Research Paper

Volume : 4 | Issue : 7 | July 2015 • ISSN No 2277 - 8179

Effect of Obesity on Pregnancy Outcomes – Indian Perspective: A Review

MEDICAL SCIENCE

KEYWORDS : Obesity, Pregnancy, Obesity Complications,Pregnancy Complications

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ABSTRACT

"Health is Wealth" is an old English saying. Everybody wants to have a healthy body sans any disease or illness. Weight is an indicator of general health of a person. Being underweight is not considered healthy and so is being over-weight. BMI & central obesity are the usual markers of obesity which are specific for a person's age & height. But these values could be misleading when comparing them with the western countries to Asian Indian population. This is because of the difference in the phenotype & general body structure of the two diverse set of people in east & west. Indian people are obese at a lower BMI than specified for western people. Obesity affects women more than men. Pregnancy is one of the most important phase of a woman's life and is suggested as the major event which could lead to excess weight gain and hence obesity. This could be harmful both for the mother and the child in the long run leading to various non-communicable diseases. Hence efforts should be made to identify various factors which lead to excess weight gain during and after childbearing so that this rising problem of obesity could be managed effectively. This article reviews the rising trends of obesity in Asian Indian population with specific emphasis on obesity in women during pregnancy & its associated long term problems.

INTRODUCTION

Worldwide obesity has more than doubled between 1980 and 2014. As per WHO report, in 2014, more than 1.9 billion adults (18 years and older) were overweight. Of these over 600 million were obese. This constituted about 39% as overweight (38% men & 40% women) and 13% obese (11% men & 15% women) of the world's adult population respectively. Earlier this trend of overweight & obesity was more confined to developed countries but now it has its impact on developing countries too. Asia showed a high prevalence of obesity and abdominal obesity especially in South Asia (K. G. M. M. Albert et al 2006). In India the epidemic of obesity is seen alongside continuing problem of under nutrition, creating a double burden (Vaidya AD 2014). According to NFHS 2005-06 surveys more than 30 million people of India are obese, which is approximately 6% of the obese people worldwide. Currently third in the chart next only to US & China; India is racing ahead to top the chart. There is also a steady rise in obesity among children in Asian population with it rising up to 25% in some developing countries (Kelishadi R 2007). India also has a high prevalence of obesity & abdominal obesity which is on the rise in the South Asian countries (K. G. M. M. Albert et al 2006). Measure of abdominal obesity includes waist circumference which is a better predictor of the risk of diabetes (Mamtani MR et al 2005), prognosis of patients with CVD (Dagenais GR 2005) in Indians (Vikram NK et al 2003). It is also affecting children, adolescent and adults alike (Mamtani MR et al 2005 & Dagenais GR et al 2005). This global prevalence of obesity as a health risk is found to be more common in females than males (WHO). Pregnancy has been reported as one of the factors for development of obesity in women world over. Excess pre pregnancy weight, weight gain during pregnancy or its retention after delivery could have detrimental effects on both mother and the child (Li Chung Lyu et al, 2009). A careful reading of the literature has shown that excess maternal weight at any phase of childbearing have negative effects on the pregnancy outcomes. It predisposes the women to various complications which then have a cascading effect on one another eventually leading to more serious long term problems like developing various non communicable diseases. The role of the present review is to understand the prevalence of various problems associated with obesity in pregnancy and the role of gestational weight gain on the various intra partum & post partum complications in mother & the infant with respect to the Indian phenotype.

DEFINING OBESITY

BMI have been used as a measure of obesity. It is the ratio of the weight to square of height of a person. Depending on it people are categorized into underweight, normal, overweight & obese groups. Table 1(a) shows the WHO recommended cut offs for BMI which are used universally.

Table: 1(a): WHO recommended cut offs for BMI

Underweight	≤18.5 Kg/m2
Normal BMI	18.5-24.9 kg/m2
Overweight	25.0-29.9 kg/m2
Obesity	≥30 kg/m2

WOMEN AND OBESITY

Obesity is a health problem that is increasing in prevalence globally with a higher prevalence in females than males (WHO). A child born to obese mother is more susceptible to obesity in adolescence & adulthood (Rashmi S Shah et al 2014). A study was undertaken by Pandey *et al.*, wherein body mass index (BMI) was calculated in 2421children between the ages of 4 and 15 years (1346 boys & 1075 girls) belonging to the upper socio economic strata of society. Their data revealed that 16% of the girls were overweight and 9.1% were found to be obese. Thus one fourth of the girls were together in the category of overweight and obesity (Pandey S et al 2014). A study done in Karnataka, India concluded that overall prevalence of overweight was 9.3% among boys and 10.5% among girls (M Shashidhar Kotian et al 2010). This is alarming because these girls could grow up to be obese women and hence mothers, further accentuating the problem of obesity.

According to the National family health survey (NFHS), the percentage of ever married women aged 15-49 years who are overweight or obese increased from 11% in NFHS-2 to 15% in NFHS-3. This prevalence was seen more in women of age between 40-49 years (23.7%), residing in urban areas (23.5%), having high qualification (23.8%), belonging to Sikh community (31.6%) and with families falling in high wealth quintiles (30.5%). Over weight and obesity is more than 3 times prevalent in urban areas than in rural areas (Jitender Gouda et al 2014).

Some of the factors such as urban living, increasing socioeconomic status and more qualification are the indicators of a rapidly developing and progressive nation. India definitely falls in this category. These changing factors are a sign of progress for a nation but their association with obesity is disturbing. Apart from above factors some other like age, parity, marital status and media exposure are the other covariates associated positively with overweight and obesity that predispose a woman to gain excess weight. (Praween Aggarwal et al 2004).

Though the problem of over-weight and underweight coexist in India, government policies and research work is more focused on dealing with the issue of under-nutrition only and very little or no emphasis is being given to the rising epidemic of overweight problem.

OBESITY AND PREGNANCY COMPLICATIONS

Pregnancy has been suggested to be one of the causes for developing overweight and obesity in women. (Stacy A et al 2003). Excessive gestational weight gain and postpartum weight retention are risk factors for female obesity. Indian culture also plays an important role in this scenario as being obese is considered good or a sign of prosperity by majority here. Motherhood adds to this view as engaging in any kind of physical activity especially in the form of exercises is not encouraged during this period. Even the post partum period involves a calorie rich diet with complete bed rest for minimum a month again not involving any activity. This could be a cause for gaining excess weight. Average postpartum weight retention could range from 0.5 to 3kg and there are also high variability seen among women, with some women retaining up to15kg. Some of the factors such as pre-pregnancy weight, excessive weight gained during gestation, lactation and diet have been cited as the risk factors for excess weight retention (Lyu LC2009). Maternal obesity has also been reported as a risk factor for various antenatal, intrapartum, postpartum and neonatal complications such as preeclampsia, induction of labor, gestational diabetes and hypertension, macrosomia, shoulder dystocia, prolonged duration of labor, increased blood loss or post partum hemorrhage, caesarean section rates and neonatal admissions (Seibre NJ et al 2001 &Tilton Z et al 1989).Obese women appear to be at risk of intrapartum and postpartum complications. The cascade of these event start with Induction of labor. (T.S. Usha Kiran et al 2005).

To get an overview of the current situation about complications in pregnancy due to obesity we reviewed recent studies on pubmed related to pregnancy, obesity and its associated complications from 2008 to 2015. After sorting for the desired results a total of 43 studies were found using key words “pregnancy”, “BMI”, “complication” and “parity”. Of these studies 9 were on Indian females. A separate paper is being worked on comparing the scenario of obesity related complications in western countries and Asian countries with that of Indian. This review focuses only on Indian scenario. Table 2 shows these Indian studies in detail. They show the odd ratios and prevalence of various complications in pregnancy due to increased BMI. The complications were relating to pre, intra, and post partum phases. All were done comparing with a reference group of normal BMI. The findings in each study show an increased prevalence of various pregnancy related complications as the BMI increases. Some of the common problems were preeclampsia, preterm labor, induction of labor, cesarean section, post partum hemorrhage, gestational diabetes mellitus, pregnancy induced hypertension, anaemia etc relating to mother. While for the neonatal these were microsomia, macrosomia, small or large for gestational age, low APGAR<7 score, admission to NICU, intrauterine growth retardation, perinatal death, stillborn etc.

The findings from these studies show that obesity increases the risk of almost all pregnancy related complications many folds. Some conditions like Preeclampsia, cesarean section and pregnancy induced hypertension were found to be 3 times more common in obese women as compared to the normal. The mean of the odd ratios for Gestational Diabetes Mellitus was 4 times in obese than the non obese. Also obese women had 6 times more chances of having a macrosomic child and 3 times of having a large for gestational age child. Perinatal death and intrauterine growth retardation was found to be 4 times more in obese. Chances of requiring a NICU admission was 3 times more in children born to obese mothers. Obese women also had more chances of having post partum hemorrhage. One important thing to mention here is that in all these studies the BMI measures were taken as per the criteria set by WHO which is universally followed. Western population being taller and well built as compared to Asians, using the same standard of BMI for comparing both is not right. This could be misleading to an extent as now there are Asia specific BMI cut off or revised consensus guidelines which re-classify BMI, as it tends to differ by race and ethnicity. Table 1 (b) shows these cut off values of BMI for Asian Indians. These cut-off values show Asians to be overweight or obese at a lower BMI compared to the WHO classification. Also a prospective bi-ethnic birth cohort study between South Asian and white British pregnant women showed that application of South Asian BMI cut-offs increased prevalence of obesity in South Asian women from 18.8% to 30.9% (Maria Bryant et al 2014). Similarly had these studies followed the new recommended guidelines then more women would fall under being overweight and obese eventually increasing the risk ratio of various pregnancy related complications too.

Table 1 (b): Cut off values of BMI for Asian Indians

Underweight	<18 Kg/m2
Normal BMI	18.5-22.9 Kg/m2
Overweight	23.0-24.9 Kg/m2
Obesity	≥25 Kg/m2

CONCLUSION

Excess weight during pregnancy leads to many complications whether it is related to prepartum, intrapartum or postpartum phase. It also increases the risk of various maternal and neonatal problems further. Definitely this problem is on the rise and need immediate attention to make this phase of motherhood less problematic and safer. The aim should be to check this rising problem of obesity at an early stage and develop adequate strategies for its effective management. More research should be focused on the issue of obesity in women and strategies developed to predict the reasons for excess weight gain before, during and after pregnancy. Also appropriate interventions should be developed to prevent this rising epidemic.

Table 2: Obesity related various Pregnancy Complications with their Odd ratios

Author	Design	Sample Size	BMI Classification	Risk Factors Assessed	Results (Odd Ratio, 95%, Significance) In Overweight & Obese Group.
1.Kumari P, Gupta M. et al, 2014, New Delhi, India	Observational case control study.	Total 400 (200 each)	A. 20-24.9 B. 25-29.9 C. ≥30	I. Maternal Complications: 1. Preeclampsia 2. Gestational Diabetes 3. PPH 4. Wound Infection. II. Obstetric Complications: 1. IOL 2. Failed IOL 3. Instrumental Delivery 4. ECS 5. CS III. Neonatal Complications: 1. Microsomia 2. Macrosomia 3. IUD 4. APGAR <7 5. NICU Admission. IV. Neonatal Complications 1. Gestational Age at Delivery i. PTB (≤34 weeks) ii. PTB (>34 - <37 weeks) iii. Post term (≥41 weeks)	I. Maternal Complications: 2.13 (1.25-3.65) & 3.35 (1.45-7.73) 3.14 (1.70-5.82) & 7.36 (3.11-17.45) 2.17 (1.23-3.83) & 3.01 (1.24-7.29) NS II. Obstetric Complications: 2.35 (1.52-3.64) & 1.71 (0.78-3.73) 1.65 (0.75-3.62) & 4.20 (1.13-15.54) 0.75 (0.38-1.49) & 0.51 (0.11-2.29) 2.79 (1.66-4.71) & 3.84 (1.69-8.75) 2.58 (1.69-3.94) & 7.25 (2.98-17.63) III. Neonatal Complications: 1.77 (0.97-3.25) & 2.38 (0.92-6.18) 3.36 (1.51-7.49) & 8.30 (2.99-23.03) 1.44 (0.43-4.82) & 2.6 (0.48-14.01) 1.38 (0.68-2.79) & 1.19 (0.35-4.34) 1.82 (0.97-3.41) & 6.52 (2.78-15.24) IV. Neonatal Complications - 0.88 (0.30-2.61) & 1.6 (0.32-7.89) 1.04 (0.49-2.21) & 1.19 (0.33-4.34) 0.32 (0.18-0.58) & 0.19 (0.04-0.82)
2.Bhasin P and Kapoor S,2013, New Delhi, INDIA	Cross-sectional study	631	A. ≤25.0 B. ≥25.0 - ≤30.0 C. ≥30.0	1. GDM 2. PIH 3. SGA/LGA 4. Gestation period 5. Birth wt	2.88 (1.48-4.64) & 2.02 (2.45-4.63) 5.58 (3.97-7.42) & 5.34 (3.23-5.43) 1.38 (1.03-1.44) & 1.65 (1.34-2.01) 1.28 (1.12-1.37) & 1.12 (1.04-1.87) 1.09 (1.05-1.22) & 0
3. Sujathaa V.V, Narasimha K.V.L Sharma et al, 2012, A.P, India	Prospective non randomized descriptive study	200 (100 each)	A. <30 B. > 30	1. Preeclampsia 2. GDM 3. Preterm labor 4. Labor induction 5. CS 6. Meconium liquor 7. LGAa > 2SDb 8. Fetal distress 9. APGAR at 1 min < 7 10. PPH 11. Genital tract infection 12. Wound infection 13. Urinary tract infection	1.52 (1.04-6.11) 4.8 (1.01-3.02) 4.8 (1.01-3.02) 3.14 (1.60-5.80) 3.45 (1.65-7.15) 2.04 (0.36-11.4) 13.8 (3.1-60.57) 2.04 (0.36-11.4) 4.2 (0.88-20.5) 1.21 (0.35-4.11) 2.02 (0.18-22.6) 1.7 (0.39-7.32) 1.2 (0.32-4.80)
4. Verma A and Shrimali L, 2012, Rajasthan, India	Prospective study	784	A. ≤ 19.9 B. 20-24.9 C. 25-29.9 D. 30 -34.9 E. > 35	I. During pregnancy 1. Hemorrhage 2. PIH 3. GDM 4. Anemia 5. IUGR II. Infant 1. PTL 2. SGA 3. LGA 4. NICU 5. Perinatal death	I. During pregnancy 1.37 (0.45-4.17) & 1.07 (0.23-5.07) 1.12 (0.59-2.04) & 1.38 (0.68-2.92) 4.96 (0.44-55.18) & 31.1 (3.69-262.3) 0.31 (0.19-0.50) & 0.18 (0.08-0.39) 1.08 (0.52-2.26) & 0.96 (0.35-2.59) II. Infant 1.15 (0.46-2.88) & 1.64 (0.58-4.67) 0.96 (0.43-2.12) & 1.05 (0.38-2.85) 3.55 (1.40-9.00) & 5.97 (2.23-15.96) 1.74 (0.83-3.61) & 2.14 (0.90-5.07) 1.64 (0.27-9.95) & 3.27 (8.53-19.91)
5. Meenakshi, Srivastava R et al, 2012, Gorakhpur, India	Prospective study	170 (87,83 respectively)	A. 25-29.9 B. >30	I. Antepartum variables: 1. PDH 2. Preeclampsia 3. Anemia 4. IUGR II. Intrapartum variables: 1. IOL 2. Vaginal delivery 3. CS 4. Increased operative time 5. Spontaneous VD III. Post partum variables: 1. Pyrexia 2. Endometritis 3. Post natal stay prolonged IV. Neonatal outcomes: 1. Preterm (<37 weeks) 2. Post maturity (>40 weeks) 3. Low birth wt (<2 kg)	I. Antepartum variables: 0.11 (0.05-0.17) & 0.13 (0.07-0.19) 0.11 (0.05-0.17) & 0.03 (0.03-0.09) 0.82 (0.76-0.88) & 1.39 (1.27-1.51) 0.15 (0.09-0.21) & 0.9 (0.03-0.15) II. Intrapartum variables: 0.21 (0.13-0.29) & 0.18 (0.12-0.24) 4.12 (3.34-4.90) & 5.12 (408-516) 0.18 (0.12-0.24) & 0 0.11 (0.4-1.01) & 0.10 (0.02-0.18) 4.12 (3.34-4.90) & 5.12 (408-516) III. Post partum variables: 0.91 (0.85-0.97) & 0.20 (0.12-0.28) 1.22 (1.22-1.32) & 0.49 (0.41-0.57) 0.32 (0.24-0.40) & 0.19 (0.11-0.27) IV. Neonatal outcomes: 0.25 (0.17-0.33) & 0.24 (0.16-0.37) 0.72 (0.64-0.80) & 0.44 (0.36-0.52) 0.41 (0.31-0.51) & 0.26 (0.18-0.34)

6.Mandal D, Mandal S, et al, 2011, India	Longi-tudinal prospec-tive study	844 (422 in each)	A. ≥ 30.0 B. 20-22	Maternal outcomes: 1. GDM 2. PIH 3. Preeclampsia 4. PTL<34WKS 5. PTL<37WKS 6. UTI 7. Thromboemboism 8. Chronic HT 9. Overt DM 10. IUFD Intrapartum: 1. Meconium stained liquor 2. NPL 3. Shoulder dystocia 4. Perineal & cervical tear Postpartum: 1. Endometritis & Infection 2. PPH 3. Peurperial pyrexia 4. Hospitalt stay >7 days	Maternal outcomes: 6.12 (3.51-10.65) 5.76 (2.90-11.56) 2.80 (1.491-5.263) 0.91 (0.503-1.654) 2.23 (1.187- 4.176) 3.29 (1.965-5.504) 11.13 (0.613- 202.9) 11.55 (2.698- 49.454) 21.51 (1.256-368.51) 6.22 (0.746-51.993) Intrapartum: 1.82 (1.252-2.649) 3.13 (1.886-5.199) 5.62 (1.237-25.52) 4.31 (2.128-8.748) Postpartum: 2.8 (15.51) 1.39 (0.722-2.697) 3.38(1.64-6.97) 2.56 (1.521-4.291)
7.Surap-aneni T and Fernandez E, 2010,A.P, India	Retrospec-tive cohort study	3201	A. < 18.4 B. 18.5-24.9 C. 25 -29.9 D. ≥30	1. CS 2. PPH 3. PTD 4. LGA 5. Macrosomia 6. Stillborn 7. NICU	2.02 (1.46-2.81) & 2.60 (1.3-3.90) 0.29 (0.07-1.21) & 0.69 (0.21-2.25) 1.57 (1.00-2.46) & 1.97 (1.19-3.28) 3.20 (1.75-5.82) & 8.66 (5.01-14.97) 1.33 (0.16-11.19) & 25.2 (9.15-69.84) 0.46 (0.06-3.54) & NA 1.06 (0.55-2.04) & 2.26 (1.23-4.13)
8.Dasgupta A, Harichan-drakumar K T, et al, 2014, Pondicherry, India	Prospec-tive cohort study	199	A. <25 B. >25 C. 25-34.9 D. ≥ 35	1. GDM 2. HT 3. PIH 4. Eclampsia / preeclampsia 5. IUGR 6. Macrosomia 7. Birth asphyxia 8. LSCS 9. Pre TD 10. IOL 11. Instrumental delivery 12. PPH 13. Wound sepsis	5 (1.564-15.75) & 8.5 (2.63-35.44) 3.6 (1.89-6.94) & 13.9 (4.12-46.43) 2.36 (1.14-4.88) & 6.22 (2.12-17.87) 5.07 (1.84-13.95) & 16.2 (3.43-76.07) 1.08 (0.37-3.11) & 3.03 (0.81-11.34) 2.48 (0.22-27.89) & 11.5 (0.99-134.4) 1.74 (0.81-3.64) & 4.07 (1.41-11.8) 2.99 (1.3-6.5) & 12.8 (3.84-43.13) 1.5 (0.66-3.49) & 1.4 (0.34-5.37) 1.3 (0.69-2.4) & 3.94 (0.93-18.6) 2.83 (1.98-6.78) & 4.56 (0.94-22.06) 3.2 (0.6-16.9) & 22.4 (4.08-122.8) 3.2 (0.60-16.9) & 9.1 (1.41-58.78)
9. Gaur K, Yadav A et al, 2013, Jaipur, India		250		I. Maternal: 1. Anemia 2. Preeclampsia 3. Nature of delivery- i. Normal ii. LSCS iii Forceps II. Wt. of child 1. Under wt. 2. Over wt.	I. Maternal: 0.77 (0.26-2.26) 11.37 (4.11-31.44) 0.13 (0.05-0.38) 2.25 (0.87-5.80) 54.0 (6.08-479.2) II. Wt. of child 17.6 (5.77-53.6) 5.68 (1.89-17.01)

Abbreviations: PPH: Post Partum Hemorrhage, **IOL:** Induction of Labor, **CS:** Cesarean Section, **ECS:** Elective Cesarean Section, **IUD:** Intra Uterine Death, **NICU:** Neonatal Intensive Care Unit, **PTB:** Pre Term Birth, **GDM:** Gestational Diabetes Mellitus, **PIH:** Pregnancy Induced Hypertension, **SGA:** Small for Gestational Age, **LGA:** Large for Gestational Age, **IUGR:** Intra Uterine Growth Retardation, **PTL:** Preterm Labor, **VD:** Vaginal Delivery, **UTI:** Urinary Tract Infection, **NPL:** Non Progress Labor, wt: weight

Volume : 4 | Issue : 7 | July 2015 • ISSN No 2277 - 8179

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