



Overweight, Obesity and Socio-Economic Change among Tribal Population in Rural and Peri-Urban Population in Birbhum District, West Bengal, India

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ABSTRACT

Introduction: Non communicable diseases (NCDs) have become a major concern for global health. Cardiovascular diseases (CVDs) contribute 48 % towards the deaths due to NCDs in India. The prevalence of non-communicable diseases is increasing in tribal areas of India owing to the development and adoption of modern lifestyle.

Objectives: The study aims to find the prevalence of overweight and obesity, and its association with socio-economic change among Tribal population in rural and peri-urban areas of Birbhum district, West Bengal.

Materials and Methods: A cross-sectional study was conducted among all men and women 18 years and above in 12 randomly selected villages in 2 blocks of Birbhum district, West Bengal. Minimum sample size calculated was 817. Data collection was done using a pretested questionnaire. In addition various anthropometric measurements were taken.

Results: The study observed that among tribal population, 53.73% are underweight, 7.59% overweight and 5.26 % obese. The age group 18-44 has the highest percentage of underweight, overweight is higher for the age group 45-60 and obese is higher for the age group 31-44. Hence in the study the socio-demographic factors are associated with nutritional level among Scheduled tribe population. The wealth quantile shows the impact on nutritional health among Scheduled tribe population.

Conclusion: Scheduled Tribe people are one of the most vulnerable groups in India. As a result, this population is at high risk in practically every health parameter. With urbanization and economic development, a nutritional transition characterized by improved dietary habits, improvement in socio-economic status and increasingly sedentary lifestyle has been observed which has contributed to the increasing prevalence of overweight and obesity among the tribal population in Birbhum district in rural and peri-urban areas.

Key Words: Undernutrition, overweight, obese

Introduction

Obesity has emerged as a potential global public health threat, and its prevalence has been increasing since the beginning of the 21st century. As of 2016, more than 2 billion adults, representing 44 percent of the global adult population, were overweight or obese, with over 70 percent of them residing in low-income or middle-income countries (LMICs). [Schneider P et al, 2020]. According to the World Health Organization (WHO), obesity is one of the most common, yet among the most neglected, public health problems in both developed and developing countries (WHO, 2000). Overweight and obesity are defined as the abnormal or excessive fat accumulation that may impair health (WHO, 2017). Obesity is a complex, multifactorial disease that develops from the interaction between genotype and the environment. Our understanding of how and why obesity occurs is incomplete; however, it involves the integration of social, behavioral, cultural, physiological, metabolic, and genetic factors (National Research Council, 1989). Obesity has very high costs for societies, as the resulting disabilities and diseases create huge burdens for families and health systems. The experience of developed countries clearly demonstrated that the cost of morbidity and mortality associated with increasing obesity and related non-communicable diseases would be overwhelming for them (WHO/IASO/IOTF, 2000)

It is generally believed that the tribal group may not have a significant burden of non-communicable diseases due to their simple lifestyle, healthy dietary habits, heavy physical work, and a cleaner environment (Rizwan SA et al 2014). The Indian National Family and Health Survey 2005–06 indicated a 47–48% prevalence of undernutrition among the tribes (Arnold F et al., 2009).

A considerably large burden of this socio-economic disadvantage is reported among Indian tribal populations. Undernutrition has been a major health concern among India tribal populations (Gopalan C et al, 1992, Basu SK et al, 1990, Census 2001). Major tribal-dominated states, such as Maharashtra, West Bengal, Andhra Pradesh, Gujarat, and Madhya Pradesh have experienced a high rate of urbanization, with more than 20–30% increase during 2001–2011 (census year) (Census 2011).

While BMI is often used as an indicator for adiposity, it is often criticized because it does not differentiate between lean mass and fat. In 1997, the WHO acknowledged the significance of abdominal obesity and proposed using indicators such as waist circumference to identify populations at a higher risk of abdominal obesity (WHO, 2008). It has been recently suggested that there is an urgent need to evaluate the nutritional status of various tribes in India. In this study we are trying to find out the nutritional status of tribal adult population in Birbhum district, West Bengal.

Materials and Methods

A cross sectional study was conducted among tribal population aged 18 years and above. The study considers those people who have been residing there at least a long decade. Data were collected from tribal people belonged to the Santal community. Age of the participants was confirmed on the basis of birth certificate. For those who did not have a birth certificate, the school certificate, Voter ID card or Aadhaar card was carefully considered as a secondary source.

The study was conducted in two blocks (Suri-1 and Rajnagar) of Birbhum district in West Bengal during June 2023. Prior permission and ethical approval were obtained from local community leaders as well as relevant authorities before the commencement of the study. Eligible participants were evaluated using a structured questionnaire, waist, hip, and weight and height measurements. The questionnaire included demographic information such as sex, level of education, employment status, use of fuel and sanitation facility used and physical activity. Body mass index (BMI) was calculated as weight (kg) divided by the square of height (m²). Using this, the patients were categorized as underweight (<18.5 kg/m²), normal or lean BMI (18.5–22.9 kg/m²), overweight (23.0–24.9 kg/m²) and obese (≥25 kg/m²) based on the revised consensus guidelines for India (ICMR). For simple logistic regression, undernutrition or overweight or obesity class was coded into “1” and other for “0” in the study.

Waist hip ratio was calculated by taking the ratio of waist and hip in the analysis. The WHO states that [abdominal obesity](#) is defined as a waist–hip ratio above 0.90 for males and above 0.85 for females. Risk factor was regrouped in binary (0 and 1) as it was treated as the dependent variable. By univariate logistic regression, the Odds Ratio was calculated to identify the risk factors. STATA version 12 was used. A value of P < 0.05 was considered statistically significant.

Explanatory Variables

In the study, we categorized education levels into six variables: illiterate, read and write primary (1 to 4 years), middle school (5 to 8 years), Secondary and Higher Secondary school (9 to 12 years), Graduation and more (> 12 years) and don't know those who denied replying.

Houses made from mud, thatch, or other low-quality materials are called kuccha houses, houses that use partly low-quality and partly high quality materials are called semi-pukka houses, and houses made with high quality materials throughout, including the floor, roof, and exterior walls, are called pukka houses.

Again, in the study, sanitary latrine has been divided into present and in use, present and not in use and absent. Open defecation is identified as absent.

Type of fuel used has been divided into firewood, biogas, LPG, electricity and others. Among category others Gul/coal, dung cake were included.

In physical activity, sedentary activity includes landlord, service, business, housewife, postman, teacher and white collar workers. Moderate activity includes labourer, other labourer, cultivator, artisan, mason, servant maid, tailor, rickshaw –puller, etc. Heavy activity includes blacksmith, stone cutter, railway gagman, wood cutter, mine worker etc. Sedentary activity was asked during the physical activity questionnaire and was analyzed from the question “How much time do you usually spend sitting on a typical day?”, which may include time spent sitting at a desk, traveling in a car or bus, reading, playing cards, watching television or using a computer.

In the formation of quintile, five groups have been created such as poor, poor middle, upper middle and upper. Quintile was calculated on the basis of type of house, type of fuel materials used for cooking, sanitation and household assets through principal components analysis (PCA) guidelines.

Results

The prevalence of high-risk WC and BMI ≥23 are presented across survey cycles and sociodemographic characteristics in **Table 1**. The women tribal populations are comparatively at high risk comparatively to men population in study area. Both men and women population are at high risk with no education. Body mass index (≥23) is higher for men population with education 9th standard and above. High risk waist-hip ratio and overweight and obese are more prevalent among tribal population those who belong to upper middle and upper wealth quintile.

One of the most critical [health indicators](#) for determining nutritional status is body mass index (BMI). **Table- 2** displays the various background variables and the BMI among Indian tribal population in the age group. The age group 61 and above has the highest percentage of underweight, whereas the age group 45-60 has the highest prevalence of overweight and 31-44 has the highest percentage of obesity.

Underweight is most prevalent among the tribal population with no education (37.41%) and lowest among the tribal population. Contrarily, overweight and obesity are lowest among the tribal women with no education (6.35% and 4.47%, respectively), and highest among the population with higher education (9 to 12th standard) 11.19% and 5.97%, respectively.

Underweight is mostly prevalent among the tribal population those who use no toilet facility (33.51%) and overweight and obesity are comparatively lower for the population who use open defecation in the study area.

Underweight, overweight and obese are mostly prevalent among the population who are involved in sedentary activities and lower who are involved in moderate and heavy activities.

The poor and poorer tribal populations are found underweight (73.23%) than the tribal population in any other wealth quintile, and overweight and obesity are more prevalent among the tribal population in the upper middle and upper wealth quintile (50.00% and 41.66%, respectively) than the population belonging to any other wealth quintile.

Table-3 shows unadjusted odd ratio in the study for undernutrition type of house (kuccha), moderate physical activity, middle and upper middle were statistically significant. Undernutrition shows odds for tribal population who had kuccha house (OR= 2.06, 95% CI: 1.34 - 3.15), education 9-12th standard (OR =.76, 95% CI: .50 - 1.15), moderate physical activity (OR= .52, 95% CI: .38 - .709), middle quintile (OR= .52, 95% CI: .34 - .79) and upper middle (OR= .25, 95% CI= .11 - .58)

Similarly unadjusted odd ratio in the study for overweight type of house (semi pucca & kuccha), upper middle quintile and upper were statistically significant. Overweight shows odds for tribal population who had semipucca house (OR = .42, 95% CI: .24 - .74), kuccha house (OR =.13, 95% CI: .05 - .323), upper middle quintile (OR= 4.2, 95% CI: 1.7 - 10.35), upper quintile (OR= 10.58, 95% CI: 3.2 - 4.20).

Again, unadjusted odd ratio in the study for obese age group 31-44, college education and upper quintile were statistically significant. Obese shows odds for tribal population who had age group (31-44 years) [OR= 2.15, 95% CI: 1.03 - 4.49], college education (OR= 5.34, 95% CI: 1.6 - 17.53) and upper quintile (OR= 10, 95% CI= 3.10 - 32.16).

Table-4 shows unadjusted odd ratio in the study for risk factors, sex, age group, sanitary latrine not in use were statistically significant. Risk factor shows odds for tribal population who had sex female (OR= 2.85, 95% CI: 2.138 - 3.803), age group (31-44) (OR= 1.82, 95% CI: 1.282 - 2.575), age group (45-60) (OR= 2.29, 95% CI: 1.596 - 3.298), age group (61 & above) (OR= 2.26, 95% CI: 1.296 - 3.943), sanitary latrine present but not in use (OR= 0.29, 95% CI: .1682 - .5098).

Discussion

The results showed significant socioeconomic differences in BMI and WHR. Lifestyle factors contributed independently to the variation, but could not alone explain the socioeconomic differences. Obesity is a result of energy imbalance in the body, where the energy intake from food exceeds the energy expenditure through physical activity. A recent study on the pattern of physical activity in India revealed that a significant proportion of the Indian population (57%) is physically inactive or only mildly active, and females are less physically active than males (Podder V et al, 2020). Policymakers and healthcare providers must prioritize initiatives that promote physical activity and encourage individuals to lead active lifestyles. According to some studies, some key factors contributing to malnutrition among the scheduled tribes are low scores on wealth index, low access to health services and lack of education (Van De Poel E, 2009, Mittal P.C, 2006).

Reduced physical activity owing to organized work and mechanized transport, particularly for the wealthier sections of the society, has led to the adoption of a sedentary lifestyle. Consumption of fat-rich diet is one of the factors that explain the higher prevalence of abdominal obesity in the wealthier sections. As per a research study, higher-income groups consumed a diet where 32% of energy was derived from fat, while for the lower-income groups, only 17% of energy was derived from fat [Shetty P.S. 2002].

The present study provides crucial insights regarding the tribal health in India. An alarming -fold increase in overweight and/or obesity (12.85%) was observed, compared to the 2–3% increase reported previously (ICMR, 2004) with an adult undernutrition prevalence as high as 33.41% which requires immediate attention.

In the present study there was a powerful inverse relationship between level of education and obesity in women. These correlations were highest in illiterate or low literacy women and lowest in ones who were 5th to 12th standards in education. People with higher education levels are more likely to find underweight people. Because the educated have an awareness of health and nutrition, overweight and obesity are sometimes found even among the educated. However, some paradoxes also found that those who wanted to lose weight reported lower food intake than those with a lower BMI (N.R. Rout, 2009).

One of the most striking characteristics of our study was the low level of physical activity reported by most of the participants. In this region tribal women do not have much access to sporting activities, and physical activity is restricted to housework. Among women who are at a greater risk of complications resulting from extreme waist-hip ratio, it is important to increase awareness to maintain a healthy weight; understanding the factors that are associated with higher prevalence or likelihood of both conditions are important in this context.

However, various developmental and economic activities undertaken by the state and central government agencies have allowed several tribes to lead a comparatively affluent lifestyle in varying proportions, which has made them vulnerable to various metabolic risk factors. This apparent shift is converse to the traditional wisdom regarding tribes that they do not encounter lifestyle diseases.

Research suggests that the prevalence of obesity and non-communicable diseases in India is associated with a high consumption of carbohydrates and sugar. Policies, such as India's Public Distribution System (PDS) for food, which distributes staple grains, such as wheat and rice, and sugar, at low prices may contribute to overconsumption, the 2019 [book](#) suggests, adding that an increased intake of sugar and fat products, as well as refined cereals, is linked to a rise in obesity and diabetes incidence, especially with sedentary lifestyles and abdominal obesity (belly fat).

Conclusion

The alarming trend of an increasing prevalence of overweight/obesity, undernutrition, and hypertension is observed among indigenous populations of India, emphasizing the incorporation of a specific health management policy.

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Conflict of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and publication of this article.

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Table -1: Gender wise association between Waist hip ratio and BMI and Socioeconomic and demographic characteristics in rural and peri-urban population for tribal

Background Characteristics	Women			Men		
	WHR>0.85	BMI>=23	N	WHR>0.90	BMI>=23	N
Age						
18-30	68.49	9.59	146	35.56	10.00	180
31-44	83.06	18.55	124	40.00	15.79	95
45-60	75.51	14.29	98	61.11	13.89	108
61 & above	72.97	5.41	37	62.07	13.79	29
Level of Education						
Illiterate	74.42	12.02	258	49.10	8.98	167
Read and Write	60.00	40.00	5	66.67	0.00	3
1 - 4 Standard	73.17	10.00	41	41.67	13.33	60
5 - 8 Standard	85.37	9.86	41	41.38	8.05	87
9th- 12thStandard	72.55	9.80	51	44.58	21.69	83
College	75.00	25.00	8	33.33	33.33	12
Not Applicable	100.00	0.00	1	0.00	0.00	0
Type of House						
Pucca	74.71	19.54	87	54.12	23.53	85
Semipucca	76.29	11.34	194	44.95	12.12	198
Kuccha	73.39	11.29	124	39.53	6.20	129
Sanitary Latrine						
Present and in use	81.08	17.57	74	50.63	17.72	79
Present but not in use	51.28	12.82	39	20.41	6.12	49
Absent	76.71	11.99	292	47.89	12.32	284
Type of Physical Activity						
Sedentary	71.04	14.93	221	47.78	22.22	90
Moderate	79.55	10.80	176	43.96	9.73	298
Heavy	87.50	12.50	8	50.00	12.50	24
Quintile						
Poor	70.85	11.06	199	39.00	7.50	200
Poor Middle	71.56	11.93	109	49.02	11.76	102
Middle	85.92	12.68	71	47.95	16.44	73
Upper Middle	90.48	23.81	21	51.85	25.93	27
Upper	60.00	75.00	3	90.00	60.00	10

Table-2: Nutritional Status of Tribal Population by different sociodemographic characteristics in rural and peri-urban Birbhum district, West Bengal

Indicators	Undernutrition	Normal	Overweight	Obese	Sample Size
Age					
18-30	104(31.90)	190(58.28)	19(5.83)	13(3.99)	326
31-44	52(23.74)	129(58.90)	20(9.13)	18(8.22)	219
45-60	78(37.86)	99(48.06)	19(9.22)	10(4.85)	206
61 & above	39(59.09)	21(31.82)	4(6.06)	2(3.03)	66
Level of Education					
Illiterate	159(37.41)	220(51.76)	27(6.35)	19(4.47)	425
Read and Write	2(25.00)	4(50.00)	1(12.50)	1(12.50)	8
1 - 4 Standard	29(28.71)	58(57.43)	9(8.91)	5(4.95)	101
5 - 8 Standard	38(29.69)	76(59.38)	8(6.25)	6(4.69)	128
9th- 12thStandard	42(31.34)	69(51.49)	15(11.19)	8(5.97)	134
College	2(10.00)	12(60.00)	2(10.00)	4(20.00)	20
Not Applicable	1(100.00)	0	0	0	1
Type of House					
Pucca	43(25.00)	92(53.49)	27(15.70)	10(5.81)	172
Semipucca	127(32.40)	219(55.87)	29(7.40)	17(4.34)	392
Kuccha	103(40.71)	128(50.59)	6(2.37)	16(6.32)	253
Sanitary Latrine					
Present and in use	47(30.72)	79(51.63)	15(9.80)	12(7.84)	153
Present but not in use	33(37.50)	47(53.41)	4(4.55)	4(4.55)	88
Absent	193(33.51)	313(54.34)	43(7.47)	27(4.69)	576
Type of Physical Activity					
Sedentary	131(42.12)	127(40.84)	31(9.97)	22(7.07)	311
Moderate	131(27.64)	295(62.24)	28(5.91)	20(4.22)	474
Heavy	11(34.38)	17(53.13)	3(9.38)	1(3.13)	32
Quintile					
Poor	159(39.85)	203(50.88)	18(4.51)	19(4.76)	399
Poor Middle	70(33.18)	116(54.98)	18(8.53)	7(3.32)	211
Middle	37(25.69)	86(59.72)	13(9.03)	8(5.56)	144
Upper Middle	7(14.58)	29(60.42)	8(16.67)	4(8.33)	48
Upper	0	5(33.33)	5(33.33)	5(33.33)	15

Table-3: Odd ratio showing the association between socio-demographic variables and nutritional status of scheduled population in Birbhum District

Background Characteristics	Undernutrition		Overweight		Obese	
	COR (95% CI)	p-value	COR (95% CI)	p-value	COR (95% CI)	p-value
Sex						
Male(Reference)						
Female	1.23(.92 1.65)	0.152	.95(.56 1.59)	0.846	1.18(.63 2.18)	0.598
Age						
18-30(Reference)						
31-44	0.66(0.45 .98)	0.039	1.62(.84 3.11)	0.145	2.15(1.03 4.49)	0.04
45-60	1.30(.90 1.87)	0.158	1.64(.84 3.18)	0.142	1.22(.52 2.85)	0.633
61 & above	3.08(1.7 5.3)	0.000	1.04(.34 3.17)	0.942	.75(.16 3.41)	0.712

Level of Education							
Illiterate(Reference)							
Read and Write	0.55(.11 2.7)	0.478	2.1(.24 17.7)	0.493	3.05(.35 26.08)	0.308	
1 - 4 Standard	.67 (.41 1.08)	0.102	1.4(.65 3.17)	0.362	1.11(.40 3.05)	0.835	
5 - 8 Standard	.70(.46 1.08)	0.111	.98(.43 2.21)	0.967	1.05(.41 2.68)	0.918	
9th- 12thStandard	.76(.50 1.15)	0.203	1.8(.95 3.6)	0.067	1.35(.57 3.17)	0.482	
College	.18 (.042 .811)	0.025	1.6(.36 7.42)	0.522	5.34(1.6 17.53)	0.006	
Type of House							
Pucca(Reference)							
Semipucca	1.43(.95 2.15)	0.079	.42(.24 .74)	0.003	.73(.32 1.63)	0.451	
Kuccha	2.06(1.3 3.15)	0.001	.13(.05 .323)	0.000	1.09(.48 2.47)	0.83	
Sanitary Latrine							
Present and in use(Reference)							
Present but not in use	1.35(.77 2.34)	0.282	.43(.14 1.36)	0.154	.55(.17 1.79)	0.328	
Absent	1.13(.77 1.66)	0.514	.74(.40 1.37)	0.344	.57(.28 1.16)	0.127	
Type of Physical Activity							
Sedentary(Reference)							
Moderate	.52(.38 .709)	0.000	.56(.33 .96)	0.037	.57(.31 1.07)	0.085	
Heavy	.71(.33 1.54)	0.398	.93(.26 3.24)	0.915	.42(.05 3.25)	0.409	
Quintile							
Poor(Reference)							
Poor Middle	.74(.52 1.06)	0.106	1.9(1.00 3.88)	0.049	.68(.28 1.65)	0.403	
Middle	.52(.34 .79)	0.003	2.10(1.0 4.4)	0.049	1.17(.50 2.74)	0.708	
Upper Middle	.25(.11 .58)	0.001	4.2(1.7 10.35)	0.002	1.81(.59 5.58)	0.297	
Upper			10.58(3.2 4.2)	0.000	10(3.10 32.16)	0.000	

Table-4: Odd ratio showing the association between high waist-hip-ratio and socioeconomic variables among tribal study population in rural and periurban areas of Birbhum district

Characteristics	Crude Odd Ratio	95% CI	p-value
Sex			
Male(Reference)			
Female	2.85	2.138 3.803	0.000
Age			
18-30(Reference)			
31-44	1.82	1.282 2.575	0.001
45-60	2.29	1.596 3.298	0.000
61 & above	2.26	1.296 3.943	0.004
Level of Education			
Illiterate(Reference)			
Read and Write	0.99	.2325 4.182	0.985
1 - 4 Standard	0.56	.3602 .8632	0.009
5 - 8 Standard	0.67	.4499 .9995	0.050
9th- 12thStandard	0.65	.4373 .9577	0.030
College	0.59	.2409 1.453	0.252
Type of House			
Pucca(Reference)			
Semipucca	0.89	.6150 1.279	0.522
Kuccha	0.75	.5083 1.117	0.159
Sanitary Latrine			
Present and in use(Reference)			
Present but not in use	0.29	.1682 .5098	0.000
Absent	0.96	.6644 1.381	0.818
Type of Physical Activity			

Sedentary(Reference)				
Moderate	0.83	.6234	1.114	0.219
Heavy	0.97	.4618	2.033	0.934
Quintile				
Poor(Reference)				
Poor Middle	1.25	.8891	1.744	0.202
Middle	1.53	1.034	2.263	0.033
Upper Middle	1.62	.8711	3.030	0.127
Upper	12.47	1.624	95.764	0.015