Obesity and its association with reproductive outcomes among women in India

Introduction

As per the World Health Organization (WHO), there will be 2.3 billion overweight people aged 15 years, and over 700 million obese people worldwide in 2015 (WHO, 2012). It is a major contributor to the global burden of chronic disease, disability and premature death. Historically, most populations suffering from obesity resided in high-income, industrialized countries (Caballero, 2007). However, in the recent times, the most dramatic increases in the prevalence of overweight or obesity are seen in low-income countries (Prentice 2006; WHO, 2011). In low-income countries, overweight and obesity often coexist with under-nutrition (Mendez, Monterio and Popkin, 2005). In India, more than 30 million of people are either overweight or obese (NFHS, 2005-06). The most apparent factors leading to overweight or obesity are excessive intake of energy-dense food, lack of physical activity and sedentary life style (Prentice, 2006; Sinha and Kapoor, 2010). Type 2 diabetes mellitus, cardiovascular diseases (CVD), hypertension and heart diseases are the common chronic co-morbidities associated with overweight or obese health condition (Misra, Chowbey and Makkar *et al.*, 2009; Chan and Woo, 2010). In addition, in number of studies it is evident that, the level and risk factors of overweight or obesity significantly differ for men and women. In 138 of 194 countries for which the WHO reports obesity statistics, women are more than 50% more likely to be obese (WHO Global InfoBase: Obesity and Overweight, available online at *http://www.who.int/topics/obesity/en/*). Similar pattern is also observed in low-middle income countries. In South Africa, the prevalence of overweight or obesity is substantially higher for women than men (Case and Menendez, 2009). In India, more than 15 percent of women are either overweight or obese whereas only one tenth of men report this health condition (NFHS, 2005-06). Childhood and adult poverty, depression and attitudes about obesity were found as some of the potential factors for this vast difference in the prevalence of overweight or obesity between women and men (Case and Menendez, 2009).

Considering the high prevalence of overweight or obesity among women, number of studies examined the health consequences central to women only. In 2008, in New Zealand, 49 percent of women who had stillborn babies and 45 percent of mothers of neonatal deaths were attributed

due to their overweight or obese condition (PMMRC's latest report for the year July 2009 to June 2010). Another study from Australia evidently reported that, women with high gestational weight gain (GWG), are more likely to have short and long term negative health outcomes for maternal and child health and highlight the need for prevention (Willcox et al., 2012). Similarly, a study conducted in United States found that, obesity is associated with early puberty, aberrant menstrual patterns, decreased contraceptive efficacy, ovulatory disorders and increase the miscarriage rate (Lash and Armstrong, 2009). However, studies that have analyzed the adverse reproductive health outcomes among overweight or obese women in South-Asian countries are limited. In a study in India to examine the adverse impact of being overweight or obese on pregnancy, stated that overweight or obese women experience more stillbirths or terminated pregnancies than normal health women (Sudha, Reddy and Reddy, 2009; Agrawal, 2010). Yet, these studies have ignored many other adverse health outcomes which are evident to be prevalent among overweight or obese women during their gestation, motherhood and on pregnancy in western or developed countries.

Need of the study

Physiology of men and women are different. Reproduction is an important aspect of human role and essential for its existence. Thus, birth of a healthy child is believed as fundamental for the child's survival. It is not uncommon that mother's health remains the important determinant for the health of the child at birth. Birth of an under-nourished or low birth weight child to an anemic mother is well established in number of studies. However, pregnancy outcomes of an overweight or obese mother are not or partly understood at different dimensions. In a nutshell, the complications during pregnancy, at delivery or childbirth and problems related to motherhood of an overweight or obese mother is least explored. Moreover, the existing studies conducted on these issues are largely from western or industrialized countries which have least implications in the low-income countries like in India.

With this backdrop, the present study is an attempt to shed light on the level and trend of overweight and obesity in India and its impact on three stages of woman's reproductive life i.e. during her gestation, on pregnancy outcomes and motherhood among ever-married women.

Based on this perspective, the specific objectives for the study are

1) To measure the prevalence of overweight/obesity among women by selected socio-economic and demographic covariates in India.

2) To understand the adverse health impacts during gestation and on its final outcomes among overweight/obese women in India.

3) To examine the effect of being overweight or obesity on secondary infertility among women in India.

Methods

Data Source

National Family Health Survey (NFHS), 2005-06, data is used for the analysis of prevalence of overweight or obesity and its association with gestational problems, pregnancy outcomes and infertility among overweight/obese women in India. NFHS is the Indian version of Demographic Health Survey (DHS) program, which collects, analyze and disseminate accurate and representative data on population, health, HIV and nutrition through more than 300 surveys in over 90 countries. The information is processed and presented in reports and data formats that describe the situation of the relevant country. It incorporates many steps including scientific sampling procedure to ensure that the data properly reflect the situation of the relevant country and that data are comparable across countries (IIPS and Macro International, 2007).

The information based on 49394 ever married women with at least one child in the last five years preceding the survey aged 15-49 years incorporated in the National Family Health Survey (NFHS, 2005-06), is used to analyze the prevalence of overweight/obesity and its association during gestation and on its final outcomes in India.

Further, individual data on 118733 women included in NFHS third round in India is used to estimate secondary infertility among women due to overweight/obese condition. The unit of analysis is woman in the study.

Variables

The variables used in this study can be divided into two categories i.e. outcome and predictor variables.

Outcome Variables

Vaginal bleeding: Excessive vaginal bleeding occurs due to the complication during the pregnancy. Information on this is collected in NFHS and used in this study as an outcome variable.

Leg, body or face swelling: Information on leg, body or face swelling as complication during gestation is collected in NFHS and used in this study.

Stillbirth: Information on whether a woman ever had a pregnancy that ended in stillbirth is collected in the dataset and used in this study.

Caesarean delivery: Information on whether a woman delivered her child through caesarean section or not is collected in NFHS and used in this study as an outcome variable.

Very large or larger than average child: This information is available in NFHS and used in this study to examine the size of the child at birth among mothers with different BMI level.

Overweight child: Weight of child at birth is recorded in NFHS. This information is used to estimate the overweight child at birth. As per the guidelines laid by WHO, a baby weighed more than 3500gm i.e. 3.5 kg is referred as overweight child at birth. Babies weighed below 2500gm and 2500-3500gm are treated as underweight and normal weight at birth respectively. However, this study considered overweight baby at birth, as the only adverse effects on pregnancy outcomes among overweight/obese women in India.

Secondary infertility: Women aged 15-49 years remained married for last five years, with at least one child, non-amenorrheic, no child birth since last five years, menstrual cycle has not resumed since last six months and woman herself says that she can't get pregnant informations are used to estimate secondary infertility in this study.

Predictor variables:

Overweight/Obesity: In NFHS, each ever-married women aged 15−49 years were weighed using a solar-powered scale with an accuracy of ±100 g. Their height was measured using an adjustable wooden measuring board, specifically designed to provide accurate measurements (to the nearest 0.1 cm) in a developing-country field situation. The weight and height data can be used to calculate the body mass index (BMI).

As per the guidelines given by WHO, a BMI of less than 18.5 kg/m^2 is defined as underweight, indicating chronic energy deficiency. BMI in the range of 18.5 and 24.9 kg/m^2 is defined as normal; 25.0 and 29.9 kg/m^2 as overweight and more than 30.0 kg/m^2 as obese (WHO, 1998). Based on these cut-offs, this study used a two-category variable specifying the nutritional status of women, merging underweight and normal indicating as 'not obese' and women with above 25.0 kg/m^2 as overweight or obese. Women who were pregnant at the time of the survey or women who had given birth during the two months preceding the survey are excluded.

Beside this, the survey collected information on a number of demographic and socioeconomic factors which could potentially affect the nutritional status of women. In a nutshell, it collects information on place of residence, age, caste, religion, educational attainment, wealth index, work status and media exposure of the respondents. All these above mentioned information were used to estimate the differentials in the prevalence of overweight or obesity and its association with reproductive outcomes among women in India.

Statistical Analysis

Descriptive statistics and bivariate analysis are carried out to estimate the level and trend of overweight/obesity in India. Further, bivariate and tri-variate analysis are used to understand the socioeconomic and demographic differentials in the prevalence of overweight or obesity in India.

Multivariate analysis in terms of binary logistic regression is done to check the associations of selected socioeconomic and demographic covariates on the prevalence of overweight or obesity and its consequences during gestation, on pregnancy outcomes and secondary infertility among women in India. Binary logistic is used due to the nature of the outcome variables. The outcome variables have two categories namely yes and no (coded as 0 and 1 respectively). The results are presented in the form of odds ratio (OR) with 95% of confidence interval. The odds ratio (OR)

explains the probability that an overweight or obese woman will have the adverse reproductive co-morbidities relative to the probability that a woman with normal BMI will develop the same. In all the analysis, weights are used to restore the representativeness of the sample.

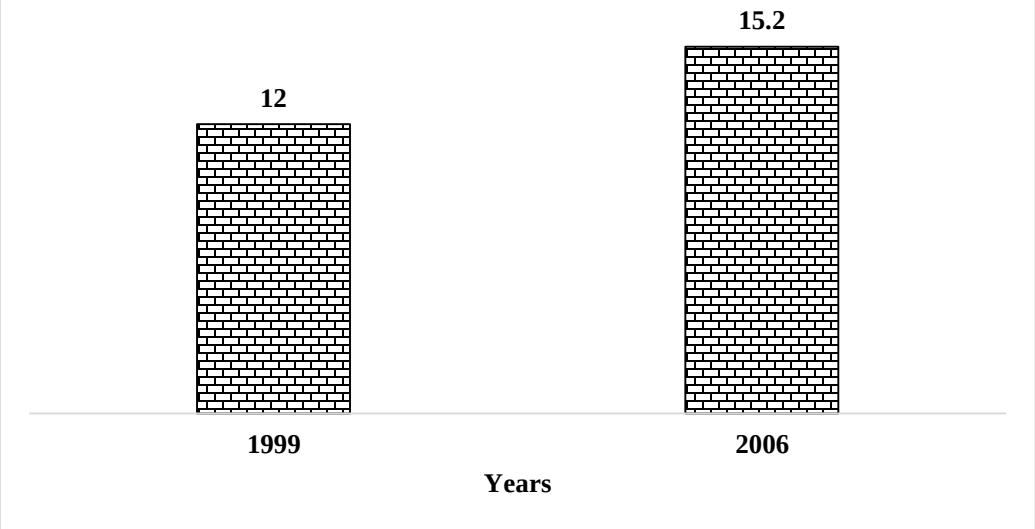
The model is usually put into a more compact form as follows:

$$ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_{1x_1} + \cdots + \beta_{Mx_{m,i}}$$

Where $\beta_{0,\ldots,}\beta_M$ are regression coefficients indicating the relative effect of a particular explanatory variable on the outcome. These coefficients change as per the context in the analysis in the study.

Results

Figure 1. Prevalence of overweight/obesity among women in India



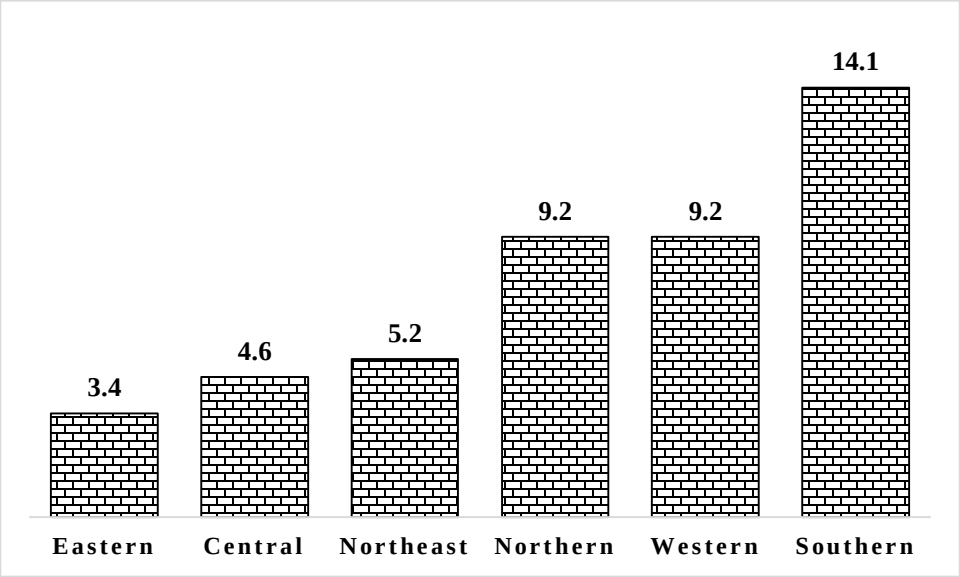
It is evident in Figure. 1 that, the prevalence of overweight/obesity among women is increasing over the years in India. In particular, in 1999, nearly, one tenth (12 percent) of women were overweight/obese which has increased to more than 15 percent in 2006.

Table 1. Level of BMI among ever married women in India, 2005-06

Description	Level
Minimum	12.04
Maximum	59.62
Mean	20.37
Standard deviation	3.46
Coefficient of Variance	11.96
Sample Size	49394

The level of BMI among women is presented in the Table 1. The maximum and minimum level of BMI among women stands at 59.62 and 12.04 respectively in India. Although, the mean value of BMI falls in the normal range, the standard deviation and coefficient of variance shows greater variability in the BMI score, showing the uneven concentration of women in the normal BMI range.

Figure 2. Prevalence of overweight/obesity among women from different regions in India, 2005-06



It is observed in the study that, southern (14 percent) region has the highest prevalence of overweight or obesity followed with Western and Northern (9 percent each) regions. Eastern (3 percent) region records the lowest prevalence of overweight/obesity in India (Figure 2).

Table 2. Prevalence of overweight/obesity by different covariates in India, 2005-06.

Age	Rural	Urban	Total
15-24	1.4	4.5	1.9
25-34	3.9	16.4	7.2
35+	5.0	26.9	9.5
Caste			
[1]SC	2.7	10.1	4.4
[2]ST	1.0	6.3	1.5
[3]OBC	3.7	16.4	6.6
Others	6.2	21.5	11.5
Religion			
Hindu	3.3	16.7	6.4
Muslims	4.7	15.6	8.0
Christian	6.3	20.2	10.9
Others	10.0	22.0	13.2
Education			
No Education	1.9	7.8	2.6
Primary	3.4	10.8	5.0
Secondary	7.1	18.5	11.3
Higher	16.9	34.6	28.8
Wealth Index			
Poorest	0.9	2.9	1.0
Poorer	1.9	6.1	2.3
Middle	3.7	7.2	4.4
Richer	8.9	11.8	10.0
Richest	17.9	28.2	25.1
Work status			
No	4.4	17.0	8.0
Yes	2.7	15.2	4.5
Media Exposure			
No Exposure	1.5	6.6	1.9
Have Exposure	5.3	18.0	9.4
Parity			
First Parity	4.3	16.7	8.0
Second Parity	4.7	19.9	9.1
Third and more	3.0	13.6	4.9

1 Scheduled Caste, 2 Scheduled Tribes, 3 other backward classes

It is evident in the Table 2 that, women aged 35 and above years are more overweight/obese than their counterpart women aged 15-24 years. This pattern is observed across the place of residence in India. Women from upper caste groups have higher proportion of overweight/obesity than women from lower castes. Education and prevalence of overweight/obesity is positively correlated in India. Women with higher education are more overweight/obese than women with no education. However, women from urban area across their educational attainment have higher proportion of overweight/obesity than rural counterpart women.

Furthermore, women from affluent families are more overweight/obese than poor women in India. In urban area, more than one fourth (28 percent) of women from affluent households as compared to only three percent of women from poorest wealth quintile are overweight/obese. Media exposure and prevalence of overweight/obesity is positively associated in the study. Women with media exposure across their place of residence have higher prevalence of overweight/obesity than the referent women without media exposure.

Table 3. Adjusted effects of selected covariates on the prevalence of overweight/obesity in India, 2005-06

Characteristics	India	
	Odds Ratio	95% CI
Age		
15-24®		
25-34	2.196***	1.546-3.120
35+	4.617***	3.148-6.772
Caste		
[1]SCs®		
[2]STs	0.501***	0.378-0.662
[3]OBCs	1.155**	1.003-1.331
Others	1.163**	1.007-1.343
Religion		
Hindu/Hinduism®		
Buddhist	--	--
Muslims/Islam	1.393***	1.225-1.584
Christianity	1.356**	1.038-1.771
Others	1.446***	1.209-1.731
Education		
No Education®		
Primary	1.243**	1.042-1.482
Secondary	1.528***	1.324-1.765
Higher	2.526***	2.100-3.037
Wealth Index		
Poorest®		
Poorer	1.983***	1.480-2.656
Middle	3.342***	2.547-4.385
Richer	6.608***	5.056-8.636
Richest	15.644***	11.924-20.526
Work status		
No®		
Yes	0.885**	0.786-0.997
Media Exposure		
No Exposure®		
Had exposure	1.563***	1.296-1.887
Parity		
First®		
Second	1.266***	1.136-1.411
Third and more	1.245***	1.095-1.416
Constant	0.003	
Pseudo R2	0.1837	

®-Reference group, **p<0.05, ***p<0.01; 1 Scheduled Caste, 2 Scheduled Tribes, 3 other backward classes

The adjusted effects of selected socioeconomic and demographic characteristics on the prevalence of overweight or obesity among women in India is presented in Table 3. Women aged 35 and above years are 4 times more likely to be overweight or obese than their counterpart women aged 15-24 years. Women from upper caste groups (OR: 1.16, CI: 1.01-1.34) are more likely to be overweight or obese than women from lower castes. Women with higher education are 3 times more likely to be overweight or obese than women with no education. Furthermore, women from affluent families are 15 times more likely to be overweight or obese than women from poor households in India. Media exposure and prevalence of overweight or obesity is positively correlated in India. Women with media exposure are more likely to be overweight or obese than their counterpart women without media exposure. In addition, women of higher parities are more likely to be overweight or obese as compared to women of first parity.

Figure 3. Adverse health impacts during gestation among women in India, 2005-06

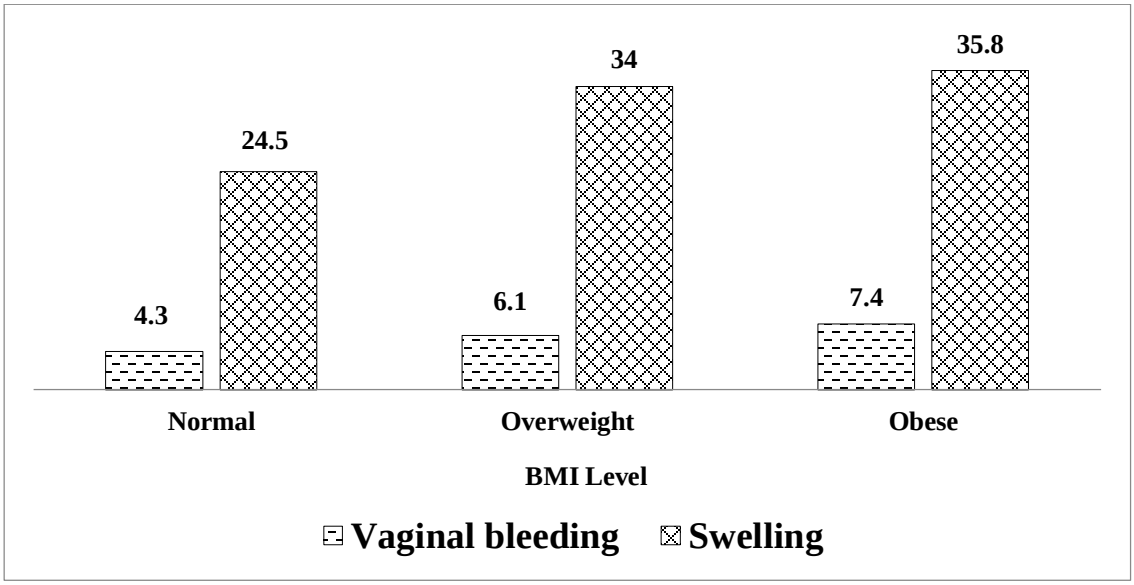


Table 4. Prevalence of adverse reproductive health outcomes among women in India, 2005-06

Characteristics	During pregnancy						Final pregnancy outcomes					
	Vaginal bleeding		Leg, face and body swelling		Stillbirth		Cesarean Delivery		Very large or larger than child		Overweight child	
	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese
Economic condition												
Poor	3.8	3.3	24.1	28.7	16.9	19.4	2.3	8.0	21.9	25.2	8.2	18.7
Non-poor	4.8	6.7	24.9	34.9	18.5	23.4	11.7	30.1	24.8	27.7	7.7	10.1
Religion												
Hindu	4.1	6.4	23.4	33.6	17.4	25.2	7.1	29.2	23.5	27.9	7.6	10.4
Muslims/Islam	4.3	4.1	29.4	35.4	20.2	19.7	4.9	21.0	23.0	26.6	9.0	13.9
Christian	4.8	9.1	30.6	38.8	15.9	11.0	13.4	37.3	24.3	30.8	10.7	9.7
Others	4.3	6.4	25.4	37.3	12.5	11.7	10.0	25.3	18.2	21.5	7.5	2.3
Years of schooling												
Below 10 years	4.9	6.1	24.1	33.0	17.8	22.7	9.6	25.8	25.3	28.8	6.9	10.5
10 and above years	6.3	7.6	28.7	37.9	18.0	23.9	24.1	42.4	24.0	26.3	8.0	9.3
Occupation												
Housewife	4.4	6.3	24.5	34.1	17.8	22.0	8.6	28.3	23.5	27.6	7.4	10.6
Working outside home	4.1	6.5	24.5	35.1	17.6	27.0	4.4	25.6	23.0	26.5	9.0	10.3
Age at first birth												
Below 19 years	3.9	5.0	23.9	29.2	16.7	22.9	3.8	15.3	23.1	28.1	8.4	13.3
20 and above years	4.9	7.0	25.4	36.7	19.4	23.1	11.9	33.8	23.7	27.0	7.4	9.7
Parity												
First Parity	4.9	7.0	27.9	38.8	14.9	20.6	12.7	38.3	24.1	29.2	7.0	10.0
2-3 Parity	4.5	6.6	22.5	33.9	17.9	25.1	6.5	27.4	24.0	27.2	7.7	10.2
3 and above	3.6	4.4	24.7	27.5	19.6	23.2	1.3	6.0	21.3	24.0	12.3	16.0
Media exposure												
No exposure	3.6	5.2	24.0	36.4	16.9	19.5	2.0	8.9	20.7	28.9	9.3	19.3
Had exposure	4.6	6.5	24.8	34.1	18.1	23.4	9.5	29.6	24.7	27.2	7.6	10.2

It is evident in Figure 3 that, as the BMI level shift towards obese condition, women experience more vaginal bleeding and leg, body and face swelling during their gestational period. In particular, only four percent of women with normal BMI as compared to more than seven percent of obese women experience excessive vaginal bleeding during pregnancy in India. Further, one fourth of normal BMI women reports leg, body and face swelling during pregnancy which has increased to more than 35 percent among obese women.

Women's economic condition and prevalence of adverse reproductive outcomes is positively associated in the study. Women from affluent households experience more adverse reproductive outcomes during gestation and at final outcomes of pregnancy than their counterpart poor women. Nevertheless, overweight/obese women from affluent families have higher proportion of adverse reproductive health outcomes than the referent poor women in India. Women with 10 and above years of schooling reports more adverse reproductive health outcomes than the women with below 10 years of schooling. Overweight/obese women across their work status have higher prevalence of adverse reproductive health outcomes than the normal BMI women. Overweight/obese women given first childbirth across ages experience more adverse reproductive health outcomes than the women with normal BMI. However, overweight/obese women given first childbirth aged 20 and above years reports more vaginal bleeding and leg, body and face swelling during pregnancy and stillbirth and caesarean deliveries than their counterpart who have given first childbirth below 19 years. Overweight/obese women of first parity reports more vaginal bleeding, leg, face and body swelling, stillbirth, caesarean deliveries and very large or larger than average child at birth (Table 4).

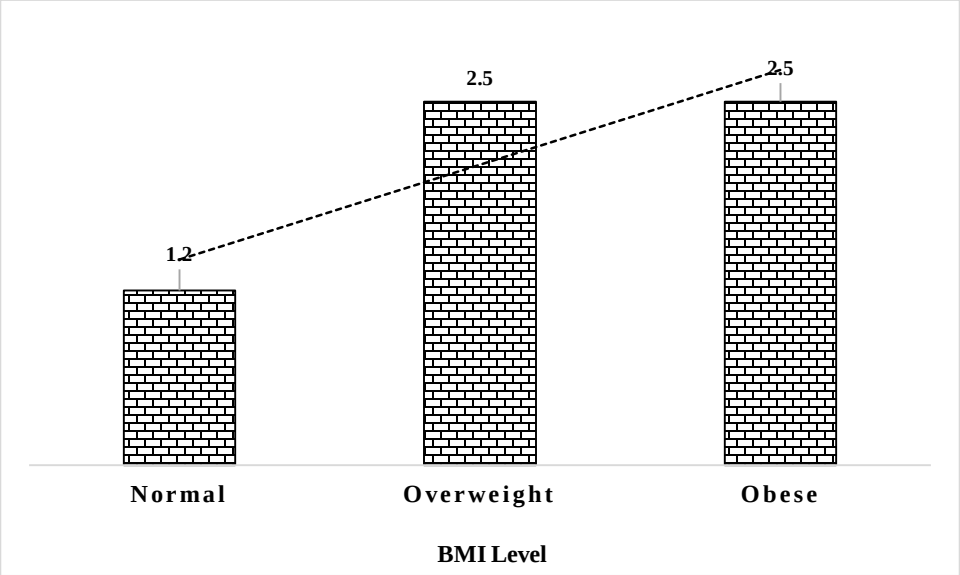
Table 5. Adjusted effects of socioeconomic and demographic characteristics on the prevalence of adverse pregnancy outcomes in India, 2005-06

Characteristics	Bleeding	Swelling	Stillbirth	Cesarean delivery	Very large child	Overweight child
Health condition						
Normal BMI®						
Overweight/Obese	1.171*	1.540***	1.306***	2.391***	1.150***	1.382***
Economic condition						
Poor®						
Non-poor	1.208**	1.089**	1.175***	2.671***	1.150***	1.247*
Religion						
Hindu®						
Muslims/Islam	1.185	1.290***	0.959	0.943	0.92	1.04
Christian	1.005	1.314***	0.799**	1.315**	0.998	1.372**
Others	2.131***	0.952	0.578***	0.991	0.577***	0.672*
Years of schooling						
Less than 10 years®						
10 and above years	1.156*	1.189***	0.963	1.615***	0.880***	1.146
Occupation						
Housewife®						
Working outside home	0.96	1.143***	1.094*	0.905*	1.001	1.137
Age at first birth						
Below 19 years®						
20 and above years	1.108	1.071*	1.331***	1.814***	0.985	0.878
Parity						
First Parity®						
2-3 Parity	0.976	0.747***	1.371***	0.656***	1.039	1.068
3 and above parity	0.807	0.768***	1.610***	0.192***	0.925	1.623***
Media exposure						
No exposure®						
Had exposure	1.124	0.926	1.015	1.912***	1.138**	0.94
Constant	0.038	0.345	0.134	0.029	0.282	0.064
Pseudo R2	0.01	0.12	0.01	0.12	0.003	0.01

®-Reference group, *p<0.1, **p<0.05, ***p<0.01

The result of multivariate analysis shows that, overweight/obese women are more likely to have all the selected adverse reproductive outcomes than the referent normal BMI women. Women from other religion groups are 2 times more likely to have vaginal bleeding during gestation. Women of higher parities are less likely to experience leg, body and face swelling during pregnancy than women of first parity. Women from affluent families are 2 times more likely to have caesarean deliveries than their counterpart women from poor families. Women who have given their first childbirth aged 20 and above years are 1.33 and 1.81 times more likely to have stillbirths and caesarean delivery respectively than the women who have delivered child before 19 years of age. Furthermore, parity and prevalence of stillbirths is positively associated in the study however, this is inversely correlated with caesarean deliveries in India (Table 5).

Figure 4. Prevalence of secondary infertility among women in India, 2005-06



It is evident in Figure 4 that, as the BMI level shifts from normal towards overweight or obesity, prevalence of secondary infertility among women increases in India. To be specific, the prevalence of secondary infertility among normal BMI women stands at 1.2 which has increased to 2.5 percent among overweight or obese women in India.

Table 6. Adjusted effects of socioeconomic and demographic covariates on the prevalence of secondary infertility among women in India, 2005-06

Characteristics	Secondary Infertility	
	Odds ratio	95% CI
BMI Level		
Normal		
Overweight/obese	0.850*	0.710-1.016
Place of residence		
Urban		
Rural	1.099	0.934-1.293
Age group		
15-24		
25-34	0.124***	0.074-0.206
35 and above	0.020***	0.012-0.032
Caste		
[1]SC		
[2]ST	0.950	0.714-1.264
[3]OBC	0.968	0.793-1.182
Others	0.950	0.766-1.180
Religion		
Hindu		
Muslims/Islam	1.111	0.873-1.414
Christian	0.636**	0.438-0.926
Others	0.952	0.698-1.300
Education		
No education		
Primary	0.991	0.817-1.203
Secondary	1.708***	1.393-2.094
Higher	2.945***	2.002-4.333
Economic status		
Poor		
Non-poor	0.814**	0.674-0.982
Work Status		
Housewife		
Working outside home	0.970	0.834-1.128
Media Exposure		
No exposure		
Had exposure	0.897	0.744-1.081
Constant	1255.485	
Pseudo R2	0.1524	

1 Scheduled Caste, 2 Scheduled Tribes and 3 other backward classes *p<0.1, **p<0.05, ***p<0.01

The adjusted effect of socioeconomic and demographic characteristics on the prevalence of secondary infertility in India is presented in Table 6. Comparing women from different age groups it is observed that, women aged 25-34 and 35 and above years are 0.124 and 0.020 times less likely

to be secondary infertile than the young women aged 15-24 years. However, a positive association between educational attainment and prevalence of secondary infertility among women is observed in this study. Women studied up to secondary and higher level are 1.708 and 2.945 times more likely to be secondary infertile respectively than women with no education in India.

Discussion

This study evidently found that overweight/obesity is increasing alarmingly over the years in India. India is a low-middle income country where the health problems related to under-nutrition are still major concerns. Thus, with this increasing epidemic of overweight/obesity India face double burden of nutritional health problems. It has to grapple the problem of under-nutrition or anemia on one hand and overweight/obesity on the other (Mendez, Monterio and Popkin, 2005; Kennedy, Nantel and Shetty, 2006). Another critical outcome of the study is that, prevalence of overweight/obesity in India varies largely among different subgroups of population. In a nutshell, the elevated adiposity level is noticeably higher among richer and educated sections of the society. This finding is contrary to number of studies conducted in developed or industrialized countries, where overweight or obesity generally concentrates among low-middle income groups (Prentice, 2006; Ziraba, Fotso and Ochako, 2009). Nevertheless, in the recent time, few studies from developing countries substantiates the findings of this study that overweight/obesity is more among the affluent or better off sections of the society (Mendez, Monterio and Popkin, 2005).

Furthermore, alike many other studies, this study equally opined that women at late ages, with higher parities and media exposure are more overweight/obese than their respective counterpart women in India (Kain, Vio and Albala, 2003; Agrawal and Mishra, 2004; Mendez, Monterio and Popkin, 2005; Kim, Yount, Ramakrishnan and Martorell, 2007). A number of studies attempted to determine the causes behind this positive association between overweight or obesity and socio-demographic covariates. Among all, the physical activity declines along with metabolic rate in the middle years of women. On the other hand, the energy requirement decreases, therefore, even regular or routine eating may lead to weight gain (Sinha and Kapoor, 2010). Further, the rising economy, urbanization and standard of living of people in India certainly ensured people to lead a sedentary life. In addition, reduced physical activity at work due to mechanization, improved motorized transport and preferences of viewing television for longer duration have resulted in positive energy balance in most of the Asian countries (Gopalan, 1996; Vijayalakshmi, Reddy and

Krishnaswamy, 2002; Popkin, 2006; Parizkova, Chin, Chia and Yang, 2007). Besides, the transition in nutrition intake from traditional to the modern i.e. more energy dense or junk food has helped the women to gain more weight in the recent decades (Pookin and Shu, 2007).

In addition, this study substantiate the result of many other studies that, overweight/obese women experience more adverse final pregnancy outcomes than the normal BMI women (Agrawal and Mishra, 2004; Lash and Armstrong, 2009; PMMRC, 2010; Willcox, Campbell and Pligt et al., 2012). Although, the reasons are quite obvious and established in number of studies worldwide, naming a few with much relevance to the low-middle income countries would be worthwhile. Among all, the foremost cultural practice and social value of giving rich diets to mothers during and after delivery certainly helps woman to gain more gestational weight (Sinha and Kapoor, 2010). Besides, studies also cited the medical or other physiological factors, leading overweight/obese women to have more adverse health problems. In a nutshell, the incidence of gestational diabetes mellitus (GDM) in pregnancy in women who are overweight/obese is higher than that of normal BMI women. This is a major cause to have stillbirth or very large baby or other complications among women (Chu et al., 2007; Sathyapalan et al., 2009; IOG, 2011). Furthermore, overweight/obese women are more likely to have high blood pressure 10 times more than the normal BMI women. This condition could prevent the placenta from getting proper amount of blood needed and decrease oxygen flow to the baby. In medical term it is called 'Preeclampsia'. In this condition the woman has to go through the assisted or caesarean delivery (Leddy, Power and Schulkin 2008; Dennedy and Dunne, 2010). In addition, overweight/obese women are more likely to have hypertension, higher obstetric pain and difficulty in initiating breastfeeding (Joshua L et al., 2004; IOG, 2011). However, analyses of all these health issues are out of the purview of this study.

A number of studies from South-Asian countries evidently reports that infertility is a major health problem and is increasing rapidly (Jejeebhoy, 1998; Unisa, 2010). Moreover, the secondary infertility in terms of its level, trend and treatment seeking behavior has been mentioned in many of these studies. Yet, the causes that lead to this health condition are not understood in these studies (Lindsay et al., 1994; Jejeebhoy, 1998). However, this study found a positive correlation between overweight/obesity and secondary infertility. As the BMI level of woman shifts towards obese condition, they are more likely to be secondary infertile. This finding equates with the number of

studies conducted in western or industrialized countries (Kesmodel, 2012). While examining the causes many studies cited that, in obese women with excessive adipose tissue, abnormal hypothalamic and pituitary hormone secretions are common and leads to anovulation (lack of ovulation). Further, overweight/obesity is strongly related to polycystic ovarian syndrome (PCOS) in women. Overweight/obese women are also particularly susceptible to diabetes and insulin resistance. Even with fertility drugs or IVF treatments, pregnancy rates are adversely affected by obesity. Many studies have demonstrated that in obese women, especially those with PCOS, as little as a 5-10% weight loss often is associated with resumption of ovulation and higher pregnancy rates with all fertility treatments (Laurence and Jacobs, 2010).

Limitations of the study

There are a number of measurement issues which needs to be kept in mind while considering the findings of this study:

First, the survey considered only the weight and height of women to measure the prevalence of overweight and obesity in India. However, there are many other sophisticated means to determine the overweight and obesity condition of a woman in a better way. Waist circumference (WC) is one among those tools which can give a better measurement on these issues especially in Asian region (WHO, 2004; Pan and Wen-Ting, 2008).

Second, the survey collected limited information on lifestyle, physical activity, and diet. Although, the demographic, socioeconomic, and lifestyle factors incorporated in this study may capture much of the variation, more detailed information on these subjects in future studies can help understand the causes of overweight and obesity better.

Conclusion

Many South-Asian countries including India often follows health policy which gives much emphasize to the erstwhile health issues like under-nutrition and anemia thereby overlooks the problem of overweight or obesity. For an instance, in India, the most hyped flagship program National Rural Health Mission (NRHM), has number of building blocks to address the anemia and under-nutrition prevailing among women or children. Yet, the program does not recognize the issue of obesity which is rising alarmingly among the richer and educated sections in India. With this backdrop, the growing demand which appears before the government or the urban health

planners is, to address this rising epidemic with equal importance with the other prevailing issues. A timely prevention will hopefully reduce the burden of many chronic co-morbidities like infertility on the health systems of the country.

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