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### Original Article

# Assymetry In Length, Weight and Circumference of Long Bones of Upper Limb In North Costal Andhra Population

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#### ABSTRACT

The lack of uniformity in the length, weight and mid shaft circumference of long bones of upper limb can be attributed to the type of movements performed by individual during life. The present study reports the positive evidence of Right sided dominance in the weight, length and circumference of 50 pairs of upper limb bones collected from skeletons of North costal Andhra population in south Indian Region of India. Length was measured on an osteometric Board and weight measured on Automatic Balance. Mean length of Humerus, Radius and Ulna was greater on the right side than the left side. Mean weight of humerus, radius and ulna are also greater on right side. Mean circumference of mid part of shaft of humerus was greater on left side and for radius and ulna on right side. In overall the present study reveals that right dominance in North costal Andhra population.

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### 1. Introduction

Most of the long bones of the body are developed by endochondral ossification. The Growth of the Long bones in length mainly depends upon the proliferative zone of epiphyseal plate. The endochondral ossification extends into calcified zones of adjacent growth cartilages, which are continually replaced by the longitudinal interstitial growth of their proliferative zones. The growth of diameter depends on continuous deposition in sub periosteal region of the bone as periosteal ossification [1]. Growth of the bone is influenced by vitamins, minerals, hormones and genetic factor.

### 2. Materials and Methods:

Material for the present study contributed of 50 pairs of unknown sex of humerus, radius and ulna of both sides. In The present study, the bones were collected from unclaimed bodies of macerated skeletons which are available in the department of anatomy, Maharajas institute of medical sciences, Vijayanagaram, North Coastal Andhra Pradesh Region in South India. Length,

weight and circumference of these bones were recorded. Length was measured using an osteometric board. Weight was taken by using automatic top pan balance sensitive to 0.1gram. Many authors conclude the right dominance of upper limbs in different regions of population. So it is felt appropriate to study the dimensions of long bones of upper limbs in the available samples of north coastal population to bring out the results in asymmetry.

### 3. Results

The absolute parameters of Length, Weight and circumference of mid shafts of both sides of upper limb long bones are presented in tables. TABLE 01 depicts the side dominance parameters of Humerus, TABLE 02 depicts the side dominance parameters of Radius, and TABLE 03 depicts the side dominance parameters of Ulna.

The Mean, SD and P values of both side Upper limb long bones were mentioned in (TABLE 04) as, Mean length of humerus, radius and ulna was greater on the right side than the left side, the difference on both sides for humerus is significant ( $p < 0.75$ ). Mean weight of humerus, radius and ulna are also greater on right side, the difference was significant for humerus ( $p < 0.99$ ) and radius ( $p < 0.98$ ). Mean circumference of mid part of shaft of humerus was greater on left side ( $p < 0.753$ ) for radius and ulna on right side ( $p < 0.336, p < 0.03$ ).

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**TABLE: 01. Side Dominance parameters of Right and Left Humerus**

HUMERUS				HUMERUS		
RIGHT				LEFT		
S.NO	LENGTH	CIRCUMFERENCE	WEIGHT	LENGTH	CIRCUMFERENCE	WEIGHT
1	34	6.4	115	34	6	130
2	34	5.9	115	34	6.5	110
3	31.5	6.1	120	31.5	5.3	90
4	29.5	5.4	60	33	6.3	135
5	29.5	5.4	80	30	6.5	125
6	29.5	6	110	34	6.3	120
7	31.5	5	60	30	5.4	55
8	31	6	125	30.5	5.4	70
9	32	6.2	110	33.5	5.9	105
10	31.5	6.2	85	31.5	6	95
11	30.5	6.4	90	32	5.7	115
12	34.5	5.1	85	32	6.1	125
13	29	5.4	60	28	5.7	70
14	27	5.2	70	28.5	5.5	85
15	30	5	40	26.5	4.6	45
16	29	5.5	60	31	5.5	100
17	31	6.7	105	33	5.5	90
18	33.5	6.7	115	30.5	6.3	125
19	31.5	6	135	31.5	6	140
20	32	6.5	120	29.5	5.9	85
21	33.5	5.5	70	29.5	5.8	50
22	31	6.1	115	33.5	6	100
23	30	5.5	75	31	5.3	90
24	31	7	160	32.5	7	125
25	32	6.7	105	29	6.1	75
26	31	5	65	28	5.5	40
27	28	6.4	110	29.5	5.5	40
28	29.5	6	100	30.5	5.8	50
29	33.5	5	65	32	6.5	95
30	31	5.2	90	29.5	5.6	70
31	33.5	5.2	85	31	6.5	110
32	30.5	5.2	90	33.5	6	105
33	31.5	5.9	90	28	5.1	45
34	31	5.2	90	29.5	5.6	70
35	32	5.2	60	28.5	5	80
36	29.5	5.3	90	29.5	5.2	105
37	30.5	5.5	90	34.5	6.3	140
38	30.5	5.8	120	33	6.6	125
39	31	5.5	80	31.5	6.1	110
40	32	6.4	120	30	6	115
41	31.5	6.1	120	31.5	5.3	90
42	29.5	6	110	34	6.3	120
43	32	6.2	110	33.5	5.9	105
44	34.5	5.1	85	32	6.1	125
45	30	5	40	26.5	4.6	45
46	33.5	5.5	70	29.5	5.8	50
47	31	7	160	32.5	7	125
48	28	6.4	110	29.5	5.5	40
49	26	6.3	125	28.5	5.7	95
50	31	5.2	90	29.5	5.6	70
SUM	1551.5	289.5	4750	1545.5	291.7	4620

**TABLE: 02. Side Dominance parameters of Right and Left Radius.**

S.NO	RADIUS RIGHT			RADIUS LEFT		
	LENGTH	CIRCUMFERENCE	WEIGHT	LENGTH	CIRCUMFERENCE	WEIGHT
1	25	4	35	24.5	3.5	20
2	24	3.6	25	23	3.8	20
3	22	3.5	25	22	3.6	25
4	24.5	3.4	20	25.5	4.2	40
5	25	4	30	24	3.5	25
6	23.5	3.6	30	28	5.1	50
7	23	3.3	25	24	3.7	25
8	24	3.9	25	24	3.1	20
9	27	4.2	45	25	4.2	30
10	25	3.6	25	25.5	4.3	45
11	23.5	4	20	25	3.7	25
12	24.5	4.3	30	22	3.5	25
13	25	4.2	35	26	4.3	45
14	25	3.8	25	22.5	3.2	15
15	25	3.8	30	24	4.4	30
16	28	4.5	55	23.5	3.2	30
17	26	3.5	30	23	4.6	25
18	26	4.4	50	26	3.8	30
19	26	4	35	26	4.3	40
20	26.5	4.3	45	25	4.1	35
21	23.5	3.7	25	23	3.3	20
22	25	3.8	30	24	4.1	45
23	23.5	3.8	30	24	4.5	30
24	24.5	4.2	35	25	4.1	25
25	24	4.1	40	23	4.1	35
26	22.5	3.6	25	25	4	35
27	23	3.5	25	22.5	3.6	25
28	24	4.8	30	25.5	4	40
29	25	4	30	22	4	25
30	23.5	3.8	30	21.5	3.3	20
31	26	4	40	24	3.8	30
32	22	3.7	25	26	4.2	40
33	24.5	3.6	25	23	4.3	30
34	23.5	3.8	30	21.5	3.3	20
35	24.5	4.2	35	26	4.4	35
36	24.5	4.3	30	27	4.1	40
37	23.5	3.6	20	25.5	3.6	30
38	26	3.7	25	22.5	3.6	25
39	24	4.8	30	23.5	3.2	30
40	24	4	40	22.5	3.2	15
41	22	3.5	25	22	3.6	25
42	23.5	3.6	30	28	5.1	50
43	27	4.2	45	25	4.2	30
44	24.5	4.3	30	22	3.5	25
45	25	3.8	30	24	4.4	30
46	23.5	3.7	25	23	3.3	20
47	24.5	4.2	35	25	4.1	25
48	23	3.5	25	22.5	3.6	25
49	23.5	3.7	25	26	4.1	35
50	23.5	3.8	30	21.5	3.3	20
SUM	1219.5	195.2	1540	1204.5	194	1480

**TABLE: 03. Side Dominance parameters of Right and Left Ulna.**

S.NO	ULNA RIGHT			ULNA LEFT		
	LENGTH	CIRCUMFERENCE	WEIGHT	LENGTH	CIRCUMFERENCE	WEIGHT
1	28	5	70	24	4	30
2	24	3.5	25	27	3.8	35
3	26.5	4.4	25	25	4.5	30
4	25	4	35	26	4.5	45
5	27	4.6	50	26	4	25
6	28.5	4.5	55	27	4.3	45
7	27	4.4	45	28.5	5	55
8	30	5	65	25.5	4	35
9	27.5	5.2	65	24.5	4	30
10	26	4.2	30	28.5	4.5	50
11	27	4.5	50	28.5	4.1	45
12	26	4.2	35	26	4.3	25
13	25	4.4	45	24.5	3.8	25
14	28	4	45	26.5	4.1	45
15	24.5	4.2	45	24.5	3.6	30
16	24	4	35	24	3.6	25
17	25.5	4.8	40	25	3.6	30
18	27.5	5.1	45	23.5	3.6	25
19	30	5.3	90	28.5	4.2	50
20	28	4.5	45	23.5	3.1	25
21	27	4.5	60	25.5	4	25
22	27	4.5	60	27	4.5	60
23	26.5	4	25	26	4.2	35
24	27	4.9	60	27	4.5	45
25	28.5	4	45	25.5	3.5	30
26	23.5	3.7	30	25.5	4.4	40
27	27.5	4.2	50	29	4.5	55
28	27	4.3	40	29	4.4	50
29	27.5	4.6	55	27	4.5	60
30	29	4.6	60	25.5	4.4	40
31	26.5	4.3	40	24.5	3.7	20
32	26	4	25	24	3.7	25
33	28.5	4.8	60	26	4.6	35
34	29	4.6	60	25.5	4.4	40
35	27	5	55	28.5	4.2	50
36	19	3.2	15	23.5	3.6	25
37	30	5	60	27	4.5	60
38	25	4.1	30	25.5	4	35
39	27	4.2	45	26	4.3	25
40	27	4.8	45	25	3.6	30
41	26.5	4.4	25	25	4.5	30
42	28.5	4.5	55	27	4.3	45
43	27.5	5.2	65	24.5	4	30
44	26	4.2	35	26	4.3	25
45	24.5	4.2	45	24.5	3.6	30
46	27	4.5	60	25.5	4	25
47	27	4.9	60	27	4.5	45
48	27.5	4.2	50	29	4.5	55
49	29.5	4.5	55	28	4.2	50
50	29	4.6	60	25.5	4.4	40
SUM	1343.5	222.3	2370	1301	206.4	1865

**TABLE: 04. The Statistical Significance of MEAN+/-SD and P values of Length, Circumference and Weight of Right and Left Humerus, Radius and Ulna.**

PARAMETERS	RIGHT	LEFT	
	MEAN+/-S.D	MEAN+/-S.D	P=
LENGTH	31.03+/-182	30.91+/-2.04	0.759564
CIRCUMFERENCE	5.79+/-0.57	5.83+/-051	0.753579
WEIGHT	95+/-26.62	92.4+/-29.76	0.995551
	<b>RADIUS</b>		
LENGTH	24.39+/-1.29	24.09+/-1.65	0.320308
CIRCUMFERENCE	3.90+/-0.34	3.88+/-0.47	0.336173
WEIGHT	30.8+/-7.50	29.6+/-8.59	0.986499
	<b>ULNA</b>		
LENGTH	26.87+/-1.91	26.02+/-1.55	0.01784
CIRCUMFERENCE	4.44+/-0.43	4.12+/-0.37	0.03005
WEIGHT	47.4+/-14.46	37.3+/-11.32	0.96354

#### 4. Discussion

Many researchers have demonstrated asymmetry in length of long bones of upper limbs and lower limbs along with weight of long bones. According to Tonka Cuk (2001) [2] Assymetry is more pronounced in the upper extremity than lower because we use our arms in countless one handed or both handed and bilateral asymmetry of the humerus is reflecting the hand performance. According to Pande BS (1971) [3], Taylor (1977) [4] right dominance of long bones are considered as congenital phenomenon. According to Prives MG (1960) [5] the dominance pattern could be influenced by postnatal adaptation and physical work. Latimer HB (1965) [6], Ingalls NW (1931) [7] these authors observed the predominance of right dominance in the upper limbs than lower limb long bones.

#### 5. Conclusion

The present study conducted on long bones of upper limb in north costal Andhra population concluded that the Bones of right upper extremity are longer and heavier and dominant. These results are suitable only for selected samples because shortage of samples that were available for this study. The right dominance of upper extremity seems to be dominant left cerebral hemisphere. The lack of uniformity in the assymetry, in the length, weight and circumference of mid shaft of long bones of upper limbs can be attributed to the type of movements performed by individual during life.

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