

Emerging Obesity Threats among Women in India: Findings from a Population Based Survey

¹Praween Agrawal and ²Sutapa Agrawal

¹International Planned Parenthood Federation South Asia Regional Office, New Delhi, India

²South Asia Network for Chronic Disease, Public Health Foundation of India, New Delhi, India

Abstract: India which is typically known for high prevalence of under nutrition, significant proportion of overweight and obese people now coexist with those who are under nourished. The present study aims to find out the prevalence of overweight and obesity among married women in India by exploring data from NFHS-2, 1998 to 99. As expected the prevalence of obesity among women is much higher in urban India than in rural India. The range of Mean BMI is also significantly wider which indicates a differential in the nutritional status of women across the states. The prevalence of overweight and obesity also varies with the background characteristics and dietary habits of women. Adverse health outcomes like asthma induced and spontaneous abortion and caesarean birth are positively associated with overweight and obesity condition of married women. Traditional focus on under nutrition among women in India should be expanded to encompass all aspects of malnutrition which includes overweight and obesity.

Key words: Obesity, overweight, BMI, NFHS-2, India

INTRODUCTION

Obesity is defined as a condition in which excess of body fat is accumulated. It is a heterogenous, multifactorial disease in which genetics and environmental factors play major determining roles (Kadiri, 2000). The practical and clinical definition of obesity is based on the Body Mass Index (BMI; weight (kg)/height (m²)). It is generally agreed that a BMI of >35 is an indicative of clinical obesity, BMI of 30.0-34.99 indicative of obesity while a BMI of 25.0-29.9 is suggestive of overweight in an individual. However, BMI between 18.5-24.99 indicates normal condition and a BMI <18.5 represents underweight. Quetelet in 1869 was the first person to observe that among adults of normal built but different heights, weight was roughly proportional to height squared. The Quetelet Index (Weight in kg/Height in m²) was later renamed the Body Mass Index (BMI) by Keys *et al.* (1972). Despite its inherent limitations like being independent of the age of the respondent and not providing information on a person's percentage of body fat, BMI has been widely used as a measure of obesity and the risk of mortality.

Obesity is increasing at an alarming rate throughout the world and has become a global problem. The WHO in 2002 declared overweight as one of the top 10 health risks

in the world and one of the top five in developed nations. According to recent estimates, there are >1 billion overweight people worldwide and some 300 million of these are estimated to be clinically obese (WHO, 2002). Once considered a problem related to affluence, obesity is now fast growing in many developing countries and in the poor neighbourhoods of the developed countries (WHO, 2000, 2003). Also, WHO stated that the growth in the number of severely overweight adults is expected to be double that of under-weight during 1995 to 2025 (WHO, 1998). In many developed countries, prevalence of obesity has doubled in the last decade as in the UK (Prescott-Clark and Primates, 1998) and the US (Flegal *et al.*, 1998). But prevalence differs markedly. Obesity prevalence in US white men and women are 20.0 and 22.4%, respectively (Flegal *et al.*, 1998) in France prevalence is far lower - 6.5 and 7%, respectively (Maillard *et al.*, 1999). In the Middle East in Jordan, prevalence of obesity among men and women are very high which is 32.7 and 59.8%, respectively (Ajlouni *et al.*, 1998). But it is very low (2.5 and 8%) in Southern Iran (Pishdad, 1996).

In most populations among sub-Saharan Africans, especially in the indigent masses, obesity prevalence remains very low at 1-5%. However, in South Africa and some neighbouring countries, Botswana, Namibia and

Zimbabwe with rise in socioeconomic status, urbanization and diminishing physical activity, the proportion of obesity has increased. The 8% men and much more women (34%) were found obese in Cape Town, i.e. to a level similar to that of African-American women (Walker *et al.*, 2001).

Obesity and related ill health are becoming serious problems in parts of the developing countries most notably in Asia. Concerns about the environmental effects of large-scale industrialised livestock production an important problem in many high-income countries are gradually becoming important around large cities in many developing countries (Pinstrip-Andersen and Pandya-Lorch, 2001). In Japan, remarkably prevalence of obesity is uniformly low which are 1.2% among men and 2.9% among women despite considerable rise in the socio-economic status (Yoshiike *et al.*, 1998). In China, during 1992, the prevalence of obesity was 1 and 1.7% among urban males and females (aged 20-45 years), respectively whereas it was <1% in rural areas for both sexes (Ge, 1997). Between 1992 and 1998 the prevalence of obesity among Singaporeans remained unchanged at 6% level, however, secular trends in increasing obesity prevalence were evident among certain ethnic groups. Among Malaysian women 11.1% were classified as obese in 1992 which increased to 16.2% in 1998 (WHO, 2000).

Even in countries like India which are typically known for high prevalence of under nutrition, significant proportion of overweight and obese people now coexist with those who are under nourished (Popkin, 2002). The National Family Health Survey (NFHS-2), 1998 to 99 shows 6% obesity with a BMI of 30 or more and 18% overweight with BMI between 25-30 in urban India among women aged 15-49 years (IIPS and ORC Macro, 2000). The recently conducted National Family Health Survey (NFHS-3, 2005 to 2006) shows a significant increase in the overweight and obesity among women aged 15-49 years. About 15% women in India are found to be overweight or obese. The condition of overweight or obesity in urban India is unprecedentedly as high as 29%. In rural India also the condition of overweight and obesity is found to be increasing (8%) (NFHS-3 Fact sheet).

There also exists a gender differential in the prevalence of obesity. In general the prevalence of obesity is higher in women as compared to men (Shetty and James, 1994; Gopalan, 1998). Research on obesity in India has also found the prevalence of obesity to be higher among women (Misra *et al.*, 2001; Zargar *et al.*, 2000; Gopinath *et al.*, 1994). Age wise a significant increase has been noticed for obesity. In a recent study among women in Northern India by Agrawal and Mishra (2004) it was found that urban

residence significantly increases the risk of obesity (RR = 1.57; 95% CI: 1.06, 2.32). Further, older women were found to be relatively more overweight and obese than younger women.

The etiology of obesity is multi factorial. Problems of overweight and obesity are caused by a chronic imbalance between energy intake and actual energy needs of the body. This imbalance between food intake and energy expenditure is determined, largely by socio-economic conditions. In many developing countries with increasing urbanization, mechanization of jobs and transportation, availability of processed and fast foods and dependence on television for leisure, people are fast adopting less physically active lifestyles and consuming more energy-dense, nutrient-poor diets (WHO, 2003; Bell *et al.*, 2002; Popkin, 2002, 2001; Popkin *et al.*, 2001; Drewnowski and Popkin, 1997). Because of urbanization and modernization the lives are now becoming more sedentary and less physically active than it was before. Urbanization involves changes in occupation patterns, life-styles, family structures and value systems. These changes are reflected in dietary practices and in the levels of physical activity.

The process of urbanisation automatically brings with it changes in the activity pattern (Schneider, 2000). Still in India, the level of urbanization is comparatively very low. There is much scope for urbanization and concentration of population in urban areas. Again, globalization is also playing an important role in modernization and sedentary life style. Globalization has made cheap vegetable oils and fats widely available, greatly increasing the fat consumption in all nations (Drewnowski and Popkin, 1997). So, in the near future, obesity is likely to emerge as a challenging problem for India. Though the pattern of obesity is still in the early stages in India compared to western countries, it nevertheless needs to be tackled aggressively before it assumes serious epidemic proportions. Therefore, attention should be given for the emerging future as prevention is better than cure. In view of the above discussion objectives of the present study are:

- To explore the prevalence of overweight and obesity among ever-married women aged 15-49 years in the states of India by residence
- To investigate the prevalence of overweight and obesity among ever-married women aged 15-49 according to selected socio-economic and demographic characteristics and dietary behavior
- To know the differentials in the morbidity pattern with special focus on maternal health of women according to level of BMI

MATERIALS AND METHODS

India's second National Family Health Survey (NFHS-2)'s data has been used for the present analysis which was conducted in 1998 to 99. This survey was designed on the lines of the Demographic and Health Surveys (DHS) that have been conducted in many developing countries since 1980s. NFHS-2 collected demographic, socio-economic and health information from a nationally representative probability sample of 90,303 ever-married women aged 15-49 years residing in India's 92,486 households. All states of India are represented in the sample (except the small Union Territories) covering >99% of country's population. The sample is a multi-stage cluster sample with an overall response rate of 98%. Details of sample design including sampling frame and sample implementation are provided in the basic survey report for all India (IIPS and ORC Macro, 2000). The analysis for the present study focuses on 70160 ever-married non-pregnant women aged 15-49 years who had not given a birth in the last 2 months preceding the survey. All India BMI weights has been used while generating estimates for all India whereas state-level BMI weights has been used for generating estimates for a particular state. All India weights takes into account the variability in sampling fractions among the states and also the non-responses.

Simple bi-variate analysis has been done and results have been shown in percentages and means. To substantiate the bi-variate analysis a multivariate analysis (logistic regression) has been employed.

RESULTS AND DISCUSSION

Prevalence of overweight and obesity in the states of India by residence: Table 1 shows the prevalence of overweight and obesity among ever-married women aged 15-49 years in the states of India by residence. Overall in India, 3% of women are obese and 9% overweight whereas in urban area about 7% are obese and 18% overweight. However in rural area, prevalence of obesity is quite lower than urban area (1.7% obese and 5.1% overweight).

State wise, Delhi shows the highest prevalence of obesity among women followed by Punjab and Gujarat. On the other hand, states like Orissa, Bihar, Nagaland and Mizoram show below 1% prevalence of obesity among women. Other states which fall below the national average are Andhra Pradesh, Himachal Pradesh, Rajasthan, Madhya Pradesh, West Bengal and rest of North Eastern states. States above the national level of prevalence of obesity are Goa, Kerala, Haryana, Uttar Pradesh, Jammu and Kashmir, Maharashtra, Karnataka and Tamil Nadu.

Thus, there are 11 states which fall above the national average of prevalence of obesity and 15 states below the national average in prevalence of obesity.

On the other hand, the prevalence of urban obesity is highest in Punjab (17%) followed by Delhi (10.7%) and Haryana (10%). Other states like Gujarat, Himachal Pradesh, Goa, Jammu and Kashmir and Karnataka have a higher prevalence of urban obesity than the national level. However, the states of Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, Orissa, West Bengal all the North Eastern States, Maharashtra and all the South Indian states except Karnataka shows lower prevalence of urban obesity than national average. Looking at the rural area, Delhi again shows the highest prevalence of rural obesity of 6.7% followed by Punjab (6.2%) and Kerala (3.8%). Other states which fall above the national average of rural obesity are Jammu and Kashmir, Himachal Pradesh, Haryana, Uttar Pradesh, Gujarat, Goa, Tamil Nadu, Sikkim, Tripura and Assam. However, the states below the national average of rural obesity are Rajasthan, Madhya Pradesh, Bihar, Orissa, West Bengal, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Maharashtra, Andhra Pradesh and Karnataka. Thus, there are 13 states which fall below the national average of prevalence of rural obesity and 13 states fall above the national average.

The prevalence of overweight also shows similar pattern as obesity. Overall, state wise, Delhi has the highest prevalence of overweight (26%) followed by Punjab (22%), Kerala (17%) and Goa (17%). Other states having higher prevalence of overweight than national level are Jammu and Kashmir, Himachal Pradesh, Haryana, Gujarat, Maharashtra all the Southern States and Sikkim. However, the states like Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar, Orissa, West Bengal and North-Eastern States (except Sikkim) fall below the national average in the prevalence of overweight.

In urban India, pattern of prevalence of overweight are found almost similar to the pattern of prevalence of urban obesity. Fourteen states fall above the national average whereas 12 states are below the national average. States like West Bengal and Tripura which fall below the national average in case of urban obesity now falls above the national average of urban overweight. Similarly in case of rural India, pattern of prevalence of overweight is found almost similar to the pattern of rural obesity. In total, 14 states fall above the national level in the prevalence of rural overweight and rest of the states fall below the national level.

Mean Body Mass Index (BMI) in the states of India by residence: Table 2 shows the mean Body Mass Index (BMI) among ever-married women age 15-49 years in the

Table 1: Prevalence of overweight and obesity among women^a in the states of India by residence, 1998 to 99^b

India/States	Overweight (25.0≤BMI<30.0)			Obesity (BMI≥30.0)			No. of women
	Urban	Rural	Total	Urban	Rural	Total	
Delhi	25.8	22.0	25.6	10.7	6.7	10.4	1949
Punjab	29.2	19.0	22.2	17.3	6.2	9.6	2355
Gujarat	19.5	5.9	11.7	9.3	2.6	5.4	3128
Goa	20.5	14.6	17.0	7.3	3.2	4.9	1028
Kerala	20.5	16.4	17.4	5.8	3.8	4.3	2390
Haryana	25.9	7.8	13.0	10.0	1.8	4.2	2453
Uttar Pradesh	14.8	3.9	6.2	6.0	3.2	3.8	5224
Jammu and Kashmir	23.8	7.2	10.9	8.4	1.9	3.3	2269
Maharashtra	17.6	3.5	9.3	6.3	1.1	3.2	4354
Karnataka	21.1	5.9	11.3	7.6	0.9	3.2	3555
Tamil Nadu	20.2	8.0	12.2	5.6	1.8	3.1	3921
India	18.2	5.1	8.6	6.5	1.7	3.0	70520
Sikkim	25.0	11.5	13.4	2.3	3.1	3.0	905
Andhra Pradesh	20.7	6.9	10.4	5.9	1.4	2.6	3358
Assam	11.5	2.9	3.7	2.6	2.5	2.5	2676
Himachal Pradesh	24.5	10.1	11.4	9.1	1.8	2.5	2598
Tripura	18.4	3.1	6.4	1.0	2.3	2.1	902
Rajasthan	14.0	3.0	5.8	5.2	0.8	1.9	5120
Madhya Pradesh	13.0	2.4	5.2	4.4	0.9	1.8	5469
West Bengal	18.8	3.5	7.2	5.5	0.3	1.6	3574
Manipur	15.5	7.1	9.9	1.5	1.2	1.3	1202
Meghalaya	7.4	3.5	4.4	3.7	0.6	1.2	653
Arunachal Pradesh	7.3	4.3	4.8	0.0	1.4	1.2	912
Orissa	11.2	3.0	3.9	2.7	0.7	0.9	3618
Bihar	8.2	2.8	3.4	2.5	0.6	0.9	5395
Nagaland	13.9	6.1	7.8	1.5	0.6	0.8	632
Mizoram	6.6	2.9	4.9	0.9	0.5	0.7	880

^aThis table and all subsequent tables refers to ever-married women age 15-49 years. This table and all subsequent tables excludes women who were pregnant at the time of survey and those with a birth in the last 2 months preceding the survey. The states has been ranked according to the prevalence of total obesity

Table 2: Mean Body Mass Index (BMI) among women in states of India by residence, 1998 to 99

India/States	Mean BMI		
	Urban	Rural	Total
Delhi	24.2	24.4	24.2
Punjab	25.3	22.3	23.2
Sikkim	22.8	22.3	22.4
Kerala	22.8	22.0	22.2
Goa	22.5	21.1	21.7
Haryana	23.6	20.4	21.3
Tamil Nadu	22.8	20.4	21.2
Manipur	21.6	20.8	21.1
Arunachal Pradesh	20.9	21.1	21.1
Jammu and Kashmir	23.4	20.4	21.1
Gujarat	22.9	19.6	21.0
Nagaland	21.6	20.7	20.9
Himachal Pradesh	23.5	20.6	20.9
Tripura	21.6	20.3	20.6
Karnataka	22.6	19.4	20.5
Mizoram	21.1	19.9	20.5
Andhra Pradesh	22.6	19.7	20.4
India	22.4	19.7	20.4
Meghalaya	21.1	20.2	20.4
Maharashtra	22.0	19.1	20.3
Assam	21.6	20.0	20.1
Madhya Pradesh	21.3	19.7	20.1
Uttar Pradesh	21.9	19.5	20.1
Rajasthan	21.5	19.4	19.9
West Bengal	22.4	19.0	19.8
Bihar	20.9	19.4	19.6
Orissa	20.8	19.1	19.3

The states has been ranked according to the prevalence of total mean BMI

states of India by residence. Overall, the mean BMI for ever-married women in India is 20.4 whereas it is quite

higher in urban area (22.4). However, in rural area it is slightly lower than the national average (19.7). The distribution of mean BMI by residence in the states of India shows that the total and rural mean BMI is highest in Delhi. However, mean BMI in urban area is highest in Punjab. West Bengal shows the lowest level of mean BMI for rural area. The range from low to high mean BMI is significantly higher which indicates a significant differential in the nutritional status of women across the states of India.

Prevalence of overweight and obesity among ever married women in India according to their socio-economic and demographic status: Table 3 shows the prevalence of overweight and obesity among ever-married women in India according to age, residence, education, religion, ethnicity, occupation, standard of living and migration streams. Age wise significant differentials are found. The <2% women are found to be obese in <30 years of age compared to about 5% in age 40 years and above. Similarly, 3-6% women are overweight in the 20-29 age group whereas about 14% women are overweight in the age 40 years and above. The finding commensurate with a Morocco study by Bour where level of obesity increased from 2.2% among women in the age group 20-25 years to 28.6% among women in 45-49 age group.

Significant differences in overweight and obesity condition of women are found according to place of

Table 3: Prevalence of overweight and obesity among women according to background characteristics, India, 1998 to 99

Background characteristics	Overweight	Obese	No. of women
Age in years			
15-19	1.4	1.1	2841
20-24	2.7	1.2	10723
25-29	5.8	1.7	14556
30-34	9.0	2.9	13234
35-39	11.4	3.9	11755
40-44	13.4	4.7	9642
45-49	14.4	5.4	7408
Residence			
Urban	18.2	6.5	18880
Rural	5.1	1.7	51360
Types of place of residence			
Capital/Large city	22.7	9.1	4771
Small city	18.0	6.7	5621
Town	15.8	5.0	8410
Country side	5.1	1.7	51360
Education			
Illiterate	4.3	1.6	40990
Literate, <middle school complete	10.6	3.5	13935
Middle school complete	13.8	4.1	5575
High school complete and above	21.1	7.5	9649
Religion			
Hindu	7.9	2.7	57580
Muslim	9.8	3.4	8450
Christian	14.7	4.0	1797
Sikh	23.4	9.0	1185
Buddhist	7.7	2.6	571
Jain	26.2	10.9	256
Others	5.6	2.2	321
Ethnicity			
Scheduled caste	5.0	1.9	12877
Scheduled tribe	2.9	1.2	5930
Other backward class	8.0	2.4	22945
Others	12.2	4.4	27814
Occupation			
Not working	10.7	3.9	41971
Professional/Technical/Managerial	20.6	7.2	1703
Clerical/Sales	17.9	4.9	1387
Labour	3.7	1.1	24168
Household worker	8.8	1.0	707
Standard of living index			
Low	2.2	1.0	22451
Medium	7.3	2.2	32453
High	21.5	7.8	14468
Migration stream			
Rural to rural	4.7	1.7	39826
Rural to urban	14.6	4.2	7191
Urban to rural	10.3	2.6	3731
Urban to urban	21.7	8.7	8065
Total percent	8.6	3.0	-
No. of women	6066.0	2097.0	70160

residence. The <2% women are obese in rural area compared to 7% in urban area. Similarly, 5% women are overweight in rural area compared to 18% in urban area. Further, a significant variation in overweight and obesity is found within the urban area according to town small city and large or capital city. Prevalence of obesity is found to be 9% in large city compared to 7% in small city and 5% in town. Similarly, prevalence of overweight is found to be 23% in large city compared to 18% in small city and 16% in town. Urbanisation seems to play an

important catalyst in the growing prevalence of overweight and obesity by effecting the lifestyle pattern and junk food habits among the urban residents.

A significant variation in overweight and obesity are also found according to educational status of women. The <2% illiterate women are found to be obese compared to 8% among women who have completed high school and above education. Similarly, only 4% illiterate women are found to be overweight compared to 14% with middle school complete and further 21% with high school complete and above. This finding is contradictory compared to finding from developed countries where an inverse relationship is found between obesity and educational status. In a Morocco study by Bour a higher proportion of illiterate and low educational status women were found obese compared to women having a secondary school education and post-secondary education.

A significant variation is found in the prevalence of overweight and obesity by religion. Jain women are found to be most obese (11%) and overweight (26%) followed by Sikh women. However, Hindu women and women belonging to other religion are found to be least obese and overweight. It may be because of the differential in their food habits.

Ethnicity wise differentials in obesity and overweight are found among women. Women belonging to other castes are found to be most obese and overweight (4 and 12%, respectively) followed by other backward class and scheduled caste women. However, scheduled tribe women are found to be least overweight and obese.

A significant differential in the overweight and obesity condition among women is also found according to their occupational status. Women working in professional/technical or managerial jobs are found to be most obese (7%) and overweight (21%) followed by women working in clerical/sales job (5 and 18%, respectively). However, only 1% women working as household workers or labourer are found to be obese. Different occupation involves different level of physical activities. Jobs like professional/technical or managerial and clerical or sales needs relatively lower physical activity level than the labourer or household workers. Thus, occupational differential in obesity indirectly illustrate that physical activity level is inversely associated with the obesity and overweight.

Standard of living index of the household also shows significant differences in the prevalence of overweight and obesity. Higher the standard of living, higher the prevalence of overweight and obesity is found. About 8% women belonging to high (SLI) Standard of Living are

obese compared to only 2% among medium standard of living households and 1% among low SLI. Similarly, 22% women belonging to higher standard of living households are overweight, compared to 7% in the medium standard of living and 2% in the low standard of living households. Standard of living index is computed by the different household amenities and facilities available in the house. Higher standard of living may indirectly affect the level of physical activities among the women. Moreover, women belonging to higher standard of living households might be consuming more junk foods and adopting the sedentary life style more because of being affluent.

Migration has also shown significant differences in the prevalence of overweight and obesity among women in India. Migration is associated with several socio-cultural characteristics of the place of origin. Also, the migrants get influenced by the socio-cultural milieu of the place of destination. It is seen that the prevalence of overweight and obesity significantly differs according to the stream of migration. Among the women who migrated from urban to urban area, prevalence of obesity is found to be 9% whereas in case of women migrating from urban to rural area it is <3%. On the other hand, prevalence of obesity is found to be <2% among women migrating from rural to rural area which increases to >4% if women migrate from rural to urban area. A similar pattern was also found in the prevalence of overweight among women according to stream of migration. About 22% women migrating from urban to urban area are found to be overweight compared to 10% if migrating from urban to rural area. About 15% women migrating from rural to urban area are found to be overweight compared to 5% if migrating from rural to rural area.

Prevalence of overweight and obesity among women according to their food habits: Diet has been considered as an important risk factor for obesity. Large-scale epidemiological studies on diet and obesity have been performed in many countries. With respect to the frequency of meals, it has been reported that the prevalence of obesity rises as the frequency of meals decreases. However, this issue does not yet seem to have been settled because some other studies has come to the opposite conclusion. The large-scale surveys performed in various parts of Europe and United States has demonstrated that the body weight increases as the total dietary calorie intake increases. In large-scale surveys like National Health and Nutrition Examination Surveys (NHANES) performed in the United States and other surveys performed in Germany, Scotland and Denmark, the BMI was higher in the high fat diet group than in low fat diet group. Distinct feature of Indian diet is the high

intake of dairy products and added sugar (Popkin *et al.*, 2001). In many ways this seems to be an inexorable shift to the higher fat Western diet reflected in a large proportion of the population consuming over 30% of energy from fat. According to Dr. Walter Willett, Chairman, Department of Nutrition, Harvard University, a major source of edible oil in India, Dalda, a vegetable ghee has trans fatty acid levels of about 50%.

In this study, the prevalence of overweight and obesity among women is seen according to food habit and frequency of intake of specific food items shown in Table 4. Women who consume vegetarian diet were found to be more obese (4%) and overweight (11%) than women consuming non-vegetarian diet (2.5% obese and 8% overweight). It may be because of the fact that vegetarian people may consume more fatty foods and dairy products.

Further, looking at the consumption of milk or curd, it is again evident that more the frequency of intake,

Table 4: Prevalence of overweight and obesity among women according to food habits and frequency of intake of specific food items, India, 1998 to 99

Food habits/Frequency of intake	Overweight	Obese
Food habits		
Vegetarian	10.8	3.9
Non-vegetarian	8.2	2.5
Intake of vegetarian food items (Mild or curd)		
Daily	13.2	4.4
Weekly	7.8	2.5
Occasionally	5.5	1.8
Never	5.6	1.7
Pulses or beans		
Daily	11.1	3.6
Weekly	7.5	2.4
Occasionally	5.6	2.3
Never	7.9	3.6
Green leafy vegetables		
Daily	9.8	3.3
Weekly	8.5	2.7
Occasionally	7.6	2.5
Never	5.3	3.4
Other vegetables		
Daily	9.8	3.2
Weekly	8.0	2.5
Occasionally	5.5	2.7
Never	3.3	2.2
Fruits		
Daily	20.8	8.2
Weekly	12.2	3.7
Occasionally	6.0	1.9
Never	3.0	1.2
All the above vegetarian items daily	23.3	9.5
Intake of non-vegetarian food items (Eggs)		
Daily	16.0	5.0
Weekly	10.6	3.1
Occasionally	6.4	2.1
Never	10.2	3.6
Chicken/Meat/Fish		
Daily	15.2	3.9
Weekly	9.8	2.8
Occasionally	5.7	2.0
Never	10.9	4.0

among women. The <4% women are obese and about 13% are overweight among those who consumes milk or curd daily as compared to <2% obese who consumes these dairy items occasionally or never.

On the other hand, a mixed pattern of prevalence of obesity or overweight is seen according to the consumption of pulse or beans. More the frequency of intake of pulse or beans, prevalence of obesity or overweight is found to be more among women. Women who never consume pulse or beans also found to be more obese or overweight compared to women who consumes weekly or occasionally. It may be because of the facts that women who never consume pulse or beans might be consuming non-vegetarian items more. An almost similar situation is apparent in case of consumption of non-vegetarian items like eggs or meat or fish in prevalence of obesity and overweight among women. Women consuming non vegetarian items either more frequently or never are more obese and overweight. This may be due to the fact that women who never consume non-vegetarian items might be consuming fatty as well as dairy products more frequently. It is also a very much common practice in India that vegetarian people consume more fatty as well as dairy products as a substitute of non-vegetarian diets.

When the daily consumption pattern of all the vegetarian items like milk or curd, pulse or beans, green leafy as well as other vegetables and fruits was considered it is found to be significantly among obese women (10%) or overweight women (23%). Thus, higher amount of calories intake (more than the requirement) extensively aggravates the overweight or obesity among women.

General and maternal health status of women according to level of BMI: The importance of obesity as a risk factor for a number of diseases including Type 2 diabetes, cardiovascular disease, hypertension, gallstones and certain cancers is well documented (WHO, 1998). Obesity or significant overweight can contribute to many problems in women's reproductive system like prolonged or heavy periods, menstrual pain, delayed ovulation, mid cycle spotting, short luteal phase, premenstrual spotting, premenstrual syndrome, infertility, amenorrhea, fibroids/tumors of uterus, breast cancer, endometrial cancer, ovarian cancer, uterine prolapse, etc. Several studies in India have related overweight conditions with diabetes, hypertension, and heart disease (Misra *et al.*, 2001; Gopinath *et al.*, 1994).

In the present study an attempt has also been made to look into the health status of women by some of the important health parameters. Table 5 shows the general and maternal health status of women according to level of

Table 5: General and maternal health status of women according to level of BMI, India, 1998 to 99

General and maternal health status	Under weight	Normal	Over weight	Obese
Asthma ^{1***}	2675.0	2022.0	2780.0	3641.0
Ever had a terminated pregnancy***	18.6	19.9	25.3	26.5
Ever had a still birth*	6.2	5.9	5.5	5.3
Spontaneous abortion***				
At least one spontaneous abortion	8.3	8.4	9.3	10.0
Two or more spontaneous abortion	2.9	3.3	3.6	4.6
Induced abortion***				
At least one induced abortion	2.7	3.9	7.3	7.4
Two or more induced abortion	0.6	1.1	2.6	2.7
Last birth caesarean***	13.7	18.5	30.9	35.3

¹Prevalence per 10,000 population; Chi-square significance level ***p<0.001,*p<0.1

BMI. Prevalence of asthma was found to be significantly higher among obese women (3641/100000) than overweight (2780) and normal (2022) women.

Maternal health status is seen as experience of terminated pregnancy, still birth, spontaneous abortion, induced abortion and last birth caesarean. Almost all the maternal health problems are also found to significantly higher among obese women. About >25% of overweight or obese women ever had a terminated pregnancy compared to <20% of normal and even underweight women. Also, at least one as well as two or more spontaneous abortion is found significantly higher among women with higher BMI. Induced abortion also is found significantly higher among women with higher BMI. About 10% of obese or overweight women have experienced induced abortion compared to 5 or <5% of normal and underweight women. Caesarean delivery which indirectly shows complication in pregnancy is also found to be significantly higher among obese women followed by overweight and normal women. About 35% of obese women have last birth caesarean section compared to 31% among overweight women and 19% of normal women.

Logistic regression results for overweight and obesity among women: In order to see the independent effect of each socio-economic and demographic component on the prevalence of obesity and overweight among women, logistic regression analysis was carried out. Table 6 shows the logistic regression results showing the adjusted effects of selected socio-economic demographic, health and dietary factors on overweight and obesity among women in India. The likelihood of overweight or obesity significantly increases with higher age, education, household standard of living, number of induced and spontaneous abortion, presence of asthma and frequency of intake of specific food items. However, the likelihood of obese/overweight decreases among rural residents and scheduled caste women.

Table 6: Logistic regression results showing adjusted effects (odds ratios) for overweight and obese women according to selected socio-economic, demographic and health status, India, 1998 to 99

Socio-economic/Demographic/Health status	Odds ratios	p-value
Age	1.349***	0.000
Residence		
Urban [®]	-	-
Rural	0.519***	0.000
Education		
Illiterate [®]	-	-
Literate, <middle school complete	1.430***	0.000
Middle school complete	1.621***	0.000
High school complete and above	1.798***	0.000
Religion		
Hindu [®]	-	-
Muslim	1.262***	0.000
Christian	1.051	0.425
Sikh	1.912***	0.000
Buddhist	1.418***	0.003
Jain	1.303*	0.078
Others	0.866	0.378
Ethnicity		
Scheduled caste [®]	-	-
Scheduled tribe	0.653***	0.000
Other backward class	1.113**	0.022
Others	1.159***	0.001
Occupation		
Not working [®]	-	-
Professional/Technical/Managerial	0.947	0.366
Clerical/Sales	0.994	0.935
Labour	0.670***	0.000
Household worker	0.978	0.865
Standard of living index		
Low [®]	-	-
Medium	1.634***	0.000
High	2.818***	0.000
Induced abortion		
No [®]	-	-
At least one induced abortion	1.177***	0.002
Two or more induced abortion	1.364***	0.001
Spontaneous abortion		
No [®]	-	-
At least one spontaneous abortion	1.104**	0.026
Two or more spontaneous abortion	1.134*	0.062
Asthma		
No [®]	-	-
Yes	1.267***	0.004
Intake of milk or curd		
Not daily [®]	-	-
Daily	1.224***	0.000
Intake of chicken/Meat/Fish		
Not daily [®]	-	-
Daily	1.288***	0.000
Constant	0.028	0.000

[®]Reference category; *p<0.1; **p<0.05; ***p<0.01

Age is found to be an important factor. Higher is the age, greater is the chance to become obese or overweight. The likelihood of overweight or obesity among women with high school and above education is about 1.8 times more than illiterate women. Standard of living also has significant impact on overweight or obesity status of women. The likelihood of overweight or obesity is found to be one and half times more among women belonging to a medium SLI and further almost three times higher among women belonging to a high SLI with reference to women

belonging to a low SLI. On the other hand, the likelihood of overweight and obesity significantly decreases to almost half times among women residing in rural area with reference to women residing in urban area. Occupational differences also persist in the prevalence of obesity/overweight among women. The likelihood of overweight and obesity decreases among women working as labourer with reference to not working women.

Further, religious and ethnic backgrounds of women are also found to be an important factor. Women belonging to Sikh religion are almost two times more likely to be overweight or obese with reference to Hindu women. In addition, women from other caste are more likely and scheduled tribes are less likely to be overweight or obese with reference to scheduled caste women.

Considering health parameters, presence of asthma aggravates the likelihood of overweight and obesity among women. Looking to the abortion of both spontaneous and induced its occurrence as well as repetition enhances the likelihood of overweight and obesity among women. It may also be vice-versa, i.e. because of overweight and obesity condition of women, health problems like asthma and abortion may occur.

The effect of dietary habits on overweight and obesity are also apparent. The likelihood of overweight and obesity is found to be significantly higher among women who consume milk or curd daily with reference to women who does not consumes daily. Similarly likelihood of overweight and obesity is found to be significantly higher among women who consume chicken/meat or fish daily with reference to its counterparts.

CONCLUSION

The prevalence of overweight and obesity among married women in India has reached an alarming state. In India, 11% women were found to be overweight and obese during 1998 to 99 (NFHS-2) which increased to 15% during 2005 to 2006 (NFHS-3). In case of urban overweight or obesity the condition has been worsen as the prevalence went up from 25-29% in NFHS-3. Also, the condition of overweight and obesity among women in rural India is on rise which has increased from 7-9% during NFHS-3.

A majority of the states are above the national average of overweight or obesity. The prevalence of rural as well as total overweight and obesity is found to be highest in the state of Delhi. However, the state of Punjab shows the highest prevalence of urban overweight and obesity. An almost similar pattern emerges in the case of mean BMI. The range of mean BMI is significantly wider which indicates a differential in the nutritional status of

women in the states. Also, the prevalence of overweight and obesity varies with the background characteristics of women like age, ethnicity, religion, occupational status, household standard of living and dietary habits of the women which are also found statistically significant. The adverse health outcomes like asthma induced and spontaneous abortion and caesarean birth are positively associated with overweight and obesity condition of women. Several general and reproductive health problems were found significantly higher among overweight and obese women compared to normal women.

There is an urgent need to recognize the gravity of this emerging health problem and incorporate obesity in the general health system. Obese women should be given special attention by health providers and policy makers. In the era of growing urbanisation and migration, the traditional focus on under nutrition among women in India should be expanded to encompass all aspects of malnutrition which includes over nutrition, i.e., overweight and obesity. A healthy lifestyle should be promoted to tackle this emerging health threat. Immediate efforts are needed at a national level to control this problem among women in India.

ACKNOWLEDGEMENTS

Researchers are thankful to Vinod Mishra, Tim Dyson and Late P.N. Mari Bhat for useful comments on an earlier draft. An earlier version of this study was presented at the IUSSP Asia-Pacific Regional Population Conference at Bangkok, June 10-13, 2002.

REFERENCES

- Agrawal, P. and V. Mishra, 2004. Covariates of overweight and obesity among women in North India. East West Center Working Papers, Population and Health Series, No. 116.
- Ajlouni, K., H. Jaddou and A. Batieha, 1998. Obesity in Jordan. *Int. J. Obesity Relat. Metab. Disorders*, 22: 624-628.
- Bell, A.C., K. Ge and B.M. Popkin, 2002. The road to obesity or the path to prevention: Motorized transportation and obesity in China. *Obesity Res.*, 10: 277-283.
- Drewnowski, A. and B.M. Popkin, 1997. The nutrition transition: New trends in the global diet. *Nutr. Rev.*, 55: 31-43.
- Flegal, K.M., M.D. Carroll, R.J. Kuczmarski and C.L. Johnson, 1998. Overweight and obesity in the United States: Prevalence and trends, 1960-1994. *Int. J. Obes. Relat. Metab. Disord.*, 22: 39-47.
- Ge, K., 1997. Body mass index in young Chinese adults. *Asia Pacific J. Clin. Nutr.*, 6: 175-179.
- Gopalan, C., 1998. Obesity in the Indian Urban middle class. *Bull. Nutr. Found. India*, 19: 1-5.
- Gopinath, N., S.L. Chadha, P. Jain, S. Shekhawat and R. Tandon, 1994. An epidemiological study of obesity in adults in the urban population of Delhi. *J. Assoc. Physicians India*, 42: 212-215.
- IIPS and ORC Macro, 2000. National Family Health Survey (NFHS-2), 1998-99: India. International Institute for Population Sciences, Mumbai.
- Kadiri, A., 2000. Determinants of obesity. *Cahiers du Medecin*, 3: 7-8.
- Keys, A.K., F. Fidanza, M.J. Karvonen, N. Kimura and H.L. Taylor, 1972. Indices of relative weight and obesity. *J. Chronic. Dis.*, 25: 329-343.
- Maillard, G., M.A. Charles, N. Thibult, A. Forhan, C. Sermet, A. Basdevant and E. Eschwege, 1999. Trends in the prevalence of obesity in the French Population between 1980 and 1991. *Int. J. Obesity Relat. Metab. Disorders*, 23: 389-394.
- Misra, A., R.M. Pandey, J.R. Devi, R. Sharma, N.K. Vikram and N. Khanna, 2001. High prevalence of diabetes, obesity and dyslipidaemia in urban slum population in northern India. *Int. J. Obesity Relat. Metab. Disorders*, 25: 1722-1729.
- Pinstrup-Andersen, P. and R. Pandya-Lorch, 2001. Emerging food and agriculture concerns in the developing world. Proceedings of an International Conference on Sustainable Food Security for All by 2020, September 4-6, 2001, Bonn, Germany, pp: 28-30.
- Pishdad, G.R., 1996. Overweight and obesity in adults aged 20-74 in Southern Iran. *Int. J. Obesity Relat. Metab. Disorders*, 20: 963-965.
- Popkin, B.M., 2001. Nutrition in transition: The changing global nutrition challenge. *Asia Pacific J. Clin. Nutr.*, 10: S13-S18.
- Popkin, B.M., 2002. The shift in stages of the nutritional transition in the developing world differs from past experiences. *Public Health Nutr.*, 5: 205-214.
- Popkin, B.M., S. Horton, S. Kim, A. Mahal and J. Shuigao, 2001. Trends in diet, nutritional status and diet-related non-communicable diseases in China and India: The economic costs of the nutrition transition. *Nutr. Rev.*, 59: 379-390.
- Prescot-Clark, P. and P. Primates, 1998. Health survey for England 1996. The Stationery Office, London.
- Schneider, D., 2000. International trends in adolescent nutrition. *Social Sci. Med.*, 51: 955-967.
- Shetty, P.S. and W.P.T. James, 1994. Body mass Index-a measure of chronic energy deficiency in adults. Food and Nutrition Paper No. 56, Food and Agricultural Organization, Rome, Italy.

- WHO, 1998. World Health Report: Life in 21st Century: A Vision for All. WHO, Geneva, Switzerland.
- WHO, 2000. International Association for the Study of Obesity (IASO) and International Obesity Task Force (IOTF). The Asia-Pacific Perspective: Redefining Obesity and Its Treatment. World Health Organization, Geneva, Switzerland.
- WHO, 2002. The world health report 2002: Reducing risks, promoting healthy life. World Health Organization, Geneva, Switzerland.
- WHO, 2003. Diet nutrition and the prevention of chronic diseases. Report of a joint WHO/FAO expert consultation. Technical Report Series No. 916, World Health Organization, Geneva, Switzerland.
- Walker, A.R., F. Adam and B.F. Walker, 2001. World pandemic of obesity: The situation in Southern African populations. *Public Health*, 115: 368-372.
- Yoshiike, Y., M. Matsumura, M.M. Zaman and M. Yamaguchi, 1998. Descriptive epidemiology of body mass index in Japanese adults in a representative sample from the National Nutrition Survey 1990-1994. *Int. J. Obes. Relat. Metab. Disord.*, 22: 684-687.
- Zargar, A.H., S.R. Masoodi, B.A. Laway, A.K. Khan, A.I. Wani, M.I. Bashir and S. Akhtar, 2000. Prevalence of obesity in adults-An epidemiological study from Kashmir valley of Indian subcontinent. *J. Assoc. Phys. India*, 48: 1170-1174.