A comparative assessment of obesity and its association with reproductive outcomes among women in four selected South-Asian countries

When you treat diabetes you treat diabetes, when you treat heart disease you treat heart disease, when you treat osteoarthritis you treat osteoarthritis, but when you treat obesity you treat all of the above and more!

-Dr. Arya Sharma on Alberta's Obesity Initiative, 2011.

Introduction

Overweight and obesity have reached epidemic proportions globally, with more than 1 billion overweight, and at least 300 million of them clinically obese (WHO, 2003). The number is increasing alarmingly further and expected to reach 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 decades, the most dramatic increases in the prevalence of overweight or obesity are seen in low-income countries such as India, Maldives and Thailand (Prentice 2006; WHO, 2011). In low-income countries, overweight and obesity often coexist with under-nutrition thus, poses double burden of nutritional problem (Mendez, Monterio and Popkin, 2005). While examining the trend, many health analysts or scholars attributed this as the 'nutritional transition'- to emphasize the tremendous shifts in dietary habits and physical activity patterns in the last decades of the twentieth century in the developing countries (Griffiths and Bentley, 2001; Popkin, 2002; Popkin and Gordon-Larsen, 2004).

Overweight and obesity virtually affect all ages and socioeconomic groups. The recent conclusion of the National Health and Nutrition Examination Survey, 2009-10 suggest that, more than one-third of adults and almost 17% of youth were obese in 2009-2010 in USA. Almost 41 million women and more than 37 million men aged 20 and over were obese. In the age group 2-19 years, more than 5 million girls and approximately 7 million boys were obese (Ogden, Carroll, Kit and Flegal, 2012). The situation in low-income countries is also worrisome, with large proportion of both men and women are either overweight or obese. India, alone registers more than 30 million of overweight or obese population in the country (NFHS-3). According to the world health organization (WHO), in Bangladesh, more than 8 percent of total population is

either overweight or obese and has larger contribution to the Non-communicable disease (NCD) deaths (WHO, 2011). In Maldives, more than half of women (53 percent) are either overweight or obese (WHO, 2011). Unlike the developed countries where overweight or obesity is generally concentrated among low-middle groups, elevated adiposity level in developing countries are more associated among richer sections of the society, noticeably in urban area (Prentice, 2006; Ziraba, Fotso and Ochako, 2009; Ghaia and Kulkarni, 2011; Gaur and Keshri, 2012).

The causes of overweight or obesity could be many. Nevertheless, the most obvious 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 *et al.*, 2009; Chan and Woo, 2010). In addition, forty four percent of the diabetes burden, 23% of the ischemic heart disease and between 7% to 41% of certain cancer burdens are attributable to overweight or obesity worldwide (WHO, 2012). The level and risk factors of overweight or obesity significantly differ for men and women as evident in the number of studies. In all but of handful (primarily Western European) countries, obesity is much more prevalent among women than men. 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/*). This trend is also witnessed 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-3). Maldives also register much higher proportion of overweight or obese women as compared to men in the country. Meanwhile, the reasons for such sex differentials is not documented largely in the varying contexts. However,   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).

Relevant literatures

With the given high prevalence of overweight or obesity among women, many studies have attempted to document women-specific health consequences associated to them. In a nutshell,

the adverse health effects related to pregnancy and reproduction was emphasized in number of studies. In 2008 in New Zealand, 49 percent of women who had stillbirths and 45 percent of mothers of neonatal deaths were attributed to their overweight or obese condition (Perinatal and Maternal Mortality Review Committee'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. Excess GWG increases the likelihood of antenatal hypertensive disorders, gestational diabetes, atypical delivery outcomes and failure to breastfeed, and is associated with increased neonatal mortality, and neonatal, infant and later life adiposity. Further, increased and persistent postpartum overweight, higher weight in subsequent pregnancies and increased risks of overweight and obesity in later adult life, with each being are known for risk of development of cardiovascular disease and type II diabetes (Willcox et al., 2012). Similarly, a study conducted in the 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, there are limited numbers of studies which have analyzed the reproductive health consequences central to overweight or obese women in South-Asian countries. In a study in India to examine the adverse impact of being overweight or obesity on pregnancy stated that overweight or obese women experience more stillbirths or premature pregnancy termination than normal women (Sudha, Reddy and Reddy, 2009; Agrawal, 2010). However, the study has limitations in exploring many other adverse reproductive outcomes, as evident to be associated among overweight or obese women from western countries.

Need of the study

Men and women have different physiology. 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. Most often giving birth to a healthy child depends on mother's health. Birth of an undernourished or low birth weight baby to an anemic mother is established largely in number of studies. However, pregnancy outcomes of an overweight or obese mother are not or partly understood at different dimensions. Moreover, the complications during pregnancy and problems related to motherhood of an overweight or obese mother is least explored. Besides, the existing

studies conducted on these issues are largely from western or industrialized countries which have least implications in the low-income countries from South-Asia.

With this backdrop, the present study is an attempt to shed light on the level and trend of overweight and obesity in the South-Asian countries and its impact during gestation, on pregnancy outcomes and reproduction among ever-married women. India, Pakistan, Sri Lanka, Nepal, Bangladesh, Maldives and Afghanistan comprise the Southern part of Asia. They foster more or less equal economic development, generally regarded as low-income countries. The average human development index (HDI) value (0.552) of South-Asian countries stands at the second lowest in the world (HDI report, 2013).

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 the four selected South-Asian countries.

2)   To understand the adverse health impacts during gestation and on its final outcomes among overweight/obese women in the four selected South-Asian countries.

3)   To examine the effect of being overweight or obesity on secondary infertility among women in the four selected South-Asian countries.

Methodology

Data Source

Demographic Health Survey (DHS) 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. DHS is a 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.

For this study, India, Nepal, Maldives and Bangladesh datasets are used. Due to the unavailability of the required information, analysis for the other three South-Asian countries i.e. Sri Lanka, Pakistan and Afghanistan is excluded in the study.

The information available on ever-married women aged 15-49 years with at least one child in the last five years are from 49394, 6074, 3104 and 5753 observations in India (NFHS, 2005-06), Bangladesh (DHS, 2007), Maldives (DHS, 2009) and Nepal (DHS, 2006) respectively is used to analyze the prevalence of overweight/obesity and its association during gestation and its final outcomes.

Further, individual data on 118733 women included in India, 64428 women in Nepal, 65016 in Bangladesh and 5666 women in Maldives are used to estimate secondary infertility by the above two broad categories of nutritional status. 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 DHS 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 DHS and used in this study.

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

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

Very large or larger than average child: This information is available in DHS 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 DHS. This information is used to estimate the overweight child at birth. As per the guidelines laid by World Health Organization (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 the four selected countries.

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 DHS, 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 World Health Organization, 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 of 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 are used in this study to analyze the association between overweight or obesity and its association with reproductive outcomes among women in the four selected countries.

Statistical analysis

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

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, pregnancy outcomes and secondary infertility among women in the four selected South-Asian countries. Inter-country comparisons based on the consequences of being overweight or obese is also done with the help of multivariate analysis. 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 $\beta_{0,\ldots,}$ β_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 in selected South-Asian countries
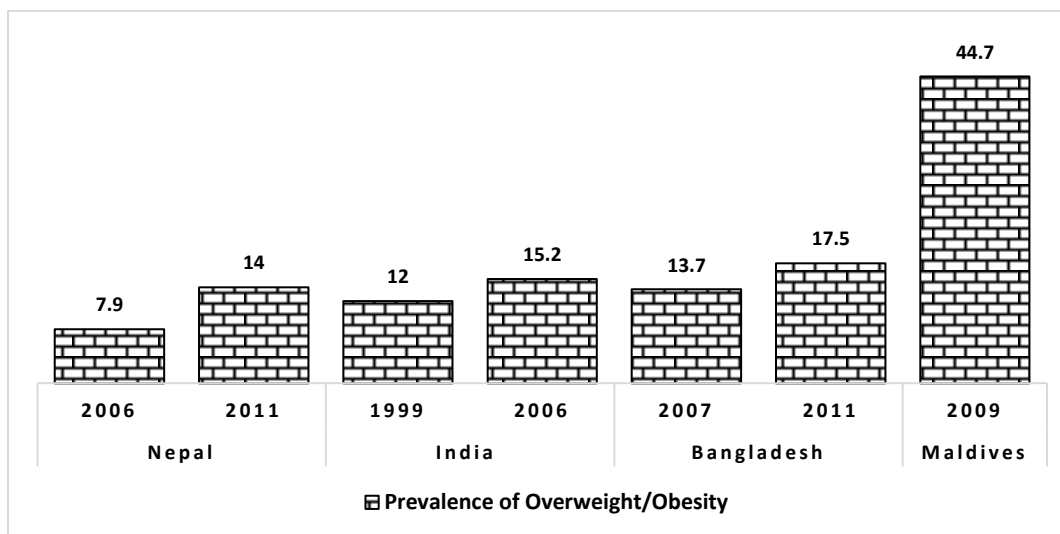
It is evident in Figure 1 that, the prevalence of overweight/obesity is increasing over the years in all the four selected South-Asian countries. In particular, the proportion of overweight/obesity in Nepal in 2006 was eight percent which has increased to 14 percent in 2011. In 1999, nearly, one tenth (12 percent) of women were overweight/obese in India. However, it has increased to more than 15 percent in 2006. In Bangladesh, the prevalence of overweight/obesity among women has increased to 18 percent in 2011 from less than 14 percent in 2007. Strikingly, Maldives records the highest proportion of overweight/obese women among all the studied South-Asian countries.

Table 1. Level of Body Mass Index in selected South-Asian countries

Country	Minimum	Maximum	Mean	Standard deviation	Coefficients of Variance	Sample Size
India	12.04	59.62	20.37	3.46	11.96	49394
Maldives	13.51	51.20	24.36	4.49	21.08	3104
Bangladesh	12.31	42.70	20.3	3.26	10.65	6074
Nepal	12.77	33.92	20.34	2.59	6.73	5753

The level of overweight/obesity in selected South-Asian countries is presented in Table 1. Comparing countries for the minimum level of BMI, it is observed that India has the lowest level of BMI followed by Bangladesh, Nepal and Maldives. Meanwhile, India also records the

maximum (59.6) level of BMI followed by Maldives, Bangladesh and Nepal. The mean of BMI level, in all the selected countries fall in the range of normal health condition. However, Maldives records the highest BMI mean, close to the upper limit of the normal BMI range. This evidently shows its greater risk of women for being overweight or obese. Furthermore, Maldives also records greater variability (SD: 4.59 and CV: 21.08) from its average BMI score, showing less concentration of its women in the normal BMI range.

Table 2. Prevalence of overweight/obesity by different background characteristics in selected South-Asian countries

Characteristics	India			Bangladesh			Nepal			Maldives		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
Age												
15-24	1.9	1.4	4.5	4.4	3.2	8.9	4.1	3.2	9.5	31.0	28.4	40.5
25-34	7.2	3.9	16.4	10.8	7.2	23.4	7.2	5.1	22.4	41.9	39.5	46.9
35+	9.5	5.0	26.9	12.4	6.8	36.4	6.0	4.9	21.2	49.4	49.9	47.9
Caste												
[1]SCs	4.4	2.7	10.1	--	--	--	--	--	--	--	--	--
[2]STs	1.5	1.0	6.3	--	--	--	--	--	--	--	--	--
[3]OBCs	6.6	3.7	16.4	--	--	--	--	--	--	--	--	--
Others	11.5	6.2	21.5	--	--	--	--	--	--	--	--	--
Religion												
Hindu/Hinduism	6.4	3.3	16.7	8.9	6.5	18.2	5.0	3.5	15.5	--	--	--
Buddhist	--	--	--	--	--	--	11.5	9.2	37.4	--	--	--
Muslims/Islam	8.0	4.7	15.6	7.8	5.2	17.5	2.8	2.0	9.4	--	--	--
Christian	10.9	6.3	20.2	--	--	--	--	--	--	--	--	--
Others	13.2	10.0	22.0	--	--	--	21.4	20.5	27.8	--	--	--
Education												
No Education	2.6	1.9	7.8	3.6	2.8	7.9	3.1	2.5	10.0	48.9	49.1	47.6
Primary	5.0	3.4	10.8	5.2	3.7	11.2	6.4	5.6	11.5	43.9	42.6	49.3
Secondary	11.3	7.1	18.5	9.6	6.9	20.0	11.2	8.4	20.8	36.1	30.6	44.5
Higher	28.8	16.9	34.6	28.5	18.3	40.4	24.6	14.9	37.5	45.0	39.3	47.5
Wealth Index												
Poorest	1.0	0.9	2.9	1.6	1.7	1.3	3.0	3.0	--	37.5	37.5	--
Poorer	2.3	1.9	6.1	2.3	2.1	4.4	2.0	2.1	1.6	40.5	40.8	--
Middle	4.4	3.7	7.2	4.4	4.5	4.6	2.9	3.0	--	37.5	36.6	63.0
Richer	10.0	8.9	11.8	8.5	8.4	8.9	5.5	5.1	8.3	45.1	43.6	46.5
Richest	25.1	17.9	28.2	25.0	19.7	28.1	20.0	15.9	24.1	44.8	27.4	45.3
Work status												
No	8.0	4.4	17.0	8.8	5.8	20.4	6.9	4.7	15.0	40.2	37.1	47.8
Yes	4.5	2.7	15.2	4.5	3.2	9.5	5.3	4.1	18.3	42.6	42.9	41.9
Media Exposure												
No Exposure	1.9	1.5	6.6	2.6	2.5	4.4	1.3	1.3	--	--	--	--
Had exposure	9.4	5.3	18.0	15.9	12.9	30.3	12.9	9.3	22.7	42.1	41.0	44.4
Parity												
First	8.0	4.3	16.7	7.0	4.9	14.8	6.1	4.3	15.8	35.4	30.9	44.8
Second	9.1	4.7	19.9	9.3	5.9	19.6	8.5	5.9	23.9	40.3	36.3	48.0
Third and more	4.9	3.0	13.6	7.2	4.8	18.9	4.0	3.4	10.5	48.2	48.9	45.5

1 Scheduled Caste, 2 Scheduled Tribes and 3 other backward classes, -- No cases or excluded

Age of women and prevalence of overweight or obesity is positively associated in the study. Women at late age i.e. 35 and above years are more overweight or obese than their counterpart from 15-24 years. This pattern is observed across the countries and place of residence. Yet, urban women across their age are more overweight or obese than rural women in all the four selected countries. However, women in Maldives across their place of residence and age have higher proportion of overweight and obesity as compared to women from any other countries. In India, women from upper caste groups irrespective of their place of residence are more overweight or obese than women from lower castes. Nevertheless, urban women from upper castes (22 percent) are more overweight or obese than their rural counterparts (10 percent).

Education and prevalence of overweight or obesity is positively correlated in India, Bangladesh and Nepal. This pattern is observed across the place of residence in these three countries. In Maldives, women with no education across their place of residence are more overweight or obese than women with education. Furthermore, women from affluent families across their place of residence in India, Bangladesh and Nepal are more overweight or obese than their counterpart poor women. Yet, in Maldives, at national level poorest women (38 percent) have higher proportion of overweight or obesity than affluent women (45 percent). Women not involved in any kind of income generating activity are more overweight or obese than working women in India, Bangladesh and Nepal. In Maldives, working women have higher proportion of overweight and obesity than non-working women. The only exception is the urban not working women (48 percent), have higher prevalence of overweight or obesity than working women (42 percent) in Maldives. Women with media exposure across their place of residence are more overweight or obese than women without media exposure in all the four selected countries. Women of higher parities are more overweight or obese than women in the reference group of the first parity in all the selected countries (Table 2).

Table 3. Adjusted effects of selected characteristics on the prevalence of overweight/obesity in four South-Asian countries.

| Characteristics	India		Bangladesh		Nepal		Maldives	
	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI	Odds Ratio	95% CI
Age								
15-24[®]								
25-34	2.196***	1.546-3.120	5.584***	2.789-11.182	2.429***	1.479-3.989	1.374*	0.983-1.921
35+	4.617***	3.148-6.772	6.820***	2.699-17.238	9.962***	3.687-26.914	1.473	0.909-2.387
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	--	--	--	--	2.317**	1.096-4.899	--	--
Muslims/Islam	1.393***	1.225-1.584	0.82	0.394-1.708	--	--	--	--
Christianity	1.356**	1.038-1.771	--	--	0.525	0.121-2.272	--	--
Others	1.446***	1.209-1.731	--	--	1.622	0.536-4.912	--	--
Education								
No Education[®]								
Primary	1.243**	1.042-1.482	1.005	0.491-2.058	6.042**	1.109-32.929	0.709	0.467-1.076
Secondary	1.528***	1.324-1.765	1.578	0.718-3.472	7.625**	1.158-50.191	0.578**	0.355-0.941
Higher	2.526***	2.100-3.037	2.373	0.833-6.755	12.314**	1.632-92.922	0.75	0.353-1.592
Wealth Index								
Poorest[®]								
Poorer	1.983***	1.480-2.656	1.657	0.667-4.120	0.289**	0.090-0.930	0.858	0.615-1.198
Middle	3.342***	2.547-4.385	3.643***	1.407-9.429	0.504	0.147-1.725	0.803	0.573-1.127
Richer	6.608***	5.056-8.636	5.501***	2.189-13.821	0.639	0.266-1.536	1.141	0.776-1.677
Richest	15.644***	11.924-20.526	12.66***	4.287-37.361	1.672	0.681-4.104	1.354	0.859-2.133
Work status								
No[®]								
Yes	0.885**	0.786-0.997	0.554*	0.297-1.035	0.884	0.553-1.413	1.056	0.819-1.362
Media Exposure								
No Exposure[®]								
Had exposure	1.563***	1.296-1.887	1.857	0.865-3.986	1.889	0.330-10.806	--	--
Parity								
First[®]								
Second	1.266***	1.136-1.411	0.527	0.245-1.135	1.581*	0.923-2.710	0.975	0.697-1.363
Third and more	1.245***	1.095-1.416	0.499*	0.228-1.089	0.730	0.340-1.568	1.282	0.854-1.925
Constant	0.003		0.007		0.005		0.749	
Pseudo R2	0.1837		0.2124		0.1928		0.024	

®-Reference group, *p<0.1, **p<0.05, ***p<0.01, 1 Scheduled Caste, 2 Scheduled Tribes and 3 other backward classes, -- No cases or excluded

It is observed in the study that, women aged 35 and above years are more likely to be overweight or obese than young women in the four selected countries. However, women aged 35 and above

years in Nepal have higher odds ratio (OD: 10; CI: 3.7-26.9) to be overweight or obese than their counterpart women from any other countries. Education and prevalence of overweight or obesity among women is positively correlated in India, Bangladesh and Nepal. Yet, women with higher education in Nepal have the higher odds ratio to be overweight or obese than their counterpart women from other three countries.

Affluent women in India and Bangladesh are 15 and 12 times more likely to be overweight or obese respectively than the referent poor women. In Maldives, economic condition has little effect on overweight or obesity among women. In India, working women are 0.9 times less likely to be overweight or obese than women without work. Furthermore, parity of women is positively correlated in India which is not followed uniformly in other three countries. (Table 3).

Figure 2. Adverse health impact during gestation among overweight/obese women in India, 2005-06
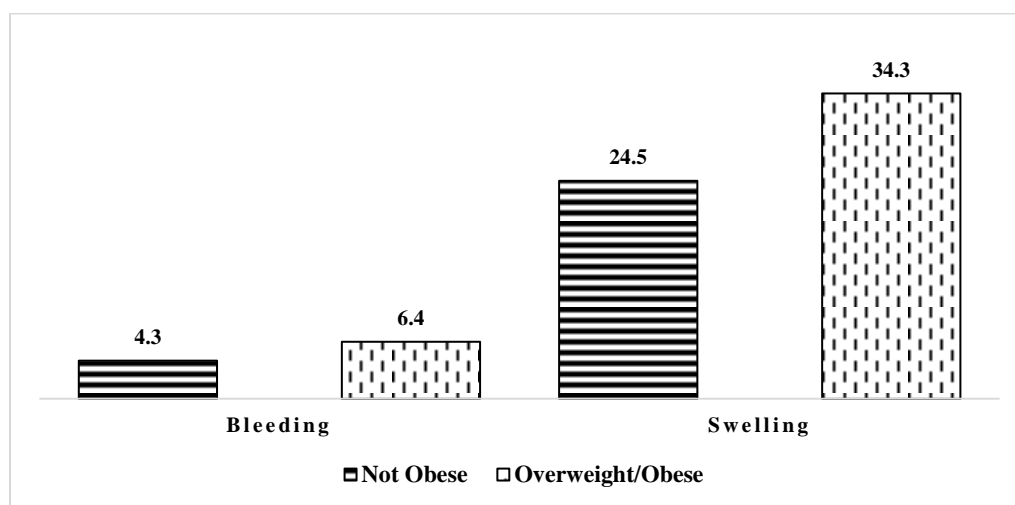
As the BMI level shifts towards overweight/obese condition women in India experience more adverse health problems during their gestation period. In particular, only four percent of not obese women as compared to more than six percent of overweight/obese women experience vaginal bleeding during gestation. Furthermore, nearly one fourth of not obese women and 34 percent of overweight/obese women report leg, body and face swelling during gestation in India. The information on adverse health problems during gestation among women in Bangladesh, Nepal and Maldives is not available in the datasets used. Thus, inter-country comparison on adverse health problems during gestation among women is not presented in the study (Figure 2).

Table 4. Prevalence of adverse health effects during gestation by background characteristics among women in India, 2005-06

Characteristics	Vaginal bleeding		Face and Body swelling	
	Not Obese	Overweight/Obese	Not Obese	Overweight/Obese
Economic condition				
Poor	3.8	3.3	24.1	28.7
Non-poor	4.8	6.7	24.9	34.9
Religion				
Hindu	4.1	6.4	23.4	33.6
Muslims	4.3	4.1	29.4	35.4
Christian	4.8	9.1	30.6	38.8
Others	4.3	6.4	25.4	37.3
Years of schooling				
Less than 10 years	4.9	6.1	24.1	33.0
10 and above years	6.3	7.6	28.7	37.9
Occupation				
Housewife	4.4	6.3	24.5	34.1
Working outside home	4.1	6.5	24.5	35.1
Age at first birth				
Below 19 years	3.9	5.0	23.9	29.2
20 and above years	4.9	7.0	25.4	36.7
Parity				
First Parity	4.9	7.0	27.9	38.8
2-3 Parity	4.5	6.6	22.5	33.9
4 and above	3.6	4.4	24.7	27.5
Media exposure				
No exposure	3.6	5.2	24.0	36.4
Had exposure	4.6	6.5	24.8	34.1

It is evident in the study that overweight/obese women irrespective of their economic status experience more vaginal bleeding and leg, face and body swelling than counterpart women who are not obese. However, overweight/obese women from affluent families experience more of these problems in India. Overweight/obese women across religion have higher prevalence of vaginal bleeding and leg, face and body swelling during gestation than the referent women who are not obese. Furthermore, overweight/obese women regardless of their years of schooling have higher proportion of vaginal bleeding and leg, face and body swelling during gestation than their counterpart women who have below the overweight/obesity BMI level. However, overweight/obese women with 10 and above years of schooling report these adverse health problems more during gestation than women with less than 10 years of schooling. Overweight/obese women across their occupational status reports more vaginal bleeding and leg, face and body swelling than women who are not obese.

Age at first child birth and prevalence of adverse health outcomes during gestation is positively associated in the study. Nevertheless, the proportion of the adverse health outcomes is higher among overweight/obese women. Prevalence of vaginal bleeding and leg, face and body swelling during gestation and parity of women are inversely related in the study. Women from higher parities report less prevalence of vaginal bleeding and leg, face and body swelling than women from first parity. Yet, overweight/obese women across parity have higher prevalence of vaginal bleeding and leg, face and body swelling than their counterpart women below overweight/obese BMI level in India. Media exposure and prevalence of vaginal bleeding during gestation are positively correlated in the study. Women with media exposure experience more vaginal bleeding during gestation than women without exposure. However, overweight/obese women with media exposure report more vaginal bleeding during gestation than their counterpart women group without media exposure (Table 4).

Figure 3. Selected adverse pregnancy outcomes among women in the four selected countries
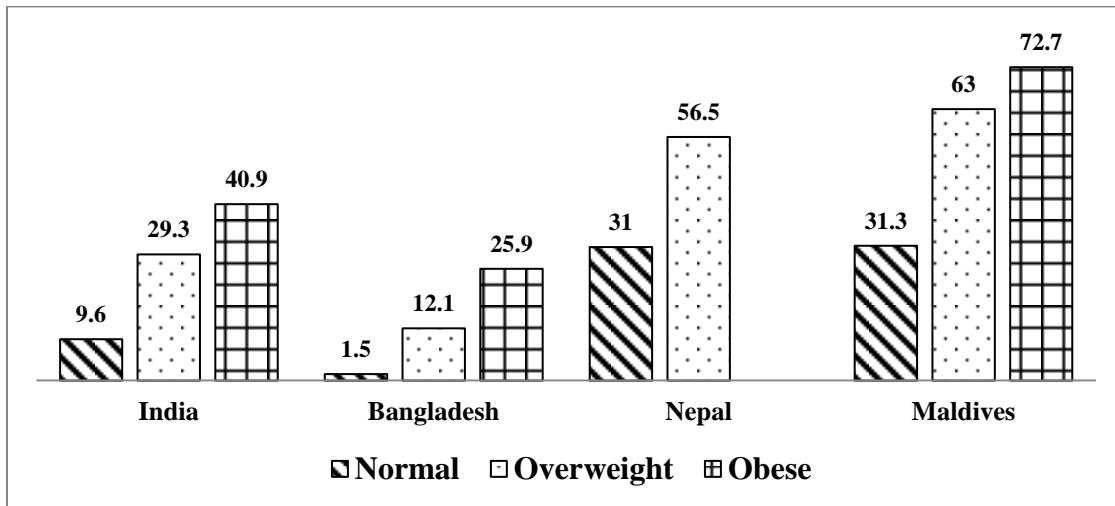
The prevalence of selected adverse pregnancy outcomes and BMI level of women is positively correlated in the study. As the BMI level shifts towards overweight or obese condition, women are more to experience selected adverse pregnancy outcomes. This pattern is observed across all the four selected countries. In India, more than 40 percent of obese women report to have faced all the four selected adverse pregnancy outcomes as compared to only one tenth of women with normal BMI level. Similarly, in Nepal, more than one fourth (26 percent) of obese women as compared to only two percent of women with normal BMI level experienced all the four selected

adverse pregnancy outcomes. Nearly, three fourth (73 percent) of obese women and 31 percent of normal BMI women reported to experience all the four selected adverse pregnancy outcomes in Maldives (Figure 3).

The bivariate analysis presents the socioeconomic and demographic differentials in the prevalence of four selected adverse pregnancy outcomes among women in the four selected countries. Overweight/obese women from affluent families experience more stillbirths in India, Bangladesh and Maldives. However, in Nepal overweight/obese women from poor households reports more stillbirth (32 percent) than counterpart women from rich families (17 percent). Overweight/obese women irrespective of their occupational status report more stillbirths in the four selected countries. Furthermore, in India, Bangladesh and Maldives women working outside the home have higher prevalence of stillbirths than housewives women. Parity and stillbirth are positively correlated in the study. However, overweight/obese women of higher parities report more stillbirth than women who are not obese in all the four selected countries.

Economic condition of women and prevalence of caesarean delivery is positively associated in India, Bangladesh and Maldives. Yet, overweight/obese women from affluent families have higher prevalence of caesarean delivery than counterpart women from poor households in these countries. In Nepal, overweight/obese women from poor families (32 percent) have higher prevalence of caesarean delivery than the referent women from affluent households (17 percent). In addition, years of schooling and prevalence of caesarean delivery among women is positively related in all the four selected countries. Nevertheless, overweight/obese women with 10 and above years of schooling experience more caesarean deliveries than their counterpart women with less than 10 years of schooling. Overweight/obese women irrespective of their occupational status report more caesarean deliveries than the referent not obese women in all the four selected countries. However, overweight/obese housewives in Indian, Bangladesh and Nepal experience more caesarean deliveries than the working women. Contrary to this, in Maldives working overweight/obese women have higher prevalence of caesarean deliveries than the housewives with this referent BMI level. Age at first childbirth and prevalence of caesarean is positively associated in the study. Yet, overweight/obese women across their age at first child birth reports more caesarean deliveries than not obese women.

Economic condition and proportion of very large or larger than average child at birth is positively associated in the study however the prevalence is higher among overweight/obese

women. Overweight/obese women with below 10 years of schooling experience more very large or larger than average child at birth in India and Nepal. However, in Maldives overweight/obese women with more than 10 years of schooling have higher prevalence of very large or larger than average child at birth.

Overweight/obese women from poor households have more overweight child at birth than the counterpart women from affluent families in India and Nepal. However, in Maldives overweight/obese women from affluent families have higher prevalence of overweight child at birth than the referent women from poor families. Parity and overweight child at birth is positively associated in the study. Women of higher parities are to have overweight child at birth than women of first parity. Nevertheless, overweight/obese women of higher parities have more overweight child at birth than their counterpart women who are not obese in all the four selected countries. (*Tables 1.1, 1.2, 1.3 and 1.4 in the appendix*).

Table 5. Prevalence of any of four selected adverse pregnancy outcomes among women in the four selected countries.

Characteristics	India		Bangladesh		Nepal		Maldives	
	Odds Ratio	95 % CI	Odds Ratio	95 % CI	Odds Ratio	95 % CI	Odds Ratio	95 % CI
Health condition								
Not obese[®]								
Overweight/Obese	1.389***	1.267-1.524	2.266***	1.360-3.776	0.661*	0.424-1.028	2.137***	1.991-2.293
Economic condition								
Poor[®]								
Non-poor	0.837***	0.770-0.911	0.778	0.576-1.052	0.385***	0.212-0.698	1.226***	1.140-1.320
Religion								
Hindu[®]								
Buddhist	--	---	--	--	5.323***	2.414-11.734	--	--
Muslims/Islam	0.897**	0.819-0.981	0.954	0.584-1.557	0.653	0.194-2.198	--	--
Christian	0.930	0.785-1.103	--	--	--	--	--	--
Others	0.621***	0.531-0.725	--	--	3.755**	1.118-12.605	--	--
Years of schooling								
Less than 10 years[®]								
10 and above years	0.880***	0.815-0.950	2.142***	1.208-3.798	1.478	0.917-2.381	1.203***	1.058-1.369
Occupation								
Housewife[®]								
Working outside home	1.033	0.962-1.110	0.858	0.630-1.168	0.687**	0.483-0.978	0.936*	0.873-1.004
Age at first birth								
Below 19 years[®]								
20 and above years	1.057*	0.989-1.130	1.871***	1.384-2.530	0.587***	0.414-0.833	1.386***	1.266-1.517
Parity								
First Parity[®]								
2-3 Parity	1.220***	1.139-1.306	1.002	0.740-1.357	1.940***	1.371-2.743	1.171***	1.086-1.264
4 and above parity	1.375***	1.265-1.494	1.627***	1.135-2.332	3.517***	1.422-8.703	1.246***	1.096-1.418
Media exposure								
No exposure[®]								
Had exposure	0.757***	0.675-0.850	2.034***	1.420-2.914	0.179**	0.036-0.903	--	--
Constant	2.590		0.198		25.482		0.601	
Pseudo R2	0.0095		0.0566		0.0793		0.0292	

®-Reference group, *p<0.1, **p<0.05, ***p<0.01 – No cases/excluded

It is evident in the Table 5 that overweight/obese women are more likely to experience any of the four selected adverse pregnancy outcomes than women who are not obese. This pattern is observed in India, Bangladesh and Maldives. Yet, overweight/obese women in Bangladesh have the higher odds ratio (2.3 times) than their counterpart women from any other countries to experience any of the four selected adverse pregnancy outcomes. In Nepal, overweight/obese women are less likely to report any of the four selected adverse pregnancy outcomes than their counterpart not obese women. In India and Nepal, non-poor women are less likely to meet any of these four selected adverse pregnancy outcomes than the poor women. However, in Maldives, non-poor women (1.2 times) are more likely to experience any of the four selected pregnancy outcomes than the poor women.

Furthermore, in India, women with ten and above years of schooling (0.9 times) are less likely to have any of the four selected adverse pregnancy outcomes than women with less than 10 years of schooling. Contrary to this, in Bangladesh and Maldives women with ten and above years of schooling are more likely to experience any of the four selected pregnancy outcomes than the counterpart referent women. In India, Bangladesh and Maldives, women who have given their first childbirth at 20 and above years are more likely report any of these four selected adverse pregnancy outcomes than women given first childbirth below aged 19 years. Parity and experiencing any of the four selected adverse pregnancy outcomes is positively correlated in all the four selected countries. Women of the higher parities are more likely to experience any of the four selected adverse pregnancy outcomes than women of first parity in all the selected countries. Nevertheless, women of four and above parities in Nepal have higher odds ratios to have any of these four selected adverse pregnancy outcomes than women from any other countries. Women with media exposure in Bangladesh (2 times) are more likely to report any of these four selected adverse pregnancy outcomes than women without media exposure. However, in India and Nepal women with media exposure experience less of these four selected adverse pregnancy outcomes than their counterpart without media exposure.

Table 6. Odds ratio for the prevalence of adverse pregnancy outcomes among women in four selected countries

| Characteristics	Stillbirth				Caesarean delivery				Very large or larger than average child			Overweight child		
Health condition	India	Bangladesh	Nepal	Maldives	India	Bangladesh	Nepal	Maldives	India	Nepal	Maldives	India	Nepal	Maldives
Not obese														
Overweight/Obese	1.306***	1.508	1.016	1.548***	2.391***	4.210***	2.626***	1.710***	1.150***	1.009	1.753***	1.382***	1.318	2.248***
Economic condition														
Poor														
Non-poor	1.175***	0.775	1.045	1.115	2.671***	1.442	1.379	1.267*	1.150***	1.014	1.348*	1.247*	0.716	1.741***
Religion														
Hindu														
Buddhist	--	--	2.067**	--	--	--	1.077	--	--	3.885***	--	--	2.006	--
Muslims/Islam	0.959	0.828	1.615	--	0.943	0.952	0.591	--	0.92	0.203**	--	1.04	0.177	--
Christian	0.799**	--	--	--	1.315**	--	--	--	0.998	--	--	1.372**	--	--
Others	0.578***	--	0.675	--	0.991	--	0.291	--	0.577***	1.454	--	0.672*	2.914	--
Years of schooling														
Less than 10 years														
10 and above years	0.963	1.745*	1.880**	1.417	1.615***	1.826	2.023*	0.914	0.880***	0.961	1.341	1.146	2.956***	1.042
Occupation														
Housewife														
Working outside home	1.094*	0.884	0.768	0.839	0.905*	0.905	0.301***	0.926	1.001	1.031	0.941	1.137	0.513*	0.989
Age at first birth														
Below 19 years														
20 and above years	1.331***	1.708***	0.914	0.963	1.814***	2.728***	3.107***	1.916***	0.985	0.791	0.746	0.878	0.571*	1.161
Parity														
First Parity														
2-3 Parity	1.371***	1.334	2.360***	1.750***	0.656***	0.484**	0.420***	0.819	1.039	1.07	1.065	1.068	1.346	1.176
3 and above parity	1.610***	2.331***	2.819***	2.128***	0.192***	0.362**	0.226	0.736	0.925	1.822	1.404	1.623***	2.287	1.444
Media exposure														
No exposure														
Have exposure	1.015	1.478**	2.064	0.142	1.912***	2.983***	1.709	--	1.138**	1.505	0.16	0.94	--	--
Constant	**0.134**	**0.159**	**0.068**	**0.855**	**0.029**	**0.034**	**0.036**	**0.262**	**0.282**	**0.182**	**0.866**	**0.064**	**0.2195**	**0.066**
Pseudo R2	**0.01**	**0.035**	**0.04**	**0.03**	**0.1196**	**0.2038**	**0.1727**	**0.0305**	**0.0032**	**0.0345**	**0.0225**	**0.0075**	**0.0643**	**0.0353**

®-Reference group, *p<0.1, **p<0.05, ***p<0.01 and – No cases/excluded

It is evident in the study that overweight/obese women across all the four selected countries experience more adverse pregnancy outcomes i.e. stillbirth, caesarean deliveries, very large or larger than average and overweight child at birth than their counterpart not obese women. However, inter-country variation is observed on each selected pregnancy outcome. In a nutshell, overweight/obese women in India and Maldives are 1.3 and 1.5 times more likely to experience stillbirth respectively whereas in Bangladesh and Nepal the effect of being overweight/obesity on stillbirth is not statistically significant. Furthermore, overweight/obese women in Bangladesh (OD: 4.2) have the higher odds ratio to experience caesarean deliveries than women from any other countries. Women from affluent families in India are more likely to have stillbirth, caesarean deliveries, very large or larger than average and overweight child at birth than poor women. This pattern is not followed uniformly in other three countries. Nevertheless, affluent women in Maldives are more likely to have caesarean deliveries, very large or larger than average and overweight child at birth than the referent poor women (statistically significant). In Nepal, women with 10 and above years of schooling are two times more likely to have stillbirth than the women with less than 10 years of schooling. Furthermore, women with 10 and above years of schooling in India and Nepal are 1.6 and 2 times more likely to have caesarean deliveries than their counterpart women with less than 10 years of schooling respectively. In addition, in Nepal, women with 10 and above years of schooling have highest odds ratio (OD: 2.96) to have overweight child at birth than women from any other countries. Working women in Nepal are 0.3 times less likely to have caesarean deliveries than the housewives.

In India and Bangladesh, women given their first childbirth at 20 and above years are more likely to experience stillbirths than women who have given first childbirth before 19 of years of age. However, this association is not observed in Nepal and Maldives. Further, women giving their first childbirth at 20 and above years and caesarean deliveries is positively correlated in all the four selected countries. Yet, women given their first childbirth at 20 and above years in Nepal are more likely (OD: 3.1) to experience caesarean deliveries than the counterpart women from any other countries. Parity and stillbirth is positively correlated in all the four selected countries. Women of third and above parities have higher proportion of stillbirth than women of first parity in all the selected countries. However, in Nepal, women of third and above parities are more likely to have stillbirth than their counterpart women from any other countries. Contrary to this, women of higher parities are less likely to have caesarean deliveries in all the four selected

countries. In India, women of third and above parities are 1.6 times more likely to have overweight child at birth than women of first parity. Women with media exposure in India and Bangladesh are 2 and 3 times more likely to experience caesarean deliveries than their counterpart women without exposure (Table 6).

Figure 4. Prevalence of secondary infertility in the selected four countries
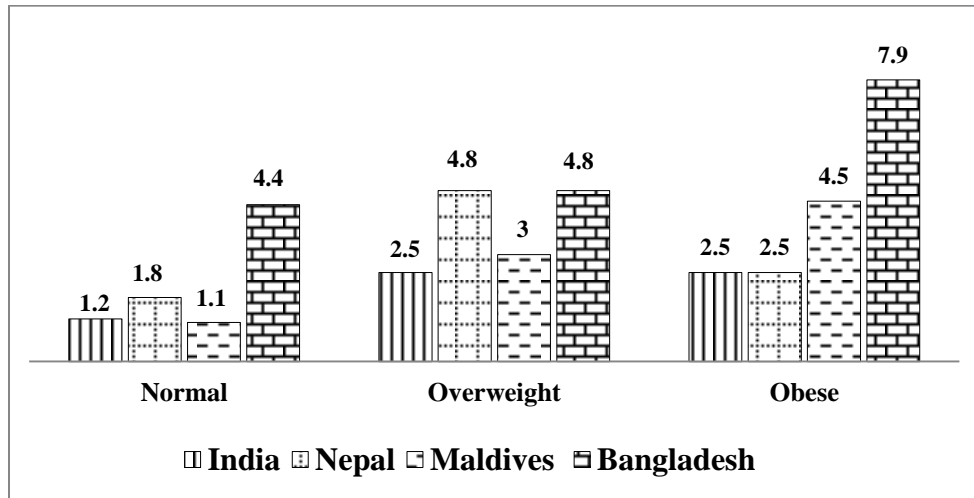
The prevalence of secondary infertility among women in the four selected South-Asian countries is presented in Figure 4. The proportion of secondary infertility and BMI level of women is positively correlated in the study. This pattern is followed in all the selected countries. In India, a meager of one percent of women with normal BMI level are secondary infertile which has increased to more than two percent among obese women. Similarly, barely one percent of women with normal BMI and more than four percent of obese women in Maldives are secondary infertile. Furthermore, in Bangladesh only four percent of normal BMI women are secondary infertile which has doubled (8 percent) among the obese women.

Table 7. Prevalence of secondary infertility by socioeconomic and demographic characteristics in four South-Asian countries

Characteristics	India		Bangladesh		Nepal		Maldives	
	Not obese	Overweight/Obese	Not obese	Overweight/Obese	Not obese	Overweight/Obese	Not obese	Overweight/Obese
Place of residence								
Urban	1.2	2.5	5.0	4.9	1.3	4.2	0.3	3.7
Rural	1.2	2.6	4.2	5.6	1.8	4.8	1.5	3.3
Age group								
15-24	0.1	--	0.5	0.2	0.1	1.9	--	--
25-34	0.6	1.0	2.5	4.6	1.5	4.7	0.7	1.8
35 and above	4.2	4.3	11.3	8.1	5.1	5.5	2.5	5.5
Caste								
[1]SCs	1.2	2.6	--	--	--	--	--	--
[2]STs	1.3	1.6	--	--	--	--	--	--
[3]OBC	1.2	3.2	--	--	--	--	--	--
Others	1.2	1.9	--	--	--	--	--	--
Religion								
Hindu	1.2	2.5	--	--	1.9	4.7	--	--
Buddhist	--	--	--	--	1.3	4.4	--	--
Muslims/Islam	1.0	2.5	4.4	5.2	0.8	4.0	--	--
Non-Islam	--	--	4.2	5.5	--	--	--	--
Christian	1.7	3.6	--	--	--	--	--	--
Others	1.3	2.2	--	--	0.9	3.6	--	--
Education								
No education	1.8	4.0	7.0	7.5	2.9	7.9	3.6	5.0
Primary	1.5	3.9	4.7	6.7	0.9	1.8	1.0	4.2
Secondary	0.6	2.0	1.8	4.0	0.2	1.8	--	0.8
Higher	0.4	1.1	0.7	3.3	0.1	3.8	1.7	2.1
Economic status								
Poor	1.2	2.8	4.6	5.8	1.8	2.8	1.9	3.3
Non-poor	1.2	2.5	4.3	5.2	1.7	4.8	0.6	3.5
Work Status								
Not working	1.0	2.5	4.1	4.7	0.7	4.9	1.2	3.7
Working	1.6	2.7	5.0	7.0	2.2	4.4	1.0	3.0
Media Exposure								
No exposure	1.5	1.7	5.7	9.9	2.4	33.3	--	--
Had exposure	1.1	2.6	1.8	--	0.6	2.8	0.9	3.0

1 Scheduled Caste, 2 Scheduled Tribes and 3 other backward classes – No cases/ excluded

It is observed in the study that, overweight/obese women across their socioeconomic and demographic characteristics reports more secondary infertility than their counterpart women who are not obese. This pattern is observed in all the four selected countries. However, overweight/obese women residing in rural area have higher proportion of secondary infertility

than their urban counterparts in India, Bangladesh and Nepal. Overweight/obese women aged 35 and above years are more secondary infertile than women aged 15-24 years in all the selected countries. Furthermore, illiterate women with higher BMI level across countries are more secondary infertile than their counterpart women with higher education. Overweight/obese women from poor families are more secondary infertile in India and Bangladesh. Contrary to this, overweight/obese women from affluent households have higher proportion of secondary infertility in Nepal and Maldives (Table 7).

Table 8. Adjusted effects of selected covariates on the prevalence of secondary infertility among women in four South-Asian countries

Characteristics	India		Bangladesh		Nepal		Maldives	
	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI	Odds ratio	95% CI
BMI Level								
Not obese								
Overweight/obese	0.850*	0.710-1.016	0.812*	0.647-1.018	0.280***	0.189-0.413	0.404***	0.209-0.708
Place of residence								
Urban								
Rural	1.099	0.934-1.293	1.204**	1.029-1.409	0.850	0.591-1.222	0.735	0.315-1.716
Age group								
15-24							--	--
25-34	0.124***	0.074-0.206	0.302***	0.209-0.435	0.096***	0.054-0.173	--	--
35 and above	0.020***	0.012-0.032	0.056***	0.040-0.079	0.063***	0.035-0.115	--	--
Below 30 years	--	--	--	--	--	--		
Above 30 years	--	--	--	--	--	--	0.050***	0.009-0.269
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								
Buddhist	--	--	--	--	1.520	0.851-2.714	--	--
Muslims/Islam	1.111	0.873-1.414	--	--	--	--	--	--
Non-Islam	--	--	1.477***	1.125-1.939	--	--	--	--
Christian	0.636**	0.438-0.926	--	--	--	--	--	--
Others	0.952	0.698-1.300	--	--	1.378	0.608-3.123	--	--
Education								
No education								
Primary	0.991	0.817-1.203	0.867*	0.749-1.004	1.45	0.917-2.295	1.519	0.765-3.015
Secondary	1.708***	1.393-2.094	0.964	0.764-1.216	4.666***	2.863-7.603	5.796**	1.112-30.198
Higher	2.945***	2.002-4.333	--	--	3.703***	1.837-7.465	0.607	0.126-2.929
Economic status								
Poor								
Non-poor	0.814**	0.674-0.982	0.874*	0.760-1.004	1.125	0.765-1.654	0.993	0.549-1.796
Work Status								
Housewife								
Working outside home	0.970	0.834-1.128	0.876*	0.764-1.005	1.721***	1.207-2.453	--	--
Media Exposure								
No exposure								
Had exposure	0.897	0.744-1.081	2.230***	1.474-3.373	1.249	0.759-2.056		
Constant	1255.485		118.887		--			
Pseudo R2	0.1524		0.126		188.045	0.1894		

1 Scheduled Caste, 2 Scheduled Tribes and 3 other backward classes – No cases/ excluded *p<0.1, **p<0.05, ***p<0.01

It is evident in the Table 8 that, overweight/obese women are less likely to be secondary infertile than the normal BMI women in all the selected countries. Women residing in rural area are more likely to be secondary infertile in India and Bangladesh. In India, Bangladesh and Nepal, women aged 35 and above years are less likely to experience secondary infertility than the young women than women aged 15-24 years. Similarly, in Maldives, age of women doesn't seems to have any effect on the prevalence of secondary infertility. Furthermore, in India and Nepal, women with higher education are nearly 3 times more likely to be secondary infertile than women with no education respectively.

Working women are less likely to experience secondary infertility in India and Bangladesh. Contrary to this, in Nepal, working women (OR: 1.8, CI: 1.21-2.45) are more likely to have secondary infertility than housewives. Media exposure and prevalence of secondary infertility is positively associated in Bangladesh. Women with media exposure are 2 times more likely to be secondary infertile than women without media exposure in Bangladesh.

Discussion

This study evidently concludes that overweight/obesity is increasing alarmingly over the years in all the four selected countries noticeably among its women. The studied countries fosters low-middle economic status wherein nutrition-deficiency related diseases are still a major health concern. Thus, with this increasing epidemic of overweight/obesity these countries face double burden of nutritional health problems. It has to grapple the problem of undernutrition 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 India, Nepal and Bangladesh follows more or less similar pattern in the prevalence of overweight/obesity whereas Maldives has much higher proportion of overweight/obesity than these countries. Much of variation is also observed in the prevalence of overweight/obesity between different subgroups of population in the studied countries. In a nutshell, the elevated adiposity level in these four selected countries is more associated among richer and educated sections of the society. This finding generally contrasts with the results of many studies conducted in developed or industrialized countries where overweight or obesity is generally concentrated among low-middle income and with no or little educated 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 (Ramachandran et al., 2004; Mendez, Monterio and Popkin, 2005).

Furthermore, along with many other studies this study equally opined that women at late age, with higher education, parities, media exposure and from affluent households are more overweight/obese than their respective counterpart women in all the four countries (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 examine the association between overweight or obesity and 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). However, in Maldives, the prevalence of overweight/obesity is much higher for all the selected subgroups of the population. In addition, working women in Maldives as compared to the housewives in India, Bangladesh and Nepal have highest proportion of overweight/obesity.

The probable reasons behind rising overweight/obesity in these selected countries could be many. In a nutshell, the rising economy, urbanization and standard of living of people in the four selected South-Asian countries 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 this, 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 (Chin, Chia and Yang, 2007; Pookin and Shu, 2007).

In addition, along with many other studies, this study equally concluded that women at higher BMI level will have more adverse reproductive outcomes than normal BMI women. Although, lots of variation is observed between the studied countries, all countries have the prevalence of adverse reproductive outcomes due to the overweight/obesity among women. This findings corroborates the results of many other studies which concludes that overweight/obese women will have 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 worth mentioning. 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). Meanwhile, studies also cited the medical or other physiological factors whereby an overweight/obese women will have more adverse health problems. In a nutshell, the incidence of gestational diabetes mellitus (GDM) in pregnancy among overweight/obese women 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).

Further, overweight/obese women are 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 purview of this study.

A number of studies from low-middle income countries including from South-Asia evidently reports that infertility is a major health problem and increasing alarmingly (Jejeebhoy, 1998; Unisa, 2010). Moreover, secondary infertility in terms of its level, trend and treatment seeking behavior has been mentioned in many of these studies. Yet, the basic reasons behind this health condition are not very clear in these studies (Lindsay et al., 1994; Jejeebhoy, 1998). However, this study evidently found a positive correlation between overweight/obesity and secondary infertility. As the BMI level shifts towards obese condition, women are more to be secondary infertile. This association is also established in number of studies from western or industrialized countries (Kesmodel, 2012). In an attempt to find the causes behind this association a study stated 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 the four selected countries. 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.

Third, the information on consequences of being overweight or obese is limited for some studied countries thus, cross-country comparison could not be made in all the contexts, considered in this study.

Conclusion

Many South-Asian countries often follows health policy which gives much emphasize to the erstwhile health issues like malnutrition and anemia and merely overlooks problems like overweight or obesity. As an instance, in India, the most hyped central sponsored flagship program National Rural Health Mission (NRHM), has number of building blocks to address the problem of anemia and malnutrition which is prevailing among women or children. Yet, the program does not recognize this growing epidemic in India. Overweight and obesity is rising alarmingly noticeably among affluent households, educated population in these studied

countries. With this backdrop, the growing demand which appears before government or the health planners is, to address this rising epidemic with equal importance with the other prevailing issues. Large variations in the prevalence of overweight/obesity and its degree of association with adverse reproductive outcomes is observed in the studied countries. Thus, country-specific program or policy should be undertaken to address this problem. 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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Appendix

Table 1.1 Prevalence of stillbirth among women by different socioeconomic and demographic characteristics in four South-Asian countries

Characteristics	India		Bangladesh		Nepal		Maldives	
	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese
Economic condition								
Poor	16.9	19.4	19.5	15.4	19.0	32.3	15.5	22.1
Non-poor	18.5	23.4	18.9	25.2	16.5	16.6	14.8	22.4
Religion								
Hindu	17.4	25.2	20.2	24.3	17.8	21.5	--	--
Buddhist	--	--	--	--	13.8	21.3	--	--
Muslims/Islam	20.2	19.7	19.3	24.3	20.7	12.5	--	--
Christian	15.9	11.0	7.1	--	--	--	--	--
Others	12.5	11.7	11.6	--	20.7	6.7	--	--
Years of schooling								
Below 10 years	17.8	22.7	17.4	24.3	16.0	14.5	13.2	20.6
10 and above years	18.0	23.9	23.6	23.8	16.3	34.4	21.7	20.5
Occupation								
Housewife	17.8	22.0	19.0	23.0	15.6	30.6	17.1	22.7
Working outside home	17.6	27.0	19.7	29.8	18.2	15.0	11.6	21.9
Age at first birth								
Below 19 years	16.7	22.9	17.9	23.5	16.2	15.1	17.9	25.4
20 and above years	19.4	23.1	23.9	25.0	20.1	22.9	14.1	20.6
Parity								
First Parity	14.9	20.6	13.2	21.0	11.8	20.8	9.6	17.9
2-3 Parity	17.9	25.1	20.1	24.1	18.5	19.0	17.2	21.6
3 and above	19.6	23.2	26.1	29.7	23.0	20.4	25.3	29.9
Media exposure								
No exposure	16.9	19.5	20.6	13.1	11.6	--	55.6	--
Had exposure	18.1	23.4	16.5	48.8	17.1	21.1	15.0	22.1

Table 1.2 Prevalence of caesarean delivery among women by different socioeconomic and demographic characteristics in four South-Asian countries

Characteristics	India		Bangladesh		Nepal		Maldives	
	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese	Normal BMI	Overweight/ Obese
Economic condition								
Poor	2.3	8.0	1.7	13.2	19.0	32.3	21.6	33.7
Non-poor	11.7	30.1	9.6	30.1	16.5	16.6	33.0	41.5
Religion								
Hindu	7.1	29.2	10.9	23.7	17.8	21.5	--	--
Buddhist	--	--	--	--	13.8	21.3	--	--
Muslims/Islam	4.9	21.0	5.5	28.5	20.7	12.5	--	--
Christian	13.4	37.3	28.6	--	--	--	--	--
Others	10.0	25.3	--	--	20.7	6.7	--	--
Years of schooling								
Below 10 years	9.6	25.8	6.4	25.7	16.0	14.5	29.3	39.9
10 and above years	24.1	42.4	29.9	52.4	16.3	34.4	33.0	45.2
Occupation								
Housewife	8.6	28.3	6.4	29.1	15.6	30.6	28.3	37.2
Working outside home	4.4	25.6	4.5	23.8	18.2	15.0	28.2	40.6
Age at first birth								
Below 19 years	3.8	15.3	4.1	15.1	16.2	15.1	18.5	29.9
20 and above years	11.9	33.8	12.4	46.6	20.1	22.9	31.8	43.4
Parity								
First Parity	12.7	38.3	10.0	49.0	11.8	20.8	34.6	47.6
2-3 Parity	6.5	27.4	4.8	22.4	18.5	19.0	24.5	38.9
3 and above	1.3	6.0	1.7	8.8	23.0	20.4	19.5	24.5
Media exposure								
No exposure	2.0	8.9	2.2	9.8	11.6	--	100.0	--
Had exposure	9.5	29.6	14.1	46.3	17.1	21.1	30.7	40.4

Table 1.3 Prevalence of very large or larger than average child at birth among women by different socioeconomic and demographic characteristics in four South-Asian countries

Characteristics	India		Nepal		Maldives	
	Normal BMI	Overweight/Obese	Normal BMI	Overweight/Obese	Normal BMI	Overweight/Obese
Economic condition						
Poor	21.9	25.2	22.2	30.8	11.1	17.3
Non-poor	24.8	27.7	22.3	25.1	15.6	18.9
Religion						
Hindu	23.5	27.9	22.0	22.0	--	--
Buddhist	--	--	24.5	55.3	--	--
Muslims	23.0	26.6	23.7	44.4	--	--
Christian	24.3	30.8	--	--	--	--
Others	18.2	21.5	22.9	10.0	--	--
Years of schooling						
Below 10 years	25.3	28.8	24.0	23.3	13.6	18.7
10 and above years	24.0	26.3	19.4	21.9	20.1	21.1
Occupation						
Housewife	23.5	27.6	20.2	26.5	12.7	19.0
Working outside home	23.0	26.5	22.7	26.0	15.5	17.1
Age at first birth						
Below 19 years	23.1	28.1	22.1	25.6	15.5	19.2
20 and above years	23.7	27.0	22.6	26.6	13.1	17.8
Parity						
First Parity	24.1	29.2	21.6	24.0	13.2	17.5
2-3 Parity	24.0	27.2	22.2	26.5	14.0	19.6
3 and above parity	21.3	24.0	23.2	27.8	14.4	17.4
Media exposure						
No exposure	20.7	28.9	16.8	16.7	44.4	--
Had exposure	24.7	27.2	23.5	23.3	12.3	19.8

Table 1.4 Prevalence of overweight child at birth among women by different socioeconomic and demographic characteristics in four South-Asian countries

Characteristics	India		Nepal		Maldives	
	Normal BMI	Overweight/Obese	Normal BMI	Overweight/Obese	Normal BMI	Overweight/Obese
Economic condition						
Poor	8.2	18.7	15.2	30.8	8.7	17.4
Non-poor	7.7	10.1	11.0	13.8	13.0	22.2
Religion						
Hindu	7.6	10.4	11.7	13.5	--	--
Buddhist	--	--	7.5	24.0	--	--
Muslims	9.0	13.9	18.4	--	--	--
Christian	10.7	9.7	--	--	--	--
Others	7.5	2.3	12.5	20.0	--	--
Years of schooling						
Below 10 years	6.9	10.5	8.7	12.1	11.5	19.3
10 and above years	8.0	9.3	21.6	23.1	8.8	28.3
Occupation						
Housewife	7.4	10.6	12.9	18.8	10.8	20.9
Working outside home	9.0	10.3	11.2	11.6	12.1	19.2
Age at first birth						
Below 19 years	8.4	13.3	13.4	16.3	11.3	19.6
20 and above years	7.4	9.7	10.3	14.5	11.2	20.7
Parity						
First Parity	7.0	10.0	9.4	8.2	10.7	14.9
2-3 Parity	7.7	10.2	14.2	20.0	11.9	22.0
3 and above parity	12.3	16.0	17.1	37.5	11.0	25.4
Media exposure						
No exposure	9.3	19.3	20.0	20.0	--	--
Had exposure	7.6	10.2	16.2	11.8	11.0	21.6