Nutritional Status among Women in India: A Comparative Assessment of Bihar and Maharashtra States

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Abstract

Improving the nutritional status of women in India is a significant component of achieving Sustainable Development Goals (SDGs), and there is still a significant gap that needs to be addressed. Therefore, the present study assessed the nutritional status of women based on body mass index (overweight or obesity) by using the recent round of National Family and Health Survey (NFHS-5), 2019-21. Bivariate analysis has been used to understand the prevalence of overweight or obesity, and logistic regression analysis is used to determine the significant effect of the predictor variables on outcome variables. The prevalence of overweight or obesity in Maharashtra and Bihar is 24% and 16%, respectively and it is higher in urban areas (25%) compared to rural areas (14%). About 64% of the sample in Bihar had anaemia, whereas it is only 54% in Maharashtra. Moreover, the results indicate that individuals with diabetes in both states have significantly higher odds of health outcomes than their reference groups, with odds ratios of 1.73 in Bihar and 1.61 in Maharashtra. Similarly, individuals with hypertension in both Bihar and Maharashtra states have significantly 1.71 times and 1.99 times higher odds of hypertension than their counterparts. Overall, the study concludes that the burden of overweight or obesity due to increasing sedentary lifestyles and junk food habits, especially in urban and economically sound areas, is alarming. Prevention and control of this serious problem through awareness programmes to adopt diversified nutritional food and a healthy lifestyle are strongly recommended.

Keywords: Body Mass Index, Anaemia, Overweight, Obesity, Bihar, Maharashtra

1. Introduction

Nutritional factors have the most significant adverse effect on the health and well-being of the people, with excessive intake of saturated fat, trans-unsaturated fatty acids, sugar, and salt being the primary contributors. The global incidence of obesity has increased nearly threefold in the last forty years, with over 1.9 billion adults aged 18 and above being overweight and more than 650 million classified as obese in 2016, resulting in a significant public health challenge (World Health

Organization [WHO], 2021). According to WHO, increased consumption of food with high energy density, high fat and sugar content, and insufficient physical activity are the main reasons for overweight and obesity. The significant risk factors for cardiovascular disease worldwide are elevated blood pressure, responsible for 19% of global deaths annually (Forouzanfar et al., 2015); excess body weight, hypercholesterolemia, smoking, and high blood glucose levels.

The ongoing demographic and economic transition in many developing countries is leading to significant changes in lifestyle and diet, which in turn are profoundly affecting the risks of diseases. Notwithstanding malnutrition and nutrient deficiencies being acute distress in the developing world, recent dietary shifts and changes in physical activity patterns, diet-related metabolic problems have become a disturbing public health puzzle in many developing nations, predominantly among urban inhabitants (Kulaste & Chauhan, 2020).

WHO has recommended the Body Mass Index (BMI) for classifying the relative body weight of adults aged at least 20 years into categories associated with increased risk of some non-communicable diseases. BMI also has several advantages for defining the anthropometric characteristics of an adult. It is an age and gender-independent and inexpensive tool for screening weight categories (Daniels, 2009). It has also been recognised as a useful epidemiological tool for estimating the prevalence of obesity and chronic undernutrition and the risk of increased morbidity and mortality associated with these nutrition states in adults. Therefore, it is relevant to health policies and programmes in meeting the health care needs, especially for the adult population. BMI can serve as the basis for segmenting or dividing the adult population into different groups. Each has other dominating health and mortality risks, particularly those associated with the body relative weight. However, it is not a diagnostic tool for assessing individual health status.

1.1 Overweight/obesity among women in India

The prevalence of overweight and obesity rising among women in India has become a major public health issue, having more than doubled in the last thirty years from 8% in 1980 to 21% in 2013. Overweight and obesity are linked to various detrimental health outcomes. Many factors contribute to the high prevalence of overweight and obesity among women in India, including changes in diet and physical activity levels (Garg et al., 2010). The shift towards a diet high in fat and sugar and

a decrease in physical activity due to sedentary lifestyles contribute to the rise in overweight and obesity among women.

According to the National Family Health Survey (NFHS-5) 2019-2021, the prevalence of overweight and obesity among adults (aged 18-49 years) has increased significantly in India over the past decade. The data reveals that 23% of women and 20% of men are overweight or obese (International Institute for Population Sciences [IIPS] & ICF, 2022). Another South India study found that 31% of respondents were overweight or obese, and 41% had abdominal obesity (Thankappan, Shanmugam & Padmanabhan, 2020). A significant gap still needs to be addressed to improve women's nutritional status in India (Gupta & Gupta, 2020). Therefore, understanding the prevalence and determinants of overweight and obesity among women in India is essential to developing targeted interventions to prevent and manage this issue, improve women's health and well-being, and reduce the economic burden on individuals and the healthcare system.

1.2 Why Bihar and Maharashtra?

Maharashtra is a highly developed state in India with a large and diverse population. It boasts the largest economy in India and is a leading industrial and urbanized state. Maharashtra has a high Human Development Index ranking, indicating strong socioeconomic, demographic, and health transition conditions. The state also has a well-developed healthcare system, making it an important representation of the Indian population. In contrast, Bihar has the highest population density in India but ranks weakest regarding health outcomes. Despite having a higher energy intake, the population in Bihar experiences nutritional deficiencies, suggesting that diet and other factors may contribute to malnutrition (Yadav & Singh, 1999). Moreover, Bihar has a lower Human Development Index ranking than other Indian states. Given this context, this study aims to compare the nutritional status of Maharashtra and Bihar, specifically focusing on the prevalence and determinants of overweight and obesity and their impact on health status.

By comparing these two states, we can better understand the factors that contribute to the differences in overweight and obesity prevalence rates and inform targeted interventions to address these issues in both states. Moreover, both states have high rates of anemia, but the contributing factors vary. Interventions to address anaemia in both states may need to be tailored to each State's

specific socioeconomic and demographic conditions. Further, it provides valuable insights into the regional variations in the burden of these conditions. Identifying these risk factors can help inform targeted interventions that address the specific needs of each region.

2. Review of literature

Improving the nutritional status of women in India is a significant component of achieving the Sustainable Development Goals (SDGs). As per the global nutrition report, India has shown limited progress toward achieving the diet-related non-communicable disease (NCD) targets. The country has shown no progress toward obesity, with an estimated 6% of women aged 18 years and over (Micha et al., 2022). The obesity prevalence in India is below the regional average of 10% for women and 8% for men (Kelly et al., 2008) and diabetes is estimated to affect 9% of adult women and 10% of adult men. About 50% of the adult population had a BMI below 18.5 kg/m2, while only a negligible proportion was overweight or obese (Bray & Bellanger, 2006).

Furthermore, Subramanian et al. (2022) conducted a systematic review and meta-analysis of 114 studies published between 2006 and 2019. The authors reported that the overall prevalence of overweight and obesity among Indian women was 25% and 9%, respectively. Urban areas, as well as women with higher education and socioeconomic status, exhibited the greatest incidence of overweight and obesity. Dhillon et al. (2021) also conducted a systematic review and meta-analysis of 73 studies published between 2005 and 2019. The authors reported that the overall prevalence of overweight and obesity among Indian women was 25% and 10%, respectively.

Moreover, various determinants have been associated with overweight and obesity among women in India. Raj et al. (2020) conducted a systematic review and meta-analysis and found that lower socioeconomic status was associated with a higher prevalence of overweight and obesity among women in India. Kalaivani and Kalaivani (2019) reviewed the literature and reported that older age, urban residence, higher educational status, and higher socioeconomic status were positively associated with overweight and obesity among women in India. Bhaskar and Deo (2019) also reported that women with higher education and household wealth were more likely to be overweight and obese. However, these findings indicate the need for targeted interventions to address the increasing burden of overweight and obesity among women in India.

3. Need of the study

Over the past decade, the incidence of overweight and obesity in Indian women has increased significantly. According to the NFHS-5 report, there was no significant improvement in health and nutritional status among women in India. Nutrition promotes the health and reduces the risk factors of disease. By consuming nutrient-rich foods instead of those high in sugar and fat, a healthy diet can aid in preventing weight gain, as well as playing a vital role in the prevention and management of various diseases (McClelland et al., 2002). Cardiovascular diseases, type 2 diabetes, high blood pressure, osteoporosis, and some forms of cancer are among the particular health conditions that are associated with inadequate nutrition and insufficient physical activity. Being overweight and incredibly obese also is very much linked to many health issues. Therefore, to address these issues, the present study attempted to find the prevalence and risk factors for overweight and obesity in women aged 15-49 years in the Bihar and Maharashtra states of India. Also, the study suggested key insights and better planning for policy recommendations.

4. Objectives

The main objective of the present study is to assess the nutritional status of women (15-49 years) in Bihar and Maharashtra. The specific objectives are:

- To examine the prevalence of overweight or obesity among women of Bihar and Maharashtra.

- To study the correlation between overweight or obesity and the risk factors like hypertension, diabetes, and anaemia among women of Bihar and Maharashtra.

5. Methods and materials

5.1 Data source

The data for the present study is used from the National Family Health Survey (NFHS-5), which was conducted in two phases covering all the states and Union territories of India during 2019-21. The International Institute for Population Sciences (IIPS) is the nodal agency of conducting NFHS study, Mumbai, India; ICF, Calverton, Maryland, USA and the East-West Center, Honolulu,

Hawaii, USA. NFHS is a large-scale, multi-round cross sectional survey conducted in a representative sample of households in all states and Union Territories of India and collected detailed information related to population, health, and nutrition of children and women. In the NFHS-5 survey, the Clinical, Anthropometric and Biomedical (CAB) components were designed to provide vital estimates of the prevalence of HIV, malnutrition, anaemia, high blood glucose level, and hypertension through a series of biomarker tests and measurements.

A stratified two-stage sample has been adopted in the NFHS-5 survey. The 2011 census was the sampling frame for selecting Primary Sampling Units (PSUs). Villages are PSUs in rural areas and taken sampling frame with probability proportional to size (PPS). Census Enumeration Blocks (CEBs) are PSUs in urban areas obtained from the Office of the Registrar General and Census Commissioner, Government of India, New Delhi. Both villages and CEBs were sorted according to the percentage of scheduled castes (SCs) and scheduled tribes (STs) population in each village and CEB. Finally, households were randomly selected using systematic sampling.

5.2 Study population

The respondents of this study are women aged 15-49 years. For the study purpose, the individual data records (Women's file) of Bihar (n=42,483) and Maharashtra (n=33,755) states are used. However, the present study is limited to assessing nutritional status (overweight or obesity); therefore, the final sample size is 37,928 and 31,180 in Bihar and Maharashtra states, respectively.

5.3 Variables

5.3.1 Dependent variable

Anthropometry pertains to the study of human body measurements, specifically bone, muscle, and adipose tissue dimensions, to evaluate growth, development, and health indicators. NFHS-5 collected anthropometric data on the height and weight of women aged 15-49. These data were used to calculate several measures of nutritional status, including the respondent's body mass index (BMI). BMI is measured as the weight ratio in kilograms to the square of height in meters. It was categorized into thin (BMI<18.5 kg/m^2), normal (18.5 to 24.9), overweight (BMI 25-29.9

kg/m^2), and obese (>29.9 kg/m2). However, the last two categories of BMI are considered as the 'dependent variable' of the study, i.e., overweight or obesity (BMI >25 kg/m2).

5.3.2 Independent variables

The main predictors of the study are anaemia, diabetes, hypertension, chronic respiratory diseases including Asthma, and dietary diversity. In NFHS-5, an individual is classified as having hypertension if she has a systolic blood pressure level ≥140 mmHg, or a diastolic blood pressure ≥90 mmHg, or she is currently taking antihypertensive medication to lower her blood pressure. All the predictors are coded as "1", if they experience any issues; otherwise coded as "0". Consuming a wide variety of nutritious foods is important for the population's health. In NFHS-5, women were asked how often (daily, weekly, occasionally, or never) they consume various types of food (milk or curd, pulses, and beans, green leafy vegetables, other vegetables, fruits, fish, eggs, chicken or meat, aerated drinks, and fried food); however, for the analysis purpose, we have collated daily, weekly, or occasionally coded as "1", and '0' was coded if they never consume any food items.

The background characteristics of the study are Women's age group (15-24, 25-34, & 35-49 years), Education level (No education, Primary, Secondary, & Higher and above), Religion (Hindu, Muslim, & Others), Social Group (Schedule Castes, Scheduled Tribes, Other Backward Classes, & Others), Wealth Quintile (Poorest, Poorer, Middle, Richer, & Richest), and Place of residence (Urban & Rural).

## 5.4 Statistical analysis

The statistical analysis was performed using STATA software, version 16. Univariate and bivariate analyses have been used to fulfill the study objectives. Additionally, logistic regression analysis is used to find out the significant effect of the predictor variables on outcome variables at a 95% confidence interval (CI) with significance levels of p<0.01, p<0.05, and p<0.1.

6. Results

6.1 Profile of the sample in Bihar and Maharashtra

The sample distribution of the study has been presented in Table 1. For instance, BMI in Bihar, the majority of individuals (58%) have a normal BMI, while a significant proportion of the population is thin (26%), and a smaller proportion is c. In Maharashtra, a similar proportion of individuals have a normal BMI (56%), but there are fewer thin individuals (21%) and a higher proportion of overweight (17%) and obese (6%) individuals compared to Bihar. For India, the prevalence of normal BMI is similar to Maharashtra at 57%. Still, there are more thin individuals (19%) and slightly fewer overweight (18%) and obese (6%) individuals compared to Maharashtra (**Fig. 1**). In Bihar, about 64% of the sample had anaemia. In contrast, it is only 54% in Maharashtra.

Fig. 1 Body mass index in Bihar, Maharashtra, and India, 2019-21
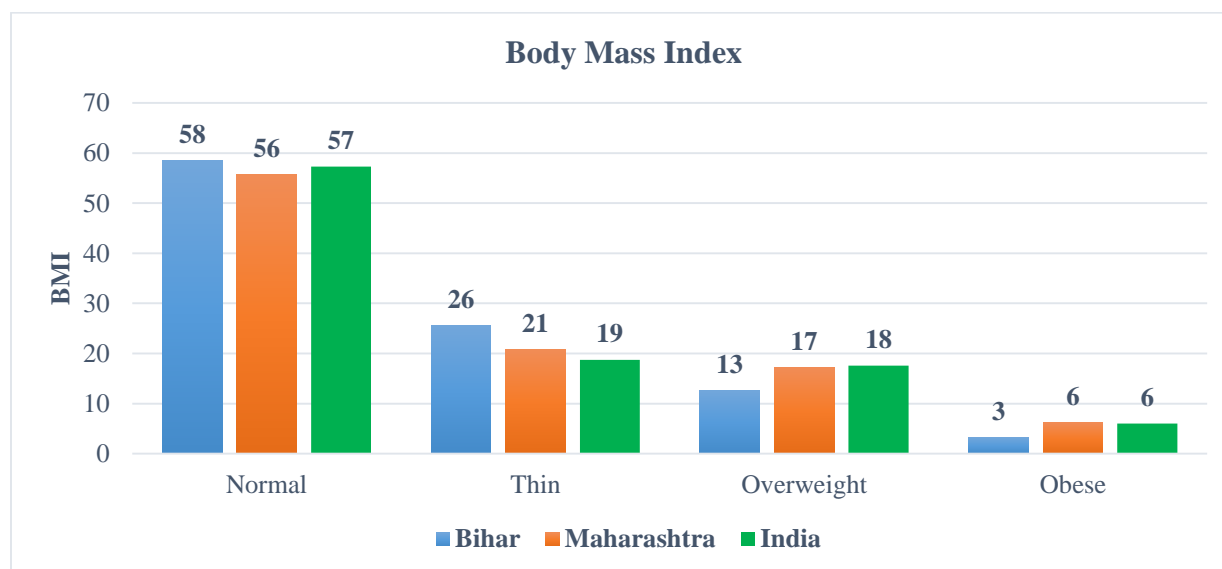
The highest percentage of women was in the 15-24 age group (42%) in Bihar, followed by the 35-49 age group (30%) and the 25-34 age group (28%). In Maharashtra, the highest percentage of women were in the 35-49 age group (39%), followed by the 25-34 age group (32%) and the 15-24 age group (29%). By educational level, the highest percentage of women do not have formal education (38%) in Bihar, whereas only 12% in Maharashtra. About 85% and 80% of the sample belong to Hindus in Bihar and Maharashtra. In Bihar, the highest percentage of women belonged to other backward classes (56%); in Maharashtra, it is all other social groups (39%). In Bihar, the

highest percentage of women belonged to the poorest wealth quintile (41%); in Maharashtra, the highest percentage belonged to the richest wealth quintile (28%). Most of the participants resided in rural regions of Bihar and Maharashtra, accounting for 84% and 52% of the sample, respectively.

Table 1. Profile of the respondents in Bihar and Maharashtra by background characteristics, NFHS-5 (2019-21)

Background Characteristic	Bihar		Maharashtra	
	%	Sample	%	Sample
Nutritional Status (BMI)				
Normal	58.4	22330	55.7	18184
Thin	25.6	9905	20.8	6888
Overweight	12.7	4534	17.2	4655
Obese	3.3	1159	6.3	1453
Anaemia Status				
No	36.5	14416	45.8	14554
Yes	63.5	26435	54.2	17691
Women Age Group				
15-24 years	41.7	17689	29.1	9906
25-34 years	28.0	11841	32.3	10581
35-49 years	30.3	12953	38.7	13268
Education Level				
No education	38.3	16693	11.8	4470
Primary	10.7	4459	10.0	3747
Secondary	43.3	18431	58.0	20226
Higher and above	7.8	2900	20.3	5312
Religious Group				
Hindu	85.1	36527	80.0	27485
Muslim	14.8	5888	11.7	3502
Others	0.2	68	8.3	2768
Social Group				
Schedule Castes	23.6	10318	18.0	5783
Scheduled Tribes	3.4	1421	12.5	4870
Other Backward Classes	56.2	23855	30.6	10859
Others	16.7	6560	39.0	10275
Wealth Index				
Poorest	40.9	17582	7.3	3374
Poorer	26.6	11785	14.8	6357
Middle	16.4	7069	22.1	8370
Richer	10.6	4248	27.6	8969
Richest	5.5	1799	28.3	6685
Place of Residence				
Urban	15.9	4601	47.6	11197
Rural	84.1	37882	52.4	22558

6.2 Prevalence of overweight or obesity in Bihar and Maharashtra

The prevalence of overweight or obesity in Maharashtra and Bihar is 24% and 16%, respectively (**Fig. 2**). In Bihar, the prevalence of overweight or obesity is higher in urban areas (25%) compared to rural areas (14%). Similarly, in Maharashtra, this prevalence is higher in urban areas (30%) than in rural areas (18%). **Table 2** shows the prevalence of overweight or obesity among women in Bihar and Maharashtra by socio-demographic characteristics. Overall, the prevalence of overweight or obesity is higher in those who do not have anaemia compared to those who have anaemia in both Bihar and Maharashtra.

Fig. 2 Prevalence of overweight or obesity among women by place of residence, 2019-21
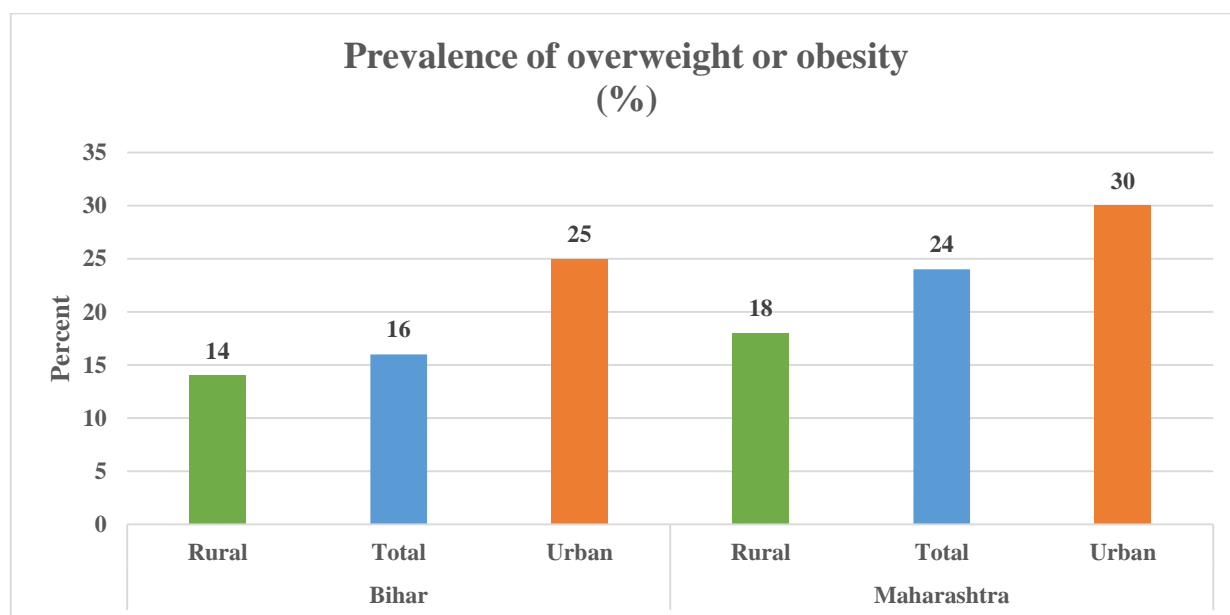
Moreover, the prevalence of overweight or obesity is highest in the 35-49 age group for both Bihar (28%) and Maharashtra (33%). By education level, the prevalence of overweight or obesity is highest in the Higher and above education level group in Bihar (23%). In Maharashtra, it is highest in the primary education level group (26%). The prevalence is higher among the Muslim religious group (32%) compared to the Hindu (22%) and other religious groups (23%). By social groups, the highest prevalence of overweight or obesity has other social groups compared to their counterparts in both Bihar and Maharashtra. Finally, the prevalence of overweight or obesity is

higher in the richest wealth quintile, 37% and 33% in both Bihar and Maharashtra, respectively, and it increases with increasing wealth quintile in both states.

Table 2. Prevalence of overweight or obesity among women (aged 15-49 years) in Bihar and Maharashtra (2019-21) by socio-demographic characteristics

Background Characteristic	Prevalence of overweight or obesity			
	Bihar	**N**	**Maharashtra**	**N**
Anaemia Status				
No	17.8	13283	25.8	13854
Yes	14.7	24227	21.3	17005
Women Age Group				
15-24 years	4.6	14907	9.4	8733
25-34 years	18.0	10490	23.3	9684
35-49 years	27.8	12531	33.4	12763
Education Level				
No education	15.6	15072	22.6	4251
Primary	18.6	3956	25.6	3567
Secondary	14.4	16343	23.1	18627
Higher and above	23.3	2557	24.0	4735
Religious Group				
Hindu	15.7	32795	22.3	25506
Muslim	17.7	5070	32.0	3132
Others	5.1	63	23.3	2542
Social Group				
Schedule Castes	11.6	9088	21.4	5369
Scheduled Tribes	13.2	1263	13.7	4544
Other Backward Classes	15.7	21336	22.7	10157
Others	23.8	5956	27.1	9398
Wealth Index				
Poorest	8.7	15410	9.1	3149
Poorer	14.8	10570	16.2	5930
Middle	21.8	6435	20.2	7811
Richer	26.2	3866	25.4	8284
Richest	36.5	1647	32.6	6006
Place of Residence				
Urban	25.2	4173	29.6	10099
Rural	14.2	33755	18.3	21081
Total	**16.0**	**37928**	**23.5**	**31180**

6.3 Association between overweight or obesity and dietary intake

The present study considered different dietary intakes, such as milk or curd, pulses, and beans, green leafy vegetables, fruits, fish, eggs, chicken or meat, fried food, and aerated drinks. **Table 3** represents the association between overweight or obesity and dietary intake in Bihar and

Maharashtra, 2019-21. In Bihar, the percentage of individuals who are overweight or obese is 16% for those who consume milk or curd, and it is 24% in Maharashtra. The prevalence of overweight or obese people is less than those who consume pulses and beans in Bihar, but this is the opposite situation in Maharashtra.

Table 3. Association between overweight or obesity and dietary intake in Bihar and Maharashtra, 2019-21
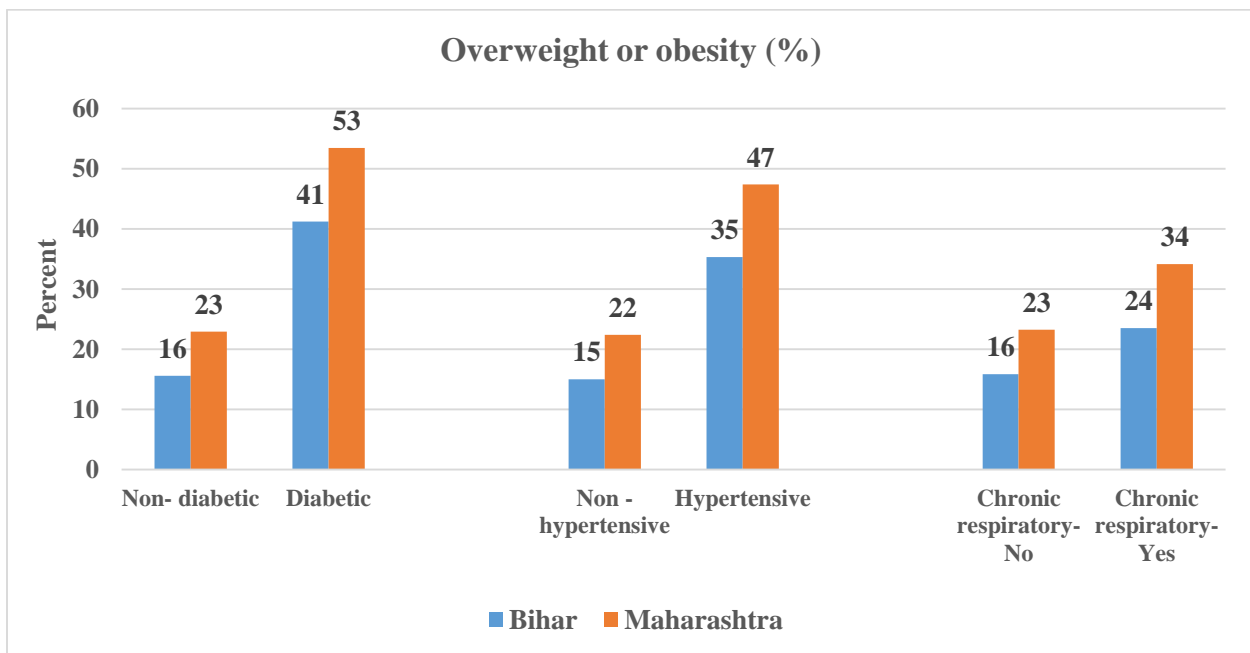
| Diet intake | Overweight or obesity | | | |
	Bihar	**N**	**Maharashtra**	**N**
Milk or curd				
No	14.6	1317	22.6	2336
Yes	16.0	36611	23.5	28844
Pulses and beans				
No	20.4	125	17.9	107
Yes	16.0	37803	23.5	31073
Green leafy vegetables				
No	10.0	48	18.4	105
Yes	16.0	37880	23.5	31075
Fruits				
No	16.5	439	19.2	885
Yes	16.0	37489	23.6	30295
Eggs				
No	17.6	7223	24.8	8883
Yes	15.6	30705	23.0	22297
Fish				
No	18.2	5989	22.9	12590
Yes	15.6	31939	23.8	18590
Chicken or meat				
No	17.1	7088	23.7	9904
Yes	15.7	30840	23.4	21276
Fried food				
No	18.6	725	21.2	2008
Yes	15.9	37203	23.6	29172
Aerated drinks				
No	14.9	3891	22.1	7637
Yes	16.1	34037	23.9	23543
Total	**16.0**	**37928**	**23.5**	**31180**

Overall, the prevalence of overweight or obesity is more or less the same among respondents who consume green leafy vegetables, fruits, eggs, fish, chicken and meat, fried food, and aerated foods in Bihar. However, this prevalence slightly varies among dietary intake in Maharashtra state.

6.4 Association of overweight or obesity with chronic diseases

The study considered three major chronic diseases to compare the status of overweight or obesity in Bihar and Maharashtra. Overall, the prevalence of overweight or obesity in Bihar and Maharashtra is higher among people with chronic risk factors compared to those without chronic diseases (**Fig. 3**). For diabetes, the percentage of overweight or obesity is 41% in Bihar and 53% in Maharashtra, compared to 16% and 23% respectively for non-diabetic individuals. For hypertension, the percentage of overweight or obese is 35% in Bihar and 47% in Maharashtra, compared to 15% and 22%, respectively for non-hypertensive individuals. For chronic respiratory diseases, the percentage of overweight or obese is 24% in Bihar and 34% in Maharashtra, compared to 16% and 23%, respectively for those without chronic respiratory diseases.

Fig 3. Association of overweight or obesity with chronic diseases in Bihar and Maharashtra

6.5 Determinants of overweight or obesity in Bihar and Maharashtra

Table 4 shows the determinants of overweight or obesity in Bihar and Maharashtra, 2019-21. In Bihar, individuals with diabetes have 1.73 times the odds of health outcome (Odds Ratio [OR]=1.73) compared to the reference group, with a 95% CI ranging from 1.41 to 2.14. Similarly, in Maharashtra, individuals with diabetes have 1.61 times the odds of the health outcome

(OR=1.66; 95% CI: 1.32-1.97) compared to the reference category, and this difference is also statistically significant. Likewise, the odds of having hypertension are higher among those who have hypertension than those who do not in both Bihar and Maharashtra, and this difference is also statistically significant. The odds of having chronic respiratory/asthma are not significantly different between those with the condition and those who do not have it in Bihar. Still, the odds are 1.23 times higher among those with the condition in Maharashtra. The odds of having aneamia are significantly lower among those who have aneamia compared to those who do not have aneamia in both Bihar and Maharashtra. The odds of having aneamia are 0.80 and 0.83 times lower in Bihar and Maharashtra, respectively.

Table 4. Logistic regression results: Determinants of overweight or obesity in Bihar and Maharashtra, 2019-21

Covariates	Bihar		Maharashtra	
	Odds Ratio	[95% CI]	Odds Ratio	[95% CI]
Diabetes				
No	1.00		1.00	
Yes	1.73***	(1.41 2.14)	1.61***	(1.32 1.97)
Hypertension				
No	1.00		1.00	
Yes	1.71***	(1.52 1.92)	1.99***	(1.75 2.27)
Chronic respiratory/Asthma				
No	1.00		1.00	
Yes	0.99	(0.78 1.25)	1.23*	(1.00 1.52)
Anaemia Status				
No	1.00		1.00	
Yes	0.80***	(0.75 0.85)	0.83***	(0.78 0.88)
Women Age Group				
15-24 years	1.00		1.00	
25-34 years	5.14***	(4.65 5.68)	3.05***	(2.75 3.37)
35-49 years	9.19***	(8.31 10.17)	4.89***	(4.43 5.41)
Education Level				
No education	1.00		1.00	
Primary	1.24***	(1.12 1.38)	1.04	(0.92 1.18)
Secondary	1.22***	(1.12 1.33)	1.06	(0.95 1.17)
Higher and above	1.35***	(1.17 1.55)	0.94	(0.82 1.08)
Religious Group				
Hindu	1.00		1.00	
Muslim	1.25***	(1.14 1.37)	1.47***	(1.31 1.64)
Others	0.57	(0.20 1.66)	0.88*	(0.77 1.01)
Social Group				
Schedule Castes	1.00		1.00	
Scheduled Tribes	1.12	(0.92 1.36)	0.70***	(0.61 0.80)
Other Backward Classes	1.09**	(1.01 1.19)	0.90**	(0.81 1.00)

Others	1.34***	(1.21 1.48)	1.09*	(0.98 1.21)
Wealth Index				
Poorest	1.00		1.00	
Poorer	1.60***	(1.47 1.75)	1.53***	(1.32 1.79)
Middle	2.39***	(2.17 2.64)	1.86***	(1.60 2.16)
Richer	2.88***	(2.56 3.24)	2.47***	(2.12 2.88)
Richest	3.88***	(3.32 4.54)	3.07***	(2.60 3.63)
Place of Residence				
Urban	1.00		1.00	
Rural	0.88**	(0.80 0.97)	0.84***	(0.78 0.91)
Constant	0.02***	(0.02 0.02)	0.04***	(0.03 0.05)

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1

Women in the age groups 35-49 and 25-34 years are 9.19 times (OR=9.19; 95% CI: 8.31-10.17, p<0.01) and 5.14 times (OR=5.14; 95% CI: 4.65-5.68, p<0.01) more likely to be over-weighted or obese compared to the reference group of 15-24 years in Bihar; The respective figures are 4.89 times and 3.05 times more likely to be overweighed or obese in Maharashtra. The odds ratio for women with Higher and above education is 1.35 times (OR=1.35; 95% CI: 1.17-1.55, p<0.01) more likely to be over-weighted or obese compared to those without education in Bihar.

Muslim religious women are 1.25 times in Bihar and 1.47 times in Maharashtra more likely to be over-weighted or obsessed compared to their Hindu counterparts. Compared to the Schedule Castes, the odds of other social groups are 1.34 times (OR=1.34; 95% CI: 1.21-1.48, p<0.01) more in Bihar, and Schedule Tribes are 0.70 times (OR=0.70; 95% CI: 0.61-0.80, p<0.01) less likely to be over-weighted or obese in Maharashtra and the association is statistically significant. The richest wealth quintile is 3.88 times in Bihar and 3.07 times in Maharashtra more likely to be over-weighted or obese compared to their poorest quintile counterparts. Finally, compared to the women who reside in urban areas, the odds of being overweight or obese are experiencing 0.88 times in Bihar and 0.84 times in Maharashtra, lower for the women who reside in rural areas.

7. Summary and Discussion

The findings show that the prevalence of overweight or obesity is higher in urban areas than in rural areas in both Bihar and Maharashtra. Further, the prevalence of overweight or obesity is higher in the age group of 35-49 years. The Muslim religious group and the richest wealth quintile have the highest prevalence of overweight or obesity in both states. These results suggest that there

is a need for preventive measures, especially in urban areas and among certain socio-demographic groups, to control the prevalence of overweight and obesity in Bihar and Maharashtra.

Lack of access to food is the primary reason for the poor nutritional status of women in rural India (Mathur & Shah, 2021). In both states, the consumption of green leafy vegetables and fruits was lower among those with overweight or obesity than those without. On the other hand, the consumption of aerated drinks was higher among those with overweight or obesity compared to their counterparts. The consumption of other types of dietary intake, such as milk or curd, pulses and beans, eggs, fish, and chicken or meat, did not show a clear association with overweight or obesity.

The prevalence of overweight or obesity is higher among women with chronic diseases in Bihar and Maharashtra and there is a positive association between chronic diseases and overweight or obesity in both states. The study found that women with diabetes, hypertension, and chronic respiratory diseases are more likely to be overweight or obese than their counterparts. The findings suggest a need for targeted interventions to address the high prevalence of overweight and obesity in individuals with chronic diseases, particularly in Maharashtra, where the prevalence is significantly higher than in Bihar.

The regression results suggested that women with diabetes and hypertension are at a significantly higher risk of being overweight or obese in both states. However, anaemia status is negatively associated with overweight or obesity risk in both states. Women in the age group of 25-49 years are at a significantly higher risk compared to those in the age group of 15-24 years. Muslims in both states are at a higher risk compared to Hindus, while individuals from scheduled tribes in Maharashtra and individuals from the richest wealth index in both states are at the highest risk. Finally, women's educational level and place of residence are also significant predictors of overweight or obesity in Maharashtra. Still, individuals living in rural areas in Bihar are at a lower risk compared to those in urban areas.

8. Conclusion

The study concludes that a better understanding of overweight and obesity among women in India requires a multifaceted approach involving policy and environmental changes and individual-level interventions. Strategies such as promoting healthy diets, increasing physical activity, and improving access to healthcare services can be helped to reduce the burden of overweight and obesity among women in India. Recommendations of the present study prioritised primary and secondary prevention and health promotion to create enabling environments for healthy lifestyles, early detection, and routine screening among adults. To ensure these needs are met, the present study will provide policymakers with a roadmap on how various nutritional elements affect and may cater more appropriately to the states' women population.
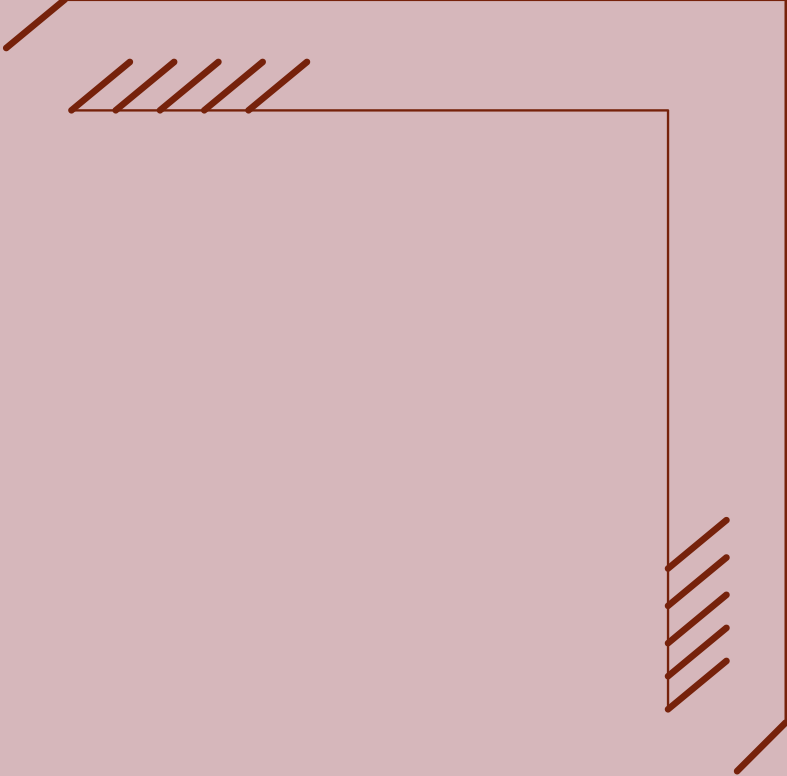
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