# SEXUAL DIMORPHISM IN ADULT HUMAN CLAVICLES OF NORTH INTERIOR KARNATAKA REGION

\*Kiran.V. Padeyappanavr \*\* Ameer Khusru.M. Kazi \*\*\* P.S. Bhusreddy \*\*\*\* Umesh K.Kulkarni

#### **ABSTRACT:**

Gender differences determined in 333 dried clavicles from adult bodies of known sexes (196 males and 137 females) were obtained from North Interior Karnataka region by taking their weight and measuring their length and midclavicular circumference. The data was subjected to statistical analysis, by taking only the weight of the clavicle in to consideration, Sex could be determined correctly in 48% in right male, 40% left male, 67% right and 55% left female clavicles. On the basis of length alone sex could be determined in 36% right 44% left male, 39% right female and 22% left female clavicles. Similarly from mid-clavicular circumference of the bones sex could be estimated in 66% right, 50% left male, 44% left males and 9% left female clavicles.

#### **KEY WORDS:**

Bone, Clavicle, Multivariate analysis.

#### **INTRODUCTION:**

Dimorphism in the clavicle has been the subject of a detailed study both in the westerncountries and India. Terry (1932), Olivier (1951) observed that the mid clavicular circumference was a good for determining the sex of a clavicle<sup>1,</sup> <sup>2</sup>. Jit & Singh (1961) were pioneers in this field in North India<sup>3</sup>. They gave us the concept & demarking point  $(3 \pm 5D)$  which was found to be extremely useful and provided almost 100%, specificity but unfortunately by this method the percentage of the bones, the sex of which could be determined was less than 15% (Jit and Sahni, 1983)<sup>4</sup>. Further Singh and Gangrade (1968a, 1968b) showed that even within India, parameters of the clavicles of Varanasi zone, differed from those of the clavicles of Amritsar zone 5, 6. Jit and Sahni (1983) also recorded different measurements of the clavicles in Chandigarh zone. It was considered appropriate that multivariate analysis (Armitage, 1971) be used to determine the sex of the clavicle from Patiala zone which will also elicit zonal differences. Determination of the sex of deceased is easy when a complete skeleton is available for examination <sup>7</sup>. Even when the entire pelvis and skull are available not more than 98% accuracy can be achieved in identifying the sex (Krogman, 1962)<sup>8</sup>. On the whole, the bones of a male skeleton are heavier, larger and markings of muscular attachments are more pronounced than that of female. Several workers (Jit and Singh 1966)<sup>9</sup>, Singh and Gangrade, 1968a, 1968b, Singh 1969<sup>10</sup>, Singh et al 1972<sup>11</sup>, Jit and Sahni 1983, Sayee et al 1992) recorded that the mid clavicular circumference was a good criterion for sexing the clavicle. Singh and Jit (1996) deter mined sex on the basis of volume of clavicle  $^{12}$ .

<sup>\*</sup> Asst. Professor, BIMS, Belgaum

E-mail.: dr.kiranvp@gmail.com

<sup>\*\*</sup> Associate Professor, Al-Ameen Medical College, Bijapur

<sup>\*\*\*</sup> Asst. Professor, KIMS, Hubli

<sup>\*\*\*\*</sup> Associate Professor, BIMS, Belgaum

#### MATERIALS AND METHODS:

333 dried clavicles from bodies of known (196 males and 137 females) were obtained from the departments of Anatomy of Al - Ameen Medical College, Shri B.M. Patil Medical College, Bijapur, S.Nijalingappa Medical College Bagalkot from the dissected bodies and known whole body skeletons also. Only the clavicles with complete ossification were included in the present study. Bones showing any deformity, damage or degradation were excluded. Out of 196 clavicles of males, 92 were of right side and 104 of left side. Among these 24 clavicles were paired and remaining are single either of right (66) or left side (78). Out of 137 clavicles of females, 61 belong to right side and 75 to left side. Among these 14 clavicles were paired and remaining are single either of right (47) or left side (52). Following metrical data for each clavicle was noted in the following manner:

#### 1) Length of clavicle:

The maximum length of the clavicle was measured in millimeter (mms) from sternal end to acromial end with the help of Vernier caliper and graph paper.

#### 2) Weight of clavicle:

The weight of the bone was taken with the help of chemical balance in grams (gms).

#### 3) Mid-shaft circumference of clavicle:

While taking the length, a mark was done at the middle of the clavicle with a pencil and the circumference was measured with the help of calibrated narrow strip of graph paper or a thread in mms.

#### **REVIEW OF LITERATURE:**

While discussing sexual dimorphism, Davivongs(1963) has summarized the characteristic features of male bones. He points out that "as a general rule, male bones are massive and heavier than female bones. The crest, ridges, tuberosities and lines of attachment of muscles and ligaments are more strongly marked in males. This rule also governs the size of joints and articular surfaces of the bones."<sup>13</sup>.

Although workers like Stewart (1954) have considered "guess work" of anthropometric observations are the "measurements" carried out by internationally accepted techniques<sup>14</sup>.

The methods of recording the principal dimensions are established for all skeletal elements and the proportions are expressed as indices (Williams and Warwick, 1989)<sup>15</sup>.

In forensic work, when 100% accuracy is essential, ideally there should have no overlap of the values for both sexes.

But Hrdlicka (Stewart 1952) has pointed out that the male bones from hypo masculine to hyper masculine while the female bones have a range of hypo feminity, the overlapping would thus cause difficulty or even impossibility in sex determination <sup>16</sup>.

Application of multivariate analysis to the metrical data reduces the overlap and hence more chances of sex differentiation in a multivariate discriminant function analysis are also well documented (Giles 1964, Howells 1941). It is planned to apply this statistical analysis to a large series of such type in future work<sup>17,18</sup>.

In Univariate analysis, if the sexing is done on the basis of demarking points calculated for each parameter using a formula (mean  $\pm$ 3S.D) chances of misclassification of sex are minimal. Here it is not necessary for all the parameters to cross the demarking point for any one parameter, if it crossed would identify the unknown sex of the bone with 100% accuracy  $(Singh and Potturi, 1978)^{19}$ .

Based on calculation of demarking points, the utility and limitations of different measurements and indices of the clavicle are presented as follows:

#### **OBSERVATIONS AND RESULTS:**

#### **Right clavicle:**

In the present study, the length of the male right clavicle varies from 120.0mm to 167mm with an average of  $141.9 \pm 9.732$ mm where as that of the female right bones extends from 100 to 145 mm with an average of  $125.44 \pm 8.86$ . Right clavicle with the length of 145 mm and above is definitely a male one and the one measuring less than 120 mm is definitely a female one 35.86% of male right bones and 29.5% of female right bones are not overlapped.

But when nearly 100% accuracy of sexing is required, it is advisable to calculate the maximum and minimum limits by adding  $\pm 3$  S.D. to the mean value of each measurement. This would cover 99.75% of the sample and would be useful also for any other sample from the zone. Such limiting points are known as demarcating points (D.P.). When D.P. is applied, a right clavicle having a length of 153.88 mm is definitely male and one having length less than 110.27 mm is female.

By these points, percentage of identified bones comes down to 10.86% in male and 4.91% in females. The sex difference in the mean values of length of right clavicles of male and females is statistically highly significant (up to 99.99%) i.e., P<0.001.

### Left clavicle:

The length of male left clavicle varies from 121 to 170 mm with an average of 143.5 mm  $\pm$  10.35 whereas that of female left clavicles extends from 105-145 mm with an average of

129.7 mm  $\pm$  9.55. Left clavicle with the length above 145 mm is definitely a male and the one measuring 121 mm or less is definitely a female.

44.23% male left clavicles and 22.36% female left clavicles did not showed overlapping. The sex difference in the mean values of length of left clavicles in males and females is statistically highly significant (P<0.001).

Difference between the two sides.

### Male clavicles:

In the present study, in male clavicles, out of 196 clavicles, 26 are paired. In 17 pairs, left clavicle is found to be longer by 2 mm to 12 mm than right clavicle. In 7 pairs, right clavicle is longer than left by 2-9 mms.

### Female clavicles:

In female clavicles, out of 137 clavicles 14 are paired. In 9 pairs, left clavicle is found to be longer by 4 to 11 mms. In 4 pairs, a right clavicle is longer than left by 2 to 10 mms.

### **Right clavicle:**

The weight of male right clavicle varies from 11-28 gms with an average of 16.99 gms  $\pm$ 4.08 whereas that of female right clavicle varies from 4 – 17 gms, with an average of 10.31  $\pm$  2.99. A right clavicle having the weight more than 17 gms is definitely a male and that having a weight less than 11 gms is definitely a female.

47.82% male bones and 67.21% female bones are not overlapped. By applying demarking points, percentage of identified bones came down to 26.08% in males and 14.75% in females. Sex difference in mean values of weight of right clavicles in males and females is statistically significant (P<0.001).

### Left clavicle:

The weight of male left clavicle varies from 10-31 gms with an average of 17.04 gms  $\pm$ 

4.53 whereas that of female left bone varies from 5 - 18 gms with an average of  $10.7 \pm 3.27$ . Any left clavicle, having weight more than 18 gms is definitely a male, that having a weight less than 10 gms is definitely a female.

40.38% male bones and 55.26% female bones are not showing overlapping. Sex difference in mean values of weight of left clavicles in males and females is statistically highly significant (P<0.001).

#### **Right clavicle:**

As shown in table mean value of midshaft circumference of right clavicle in males (38.34 mm  $\pm$  4.24) is higher than in females (31.78mm  $\pm$  3.24). Right clavicle with midshaft circumference more than 37 mm is definitely a

male and less than 30 mm is definitely a female.

In the present study, 66.30% and 44.26% male and female samples respectively are not overlapped. The sex difference in mean values is statistically highly significant (P<0.001).

#### Female clavicle:

The mean value of midshaft circumference of left clavicles in males (37.96 mm  $\pm$  3.67) is higher than females (32.44 mm  $\pm$ 3.47). Left clavicle with midshaft circumference more than 39 mm is definitely a male and 28 mm or less is definitely female.

In the present study, 50% male bones and 92.21% female bones are not showing overlapping. The sex difference in mean values is statistically highly significant (P<0.001).

Details of measurements	Rig	ght	Le	ft	
	Male	Female	Male	Female	
No of bones	92	61	104	76	
Range	120-167	100-145	121-170	105-145	
Mean	141.9	125.4	143.5	129.7	
Median	141	125	143	130	
Mode	130	120	140	125	
Standard Deviation	9.732	8.86	10.35	9.55	
Coefficient of variation (CV)	1458	1414	1386	1357	
Identification Point	> 145	< 120	> 145	< 121	
% of identified bones	35.86	29.50	44.23	22.36	
Calculated range	110.27-	91.14-	110.65-	95.45-	
	176.73	153.86	180.35	154.55	
Demarking point.	> 153.88	< 110.27	> 154.55	< 110.65	
% beyond demarking point.	10.86	4.91	18.26	2.63	

### Length of Clavicles (in mm)

Note : P < 0.001 implies that, it is statistically highly significant.

Details of measurements	Rig	ght	Left			
	Male	Male Female		Female		
No of bones	92	61	104	76		
Range	11-28	4-17	10-31	5-18		
Mean	16.99	10.31	17.09	10.7		
Median	16.5	10	17	10		
Mode	16	9	16	8		
Standard Deviation	4.08	2.99	4.53	3.27		
Coefficient of variation (CV)	415.7	344.1	377.3	326.8		
Identification Point	> 17	< 11	> 18	< 10		
% of identified bones	47.82 %	67.21 %	40.38	55.26		
Calculated range	7.0 - 32.08	1.01-19.99	5.47 - 35.53	173 - 21.27		
Demarking point.	> 19.99	< 7.0	> 21.27	< 5.47		
% beyond demarking point.	26.08	14.75	21.15	2.63		

#### Weight (in gms) of Clavicles

Note : P < 0.001 implies that, it is statistically highly significant.

Mid-Shaft Circumference (in mm)

Details of measurements	Ri	ght	Left							
	Male	Female	Male	Female						
No of bones	92	61	104	76						
Range	30-54	24-37	28-45	25-39						
Mean	38.34	31.78	37.96	32.44						
Median	39	31	38.5	32						
Mode	40	30	40	30						
Standard Deviation	4.24	3.24	3.67	3.47						
Coefficient of variation (CV)	903.07	980.78	1032.68	933.16						
Identification Point	> 37	< 30	> 39	< 28						
% of identified bones	66.30 %	44.26 %	50 %	9.21						
Calculated range	25.76 -	20.76 -	25.0 -	21.53 -						
	58.24	40.24	48.67	42.47						
Demarking point.	> 40.24	< 25.76	> 42.47	< 25.0						
% beyond demarking point.	43.47	4.91	15.38	3.94						
Note $\cdot P < 0.001$ implies that it is statistically highly significant.										

Table No: 1 Length of Clavicle (in mm) Right Side Ν Range S.D. х F F F F M S.S.D. Investigators Μ Μ Μ 1 Robert Van Doengen (1963) 50 139.5 125.1 8.7 6.8 < 0.001 50 --119.78-103.03-2 Jit I and Sing S (1966) 120 51 145.58 130.36 8.6 9.11 \_ 171.39 157.69 Singh S. and Gangrade K.C. 103.28-116.83-81 3 19 141.19 125.78 8.22 7.5 -(1968) 166.15 148.28 4 Choudhary D. S et al (1977) 142.9 131.6 172 30 -\_ \_ -\_ 5 Jit I and Sahni D. (1983) 260 80 148 132.4 127-116-8.6 8.4 <0.001 6 Terry (1932) USA White 152.9 0.88 --7 Terry (1932) USA Negroes 153.3 140.98 \_ 0.83 0.76 \_ \_ \_ 8 Singh (72) USA White 151.4 133.68 \_ -\_ \_ ---9 Singh (72) 155.72 137.6 \_ \_ \_ \_ 10 Present Study 92 61 141.9 125.4 120-167 100-145 9.73 8.86 < 0.001

#### SEXUAL DIMORPHISM IN ADULT HUMAN CLAVICLES OF NORTH INTERIOR KARNATAKA REGION

er	igth of Clavicle (in mm)									
				Left S	ide	De		0	-	
	Investigators	M	F	м	F	M	nge F	М	D. F	S.S.D
1	Robert Van Doengen (1963)	50	50	139.5	125.1	-		8.7	6.8	< 0.00
2	Jit I and Sing S (1966)	116	61	147.59	129.8	119.84- 175.34	103.49- 15.11	9.25	8.77	-
3	Singh S. and Gangrade K.C. (1968)	82	18	144.18	127.77	120.15- 168.21	103.5	8.01	8.09	2
4	Choudhary D. S et al (1977)	72	30	142.9	131.6	-	-	-		-
5	Jit I and Sahni D. (1983)	260	80	149.8	134	127-176	117-149	8.4	8.1	< 0.00
6	Terry (1932) USA White	-	-	154.1	-	-	-	0.91	-	-
7	Terry (1932) USA Negroes	-	-	155.86	141.78	-	-	0.92	0.83	-
8	Singh (72) USA White	-	-	153.37	134.84	-	-	-	-	-
9	Singh (72) USA Negroes	-	·	157.32	140.8	-		-	-	-
10	Present Study	104	76	143.5	129.7	121-170	105-145	10.35	9.95	<0.00

				Table N	lo : 3					
We	eight of Clavicle (in gms)			Dista	D: 1					
				Right	side	-				
			N		X	Ra	nge	S.	.D.	
	Investigators	M	F	M	F	M	F	M	F	S.S.D.
1	Jit I and Sing S (1966)	117	51	18.89	12.47	7.82- 29.96	4.07- 20.87	3.69	2.8	-
2	Singh S. and Gangrade K.C. (1968)	81	19	21.46	12.83	8.85- 34.08	4.60- 21.07	4.2	2.74	-
3	Jit I and Sahni D. (1983)	260	80	25.78	17.55	19-42	11.10- 23.00	4.15	3.21	<0.001
4	Present Study	92	61	16.99	10.31	11-28	4-17	4.08	2.99	<0.001

				Table N	0:4					
We	eight of Clavicle (in gms)	5		Loft S	ide					
			N	Len 3	K	Range		S.	D.	
	Investigators	Μ	F	Μ	F	М	F	М	F	S.S.D.
1	Jit I and Sing S (1966)	114	61	18.68	12.03	6.05- 31.31	3.96- 20.10	4.21	2.69	-
2	Singh S. and Gangrade K.C. (1968)	82	18	21.32	12.84	8.92- 33.73	4.94- 20.75	4.13	2.63	-
3	Jit I and Sahni D. (1983)	260	80	25.34	17.21	19.0- 45.9	11.00- 24.0	4.37	3.22	<0.001
4	Present Study	104	76	17.08	10.7	10-31	5-18	4.53	3.27	<0.001

Mid	Shaft Circumference of Clavic	e (in mm	)	Table N	o : 5					
IVIIG			/	Right S	Side			-	2	
	Investigators	1	1	X		Rai M	nge F	S. M	D. F	S.S.D.
1	Robert Van Doengen (1963)	50	50	36.2	29.5	-	-	3.44	3.36	<0.001
2	Jit I and Sing S (1966)	117	51	36.17	29.69	27.11- 45.23	24.47- 34.91	3.02	1.74	-
3	Singh S. and Gangrade K.C. (1968)	81	19	35.09	28.52	25.58	21.41	3.17	2.37	-
4	Choudhary D. S et al (1977)	172	30	36.79	30.6	-	-	-	-	-
5	Jit I and Sahni D. (1983)	260	80	36.2	30.4	31.45	24-35	3.5	2.7	<0.001
6	Terry (1932) USA Negroes	-	-	40.02	35.26	-	-	0.22	0.42	-
7	Terry (1932) American White	-	-	40.02	-	-	-	0.36	-	-
8	Oliver (1951) French	-	-	38.4	31.06	-	-	-	-	
9	Singh (72) American White	-	-	38.47	31.61	-	-	-	-	-
10	Singh (72) Negroes	-	-	39.96	33.06	-	-	-	-	-
11	Present Study	92	61	38.34	31.76	30-54	24-37	4.24	3.24	<0.001

#### SEXUAL DIMORPHISM IN ADULT HUMAN CLAVICLES OF NORTH INTERIOR KARNATAKA REGION

				Right S	Side					
			N	)	X	Ra	nge	S.	D.	
	Investigators	Μ	F	Μ	F	Μ	F	Μ	F	S.S.D.
1	Robert Van Doengen (1963)	50	50	36.2	29.5	-	-	3.44	3.36	<0.001
2	Jit I and Sing S (1966)	114	61	35.7	29.51	26.22- 45.18	23.60- 35.42	3.16	1.97	-
3	Singh S. and Gangrade K.C. (1968)	82	18	34.64	28	25.12- 44.16	21.32- 34.68	3.17	2.22	-
4	Choudhary D. S et al (1977)	172	30	36.79	30.6	-	-	-	-	-
5	Jit I and Sahni D. (1983)	260	80	35.9	30	27.8- 44.0	21.6- 38.4	2.7	2.8	<0.001
6	Terry (1932) USA Negroes	-	-	38.58	-	-	-	0.28	-	-
7	Terry (1932) American White	-	-	40.06	38.42	-	-	0.36	0.38	-
8	Oliver (1951) French	-	-	38.4	31.6	-	-	-	-	-
9	Singh (72) American White	-	-	37.61	30.72	-	-	-	-	-
10	Singh (72) Negroes	-	-	39.08	32.66	-	-	-	-	-
11	Present Study	104	76	37.96	32.44	28-45	25-39	3.67	3.47	<0.001

#### **DISCUSSION:**

Comparison with the other studies

The Osteometric data of the clavicle of present study is compared with other similar studies. The following tables represent the comparison of the findings of the present study with the available studies in the past.

Abbreviations used in these tables are:-

N = Sample size

X=Mean

S.D. = Standard Deviation

S.S.D = Statistically significant difference between two sexes

P=Probability

n.s.=Not significant

# LENGTH OF CLAVICLE (in mm) Right side

The above table indicates that Doengen  $(1963)^{20}$ ; Jit and Sahni (1983) and also the present study observed statistically significant difference between male and female values.

The mean value of length of right clavicle in male in the present study (141.9mm) is comparable with the study of Doengen (139.57mm); Singh and Gangrade (141.19mm) and Choudhary et al (142.19mm). these values are higher in the studies of Jit and Singh (145.58mm); Jit and Sahni (148.0mm); Terry for USA Whites (151.40mm) and USA negroes (155.72mm).

The mean value of right clavicle in females in the present study (125.4mm) is comparable with all the studies except Terry for USA Negroes (140.98mm) and Singh for USA Negroes (137.60m)

# <u>LENGTH OF CLAVICLE (in mm)</u> <u>Left side</u>

The mean value of length of left clavicle in males in the present study (143.5mm) is comparable with the studies of Doengen (139.5mm); Singh and Gangrade (144.18mm) and Chaudhary et al (142.9mm). It is lower than the studies of Jit and Singh (147.59mm); Jit and Sahni (149.8mm) Terry for USA Whites (154.10mm) and USA Negroes (155.86); Singh for USA Whites (153.37mm) and USA Negroes (157.32mm).

The mean length of left clavicle in females in the present study (129.7mm) is comparable with the most of the studies except with Terry for USA Negroes (141.78mm) and Singh for USA Negroes (140.80mm).

The studies by Doengen; Jit and Sahni and the present one show statistically significant sex difference between mean values of length of left clavicle in males and females. Difference in length of the clavicles may be due to the fact that American Negroes and Whites are taller than Indians.

# <u>WEIGHT OF CLAVICLE (in gms)</u> <u>Right side</u>

The above table indicates that studies including present one and by Jit and Sahni (1983) show statistically significant sex difference in weight of right clavicle in males and females.

In the present study, the mean weight of right clavicle in males (16.99 gms) is comparable with the studies of Jit and Singh (18.69 gms), Singh and Gangrade (21.46 gms). But, it is lower than the studies of Jit and Sahni (25.78 gms).

The mean weight of right clavicle in females in the present study (10.31 gms) is

comparable with the studies of Jit and Singh (12.47 gms); Singh and Gangrade (12.83 gms) except with Jit and Sahni (17.55 gms).

### WEIGHT OF CLAVICLE (in gms) Left side

The mean weight of left clavicle in males in the present study (17.09 gms) is comparable with Gangrade (21.32 gms) but it is lower than

the studies of Jit and Sahni (25.34mm). The mean weight of the left clavicle in females in the present study (10.7 gms) is comparable with all the studies except with the Jit and Sahni (17.21 gms).

The present study by Jit and Sahni (1983) shows statistically significant sex difference between mean weight of left clavicle in males and females.

## MID SHAFT CIRCUMFERENCE OF CLAVICLE (in mm) Right side

The above table shows that it is the most popular clavicular parameter for sex identification which can be judged by the list of maximum no. of studies. However, the most of the studies have not statistical significance. Doengen (1963); Jit and Sahni (1983) and also the present study observed statistically significant sex difference between male and female values.

The mean mid shaft circumference of right clavicle in males in the present study (38.34 mm) is comparable with almost all studies except those with Terry for USA Negroes (40.02 mm) and USA Whites (40.02 mm). The mean mid shaft circumference of right clavicle in females in the present study (31.78mm) is also comparable

with almost all studies except with Terry for USA Negroes (35.26 mm).

# MID SHAFT CIRCUMFERENCE OF CLAVICLE (in mm) Left side

A statistically significant sex difference between mean values of midshaft circumference in males and females is seen in the studies by Doengen (1963); Jit and Sahni (1983) and present one.

The mean midshaft circumference of left clavicle in males in the present study (37.96 mm) is comparable with all the studies except with Terry for American Whites (40.06 mm).

The mean midshaft circumference of left clavicle in females in the present study (32.44 mm) is comparable with all studies except with Terry for American Whites (38.42 mm).

The difference in the midshaft circumference of clavicles is seen because people in the Western countries are definitely strong and stout than Indians.

Olivier (1951) found the French left clavicle to be longer than the right. Similar results were obtained by Jit and Singh (1966); they noted that the clavicle was longer than the right by 0.5mm to 22.5 mm in66.3% paired male clavicles in Amritsar zone. Singh and Gangrade (1968b) in Varanasi zone also found that the mean length of the left male and female clavicles was longer than that of the right clavicle. Similarly, observations made by Jit and Sahni (1983) in Chandigarh zone concluded that the left clavicle was longer than the right 60% instances and both clavicles were equal in length in 30% bones. The left clavicle was longer in the right handed persons.

The authors adopted the well known procedure given by Washburn (1948, 1949) of determining the sex of a bone by drawing squared bar diagrams wherein the abscissa represented the measurements and ordinate the number of cases, each case was represented by a square. Measurements of bones from both sexes were drawn in the same diagram so that the number of cases belonging to one sex falling in the range of measurements of the other sex could be easily noted. Jit and Singh (1966) and Jit et al.  $(1980)^{21}$ adopted this procedure in case of clavicle and sternum respectively. The maximum and minimum measurements in the overlapping zone were termed as identification points by Singh and Potturi (1978). Further the possibility of occurrence of a rare case beyond the identification point, however, could not be ruled out. It was therefore, necessary to eliminate such a case particularly the one which attracted a lawsuit. Jit and Singh (1966) gave us the concept of  $\pm$  3SD which they called the demarking point, beyond which there was hardly any possibility of a measurement of a bone occurring ordinarily. According to them it gave us 99.7% accuracy. When Washburn's procedure (1948, 1949) was applied to length of the clavicle, 18% right, 20% left male and 9% right and 7% left female clavicles could be sexed <sup>22, 23</sup>. Similarly on the basis of mid clavicular circumference, only 10% right, 4% left male and 11% right and 6% left female clavicles could be sexed correctly. The present results of mid clavicular circumference do not tally with those of the previous workers (Jit and Singh, 1966; Singh and Gangrade, 1968b; Jit and Sahni, 1983 and Harbir Kaur, 1989 <sup>24</sup> who got much better results. It is difficult to offer a good explanation for the difference; zonal differences cannot give such wide variations in results.

In the present study for identification of clavicle, 196 male and 137 females adult, fully

ossified, dried clavicles are studied from departments of Anatomy of Al-Ameen Medical College, Shri B.M. Patil Medical College, Bijapur; S. Nijalingappa Medical College, Bagalkot from dissected bodies and known whole body skeleton.

Its different measurements viz. Length, weight, midshaft circumference of each clavicle is taken.

Univariate statistical tests are applied to the metrical data obtained to assess whether the differences between the means of each parameter are statistically significant or not.

The demarking points of identification of sex have been worked out for this population using a formula mean  $\pm$  3 S.D. This will be useful in deciding the sex of unknown sample in future, which is an often required in medico legal cases.

Length, weight and midshaft circumference of the clavicles have been found to be more discriminating parameters for the identification of sex from clavicle.

However, the sex overlap is observed in all the parameters and indices. This may be due to genetic, nutritional and socio-economic differences in the individuals or may be due to hypomasculinity in male clavicles and hypermasculinity in female clavicles.

Continuance of such studies in a defined geographic area over a period of time will help in establishing anthropometric standards. Such studies will also help to observe the changing trends in metric measurements if any. The anthropometric standards will have to be evaluated from time to time for their validity.

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