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Anthropometric Study of Growth Status of Gond Tribes and Nontribes Boys of Patharia Block, Mungeli District of Chhattisgarh

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Abstract: **A cross sectional study of the growth status was carried out on 561 boys (279 Gond tribe boys & 282 non-tribe boys) aged 5+to 18+ years in Patharia block ,Mungeli district of Chhattisgarh. Aims : The study was aimed to find out the growth status of the Gond tribe boys of Patharia block, which is a semi-tribal area, and was compared with the Non-tribe boys of same block. Materials and Methods: The students were classified into two categories. The categories were Gond tribe (GT) boys & Non tribe (NT) boys excluding other tribe boys. They were grouped according to age group. Anthropometric measurements taken in to consideration are stature, body weight. Descriptive analysis was carried out and comparative statistics was used to observe difference between Gond Tribe boys & Non Tribe boys on anthropometric measurements and mean, standard deviation, student, t-test, p value was computed to see the relationship between anthropometric variables. Results: At all ages, Gond Tribe boys weighed less than Non tribe boys. At 5 years this difference was statistically highly significant. Later on Gond Tribe boys seemed to catch up with Non tribe boys up to the age of 10 years. At 11 and 12 years Gond Tribe boys were again significantly less in weight than Non tribe boys. At the age of 17 and 18 years Gond Tribe boys and Non tribe boys were equal in weight. When BMI was compared, at the most of ages BMI was less for Gond Tribe than Non tribe boys but the difference was not statistically significant. At 9 and 10 years BMI of Non tribe boys was statistically significantly lower than Gond Tribe boys. This may be because of spurt in height, while the weight lagged behind. In both, Gond Tribe and Non tribe boys, BMI progressively increased with age. According to Indian standards, amongst both groups, normal BMI was achieved at the age of 16 to 18 years. In spite of possibility of undernutrition as assessed by BMI, stature did not seem to be affected. What is noteworthy is that stature of most of the boys was normal. Based on study findings it can be concluded that the poor growth status of the Gond Tribe boys & Non tribe boys, as judged by body weight and BMI, in comparison to the international standard as well as Indian standard may be due to the poor socio-economic condition. However, what is most noteworthy is good development of stature in both Gond Tribe and Non tribe boys. BMI is the result of complex interaction between energy intake and energy expenditure. Other factors apart from undernutrition may be responsible for low BMI. This may include physical over activity. The factors responsible for low BMI in both, Gond Tribe and Non tribe boys, should be investigated further and proper intervention strategies should be evolved in future.**

Keywords: **Gond tribe, Nontribes, Chhattisgarh, Body mass index.**

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1. INTRODUCTION

Chhattisgarh is a comparatively young state in the history of India that came into independent existence only in the new millennium. It was previously a part of Madhya Pradesh, which factually meant 'Central region'. Total Population of Chhattisgarh is 2, 55, and 40,196. (2.55 Cr) as of 2011 census[1]. It is ranked 16th in India in order of population.

Mungeli is one of the districts of Chhattisgarh. Headquarter of Mungeli is at Mungeli city. Mungeli is newly formed District Functional from 1st January 2012 in the Indian state of Chhattisgarh. Mungeli is located at 22.07°N 81.68°E. It has an average elevation of 288 meters (944 feet) and Patharia is one of the blocks of Mungeli district.

The population of Chhattisgarh is notable for the high proportion of Scheduled Tribes and for some specific sects. Of the total population of Chhattisgarh, tribals constitute at least 32.5 percent, which is a significantly high percentage. Among the tribes of Chhattisgarh Gond tribe is considered as the most prominent one.

India has several socially disadvantaged communities among which schedule tribes are the most deprived ones. **Mitra et al.**[2]

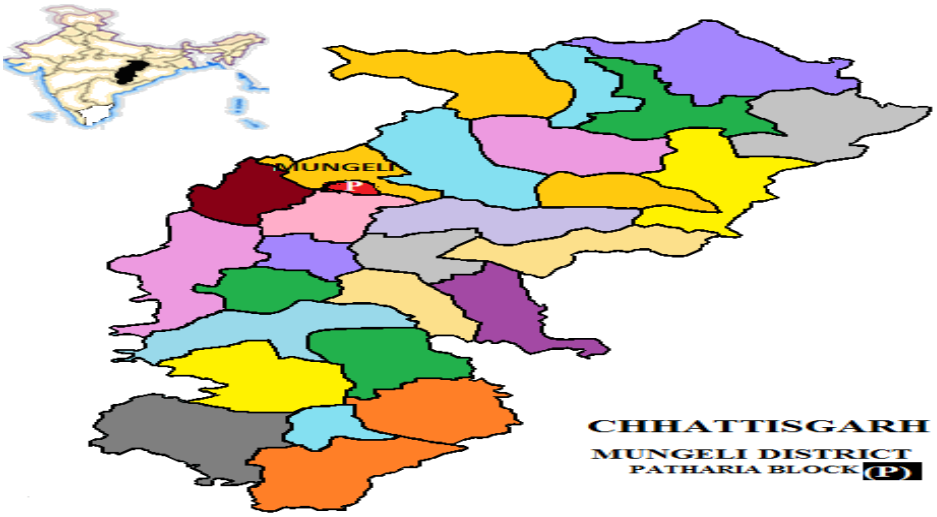

Figure No. 1

The Gonds are one of the most famous and important tribes in India, known for their unique customs and traditions. They are mainly a nomadic tribe and call themselves as Koytoria. The term 'Gond' is derived from the Telugu word 'Konda' which means hill. Gond Tribes are primarily located in Madhya Pradesh, Chhattisgarh, eastern Maharashtra, northern Andhra Pradesh and western Orissa. With a population of over 4 millions, Gonds also form the largest tribal group in central India

The tribal population, which constitutes 8.08 percent of the total population in India, is characterized by widespread poverty, illiteracy, malnutrition, lack of safe drinking water and hygienic conditions, which are the contributing factors for their dismal health conditions.

A few studies based on published data have indicated patterns of anthropometric variation along ethnic, geographic, latitude, longitude and altitude, nutrition and several confounding variables. [3,4,5,6,2].

This work is an attempt to study the growth status and anthropometric variation of Gond, a primitive tribe, boys of Patharia block, Mungeli district, Chhattisgarh state and compare them with Non - tribe boys of the same region.

2. AIMS & OBJECTIVES

- To study the growth status of Gond tribe and Non-tribe boys by anthropometry.
- Find out factors affecting their growth status.
- To evaluate overall growth and health status of Gond tribe boys and Non-tribe boys children.

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3. MATERIAL & METHODS

The present study consisted of acquisition of anthropometric data for Gond tribe and non-tribe boys from the same area. In the present study, data were collected from Patharia block, Mungeli district, Chhattisgarh from October 2012 to July 2013. Easy approachability and average density of Gond tribe and non-tribe population were the major criteria for selection of Patharia block. In order to study the physical growth and nutritional status of Gond tribe boys and Non-tribe boys, a simple schedule was prepared to record the different Anthropometric variables.

4. SAMPLE

A total number of 279 Gond tribe boys and 282 non tribe boys were selected as subjects for the study. The data were collected on students of school. They were grouped into two groups- Non tribe (NT) and Gond tribe (GT). Before testing, the investigator had a meeting with the students in the presence of their teacher to ensure maximum co-operation on each test. The purpose of the study was explained to them, so that there was no ambiguity among the subjects regarding the efforts they had to put in for the successful completion of the investigation.

All the subjects were convinced of the need for the investigation and assured that the subjects will be made available for the collection of data. A semi-structured interview-cum-schedule was prepared to collect information regarding food habit of the family in general, socio-economic condition, occupation, & size of the family; in brief of the health condition of the individuals.

1. Cases taken in this study were registered cases in government school of Patharia block.
2. 561 boys (279 Gond tribe boys & 282 non-tribe boys) were included in the study according to inclusion and exclusion criteria.
3. Age range was 5 to 18 yrs.
4. Individuals were examined for the following Anthropometric measurement:-
    1. Weight
    2. Stature

Analyse, compare and interpret the data with statistical methods.

5. ANTHROPOMETRIC MEASUREMENTS

Subjects were examined for the following anthropometric measurements according to standard methods [7,8,9] :-

1. Body Weight:

Weighing was done with the subject wearing minimum clothes. The subject was asked to stand on the weighing machine and the weight recorded to the nearest of 0.5kg.

Instrument used: **Portable Weighing Machine**.

2. Stature (cm):

It is erect body length from the soles of the feet to the Vertex. Vertex is the most superior or the highest point on the head when the head is in Frankfort plane.

The head is in the **Frankfort plane** when 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

The Anthropometer was used to measure the height of the subject. The subject was made to stand erect on a horizontal firm surface, taking care that his heels were touching each other. Slight upward pressure was applied below the mastoid process in order to help in stretching to the fullest. The head should be held so that his Frankfort plane becomes horizontal. The rod was held vertically and the horizontal arm was brought down so that it touched the highest point on the head in the mid sagittal plane and the measurement was taken in centimetres.

Instrument used: **Anthropometer.**

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6. SELECTION OF SUBJECTS

INCLUTION CRITERIA:

1. Children of schools of Patharia block, Chhattisgarh.
2. Age group 5 to18 yrs. male and apparently healthy.

EXCLUTION CRITERIA:

1. Children other than schools of Patharia block of Chhattisgarh.
2. Age less than 5 and more than 18 yrs.
3. Females
4. Apparently ill child.
5. Boys belonging to other scheduled tribes

7. STATISTICAL ANALYSIS

Total of 561 boys formed the sample for the present study. The students were classified into two categories according to the cast, and cast certificate issued by Government of India/Chhattisgarh. The categories were Gond tribe (GT) boys (ST Gond tribe) & Non tribe (NT) boys (SC, OBC & General). Age was calculated from date of birth registered in school & they were grouped according to age group. The age of the students ranged from 5+ years to 18+ years.

Keeping in mind the differences with regard to ethnicity, as well as socioeconomic status between the two groups, the study was conducted to compare the growth status between two groups

Descriptive analysis was carried out and comparative statistics was used to observe difference between GT & NT boys on various anthropometric measurements and mean, standard deviation, student, t- test, p value was computed to see the relationship between anthropometric variables. SPSS was used to compute data. Analysis was done by using Windows Microsoft Excel and SPSS.

8. OBSERVATION

BODY WEIGHT (Table No.1 Figure No. 2) When Gond tribe (GT) and Non-tribe (NT) boys were compared, it was seen that the distance curve for GT boys ran below the distance curve for NT boys except at the age period of 9+ and 17+ where it coincides with the Gond tribe. Difference is significant at the age periods of 5+, 11+ and 12+ (p value < 0.05) and highly significant at the age period of 5+ (p value <0.01).

The S.D. varied from a minimum of 1.34 and 2.13 at 6+ and 5+ to a maximum of 8.8 and 8.5 at 16+ and 11+, indicating the extent of variation in the total sample of Gond tribe boys and Non-tribe boys respectively.

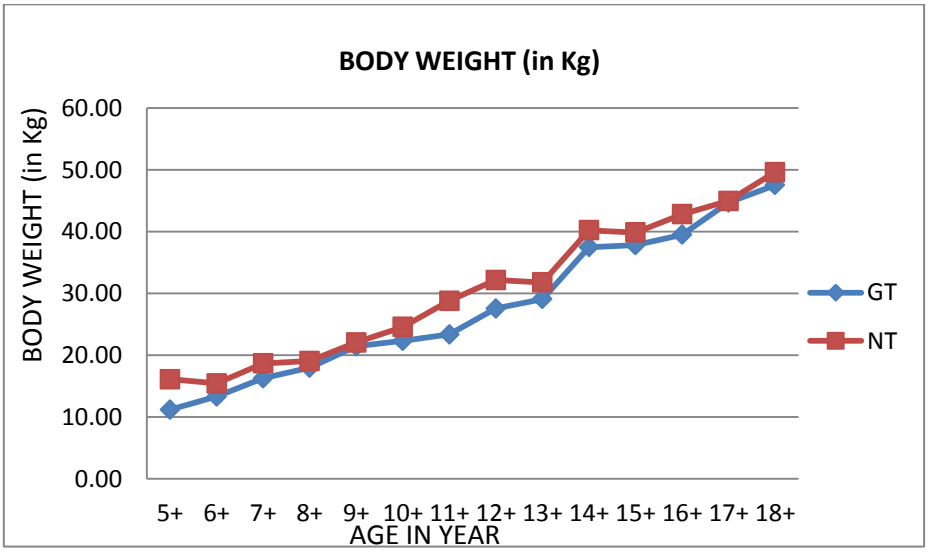

Figure No. 2

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TABLE-1 BODY WEIGHT (in Kg)										
Age	GOND TRIBE(GT)				NON TRIBE(NT)				t-test	P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E		
5+	19	11.18	1.49	1.49	18	16.11	2.13	2.13	-8.12	0.001
6+	17	13.29	1.34	0.32	22	15.42	2.20	0.47	-0.46	0.64
7+	18	16.25	1.45	0.34	20	18.67	2.68	0.60	-1.91	0.64
8+	17	17.97	2.54	0.62	18	19.06	2.62	0.62	-1.24	0.22
9+	23	21.43	4.76	0.99	19	22.05	3.84	0.88	-0.46	0.65
10+	18	22.31	1.98	0.47	25	24.56	6.32	1.26	-1.46	0.15
11+	18	23.36	5.24	1.23	19	28.80	8.50	1.95	-2.33	0.03
12+	24	27.54	5.73	1.17	22	32.16	7.28	1.55	-2.40	0.02
13+	18	29.08	6.57	1.55	22	31.77	5.61	1.20	-1.37	0.17
14+	17	37.47	7.16	1.74	19	40.21	6.63	1.52	-1.19	0.24
15+	23	37.80	6.68	1.39	21	39.83	8.31	1.81	-1.19	0.24
16+	23	39.48	8.81	1.84	18	42.81	8.31	1.96	-0.90	0.38
17+	25	44.68	6.91	1.38	19	44.95	6.88	1.58	-0.13	0.90
18+	19	47.50	7.80	1.79	20	49.60	8.46	1.89	-0.80	0.43
Total	**279**				**282**					

STATURE (Table No.2; Figure No.2) A comparison of distance curve for stature reveals that curve for Gond tribe (GT) boys ran below the distance curve for Non-tribe (NT) boys at most of the age groups except at the age period of 5+ and 17+ where it is above the Non- tribe. Difference is significant at the age periods of 9+ 10+ 11+ (p value < 0.05) and highly significant at the age period of 9+ & 10 + (p value <0.01).

The S.D. varies from a minimum of 4.32 and 4.69 at 5+ and 11+ to a maximum of 20.10 and 17.65 at 10+ and 12+ indicating the extent of variation in the total sample of GT and NT respectively.

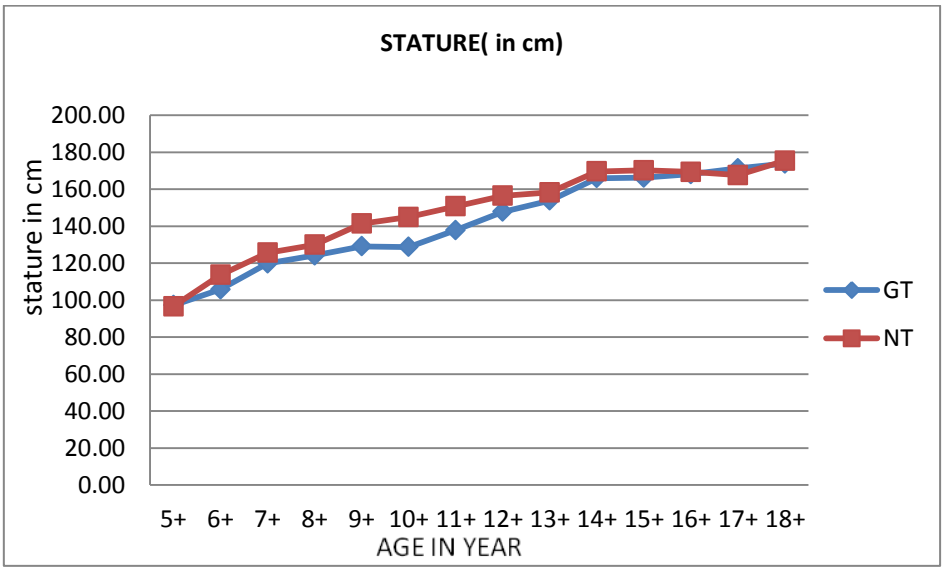

Figure No. 2

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TABLE NO -2 STATURE(in cm)										
Age	GOND TRIBE(GT)				NON TRIBE(NT)				t-test	P value
	No.	Mean	S.D.	S.E	No.	Mean	S.D.	S.E		
5+	19	97.26	4.32	4.32	18	96.67	4.69	4.69	0.40	0.69
6+	17	105.85	9.23	2.24	22	113.70	10.46	2.23	-1.89	0.06
7+	18	119.89	10.67	2.51	20	125.63	12.58	2.81	-2.42	0.06
8+	17	124.18	12.96	3.14	18	130.00	12.18	2.87	-1.37	0.18
9+	23	129.15	14.23	2.97	19	141.39	11.69	2.68	-3.00	0.001
10+	18	128.78	20.10	4.74	25	144.94	14.05	2.81	-3.11	0.001
11+	18	137.89	15.12	3.56	19	150.74	17.36	3.98	-2.40	0.02
12+	24	147.85	13.66	2.79	22	156.50	17.65	3.76	-1.87	0.07
13+	18	153.89	14.44	3.40	22	158.27	11.91	2.54	-1.03	0.30
14+	17	165.97	11.86	2.88	19	169.63	7.81	1.79	-1.10	0.28
15+	23	166.24	14.13	2.95	21	170.29	10.74	2.34	-1.10	0.28
16+	23	168.16	14.43	3.01	18	169.39	7.07	1.67	-1.06	0.29
17+	25	171.30	13.81	2.76	19	167.63	10.84	2.49	0.96	0.34
18+	19	173.87	12.51	2.87	20	175.45	7.94	1.78	-0.47	0.64
Total	**279**				**282**					

TABLE -3 BBODY MASS INDEX (BMI) in kg/m^2										
GOND TRIBE					NON TRIBE				T TEST	P VALUE
AGE	No.	MEAN	SD	SE	No.	MEAN	SD	SE		
5+	19	11.54	1.77	0.41	18	12.22	1.5	0.35	-1.27	0.21
6+	17	11.97	1.34	0.33	22	12.05	2.03	0.43	-0.15	0.89
7+	18	11.46	1.7	0.4	20	12.22	1.81	0.4	-1.33	0.19
8+	17	12.16	2.05	0.5	18	11.37	1.55	0.37	1.29	0.21
9+	23	12.95	2.28	0.48	19	10.97	0.81	0.19	3.59	<0.001
10+	18	14.38	4.89	1.15	25	11.61	1.7	0.34	2.63	0.01
11+	18	12.27	2.04	0.48	19	12.45	1.26	0.29	-0.34	0.74
12+	23	12.7	1.27	0.27	22	13.06	1.44	0.31	-0.89	0.38
13+	18	12.79	1.29	0.3	22	12.6	1.03	0.22	0.5	0.62
14+	17	13.69	2.96	0.72	19	13.92	1.78	0.41	-0.28	0.78
15+	23	13.6	1.03	0.21	21	13.69	2.26	0.49	-0.17	0.86
16+	23	13.92	2.27	0.47	18	15.37	2.27	0.53	-2.03	0.05
17+	25	15.28	2.19	0.44	19	16.08	2.76	0.63	-1.08	0.29
18+	19	15.68	1.98	0.45	20	16.23	3.26	0.73	-0.62	0.54

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TABLE NO -4 BODY MASS INDEX (BMI) PERCENTAGE DISTRIBUTIONS OF BMI VALUES ACCORDING TO INDIAN STANDARD			
CAT	**BMI > 15 (Normal)**	**BMI 13- 15 (Moderate)**	**BMI < 13 (Severe)**
GT	40 (14.3%)	125(44.8%)	114(40.8%)
NT	39(13.8%)	116(41.1%)	127(45%)

TABLE NO -5 PERCENTAGE DISTRIBUTIONS OF BMI VALUES ACCORDING TO INTERNATIONAL STANDARD

CATEGORY	GT	NT	TOTAL
BMI> 18.5	11 (3.9%)	17 (6%)	28 (5%)
TOTAL	279	282	561

BODY MASS INDEX (BMI) (Table No.3, 4 & 5) The mean value for body mass index changes markedly within the entire period of growth in both groups.

The index varies between 9 to 25 in GT and NT both. The highest value for this index is observed at 10+ years in GT, while the lowest value is observed at 5+ in NT.

Most of the GT boys (44.8%) were moderately malnourished and 40.8% were severely malnourished. Only 14.3% were normal according to Indian standard.

Most of the NT boys (45%) were severely malnourished and 41.1% were moderately malnourished. Only 13.9% were normal according to Indian standard.

In both GT and NT only 5% boys were normal having (BM I>18.5) according to international standard.

At most of the ages BMI was less for GT boys than NT boys but the difference was not statistically significant. At 9 and 10 years BMI of NT boys was statistically significantly lower than GT boys.

TABLE NO -6

OCCUPATION	GT		NT		TOTAL	
	Frequency	Percent %	Frequency	Percent %	Frequency	Percent %
AGRICULTURE	249	89.2	259	91.8	508	90.6
BARBER	0	0	9	3.2	9	1.6
CARPENTER	3	1.1	2	0.7	5	0.9
CLEARK	3	1.1	0	0	3	0.5
MEDIUM SCALE BUSSINESS	6	2.2	0	0	6	1.1
SMALL SCALE BUSSINESS	10	3.6	7	2.5	17	3
TEACHER	8	2.9	5	1.8	13	2.3
Total	279	100	282	100	561	100

Since vast majority of boys of Gond tribe and non-tribe groups had parents having agriculture as occupation, further statistical analysis seemed futile.

9. DISCUSSION

This study was conducted on 279 Gond tribe (GT) and 281 Non-tribe (NT) boys studying in government schools of Patharia block, Dist. Mungeli, Chhattisgarh. This area was chosen as it showed average density of Gond tribe and Non-tribe population as per data from block office, Patharia.

Majority of the selected subject's parents belonged to low economic status & were mainly in agriculture (90.6%). Joint Families (83.6%) predominated in comparison to Nuclear families (16.3%).

The present study examined the anthropometric parameters of growth of children from 5–18 years.

At all ages, GT boys weighed less than NT boys. At 5 years this difference was statistically highly significant. Later on GT boys seemed to catch up with NT boy's upto the age of 10 years. At 11 and 12 years GT boys were again significantly less in weight than NT boys. At the age of 17 and 18 years GT boys and NT boys were equal in weight.

Stature of most of the boys was normal. Though the GT boys were slightly shorter than NT boys, at most age groups the difference was not statistically significant. The stature of GT boys was significantly less than NT boys at 9, 10 and 11 years. There was probably an earlier pubertal spurt in height in NT boys. At 16 to 18 years stature of both the groups was equal.

Body Mass Index was used to assess the nutritional status.

Body Mass Index is used as an indicator of chronic energy deficiency (CED). According to **JAMES et al (1988)** [10]the grades of CED are classified as follows for adults - BMI <16.0 as grade III undernutrition, 16.0–16.9 as grade II undernutrition, 17.0–18.4 as grade I undernutrition and >18.5 as normal. According to **ICMR technical report series no. 18, (1972)**[11] for Indian children BMI >15.0(Normal), 13.0-15.0 (Moderate undernutrition) and <13.0 (severe undernutrition**).**

At most of the ages BMI was less for GT than NT but the difference was not statistically significant. At 9 and 10 years BMI of NT was statistically significantly lower than GT. This may be because of spurt in height, while the weight lagged behind.

In both, GT and NT, BMI progressively increased with age. According to Indian standards, BMI more than 15 is considered as normal. As a group, this was achieved at the age of 16 to 18 years. Progressive increase in BMI with age has been observed even in developed countries[12.]

In spite of undernutrition as assessed by BMI, stature did not seem to be affected. **Mitra et al, (2002)**[2] pointed out lower weight and stature for Kamar children of Raipur District, Chhattisgarh compared with the data for other tribes and for all India and attributed this to undernutrition.

Shukla et al. (2008)[13] have observed a mean height of 170 and 173 cms. at the age of 18 years in rural and urban school boys respectively.

Gupta (2012) has reported a mean height of 162 cm. with a range of 142 to 177 cm. for Gond adult males from Kanker district.

According to **ICMR, (1990)**[14] the data for stature of Indian boys ranged from 109 cm. at 5 years to 177 cm. at 18 years.

When BMI is observed to be low in studied population, it is generally presumed to be the effect of undernutrition. But, undernutrition should also have adverse ef fect on stature. [15,16]

Because of this disparity in observed stature and BMI, it is logical to think of other causes of low BMI. According to **Mitra et al. (2002)**[2]growth represents a complex interaction of nutritional intake, absorption and requirements, all of which vary within and among populations. Nutritional requirements alone are complex function of body size, age, health and activity levels**.**[17]**.** Even the best estimates of nutritional intakes are not an ideal indicator of a population's nutritional status because intake accounts for only one of the relevant variables[18.]

10. SUMMARY & CONCLUSION

In the present cross-sectional study, data were collected from local population of Patharia block of Chhattisgarh. Total number of subjects were 561, 279 (GT boys) and 282(NT boys). The subjects aged 5+ to 18+ years were measured for 19 body measures to compare GT boys and NT boys. Standard techniques, equipments and statistical methods were employed for collection, analysis and interpretation of data.

The major findings of this study could be summarized as follows: -

At all ages, GT boys weighed less than NT boys. At 5 years this difference was statistically highly significant. Later on GT boys seemed to catch up with NT boys up to the age of 10 years. At 11 and 12 years GT boys were again significantly less in weight than NT boys. At the age of 17 and 18 years GT boys and NT boys were equal in weight.

When BMI was compared, at the most of ages BMI was less for GT than NT boys but the difference was not statistically significant. At 9 and 10 years BMI of NT boys was statistically significantly lower than GT boys. This may be because of spurt in height, while the weight lagged behind.

In both, GT and NT boys, BMI progressively increased with age. According to Indian standards, amongst both groups, normal BMI was achieved at the age of 16 to 18 years. In spite of possibility of undernutrition as assessed by BMI, stature did not seem to be affected. What is noteworthy is that stature of most of the boys was normal.

Based on study findings it can be concluded that the poor growth status of the GT boys & NT boys, as judged by body weight and BMI, in comparison to the international standard as well as Indian standard may be due to the poor socio-economic condition.

However, what is most noteworthy is good development of stature in both GT and NT boys. BMI is the result of complex interaction between energy intake and energy expenditure. Other factors apart from undernutrition may be responsible for low BMI. This may include physical over activity.

The factors responsible for low BMI in both, GT and NT boys, should be investigated further and proper intervention strategies should be evolved in future.

REFERENCES

[1] Census of India: Provisional population totals data on Rural and Urban areas, Chhattisgarh, Series 23, Paper 2, Vol. 1 (2011).

[2] Mitra, M., Kumar, P. V., Ghosh, R. & Bharati, P.: Growth Pattern of the Kamars - A Primitive Tribe of Chhattisgarh, Coll. Antropol. 26- 2: 485– 499 (2002).

[3] Agrawal, A. K.: An anthropometric study of growth pattern of Kurmi children of Balodabazaar block of Chhattisgarh, Thesis for degree of Master of Surgery (Anatomy), Medical College, Raipur C. G. (2008).

[4] Bharati, S., Demarchi D. A., Mukherji D., Vasulu, T. S. & Bharati, P.: Spatial patterns of anthropometric variation in India with reference to geographic, climatic, ethnic and linguistic backgrounds, Annals of Human Biology, 32(4): 407–44 (2005) .

[5] Chatterjee, M.: Comparative Anthropometry of Gond & Halba tribe and non-tribe population of Gariyaband block of Chhattisgarh region, Thesis for degree of Master of Surgery (Anatomy) Department of anatomy, Medical College, Raipur, C. G. (1982).

[6] Gupta R.: Anthropometry of Gond adult male and female of North Bastar district Kanker of Chhattisgarh, Thesis for degree of Master of Surgery (Anatomy), Medical College, Raipur, C. G. (2012).

[7] National Health and Nutrition Examination Survey (NHANES), Anthropometry Procedures Manual, CDC (2007).

[8] International Society for the Advancement of Kinanthropometry (ISAK), International Standards for Anthropometric Assessment, (2001).

[9] Singh, I. P. & Bhasin, M. K.: Introduction In: A laboratory manual on biological anthropology. 1st ed, Kamla Raj Enterprises, Delhi. (1968).

[10] James, W. P., Ferro-Luzzi, A., & Waterlow, J. C.: Definition of chronic energy deficiency in adults, Eur J Clin Nutr., 42:969–981 (1988).

[11] ICMR: Growth and physical development of Indian infants and children. Tech Report Series No. 18, New Delhi: ICMR (1972).

[12] Fryar, C.D., Gu, Q. and Ogden, C.L. Anthropometric Reference Data for Children and Adults: United States, 2007–2010. Vital and Health Statistics, Series 11, No. 252, CDC (2012)

[13] Shukla, M., Venugopal, R. & Mitra, M. : A Comparative Study of Growth Pattern and Motor Quality of Boys of Jawahar Navodaya Vidyalaya and Kendriya Vidyalaya in Chhattisgarh, India, Journal of Exercise Science and Physiotherapy, 4, 133- 142 (2008) .

[14] ICMR: Nutrient Requirements and Recommended Dietary Allowances for Indians (1990).

[15] Heird, W. C.: Food Insecurity, Hunger, and Undernutrition in Nelson Textbook of Pediatrics, 17th edition, Saunders, p 255-259 (2003).

[16] Martins V. J. B., Florêncio, T. M. M. T., Grillo, L. P., Franco, M. C. P., Martins, P. A., Clemente, A. P. G., Santos, C. D. L., Vieira, M. F. A. and Sawaya, A. L.: Long-Lasting Effects of Undernutrition, Int. J. Environ. Res. Public Health, 8, 1817-1846 (2011).

[17] Pike, R., and Brown, M.: Nutrition: An integrated approach, John Wiley and Sons, Inc., New York (1975).

[18] Dwyer, J. T.: Anthropometric assessment of nutritional status. Wiley-Liss Inc. (1991).