, medial and lateral calf skinfolds ($p < 0.05$) but no significant differences in weight ($p > 0.05$). Index for sexual dimorphism and demarking point were calculated and all the parameters were observed to be sexually dimorphic. In conclusion, males have higher values for height and weight, while the females have higher values for the calf height, upper one-third calf circumference, medial and lateral calf skinfolds.

Keywords- Morphometric, calf, circumference, height, skinfold, weight.

INTRODUCTION

Forensic anthropologists and anatomists are often interested in determining the sex of human from their skeletal remains to solve problems of medico-legal system (Kewal, 2007). In forensic anthropology, it is sometimes necessary to determine sex of isolated bones other than those of which sexually dimorphic characters have been well studied (Gumsu and Asala, 2007).

Skinfold thickness has been used in myriad of studies of sexual dimorphism, nutritional status, body composition, and relative subcutaneous fat distribution (Yaw and John, 2010). Because the thickness of subcutaneous

fat is very specific to adipose tissue and can be measured noninvasively, skinfold thickness remains an important and valid anthropometric indicator of regional and total body fatness, especially in research settings (Yaw and John, 2010).

Sexual dimorphism in human body size and composition is well established, and apparent in diverse populations (Gray and Wolfe, 1980). Average stature and lean mass tend to be greater in males than females, whereas average adiposity tends to be greater in females than males (Jonathan, 2012).

Holden and Mace (1999) found that sexual dimorphism is reduced in societies where women contribute more to food production. Others have linked between population variability in stature dimorphism with marriage practices and dietary protein supply (Gray and Wolfe, 1980).

Sexual dimorphism is the systematic difference in form between individuals of different sex in the same species (Marin et al., 2006). Jit and Singh (1966) advocated the demarking point, which identify the sex of the individual with 100% accuracy. Singh and Gangrade (1968) reported that even within the same general population mean value may differ significantly in bone parameters from different zones. Singh and Singh (1972) have shown that demarking point should be calculated separately for different regions of population because the mean of parameter may differ in values. To be certain in identification calculated ranges has to be considered, which was worked out by adding and subtracting 3X standard deviation (SD) to and from the mean of any parameter. Jit and Singh (1966) have called the limiting

point of such calculated range as demarking points which identify sex with 100% accuracy from any given population or region. Sexual dimorphism was observed by the statistically significance difference and the index of sexual dimorphism.

Amaza et al (2012) carried out a study of estimation of sex using demarking points from Diameters of Lumbar Pedicles in Adult Nigerians. They observed that the vertical and horizontal diameters of lumbar vertebrae were sexually dimorphic, and Index of sexual dimorphism also showed that male parameters were all greater than female from L1 through L5.

BMI is a measure of overall adiposity based on weight relative to height and therefore does not give any information on body composition. Skinfold data require equations to calculate (BF %) from thickness measurements respectively (Das and Bose, 2012). Thus, this study was designed to determine the gender difference and also to establish standard anthropometric values for the arm and skinfold of Bauchi State Students in University of Maiduguri.

MATERIALS AND METHODS

For this study, 194 Bauchi State students (100 males and 94 females) of age ranging from 18 to 39 and 18 to 35 years respectively and with no structural deformity were accessed for the following parameters (standing height, weight, arm height, mid-arm circumference, triceps and biceps skinfolds).

The subjects stood barefooted, erect, and facing forward. Their arms were held laterally by their sides with the palms facing forward, feet closely apposed and straight, and the eyes looking straight ahead with their backs against the metre rule. Standing heights were thus measured to the nearest metre.

The weight of everyone was measured using a bathroom scale to the nearest kilogram. The subject mounts the scale barefooted and as light as possible, standing erect with head straight forward, arms laterally positioned by the side of the body and the feet closely apposed and straight.

The measurement was done in sitting position and sites were marked from medial condyle of the tibia (point a) to the medial malleolus (point b). The distance between points a-b was measured as calf height and recorded to the nearest 0.1 cm.

The measurement was done in sitting position and sites were marked by dividing the height of the calf into three to obtain the upper one-third point. The measuring tape was wrapped perpendicular to the long axis of the calf and the two ends of the overlapping tape are pulled together so that the zero ends lie below the measurement value. The measurement was read to the nearest 0.1 cm.

The subjects were asked to seat on a protocol chair with the knee flexed at a 90° angle. The MSC is measured at the posteromedial surface of the marked upper one-third calf point. The thumb and the index finger were used to grasp a fold of skin and subcutaneous adipose tissue approximately 2.0 cm above the upper one-

third calf circumference. The caliper jaws were placed over the complete skinfold for about three seconds to ensure the caliper read an accurate measurement. The thickness was read to the nearest 0.1 mm.

The subjects were asked to seat on a protocol chair with the knee flexed at a 90° angle. The LSC was measured at the posterolateral surface of the marked upper one-third calf point. The thumb and the index finger were used to grasp a fold of skin and subcutaneous adipose tissue approximately 2.0 cm above the upper one-third calf circumference. The caliper jaws were placed over the complete skinfold for about three seconds to ensure the caliper read an accurate measurement. The thickness was read to the nearest 0.1 mm.

The data obtained was subjected to statistical analysis using InStat GraphPad (version 3.05). The level of significance for difference in the parameters tested was placed at $p < 0.05$. Index for sexual dimorphism (ISD) was used to assess whether the parameters measured were sexually dimorphic. All analyses were performed separately for males and females. Data were analyzed with a statistical software

package; insta3 version 3.5. Standard deviation (SD), body mass index (BMI), demarking point (DP) and index for sexual dimorphism (ISD) were also calculated. Tables were generated as mean \pm S.D along with level of significance ($P < 0.05$).

Values for BMI were obtained from the values of weight and height using the formula stated by ADOLPHE QUET ELET mathematically represented by the formula

$$\text{BMI} = \frac{\text{weight}}{\text{height}^2}$$

ISD was calculated thus:

$$\text{ISD} = \frac{\text{Male mean}}{\text{Female mean}} \times 100\%$$

(Marin, 2006)

ISD is expressed as a percentage and a value greater than 100% indicates sexual dimorphism while value less than 100% is considered not sexually dimorphic.

Values for DP were calculated using the formula adopted by Jit and Singh, 1966; Singh and Gangrade, 1968.

$$\text{DP} = \text{mean} \pm 3 \times \text{Standard deviation.}$$

RESULTS

The anthropometric parameters subjected to analysis were the height, weight, calf height, calf circumference, medial calf skinfold and lateral calf skinfold. The descriptive statistics obtained were age group, mean, standard deviation, 95% Class Interval, Calculated Range, and p values for all parameters of males and females and they are presented in

TABLE 1: Distribution of Subjects According to Age Groups

Age Group (Years)	Males (n=100)	Females (n=94)	Total
18-20	12	18	30
21-23	13	19	32
24-26	38	14	52
27-29	14	13	27
30-32	11	15	26
33-35	12	15	27
Total	100	94	194

Tables 1 to 6. The calculated Body Mass Index (BMI) for both males and females was presented in table 7 while the calculated Index for sexual dimorphism (ISD), demarking points (DP) and the Calculated Range per age group of males and females were represented in Table 9 to 10.

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

Table 2 shows that the minimum and maximum values for height in males are 1.65m and 1.73m at the age groups of 18-20 and 30-32 years while females had 1.58m in all the age groups 18-20, 27-29 and 33-35 years and 1.59m at the age group of 27-29 and 30-32 years respectively.

Table 3 shows that the minimum value for weight of males and females are 58.46kg at the age group of 21-23 years and 58.20kg at the age group of 30-32 and 33- 35 years respectively. Also, according to the table 4.2, the maximum value for weight of males and

females was 65.17kg and 63.39kg at the age group of 33-35 and 27-29 years respectively. According to the table 4, the minimum calf height value for males and females were 17.0cm and 13.04cm at the age group of 18-20 and 33-35 years respectively. The table also clarifies that the maximum calf height values for males and females were 17.76cm and 18.28cm at the age group of 33-35 and 24-26 years respectively.

TABLE 2: Descriptive Statistics of Height (M) for Gender with age Range from 18-20 to 33-35 Years.

Age (Years)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	1.65 \pm 0.10	1.59 - 1.72	18	1.58 \pm 0.04**	1.56 - 1.60
21-23	13	1.69 \pm 0.10	1.63 - 1.75	19	1.58 \pm 0.04***	1.56 - 1.60
24-26	38	1.71 \pm 0.07	1.67 - 1.74	14	1.58 \pm 0.08***	1.54 - 1.63
27-29	14	1.70 \pm 0.06	1.69 - 1.74	13	1.59 \pm 0.06***	1.55 - 1.62
30-32	11	1.73 \pm 0.08	1.67 - 1.78	15	1.59 \pm 0.05***	1.56 - 1.61
33-35	12	1.72 \pm 0.05	1.67 - 1.77	15	1.58 \pm 0.03***	1.56 - 1.60

Table 3: Descriptive Statistics of Weight (kg) for Gender with age range from 18-20 to 33-35 Years.

Age (Yrs)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	58.58 \pm 6.82	54.25 - 62.92	18	59.28 \pm 9.55 ^{NS}	54.53 - 64.03
21-23	13	58.46 \pm 6.57	54.49 - 62.43	19	61.11 \pm 10.6 ^{NS}	56.00 - 66.21
24-26	38	62.55 \pm 9.46	59.44 - 65.66	14	61.64 \pm 11.8 ^{NS}	54.83 - 68.46
27-29	14	64.79 \pm 6.66	60.94 - 68.63	13	63.39 \pm 9.03 ^{NS}	57.93 - 68.84
30-32	11	61.73 \pm 9.17	54.57 - 66.89	15	58.20 \pm 7.21 ^{NS}	54.21 - 62.20
33-35	12	65.17 \pm 9.28	55.42 - 74.91	15	58.20 \pm 6.85*	54.41 - 61.99

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

Table 4: Descriptive Statistics of Calf Height (inch) for Gender with age range from 18-20 to 33-35 Yrs.

Age (Yrs)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	17.06 \pm 1.32	16.22 – 17.90	18	18.07 \pm 1.03*	17.59 - 18.73
21-23	13	17.2 \pm 1.33	16.42 - 18.04	19	18.15 \pm 0.76**	17.78 - 18.52
24-26	38	17.50 \pm 1.01	17.16 - 17.83	14	18.28 \pm 1.26*	17.55 - 19.0
27-29	14	17.44 \pm 0.80	16.9 7- 17.90	13	18.07 \pm 1.03*	17.4 5- 18.70
30-32	11	17.51 \pm 1.11	16.77 - 18.26	15	13.71 \pm 1.08***	13.11 - 14.31
33-35	12	17.76 \pm 1.10	16.60 - 18.92	15	13.04 \pm 0.88***	12.55-13.52

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001;

*P: < 0.05 Significant and ns P > 0.05 Not Significant

The table 5 below indicates that the minimum values for calf circumference of males and females were 12.48cm and 13.04cm at the age group of (21-23 and 30-32) and 33-35 years respectively. The table also indicates that the maximum values for the calf circumference of males and females were 13.42cm at the age group of 27-29 years and 14.91cm at the age group of 27-29 respectively.

The table 6 below shows that the minimum values for medial calf skinfold of males and females were 4.12mm and 5.49mm at the age group of 30-32 and 33-35 years respectively. Maximum values for males and females were 5.68mm and 12.24mm at the age group of 33-35 and 21-23 years respectively.

Table 5: Descriptive Statistics of Calf Circumference (inch) for Gender with age range from 18-20 to 33-35 Years.

Age (Yrs)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	12.54 \pm 0.87	11.98 - 13.10	18	14.05 \pm 1.43**	13.34 - 14.76
21-23	13	12.48 \pm 0.67	12.07 - 12.89	19	14.57 \pm 1.38***	13.91 - 15.24
24-26	38	12.92 \pm 1.17	12.53 - 13.31	14	14.28 \pm 1.38***	13.48 - 15.08
27-29	14	13.42 \pm 0.84	12.94 - 13.91	13	14.91 \pm 0.99***	14.28 - 15.55
30-32	11	12.48 \pm 1.01	11.79 - 13.16	15	13.71 \pm 1.08***	13.11 - 14.31
33-35	12	12.68 \pm 1.38	11.22 - 14.14	15	13.04 \pm 0.88 ^{ns}	12.55 - 13.52

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001;

*P: < 0.05 Significant and ns P > 0.05 Not Significant

Table 6: Descriptive Statistics of Medial Calf Skinfold (mm) for Males and Females with age range from 18-20 to 33-35 Years.

Age (Yrs)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	4.96 \pm 1.23	4.18 - 5.75	18	12.02 \pm 3.72***	10.17 - 13.87
21-23	13	4.97 \pm 1.57	4.02 - 5.93	19	12.24 \pm 4.98***	9.84 - 14.64
24-26	38	4.33 \pm 1.65	3.78 - 4.87	14	12.23 \pm 4.67***	9.53 - 14.93
27-29	14	4.95 \pm 1.60	4.02 - 5.87	13	12.13 \pm 5.10***	9.04 - 15.21
30-32	11	4.12 \pm 1.43	3.16 - 5.09	15	7.55 \pm 2.67***	6.00 - 9.09
33-35	12	5.68 \pm 4.28	1.19 - 10.17	15	5.49 \pm 1.36 ^{ns}	4.73 - 6.25

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001;

*P: < 0.05 Significant and ns P > 0.05 Not Significant

The table 7 below is showing that the minimum values for male's and female's lateral calf skinfold were 5.24mm and 8.18mm at the age group of 30-32 and 33-35 years respectively.

Maximum values for males and females were 7.06mm and 16.59mm at the age group of 27-29 and 24-26 years respectively

Table 7: Descriptive Statistics of Lateral Calf Skinfold (mm) for Males and Females with Age Range from 18-20 to 33-35 Years.

Age (Yrs)	Males			Females		
	N	Mean \pm SD	95% CI	N	Mean \pm SD	95% CI
18-20	12	6.59 \pm 1.25	5.79 - 7.38	18	14.88 \pm 6.09***	11.85 - 17.91
21-23	13	6.06 \pm 1.74	5.00 - 7.11	19	15.71 \pm 3.91***	13.82 - 17.59
24-26	38	5.96 \pm 2.43	5.69 - 8.43	14	16.59 \pm 7.60***	12.20 - 20.98
27-29	14	7.06 \pm 2.36	5.69 - 8.43	13	15.60 \pm 6.78***	11.50 - 19.70
30-32	11	5.24 \pm 1.94	3.94 - 6.55	15	9.40 \pm 2.03***	8.27 - 10.52
33-35	12	6.18 \pm 2.41	3.64 - 8.72	15	8.18 \pm 0.71**	7.79 - 8.58

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ***P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

The table 8 below presents the values for the body mass index (BMI) of both male and female with age ranged from 18-20 to 33-35 years. The values obtained were used to

categorize individual as underweight, normal, overweight and obese. According to the method of classification given by National Institutes of Health, 1998, an individual with

BMI less than 18.5 kg/m² was considered as underweight, an individual with BMI ranged from 18.5 To 24.9 kg/m² was considered as normal or desirable weight, an individual with BMI ranging from 25.0 to 29.9 kg/m² was considered as overweight.

From the table 8, the minimum BMI for males and females were 20.58kg/m² and 23.37kg/m² respectively at the age group of 30-33 years. Females at the age group of 33-35 years also have 23.37 kg/m² as the BMI.

Table 8: Mean Weight, Mean Height and Body Mass Index (BMI) for Males and Females with Age Range from 18-20 to 33-35 Years

Ages (Years)	Males			Females		
	Mean Weight (Kg)	Mean Height (M)	BMI (kg/m ²)	Mean Weight (Kg)	Mean Height (M)	BMI (kg/m ²)
18-20	58.58	1.65	21.53	59.27	1.57	24.09
21-23	58.46	1.68	20.73	61.10	1.57	24.83
24-26	62.55	1.71	21.42	61.64	1.58	24.75
27-29	64.78	1.70	22.41	63.38	1.58	25.45
30-32	60.72	1.72	20.58	58.20	1.58	23.37
33-35	65.16	1.72	22.08	58.20	1.58	23.37

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ****P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

for sexual dimorphism, calculated range and demarking points for height, weight, calf height, upper one-third calf circumference, medial and lateral calf skinfolds of males. The

for sexual dimorphism, calculated range and demarking points for height, weight, calf height, upper one-third calf circumference, medial and lateral calf skinfolds of females.

Table 9: The Index for Sexual Dimorphism, Calculated Range and the Demarking Point for Males with Age Group Range from 18-20 to 33-35 Years

Age (Yrs)	Height (m)			Weight (kg)			Calf Height (cm)		
	ISD	CR	DP	ISD		DP	ISD	CR	DP
18-20	104.43	1.35-1.95	>1.70	98.82	38.09-79.07	>87.93	95.69	26.94-45.90	>45.14
21-23	106.96	1.39-1.99	>1.70	95.66	38.75-78.17	>71.71	98.80	28.32-44.22	>43.34
24-26	108.23	1.50-1.92	>1.82	101.48	34.17-90.93	>97.04	95.81	30.94-42.28	>46.22
27-29	106.92	1.52-1.88	>1.77	102.21	44.81-84.77	>90.48	96.78	26.54-45.68	>44.48
30-32	108.81	1.49-1.97	>1.74	104.35	33.22-88.24	>79.83	104.15	30.40-42.82	>41.39
33-35	108.86	1.57-1.87	>1.67	111.98	37.33-93.01	>78.75	104.63	33.80-43.46	>46.37

SD: Standard Deviation; N: Number of Samples; CI: Confidence Interval, ****P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

Table 10: The Index for Sexual Dimorphism, Calculated Range and the Demarking Point for Males with Age Group Range from 18-20 to 33-35 Years

Age (Years)	Upper One-Third Calf Circumference (cm)			Medial Calf Skinfold (mm)			Lateral Calf Skinfold (mm)		
	ISD	CR	DP	ISD	CR	DP	ISD	CR	DP
18-20	82.40	19.84-31.66	>43.40	41.70	-1.23-14.55	>37.99	40.73	-1.98-9.36	>30.00
21-23	82.61	20.67-30.63	>42.87	41.36	2.14-9.58	>37.82	46.47	0.96-5.10	>16.99
24-26	86.29	18.70-34.30	>42.26	38.94	-2.85-15.81	>37.25	29.36	0.90-5.46	>35.01
27-29	89.16	21.69-34.89	>40.61	47.47	-2.82-18.18	>31.18	39.33	0.82-5.74	>21.57
30-32	102.08	22.14-30.18	>31.18	82.10	-1.90-13.46	>15.35	91.59	1.51-4.81	>8.73
33-35	104.26	19.68-33.66	>30.53	104.51	-0.45-12.51	>9.34	97.07	0.82-5.14	>5.08

ISD: Index for sexual Dimorphism **CR:** Calculated Range **DP:** Demarking Point

Table 11: The Index for Sexual Dimorphism, Calculated Range and the Demarking Point for Females with Age Group Range from 18-20 to 33-35 Years

Age (Years)	Height (m)			Weight (kg)			Calf Height (cm)		
	ISD	CR	DP	ISD	CR	DP	ISD	CR	DP
18-20	104.43	1.46-1.70	<1.35	98.82	30.63-87.93	<38.09	93.94	9.75-18.35	<9.85
21-23	106.96	1.46-1.70	<1.39	95.66	29.31-71.71	<38.75	94.93	10.41-18.74	<10.45
24-26	108.23	1.34-1.82	<1.50	101.48	26.24-97.04	<34.17	95.70	10.13-18.43	<9.38
27-29	106.92	1.53-1.77	<1.52	102.21	36.30-90.48	<44.81	96.49	11.92-17.90	<10.89
30-32	108.81	1.44-1.74	<1.49	104.35	36.57-79.83	<33.22	127.74	10.46-16.96	<9.43
33-35	108.86	1.49-1.67	<1.57	111.98	37.65-78.75	<37.33	136.25	10.39-15.68	<8.51

ISD: Index for sexual Dimorphism **CR:** Calculated Range **DP:** Demarking Point

Table 12: The Index for Sexual Dimorphism, Calculated Range and the Demarking Point for Females with Age Group Range from 18-20 to 33-35 Years

Age (Yrs)	Upper One-Third Calf Circumference (cm)			Medial Calf Skinfold (mm)			Lateral Calf Skinfold (mm)		
	ISD	CR	DP	ISD	CR	DP	ISD	CR	DP
18-20	89.2 2	9.75- 18.35	<9.85	41.31	0.86-23.18	<2.42	44.2 9	-3.39- 33.15	<4.50
21-23	85.6 3	10.41- 18.74	<10.4 5	40.63	-2.70- 27.19	<3.11	38.5 4	3.96- 27.45	<5.33
24-26	90.4 6	10.13- 18.43	<9.38	35.40	-1.78- 26.25	<2.19	35.9 6	-6.23- 39.41	<7.22
27-29	90.0 2	11.92- 17.90	<10.8 9	40.80	-3.17- 27.43	<3.12	45.2 5	-4.74- 35.95	<9.62
30-32	91.0 2	10.46- 16.96	<9.43	54.66	-0.46- 15.56	<1.62	55.7 9	3.28- 15.51	<4.36
33-35	97.2 6	10.39- 15.68	<8.51	103.4 5	1.38-9.59	<11.4 8	75.5 2	6.05- 10.31	<7.69

ISD: Index for sexual Dimorphism **CR:** Calculated Range **DP:** Demarking Point

Table 13: The Descriptive Statistics of Males and Females Parameters for all Age.

Parameter s	Males (N=100)				Females (N=94)				ISD
	95% CI	CR	DP	Mean	95% CI	CR	DP	Mean	
Height (m)	1.69 - 1.72	1.46 - 1.94	>1.73	1.70	1.57 - 1.59	1.43 - 1.73	<1.46	1.58** *	107.5 9
Weight (kg)	60.42- 63.74	37.03- 63.13	>88.1 5	62.08	58-31- 62.13	32.29 - 88.15	<37.0 3	60.22 ^{ns}	103.0 9
CH (inch)	17.24- 17.69	16.30- 23.06	22.44	17.47	17.77- 18.21	16.02- 22.44	16.30	17.99* **	97.09
CC (inch)	12.64- 13.07	10.52- 16.92	22.81	12.86	13.82- 14.37	14.80- 22.81	10.52	14.09* **	91.27
MCS (mm)	4.34-5.07	3.16- 14.27	63.26	4.70	9.36- 11.31	34.80- 63.26	3.16	10.33* **	45.49
LCS (mm)	5.72-6.58	6.81- 19.78	97.61	6.15	12.24- 14.67	62.03- 97.61	6.81	13.46* **	45.68

N: Number of Sample; **SD:** Standard Deviation; **CI:** Confidence Interval; **DP:** Demarking Point; **CR:** Calculated Range; ***P < 0.0001; **P < 0.001; *P: < 0.05 Significant and ns P > 0.05 Not Significant

DISCUSSION

In this study, the mean values for height of the subjects and calf height increased in both sexes with respect to ages, except for males at the age group 27-29 years where there was decrease. Male's heights were higher than the female counterparts ($p < 0.0001$).

The mean values for weight also increase in both sexes with respect to ages. The mean values for female's weights are higher than the mean values for males except for the age group 24-26 years where the value decreases.

The mean values for Calf circumference increase in males with respect to their ages and it decreases in females except for the ages of 18-20. With respect to their ages, the mean values for female's calf circumference were higher than those of the males except for the age of 27-29. Statistically, the mean calf circumference was considered significant ($p < 0.0001$).

The mean value for medial calf skinfold in both males and female fluctuated across the age groups studied. The mean value for lateral calf skinfold of males also fluctuated across the age groups while female decreased with respect to their age group except for the age groups 18-20 and 21-23 years where the mean value increased.

The mean medial and lateral calf skinfold was both statistically significant ($p < 0.05$), this corresponds to study by (Berna, 2012). According to Berna (2012) descriptive statistics of weight, height and BMI were: mean weight of males was 64.69 kg, females had 61.66 kg, ($P < 0.05$), mean height of males were 168.42 cm, females had 163.97 cm, ($P < 0.001$), BMI of males were 22.73 kg/m², females were 22.90 kg/m², ($P > 0.05$).

In this study, BMI was also observed, and it was revealed that all the age groups in both males and females were considered normal or desirable with minimum BMI of 21.42kg/m² at the age group of 24-26 years of males except for female at the age group of 27-29 years, where the BMI value was 25.06 kg/m² which

was considered as overweight according to the classification given by National Institutes of Health, 1998.

Comparisons of the ISD and P value of the six parameters observed that medial calf skinfold has the least ISD of 45.49 while the parameter with highest ISD was 107.71. The result of this study also correlates with that of Das and Bose, (2012)

The present study showed that ISD for heights of all the age groups were above 100 which indicated that height as a parameter was sexually dimorphic. On the other hand, the ISD for weight of all the age groups were equally above 100 except at the age groups of 18-20 and 21-23 years confirming that the age groups of 18-20 and 21-23 years were not sexually dimorphic.

The ISD for calf height of all the age groups were below 100 except at the age groups of 30-32 and 33-35 years which showed that calf height was sexually dimorphic at the age groups of 30-32 and 33-35 years. The ISD for calf circumference were all below 100 which clarifies that calf circumference was not a desirable parameter for determination of sex.

The ISD for medial calf skinfold of all the age groups were below 100 except at the age group of 33-35 years which indicate that medial calf skinfold was sexually dimorphic at the age group of 33-35 years. The ISD for lateral calf skinfold of all the age groups were below 100 which show that this parameter was suitable for determination of sex.

In conclusion, calf skinfold thickness and subcutaneous fat are statistically significant in assessment of sex which was found to be sexually dimorphic in females than males. There were significant differences between males and females standing height, calf height, upper one-third calf circumference, medial and lateral calf skinfolds, but no significant differences in weight. Index for sexual dimorphism and demarking point for all the

parameters were observed to be sexually dimorphic. Males have higher values for height and weight, while the females have higher values for the calf height, upper one-third calf

circumference, medial and lateral calf skinfolds. Further as well as similar studies should be carried out in other regions of Nigeria.

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