



Gender Differentials in the Prevalence of Overweight and Obesity in India

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Abstract

Introduction: With global gender disparities in the prevalence of overweight and obesity, the majority of the studies do not explain why these gender disparities exist. Physical activity, cultural values, biological factors (such as menopause), and urbanization have been the most common explanations regarding gender disparities in overweight and obesity. However, rarely have studies gone beyond general explanations.

Aims: In this study, an attempt has been made to assess the differentials and determinants of gender gap in the prevalence of overweight/obesity in India and across its states by different socioeconomic and demographic factors.

Data and Methods: National Family Health Survey 2015-16 data and NFHS -3 (2005-06) data of 15-49 years old women and 15-54 years old men, were utilized to analyze gender gap in the recent scenario and over the time.

Results and Conclusion: The prevalence of overweight/ obesity has increased significantly among men and women. At the same time, the difference in the prevalence of overweight/ obesity among men and women has declined over time. Earlier, women were predominantly more overweight/obese compared to men; however, overweight/ obesity prevalence has increased more swiftly among men than among women in the last decade. A rapid increase was observed in the prevalence of overweight/ obesity among men in the younger adult age groups. Irrespective of age, the gender gap in overweight/ obesity rose with education. The gender gap was also the highest among the castes other than SCs and STs. Muslims were found to have a higher gender gap compared to Hindus and others. Wealth quintiles had a positive relationship with the gender gap. The gender gap in the prevalence of overweight/ obesity prevalence increased among respondents of the richest wealth quintile. The pattern of higher gender gap in overweight and obesity was also observed among people who were working, living in nuclear families and living in low fertility states in both urban and rural areas. We found that food habits do not reflect any consistent pattern of the risk of overweight/ obesity among men and women, which may be due to complex and non-uniform food patterns across the Indian states.

Keywords: Gender, Obesity, Gender Gap, India

Introduction

Adult obesity has become a growing public health concern in developed as well as developing countries. The global epidemic of obesity could be a major risk factor not only for resurgent chronic diseases, such as hypertension,

cardiovascular diseases, or diabetes but also for impairing one's quality of life.¹ One of the major challenges of the present time is meeting the healthcare needs of a rapidly increasing number of persons suffering from various health problems.

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Non-communicable diseases (NCDs) are the most common health problems and the primary cause of death in many countries. Cardiovascular diseases, cancers, chronic respiratory diseases, and diabetes are the NCDs which have resulted in the highest number of deaths, especially in low and middle-income countries. One risk factor which is common to all these diseases is overweight/obesity. Overall, as age progresses, gender-specific fat redistribution might be a contributing factor for the difference in the pattern of chronic diseases.²

The socially constructed gender roles of men and women interact with their biological roles to affect the nutritional status of the entire family and of each sex. Poor female nutrition early in life reduces learning potential, increases reproductive and maternal health risks, and lowers productivity and longevity. This situation contributes to women's diminished ability to gain access to other assets later in life and undermines attempts to eliminate gender inequalities. In essence, women with poor nutrition are caught in a vicious circle of poverty and undernutrition, which also may turn into over-nutrition at later stages. Global survey data indicate that the prevalence of male and female overweight and obesity varies by region and rapidly increased between 1980 and 2008.³ Studies have documented global trends of overweight and obesity among females by the economic status of countries (gross national product or gross domestic product), but not among males or both sexes.^{4,5} However, some studies suggest that not only do the global differences in the prevalence of obesity vary by sex, but also that the social determinants of obesity vary by gender.⁶⁻⁸

Compared to developed countries, in many developing countries, occupation remained a significant source of physical activity for much of the latter half of the 20th century. In a number of countries and areas in South Asia, the Middle-East, North Africa, Sub-Saharan Africa, Latin America, and the Caribbean, men perform a much higher daily amount of physical activity than women.⁹⁻¹¹ However, from the end of the 20th century onward, in many developing countries, there has been a transition away from agricultural labor (both for production and subsistence) to wage labor that has decreased the physical activity of women more than that of men.¹² Among men and women, the change in occupation leading to a subsequent decrease in daily physical activity is higher in rural areas. In Russia, physical inactivity related to un- or underemployment may also be associated with excess weight gain.¹³

Research on nutrition in India has focused primarily on the problem of undernutrition, particularly among vulnerable women and children. However, there has been a steady increase in the prevalence of obesity in India during the past decade, with a trend that varies across population groups. Although the nature of obesity-related health risks is similar

in all populations, the specific level of risk associated with a given level of obesity may be different depending on gender, race, and societal conditions. Gender-wise prevalence of overweight/ obesity in India is not uniform. As public health policy makers and practitioners expand programs aimed at combating obesity, additional research is needed to identify high-risk population subgroups. Prior research has indicated that women, residents of rural areas, ethnic and racial minorities, and persons having a low socioeconomic status are particularly vulnerable to health problems, and the Central government has placed a great deal of emphasis on research and programs aimed at reducing such disparities.

Yet, given these global gender disparities in the prevalence of overweight and obesity, the majority of the studies do not explain why these gender disparities exist. Physical activity, cultural values, biological factors (such as menopause), and urbanization have been the most common explanations regarding gender disparities in overweight and obesity. However, rarely have studies gone beyond general explanations.

In this study, an attempt has been made to assess the differentials and determinants of gender gap in the prevalence of overweight/obesity in India and across its states by different socioeconomic and demographic factors.

Data and Methodology

In this study, gender differentials in the prevalence of overweight/obesity have been examined by using separate analyses for men and women and examined the levels of gender gap. Since National Family Health Survey 2015-16 data and NFHS-3 (2005-06) data of 15–49 years old women and 15–54 years old men, were utilized to analyze gender gap in the recent scenario and over time.

Overweight/ obesity prevalence among men and women was measured by Body Mass Index (BMI). To examine the differentials of gender gap in overweight/obese prevalence, bivariate distribution analysis was done separately for the states of India and by background characteristics. The logit regression analysis was carried out to assess the adjusted effect of background variables on the prevalence of obesity separately for men and women using NFHS-3 (2005-06) data. Age, place of residence, parity of women (children ever born in case of men), education, caste, religion, wealth index, working status, age at first marriage, household structure and food habits were considered as independent factors in the regression analysis.

Gender Gap in the Prevalence of Overweight/ Obesity in the States of India

Table 1 presents the prevalence of overweight/obesity among men and women by place of residence in states

of India, in 2005-06, and 2015-16. A significant increase was observed in the prevalence of overweight/obesity among men and women in 2015-16 from 2005-06. The gap in the prevalence of overweight/obesity between men and women declined significantly. However, women were more overweight/obese compared to men in 2007-08 than in 2015-16, which means that men are getting more obese and reaching the same level as the level of malnutrition among women. It was observed in the present study that gender gap was declining significantly among all states. Table 2 depicts the gender gap in the prevalence of overweight/obesity among men and women by place of residence in the states of India, 2005-06, and 2015-16, the overall gender gap has declined to 2.1% in 2015-16 from 2.9% in 2005-06. Nearly same pattern is seen in almost all the major states of India except Gujarat and Uttar Pradesh and in the smaller states of Chhattisgarh, Delhi, Goa, Meghalaya, and Manipur.

Table 1. Prevalence (%) of Overweight and Obesity by Place of Residence in the States of India, 2005-06, and 2015-16

States	2015-16						2005-06					
	Women			Men			Women			Men		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Andhra Pradesh	45.6	27.6	33.2	44.4	28.0	33.5	26.1	10.2	15.7	21.4	9.9	13.8
Arunachal Pradesh	25.7	16.3	18.8	26.0	18.4	20.6	11.8	7.1	8.5	8.3	7.9	8.0
Assam	26.1	10.9	13.2	24.8	10.5	12.9	19.7	5.0	7.8	11.1	3.3	5.0
Bihar	23.5	9.7	11.7	20.1	10.9	12.6	12.6	3.1	4.6	8.8	5.6	6.3
Chhattisgarh	24.4	7.8	11.9	20.0	6.8	10.2	16.9	2.2	5.6	14.4	2.1	5.2
Delhi	34.9	29.2	34.9	24.1	0.0	24.6	27.2	17.0	26.4	19.0	8.8	18.0
Gujarat	34.5	15.4	23.7	25.9	14.4	19.7	26.1	9.5	16.7	18.0	7.9	12.4
Goa	36.3	28.5	33.5	35.3	28.2	32.6	24.5	15.2	20.3	19.0	14.6	17.0
Himachal Pradesh	38.4	27.6	28.6	26.9	21.0	22.0	29.5	11.6	13.5	19.2	10.0	11.0
Haryana	24.3	18.8	21	21	19.3	20	28.2	12.4	17.3	21.1	6.6	11.3
Jharkhand	21.7	5.9	10.3	19.8	7.5	11.1	15.2	1.7	5.4	10.8	2.5	5.1
Jammu and Kashmir	40.6	24.1	29.1	30.1	15.8	20.5	30.4	11.3	16.8	14.9	4.5	7.7
Karnataka	31.8	16.6	23.3	28.6	17.1	22.1	26.0	8.5	15.4	19.0	6.3	11.5
Kerala	33.5	31.5	32.4	31.1	26.3	28.5	32.9	25.6	28.1	22.3	17.4	19.2
Meghalaya	18.4	10.2	12.2	17.1	8.1	10.1	7.9	4.3	5.3	4.5	7.8	6.9
Maharashtra	32.4	14.6	23.4	31.2	16.4	23.8	22.4	7.0	14.5	17.7	6.8	12.4
Manipur	31.2	22.4	26	21.8	18.5	19.8	20.0	10.2	13.3	14.9	6.2	9.2
Madhya Pradesh	23.8	9.1	13.6	17.6	7.8	10.9	18.6	3.1	7.5	10.1	2.2	4.6
Mizoram	26.8	12.3	21.1	28.1	9.9	21.0	15.3	4.7	10.8	15.2	6.9	11.1
Nagaland	20.7	13.2	16.2	16.6	12.3	14.0	11.6	3.8	6.6	10.0	3.0	6.1
Orissa	32.0	13.2	16.5	32.4	13.3	17.2	17.8	4.3	6.6	14.5	4.1	6.1
Punjab	32.4	30.6	31.3	32.1	25.0	27.8	36.1	26.2	29.9	26.9	19.7	22.9
Rajasthan	23.7	10.7	14.1	19.7	10.6	13.2	17.6	5.2	8.8	14.7	3.2	6.9
Sikkim	34.1	23.1	26.7	41.5	29.7	34.8	20.0	14.3	15.3	20.0	10.8	13.0
Tamil Nadu	36.2	25.4	30.9	30.6	25.6	28.2	29.5	13.0	20.9	18.9	10.6	14.7
Tripura	23.5	12.8	16	18.2	14.9	15.9	16.7	5.1	7.1	12.2	3.3	4.9
Uttarakhand	28.4	16	20.4	23	14.1	17.7	23.7	8.6	12.7	14.4	5.8	8.6
Uttar Pradesh	27.1	12.6	16.5	20.6	9	12.5	19.2	5.9	9.1	15.8	4.4	7.7
West Bengal	30.6	15	19.9	20.7	11.2	14.2	24.7	5.3	11.3	12.9	2.2	5.8
Total	31.3	15	20.7	26.3	14.3	18.6	23.5	7.4	12.6	16.7	5.9	9.7

Table 2. Gender Gap (%) in the Prevalence of Overweight and Obesity by Place of Residence in the states of India, 2005-06, and 2015-16

States	Gender Gap (%) in the Prevalence of Overweight/Obesity					
	2015-16			2005-06		
	Urban	Rural	Total	Urban	Rural	Total
Andhra Pradesh	1.2	-0.4	-0.3	4.7	0.3	1.9
Arunachal Pradesh	-0.3	-2.1	-1.8	3.5	-0.8	0.5
Assam	1.3	0.4	0.3	8.6	1.7	2.8
Bihar	3.4	-1.2	-0.9	3.8	-2.5	-1.7
Chhattisgarh	4.4	1.0	1.7	2.5	0.1	0.4
Delhi	10.8	29.2	10.3	8.2	8.2	8.4
Gujarat	8.6	1.0	4.0	8.1	1.6	4.3
Goa	1.0	0.3	0.9	5.5	0.6	3.3
Himachal Pradesh	11.5	6.6	6.6	10.3	1.6	2.5
Haryana	3.3	-0.5	1.0	7.1	5.8	6.0
Jharkhand	1.9	-1.6	-0.8	4.4	-0.8	0.3
Jammu and Kashmir	10.5	8.3	8.6	15.5	6.8	9.1
Karnataka	3.2	-0.5	1.2	7.0	2.2	3.9
Kerala	2.4	5.2	3.9	10.6	8.2	8.9
Meghalaya	1.3	2.1	2.1	3.4	-3.5	-1.6
Maharashtra	1.2	-1.8	-0.4	4.7	0.2	2.1
Manipur	9.4	3.9	6.2	5.1	4	4.1
Madhya Pradesh	6.2	1.3	2.7	8.5	0.9	2.9
Mizoram	-1.3	2.4	0.1	0.1	-2.2	-0.3
Nagaland	4.1	0.9	2.2	1.6	0.8	0.5
Orissa	-0.4	-0.1	-0.7	3.3	0.2	0.5
Punjab	0.3	5.6	3.5	9.2	6.5	7
Rajasthan	4	0.1	0.9	2.9	2	1.9
Sikkim	-7.4	-6.6	-8.1	0	3.5	2.3
Tamil Nadu	5.6	-0.2	2.7	10.6	2.4	6.2
Tripura	5.3	-2.1	0.1	4.5	1.8	2.2
Uttarakhand	5.4	1.9	2.7	9.3	2.8	4.1
Uttar Pradesh	6.5	3.6	4	3.4	1.5	1.4
West Bengal	9.9	3.8	5.7	11.8	3.1	5.5
Total	5	0.7	2.1	6.8	1.5	2.9

From 1998-99 to 2005-06, the percentage change in the prevalence of overweight and obesity among women increased significantly. The highest gender gap in 2005-06 was observed (9.1%) in Jammu and Kashmir followed by Kerala (8.9%), Delhi (8.4%) and Punjab (7.0%). The states of Bihar and Uttar Pradesh also showed a high increase in the prevalence of overweight and obesity among women. The gender gap was negative in the smaller states of Jharkhand, Mizoram, Meghalaya, and Bihar because of the higher prevalence of overweight and obesity among men compared to women in 2005-06. The gender gap was more than 4% in 2005-06 in 11 states of India, which reduced to 7 states in 2015-16. The highest gender gap in

2015-16 was observed (10.3%) in Delhi followed by Jammu and Kashmir (8.6%), Himachal Pradesh and Manipur. The reducing gender gap indicates the accelerated increase in the prevalence of overweight and obesity among men over time compared to women. The gender gap was observed negative in 2015-16 in the states of Andhra Pradesh, Bihar, Jharkhand, Odisha and Maharashtra, indicating the prevalence of overweight and obesity among men has surpassed the prevalence among women.

The prevalence of overweight and obesity among women increased in both urban and rural areas of almost all the states. The gender gap declined steeply in urban areas

compared to rural areas, suggesting that urbanization contributes to changes in occupation patterns, life-styles, family structures and value systems. These changes are reflected in changes in dietary practices and in the levels of physical activity. Previously, it was also found that the strongest risk factor for obesity is urbanization (Fall, 2001). While the rural population is mainly engaged in agricultural occupations involving manual labor and a fairly high level of physical activity, urban occupations except those of some of the urban slum dwellers are generally of the 'skilled' and 'semi-skilled' categories that tend to favor sedentary life styles. Bicycles, generally used in earlier years by the staff for commuting from their homes to offices, are now being rapidly displaced by motorbikes and cars in India.¹⁴ More than 4% gender gap was observed in the urban areas of 19 states in 2005-06, which reduced to 14 states in 2015-16. Rural areas of five states exhibited more than 4% gender gap in 2005-06 as also in 2015-16.

This is in contrast to what was observed in the developed countries, where the prevalence of obesity is higher in the rural areas compared to the urban areas. This difference may be attributed to the different stages of epidemiological and health transitions experienced by different countries.¹⁵ In 2015-16, Delhi was at the top with 10.8% and 29.2 % gender gap in urban and rural areas respectively followed by Himachal Pradesh (11.5% in urban and 6.6% in rural areas) and Jammu and Kashmir (10.5% in urban and 8.3% in rural areas). Jammu and Kashmir (15.5% in urban and 6.8% in rural areas) exhibited the highest gender gap in the prevalence of overweight and obesity among the states of India in 2005-06 followed by West Bengal (11.8% in urban and 3.1% in rural areas) and Tamil Nadu (10.6% in urban and 2.4% in rural areas). Urban residence per se may not be the cause of higher gender gap in the prevalence of overweight; rather, differences in lifestyle factors that predict overweight and obesity are associated with living in an urban environment.

It is also found from Table 2 that more socioeconomically developed states of Andhra Pradesh, Karnataka and Maharashtra exhibited a lower level of gender gap in the overweight and obesity prevalence compared to the less socioeconomically developed states, which are also higher fertility states like Uttar Pradesh, Jammu and Kashmir and Madhya Pradesh. However, this pattern of lower gender gap in the prevalence of overweight and obesity was not uniform with some of the more socioeconomically developed states including Kerala, Gujarat and Himachal Pradesh which were exhibiting a higher level of gender gap and some of the less socioeconomically developed states like Bihar, Orissa and Jharkhand showing a lower level of gender gap in the prevalence of overweight and obesity.

The reason for this complex scenario may be the different stages of demographic, nutrition and epidemiological transition in the states of India. States in the early phase of this transition showed a lower level of prevalence of overweight and obesity as well as a lower level of gender gap. By contrast, states in the advanced phase of this transition showed a higher level of prevalence of overweight and obesity and a lower level of gender gap. In developing countries like India, changes in occupation type and sociocultural factors that affect physical activity, particularly among women, are related to why there are more overweight and obese women in these countries compared to men.

Gender Gap in the Prevalence of Overweight and Obesity by Background Characteristics

Table 3 presents the results of gender gap in the prevalence of overweight and obesity by background characteristics using NFHS-3 data. The assessment of the prevalence of overweight and obesity among women and men by background characteristics shows that the gender gap was the least in the younger ages (0.9% in the 15–24 years age group), while with increasing age, the gap increased (7.3% in the 35–49 years age group). The gender gap in the prevalence of overweight and obesity was also significant in the urban and rural areas. Among younger adults, the gender gap in overweight and obesity prevalence was less prominent compared to the older aged people. Irrespective of age, the gender gap in overweight/obesity increased with education. However, men and women educated upto the primary level showed the maximum gender gap (6.2%) in the prevalence of overweight/obesity. More than primary level education did not seem to have much effect on the levels of gender gap in overweight and obesity prevalence. The gender gap was also higher among the castes other than SCs and STs. Among the Muslims, the gender gap was higher than among Hindus and others. The gender gap in the prevalence of overweight/obesity also increased with the wealth quintile. For instance, the gender gap was 5.8% among people in the richest wealth quintile compared to 0.5% in the poorest wealth quintile, which shows that the increase in the prevalence of overweight/obesity among men was more pronounced in the lower wealth quintiles. The pattern of high gender gap in overweight and obesity was also seen in people who were working, living in nuclear families and living in low-fertility states in both urban and rural areas.

Food habits in terms of daily consumption of milk or curd, pulses, vegetables, eggs, and meat also indicated higher level of gender gap in the prevalence of overweight and obesity.

Table 3. Gender Gap (%) in the Prevalence of Overweight and Obesity by Background Characteristics, India, 2005-06

Background Characteristics		Overweight/ Obesity (%)						Gender Gap		
		Women			Men			Urban	Rural	Total
		Urban	Rural	Total	Urban	Rural	Total			
Age group	15–24	7.7	2.3	4.0	5.6	1.7	3.1	2.1	0.6	0.9
	25–34	24.3	7.4	12.9	17.1	6.5	10.2	7.2	0.9	2.7
	35–49	39.2	13.4	22.1	26.0	8.9	14.8	13.2	4.5	7.3
Women's parity	Parity≤2	21.1	6.5	11.9	15.1	5.3	9.2	6.0	1.2	2.7
	Parity>2	28.5	8.5	13.6	21.4	6.8	10.7	7.1	1.7	2.9
Highest educational level	No education	17.6	5.1	7.3	7.7	3.1	3.9	9.9	2.0	3.4
	Primary	21.4	8.6	12.1	10.8	4.2	5.9	10.6	4.4	6.2
	Secondary	24.2	9.7	15.9	15.2	6.6	9.9	9.0	3.1	6.0
	Higher	30.9	15.4	26.7	28.3	15.0	23.0	2.6	0.4	3.7
Caste	SC	16.3	5.8	8.9	12.5	3.8	6.5	3.8	2.0	2.4
	ST	11.8	2.5	3.5	10.7	2.3	3.4	1.1	0.2	0.1
	Others	25.4	8.6	14.6	18.0	7.2	11.4	7.4	1.4	3.2
Religion	Hindu	23.2	6.7	11.8	16.5	5.6	9.3	6.7	1.1	2.5
	Muslim	23.1	8.3	14.1	13.9	5.0	8.8	9.2	3.3	5.3
	Others	28.1	16.1	20.7	25.1	12.8	17.6	3.0	3.3	3.1
Wealth index	Poorest	4.4	1.8	1.9	3.9	1.3	1.4	0.5	0.5	0.5
	Poorer	7.1	3.6	3.9	3.5	2.1	2.3	3.6	1.5	1.6
	Middle	11.5	6.3	7.4	6.9	4.6	5.2	4.6	1.7	2.2
	Richer	17.9	13.4	15.4	11.1	10.1	10.6	6.8	3.3	4.8
	Richest	32.5	24.9	30.5	25.0	23.7	24.7	7.5	1.2	5.8
Respondent currently working	No	24.5	8.5	14.5	18.6	6.4	10.6	5.9	2.1	3.9
	Yes	20.9	5.9	9.5	7.3	2.7	4.5	13.6	3.2	5.0
Who decides how to spend money	Respondent alone	25.9	6.6	13.9	20.7	7.5	11.6	5.2	-0.9	2.3
	Respondent and husband/partner	25.7	6.8	11.8	24.2	8.3	14.1	1.5	-1.5	-2.3
	Husband/partner alone	24.3	5.9	8.7	22.8	6.6	14.2	1.5	-0.7	-5.5
<i>Continued...</i>										
Current contraceptive method	Not using	16.3	4.6	8.2	12.3	4.5	7.2	4.0	0.1	1.0
	Pill	18.9	7.0	11.4	20.4	6.8	11.6	-1.5	0.2	-0.2
	IUD	35.4	17.5	27.6	36.8	16.6	27.5	-1.4	0.9	0.1
	Condom	31.6	13.0	23.3	26.1	11.3	19.1	5.5	1.7	4.2
	Female sterilization	31.3	11.1	17.3	24.3	8.7	13.7	7.0	2.4	3.6
	Male sterilization	42.9	9.7	20.2	32.4	9.1	16.3	10.5	0.6	3.9
	Periodic abstinence	30.5	7.6	14.4	23.6	6.2	11.4	6.9	1.4	3.0
	Withdrawal	33.7	11.4	19.1	20.4	7.3	12.3	13.3	4.1	6.8
Others	18.9	8.9	11.1	19.6	2.4	7.1	-0.7	6.5	4.0	
Currently/ formerly/never married	Never married	8.0	2.2	4.5	7.3	2.1	4.3	0.7	0.1	0.2
	Currently married	29.1	8.6	14.9	23.1	7.6	12.6	6.0	1.0	2.3
	Formerly married	26.5	8.9	14.4	9.9	4.7	6.0	16.6	4.2	8.4

Age at first marriage (Years)	<18	25.0	7.2	11.3	17.3	4.9	7.2	7.7	2.3	4.1
	18–25	31.7	11.3	19.5	20.4	7.2	11.1	11.3	4.1	8.4
	25–35	40.2	17.6	31.0	28.7	12.2	20.4	11.5	5.4	10.6
	>35	28.0	4.3	20.8	24.3	9.5	17.4	3.7	-5.2	3.4
Milk or curd consumption	Never	18.8	5.1	8.9	13.7	3.4	6.1	5.1	1.7	2.8
	Daily	28.0	10.8	17.4	20.1	8.8	13.5	7.9	2.0	3.9
	Weekly	21.6	6.8	11.6	12.3	4.6	7.2	9.3	2.2	4.4
	Occasionally	18.6	5.1	8.7	12.4	3.4	5.8	6.2	1.7	2.9
Pulses or beans consumption	Never	17.2	9.4	11.9	19.3	10.3	13.3	-2.1	-0.9	-1.4
	Daily	24.2	7.9	13.9	18.3	7.0	11.8	5.9	0.9	2.1
	Weekly	22.4	6.9	11.2	14.2	5.0	7.6	8.2	1.9	3.6
	Occasionally	23.5	6.7	11.2	13.2	4.2	6.6	10.3	2.5	4.6
Green leafy vegetables consumption	Never	17.1	12.3	14.3	12.6	9.2	10.3	4.5	3.1	4.0
	Daily	24.8	7.7	13.6	18.1	6.5	11.0	6.7	1.2	2.6
	Weekly	19.9	6.6	10.4	14.6	5.2	8.1	5.3	1.4	2.3
	Occasionally	24.3	8.4	12.5	10.7	5.1	6.4	13.6	3.3	6.1
Fruit consumption	Never	17.1	4.5	6.7	11.6	2.9	4.4	5.5	1.6	2.3
	Daily	33.2	15.4	26.7	26.1	13.2	21.0	7.1	2.2	5.7
	Weekly	24.1	10.2	15.9	16.7	7.9	11.6	7.4	2.3	4.3
	Occasionally	17.5	5.8	8.4	11.2	4.1	5.9	6.3	1.7	2.5
Egg consumption	Never	26.1	8.1	13.6	21.8	6.8	11.6	4.3	1.3	2.0
	Daily	29.3	12.4	20.5	18.3	9.4	13.9	11.0	3.0	6.6
	Weekly	24.0	8.4	14.4	16.4	6.6	10.6	7.6	1.8	3.8
	Occasionally	18.7	5.6	9.2	13.0	4.3	7.0	5.7	1.3	2.2
Chicken/meat/ fish consumption	Never	24.9	8.3	13.6	19.8	6.7	11.3	5.1	1.6	2.4
	Daily	29.3	12.7	20.3	21.5	10.2	15.9	7.8	2.5	4.4
	Weekly	24.9	8.5	15.1	16.7	7.3	11.3	8.2	1.3	3.8
	Occasionally	19.8	5.6	9.5	13.7	4.6	7.4	6.1	1.0	2.2
Household structure	Nuclear	24.0	7.6	13.4	16.8	5.6	9.8	7.2	2.0	3.6
	Non-nuclear	23.4	7.3	12.0	16.7	6.3	9.8	6.7	1.0	2.2
Total		23.5	7.4	12.6	15.9	5.9	9.7	7.6	1.5	2.9

Multivariate Regression Analysis of the Prevalence of Overweight and Obesity

Logit regression analysis was carried out to examine the socioeconomic and demographic predictors of the prevalence of overweight and obesity after controlling for other factors. The analysis was done separately for males and females. The results in Table 4 show that the adjusted risk of overweight and obesity after controlling for age, sex and other socioeconomic and demographic variables was more among men than among women in the younger adult ages. Compared to the younger adult ages, the likelihood of being overweight/obese in the 25–34 years age group was 96% more among men and 78% more among women. In the rural areas, the risk of

overweight/obesity was 17% lower among men and 50% lower among women, compared to the urban areas. The risk of overweight/obesity was higher with a higher level of education among men and women. Muslim men had a 15% higher likelihood, while Muslim women had a two times higher chance of being overweight/ obese than Hindus. There was 12 times more risk of being overweight/ obese among men from the richest wealth quintile compared to those in the poorest wealth quintile. The likelihood of being overweight/ obese among women was seven times more compared to those in richest wealth quintile. The risk of being overweight/ obese was lower in working women than in working men. Higher age at marriage also reduced the risk of being overweight/ obese.

Table 4. Multivariate Logistic Regression Analysis of the Prevalence of Overweight and Obesity by Selected Background Characteristics, India, 2005-06

Background Variable		Men				Women			
		OR	p value	95.0% C.I. for EXP(B)		OR	p value	95.0% C.I. for EXP(B)	
				Lower	Upper			Lower	Upper
Age group (Years)	15–24 (ref)								
	25–34	1.964	<0.001*	1.622	2.378	1.787	0.047*	1.008	3.169
	35–49	3.033	<0.001*	2.494	3.688	3.398	<0.001*	1.881	6.138
	50–54	3.066	<0.001*	2.473	3.801	-	-	-	-
Place of residence	Urban (ref)								
	Rural	0.828	<0.001*	0.77	0.89	0.493	<0.001*	0.358	0.68
Women's parity	Parity ≤2								
	Parity >2	0.99	0.778	0.921	1.064	0.715	0.044*	0.515	0.991
Highest educational level	No education (ref)								
	Primary	1.157	0.033*	1.012	1.323	0.86	0.449	0.582	1.27
	Secondary	1.425	<0.001*	1.265	1.604	1.357	0.132	0.913	2.016
	Higher	1.773	<0.001*	1.547	2.033	2.2	0.016*	1.16	4.17
Caste	SC (ref)								
	ST	0.629	<0.001*	0.54	0.733	1.466	0.687	0.228	9.428
	Others	1.047	0.308	0.958	1.144	1.225	0.234	0.877	1.709
Religion	Hindu (ref)								
	Muslim	1.152	0.007*	1.04	1.276	2.241	0.055	0.984	5.105
	Others	1.297	<0.001*	1.17	1.437	0.969	0.909	0.561	1.671
Wealth index	Poorest (ref)						0		
	Poorer	1.579	0.001	1.208	2.064	1.579	0.243	0.734	3.395
	Middle	3.003	<0.001*	2.351	3.836	2.338	0.017*	1.167	4.684
	Richer	5.417	<0.001*	4.252	6.901	4.423	<0.001*	2.138	9.148
	Richest	12.032	<0.001*	9.395	15.41	7.03	<0.001*	3.103	15.924
Currently working	No (ref)								
	Yes	0.828	0.211	0.615	1.113	0.506	0.009*	0.303	0.846
Who decides how to spend money	Respondent alone (ref)								
	Respondent and husband/partner	0.928	0.039*	0.864	0.996	0.96	0.794	0.705	1.307
	Husband/partner alone	0.907	0.294	0.755	1.089	1.038	0.883	0.634	1.698
	Someone else	0.72	0.006*	0.569	0.912	1.15	0.873	0.205	6.446
Age at first marriage (Years)	<18 (ref)								
	18–25	1.001	0.993	0.885	1.131	0.758	0.074	0.559	1.027
	25–35	0.948	0.438	0.83	1.084	0.412	0.013*	0.205	0.828
	>35	0.789	0.08	0.606	1.029	-	-	-	-
Milk or curd consumption	Never (ref)								
	Daily	1.313	<0.001*	1.151	1.498	0.781	0.374	0.452	1.347
	Weekly	1.04	0.598	0.9	1.201	0.726	0.305	0.393	1.339
	Occasionally	1.141	0.065	0.992	1.314	0.695	0.207	0.395	1.223

Pulses or beans consumption	Never (ref)								
	Daily	0.559	<0.001*	0.424	0.737	2.452	0.022*	1.139	5.276
	Weekly	0.601	<0.001*	0.455	0.794	1.689	0.13	0.858	3.327
	Occasionally	0.623	0.002	0.465	0.835	1.695	0.132	0.853	3.368
Green leafy vegetables consumption	Never (ref)								
	Daily	1.091	0.806	0.543	2.194	0.831	0.246	0.608	1.136
	Weekly	1.062	0.866	0.528	2.137	0.971	0.937	0.472	1.999
	Occasionally	0.974	0.942	0.477	1.99				
Fruit consumption	Never (ref)								
	Daily	1.192	0.2	0.911	1.56	0.405	0.048*	0.166	0.992
	Weekly	0.911	0.489	0.699	1.187	0.393	0.034*	0.166	0.934
	Occasionally	0.794	0.087	0.609	1.034	0.428	0.052	0.182	1.007
Egg consumption	Never (ref)								
	Daily	1.016	0.852	0.863	1.196	1.418	0.343	0.689	2.919
	Weekly	1.009	0.886	0.89	1.144	1.082	0.81	0.571	2.051
	Occasionally	0.888	0.055	0.786	1.003	0.798	0.522	0.4	1.591
Chicken/meat/fish consumption	Never (ref)								
	Daily	1.263	0.053	0.997	1.602	0.61	0.719	0.041	8.979
	Weekly	1.063	0.428	0.914	1.235	0.82	0.524	0.446	1.508
	Occasionally	0.86	0.04*	0.745	0.993	0.777	0.432	0.415	1.456
Household structure	Nuclear (ref)								
	Non-nuclear	0.982	0.573	0.922	1.046	1.334	0.058	0.99	1.798
Constant		0.017	<0.001*			0.167	0.018*		
-2 Log likelihood		27997.67				1382.71			

Note: *significant at 5% level of significance ($p < 0.05$)

The effect of food habits does not reflect any consistent pattern on the risk of overweight/ obesity among men and women possibly due to complex and non-uniform food patterns across the Indian states. This may also be due to the limitation that many lifestyle factors cannot be fully explored using the NFHS-3 and NFHS-2 data. It is likely that the relationship between socioeconomic status and BMI would be greatly reduced when controlling for diet and lifestyle factors in the models. The survey did not collect information to estimate either energy intake or expenditure. With the limited dietary information available in the data set, we observed that women who more frequently ate vegetables other than green leafy vegetables and fruits were more likely to be overweight.

Although food consumption patterns are often driven by sociocultural factors, the proportion of energy intake from animal source foods is the highest in high-income countries.¹⁶ High-income countries consume the greatest amount of kilocalories per capita per day and the greatest proportion of energy intake from fat. Furthermore, studies using data from developed countries have demonstrated that gender-based food preferences exist and that one's sociocultural environment likely influences these preferences. However, although women are more likely to report eating or wanting to eat "healthier" foods, they seem

to prefer and consume foods that are high in added sugars more than men, including energy-dense processed foods.¹⁷ Concomitant with the changing physical activity patterns in many developing countries, since the 1990s, there has been an influx in processed food products that consist of refined carbohydrates and added sweeteners. Thus, associated with the nutrition transition, the rapid increase in overweight and obesity in many developing countries is because the dietary carbohydrate intake is composed mostly of refined, rather than complex, carbohydrates.¹⁶

Summary and Discussion

Gender inequality in access to and control of resources not only is unfair to women and their children, but also constitutes bad economics. It results in the misallocation of scarce resources, increased healthcare costs, lowered productivity, and poor human development trends. The prevalence of overweight/ obesity has increased significantly among men and women. At the same time, the difference in the prevalence of overweight/ obesity among men and women has declined over time. Earlier, women were predominantly more overweight/obese compared to men; however, overweight/ obesity prevalence has increased more swiftly among men than among women in the last decade. Except for Gujarat, Uttar Pradesh and some

smaller states like Chhattisgarh, Delhi, Goa, Meghalaya, and Manipur, the gender gap has declined in all the states of India. The decrease in the gender gap has been observed to be higher in the urban areas compared to the rural areas over time.

It was also observed in this study that in 2005-06, the gender gap increased with age, indicating a rapid increase in the prevalence of overweight/ obesity among men in the younger adult age groups. Irrespective of age, the gender gap in overweight/ obesity rose with education. The gender gap was also the highest among the castes other than SCs and STs. Muslims were found to have a higher gender gap compared to Hindus and others. Wealth quintiles had a positive relationship with the gender gap. The gender gap in the prevalence of overweight/ obesity prevalence increased among respondents of the richest wealth quintile. The pattern of higher gender gap in overweight and obesity was also observed among people who were working, living in nuclear families and living in low fertility states in both urban and rural areas. Food habits of daily or weekly consumption of pulses, vegetables, eggs, meat, and milk or curd showed a higher gender gap in the prevalence of overweight and obesity.

Factors associated with under-and overweight are similar but related inversely. Women who report a higher standard of living, who live in households where at least one member is educated beyond high school, who work in non-manual occupations, or who watch television more than once a week are more likely to be overweight or obese. These factors are all inversely related to low BMI. In common with other developing countries that are in the early stage of nutrition transition, Indian women in the highest socioeconomic groups are more likely to be overweight or obese, whereas nearly half of poor women are underweight.¹⁸

In this study, it was also found that there was a higher risk of being overweight and obese in 2005-06 among men with lower children ever born and women with lower parity, higher educational level, castes other than SCs and STs, people from the richest wealth quintile, those who were not working and were living in nuclear families and in low-fertility states. Muslims had a higher risk of being overweight and obese compared to Hindus; this is likely related to the differences in diet, activity and socioeconomic status. We are limited in our ability to explore these associations, although there are likely to be differences in socioeconomic status between the two groups. In 1998-99 also, a similar scenario was observed, where women of lower parity, women having a higher educational level, women from castes other than SCs and STs, Muslim women, women from the richest wealth quintile, not working women, women living in nuclear families and women living in low-fertility states were found

to have a higher risk of being overweight and obese than other women. Results reflected that urban residence per se may not be the cause of overweight; rather, differences in lifestyle factors that predict overweight and obesity are associated with living in an urban environment.

The inflow of energy-dense foods may exacerbate the effect of numerous socioeconomic factors that have had a greater effect on the physical activity levels of women compared to men in many developing countries.¹⁹ In this study, we found that food habits do not reflect any consistent pattern of the risk of overweight/obesity among men and women, which may be due to complex and non-uniform food patterns across the Indian states. This may also be due to the data limitation of limited information on many lifestyle factors in NFHS-3 (2005-06) and NFHS-2 (1998-99) data. It may be possible that the relationship between socioeconomic status and BMI would be greatly reduced when controlling for diet and lifestyle factors in the regression analysis.

Conflict of Interest: None

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