

## Original Article

# Is Raised BMI an Alarming Concern for Obesity? A Study from Rural Haryana, India

Sumit Chawla<sup>1</sup>, Rakesh Thakur<sup>2</sup>, Bharti<sup>3</sup>, Kamaljit Singh<sup>4</sup>, Romesh Jain<sup>5</sup>, Herleen Pabla<sup>6</sup>, Saket Kumar<sup>7</sup>, Navya Sangwan<sup>8</sup>

<sup>1,3</sup>Associate Professor, Department of Community Medicine, Shri Atal Bihari Vajpayee Government Medical College, Chhainsa, Faridabad, Haryana; <sup>2</sup>Assistant Professor, Department of Otorhinolaryngology, Pandit Jawahar Lal Nehru Government Medical College and Hospital, Chamba; <sup>4</sup>Associate Professor, Department of Community Medicine, Dr Yashwant Singh Parmar Government Medical College and Hospital, Nahan, Himachal Pradesh, <sup>5</sup>Assistant Professor, Department of Transfusion Medicine, All India Institute Medical Sciences, Bhopal, Madhya Pradesh, <sup>6</sup>MBBS Intern, Govt. Medical College, Chandigarh, <sup>7</sup>Director General Ayurved Yoga and Naturopathy, Unani, Sidha Homeopathy Department Government of Haryana, <sup>8</sup>MBBS Intern, National Institute of Medical Science, Jaipur, Rajasthan, India

DOI:10.37821/ruhsjhs.7.4.2022.478



This is an open-access article distributed under the terms of Creative Commons Attribution-Non-Commercial-No Derivatives 4.0 International License (CC BY-NC-ND) (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

## ABSTRACT

**Introduction:** Overweight, obesity, and associated health problems are on the rise in the developing and developed world. The spreading of the fast-food culture, sedentary lifestyle, and increase in body weight has led some to coin the emerging threat of “globesity” epidemic.

**Methodology:** Multistage random sampling was used in this cross-sectional study. 1080 individuals of 15-64 years age group who were further subdivided into five subgroups (15-24, 25-34, 35-44, 45-54, and 55-64 years) taking 90 individuals from each Anganwadi area were selected and interviewed. Appropriate statistical tests were used for analysis.

**Results:** The overall prevalence of overweight (BMI = 25.00-29.99 kg/m<sup>2</sup>) was found to be 22.8% and it was higher among females (26.7%) as compared to males (18.9%). The prevalence of overweight was highest in 25-34 years age group (27.8%) and lowest in 15-24 years age group (13.0%) among males whereas among females, it was highest in 45-54 years age group (38.0%) and lowest in 25-34 years age group (15.7%).

**Conclusion:** This study confirmed the high burden of raised body mass index (BMI) in rural areas and reiterated the need to address these issues comprehensively as a part of noncommunicable disease (NCD) prevention and control strategy.

**Keywords:** BMI, Hypertension, Obesity, Rural.

## INTRODUCTION

The composition of human diet has changed considerably over time with globalization and urbanization making processed foods high in refined starch, sugar, salt, and unhealthy fats cheaply and readily available and enticing to consumers often more so than natural foods.<sup>1</sup> As a result, overweight, obesity, and associated health problems are on the rise in the developing and developed world. The spreading of the fast food culture, sedentary lifestyle and increase in body weight has led some to coin this emerging threat a “globesity” epidemic.<sup>2</sup>

Affluence, progressive ageing of population, improving socioeconomic conditions and changed life styles have caused an increase in non communicable diseases (NCDs) and these are spreading to rural areas as well. This needs to be documented to dispel myths that NCDs are the problem only in urban areas hence to assess the realistic background this study was planned. This study aimed to determine the prevalence and socio-demographic associations of raised BMI among the rural community of Block Beri, District Jhajjar, Haryana, India.

## METHODS

The study was conducted in rural community of Block Beri, District Jhajjar attached to a rural health training centre with a tertiary care government medical college in Rohtak, Haryana. The community based, descriptive, cross sectional and non-interventional study was conducted after approval from the institutional ethics committee.

Sample size was calculated to be 970 considering the prevalence of overweight as 9% in rural areas with a confidence level of 95% and 15% allowable error.<sup>3</sup> Multistage random sampling was used by including both the Community Health Centers (CHC's) and three randomly selected Primary health Centers (PHCs) of the rural block. From each PHC, two subcentres were randomly selected and from each subcentre area, two anganwadis were also selected by simple random sampling technique. Hence a total of 6 sub-health centres and 12 anganwadis were included in the study. From each anganwadi, 90 individuals of 15-64 years age group who were further subdivided into 15-24, 25-34, 35-44, 45-54, and 55-64 years age-group were selected and interviewed. Gender wise enumeration of the study population according to the subdivided age groups was done from the anganwadi registers. Nine males and nine females were selected from each of the five age subgroups by systematic random sampling. Thus, a sample size of 1080 was included in the study. In case, the desired numbers of study subjects were not available in any anganwadi area, subsequent anganwadi population was included in the study.

A pre-tested, semi-structured schedule was used for interviewing the study subjects. Written and informed consent was taken from all the subjects before initiating the interview. The confidentiality of the information was assured.

Operational definition: Outcome variable of overweight and obesity were defined on the basis of Body Mass Index

(BMI). Participants with a BMI  $\geq 24.9$  kg/m<sup>2</sup> and  $< 30.0$  kg/m<sup>2</sup> were classified as overweight, and those with a BMI  $\geq 30$  kg/m<sup>2</sup> were classified as obese following the World Health Organization's (WHO) recommendations.

Socio-economic status: Kuppuswamy scale was used for classifying socio-economic status of participants.

Collected data were entered in the Excel spreadsheet and analysis was carried out using Statistical Package for Social Studies (SPSS) version 20.0. Pearson's chi-square test and fisher exact test were used to evaluate differences between groups for categorized variables. Normally distributed data were presented as means and standard deviation, or 95% confidence intervals (CI). Student's t test and logistic regression analysis were done to evaluate factors associated with high BMI. All tests were performed at a 5% level of significance, thus an association was significant if p value was  $< 0.05$ .

## RESULTS

A total of 6 sub-health centres and 12 anganwadis were included in the study. Non-responders were not enrolled in the study. Participants with incomplete data were revisited to collect the missing data. Thus, a sample size of 1080 was included in the study comprising of 15-64 years age group which was further divided into five subgroups (15-24, 25-34, 35-44, 45-54, and 55-64 years age-group) taking 90 individuals from each anganwadi area. There was equal number of female participants and an equal number of male participants in each age group.

**Table 1: Prevalence of overweight and obesity among study participants by age groups and gender**

Age group (years)	Overweight (BMI=25.0-29.9 kg/m <sup>2</sup> )		
	Male (N=540)	Female (N=540)	Total (N=1080)
15-24	14/108 (13.0)	18/108 (16.7)	32/216 (14.8)
25-34	30/108 (27.8)	17/108 (15.7)	47/216 (21.8)
35-44	16/108 (14.8)	38/108 (35.2)	54/216 (25.0)
45-54	25/108 (23.1)	41/108 (38.0)	66/216 (30.6)
55-64	17/108 (15.7)	30/108 (27.8)	47/216 (21.8)
Total	102/540 (18.9)	144/540 (26.7)	246/1080 (22.8)
p value	0.024	0.000	0.003

  

Age group (years)	Obesity (BMI $\geq 30$ kg/m <sup>2</sup> )		
	Male (N=540)	Female (N=540)	Total (N=1080)
15-24	2/108 (1.9)	3/108 (2.8)	5/216 (2.3)
25-34	7/108 (6.5)	8/108 (7.4)	15/216 (6.9)
35-44	11/108 (10.2)	16/108 (14.8)	27/216 (12.5)
45-54	13/108 (12.0)	12/108 (11.1)	25/216 (11.6)
55-64	2/108 (1.9)	10/108 (9.3)	12/216 (5.6)
Total	35/540 (6.5)	49/540 (9.1)	84/1080 (7.8)
p value	0.004	0.034	0.000001

Figures in parentheses indicate percentages

**Table 2: Association of socio-demographic variables with overweight and obesity**

Socio-demographic Variables	(BMI $\geq$ 25 kg/m <sup>2</sup> ) (n=330)	(BMI <25 kg/m <sup>2</sup> ) (n=750)	Total (N=1080)	p value
<b>Marital status</b>				
<b>Married</b>	292 (33.0)	592 (67.0)	884 (100.0)	0.000*
<b>Unmarried</b>	26 (16.7)	130 (83.3)	156 (100.0)	
<b>Divorced</b>	0 (0.0)	4 (100.0)	4 (100.0)	
<b>Widowed</b>	12 (33.3)	24 (66.7)	36 (100.0)	
<b>Educational status</b>				
<b>Illiterate</b>	104 (32.0)	221 (68.0)	325 (100.0)	0.002*
<b>Primary</b>	18 (20.0)	72 (80.0)	90 (100.0)	
<b>Middle</b>	50 (28.9)	123 (71.1)	173 (100.0)	
<b>High school</b>	101 (27.9)	261 (72.1)	362 (100.0)	
<b>Graduate and above</b>	57 (43.8)	73 (56.2)	130 (100.0)	
<b>Occupation</b>				
<b>None</b>	133 (28.0)	342 (72.0)	475 (100.0)	0.000*
<b>Labourer</b>	58 (27.0)	157 (73.0)	215 (100.0)	
<b>Caste</b>	0 (0.0)	13 (100.0)	13 (100.0)	
<b>Business</b>	19 (63.3)	11 (36.7)	30 (100.0)	
<b>Independent</b>	22 (26.5)	61 (73.5)	83 (100.0)	
<b>Cultivation</b>	37 (30.8)	83 (69.2)	120 (100.0)	
<b>Service</b>	61 (42.4)	83 (57.6)	144 (100.0)	
<b>Socio-economic status</b>				
<b>Lower</b>	30 (20.1)	119 (79.9)	149 (100.0)	0.000
<b>Lower-middle</b>	124 (26.0)	353 (74.0)	477 (100.0)	
<b>Middle</b>	139 (38.2)	225 (61.8)	364 (100.0)	
<b>Upper-middle</b>	32 (42.7)	43 (57.3)	75 (100.0)	
<b>Upper</b>	5 (33.3)	10 (66.7)	15 (100.0)	

\* p value < 0.05, significant

Table 1 showed that the overall prevalence of overweight was 22.8% (246/1080) and it was higher among females (26.7%) as compared to males (18.9%) while prevalence of obesity was 7.8% (84/1080) and it was higher among females (9.1%) as compared to males (6.5%). The observed difference of overweight was found to be statistically significant in age groups among both males (p=0.024) and females (p=0.000).

Table 2 showed the prevalence of overweight and obesity to be highest among widowed (33.3%) followed by married (33.0%), unmarried (16.7%), and divorced (0.0%). Association with educational status, it was seen higher in graduate and above category (43.8%) than illiterate (32.0%). Association with occupation was highest among participants belonging to business category (63.3%) followed by service category (42.4%). The prevalence of overweight and obesity was highest among upper-middle (42.7%) followed by middle (38.2%), upper (33.3%), lower-middle (26.0%) and lower socio-economic status (20.1%).

A stepwise logistic regression analysis was performed in table 3 to predict the prevalence of overweight and obesity (BMI  $\geq$ 25kg/m<sup>2</sup>) using the above mentioned variables and

all were found to be statistically significant. Females are 1.63 times (aOR: 1.63, CI: 1.26-2.13, p=0.000) more likely to have BMI  $\geq$ 25 kg/m<sup>2</sup> than males. Age showed an increasing trend with 45-54 years age group, three times (aOR: 3.19, CI: 1.88-5.43, p=0.000) more likely to occur than in 15-24 years. Subjects with higher educational status (graduate and above) were more likely (aOR: 1.41, CI: 0.71-2.78, p=0.326) to have this risk factor. Business class in occupation had nearly 4 times (aOR: 3.80, CI: 1.65-8.78, p=0.002) the risk and upper socio-economic status (aOR: 3.12, CI: 0.85-11.52, p=0.088) showed positive association with BMI.

## DISCUSSION

In this study, the overall prevalence of overweight (BMI = 25.00-29.99 kg/m<sup>2</sup>) was found to be 22.8% and it was higher among females (26.7%) as compared to males (18.9%). The prevalence of overweight was highest in 25-34 years age group (27.8%) and lowest in 15-24 years age group (13.0%) among males whereas among females, it was highest in 45-54 years age group (38.0%) and lowest in 25-34 years age group (15.7%) in this study. A study conducted by Krishnan et al<sup>3</sup> in another rural area of

**Table 3: Independent association of socio-demographic variables with overweight and obesity (logistic regression analysis) (N=1080)**

Variables	Overweight and Obesity (BMI ≥25.00)		
	Prevalence (%)	aOR (C.I.)	p value
<b>Gender</b>			
<b>Female</b>	193/540 (35.7)	1.63 (1.26-2.13)	0.034
<b>Male</b>	137/540 (25.4)	Reference	
<b>Age group (years)</b>			
15-24	37/216 (17.1)	Reference	
25-34	62/216 (28.7)	1.79 (1.08-2.97)	0.023
35-44	81/216 (37.5)	2.94 (1.77-4.88)	0.000
45-54	91/216 (42.1)	3.19 (1.88-5.43)	0.000
55-64	59/216 (27.3)	1.88 (1.06-3.35)	0.032
<b>Educational status</b>			
<b>Illiterate</b>	104/325 (32.0)	Reference	
<b>Primary</b>	18/90 (20.0)	0.44 (0.23-0.83)	0.011
<b>Middle</b>	50/173 (28.9)	0.95 (0.57-1.56)	0.826
<b>High school</b>	101/362 (27.9)	0.66 (0.40-1.10)	0.113
<b>Graduate and above</b>	57/130 (43.8)	1.41 (0.71-2.78)	0.326
<b>Occupation</b>			
<b>None</b>	88/475 (18.5)	Reference	
<b>Labourer</b>	46/215 (21.4)	0.96 (0.64-1.45)	0.858
<b>Caste occupation</b>	0/13 (0.0)	0.00	0.998
<b>Business</b>	16/30 (53.3)	3.80 (1.65-8.78)	0.002
<b>Independent profession</b>	25/83 (30.1)	0.81 (0.45-1.44)	0.466
<b>Cultivation</b>	22/120 (18.3)	0.76 (0.45-1.28)	0.311
<b>Service</b>	50/144 (34.7)	1.00 (0.60-1.69)	0.988
<b>Socio-economic status</b>			
<b>Lower</b>	20/149 (13.4)	Reference	
<b>Lower middle</b>	88/477 (18.4)	1.84 (1.11-3.04)	0.017
<b>Middle</b>	106/364 (29.1)	3.99 (2.15-7.37)	0.000
<b>Upper middle</b>	27/75 (36.0)	4.18 (1.76-9.94)	0.001
<b>Upper</b>	6/15 (40.0)	3.12 (0.85-11.52)	0.088

Haryana reported that the prevalence of overweight was higher among females (12.1%) than males (7.5%). This study revealed that the prevalence of overweight was highest in 55-64 years age group (13.8%) and lowest in 15-24 years age group (2.9%) among males whereas among females, it was maximum in 45-54 years age group (21.6%) and minimum in 15-24 years age group (5.3%). Across all age groups overweight was more common among women than men, which was similar to our study.<sup>3</sup> Bhardwaj et al<sup>4</sup> reported prevalence of overweight among males and females as 5.7% and 7.2% respectively. Chow et al<sup>5</sup> in Andhra Pradesh reported the prevalence of overweight as 16.9%, which was lower than our study. Current study reported the overall prevalence of obesity (BMI ≥30 kg/m<sup>2</sup>) as 7.8% and it was higher among females (9.1%) as compared to males (6.5%). Among males, it increased from 1.9% in 15-24 years age group to 12.0% in 45-54 years age group and then decreased to 1.9% in 55-64 years age group. Among females it was highest in 35-44 years age group (14.8%), and lowest in 15-24 years age

group (2.8%). Chow et al<sup>5</sup> in Andhra Pradesh reported the prevalence of obesity as 4.4%, which was lower than our study which might be due to socioeconomic differences. Bhardwaj et al<sup>4</sup> in Nagpur reported prevalence of obesity among males and females as 0.3% and 0.7%, respectively. IDSP NCD risk factor survey reported that the prevalence of obesity was less than 4% in the surveyed states.<sup>6</sup> There have only been three multi-centre studies on the prevalence of diabetes in India. The earliest study reported a prevalence of 2.1% in urban and 1.5% in rural areas<sup>7</sup>. The National Urban Diabetes Survey<sup>8</sup> showed an overall age-standardised prevalence of 12.1% for diabetes and 14% for IGT in six large metropolitan cities. The Prevalence of Diabetes in India Study<sup>9</sup> reported diabetes prevalence of 5.9% and 2.7% in small towns and rural areas, respectively. The prevalence of diabetes varied from 4.3% in Bihar to 13.6% in Chandigarh.<sup>10,11</sup> These differences from our study might be because of the environmental conditions focusing around the socio-economic status, dietary practices, physical activities, and high alcohol consumption.



It was disturbing to observe that even in rural areas with majority in middle class, while having manual work, nearly one fourth (22.8%) of the participants were overweight and females being higher in percentage and difference in age groups for obesity was found to be statistically significant among both males ( $p < 0.05$ ) and females indicating a higher risk for developing NCDs among this group of overweight and obese individuals. According to the National Family Health Survey 5 (NFHS-5), the percentage of ever-married women aged 15-49 years who are overweight or obese increased from 20.6% in NFHS-4 to 24.0% in NFHS-5. Undernutrition is more prevalent in rural areas, whereas overweight and obesity are significantly higher in urban areas. This may be due to less physical activity in the urban areas. Furthermore, undernutrition and over-weight/obesity are both higher for women (24.0%) than men (22.9%).<sup>12</sup> This dual disease pattern in women may have an endocrine basis, but more probably has its roots in societal and cultural mores, which prevent women from leading a healthy lifestyle.

The percentage of women who are overweight or obese is highest in Delhi (41.3%) followed by Punjab (40%) and Kerala (38%), all of which are relatively richer states.<sup>12</sup>

Limitation of study: This study we have only compared sociodemographic variables, hence confounding variables also need to be studied like exercise and dietary habits etc.

## CONCLUSION

Females are 1.63 times more likely to have  $BMI \geq 25 \text{ kg/m}^2$  than males. Business class in occupation had nearly 4 times the risk and upper socioeconomic status showed positive association with BMI. This study confirmed the high burden of high BMI in rural areas and reiterated the need to address these issues comprehensively as a part of NCD prevention and control strategy in India.

## REFERENCES

1. Hawkes C. Uneven dietary development: Linking the policies and processes of globalization with the nutrition transition, obesity and diet-related chronic diseases. *Global Health*. 2006;2:4.
2. Bifulco M, Caruso MG. From the gastronomic revolution to the new globesity epidemic. *J Am Diet Assoc*. 2007;107:2058-60.
3. Krishnan A, Shah B, Lal V, Shukla DK, Paul E, Kapoor SK. Prevalence of risk factors for non-communicable diseases in a rural area of Faridabad district of Haryana. *Indian J Public*

*Health*. 2008;52:117-24.

4. Bhardwaj SD, Shwete MK, Bhatkule PR, Khadse JR. Prevalence of risk factors for non-communicable disease in a rural area of Nagpur district, Maharashtra; A WHO STEP wise approach. *Int J Biol Med Res*. 2012;3:1413-18.
5. Chow C, Cardona M, Raju PK, Iyengar S, Sukumar A, Raju R, et al. Cardiovascular disease and risk factors among 345 adults in rural India: The Andhra Pradesh Rural Health Initiative. *Int J Cardiol*. 2007;116:180-85.
6. Integrated Disease Surveillance Project. Non-communicable disease risk factors survey Phase-I. Ministry of Health and Family Welfare, Government of India 2007-08. New Delhi: MoHFW; 2009. Available from: <http://www.icmr.nic.in/final/IDSP-NCD%20Reports/Phase-1%20States%20of%20India.pdf>.
7. Ahuja MMS. Epidemiological studies on diabetes mellitus in India. In: Ahuja MMS (ed) Epidemiology of diabetes in developing countries. Interprint, New Delhi 1979; pp 29-38.
8. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK. High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia*. 2001;44:10941101.
9. Sadikot SM, Nigam A, Das S, Bajaj S, Zargar AH, Prasannakumar KM et al. The burden of diabetes and impaired glucose tolerance in India using the WHO 1999 criteria: Prevalence of Diabetes in India Study (PODIS). *Diabetes Res Clin Pract*. 2004; 66:301-07.
10. Anjana RM, Pradeepa R, Deepa M, Datta M, Sudha V, Unnikrishnan R, et al. Prevalence of diabetes and prediabetes (impaired fasting glucose and/or impaired glucose tolerance) in urban and rural India: Phase I results of the Indian Council of Medical Research India DIABetes (ICMRINDIAB) study. *Diabetologia*. 2011;54:3022-27.
11. Anjana RM, Deepa M, Pradeepa R, Mahanta J, Narain K, Das HK, et al. Prevalence of diabetes and prediabetes in 15 states of India: Results from the ICMR-INDIAB population-based cross-sectional study. *Lancet Diabetes Endocrinol*. 2017;5:585-96.
12. National Family Health Survey 5. Govt. of India. [http://rchiips.org/nfhs/factsheet\\_NFHS-5.shtml](http://rchiips.org/nfhs/factsheet_NFHS-5.shtml) Accessed on 14th Nov 2022.

## Corresponding Author

Dr Kamaljit Singh, Associate Professor, Department of Community Medicine, Dr Yashwant Singh Parmar Government Medical College and Hospital, Nahan, Himachal Pradesh.

email: [kjspabla65@gmail.com](mailto:kjspabla65@gmail.com)