



## **Anthropometric Characteristics, Body Composition, and Nutritional Status of Sabar Tribal People of Jhargram District of West Bengal, India**

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**Abstract:** *This Cross-sectional study has been made in tribal villages of Jhargram District of West Bengal, where 168 Sabar Tribal adults and children between 8 to 60 years were taken in this study by simple random sampling method. Anthropometric parameters are taken by anthropometric rod and steel caliper, body composition parameters were taken by Skinfold Caliper, and some Physiological parameters like hand Grip strength and PEFr by Hand Dynamometer and Peak Flow Meter respectively. The study revealed that 85.7% of female Sabar children and 68.5% of male Sabar children are malnourished, i.e., BMI is less than 18.4kg/m<sup>2</sup>. The physical parameters of adult Sabar males and females were comparable to adult Sabars of Bankura District and adult Santhals of Birbhum district of West Bengal. But they are shorter and lighter than the adult migrant Asian population. PEFr and Hand Grip strength of Sabar adults of the present study were significantly lower than standard values for adults and children. So to improve the health status of this community government might take some necessary steps to improve the socio-economic condition by providing basic facilities like education, health, and job opportunities.*

**Keywords-** *Anthropometry, Body Composition, Sabar Tribal, Nutritional status, Skinfold thickness*

### **I. Introduction**

Proper nutrition is fundamental to good health and development over prolonged periods which are reflected in components of body composition [1]. Physical growth is one of the most sensitive and reliable indicators of health and nutritional status in the human population. The study of physical growth and assessment of the nutritional status of a population is useful for understanding the health status of a population [2]. Anthropometric measurements like circumference and skinfolds on different parts of the body along with body height and weight are widely used to predict body composition [1]. Undernutrition influences growth and development in childhood which is reflected in adulthood as a risk for several diseases. The tribal population of India is approximately 8.6% and are socially and economically underprivileged. Also, data are scanty on the anthropometric and nutritional status of various tribal populations of India [3][4][5][6][7][8]. It has recently been suggested [5] that there is an urgent need to evaluate the nutritional status of various tribes in India. From this viewpoint, the objective of the present study is to report the body composition, anthropometric characteristics, and nutritional status of adults and children Sabar population of Jhargram district, West Bengal.

The major objectives of the present study are to assess the following:

- i. The anthropometric and body composition characteristics of children and adult Sabar population.
- ii. To study some Physiological parameters of this tribal population.
- iii. To compare these anthropometric, body composition, and Physiological parameters with national and international standards.

## II. Methodology

This cross-sectional study was conducted in a tribal village of Punna Pani, block Binpur, near Lalgargh of Purba Midnapore District, West Bengal. The camp was organized by an NGO which invited us to participate. The students of Serampore College and teachers of Raja Peary Mohan College along with some NGO members arranged this health camp. Permission from Panchayat and district headquarters were taken. Children, along with adult males and females between the age of 8 to 60 years of Sabar tribes were taken for this study. The study was done in February 2019 for consecutive three days from 9 am to 5 pm.

### 2.1. Study Design

The cross-sectional comparative study includes 168 subjects (both male and female) of the Sabar tribal community of age range 8 to 60 years. All the subjects were motivated to participate in this camp. The total number of subjects (N) in each group is given in the table below :

Age Range	Children		Adult Male	Adult Female
	Male	Female		
8 to 12	N = 17	N = 18	---	---
13 to 17	N = 14	N = 10	---	---
18 to 60	---	---	N = 52	N = 57

### 2.2. Inclusion Criteria :

- a. Children of age 8 years and above were taken.
- b. Adult males and females above 60 years were not included.
- c. Disabled adults were also not included in this study.

### 2.3. Sampling and data collection :

The subjects were randomly selected from the village population and the desired adults were taken by simple random sampling method. The research study was done through questionnaires, interviews, and experimental work.

Study Questionnaire :

For children :

Age, Education, Food habit, Pattern of Midday Meal, Participation in sports and games, Other activities, any physiological disorders/chronic diseases if any

For Adult Females:

Age, Education level, Number of children, Total family members, Occupation, if any

- Type of work
- Total time spent doing this work
- Income

Health problems:

Gynecological problems, Orthopedic problems, Gastrointestinal problems, Neurological problems, Psychological problems, if any

For Adult Males:

Age, Education level, Smoking habit/any other form of tobacco, Habit of alcohol intake, Occupation(Income, Total number of family members, Health related problems- Gastrointestinal, Neurological, Respiratory, any other)

#### 2.4 Ethical Consideration :

The ethical approval was obtained from the Human Ethical Committee of Serampore College and Raja Peary Mohan College. Besides, consent from Panchayat was taken before the conduction of the study.

#### 2.5 Physical Parameters :

**Stature:** The stature of the participants was measured by an anthropometric rod. It is measured in centimeters (cm).

**Body Mass:** The body mass of the participants was measured to the nearest 0.5kg by a standard weighing pan with a light cloth and bare feet. Body mass was measured in kilograms (kg).

**Body Mass Index (BMI):** BMI is a measure of Body Composition. BMI measurement is an attempt to quantify the amount of tissue mass (muscle, fat, and bone) in an individual, and then categorize that person as underweight, normal weight, overweight, or obese based on that value. BMI is expressed in Kg/m<sup>2</sup>.

BMI is calculated according to the formula :

$$BMI = \frac{\text{Body Mass (kg)}}{\text{Body height (m}^2\text{)}}$$

**Handgrip Strength:** The Handgrip Strength Test measures the maximum isometric strength of the hand and forearm muscles to provide a general measure of overall arm strength. This test is done by the handgrip dynamometer. The reading of the dynamometer was measured in kilograms (kg).

**Peak Flow Expiratory Rate (PEFR):** This is the maximum flow that can be sustained for 10 seconds during a forced expiration starting from total lung capacity. The peak expiratory flow rate is measured by Wright's Peak flow meter. PEFR was measured in liters per minute (L/min).

**Blood Pressure and Resting Heart Rate:** The blood pressure and heart rate of the subject were measured with the help of a digital sphygmomanometer. Blood pressure was measured in mm Hg. Heart rate was measured in beats per minute.

#### Body Composition and Anthropometrical Parameters

**Skinfold Measurement:** Skinfold thickness of different regions of the body was measured (Biceps, Triceps, Subscapular, Suprailiac) by the Cescorf Innovare Skinfold Caliper. Skinfold measurements were taken in millimeters (mm).

The body density ( $\text{kg}/\text{mm}^3$ ) was measured using a generalized equation [9] for predicting Body Density and the Total Body Fat Percentage (%) was calculated using Siri's equation [10]. The Total Fat Mass (kg) was calculated using the value of total Body Fat Percentage (%) and Body Mass (kg). The Fat-Free Mass (kg) was calculated by deducting the value of Total Fat Mass (kg) from that of the Total Body Mass (kg) of the subject. The following formulas are applied for adults (males and females) and children (males and females) :

$$\text{Body Density} = 1.112502 - (0.0013125 * x) + (0.0000055 * x^2) - (0.0002440 * y)$$

Where, X = Sum of Biceps, Triceps, Subscapular, supra iliac Skinfolds, Y= Age in years

$$\text{Percentage of Body Fat} = \left[ \frac{4.95}{D} - 4.50 \right] * 100, \text{ where, } D = \text{Body Density}$$

$$\text{Total Body Fat Mass} = \left( \frac{\text{Percentage of Body Fat}}{100} \right) * \text{Body Weight in kg}$$

$$\text{Fat Free Mass} = \text{Body Weight in kg} - \text{Total Body Fat Mass in kg}$$

## 2.6. Circumference (Girth) Measurements :

Circumference measurement is done at standard anatomical sites around the body, measured with a flexible anthropometric tape. The circumference is measured in centimeters (cm).

- a. Chest circumference: It is taken at the level of mesosternale with the subject keeping the arms abducted to the horizontal position.
- b. Waist circumference: It is measured at the level midway between the lowest rib and the iliac crest, with the legs closed together. In most of the subjects, this is at the apheion level.
- c. Hip circumference: It is taken at the level of the greater trochanters, with the legs closed together.
- d. Mid upper arm circumference: It is measured at the level of the mid-acromial radiale.
- e. Mid thigh circumference: It is measured at the mid trochanteric tibiale lateral site.
- f. Calf circumference: It is the maximum circumference of the calf at the medial calf skinfold site.
- g. Head circumference: It is the maximum distance between the two brow ridges.

## III. Results

Table 1 shows the socio-demographic characteristics of the Sabar population. It represents age, educational status, family income, occupation, house type, smoking habit, alcohol intake, and source of drinking water. The participants were categorized into children (8 to 17 years), adult males, and adult females (18 to 60 years) group. A total of 169 subjects were taken from tribal villages of the Jhargram district. The educational status of the participants was divided into - non-literate, primary (class I to V), secondary (class VI -X), and college level (class XI and above). The income group was categorized into - Low-income group (monthly up to Rs 3000), the moderate-income group (monthly Rs 3000-4000), and the high-income group (monthly Rs 4000-5000). Types of houses were divided into three types kutcha (made of mud and bamboo), semi pucca (made of brick wall and floor, the roof was thatched), and pucca houses (made of brick and cement). The Source of drinking water was mainly two - tubewell and tap water. Sanitary latrines are rare in these villages, so it is categorized into - present and absent. Most of the adult males were smokers and alcoholics. Thus habit among male participants was categorized into - smoker(49%), non-smoker (28%), and other forms of tobacco like gutka, khaini (22.14%), alcoholic (81%), and non-alcoholic (19%). Sex-wise occupational status of the male participants (81%) included 100-day labour, agriculture worker, cattle farmers, small businessman, and others. The occupation of female participants was mainly a collection of wood from the forest, cattle farming, leaves collection from the forest, and 100 days of labour.

The distribution of the socio-economic characteristics of the studied population indicated 37.73% of adult males and 5.26% of adult females were non-literate, but a maximum number of males (32%) and females (36.84%) had educational status up to primary level and meager 19.29% males and 3.77% had education level up to undergraduate level. The maximum number of male and female children (38.59%) had education up to madhyamik or secondary level (Class X). Adult males and females reported their monthly income upto Rs 3000 to Rs 4000 by 100 days work or collection of wood and leaves from a forest or agricultural labour. 47% of Sabar people collect their drinking water from tubewell and 52% from supplied tap water. 49% of male Sabar people were smokers and 22% use tobacco in another form. Similarly, 81% of males were addicted to alcohol use. It was also remarkable that 76% of people did not use sanitary latrines due to a lack of facilities in their villages. 59% of people of these Sabar villages had semi-pucca houses followed by 28 % with pucca houses. 96% people of these Sabar villages has electricity. 37% male Sabar people in this locality were daily labour followed by 22 % of agriculture workers but females (49%) were wood collectors followed by cattle farming.

Table 1-Distribution of the Socio-demographic characteristics among the studied population

Variables			Frequency	Percentage (%)
Children (Age : 9 – 17 years)	Male		31	18.34
	Female		28	16.56
Adult (Age : 18 – 60 years)	Male		52	31.56
	Female		57	33.72
Educational Status				
Non literate	Children	Male	--	--
		Female	--	--
	Adult	Male	20	37.73
		Female	03	5.26
Class I - V	Children	Male	14	45.16
		Female	07	25
	Adult	Male	17	32.07
		Female	21	36.84
Class VI - X	Children	Male	09	45
		Female	18	54
	Adult	Male	14	16
		Female	22	17
Class XI and above	Children	Male	08	06.45
		Female	03	07
	Adult	Male	02	02
		Female	11	10
Sanitary Latrine	Present		31	18.34
	Absent		128	75.74
Drinking Water	Tube well		80	47.33
	Running tap water		89	52.66
Monthly income	Upto Rs 3000		70	41.42
	Rs 3000 - Rs 4000		71	42.01
	Rs 4000 – Rs 5000		28	16.56
Smoking Habit (Males)	Smoker		26	49.05
	Non Smoker		15	28.30
	Other form of tobacco		12	22.64
Alcohol	Yes		43	81.83
	No		10	18.86

Occupation	Male	Farmer	12	22.64
		Daily Labor	20	37.73
		Carpenter	03	05.66
		Business	03	05.66
		Student	04	07.54
		Others	11	20.75
	Female	Wood Collection	28	49.12
		Farming and cattle cultivation	19	33.33
		100 days work	10	17.54
House Type	Pucca House		48	28.40
	Kutch House		21	12.42
	Semi Pucca House		100	59.17
Electrification	Present		162	95.85
	Absent		07	4.14

Table 2: Mean and Standard Deviation of Physiological Parameters of Children Sabar males and females :

Parameters	Male children	Female children	Significance level	Male children	Female children	Significance level
	N= 17 (8-12) years	N = 18 (9-12) years		N = 14 (13-17) years	N = 10 (13-17) years	
Age (years)	9.58 ± 1	10.77 ± 1.16	Significant, P<0.001	15.07 ± 1.38	13.8± 0.91	Significant, P<0.001
Weight(kg)	24.17 ± 2.67	25.77 ± 5.04	Significant, P<0.001	42.85 ± 10.82	36.75± 6.50	Significant, P<0.001
Height(cm)	125.05±6.64	128.27 ± 9.68	Significant, P<0.001	150.64±10.81	145.3± 6.09	Significant, P<0.001
BMI	14.85 ± 1.77	15.53 ± 1.39	Significant, P<0.001	18.53 ± 2.41	17.42 ±2.50	Significant, P<0.001
Resting heart rate (bpm)	97.11±14.25	100.27±28.53	Not significant	91.92 ± 14.42	110.9± 12.27	Significant, P<0.001
Systolic BP	99.17 ± 8.46	101.55 ± 8.89	Significant, P<0.01	114.28±15.65	110.5± 15.99	Significant, P<0.05
Diastolic BP	60.11 ± 7.21	62.66 ± 6.40	Significant, P<0.001	64.07 ± 6.99	65.9± 7.72	Significant, P<0.05
PEFR(l/min)	145.88±21.81	146.11±42.44	Not significant	247.14±54.26	205± 34.39	Significant, P<0.001
HGS (kg)	8.82 ± 3.20	8.77 ± 4.23	Not significant	21.78 ± 7.11	14 ± 4.76	Significant, P<0.001

Table 2 represents Mean  $\pm$  SD values of different Physical and Physiological parameters of Sabar children between the age of 8 to 17 years. Both male and female children were divided into two subgroups 8 to 12 years (preadolescent) and 13 to 17 years (adolescent). Significant ( $P < 0.001$ ) difference in male and female preadolescent children has been found in body height, body weight, BMI, and Systolic and Diastolic Blood Pressure. Female preadolescent children exceed their male counterparts in the above-mentioned parameters. No significant difference has been found in resting heart rate, PEFr, and handgrip strength value. But a significant difference has been found between all the Physical and Physiological parameters of male and female adolescent children (13 – 17 years). This might be due to an adolescent growth spurt.

Table 3 represents Mean  $\pm$  SD values of different anthropometric parameters and body composition parameters of male and female preadolescent and post-adolescent Sabar children of Jhargram District of West Bengal. Significant ( $P < 0.001$ ) differences in anthropometric and body composition parameters are found in male and female preadolescent children except for waist circumference, Mid thigh Circumference male, and calf circumference. In most cases, female exceeds male in the above-mentioned anthropometric and body composition parameters. In the case of adolescent children, a significant ( $P < 0.01-0.001$ ) difference has been found in male and female children except for Mid thigh circumference and body density. It is observed that adolescent males (13 to 17 years) exceed females in Body Composition parameters. This is due to the adolescent growth spurt of both male and female children. Females reach their adolescence period between 11-13 years, which is 1-2 years earlier than their male counterparts. Body height and body weight of male preadolescent children are lower than female counterparts but adolescent males exceed in body height and body weight than female counterparts due to the effect of *Testosterone Hormone* that influences the development of girth and circumference values. But females in their adolescence, due to the influence of *Estrogen* and *Progesterone* accumulate body fat, and thus the skinfold measurements exceed in females than in males. BMI and mid-upper arm circumference values of preadolescence and adolescent male and female children indicate the low nutritional status of children.

Table 3: Mean and Standard Deviation of Anthropometric Parameters of Children Sabar males and females:

Parameters	Male children	Female children	Significance level	Male children	Female children	Significance level
	N = 17 (8-12) years	N = 18 (9-12) years		N = 14 (13-17) years	N = 10 (13-17) years	
Chest Circumference(cm)	55.20 $\pm$ 2.53	56.52 $\pm$ 4.54	Significant, P<0.001	68.55 $\pm$ 7.34	64.95 $\pm$ 7.22	Significant, P<0.001
Waist Circumference (cm)	57.65 $\pm$ 3.04	57.77 $\pm$ 4.32	Not significant	68.71 $\pm$ 6.46	64.95 $\pm$ 5.99	Significant, P<0.001
Hip Circumference (cm)	58.65 $\pm$ 3.65	62.41 $\pm$ 5.05	Significant, P<0.001	72.72 $\pm$ 7.35	71.25 $\pm$ 6.03	Significant, P<0.05
MUAC (cm)	15.14 $\pm$ 0.66	15.75 $\pm$ 1.47	Significant, P<0.001	19.95 $\pm$ 3.009	18.75 $\pm$ 2.67	Significant, P<0.01
Mid Thigh Circumference (cm)	29.63 $\pm$ 1.98	29.73 $\pm$ 3.01	Not significant	36.75 $\pm$ 4.27	35.95 $\pm$ 5.23	Not significant
Calf Circumference (cm)	22.42 $\pm$ 1.25	22.65 $\pm$ 2.15	Not significant	27.67 $\pm$ 3.04	26.3 $\pm$ 2.68	Significant, P<0.001

Head Circumference (cm)	49.2 ± 1.36	48.96± 1.58	Significant, P<0.05	52.32± 1.92	48.94± 5.82	Significant, P<0.001
Sitting Height(cm)	64.35± 3.39	66.47± 2.86	Significant, P<0.001	78.39± 9.63	75.6 ± 3.83	Significant, P<0.01
Knee Height(cm)	39.14± 2.05	40.53± 3.46	Significant, P<0.001	49.64± 4.66	46.5 ± 3.28	Significant, P<0.001
Triceps skinfold(mm)	4.47 ± 1.28	6.55 ± 2.91	Significant, P<0.001	5.14 ± 1.40	7.9 ± 3.34	Significant, P<0.001
Biceps skinfold(mm)	3.35 ± 0.70	4.33 ± 1.45	Significant, P<0.001	3.35 ± 0.63	4.9 ± 1.10	Significant, P<0.001
Subscapular Skinfold(mm)	3.41 ± 0.50	4.66 ± 1.08	Significant, P<0.001	5.35 ± 2.02	6.5 ± 2.27	Significant, P<0.001
Suprailiac Skinfold(mm)	4.29 ± 1.10	5.38 ± 2.17	Significant, P<0.001	5.85 ± 1.91	7.5 ± 4.27	Significant, P<0.001
Body Density	1.09± 0.003	1.08± 0.006	Significant, P<0.001	1.08 ± 0.004	1.07 ± 0.01	Not significant
Body Fat Percent (%)	3.90 ± 1.33	6.46 ± 2.91	Significant, P<0.001	6.46 ± 1.82	9.26 ± 4.45	Significant, P<0.001
Total Fat Mass(kg)	0.94 ± 0.34	1.70 ± 0.95	Significant, P<0.001	2.81 ± 1.25	3.63 ± 2.24	Significant, P<0.001
Fat Free Mass(kg)	23.21± 2.56	24.07± 4.55	Significant, P<0.01	40.04 ± 9.91	33.11± 4.52	Significant, P<0.001

Table 4 represents Mean ± SD values of different Physical and Physiological parameters of the adult Sabar male and female population of Jhargram District of West Bengal. Significant (P<0.001) differences are found in Body Height, Body Weight, BMI, and different Physiological parameters between male and female adult Sabars of Jhargram district. Adult males are significantly higher in all of the above-mentioned parameters than female adult Sabars of Jhargram District, West Bengal, except Resting Heart Rate, where females show a higher value than males.

Table 4: Mean and Standard Deviation of Physiological Parameters of Adult Sabar Male and Females:

Parameters	Adult Males	Adult Females	Significance Level
	N= 52 (18years-60years)	N= 57 (18years-60years)	
Age (years)	35.54 ± 12.03	34.29 ± 12.25	Significant, P<0.001
Weight(kg)	55.81 ± 7.28	43.33 ± 5.25	Significant, P<0.001
Height(cm)	160.28 ± 7.57	148.84 ± 4.86	Significant, P<0.001
BMI	21.67 ± 2.56	19.52 ± 2.22	Significant, P<0.001



Resting Heart Rate (bpm)	85.15 ± 14.18	91.59 ± 13.90	Significant, P<0.001
Systolic BP	129.41 ± 17.94	121.36 ± 18.34	Significant, P<0.001
Diastolic BP	75.22 ± 11.72	72.64 ± 13.06	Significant, P<0.001
PEFR(l/min)	331.32 ± 68.80	249.64 ± 51.09	Significant, P<0.001
HGS (kg)	30.07 ± 8.004	23.82 ± 30.51	Significant, P<0.001

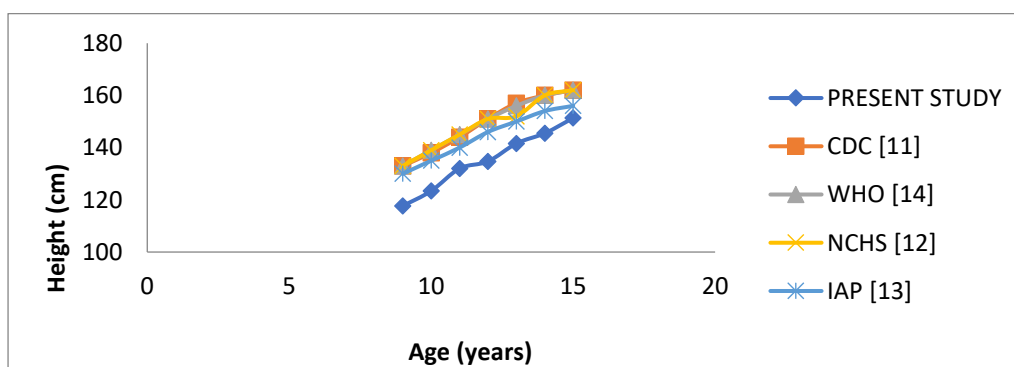
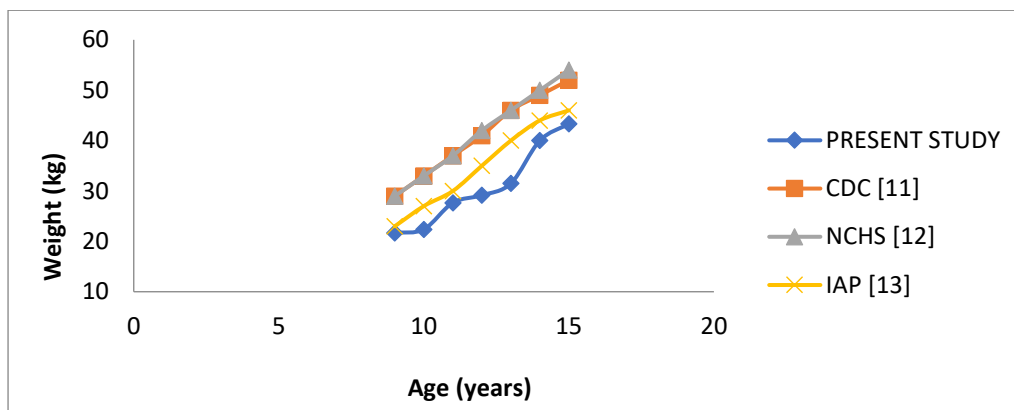
Table 5 represents Mean ± SD values of different Anthropometric parameters and body composition parameters of the adult Sabar male and female population of Jhargram District, West Bengal. Significantly (P<0.001) higher values of Anthropometric parameters of an adult male have been found in comparison to a female. Triceps and Biceps skinfold thickness is significantly higher in females than in males but the Fat-Free Mass value is significantly higher in males than in the female population.

Table 5: Mean and Standard Deviation of Anthropometric parameters of adult Sabar males and females:

Parameters	Adult Males	Adult Females	Significance Level
	N= 52(18years- 60years)	N= 57 (18years-60years)	
Chest circumference(cm)	79.98 ± 4.32	73.29 ± 4.87	Significant, P<0.001
Waist circumference (cm)	80.39 ± 5.75	73.54 ± 7.04	Significant, P<0.001
Hip circumference (cm)	83.61 ± 5.72	79.95 ± 4.98	Significant, P<0.001
MUAC (cm)	24.09 ± 1.72	21.13 ± 1.85	Significant, P<0.001
Mid thigh circumference (cm)	40.38 ± 3.60	35.12 ± 3.24	Significant, P<0.001
Calf circumference (cm)	30.26 ± 2.20	27.81 ± 2.10	Significant, P<0.001
Head circumference (cm)	54.37 ± 1.44	51.63 ± 1.60	Significant, P<0.001
Sitting height(cm)	84.79 ± 4.13	78.56 ± 2.50	Significant, P<0.001
Knee height(cm)	52.11 ± 3.01	46.05 ± 2.83	Significant, P<0.001
Triceps skinfold(mm)	4.92 ± 2.24	6.92 ± 2.99	Significant, P<0.001
Biceps skinfold(mm)	3.33 ± 0.85	3.77 ± 1.41	Significant, P<0.001
Subscapular skinfold(mm)	7.79 ± 3.68	6.19 ± 2.38	Significant, P<0.001
Suprailiac skinfold(mm)	8.32 ± 4.80	6.03 ± 2.95	Significant, P<0.001

Body Density	1.07 ± 0.01	1.07 ± 0.009	Not significant
Body fat percent(%)	10.42 ± 4.54	9.66 ± 3.92	Significant, P<0.001
Total fat mass(kg)	6.02 ± 3.40	4.31 ± 2.18	Significant, P<0.001
Fat free mass(kg)	48.73 ± 7.74	39.02 ± 3.88	Significant, P<0.001

Comparative analysis of Body Height, Body Weight, and BMI values of Sabar Children with National and International Standards, reveals that Sabar boys and girls (9 to 16 years) show lower values of Body Height, Body Weight, and BMI in comparison to International standard value [11] and [12] and also from IAP[13] growth chart. The differences are significant between ages 9 to 15 years. It is also found that the growth pattern reported by children's IAP standard[13] is lower than International standard values[11,12] but higher than tribal Sabar children of West Bengal (Figure 1, figure 2).



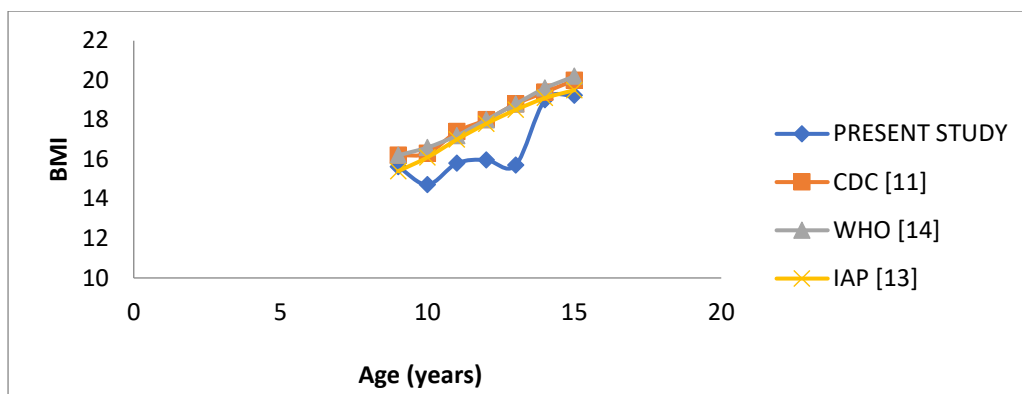


Figure 1: Comparison of Physical parameters of young Sabar girls of the present study with different standards

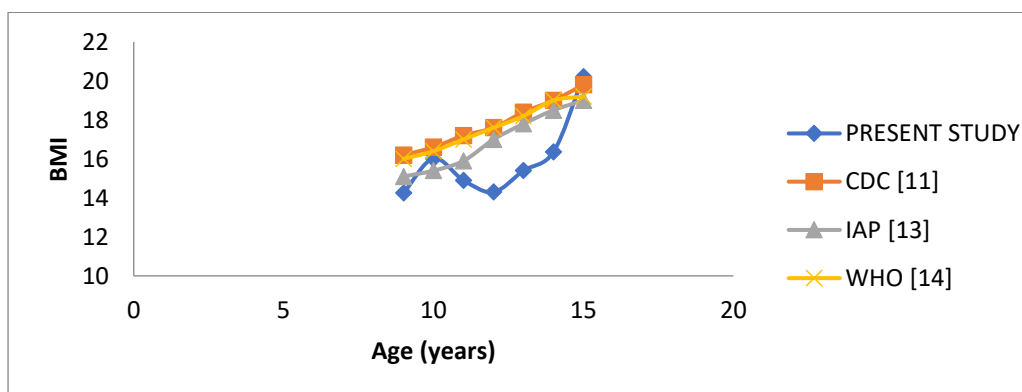
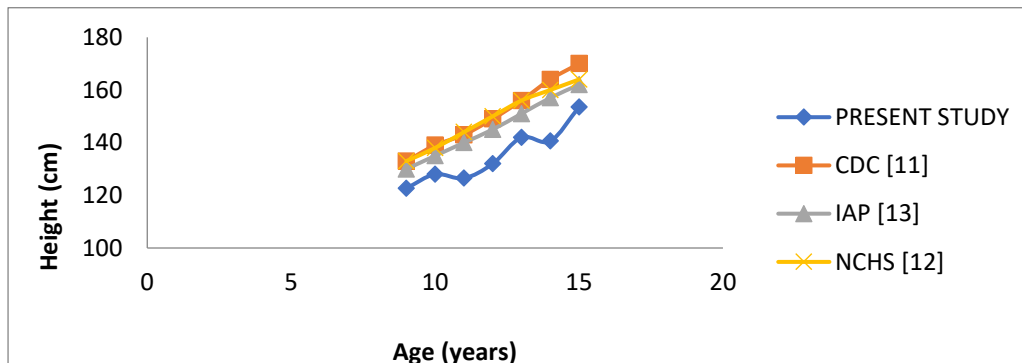
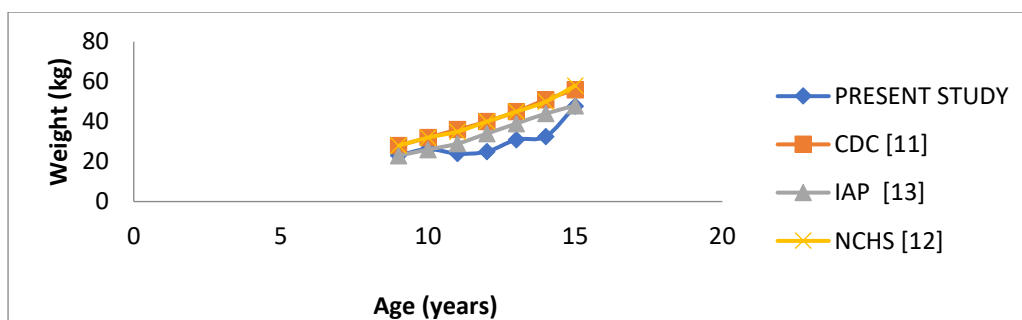


Figure 2: Comparison of Physical parameters of Young Sabar boys of the present study with different standards

Body Height, Body Weight, and BMI values of adult tribal males and females when compared with other tribal Sabars of Bankura District, [15] and adult Santhals of Birbhum District [16] of West Bengal, it was found that adult males and females of the present study (Adult Sabars of Jhargram) were comparable to adult Sabars of Bankura and adult Santhals of Birbhum. But they are shorter and lighter than the adult migrant Asian population[17](Figure 3).

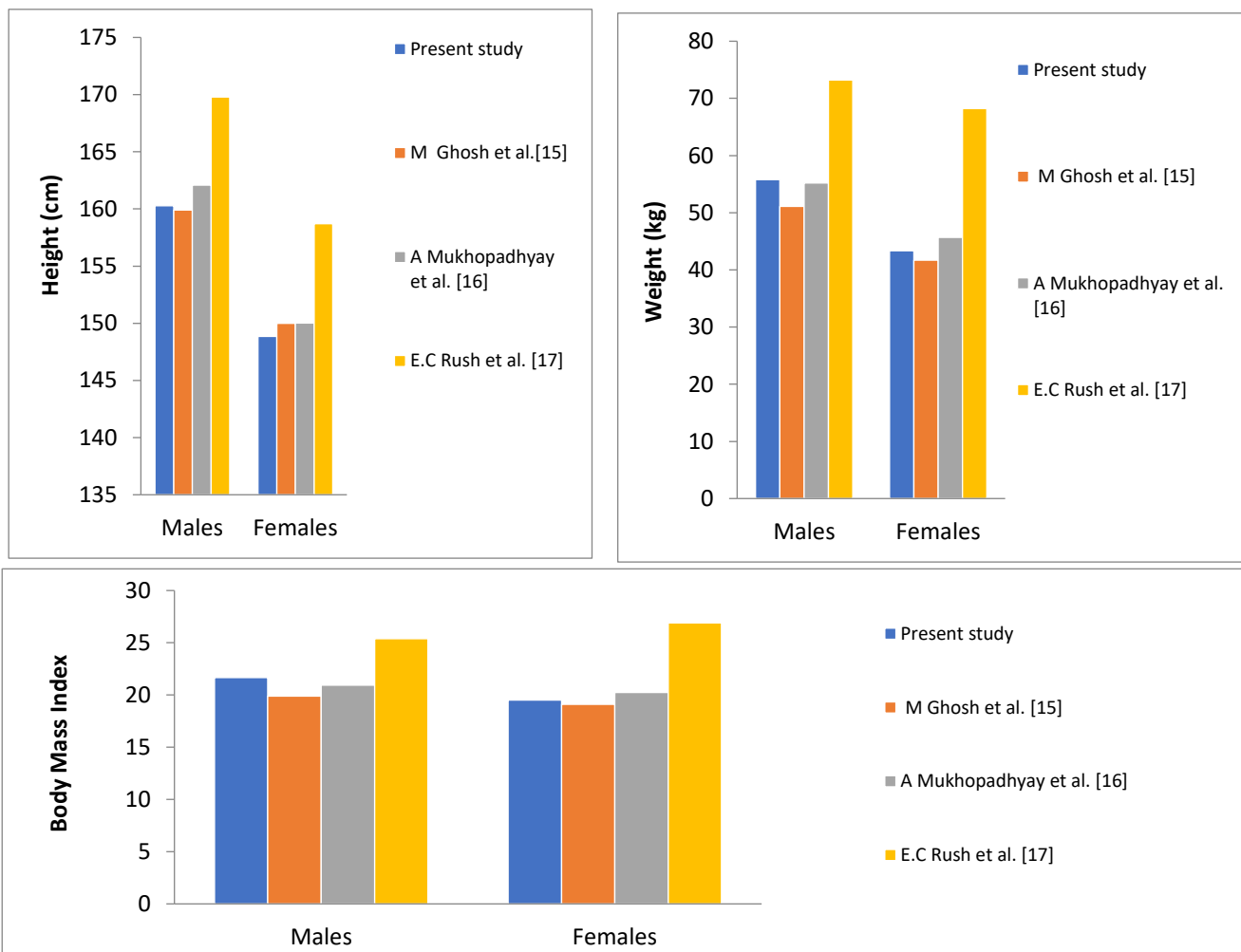


Figure 3: Comparison of Body Height and Body Weight and BMI of adult Sabar males and females with other Populations

Again Body Height, Body Weight, and BMI values of male and females Sabar preadolescent and adolescent children when compared with tribal Birhor children[18] and non-tribal children[19] of West Bengal, it was observed that Children of the present study were shorter and lighter than children of West Bengal but they are comparable (close) to Birhor children of Purulia. Similar results have been found in the case of BMI. Likewise, the PEFR values of Sabar children show significantly lower values than non-tribal children of West Bengal[20](Figure 4).

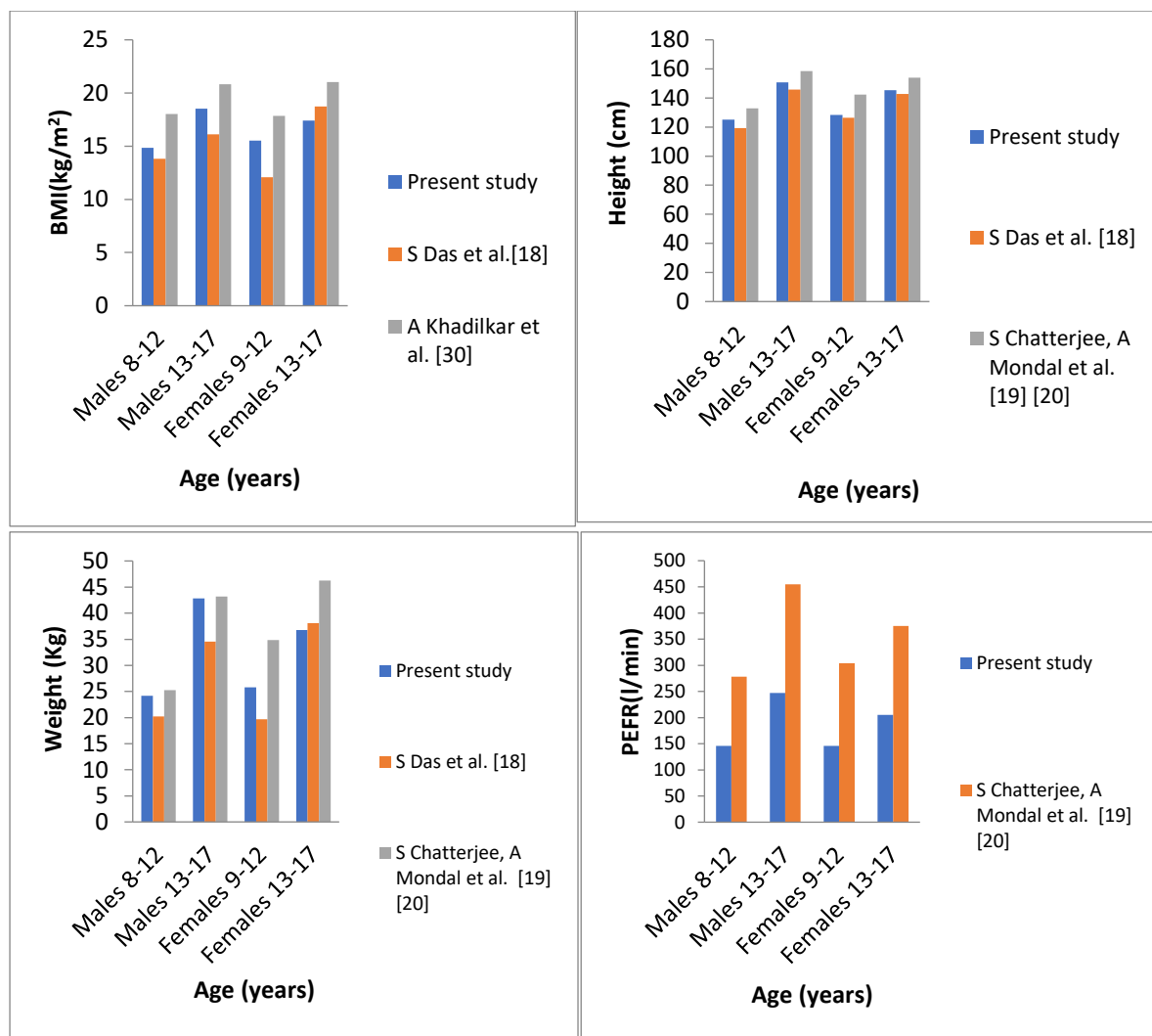


Figure 4: Comparison of Body Height and Body Weight, BMI, and PEFR values of Sabar children with other tribal and non-tribal children of West Bengal :

Regarding Anthropometrical parameters, comparative analysis revealed that adult male and female Sabar of the present study was shorter in Mid Upper Arm Circumference, Chest Circumference, and Hip Circumference Values than adult Sabars of Bankura[15] and adult Sabars of Birbhum [16]. But waist circumference values were significantly higher in adult males and females of Sabars of the present study than adult Santhals of Birbhum. Body Fat Percentage, Skinfold Thickness values of males and females adult Sabars were significantly lower than adult Sabars of Bankura[15] and adult Santhals of Birbhum [16] indicating the difference in the socio-economic pattern of these tribal populations (Figure 5, Figure 6).

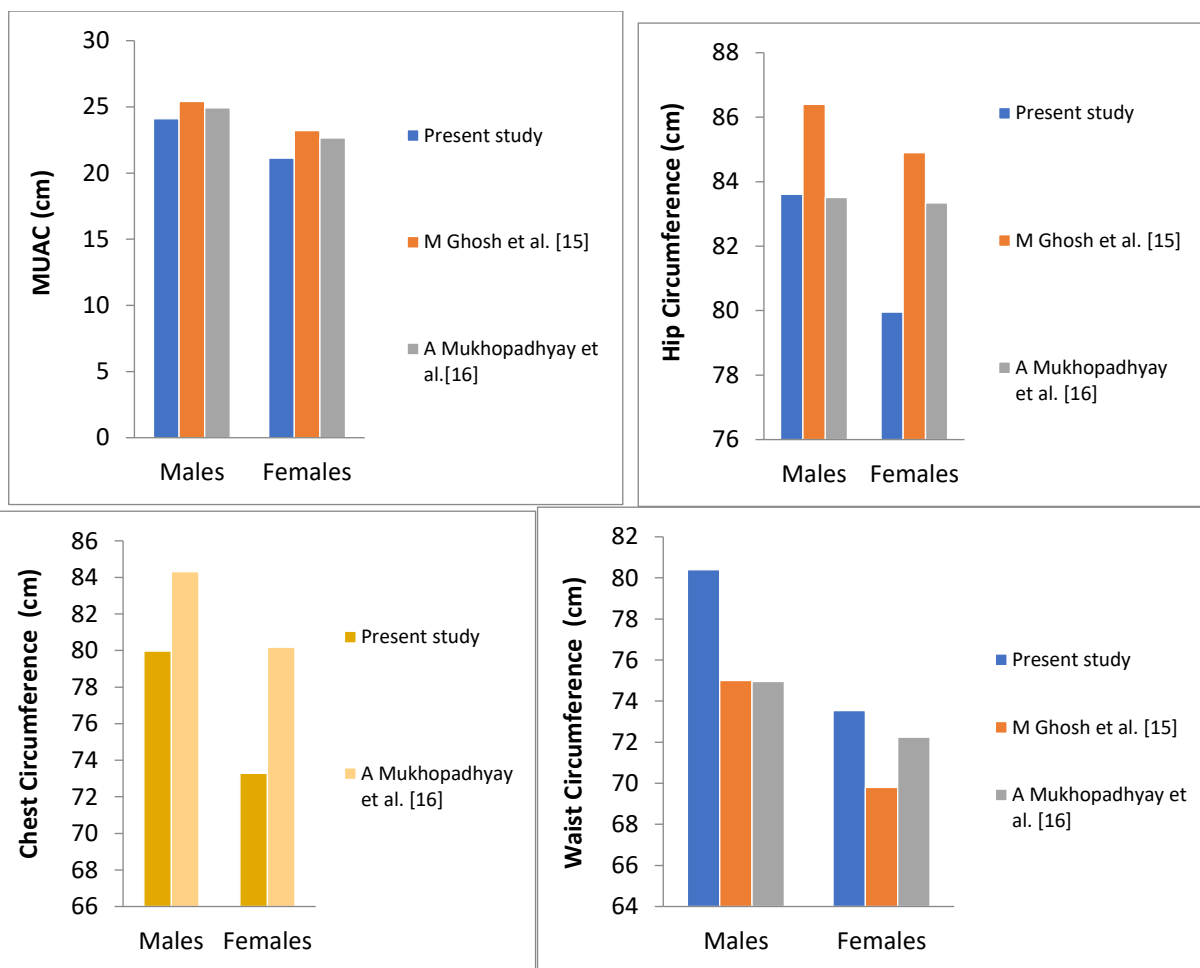


Figure 5 : Comparison of MUAC, Chest Circumference, Hip Circumference, Waist Circumference values of Sabar adults with other tribal adults of West Bengal



Figure 6: Comparison of Body Fat Percentage and Skinfold Thickness values of Adult Sabars with other population

PEFR and Handgrip Strength values of adult males and females Sabars of the present study were significantly lower than standard values for adults and children[21,22,23,24,25] for PEFR and MasyWestropp[26] for Hand GripStrength (Figure 7).

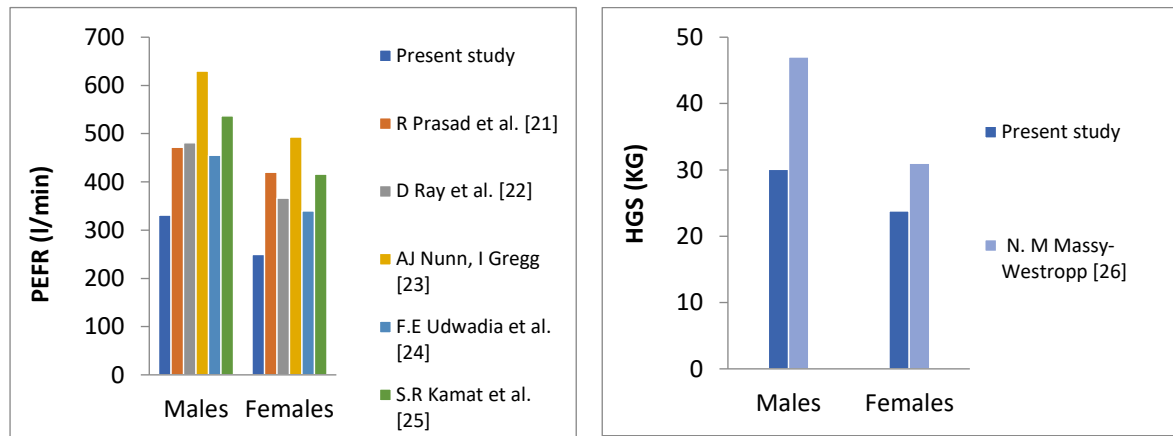
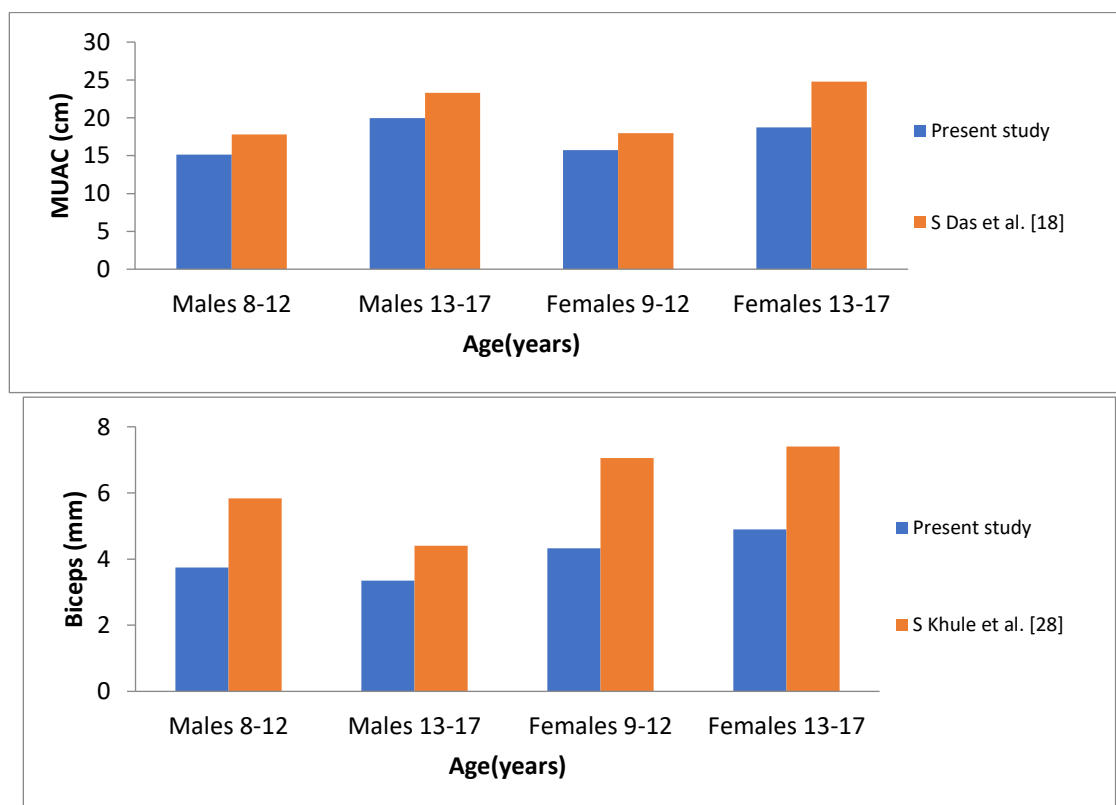


Figure 7: Comparison of PEFR and HGS values of adult Sabars with other adult population

The Mean Upper Arm Circumference (MUAC) value and body fat percentage of Sabar Children of the present study are significantly lower than Birhor Children of Purulia[18] and Asian Indian Children[27]. Biceps, Triceps, Subscapular, and suprailiac skinfold thickness values are also lower in Sabar children than in Canadian children[28,29] of similar age groups. Systolic and Diastolic Blood Pressure values of children in the present study when compared with the values of Indian children[30] was found that systolic blood pressure values are very close to Indian Standard but diastolic blood pressure is lower than the standard value for Indian children (Figure 8, Figure 9).



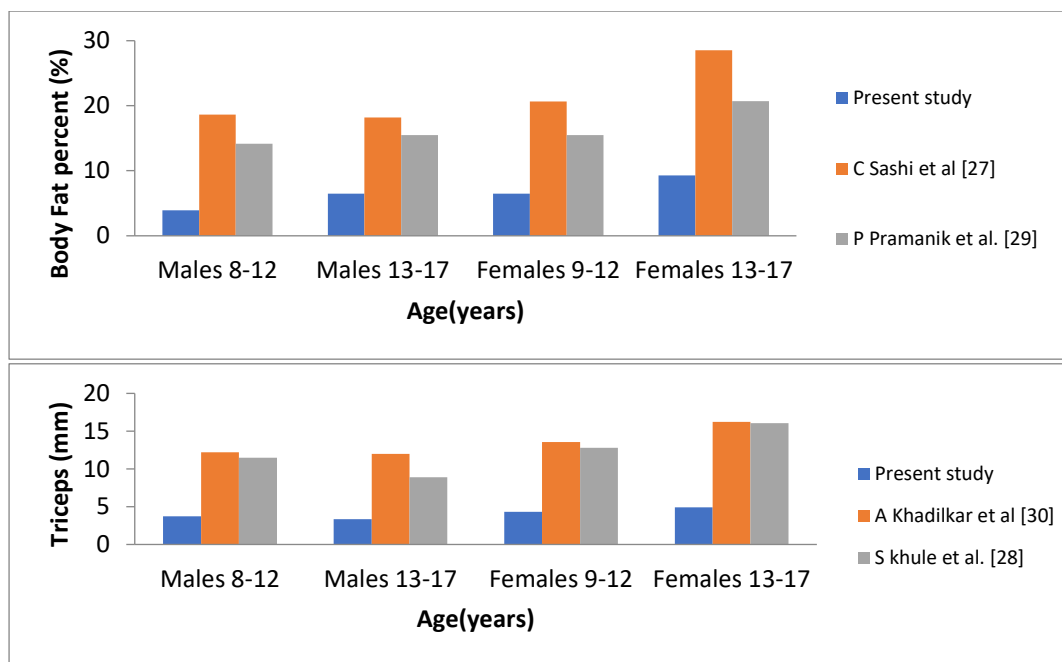


Figure 8 : Comparison of MUAC, Body Fat Percentage and Skinfold Thickness Values of Sabar Children with other children

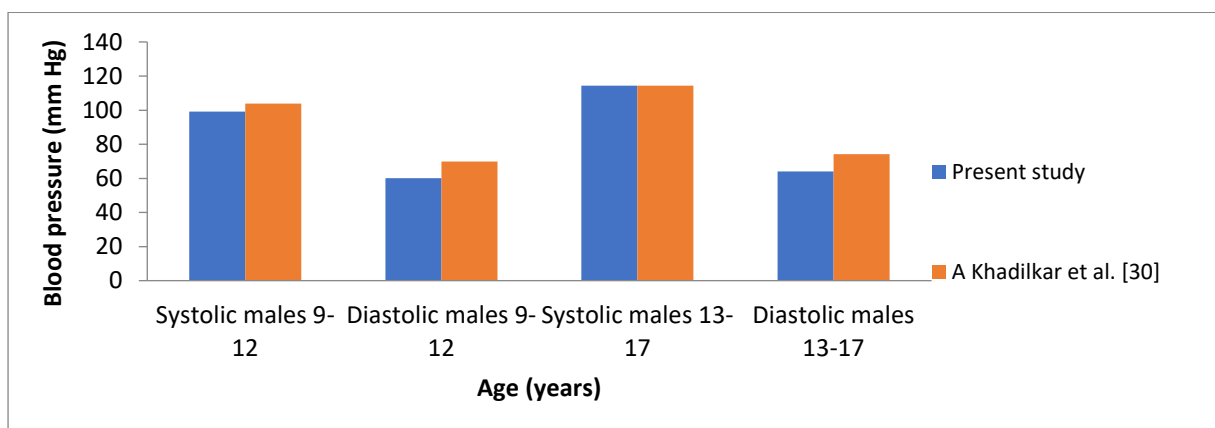


Figure 9: Comparison of Blood Pressure values of Sabar children with other Indian children :

The handgrip strength value of adolescent and preadolescent Sabar Children when compared with Bengalee children of West Bengal[19,31] and children and adolescents of Chile[32], it was found that Sabar children are lower than Bengalee children as well as children of Chile in handgrip strength. Bengalee children of West Bengal and Sabar children of Jhargram District are lower in handgrip strength than children of Chile (Figure 10).



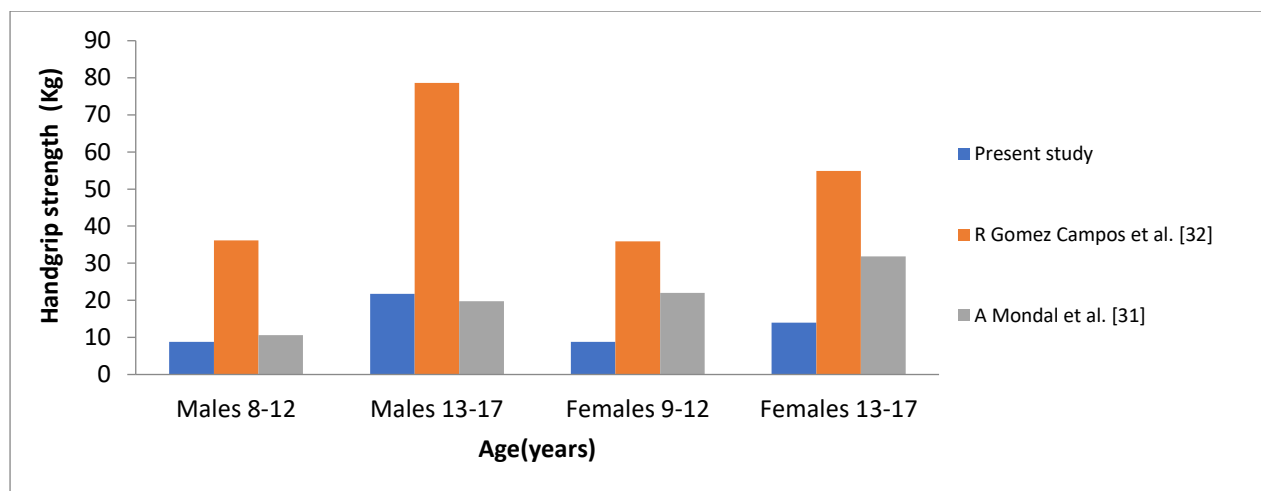


Figure 10: Comparison of Handgrip Strength values of Sabar children with other children population

#### IV. Discussion

The present study has been concerned with assessing the physiological attributes of Sabar children and adults to inform social and economic development. Anthropometry, Body Composition, and Physiological evaluations have been carried out in this study as those can lead to a precise prediction of the nutritional status of a community since nutrition refers to overall social standards [33]. The Body Height, Body Weight and BMI values of children as well as adults are lower than the National and International Standards. The BMI is a useful index to assess malnutrition or obesity. Low BMI may have been the effect of improper diet and monotonous long duration work schedules. In the present study 68.5% of male Sabar children, 85.7% of female Sabar children, 9.6% adult Sabar male and 26.3% adult Sabar females have BMI below 18.4 i.e. children are more malnourished than adults. Adult females are more undernourished than adult males.

In the case of children, the reason for undernutrition might be due to their insufficient calorie intake as well as a deficiency of protein in the diet. Midday Meal pattern (reported by questionnaire) indicates a deficiency of protein in the diet. The occupation of the adult male Sabar population is cultivation or the government 100 days working program. So the income of a family (maximum 4/6th number) is insufficient to meet the family's needs. So the females engage themselves to collect and selling wood from the forest. This high energy demanding job requires high calories. This might be the reason for 26% of undernourished adult females in this locality. Besides most of the females suffer from neurological as they carry an excessive load on their heads and have gynecological problems due to the lack of toilet facilities in this village and this might be the reason for poor health conditions which affect the economic condition of these Sabar tribal populations. The people of this low socio-economic condition tend to consume tobacco, to some extent, and alcohol regularly along with insufficient nutrition might influence their respiratory capacity as well as strength.

From this discussion, it can be highlighted that the Sabar children and females are the most undernourished of the entire population, which threatens their capacity to contribute to the socio-economic development of these tribes. Male adults with poor educational backgrounds were mostly addicted to tobacco and alcohol which might be the reason for low socio-economic status as well as poor health conditions of these populations. Therefore appropriate precautionary measures are needed to prevent further progression of the problem among the young population. Besides, to improve the health conditions of the people of this community the government might take some necessary steps :

- i. Basic education for all including health education.

- ii. Policy for economic support and job opportunities for the people of this locality.
- iii. Support systems such as high schools, hospitals, or health centers, toilets for each house, modern equipment for cultivation, and job-oriented training for the improvement of health and economic status.
- iv. Female self-support group.

## V. Conclusion

This study was conducted on the Sabar Population of a village Punna Pani of Jhargram District, West Bengal, which included both male and female populations between the age of 8 to 60 years.

Data collection was carried out which included measurement of Physical parameters, Body Composition parameters, and some Physiological parameters.

**5.1** Significant difference ( $P < 0.001$ ) in Body Height, Body Weight, BMI, and Systolic and Diastolic Blood Pressure value was observed between male and female children. Female Sabar children exceed their male counterparts in the above-mentioned parameters. Again adolescent male and female children (13-17 years) showed significant differences in Physical and Physiological parameters and the male exceeds the females.

**5.2** Preadolescent female Sabar children showed significantly higher anthropometric and body composition parameters than male preadolescent children. Adolescent female children exceed in Body Composition parameters than male children but male adolescents exceed females in Anthropometric parameters after adolescent growth spurt. Similar results have been observed in adult males and females where adult male exceed their female counterparts except for resting Heart Rate.

**5.3** Comparative analysis of physical parameters of Sabar children with national and international standards indicated the low nutritional status of this population. The physical parameters like Body Height, Body Weight, and BMI values when compared with other tribal populations of West Bengal, it was found that the adult Sabar males and females of Jhargram District were comparable to adult Sabars of Bankura district and adult Santhals of Birbhum district of West Bengal. But they are shorter and lighter than the adult migrant Asian population.

**5.4** PEFR and Handgrip strength values of adult Sabar males and females of the present study were significantly lower than standard values for adults and children.

**5.5** The study also revealed that 85.7% of female Sabar children and 68.5% of male Sabar children are malnourished i.e., BMI is less than  $18.4 \text{ kg/m}^2$  and this is an indication of the poor nutritional status of this community. Physiological Parameters of adult Sabars are also at a lower level than their non-tribal counterpart. So to improve the health status of this community government might take some necessary steps to improve the socio-economic condition focusing on their basic facilities like education, health, and job opportunities.

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