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RESEARCH ARTICLE

COMPARATIVE ANTHROPOMETRY BETWEEN SICKLING AND NON-SICKLING INDIVIDUALS OF LOCAL POPULATION OF RAIPUR CITY OF CHHATTISGARH BY MEASURING SITTING HEIGHT AND ARM LENGTH.

Praveen Kumar Banjare¹, Manik Chatterjee², Meena Goyal², Dharam Singh Rathia³, Bichitrananda Roul⁴, Praveen Kurrey⁵

1. Assistant Professor Dept. Of Anatomy Pt.JNM Medical College Raipur (C.G)
2. Professor Dept. Of Anatomy Pt.JNM Medical College Raipur (C.G)
3. Assistant Professor Dept. Of Anatomy LRM Medical College Raigarh (C.G)
4. Assistant Professor Dept. Of Anatomy Pt.JNM Medical College Raipur (C.G),
5. Assistant Professor Dept. Of Anatomy Pt.JNM Medical College Raipur (C.G),

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*Corresponding Author

Bichitrananda Roul

Abstract

Studies on child growth and development have always occupied an important position in the scientific research curriculum and are of interest to the researchers of both Medical Science and Physical Anthropology all over the world. Sickle Cell Anemia (SCA) is a hereditary anemia, predominantly seen amongst various tribal populations of India. This problem decreases the amount of oxygen flowing to body tissues which affects growth and nutritional status of individuals. In present study, 316 subjects of Raipur city [157 cases (sickling) + 159 controls (non-sickling)] were taken and various anthropometric measurements sitting height, upper extremity length, maximum calf circumference, arm length, mid arm circumference and total lower extremity length were obtained. After analysis of data of above parameters, we found that Sitting height, Upper extremity length, Mid arm circumference, Arm length, Maximum calf circumference and Total lower extremity length of cases were less than that of controls for both male and female. Significant differences were observed in Sitting height, Upper extremity length and Maximum calf circumference.

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INTRODUCTION

Sickle Cell Anemia (SCA) is a hereditary anemia, predominantly seen amongst various tribal populations of India. Sickle gene is found all over the world, particularly amongst people originated/migrated from Malaria endemic areas of Africa & Asia. According to one of the hypothesis, it is a natural mutation in Hemoglobin molecule to protect RBCs from malarial parasites by making them a little rigid, so that malarial parasites can't enter into RBCs. SCA occurs due to inherited abnormal hemoglobin (Hb) gene, which produces Hb-S (Hb-Sickle). Due to the presence of Hb-S and because of its abnormal characteristic, converts RBCs into rigid-brittle half moon (Sickle) shaped instead of soft round biconcave shape, which is the main cause of complication of Sickle Cell disease. The fragile, sickle-shaped cells deliver less oxygen to the body's tissues. They can also get stuck more easily in small blood vessels, as well as break into pieces that can interrupt healthy blood flow. These problems decrease the amount of oxygen flowing to body tissues even more.

Sickle cell anemia is inherited from both parents. If we inherit the sickle cell gene from only one parent, we will have [sickle cell trait](#). People with sickle cell trait do not have the symptoms of sickle cell

anemia. Life span of RBC in SCD is less than 30 days instead of 90 to 120 days. Anemia results from the bone marrow's inability to produce enough blood cells to keep pace with the rate of destruction.

According to a study, prevalence of SCD in India is highest in the state of Chhattisgarh (23%) and highest for Kurmi (55%) and Teli (53%) caste which belong to backward castes.

This work is an attempt to study the growth status and anthropometric variation of Sickling individuals of Raipur city of Chhattisgarh state and compare them with non - sickling individuals of the same region.

MATERIAL & METHODS

In the present study, data were collected from local population of Raipur Dist. during the months from October 2012 to July 2013.

In order to study the physical growth and nutritional status of Sickling and Non-Sickling individuals, a simple schedule was prepared to record the different Anthropometric variables.

1. Sickling cases taken in this study, were registered cases in Sickle Cell Unit of Pt.J.N.M.Medical College Raipur (C.G.).
2. Sample size 316 [157 cases (sickling) + 159 controls (non-sickling)] according to inclusion and exclusion criteria.
3. Individuals were examined for the following Anthropometric measurement:-
 1. Sitting height
 2. Arm length
4. The data were analysed, compared and interpreted by using the proper statistical methods.

INCLUSION CRITERIA

1. Individuals of local population of Raipur district of Chhattisgarh.
2. Age group 10 to 26 years.
3. Apparently healthy individuals for control and
4. Individuals suffering from Sickling who were registered in sickle cell unit of Pt. J.N.M.Medical College Raipur.

EXCLUSION CRITERIA

1. Individuals other than local population of Raipur district Chhattisgarh state.
 2. Age less than 10 and more than 26 yrs.
1. **Sitting Height:** The subject was measured with the back stretched as with the back of sacral and interscapular region. He/she on a table top with his/her feet hanging down unsupported over the edge. The subject was asked to keep the knees above the edge of the table. Gentle traction was applied under the chin and subject was asked to relax the muscles of thighs and buttocks. The head was held in Frankfort plane (the horizontal line from the ear canal to the lower border of the orbit of the eye is parallel to the floor and perpendicular to the vertical backboard) and the anthropometer was held vertically in contact with the back of the sacral and interscapular region.
Instrument used: **Anthropometer**
 2. **Arm length:** The measurement was taken from tip of the acromian and the olecranon process at flexed 90 degrees.
Instrument used: **Anthropometer**

RESULT & DISCUSSION

REF.[3]The result of analysis of 4 body measures of case (sickling) and control (non-sickling) individuals of Raipur city of Chhattisgarh, ranging from age 10+ to 25+ years are presented and each body measure is described with regard to mean, standard deviation and distance curve with the help of necessary tables and figures. They are shown

separately for males and females. Case and control differences are assessed for all body measures by using “t-test” and “p value”

SITTING HEIGHT (Table No. 1 & 2; Figure No. 1 & 2)

REF.[5]A comparison of distance curve of sitting height reveals that curve for case ran below the distance curve for control at every age periods in male and female. In male difference is significant at the age periods of 10+, 12+, 13+, 14+, 15+, 16+, 18+, 21+, 23+, and 24+ (p value < 0.05) and highly significant at the age periods of 13+, 14+, 18+, 21+, 23+ and 24+ (p value < 0.001).In female difference is significant at the age periods of 10+, 11+, 12+, 13+, 14+, 15+, 16+, 17+, 18+, 21+, 22+ and 23+ (p value < 0.05) and highly significant at the age periods of 11+, 12+, 14+, 15+ and 18+ (p value < 0.001).

ARM LENGTH (Table No. 3 & 4; Figure No. 3 & 4)

A comparison of distance curve of arm length reveals that curve for case ran below the distance curve for control in male and female except at the age period of 19+ and 21+ in male where it is above. This is because of individual variation. In male difference is significant at the age periods of 14+ where the p value is 0.01. In female difference is insignificant at all age periods (p value > 0.05)

To study the effect of sickling on growth, [Stevens MC, et. al \[1983\]](#) concluded an average reduction in weight, height, sitting height, limb length in patients with sickling(SS) as compared to control. [Barden E M, et. al \[2002\]](#) found significantly lower z scores for weight, height, arm circumference, and upper arm fat and muscle areas, delayed skeletal maturation delayed puberty, and poor nutritional status in children with SCD. Arm length was less than control but differences were statistically insignificant at most of age group.

From the above discussion, it may be tempting to state that the poor growth status of the cases & controls in comparison to Indian standard may be due to the poor socio-economic condition. Apart from under-nutrition, sickling may be responsible for less growth.

Age	DISEASED MALE			CONTROL MALE			t-test	P value
	No.	Mean	S.D.	No.	Mean	S.D.		
10+	6	61.4	1.97	5	64.74	2.14	-2.68	0.03
11+	3	65.93	1.79	5	68.14	1.9	-1.65	0.17
12+	6	66.55	1.74	5	69.4	0.98	-3.41	0.01
13+	8	68.83	0.97	5	71.5	0.85	-5.22	<0.001
14+	7	67.37	1.2	5	70.28	1.17	-4.2	<0.001
15+	4	70.8	1.34	5	74.2	0.86	-4.41	0.01
16+	7	74.6	1.67	7	77.46	1.48	-3.39	0.01
17+	3	79.23	1.4	5	81.66	2.53	-1.74	0.13
18+	3	78.93	0.23	7	81.61	1.31	-5.22	<0.001
19+	2	77.75	2.19	7	82.74	1.68	-2.98	0.15
20+	3	80.97	2.43	5	82.64	1.95	-1.01	0.38
21+	3	77.37	0.9	10	82.33	2.83	-4.8	<0.001
22+	3	80.57	1.89	5	83.62	1.14	-2.53	0.09

23+	4	81.03	0.53	6	84.6	1.39	-5.72	<0.001
24+	4	81.5	1.12	4	84.5	1.38	-3.38	0.02
25+	5	80.46	0.99	3	83.8	1.48	-3.47	0.04
Total	71	73.13	6.79	89	78.02	6.61		

TABLE NO - 2
SITTING HEIGHT (in cm)

Age	DISEASED FEMALE			CONTROL FEMALE			t-test	P value
	No.	Mean	S.D.	No.	Mean	S.D.		
10+	7	56.04	1.95	4	58.95	1.7	-2.59	0.04
11+	4	62.53	0.63	4	65.78	0.87	-5.86	<0.001
12+	8	64.99	1.4	5	68.2	0.84	-5.32	<0.001
13+	7	65.9	0.96	5	68.84	1.33	-3.72	0.01
14+	10	70.1	1.42	4	73.4	1.24	-4.3	<0.001
15+	7	73.13	0.9	4	76.08	0.41	-7.42	<0.001
16+	8	74.51	2	5	77.6	1.73	-2.94	0.02
17+	4	74.08	1.49	3	77.77	1.66	-3.04	0.04
18+	7	76.43	0.97	3	79.43	0.65	-5.71	<0.001
19+	3	74.23	3.67	9	78	4.44	-1.46	0.22
20+	5	78.42	2.16	6	80.95	2.61	-1.76	0.11
21+	3	69.4	3.35	6	78.37	6.3	-2.79	0.03
22+	4	75.98	1.37	3	79.3	0.89	-3.88	0.01
23+	3	72.63	0.96	3	75.63	0.85	-4.05	0.02
24+	2	69.2	0.85	3	72.23	0.4	-4.71	0.09
25+	4	72.78	2.3	3	75.1	1.65	-1.55	0.18
Total	86	70.21	6.22	70	74.38	6.35		

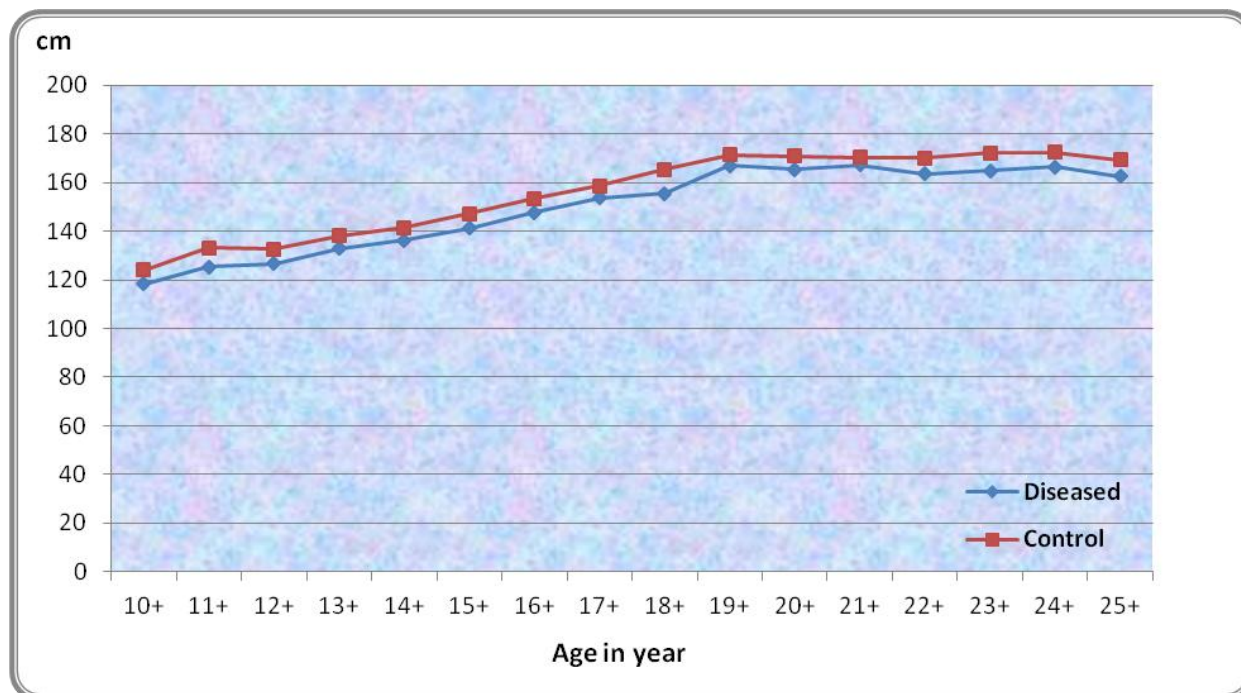


Fig. 1 Sitting Height (Male)

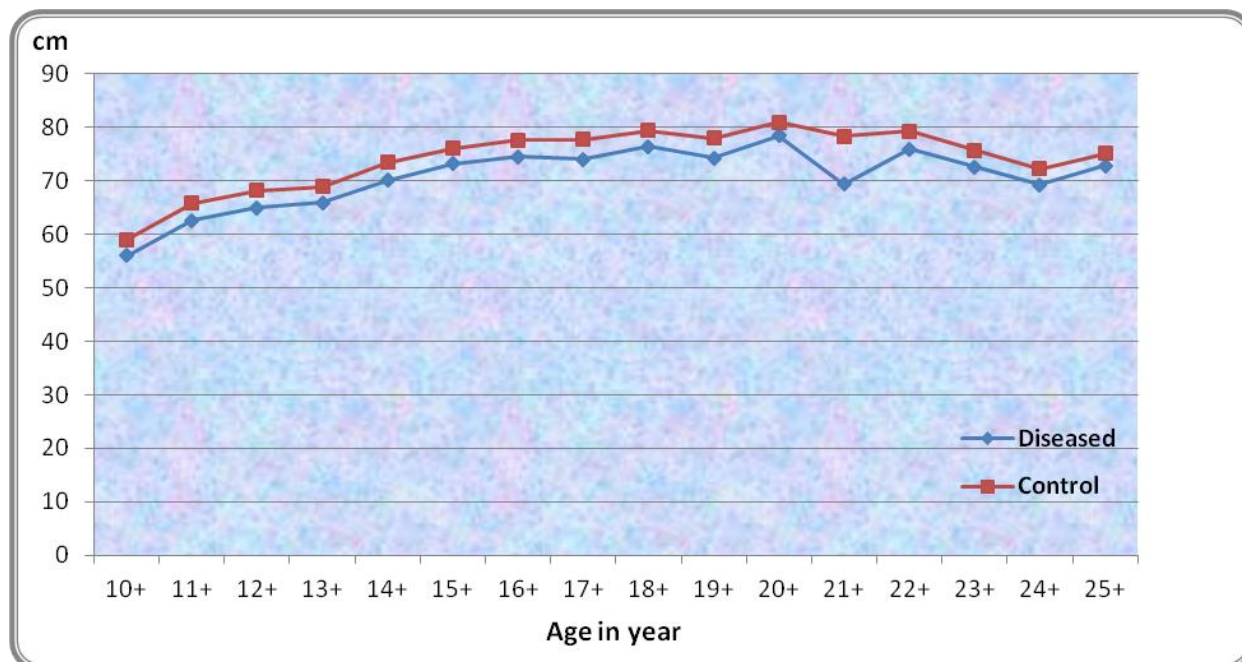


Fig. 2 Sitting Height (Female)

TABLE NO - 3
ARM LENGTH (in cm)

Age	DISEASED MALE			CONTROL MALE			t-test	P value
	No.	Mean	S.D.	No.	Mean	S.D.		
10+	6	23.98	1	5	25.1	1.29	-1.58	0.16
11+	3	24.17	0.58	5	25.36	0.72	-2.57	0.05
12+	6	26.2	0.64	5	26.82	0.76	-1.45	0.18
13+	8	28.19	0.75	5	29.08	0.75	-2.09	0.07
14+	7	29.71	0.5	5	30.58	0.46	-3.08	0.01
15+	4	29.63	1.09	5	30.88	1.44	-1.49	0.18
16+	7	32.43	0.96	7	33.23	0.69	-1.79	0.1
17+	3	33.13	0.81	5	33.54	0.68	-0.73	0.51
18+	3	31.3	2.29	7	32.94	1.85	-1.1	0.35
19+	2	32.7	0.71	7	31.91	1.45	1.06	0.35
20+	3	31.07	1.5	5	32.34	0.95	-1.32	0.28
21+	3	32.8	1.47	10	32.64	1.41	0.17	0.88
22+	3	30.6	1.95	5	30.94	1.6	-0.25	0.81
23+	4	32.1	0.62	6	32.87	0.87	-1.63	0.14
24+	4	30.2	1.35	4	31.03	1.25	-0.9	0.4
25+	5	29.68	0.9	3	30.4	0.78	-1.19	0.29
Total	71	29.47	2.95	89	30.88	2.82		

TABLE NO - 4
ARM LENGTH (in cm)

Age	DISEASED FEMALE			CONTROL FEMALE			t-test	P value
	No.	Mean	S.D.	No.	Mean	S.D.		

10+	7	22.51	1.31	4	23.13	1.32	-0.74	0.48
11+	4	22.2	0.67	4	23.03	0.82	-1.03	0.35
12+	8	24.25	1.46	5	24.92	1.55	-1.11	0.31
13+	7	26.17	0.47	5	26.98	0.5	-2.47	0.05
14+	10	26.39	1.14	4	27.28	1.21	-1.26	0.26
15+	7	28.11	0.69	4	28.93	0.64	-1.96	0.09
16+	8	30.65	1.09	5	31.26	1.24	-0.9	0.39
17+	4	31.1	0.63	3	31.9	0.26	-2.28	0.08
18+	7	31.67	1.95	3	32.33	2.46	-0.41	0.71
19+	3	30.13	0.9	9	30.33	1.24	-0.3	0.78
20+	5	28.32	1.28	6	28.78	1.39	-0.57	0.58
21+	3	28.83	0.61	6	29.45	1.09	-1.09	0.32
22+	4	28.4	0.64	3	29.33	0.67	-1.87	0.13
23+	3	28.37	1.94	3	29.47	2.29	-0.63	0.56
24+	2	27.25	1.06	3	28.03	0.25	-1.03	0.48
25+	4	29.83	0.8	3	30.6	0.6	-1.47	0.2
Total	86	27.52	3.07	70	28.47	2.88		

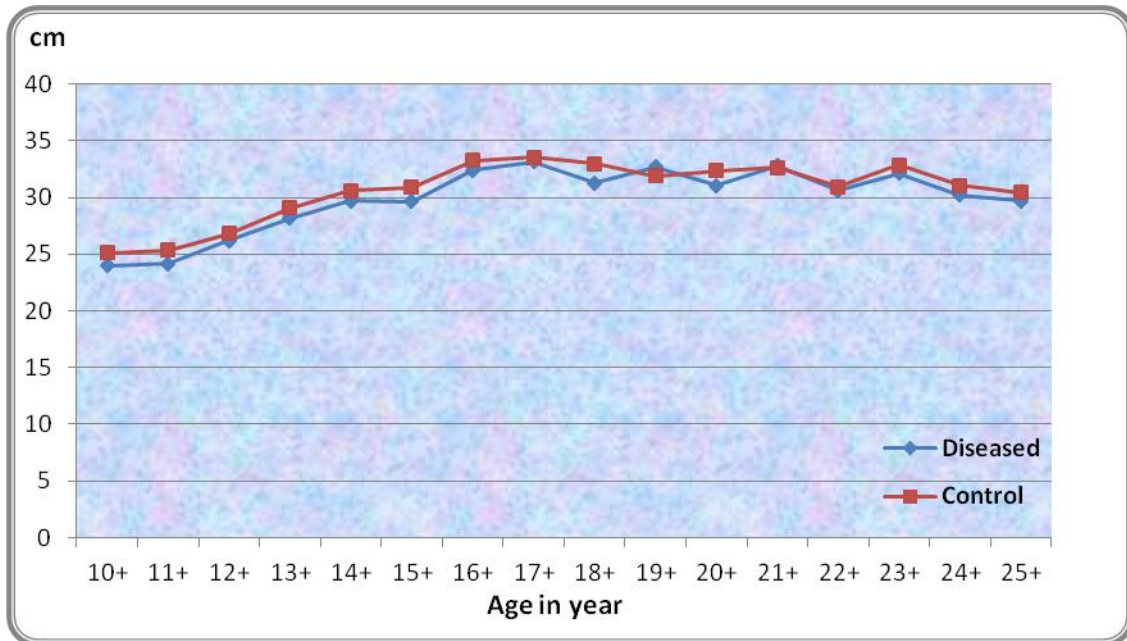


Fig. 3 Arm Length (Male)

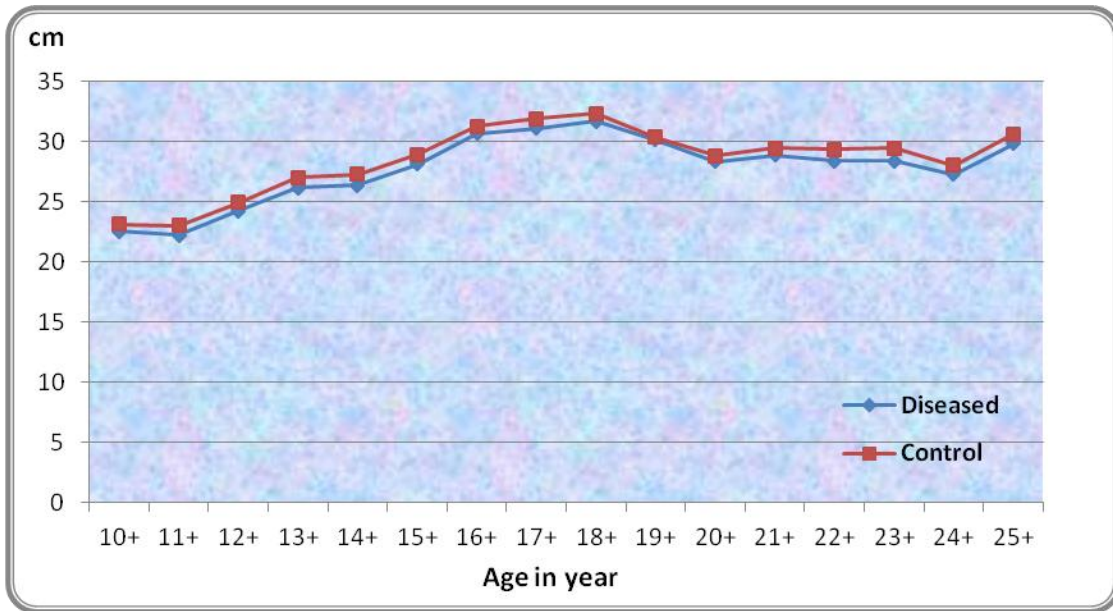


Fig. 4 Arm Length (Female)



Stature Measurement



Sitting Height Measurement



**Total Upper Extremity Length
Measurement**

CONCLUSION

On comparison mean value of Sitting height and Arm length of cases were less than that of controls for both male and female. Significant differences was observed in Sitting height.

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