

# A Study on Body Mass Index and Prevalence of Chronic Energy Deficiency among Adult Kharwar Tribes of India

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**Abstract:** The Health and nutritional status of an individual depends on the food he eats. Man needs a wide range of nutrients to lead a healthy and active life and these are derived through the diet they consume daily. Good nutrition is a basic component of health. This paper deals with the utility of various anthropometric cut-off points in the evaluation of nutritional & health status. The Kharwar is one of the Adivasi groups of Uttar Pradesh and Bihar. "They are contemporary of Mundari speaking Indian tribes" and "racially they belong to Proto-Australoids" and "linguistically to Dravidian group". The traditional economic activities of the Kharwar have been agriculture and other wage earning labour. The objective of the present study is to investigate the nutritional status of adult Kharwar tribal. This cross-sectional study was undertaken to determine the prevalence of under nutrition using body mass index (BMI) among individuals of 18 years and above. A total of 151 (75 males and 76 females) adults from the different villages of Varanasi- Mirzapur District were measured. The result revealed that prevalence of under nutrition (age and sex combined) among Kharwar was 26.5 %. The sex specific rates were 33.3 % and 19.4 % among females and males, respectively. There was a highly significant sex difference in Chronic Energy Deficiency (CED) prevalence based on BMI. Kharwar adults were experiencing serious situation, especially the women and oldest were experiencing the most serious situation with respect to their health and nutritional status.

**Keywords:** Chronic Energy Deficiency, Kharwar tribes, Nutritional Profile, Body Mass Index.

## INTRODUCTION

India has a variety of tribal populations reflecting its great ethnic diversity. They constitute about 8.2 % of the total populations, though they are scattered all over the hilly and dense forest regions of the country. Nutrition is the basics for the survival of an individual. It is not just confined to the intake of nutrients but also the utilization for proper growth and development of the body. Nutritional status grossly depends upon the feeding habits, ecology, vegetation of the area and the socioeconomic condition of the community. India in recent years has become self-sufficient from the agricultural point of view, but the problem of malnutrition still continues undoubtedly and it is still considered to be one of the crucial issues [1]. According to the Calder and Jackson [2] and Jaiswal [3] undernutrition is one of the major causes of morbidity and mortality in the developing world. Inadequate dietary intake and disease are immediate causes of malnutrition and they reinforce one another synergistically [4, 5].

Malnourishment may increase income inequality, lower social returns to educational expenditure, impede economic growth and increase unemployment [6]. Epidemiological data show that the world's populations living under low socio-economic conditions and high rates of parasitic diseases are also those that have

most of the world's malnutrition [7]. Nutrition plays a major role in human adaptation because it acts both as an independent stress (e.g. food scarcity) that may necessitate adjustment and as an important modifier of other stresses (e.g. disease severity). Good nutrition promotes the production and activities of growth hormones, which influences the metabolism of proteins, carbohydrates, fats and mineral and promotes nitrogen retention [8]. The tribals who constitute 8.2 % of the India's populations are drawing the attention of planners and administrators and are given priority in developmental measures [9]. The assessment of nutritional status is considered as a measure of health and it is necessary for planners to understand the food and nutrition situation among tribal populations for improvement of these vulnerable groups. There is very little information available regarding the diet and nutritional status of Kharwar tribe. Hence to fill up some of this knowledge gap, the present study was carried out to assess the health and nutritional status of the Kharwar tribe. This information will be useful in the formulation of suitable development programmes like "food for work" or other development programmes for the nutritional improvement of this tribe. Therefore the objective of the present study was to evaluate the nutritional status of the adult Kharwar tribe of Varanasi-Mirzapur District of Uttar Pradesh, India.

## MATERIALS AND METHODS

"The present study is cross-sectional and was conducted among 151 adult Kharwar tribe of Varanasi-

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Mirzapur District of Uttar Pradesh". The Kharwar is one of the Adivasi groups of Uttar Pradesh and Bihar. "They are contemporary of Mundari speaking Indian tribes". "Racially they belong to Proto-Australoids" and "linguistically to Dravidian group". The traditional economic activities of the Kharwar have been agriculture and other wage earning labour. The Kharwar villages are found in comparatively plain areas. They erect their houses with mud, wood, bamboo and tiles. The traditional economic activities of the Kharwar have been agriculture and other wage earning labour.

"A total of 75 males and 76 females were selected by stratified randomly sampling method and were measured". Adults were grouped into three age groups to observe the age-trend in their anthropometric measures as well the age group wise nutritional status.

**Table 1: Distribution of Kharwar Tribes According to Age Group**

Age Group (Yrs)	Kharwar Tribes (151)s			
	No.	Male	Female	%
18-39	87	43	44	57.62
40-59	44	22	22	29.12
≥60	20	10	10	13.26

In the present study Kharwar of age from 18 to 80 years (both males and females) were included. Data were collected during December-January, 2011-12. No pregnant or lactating women were found in the present sample. Individuals aged 18-39 years composed 57.6% of the sample, followed by 29.12% in the 40-59 year old age group and 13.26% in the 60 years and older age group

Several anthropometric measurements like Weight (Wt), height (Ht), circumferences and skinfolds were measured using the standard methodology of [24] and BMI was computed using standard equation. Technical errors of measurements (TEM) were within acceptable limits. "Concerning ethics, both written and oral consent were obtained from each individual before commencement of the study". Nutritional status was evaluated using internationally accepted BMI guidelines [10, 11].

BMI = (Weight in Kilograms / (Height in Meters x Height in Meters))

**Table 2: Internationally Accepted Body Mass Index Guidelines [10]**

CED BMI= <18.5	CED III= < 16.0 kg/m <sup>2</sup>
	CED II= 16.0-16.9 kg/m <sup>2</sup>
	CED I= 17.0- 18.4 kg/m <sup>2</sup>
<b>Normal: BMI = 18.5-24.9 kg/m<sup>2</sup></b>	
<b>Overweight: BMI ≥ 25.0 kg/m<sup>2</sup></b>	

Most of the researcher followed the World Health Organization's classification [10, 12] of the public health problem of low BMI, based on adult populations worldwide. This classification categorizes prevalence according to percentage of a population with BMI < 18.5.

**Table 3: Classification Categorizes Prevalence According to Percentage of a Population with BMI < 18.5**

Low (5-9%):	Warning sign, monitoring required.
Medium (10-19%):	poor situation
High (20-39%):	serious situation
Very high (≥ 40%):	critical situation

Student's t-tests were performed to test for sex differences in mean values. Age-group difference was performed by ANOVA (F test). Sex differences in CED were determined by chi-square (χ<sup>2</sup>) test. All statistical analyses were undertaken using the Statistical Package (Statistical Package for the Social Sciences (SPSS- 16)). Statistical significance was set at p < 0.05.

**RESULTS**

The data was analysed and presented in the following pages. An anthropometric and nutritional analysis of the Kharwar tribes was highlighted in this section of the paper. The data thus collected shows the age group and sex wise distribution of anthropometric measurements based on Mean, t-test with significance (p) and also prevalence of CED based on BMI.

The above two Table (4 and 5) explains, the Mean, standard deviation, t-test, ANOVA (F) and significance (p), of anthropometric measurements of adult Kharwar tribes based on Age group and, sex like weight (kg), height (cm), mid-upper arm circumference (cm), waist circumference (cm), hip circumference (cm), biceps skinfold (mm), triceps skinfold (mm), sub-scapular skinfold (mm) and BMI (kg/m<sup>2</sup>) of Kharwar tribals.

**Table 4: Sex Wise Distribution of Anthropometric Measurements of Adult Kharwar Tribes Based on Mean (SD) And T-Test With Significance (p).**

Variables	Sex		t-test	p
	Male	Female		
	Mean± SD	Mean± SD		
Age	38.90±16.80	37.90 ±16.678	0.38	0.687
Weight	48.98± 6.53	45.00 ±7.55	3.63	0.000
Height	152.81± 6.51	148.82 ± 4.46	6.03	0.000
Mid Upper Arm Circum.	24.85 ± 2.53	24.42± 5.67	1.93	0.057
Waist Circumference	71.20 ± 5.46	70.99 ± 6.10	0.23	0.724
Hip Circumference	80.68 ± 4.61	80.83 ± 6.41	-0.07	0.838
Biceps skinfold	3.90 ± .079	3.43± 0.45	1.28	0.188
Triceps skinfold	4.96 ± 1.01	4.53 ± 1.25	-0.01	0.986
Sub-scapular skinfold	5.95 ± 1.21	5.42 ± 1.55	0.18	0.873
BMI	21.50 ± 2.81	20.49 ± 3.40	0.58	0.561

Significant ( $p < 0.001$ ) sex differences in mean Weight ( $t = 3.63$ ,  $p < 0.001$ ) and Height ( $t = 6.03$ ,  $p < 0.001$ ) were observed.

Increasing trend (Table 5) was observed in height, waist circumference, hip circumference and biceps skinfold with increasing age among females; marked decline in height, mid upper arm circumference, waist circumference and hip circumference was observed among males, and triceps skinfold and sub-scapular skinfold among females with increasing age-group; marked increase then decrease in mean values of weight, biceps skinfold, triceps skinfold, sub-scapular skinfold and BMI among males. Whereas, weight, mid upper arm circumference and BMI among females with increasing age-group were observed.

Significant sex difference were found in mean weight and mean height (18-39 and 40-59 years age group), and in mean mid upper arm circumference (18-39 years age group). Results of ANOVA revealed the significant ( $p < 0.05$ ) differences in triceps skinfold, sub-scapular skinfold and BMI.

The above table reflects the age group and sex wise distribution of prevalence of CED (%) based on BMI ( $\text{kg}/\text{m}^2$ ) among adult Kharwar tribes. Result revealed that prevalence of undernutrition (CED grades age and sex combined) among Kharwar was 27.05 %.

The sex specific rates were 32.5% among females and 21.6 %, among males. It was also observed that

females (18-39 years) had the highest prevalence of CED (36.6 %) followed by elderly individuals (33.5 %) i.e.  $\geq 60$  years age group, females (40-59 years), males (18-39 years and 40-59), respectively. There was a highly significant sex difference in CED prevalence based on BMI ( $\chi^2 = 10.34$ ,  $df = 4$ ,  $p = 0.05$ ).

## DISCUSSION

India has large and diverse tribal populations. Scheduled Tribe people constitute about less than 9% of the total populations in India, with varying proportions in different States. They live in unique physical, socio-economic and cultural environment, isolated from general populations. In view of their habitat and food habits, they form a distinct group compared to other populations. Their food intake is influenced by vagaries of nature, with large seasonal variations, depending upon availability of agricultural and forest produce. Several studies have documented a close relationship between the tribal ecosystem and their health and nutritional status [13, 14, 3]. Inadequate health care facilities and ecological degradation further aggravate the situation. There are wide variations among the groups in nutritional status and access to utilization of nutrition and health services [15].

Comparisons of mean BMI of the present study with other tribal populations of North India (Table 7) as their physical, socio-economic and cultural environment were very much similar. From this table it is clear that

**Table 5: Age Group and Sex Wise Distribution of Anthropometric Measurements of Adult Kharwar Tribes Based on Mean (SD), T-Test and Anova (F) with Significance (p)**

Variables	Sex & t-test	Age-group (Years)			ANOVA (F)	Significance (p)
		Mean (SD)				
		18-39	40-59	≥ 60		
Weight	Male	49.28±5.35	51.24±6.73	44.78±6.78	3.28	0.04
	Female	44.62 ± 6.58	45.49±8.64	45.45±1.72	0.15	0.87
	t-test	3.56*** -	2.25*	0.23	-	-
Height	Male	155.44 ± 5.49	153.44±6.45	152.42±5.55	1.16	0.32
	Female	148.43 ± 6.22	148.62±8.69	149.59±2.29	0.14	0.87
	t-test	5.35***	2.60**	1.13		
Mid Upper Arm Circumference	Male	25.59 ±2.13	25.34±3.13	25.11±3.03	0.54	0.58
	Female	24.28± 3.36	25.43±4.36	25.20±2.45	0.75	0.47
	t-test	2.57**	0.10	-0.07		
Waist Circumference	Male	72.39 ± 5.03	72.24±5.77	68.16±6.67	2.69	0.07
	Female	71.13 ± 6.28	72.13±6.44	74.20±5.34	0.99	0.37
	t-test	1.29	0.07	0.94		
Hip Circumference	Male	82.38 ± 4.23	81.33±5.12	79.37±4.82	1.64	0.20
	Female	80.76±4.85	82.38±5.83	84.38±5.43	1.79	0.17
	t-test	1.54	-0.74	-1.89		
Biceps skinfold	Male	3.35 ± 0.85	3.71± 0.40	2.99± 0.42	2.89	0.06
	Female	3.23 ± 0.70	3.26±0.84	3.38± 0.87	0.16	0.85
	t-test	0.79	1.93	-1.11		
Triceps skinfold	Male	4.25± 1.22	4.75 ± 0.72	3.71±0.42	4.46	0.01
	Female	4.37± 1.13	4.36 ± 1.55	4.15± 0.76	0.12	0.88
	t-test	-0.51	1.15	-1.54		
Sub-scapular skinfold	Male	5.43± 1.33	5.92 ± 1.24	4.58 ± 0.78	4.28	0.02
	Female	5.46± 1.41	5.45± 1.90	5.27 ± 1.85	0.06	0.94
	t-test	-0.08	1.03	-1.03		
BMI	Male	20.38± 2.32	21.75±3.84	18.99±2.96	3.57	0.03
	Female	20.25± 3.34	20.48±3.41	20.28±3.55	0.04	0.96
	t-test	0.23	1.25	-0.82		

the highest mean BMI was observed in Santal (Birbhum), Birhors and Kharwar (present study) followed by Santal, Dhimal, Lodha; Oraon etc. [165]. However, the minimum mean BMI was observed among the Santal males of North India.

Similarly, Kharwar (present study) females have the highest mean BMI value followed by Birhors, Oraon; Santal, Lodha, Dhimal and Bhumij etc and the least was observed among Munda females [17, 18, 19].

In general, prevalence of CED among the tribals of North India shows that the overall CED was highest among the Mundas of Kolkata followed by Bhumij, Santal, Kora Mudi and Bhumij etc... [20] and the

Kharwar (27.05 %) (Present study) had the least prevalence of CED.

According to National Family Health Statistics- 3 report [21]; the prevalence of undernutrition in India is 33.0% among males and 28.1% among females. In urban areas, these figures were 19.8% and 17.5%, respectively. In rural areas these were 38.8% and 33.1%, respectively. However, the situation is much worse in North India especially Uttar Pradesh and Bihar with corresponding prevalence of 37.7% and 31.6%, respectively. Among urban males and females they were 19.9% and 15.5%, respectively. The corresponding rural figures were 44.9% (males) and 38.0% (females). Therefore, the use of BMI, WHO

**Table 6: Age Group and Sex Wise Distribution of Prevalence of Chronic Energy Deficiency (CED) (%) Based on BMI (Kg/M<sup>2</sup>) Among Adult Kharwar Tribes**

Nutritional Status	Sex					
	Male (N=75)			Female(N=76)		
	18-39	40-59	≥ 60	18-39	40- 59	≥ 60
	(n= 43)	(n=22)	(n= 10)	(n= 44)	(n= 22)	(n= 10)
CED III	1.5	4.7	11.2	4.6	9.2	11.2
CED II	0.5	0.5	0.5	13.7	4.6	0.5
CED I	19.5	4.6	21.8	18.3	13.7	21.8
Overall CED	21.5	9.8	33.5	36.6	27.5	33.5
Normal	76.0	75.8	65.9	54.2	63.3	55.3
Overweight	2.5	14.4	0.6	9.2	9.2	11.2

All figures presented are percentages.  
Sex difference: chi-square =10.34, df = 4, p < 0.05.

**Table 7: Sex Wise and Overall Comparison of Mean BMI (Kg/M<sup>2</sup>) and Prevalence of CED of the Kharwar Tribe with Some of The Tribal Populations of North India**

Community	Male	Female	Overall Mean	CED (%)	Reference
Bhumij	18.7	18.4	18.6	53.7	Ghosh, 2007
Dhimal	19.5	19.1	19.3	36.7	Banik <i>et al</i> , 2007
Kora Mudi	18.7	18.3	18.5	52.2	Bose <i>et al</i> , 2006
Kora Mudi	18.6	18.3	18.5	53.5	Bisai <i>et al</i> , 2008
Lodha	19.5	19.3	19.4	43.0	Mondal, 2007
Munda	18.7	17.7	18.2	58.5	Ghosh & Bharati, 2006
Oraon	18.8	19.7	19.3	39.4	Mittal & Sivastava, 2006
Santal	20.0	19.3	19.7	31.6	Bose <i>et al</i> , 2006
Santal	18.5	18.7	18.6	53.7	Ghosh & Malik, 2007
Santal	20.5	19.5	20.0	34.5	Mukhopadhyay, 2009
Lodha	19.5	--	--	45.2	Bose <i>et al</i> , 2008
Bhumij	18.7	--	--	48.4	Bose <i>et al</i> , 2008
Santal	19.5	18.1	18.8	46.7	Das & Bose, 2010
Birhor	20.5	20.2	20.3	26.5	Das <i>et al</i> , 2013
Kharwar	21.6	20.5	21.05	27.05	Present study

based cut-off points for the evaluation of CED are valid for use among tribal populations of India as the result of the present study also, shows the similar response related to prevalence of CED [19].

The primary importance, from the public health perspective is the need for immediate nutritional intervention programs to be implemented among Kharwar tribes of Varanasi–Mirzapur district of Uttar Pradesh and all other tribal groups experiencing nutritional stress. The Government should play an active role in reducing the rates of undernutrition among tribal people. It is imperative that the

recommendations should include not only adequate dietary intake but also various ways in which they can enhance their socio-economic status through improved education and employment opportunities. It has already been emphasized [22, 23, 5] that there exists variation in social and economic conditions among tribes of India. Similar studies should also be undertaken among all other tribal populations in India since they constitute a sizeable portion of India's populations.

## CONCLUSION

From our study it can be concluded that the nutritional status of Kharwar tribes was serious;

females and oldest peoples experiencing the most severe situation than the others. There is strong evidence that, in general, Kharwar tribes and other tribal populations of India were experiencing critical nutritional stress.

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## REFERENCES

- [1] Banik DS, Bose K, Bisai S, Bhattacharya M, Das S. "Chronic energy deficiency among adult Dhimals of Naxalbari, West Bengal: Comparison with other tribes of Eastern India." *Food and Nutrition Bulletin* 2007; 28: 3, 348-52.
- [2] Calder PC, Jackson AA. Undernutrition, infection and immune function. *Nutrition Research Review*. 2000;13: 3-29. <http://dx.doi.org/10.1079/095442200108728981>
- [3] Jaiswal A. *Human Genetics and Applied Biophysical Anthropology: A Comprehensive Treatment Biophysical Anthropology*, Heritage Publishers, New Delhi, India 2013; 324-370.
- [4] Jaiswal A. *Anthropo- Medical Profile of Textile Workers*, Alfa Publications, New Delhi, 2012; 35-39.
- [5] Jaiswal, A. 2013. "Health and Nutritional Status of a Primitive Tribe of Madhya Pradesh: Bhumia" *Glo J Hum Soc Sci, History Archaeology & Anthropology*, Vol: 13, Issue 1 Version 1.0, 2013, Glo J Inc. (USA), 15-19.
- [6] Bose K, Banerjee S, Bisai S, Mukhopadhyay A. Anthropometric profile and chronic energy deficiency among adult Santal tribals of Jhargram, West Bengal, India: Comparison with other tribal populations of Eastern India. *Eco Fo Nut*. 2006; 45, I-II.
- [7] Crompton DWT, Nesheim MC. Nutritional science and parasitology: A case for collaboration. *Bioscience*. 1982; 32: 677. <http://dx.doi.org/10.2307/1308819>
- [8] Bose K, Bisai S, Mondal PS, Ghosh M, Body mass index and chronic energy deficiency among adult male Lodhas and Bhumijis: A comparison with other tribal populations of West Bengal, India. *J Pub Hea*. 2008; 16: 117-121. <http://dx.doi.org/10.1007/s10389-007-0153-x>
- [9] Census of India. 2001 and 2011.
- [10] World Health Organization. *Reducing Risks Promoting Healthy Life. The World Health Report*. Geneva, 2004.
- [11] Das S, Bose K, Body Mass Index and Chronic Energy Deficiency among Adult Santals of Purulia District, West Bengal, India. *Inte. J Hum Sci*. 2010; 7: 2.
- [12] World Health Organization 1995. *Physical Status: the Use and Interpretation of Anthropometry*. Technical Report Series no. 854. Geneva: World Health Organization.
- [13] Rao HD, Rao MK, Rao RG, Nutritional status of Tribal preschool children in three ecological zones of Madhya Pradesh. *Indian Pediatrics* 1994; 31: 635-40.
- [14] Rao HD, Brahmam GNV, Rao MK, Reddy GCH, Rao P N. Nutrition profile of certain Indian Tribes. *Proceedings of a National seminar on Tribal Development options*. PK Samal, ed GB Pant. Institute of Himalayan Environment & Development, Almora, India 1996. 532-39.
- [15] Ghosh M. Nutritional status of adult Bhumij males of Kharagpur, Paschim Medinipur. Paper presented in seminar on Approaching Development in Department of Anthropology. Vidyasagar University 2007; 05.22.
- [16] Ghosh R, and Bharati P. Nutritional status of adults among Munda and Pod populations in a peri urban area of Kolkata City, India. *Asia Paci J Pub Heal*. 2006; 18 (2), 12-20. <http://dx.doi.org/10.1177/10105395060180020301>
- [17] Mondal PS. Nutritional status of adult Lodha males of Shyamraipur, Paschim Medinipur. Paper presented in seminar on Approaching Development in Department of Anthropology, Vidyasagar University, 2007; 06,
- [18] Ghosh S, Malik SL. Sex Differences in Body Size and Shape among Santhal of West Bengal *Anthropologist* 2007; 9 (2), 143-49.
- [19] Mittal PC, Srivastava S. Diet, nutritional status and food related traditions of Oraon tribes of New Mal (West Bengal), India. *Rural and Remote Health* 2006; 6 (1), 385.
- [20] Mandal H, Mukherjee S, Datta A. *India- An Illustrated Atlas of Tribal World*. Kolkata: Anthropological Survey of India 2002; 13-33.
- [21] National Family Health Survey (NFHS-3). Report on West Bengal by International Institute for Population Science (IIPS), India. Volume II, Mumbai, IIPS. Scrimshaw, N.S., Taylor, C.E., Gordon, J.E., 1968. *Interaction of Nutrition and Infection*. WHO. Geneva 2005-2006.
- [22] Mukhopadhyay A. Anthropometric characteristics and undernutrition among adult Santal tribe of Birbhum District, West Bengal, India. *Anthropological Science*. 2009; 1-4.
- [23] Topal Y.S, Samal PK. Causes for variation in social and economic conditions among tribes of Indian Central Himalaya: A comparative study. *Man in India* 2001; 81: 87-88.
- [24] Weiner, J. S., Lourie, J. A. 1981. *Human Biology: A Guide to Field Methods*. International Biological Programme, IBP No.9. Marylebone London NW.

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