



The association between Obesity and Socio-economic Change among adult Population in Rural and Peri-urban areas of Birbhum district, West Bengal, India

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ABSTRACT :

Background

Obesity is a growing global health concern, with a rapid increase being observed in morbid obesity. Although in countries like India, which is multi-ethnic having multi socio-economic levels, is typically known for high prevalence of under nutrition; significant proportions of overweight and obese now coexist with the undernourished.

Objectives:

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

Methods

A cross-sectional study was carried out among 531 among sample population of Birbhum district, age ranging from 18 to 86 years, with 249 men and 282 women adults during January 2023 to September 2023 in 2 blocks of Birbhum district, West Bengal. Anthropometric parameters such as height, weight and waist circumference were measured. WHO cut-offs were used to define CVD risk factors. The questionnaire included demographic information such as sex, level of education, physical activity, use of fuel and sanitation facility used. The analysis software was STATA and Microsoft excels datasheet.

Results

Among 531 adult population in study area the median age and BMI was 39.82 years and 20.90 kg/m², respectively. Based on the WHO cutoffs, the overall prevalence of underweight was 27.68%, overweight was 14.12%, and obesity was 12.99%.

Conclusion

The atypical SES-obesity relationship we found reflected the on-going social economy transformation in affluent regions of Birbhum district. High-income men and poorly-educated women were at higher risk of obesity in Bengali province, thus merit intense focuses.

Key Words: Obesity, Overweight, Undernutrition, Socioeconomic

Introduction :

Worldwide obesity levels have increased unprecedentedly over the past couple of decades. Indeed, according to the World Health Organization's (WHO) recent global estimates, over one billion and nearly 300 million adults are overweight and obese respectively (WHO, 2010).

Since India's economic liberalisation in the early 1990 [Pedersen JD., 2029], economic growth has not been uniformly distributed across the country. In addition to considerable heterogeneity in culture, customs and diet, the current levels of economic development between India's states varies substantially. For instance, in Bihar, the prevalence of overweight among women increased from 3.7 to 11.7% (an absolute increase of 8%) between 1998 and 2016, whereas in Delhi, the prevalence increased from 12 to 33.5% over the same period (an absolute increase of 21.5%) [IIPS, NFHS-4 2017]

The world is experiencing a real non-communicable disease emergency, which has been precipitated by unhealthy lifestyle characteristics (that is, physical inactivity, smoking, unhealthy diet and excess body mass) and associated poor health metrics (hypertension, dyslipidemia and hyperglycemia)[Wagner KH, et al, 2012, Roura LC, et al, 2015, Matheson GO et al, 2013]. Body mass index (BMI) and waist circumference (WC) can be used to assess the overweight and obesity. A report of the WHO indicated that overweight is one of the top 10 global health risk factors around the world, even among the top 5 global health risk factors in developed countries[WHO; 2013].

In the early stages of economic development and urbanisation, overweight and obesity prevalence tends to be higher among individuals of a higher socioeconomic position (SEP), arguably due to an increased financial capability to meet and exceed nutritional requirement (Dinsa GD et al, 2012, Sobal J et al, 1989, Monteiro CA et al, 2004). On the other hand, particularly in India's most developed states, lower SEP individuals may be increasingly able to afford cheap high calorie fatty foods [Dinsa GD et al, 2012, Temple NJ, 2011].

Socio-economic factors mainly include income, education, and occupational status, and such factors, which play an important role in the development of overweight and obesity. Fred C and his colleagues concluded that while economic and social development can improve health, it can also increase obesity and expand socioeconomic status disparities in obesity (Pampel FC et al, 2012)

Materials and Methods :

A cross-sectional study was carried out in the Suri-1 and Sainthia block of the Birbhum district out of 19 blocks. Out of these, 12 villages were selected by Probability Proportional to Size (PPS) sampling technique. A total of 531 participants were included in the study. Eligible participants were evaluated using a structured questionnaire, blood pressure, waist, hip, and weight and height measurements. The questionnaire included demographic information such as sex, level of education, physical activity, use of fuel and sanitation facility used. Abdominal obesity was defined as WC \geq 90 cm in males and 80 cm in females (Misra A et al, 2009). WHR classification based on WHO is healthy when \leq 0.85 for women and \leq 0.90 for men. Hence, we categorized WHR(Waist hip ratio) as healthy WHR when calculated at \leq .85 and as risk WHR for $>$ 0.86 for women and WHR as healthy when WHR calculated at \leq .90 as healthy and as risk for $>$ 0.90 for men. Statistical significance was determined at a p-value \leq 0.05. Data entry was performed in the MS excel spreadsheet. Data analysis was carried out using STATA software.

Outcome Variable

Body mass index (BMI) was calculated as weight (kg) divided by the square of height (m²). The socio-economic, demographic and lifestyle variables were recorded using structured schedules. Height and weight were recorded and the Body Mass Index (BMI) was calculated using standard procedures and equation. The WHO (2000) cut-off points were utilized to assess the prevalence of overweight (BMI \geq 23.00-24.99 kg/m²) and obesity (BMI \geq 25.00 kg/m²).

Operational Definition

Adult: An individual whose age is \geq 18 years old

Education Level: In study, the education levels have been categorized into six stages: illiterate, read & 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 not applicable those who denied replying.

- **Type of House :** 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-pucca houses, and houses made with high quality materials throughout, including the floor, roof, and exterior walls, are called pucca house.
- **Sanitary Latrine Used:** 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:** Type of fuel used has been divided into firewood, biogas, LPG, electricity and others. Among category others Gul/coal, dung cake were included.
- **Physical Activity:** 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.
- **Wealth Index**

In the formation of wealth index five groups have been created such as poor, poor middle, middle, upper middle and upper. Wealth index 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 :

Out of 531 individuals for the study population, 249(46.89%) men and 282(53.11 %) women consented for anthropometric measurements. The mean age was 39.82 ± 15.00 and the percentage of prevalence of underweight, overweight, obesity class I, and obesity class II were 27.68%, 14.12%, 12.05%, and 0.94 %, respectively.

Baseline characteristics for the study population by BMI category are outlined in Table 1. A significant difference was seen across categories in several characteristics, including socioeconomic was significantly different by BMI category.

Our study included 531 participants, of which 46.89% (N=249) were men, and 53.11% (N=282) were women. The basic characteristics of the participants are shown in Table 1. The mean age was 39.82 ± 15.00 and the high risk waist hip ratio was 67.80 %. Crude prevalence rates of underweight, overweight, obesity 27.68%, 14.12 % and 12.99% respectively. Overweight and obesity were higher among the adult population belong to higher socio economic status. Again undernutrition was higher among the people of lower socioeconomic status in study area.

Table 2 provides a breakdown of BMI class according age and gender. The overall prevalence of underweight, normal, overweight and obese class I and Obese class II were 27.68%, 45.20%, 14.12%, 12.05% and 0.94% respectively. Women population experience overweight and obese within 45-64 years compared to men population but after 65 years and above men population experience overweight and obese I in study area. From table 2 it has shown that undernutrition among women study population within age group 18-44 was comparatively higher than men population may be due to gender discrimination or poor dietary status. The percentage of undernutrition was 30.36 % for women population while it was 12.2 % for men population for age group 35-44 years.

The prevalence of underweight, overweight and obesity for the study population by BMI category are outlined in Table 3. A significant difference was seen across categories in several characteristics, including socioeconomic status, education, physical activity, and Waist hip ratio. Physical activity female, type of fuel used, waist hip ratio and wealth index was significantly associated with BMI category.

Only 10 (1.88%) and 170 (32.02%) of the participants were engaged in heavy and moderate physical activity respectively.

Discussion :

Overweight or obesity in adult population of Birbhum district has been found to be a huge public health problem. The prevalence of overweight among adults in was found to be 14.12 %, whereas the prevalence of obesity was 12.99% thus, the combined prevalence of overweight/obesity was found to be 27.11%. It was observed that there was limited physical activity. Majority of the participants spent more time on sedentary activities. This might lead them to overweight / obese.

The positive association observed between SES and obesity might be explained by the high-SES group having access to surplus food (Block J et al, 2004), and change in dietary pattern to consumption of high-fat and sugar-containing foods (Dinsa GD et al, 2012, Monteiro CA et al, 2004, Samal S, et al 2015, Gouda J et al , 2014).

Interpretation of obesity prevalence and trends in the region is difficult due to use of various anthropometric cut-offs. For example, older studies defined overweight and obesity using global BMI cut-offs of ≥ 25 kg/m² for overweight and ≥ 30 kg/m² for obesity, whereas in recent studies ethnic-specific anthropometric cut-offs have been used. Secondly, overweight has been classified differently in the literature, with some researchers defining overweight/obesity using one value. For example, in our study area overweight is considered as a BMI of 23 kg/m² and above, whereas in a Bangladeshi study [Khan MMH et al, 2009] overweight was classified using the traditional range (25.0-29.9 kg/m²)

Recent economic development has improved the availability and accessibility to foods, which has occurred simultaneously with an increased quality of life in many countries. Advances in both technical and agricultural sectors have helped to reduce under-nutrition; however, the increased availability of energy-dense foods may lead to weight gain and subsequently obesity [Jayawardena R et al, 2013].

The result that SPF(Semi diet food)consumption is associated with an increased prevalence of obesity especially among lower-middle SES group calls for interventions that increase access to and affordability of healthy diets. Policy instruments such as diversifying the public distribution system (PDS) are important to improve accessibility and affordability of healthy diets.

Nowadays, only a small proportion of the population reaches such an amount of daily physical activity, which must reinforce individualized strategies. It is important to note that breaking apart sedentary times and having little bouts of light physical activity is the beginning of human mobility for our tertiary physically inactive and sedentary bodies, whose genes were programmed 40,000 years ago to walk not only 30 min a day (2.5 km) but 20 km per day(Cordain L at al 1998). An increase in the activity level of obese subjects is limited by the ability to perform exercise of higher intensity. Training programs obese subjects can cope with are until now not rewarded by weight loss. A possible loss in fat mass is compensated by a gain in fat-free mass.

Conclusion :

Risk factors identified by our study may be divided into two categories. One category is individual-level risk factors that may be targeted by behaviour changing programming. Such factors included physical activity, television, motorbike, four wheeler usage and waist-hip ratio. The second category comprises society-level risk factors such as sanitation facility used, type of house, type of fuel used and wealth index. These risk factors must be addressed on a macro- level through social welfare policy, public infrastructure and development programs. As India continues to develop, modernize, and urbanize, there needs to be a strong education program to ensure that populations are aware of the dangers of overweight, obesity, and related noncommunicable diseases.

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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: Factors associated with BMI, underweight, overweight and obesity among adult study population in rural and peri-urban areas of Birbhun district, West Bengal

Characteristic	Underweight (BMI < 18.5 kg/m ² , n = 147)	Normal (n = 240)	Overweight (BMI ≥ 23.0 kg/m ² and < 25 kg/m ² , n = 75)	Obesity class I (BMI ≥ 25 kg/m ² and < 30 kg/m ² , n = 64)	Obesity class II (BMI ≥ 30 kg/m ² , n = 5)	p-value for trend
<i>Descriptive Characteristics</i>						
Age	37.94±14.62	39.57±14.81	42.71±15.56	41.03±15.61	48.2±13.64	0.023
Men (%)	40.14	47.08	52.00	54.69	60.00	0.00
Women (%)	59.86	52.92	48.00	45.31	40.00	0.00
Waist to hip ratio (Mean±SD)	0.87±.075	0.91±.062	0.94±.070	0.95±.060	0.99 ± .021	0.00
Hypertension (%)	7.48	9.17	17.33	10.94	20.00	0.00
<i>Socioeconomic Characteristics</i>						
Television	64.63	64.58	84.00	79.69	80.00	0.00
Freeze (%)	14.97	23.75	46.67	45.31	80.00	0.00
Motorbike (%)	44.22	46.67	73.33	64.06	100.00	0.00
Four-wheeler (%)	2.04	2.92	4.00	10.94	100.00	0.01
Cellphone	82.99	88.75	92.00	93.75	100.00	0.01
Internet	69.39	79.58	88.00	78.13	80.00	0.03
Pucca Housing (%)	53.06	51.67	66.67	67.19	80.00	0.01
Sanitary Latrine in use (%)	70.07	72.5	84.00	79.69	100.00	0.04
Wealth Index(M±SD)	2.92±1.26	3.02±1.39	3.87±1.29	3.59±1.35	4.6 ±0.89	0.00

Values are expressed as mean ± standard deviation or percentages

Table-2: Prevalence (%) of underweight, normal weight, overweight, and obesity according to age and sex

	Men (107)	Women (126)
18-34 Years		
BMI <18.50	29(27.10)	46(36.51)
BMI 18.50 -22.99	44(41.12)	60(47.62)
BMI 23 - 24.99	15(14.02)	10(7.94)
BMI 25-29.99	18(16.82)	10(7.94)
BMI ≥ 30	1(0.93)	0
35-44 Years		
BMI <18.50	5(12.2)	17(30.36)
BMI 18.50 -22.99	19(46.34)	29(51.79)
BMI 23 - 24.99	12(29.27)	6(10.71)
BMI 25-29.99	4(9.76)	4(7.14)
BMI ≥ 30	1(2.44)	0
45-54 Years		
BMI <18.50	11(19.64)	14(28.00)
BMI 18.50 -22.99	34(60.71)	18(36.00)

BMI 23 - 24.99	4(7.14)	8(16.00)
BMI 25-29.99	6(10.71)	9(18.00)
BMI>= 30	1(1.79)	1(2.00)
55-64 Years	Men(34)	Women(31)
BMI <18.50	11(32.35)	8(25.81)
BMI 18.50 -22.99	12(35.29)	12(38.71)
BMI 23 - 24.99	7(20.59)	7(22.58)
BMI 25-29.99	4(11.76)	4(12.90)
BMI>= 30	0	0
>=65 Years	Men(11)	Women(19)
BMI <18.50	3(27.27)	3(15.79)
BMI 18.50 -22.99	4(36.36)	8(42.11)
BMI 23 - 24.99	1(9.09)	5(26.32)
BMI 25-29.99	3(27.27)	2(10.53)
BMI>= 30	0	1(5.26)

N= 531, Men= 249 & Women= 282

Table-3: The prevalence of overweight and obesity among males and females by sociodemographic factors.

Variable	Male				*p-value	Female				*p-Value
	Undernutrition(59)	Normal(113)	Overweight(39)	Obese(38)		Undernutrition(88)	Normal(127)	Overweight(36)	Obese(31)	
Education Level										
Illiterate	19(32.20)	34(30.09)	6(15.38)	9(23.68)	0.036	28(31.82)	45(35.43)	6(16.67)	11(35.48)	0.574
Read & Write	0	0	0	0		1(1.14)	1(0.79)	0	1(3.23)	
1 - 4 Standard	11(18.64)	12(10.62)	7(17.95)	5(13.16)		11(12.50)	19(14.96)	8(22.22)	3(9.68)	
5 - 8 Standard	15(25.42)	30(26.55)	4(10.26)	9(23.68)		21(23.86)	24(18.90)	8(22.22)	4(12.90)	
9th- 12th Standard	12(20.34)	24(21.24)	18(46.15)	11(28.95)		22(25.00)	24(18.90)	11(30.56)	8(25.81)	
College	2(3.39)	13(11.50)	4(10.26)	4(10.53)		4(4.55)	14(11.02)	3(8.33)	4(12.90)	
Not Applicable	0	0	0	0		1(1.14)	0	0	0	
Physical Activity										
Sedentary	36(61.02)	68(60.18)	26(66.67)	28(73.68)	0.157	54(61.36)	86(67.72)	25(69.44)	28(90.32)	0.009
Moderate	23(38.98)	42(37.17)	13(33.33)	10(26.32)		32(36.36)	37(29.13)	10(27.78)	3(9.68)	
Heavy	0	3(2.65)	0	0		2(2.27)	4(3.15)	1(2.78)	0	
Type of House										
Pucca	31(52.54)	58(51.33)	29(74.36)	26(68.42)	0.011	47(53.41)	66(51.97)	21(58.33)	21(67.74)	0.308
Semipucca	18(30.51)	32(28.32)	7(17.95)	10(26.32)		26(29.55)	38(29.92)	10(27.78)	5(16.13)	

Kuchha	10(16.95)	23(20.35)	3(7.69)	2(5.26)		15(17.05)	23(18.11)	5(13.89)	5(16.13)	
Type of Fuel Used										
Firewood	32(54.24)	53(46.90)	10(25.64)	15(39.47)	0.187	54(61.36)	63(49.61)	11(30.56)	11(35.48)	0.004
Kerosene	1(1.69)	0	1(2.54)	0		1(1.14)	0	0	0	
LPG	13(22.03)	38(33.63)	24(61.54)	17(44.74)		21(23.86)	35(27.56)	19(52.78)	13(41.94)	
Electricity	1(1.69)	1(0.88)	1(2.56)	1(2.63)		1(1.14)	4(3.15)	1(2.78)	2(6.45)	
Others	12(20.34)	21(18.58)	3(7.69)	5(13.16)		11(12.50)	25(19.69)	5(13.89)	5(16.13)	
Sanitary Latrine										
Present and in use	39(66.10)	85(75.22)	34(87.18)	33(86.84)	0.009	64(72.73)	89(70.08)	29(80.56)	23(74.19)	0.817
Present but not in use	4(6.78)	2(1.77)	0	1(2.63)		6(20.45)	3(2.36)	0	1(3.23)	
Absent	16(27.12)	26(23.01)	5(12.82)	4(10.53)		18(20.45)	35(27.56)	7(19.44)	7(22.58)	
Waist -Hip Ratio										
Low Risk	30(50.85)	35(30.97)	4(10.26)	2(5.26)	0.000	54(61.36)	39(30.71)	5(13.89)	2(6.45)	0.000
High Risk	29(49.15)	78(69.03)	35(89.74)	36(94.74)		34(38.64)	88(69.29)	31(86.11)	29(93.55)	
Wealth Index										
Poor	12(20.34)	21(18.58)	2(5.13)	3(7.89)	0.000	15(17.05)	23(18.11)	3(8.33)	2(6.45)	0.002
Poor Middle	7(11.86)	19(16.81)	4(10.26)	4(10.53)		22(25.00)	32(25.20)	5(13.89)	8(25.81)	
Middle	14(23.73)	22(19.47)	3(7.69)	7(18.42)		18(20.45)	28(22.05)	7(19.44)	4(12.90)	
Upper Middle	21(35.59)	25(22.12)	10(25.64)	8(21.05)		26(29.55)	22(17.32)	8(22.22)	6(19.35)	
Upper	5(8.47)	26(23.01)	20(51.28)	16(42.11)		7(7.95)	22(17.32)	13(36.11)	11(35.48)	

*For difference between sex groups (two-sided t-test or χ^2 -test).

Wealth Index included type of house, type of fuel materials used for cooking, sanitation and household assets