Obesity and its association with maternal and child health outcomes among women in India

Background: Globally, Obesity has reached epidemic portion and one of the new emerging health problems, which increased risk of pregnancy complication and premature death due to serious chronic health condition. This study explore association between obesity and maternal and child health outcomes among women in India.

Data: Using data from National Family Health Survey (NFHS) conducted in India during 2005-06 successively, was used to estimate obesity and its impact on maternal and child health outcomes using logistic regression and cox proportional hazard model.

Results: The prevalence of obesity was 15.3% among women in India; rate of increase in the level of obesity has much higher than developed countries. However, obesity statistically significantly associated with maternal and child health outcomes. Obese women were high risk of pregnancy complication such as cesarean, prolonged labor, swelling, vaginal bleeding, and have a high risk of fetal death and deliver macrosomic infant.

Conclusion: The findings from this study suggest that obesity and its associated chronic morbidities is more severe problem in India. There is strong need to some national plan of action to address obesity before to reach emergency level.

Keywords: Obesity, Maternal complication, Child health outcomes, Cesarean and Macrosomia etc.

Introduction

Globally, obesity has reached epidemic proportions, with more than 1.4 billion adult people overweight and at least 200 million men and 300 million women, among them are obese (WHO, 2008). In India, about 20 percent of male and 18 percent of female adult are overweight/obese and 5 percent population of the country suffering from this chronic epidemic. According to National Family Health Survey (NFHS) II, 10.5 and NFHS III, 15.3 percent of female in reproductive age are overweight/obese respectively. It is an important emerging public health challenge, because it is foremost risk factor, which contributes to the main diseases leading to global burden of diseases, disability and premature mortality. In addition it has harmful effect on health, especially women's reproductive health. Obese women are more likely to face serious health problems during pregnancy which may lead to complication resulting into cesarean delivery, gestational diabetes, postpartum anemia, menstrual disorder, infertility, miscarriage, poor pregnancy outcomes (Clark *et al.,* 1988).

The causes of increase in prevalence of obesity could be attributed to changes in nutritional transition. This has eventually led to significant increase in body mass index, which hikes the prevalence of obesity over time in developed as well as developing countries. The magnitude of the problem varies between different counties as well as with respect to different socioeconomic conditions within the country (Aekplakorn *et al.,* 2004 and Yoon *et al.,* 2006). The higher prevalence of obesity is seen in urban area and is associated with the changing pattern of life style causing decreased level of physical activity and increased intake of energy dense diet. The level and risk factors of obesity and overweight significantly differ for women and men as is evident from number of studies that have shown that prevalence of obesity is higher among women as compared to men (James *et al.,* 2001). However, it is also associated with higher socioeconomic status (SES) (Ramchandran, 2008; Al-Sendi *et al.,* 2003; Kelishadi *et al.,* 2008 and Vijayalakshmi, 2002). The prevalence of non-communicable diseases, such as cardiovascular diseases, diabetes, certain cancers and also some adverse pregnancy complication are higher among obese mothers (Ramchanderan, 2010; Moura & Claro, 2012). Obesity is associated with comorbidities like menstrual dysfunction, reproductive disorder including infertility, increased rate of abortion and pregnancy complication and adverse pregnancy outcomes (Seidell *et al.,* 1993; Douchi *et al.,* 2002 and lake *et al.,* 1997). It is more likely to have a higher rate of induction of labor infection, internal

bleeding and hence requires assisted delivery (Denison *et al.*, 2008; Ryan, 2007; and Ramchanderan *et al.*, 2008). The evidence from different studies emphasizes that maternal obesity has been associated with increased risk of cesareans delivery and is more common among pregnant women who are obese (Lynch, 2008; Sarkar *et al.*, 2007; Ryan, 2007; Baura *et al.*, 2007; and Jain *et al.*, 2007). Similarly, another pregnancy complication factors like miscarriage, pre-eclampsia, gestational diabetes, bleeding, labor, obstetric complication and fetal macrosomia; has greater chance of having a cesarean delivery (Ryan, 2007; and Kasha & Kenny, 2009). Finally, maternal obesity and excessive weight gain increases the chance of fetal death or infant mortality; and high risk of prenatal death associated with pregnant women is more likely to be twice among obese women (Seligman, 2006).

After doing extensive review of literature, it is found that there is least literature available on obesity and its association with maternal and child health outcomes in India. This study tries to fill this gap by explaining how obesity is associated with maternal and child health outcomes and its variation across the country by understanding the impact of socioeconomic changes that have taken place in Indian society since beginning of this century with the help of objectives mentioned below. First we examine the level and pattern of prevalence of obesity across different states and socio economic strata of the country; secondly, we have tried to explore effect of obesity on selected socioeconomic and demographic characteristics; thirdly, it examine impact of obesity on maternal outcomes such as cesarean delivery, pregnancy complication like vaginal bleeding, labor and swelling; lastly, we explore the impact of obesity on health outcomes of newly born infant such as infant mortality and macrosomia.

Data source:

Data is derived from National Family Health Surveys second and third round (NFHS-II & III), which were conducted in India during 1998-99 and 2005-06 respectively. It is a large scale household survey carried out periodically, which facilitates cross national comparison and representative at regional level. The survey provides information on demographic, socio-economic and health profile of ever married women. This data provide an opportunity to examine the covariates of overweight/obesity and its association with adverse pregnancy and child health outcomes in India, which is undergoing rapid changes in lifestyle, physical activity and diets. So, we have used this

data sources for analysis of prevalence of obesity and its association with maternal and child health outcomes among women and children in India.

Response variables used in analysis

Body mass index (BMI) is a key variable measured at the time of the survey, which is used as outcome and an explanatory variable. The procedure used for calculation of BMI in National Family Health Survey, each ever married women with age 15-49 was weighted 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 ± 0.1cm) in a developing country field situation (Agrawal and Mishra, 2004). The weight and height data used to calculate the body mass index (BMI). Women who were pregnant at the time of survey or women who had given birth during the two months preceding the survey are excluded from the analysis, as the real BMI is affected due to the pregnancy and pregnancy outcomes. Although, this study is more interested on pre-pregnancy BMI, it is fair to assume that post pregnancy BMI will be strongly associated with pre-pregnancy BMI. The obese women are more likely to gain more weight during pregnancy. The weight gain during pregnancy and pre-pregnancy weight are positively associated with adverse pregnancy outcomes (Jain *et al.*, 2007 and Cedergren, 2006). The BMI is used to estimate the prevalence of underweight, as well as overweight and obesity.

Definition of obesity used for analysis:

As per the definition given by World Health Organization (WHO, 2003), the BMI is calculated by weight (in kilogram) divided by the square of height (in centimeter). As per this definition BMI is divided into four categories; a BMI of less than 18.5 kg/m2 is defined as underweight, indicating chronic energy deficiency. A BMI in the range of 18.5 and 24.9 kg/m2 is defined normal; 25.0 and 29.9 kg/m2 as overweight; and more than 30 kg/m2 as obese. Based on these cut-offs, we created three category variable of nutritional status of women, indicating thin, normal and women with above 25.0 kg/m2 as obese (Agrawal and Mishra, 2004)**.**

In addition, the second outcome variable asks women if the last birth was cesarean or else normal delivery. The third outcome variable is labor and delivery complication, measured by the women reporting prolonged labor, excessive bleeding and body swelling during past year of birth. The fourth outcome variable is infant mortality, which is measured using the total number of women who have reported that her last

birth ended in death of baby in first year of birth. Finally, fourth outcomes variable is fetal Macrosomia, which is measured in term of a newborn with an excessive birth weight.

Definition of macrosomia:

Fetal macrosomia has been defined in several different ways, including birth weight of 4000-4500 g (8 lb 13 oz to 9 lb 15 oz) or greater than (Jazayeri *et al.,* 1999). The study on the macrosomia has found that the macrosomia varies with ethnicity and reportedly associated with neonatal morbidity, neonatal injury, maternal injury, cesarean delivery and maternal BMI level (Spellacy *et al.,* 1999).

Methodology:

The Descriptive analysis is used to estimate prevalence of obesity across country and also inter-state differential in India. Further, bi-variate and tri-variate analysis are used to understand the socioeconomic and demographic differential in the prevalence of obesity in India. The binary logistic regression analysis is used to examine association of selected background characteristics on the prevalence of obesity and its consequences during adverse pregnancy complications such as Vaginal Bleeding, swelling and labor and outcome like Cesarean, Infant Mortality and Macrosomia in India. Further, the cox proportional hazard model has been used for analysis of effect of obesity on child health outcome as infant mortality. The STATA statistical software package is used to perform overall analysis. The result has been presented in the form of odd's ratios (OR), with 95% percent confidence interval (95 % CI). The estimation of confidence intervals takes into account design effects due to clustering at the level of the primary sampling unit.

Results

Table 1, shows prevalence of obesity across India, according to NFHS III, the prevalence of obesity was 15.3% and NHFS II, 10.5%; in just last seven years, nearly fifty percent increase in level of obesity among Indian women. Comparing regions, the highest increases in obesity were observed in northeast about 88.5%, followed by south 57.7%, East 54%, Central 50%, West 41.7% and North 26%. However, comparing states in India over time, it was observed that more than double increase in obesity among women from the northeastern state like Mizoram, Nagaland and Assam and all another state has shown more than half increase in level of obesity. The prevalence of obesity varies by place of residence, urban area 29%, and rural area 9% among women.

Further analysis in this study has been restricted to the only NFHS III data in India.

Table 2, shows prevalence of obesity by socio-economic and demographic characteristics; the women form different age group across place of residence, the higher age groups (35+), has high proportion of obesity than younger age group of 15-24 years. Women who were married, from upper caste, and highly educated have a high prevalence of obesity than their corresponding categories. While, women who have any mass media exposure are found to be more prone to become obese. Mass media exposure and currently not working status of women is associated with physical inactivity level, which is frequently more responsible for increase in level of obesity. Although, obesity is associated with sendarty life style, which is practices more by women from wealthy families and this explains high prevalence of obesity among richest section among society. However, prevalence of obesity differs by socioeconomic status and spatial distribution of population. Women from urban area are more likely to be obese than women from rural area due to socioeconomic differential. Similarly, women from south, north and west region were found to be more likely to become obese than the women from their counterpart regions.

Table 3: The adjusted logistics regression analysis describes many of the same trends as in the bivariate analysis performed above. All the covariates were found to be positively and statistically significantly associated with obesity, except marital status of women. The women of older age group from upper caste and other religion with high wealth status are more likely to be obese than their respective counterpart. However, women belonging to the south region have been found to be at very high risk of obesity than respective reference category women in India.

Table 4: Shows that prevalence of pregnancy complication and outcome during last birth by BMI level and socio-economic and demographic characteristic of women. Obese women are found to be at all time high risk of any type of pregnancy complication than thin and normal women. The obese women from high socioeconomic status with any mass media exposure are found to be more prone to pregnancy complication experienced bleeding such as excessive vaginal, prolonged labor, swelling, and cesarean delivery than women from their corresponding categories.

Table 5: The regression analysis results for the pregnancy complication, shows that obesity leads to an increased risk of complication. The covariate such as obesity in terms of BMI, age, education and wealth status are positively associated with various

pregnancy related problems; while, only one covariate education, is positive for excessive vaginal bleeding. However, the obesity, caste, religion, education, and wealth status is statistically significant and is associated with prolonged labor. In case of swelling, the obese women with higher education from Muslim religion and belonging to urban residence as well as women from northeastern states have high risk of swelling than their counterpart.

The results for cesarean delivery during last birth show that obesity is positively associated with cesarean delivery. It is also statistically significant when measured by high risk of cesarean among obese women. The other covariate such as age, caste, religion, education, working status, mass media exposure and wealth status of women were positively related to the cesarean delivery. The women with 25-34 ages, higher educated, having full mass media exposure, urban residence, belong to affluent family and from South region were more likely to have gone for cesarean delivery than corresponding reference category women.

Table 6: shows that results for prevalence of Macrosomia by selected characteristics of women, In India, prevalence of macrosomia increases with level of BMI; while, obese women nearly (6.3%) have a high proportion than lower BMI level. the diabetic women are more likely to deliver macrosomic fetus than non-diabetic. However, obese women from 15-24 age group with characteristics such as, schedule caste, Muslim religion, non-educated, no mass media exposure, currently not working, poorer wealth status and belonging to Northeastern region have high proportion in delivering macrosomic infant than their counter part women across the level of BMI.

Table 6: also shows results for infant mortality; unfortunately, the descriptive statistics does not give clear picture about obese women with high proportion infant death. It could be because of different countries use different age distribution and definition for infant mortality. The prevalence of infant death by all covariates across level of BMI has not shown any clear picture, that is why this study tires to go for further multi-varties analysis using cox proportional hazard model, which will enable us to see in-depth effect of covariates on outcome variable.

Table 7: shows that results for macrosomia; obesity has statistically significant relationship with fetal macrosomia. The obese women were more likely to deliver macrosomic infant than lean women. The diabetic women were much more likely to have macrosomic infant as compared to others. The literature from developed countries

found that macrosomia varies with ethnicity (Jazayeri *et al.*, 1999), this study also found the same results in case of India; the schedule tribe women were 1.36 times more likely to deliver macrosomic infant, and also women from Muslim religion have very high risk of delivering macrosmic infant than counterpart women. However, level of education is negatively associated with macrosomia. The women with higher education were less likely to deliver macrosomic infant than non-educated women. The working women from rural residence, and belonging to North and Northeastern region were more likely to deliver marcosomic infant with high level of statistical significance.

Table 8: shows results for Cox Proportional hazard Model, A number of findings for determinant of infant mortality have been expected. The result expected for obese women were to show that infants are more likely to die when born to obese women than other category women; we found higher magnitude of odds for infant death, but does not found statistically significant effect on infant mortality. The reason of the insignificant result for obese women may be because of age distribution of infant mortality and their different definition across countries. The majority of study from developed country found the positive relationship between infant mortality and obesity. The education and wealth status of women has significant effect on infant mortality. The increase in wealth status and level of education is negatively related to infant mortality; which means women with higher education and belonging to affluent families are less likely to have infant mortality.

Discussion:

Obesity has been increasing in India over the last decade and is now at higher level. The rate of increase in the level of obesity in India is much higher as compared to developed world. The study found that considerable proportions of women from many states of India are already overweigh/obese. The problem is more severe in some southern and northern states like Kerala, Punjab and Delhi. The India is a developing country, which is in degenerative phase of the nutritional transition because of the increase in additional burden of under nutrition and related health problem. The increase in prevalence of obesity are double burden of nutritional health problem and its associated non-communicable disease (NCD); and the same time we have to deal with the problem associated with increasing obesity (Prakash S, 2002, Monterio & Popkin, 2004). However, it is found that there is wide variation in the relationship between socioeconomic status and obesity. The changes in socioeconomic inequality and regional variation have been associated with prevalence of obesity. In India, older age

(35 and above) and urban women clearly display the relationship, whereby the rich and highly educated are more likely to be overweigh/obese controlling all other characteristics, while it is contradictory to the research conducted in the developed world, shows that poor is more likely to be obese (Popkin et al, 2002). But, in case of low income country; it is positively related to socioeconomic status (McLaren, 2007). It could be because of lower level of development, the poor are more likely to food scarcity and increased energy expenditure, and that may be the reason of lower prevalence of obesity among group with lower (SES) socio-economic status (Moneterio *et al.*, 2004).

As expected, the place of residence, mass media exposure, age and ethnicity is positively associated with obesity. Previous studies (Moneterio *et al.*, 2004) found that age is an important determinant of obesity; the study also found that increase in prevalence of obesity among older age and urban women. Unfortunately, it is going be the future challenging issue in India. The married are more likely to be obese; it may be because of married women play different role in society and some study also found that gender roles are positively associated with obesity. The sedentary life style in terms of composite physical activity level is the main reason for greater increase in prevalence of obesity among urban women (Vaz et al., 2005). Changes in physical activity and life style are positively associated with an increase in obesity rate in both developed and developing country (James, 2007). The specific role, gender and age defined role may directly impact on activity level; this study found that working women are significantly less likely to be obese, due to their greater likelihood of activity level than that of not working. The full mass media (Daily watch TV/listen Radio/reading Newspaper) exposure are also significantly associated with obesity and also lower level activity. The many studies found that causes behind the prevalence of obesity and its related consequence for both developing and developed world. However, the many factor influencing body weight gain as genes (Small effect), urbanization, rise in the economy, rapid nutrition transition, standard of leaving, prenatal/postnatal influence, life style change, unhealthy diets, too much television watching, and lower level of physical activity. The consequences like heart disease, depression, blood pressure, diabetes, asthma, sleep apnea, gallstone, kidney stone, infertility, stroke and including 11 types of cancer, including leukemia, breast, and colon cancer and also social and emotional effect including discrimination (Popkin *et al.*, 2002; Kim *et al.*, 2006; Ngoc *et al.*, 2006; and Mishra *et al.*, 2005).

This study highlights how the maternal and child health outcome has been associated with obesity; As expected, cesarean section is significantly associated with both maternal and SES of women than their counterpart women and the prevalence of cesarean increases over time. Nevertheless, (Ramchandern *et al.,* 2008) demonstrate maternal obesity is also significantly associated with adverse pregnancy complication, showing that obese mothers are more likely to suffer pregnancy complication. This study also demonstrates that maternal obesity is significantly associated with the pregnancy complication. However, some important problem not analyzed in this study but exiting literature shows that still the obesity is major risk factor in gestational hypertensive disorder, gestational diabetes mellitus and gestational thromboembolic disorder. The obese women are more likely to progress beyond the term (more than 42 week of gestation) as compared to normal BMI and lean women (Castro and Avina, 2002). In this study, the result for infant mortality partially supported finding of the existing literature. The existing literature shows a clear relationship and causal association between maternal obesity and poor infant outcomes; that relationship is associated with preterm delivery due to preeclampsia, difficult delivery due to macrosomia and increased congenital malformation (Andraesen *et al.,* 2004).The lack of relationship between obesity with infant mortality may be due to the large number of studies between obesity and infant health are from developed world where age distribution of infant or definition of infant mortality is different that of from India. In addition, the number of studies from developed world found that the macrosomia is strongly associated with maternal obesity, even after controlling maternal diabetes. Diabetes has an independent and additive effect with maternal obesity and increase in the likelihood of macrosomia (Maouzoni et al., 2006). The association between obesity, diabetes and macrosomia has increased chance that the fetus born to obese women are diabetic one and will suffer shoulder dystocia a dangerous obstetrics condition (Kiran *at el.,* 2005). Nevertheless, this study evidently found a positive association between maternal obesity, diabetes and macrosmia. The obese women with diabetes are more likely to born macrosomic infant.

Conclusions:

This study addresses many questions related to obesity in India, with relatively high obesity and its relationship with maternal and child outcomes. Presently, developing countries are experiencing much faster transition of obesity than developed countries, at much earlier stage of demographic and epidemiological transition. It is Important to

understand why Indian women suffer such high prevalence of obesity. Similarly, it is vital to quantify what extent of obesity is associated with poor health outcomes and also identify what group is more likely to suffer poor health outcomes. In India, number of flagship program has addressed reproductive problem and inequality in nutritional status among women but till now, there is no single program to address this growing epidemic in India. The maternal health problems associated with obesity are acute with no time lag to allow health care service to prepare themselves. Now, it time to address this sever epidemic with giving equal importance with other health related issues. Timely intervention of health care services may reduce the chronic co-morbidities related to obesity. A wise is saying, “An ounce of prevention is worth a pound of cure.”

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Table 1: Percentage of overweight/obese women in age group 15-49 by state and place of residence in India, NFHS III

State	NFHS II	NFHS III		
		Total	Urban	Rural
North	**16.1**	**20.4**	**32.7**	**14.2**
Jammu and Kashmir	13.8	21.9	39.4	15
Himachal Pradesh	13.4	18	38.3	15.7
Punjab	29.4	38.8	47.2	33.9
Uttaranchal	10.4	16.9	32	11.5
Haryana	16.6	21.2	34.1	15.4
Delhi	34.5	32.9	33.7	23
Rajasthan	6.7	10.4	21.9	5.9
Central	**6.8**	**10.2**	**24.4**	**5.7**
Uttar Pradesh	7.4	11.3	25	7.1
Chhattisgarh	4.2	7.1	23.6	2.5
Madhya Pradesh	6.8	8.9	23.6	3.7
East	**5.7**	**8.8**	**24.6**	**4.5**
Bihar	3.8	5.5	17.5	3.5
West Bengal	8.5	12.4	28.9	5.9
Jharkhand	3	6.6	20.5	1.9
Orissa	4.5	8.1	23.3	5.1
Northeast	**5.2**	**9.8**	**21.5**	**6.9**
Sikkim	15.6	19.2	31.9	16.2
Arunachal Pradesh	5.3	11.3	14.5	10
Nagaland	7.3	9.5	18.5	6
Manipur	10.4	17.8	27.5	13.5
Mizoram	5	11.8	18.1	4.1
Tripura	8.2	7.6	17.7	5.5
Meghalaya	5.3	7.3	11.7	6
Assam	4.1	9.5	23.2	6.6
West	**13.2**	**18.7**	**29.6**	**9.7**
Gujarat	15.6	21.1	33.6	12
Maharashtra	13.6	17.4	27.6	8.3
Goa	20.6	28.6	34.1	21.1
South	**13.2**	**22.4**	**34.7**	**15.1**
Andhra Pradesh	11.6	18.4	32.1	12
Karnataka	13.6	19.3	33	11
Kerala	20.9	34.4	41.6	30.8
Tamil Nadu	14.7	25	36.1	15.6
India	**10.5**	**15.3**	**29.6**	**8.9**

Source: Computed from NFHS III women data file.

Table 2: Percentage of obese women (15-49) by background characteristics in India, NFHS III

characteristics	NFHS II	NFHS III
Age		
15-24	2.7	4.2
25-34	9.4	12.5
35+	16.9	22.1
Marital status		
Single	-	12.6
Married	10.6	15.4
W/D/S	10.3	14.2
Caste		
Schedule Caste	5.9	10.6
Schedule Tribe	3.3	3.8
Other Backward Class	9.4	14.4
Other	15.3	22.7
Religion		
Hindu	9.6	14.2
Muslim	12.5	17.5
Other	19.9	26.3
Level of education		
No education	4.9	7.9
Primary	10.9	14.6
Secondary	17.2	23.5
Higher	28.6	39.1
Mass media		
Not exposure	3.4	4.5
Partially exposure	15.4	32.9
Working Status		
No	13.1	19.7
Yes	6.7	10.1
Standard of living		
Low	2.8	3.3
Middle	8.7	8.8
High	27	28.6
Type of Place of Residence		
Urban	23.2	29.6
Rural	6	8.9
Region residence		
North	16	20.4
Central	6.8	10.2
East	5.6	8.8
Northeast	5.2	9.8
West	13.1	18.7
South	14.2	22.4
India	**10.5**	**15.3**

Source: Computed from NFHS III women data file.

Table 3: Odds Ratio showing the effect of selected covariates on the prevalence of obesity among women in India: Results from Logistic Regression analysis, NFHS III

Covariates	Model I	SE	Model II	SE	Model III	SE
Age						
15-24®						
25-34	3.314***	0.048	3.095***	0.049	2.811***	0.051
35+	6.497***	0.047	7.247***	0.048	5.865***	0.051
Marital status						
Single®						
Married			2.537	0.534	1.356	0.539
Other			1.921	0.535	1.241	0.541
Level of education						
No education®						
Primary			1.710***	0.034	1.163***	0.038
Secondary			2.841***	0.027	1.305***	0.034
Higher			4.204***	0.038	1.514***	0.047
Place of residence						
Rural®						
Urban			2.642***	0.023	1.535***	0.027
Caste						
Schedule Caste®						
Schedule Tribe					0.506***	0.051
Other Backward Class					0.963	0.036
Other					1.135***	0.036
Religion						
Hindu®						
Muslim					1.362***	0.037
Other					1.411***	0.039
Mass media						
Not exposure®						
Partially exposure					1.095**	0.03
fully exposure					1.220***	0.048
Working Status						
No®						
Yes					0.794***	0.026
Wealth Status						
Poorest®						
Poorer					1.796***	0.092
Middle					3.038***	0.085
Richer					5.637***	0.084
Richest					11.072***	0.086
Region residence						
North®						
Central					0.851***	0.039
East					0.796***	0.043
Northeast					0.778***	0.046
West					0.810***	0.039
South					1.519***	0.036

Note: Significance: ***p<0.001, **p<0.01, and *p<0.05. Dependent Variable: obesity: 1=Yes 0=No ®: Reference category.

Source: Computed from NFHS III women data file.

Table 4: Percentage of women experienced pregnancy complication during last birth in one year preceding the survey by BMI and background characteristics, India, NFHS III

Characteristics	Vaginal Bleeding			Prolonged Labor			Swelling			Cesarean		
	Thin	Normal	Obese	Thin	Normal	Obese	Thin	Normal	Obese	Thin	Normal	Obese
Age												
15-24	3.8	3.9	5.8	18.1	18.9	26.4	24.1	25.7	32.2	5.0	9.5	29.1
25-34	3.9	5.0	6.3	15.7	20.9	34.8	24.1	30.3	32.7	4.7	10.9	34.6
35+	4.3	4.3	0.3	9.9	15.5	48.3	33.0	28.4	42.3	3.3	5.7	28.4
Caste												
Schedule caste	2.9	3.9	7.6	15.0	15.9	17.1	23.6	25.7	29.6	4.5	7.9	19.0
Schedule Tribe	5.3	4.3	0.0	13.3	13.2	25.3	27.7	30.1	51.3	1.6	3.2	22.2
Other backward class	3.5	4.1	4.5	16.9	19.6	31.7	25.3	26.4	29.8	4.5	9.0	33.1
Other	4.9	5.0	6.6	22.4	24.0	37.6	23.4	28.9	36.5	8.1	15.4	35.7
Religion												
Hindu	3.5	4.2	5.2	17.2	19.3	32.5	23.5	26.1	33.2	5.2	10.6	33.4
Muslim	5.4	3.6	6.2	15.3	18.4	30.7	28.4	34.1	34.6	2.7	5.6	29.4
Other	4.4	8.8	9.8	19.3	26.1	30.7	22.1	27.6	26.3	9.7	11.8	30.7
Level of education												
No education	3.3	3.3	6.7	11.9	11.7	23.7	25.3	26.8	25.5	1.5	2.4	10.0
Primary	4.9	4.8	7.1	15.5	17.2	18.1	25.6	28.9	38.5	3.9	6.9	14.0
Secondary	4.1	4.8	5.5	23.4	24.5	29.9	22.0	26.6	32.9	9.5	17.5	37.8
Higher	6.0	8.4	5.5	21.6	37.5	42.7	31.3	36.8	37.1	25.0	32.0	38.2
Mass media												
Not exposure	3.6	3.5	9.5	9.1	11.9	25.9	25.9	26.2	37.7	0.7	1.8	17.5
Partially exposure	3.8	4.1	7.6	16.8	16.7	34.5	25.0	29.7	32.6	3.4	5.3	23.2
fully exposure	4.1	5.1	5.1	23.7	24.7	32.1	22.2	27.2	32.7	11.3	18.5	35.8
Working Status												
No	4.0	4.0	5.7	18.6	20.7	32.7	23.7	26.4	32.6	6.1	11.6	32.7
Yes	3.4	5.0	7.7	12.9	15.8	28.0	26.5	30.3	36.6	2.4	5.3	36.7
Wealth index												
Poorest	3.0	3.7	12.9	11.1	11.7	0.0	25.5	29.4	16.0	1.3	1.7	13.0
Poorer	4.3	3.4	0.1	16.4	15.4	22.8	25.6	25.3	24.2	2.5	3.8	16.7
Middle	3.7	4.0	4.7	16.7	16.7	18.1	20.4	25.4	35.0	5.5	8.1	19.1
Richer	4.3	4.4	7.2	21.7	22.9	27.7	24.9	28.8	31.1	9.2	16.2	26.4
Richest	5.2	7.0	5.4	27.3	31.1	38.5	26.3	29.6	35.8	18.0	26.1	40.6
Place of Residence												
Urban	5.2	5.8	5.0	20.3	24.9	36.4	24.0	31.9	33.5	8.6	17.8	36.7
Rural	3.6	3.8	6.8	16.2	17.4	25.6	24.6	26.2	32.5	4.1	7.3	26.2
Region												
North	4.5	5.8	8.1	15.7	20.5	39.6	21.7	26.7	36.2	4.6	7.3	27.8
Central	3.9	4.5	7.1	11.4	12.0	37.1	25.5	27.5	32.8	2.7	4.4	22.2
East	3.4	3.3	1.5	21.7	22.6	26.5	28.9	29.6	27.8	3.4	7.1	36.7
Northeast	8.5	4.0	4.1	11.0	20.7	34.6	25.4	35.0	53.3	3.4	6.4	27.5
West	4.5	4.6	5.7	15.1	19.8	35.3	22.6	25.6	39.5	5.6	11.6	35.5
South	2.3	4.0	5.4	23.6	26.5	26.7	16.0	24.6	29.0	12.9	27.3	37.3
Total	**3.9**	**4.3**	**5.8**	**17.0**	**19.5**	**32.2**	**24.5**	**27.6**	**33.1**	**4.9**	**9.8**	**32.4**

Source: Computed from NFHS III women data file.

Table 5: Odds Ratio showing the effect of selected covariate on prevalence of pregnancy complication among women during last birth in one year preceding survey: India, Results from logistic analysis, NFHS III

	Vaginal Bleeding	Labor	Swelling	Cesarean
	OR	OR	OR	OR
BMI Level				
Thin ®				
Normal	0.91	1.01	1.217***	1.428***
Overweight/obese	1.108	1.144*	1.570***	2.432***
Age Group				
15-24®				
25-34	1.118	1.003	1.038	1.157*
35+	1.021	0.885	1.033	1.134
Caste				
Schedule caste®				
Schedule Tribe	0.758	1.074	1.118	0.584***
Other backward class	0.887	1.082	1.012	0.881
Other	0.896	1.202*	1.005	1.186
Religion				
Hindu®				
Muslim	1.283	1.016	1.368***	0.616***
Other	1.175	1.279**	0.926	0.907
Education				
No education®				
Primary	1.454*	1.137	1.283***	1.595***
Secondary	1.341*	1.364***	1.061	2.293***
Higher	1.601*	1.638***	1.295**	3.824***
Media Exposure				
Not exposure®				
Partially exposure	1.009	1.253*	1.048	1.374*
fully exposure	1.019	1.474***	0.977	2.047***
Working Status				
No®				
Yes	1.126	0.878	1.220***	0.975
Wealth Status				
Poorest®				
Poorer	0.797	1.205	0.932	1.797**
Middle	0.95	1.287*	0.924	2.360***
Richer	1.283	1.475***	0.998	3.542***
Richest	1.222	2.069***	1.179	4.920***
Place of residence				
Rural®				
Urban	1.03	0.995	1.178***	1.283***
Region residence				
North®				
Central	0.712*	0.676***	1.035	1.225
East	0.746**	0.988	1.179	1.602***
Northeast	0.694*	0.923	1.384***	1.155
West	0.954	0.923	1.111	1.353***
South	0.497	1.003	0.758***	3.276***

Note: Significance: ***p<0.001, **p<0.01, and *p<0.05. ®: Reference category.

Source: Computed from NFHS III Kids data file.

Table 6: Prevalence of pregnancy outcome among women by BMI level and background characteristics, India, NFHS III

Characteristics	Infant Death		Macrosomia		
	Normal	Obese	Thin	Normal	Obese
Age					
15-24	6.7	6.3	5.2	5.1	7.6
25-34	4.5	4.4	4.9	6.4	5.9
35+	4.7	2.8	7.1	8.4	5.9
Caste					
SC	6.2	5.5	4	5.7	7.6
ST	6.8	0.8	6.2	9.2	8.6
OBC	5	5.9	5.7	6	4.6
Other	4.7	3.4	5	5.5	7.4
Religion					
Hindu	5.5	4.9	5.1	5.6	6.2
Muslim	4.8	4.3	6.2	7.4	8.4
Other	5.4	2.9	2.7	5.7	3.4
Level of education					
No education	6.8	7.3	7.4	9.5	14.4
Primary	5.6	3.9	5.1	6.5	8.4
Secondary	3.7	4.6	4	4.8	6.1
Higher	1.4	2.1	4.1	4.4	3.6
Mass media					
Not exposure	5.7	5.4	5.3	6.4	6.7
Partially exposure	3.5	3.1	4.9	4.6	6.6
fully exposure	2.2	1	0.4	4.3	1.6
Working Status					
No	4.8	4.4	4.5	5.4	6.5
Yes	6.2	4.9	6.3	7.2	5.5
Wealth index					
Poorest	7.1	5.9	7.4	8.1	9.8
Poorer	6.5	9.5	4.8	7.2	17.1
Middle	5.5	4.7	6.5	6.6	5.9
Richer	3.6	6.6	3.4	5.3	6.9
Richest	2.9	2.7	4.2	4.9	5.3
Place of Residence					
Urban	3.9	4	4.4	5	6.3
Rural	5.9	5.6	5.5	6.6	6.2
Region residence					
North	5.3	5.1	5	4.4	5.2
Central	6.6	5.6	5.6	8.8	7.8
East	5.6	7.6	6.1	5	6.6
Northeast	5.4	6.1	5.4	7.6	9.4
West	3.8	3	4.4	6.8	11.6
South	3.9	3.3	4.9	5.2	3.5
Total	**5.4**	**4.6**	**5.1**	**5.9**	**6.3**

Source: Computed from NFHS III Kids data file

Table 7: Logistic Regression Analysis, Odds Ratio showing the probability of Macrosomia by Covariates: India, NFHS III

Covariate	OR	95 % CI
Thin (BMI< 18.5)®		
Normal (BMI: 18.5-25)	1.266**	1.082-1.481
Overweight/obese(BMI>25)	1.750***	1.421-2.154
Diabetes		
No		
Yes	1.804*	1.002-3.248
Age Group		
15-24®		
25-34	1.111	0.969-1.274
35+	1.205	0.954-1.523
Caste		
SC®		
ST	1.361**	1.051-1.762
OBC	1.102	0.900-1.348
Other	1.011	0.822-1.244
Religion		
Hindu®		
Muslim	1.656***	1.356-1.952
Other	0.984	0.791-1.225
Education		
No education®		
Primary	0.702***	0.566-0.871
Secondary	0.659***	0.549-0.792
Higher	0.613***	0.472-0.798
Media Exposure		
Not exposure®		
Partially exposure	0.92	0.787-1.074
fully exposure	0.617	0.434-0.876
Working Status		
No®		
Yes	1.265***	1.101-1.453
Wealth Status		
Poorest®		
Poorer	0.925	0.677-1.262
Middle	0.996	0.742-1.336
Richer	0.914	0.676-1.238
Richest	0.868	0.626-1.203
Place of residence		
Urban®		
Rural	1.128*	0.979-1.300
Region residence		
North®		
Central	1.326**	1.037-1.695
East	0.952	0.735-1.232
Northeast	1.660***	1.310-2.103
West	1.019	0.808-1.284
South	0.732**	0.582-0.922

Note: Significance: ***p<0.001, **p<0.01, and *p<0.05. Dependent Variable: Macrosomia: 1=Yes 0=No ®: Reference category.

Source: Computed from NFHS III Kids data file.

Table 7: Cox proportional hazard model showing effect of covariates on the prevalence of pregnancy outcomes in India, NFHS III

Covariates	Infant Death	
	OR	95 % CI
BMI Level		
Thin®		
Normal	0.906*	0.822-1.000
Obese	1.044	0.861-1.266
Age Group		
15-24®		
25-34	0.537***	0.487-0.593
35+	0.502***	0.427-0.591
Caste		
SC®		
ST	0.962	0.815-1.134
OBC	0.946	0.834-1.072
Other	1.032	0.893-1.191
Religion		
Hindu®		
Muslim	0.842*	0.729-0.973
Other	1.066	0.880-1.290
Education		
No education®		
Primary	0.902*	0.789-1.032
Secondary	0.747***	0.652-0.856
Higher	0.533***	0.382-0.743
Media Exposure		
Not exposure®		
Partially exposure	0.948	0.801-1.121
fully exposure	1.084	0.731-1.607
Working Status		
No®		
Yes	0.906*	0.820-1.002
Wealth Status		
Poorest®		
Poorer	1.061	0.929-1.213
Middle	0.873*	0.751-1.014
Richer	0.731***	0.614-0.870
Richest	0.607***	0.484-0.760
Place of residence		
Urban®		
Rural	0.922	0.820-1.037
Region residence		
North®		
Central	1.373***	1.187-1.589
East	1.058	0.900-1.244
Northeast	0.939	0.777-1.134
West	0.892	0.732-1.087
South	0.733	0.605-0.887

Note: Significance: ***p<0.001, **p<0.01, and *p<0.05. ®: Reference category.
Source: Computed from NFHS III Kids data file.