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Original Research Article

EFFECT OF MATERNAL PRE-PREGNANCY BODY MASS INDEX AND GESTATIONAL WEIGHT GAIN ON BIRTH WEIGHT AND GESTATIONAL AGE: AN OBSERVATIONAL CROSS-SECTIONAL STUDY

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Abstract

Background: Research demonstrates a relationship between birth weight (BW), gestational age (GA), and neonatal morbidities and pre-pregnancy body mass index (ppBMI) and gestational weight gain (GWG). Increased BW causes metabolic syndrome. The morbidities of preterm and low birth weight (LBW) are both short- and long-term. Since ppBMI and GWG are modifiable risk factors for obesity, monitoring them is essential. We reexamined these results in an Indian context in our study. The aim main goal is to investigate the relationship between ppBMI, GWG, and BW and GA. The investigation of the relationship between ppBMI and GWG with early newborn intensive care unit (NICU) need, infant size, and caesarean section (CS) is the secondary goal. **Materials and Methods:** With the approval of the Institutional Ethics Committee and informed consent, 230 mothers participated in a one-year observational cross-sectional study. A pre-made pro forma was used to gather the data, and SPSS was used for analysis. The stadiometer, fenton growth charts, and digital weighing scales were utilized. **Result:** GWG and ppBMI showed a positive linear connection with BW. Higher BW was linked to obesity and excess GWG, notably for GA, CS, and NICU stay. The overweight had higher CS. LBW, premature birth, and NICU stay was more common among underweight and lower GWG babies. Less GWG resulted in smaller GA. **Conclusion:** The factors that determine BW, GA, and newborn morbidities are GWG and ppBMI. In order to produce healthy children that are at low risk of obesity, metabolic syndrome, and neuro-developmental abnormalities at birth, more research should be done on diet and activity in pregnant and reproductive age women.

INTRODUCTION

In India, in 2015–2016, 22.9% of women of reproductive age were underweight, while 20.7% were overweight or obese. Overweight or obesity rates have significantly increased as compared to earlier statistics.[1] In Asia, the corresponding rates of overweight/obesity, low gestational weight gain (GWG), and high GWG are 10%, 31%, and 37%.[2] Women's pre-pregnancy body mass index (ppBMI) has been divided into four categories by the WHO: underweight (BMI <18.5–24.9), normal (18.5–24.9), overweight (25–29.9), and obese (≥30). The Institute of Medicine (IOM) suggested GWG of 12.7–18.1 kg, 11.3–15.9 kg, 6.8–11.3 kg, and 5–9.1 kg for underweight, normal, overweight, and obese mothers, respectively.[3] Numerous maternal and foetal abnormalities, including pre-eclampsia, gestational diabetes mellitus, caesarean section (CS), preterm, low birth weight (LBW), small for gestational age (SGA), and large for gestational age (LGA), have been linked to underweight, overweight, obesity, and less or excess GWG. Research indicates that the use of highly processed foods is linked to the weight of both mothers and newborns. Therefore, nutritional support during pregnancy may be helpful in preventing these issues. One modifiable risk factor for unfavorable newborn outcomes is GWG.[4,5] Excess GWG raises the risk of metabolic diseases by raising birth weight (BW) and childhood and adult obesity. In India nowadays, 25% of people have metabolic syndrome. Approximately 5.2% of teenagers and 13% of young adults suffered from obesity, diabetes, or high blood pressure.[6,7] Dietary practices and a sedentary lifestyle are the culprits, which may have their origins in greater BW brought on by excess GWG or obese mothers. Moreover, 13.2% and 18.2% of LBW and preterm births, respectively, occur in India.[8] One of the several modifiable reasons of premature birth is maternal underweight. The relationship between maternal ppBMI and GWG and BW, gestational age (GA), delivery style, and newborn problems necessitating a stay in a neonatal intensive care unit (NICU) in an Indian environment has been examined in this study.

Aims and objectives:

The main goal is to investigate the relationship between ppBMI, GWG, and BW and GA. Examining the relationship between ppBMI and GWG with early NICU admission, infant size (LGA and SGA), and caesarean section (CS) is the secondary goal.

MATERIALS AND METHODS

In a medical college hospital, an observational cross-sectional study was carried out over a one-year period in the NICU of the Department of Paediatrics and the Obstetrics ward of the Department of Gynaecology and Obstetrics. 230 pregnant women who were recruited at the time of their hospital admission for birth make up the study population. Simple random selection was used to choose the expectant mothers. The sample size should be 216, according to the sample size calculation based on the prevalence proportion of 17% for LBW incidence. In calculating sample size, the absolute error/precision was 5% and the confidence interval taken into account was 95%. Mothers who required general anaesthesia, had multiple gestations, foetal congenital anomalies, known heart disease, other systemic diseases, prior abortions or deliveries, anatomical abnormalities of the reproductive system, were admitted in a non-ambulatory state, and whose pre-pregnancy weight or early first-trimester weight was not recorded were not eligible. Prior informed permission was obtained and the institutional ethics committee approved the action. A pre-designed pro forma was used to gather the data, which included characteristics like age, height, pre-pregnancy weight, method of delivery, BW, GA, SGA/appropriate for GA (AGA)/LGA, medical and obstetric problems, and need for NICU care within 24 hours after delivery. As soon as the mother was admitted, her height and weight were recorded using a stadiometer and a digital scale, respectively. Maternal records were used to determine pre-pregnancy weight (within one month of a positive pregnancy urine test) or weight recorded on the first obstetrician visit (within one month of missing periods). Using the formula BMI = weight (kg)/(height in m)2, the ppBMI was computed. The four IOM ppBMI classifications for pregnant moms were underweight, normal, overweight, and obese. The third trimester's weight—the difference between the weight just before birth and the pre-pregnancy weight—was used to determine GWG. Within each of their corresponding ppBMI categories, mothers were categorized into three IOM groups: below recommended, normal, and above recommended GWG. LMP was used to compute GA. Included in the research were babies born via caesarean section as well as spontaneous vaginal birth. Following birth, the infant was dried and given a first examination while resting on the mother's chest or belly. Cutting and clamping of the cord was done 30 seconds after delivery. Babies who cried at birth or after taking their first few steps were kept with their mothers, and a digital newborn weighing scale was used to record Body Weight one hour following delivery. BW was recorded upon stabilization, often one hour after birth, for infants in need of resuscitation. Plotting on the sex-specific fenton foetal growth charts allowed for the determination of the neonate's SGA/AGA/LGA status.[9]

Statistical Analysis

SPSS software was used to analyze the data after they were moved to a Microsoft Excel spreadsheet. The mean and standard deviation (SD) of the ppBMI, GWG, BW, and GA data have been used for analysis, and independent (unpaired) t-tests have been employed. For several of the studies, chi-square tests have also been employed. The 95% confidence interval was used everywhere, and a $P<0.05$ was considered significant.

RESULTS

The moms that are included in the research had an average age of 26.401±2.639) years. The ppBMI was 24.781±5.169 kg/m2 on average. According to the IOM pre-pregnancy weight category, 34 (14.7%) women were underweight, 85 (37.1%) women had normal ppBMI, 73 (31.7%) women were overweight, and 38 (16.5%) women were obese. Among all the ladies, the mean GWG was 10.601±4.589 kg.

Of the 230 newborns, 109 (47.4%) were male and 121 (52.6%) were female. Of all the infants delivered, the mean BW was 2.721±0.549 kg, and the mean GA was 36.419±1.751 weeks. There were 25 (10.9%), 25 (10.9%), and 180 (78.3%), SGA, LGA, and, AGA infants born, respectively. 144 infants (62.6%) were born by CS, while 86 babies (39.4%) were delivered naturally. 49 newborns, or 25.65% of the total, experienced problems and required NICU hospitalization.

Maternal ppBMI and baby BW showed a strong positive link ($P<0.00001$), suggesting that underweight women were more likely to give birth to LBW babies whereas overweight and obese mothers were more likely to give birth to bigger babies.

Table 1: The comparison of the BW of babies of underweight, overweight, and obese mothers with that of normal BMI mothers

ppBMI category	P-value*
Underweight	<0.00001
Overweight	1.82199
Obese	0.000037

Table 2: The comparison of the BW of babies of mothers having inadequate and excess GWG with that of mothers having normal GWG

GWG	P-value*
Less	<0.00001
Excess	<0.00001

Table 3: The comparison of the immediate postnatal NICU requirement of babies of underweight, overweight, and obese mothers with that of mothers having normal ppBMI

ppBMI category	P-value
Underweight	0.0075
Overweight	0.5642
Obese	0.2293

[Table 1] demonstrates that the results of independent t-tests comparing the birth weight (BW) of babies born to underweight and obese mothers with those of babies born to mothers with normal BMI mothers were statistically significant. This suggests that underweight women were more likely to give birth to LBW babies, while obese women were more likely to give birth to larger babies. Mothers with an excess of weight did not have a substantially greater BW than moms with a normal BMI.

Maternal GWG and baby BWs showed a strong positive association (P<0.00001), suggesting that moms with extra GWG are more likely to have bigger kids, whereas those with insufficient GWG are more likely to birth LBW babies.

[Table 2] presents the significant results of independent t-tests comparing the birth weight (BW) of babies born to mothers with excess or inadequate GWG with that of mothers with normal GWG. These results suggest that women with excess GWG are more likely to give birth to larger babies, while those with inadequate GWG are more likely to deliver LBW babies. It was investigated how mother ppBMI and baby GA correlated. The findings showed that all ppBMI groups would have comparable odds of preterm or term birth, with P<0.05 (P=0.8647) not showing statistical significance.

Nevertheless, underweight women are more likely to give birth to preterm children, according to the significant (P=0.00053) result of the independent t-test comparing the GA of newborns of underweight moms with that of mothers with normal BMI. However, the results of the independent t-tests comparing the GA of babies born to mothers with normal BMI and those of overweight and obese mothers were not significant (P=0.3222 and P=0.1263, respectively). This suggests that higher ppBMI does not affect the GA, which can lead to preterm deliveries, but lower ppBMI can.

It was investigated how newborns' GWG and GA correlated. The data show that all GWG groups will have comparable odds of preterm or term birth, with P<0.05 (P=0.7215) not being statistically significant. An independent t-test comparing the GA of babies born to moms with insufficient GWG and mothers with normal GWG yielded a significant effect (P=0.0062), suggesting that women with insufficient GWG are at risk of premature delivery. The independent t-test result, which compares the GA of babies born to women with excess GWG to normal, does not show statistical significance (P=0.1133), suggesting that, in contrast to lower GWG, higher GWG does not appear to have an effect on GA.According to [Table 3], there is a significant difference in the immediate postnatal NICU requirement between babies of underweight and obese mothers and those of mothers with normal body mass index (BMI). This suggests that babies born to underweight and obese mothers are at a higher risk of experiencing serious early postnatal complications that necessitate NICU stays. The need for NICU care among infants born to overweight moms did not differ significantly from normal. This suggests that only at the extremes of ppBMI categories are there larger odds of experiencing substantial acute postnatal problems. Chi-square tests comparing the immediate postnatal NICU requirement of babies from mothers with excess and inadequate GWG with normal show significant results (P=0.0446 and 0.0196, respectively), suggesting a higher risk of perinatal complications for babies from mothers with excess and inadequate GWG.

When comparing the incidence of LGA in obese moms to normal mothers, the Chi-square test yielded a significant result (P=0.0075), meaning that the prevalence of LGA newborns was considerably higher in obese mothers than in normal mothers. However, compared to normal, SGA was not more common in other ppBMI groups. In comparison to normal, LGA was not appreciably greater in moms who were overweight. Chi-square test results comparing the incidence of SGA in women with lower GWG to normal GWG show a significant difference (P=0.0051), suggesting that moms with lower GWG had a considerably higher frequency of

SGA offspring. Babies of moms with increased GWG compared to normal did not have a higher frequency of SGA.

Chi-square test results comparing the incidence of LGA in moms with extra GWG to normal show a significant difference (P=0.0012), suggesting that mothers with excess GWG had a considerably higher frequency of LGA newborns. When comparing the incidence of CS in moms with extra GWG to normal, the Chi-square test result is significant (P=0.0266), meaning that CS was considerably more prevalent in mothers with excess GWG.

Chi-square tests were used to compare the incidence of CS in moms who were overweight or obese with those who were normal. The findings showed a significant increase in CS prevalence in the overweight and obese mothers (P=0.0171 and 0.0022, respectively)

DISCUSSION

According to our research, there is a positive relationship between BW and ppBMI, and pregnant women are more likely to give birth to kids who have greater BW. In their investigation, Tela et al. likewise found a strong positive connection between ppBMI and BW.[10] Goldstein et al., Li et al., and Slack et al. came to similar conclusions.[11–13] According to Papazian et al., McCall et al., and Chen et al., moms who were obese had a considerably greater incidence of newborn macrosomia.[14–16]

According to our study, there is a positive association between BW and GWG, and mothers who have extra GWG are more likely to give birth to kids that have greater BW. In their investigation, Tela et al. also found a strong positive connection between GWG and BW.[10] BW and GWG were discovered to be significantly correlated by Dahake and Shaikh.[17] Weekly GWG is favorably correlated with newborns' physical development across a range of age groups, according to Li et al.[12] According to Bouvier et al., mothers who had extra GWG were more likely to give birth to macrosomic newborns.[18] Goldstein et al., Guan et al., Chen et al., and Wang et al. all came to similar conclusions.[2,11,16,19, 20] Like Papazian et al., Guan et al., and Wang et al., we discovered that moms with lower GWG had a higher chance of giving birth to LBW children.[14,19,20] We discovered that there was a chance of LGA in kids born to obese moms. Similar to our study, Dzakpasu et al. demonstrated a strong connection between obesity and LGA in women.[21]

We also discovered that kids born to moms with extra GWG were at risk of having LGA. According to Bouvier et al., pregnancies with high GWG increased the chance of low birth weight babies.[18] Similar to our study, Dzakpasu et al., Guan et al., and Goldstein et al. also shown a strong connection between LGA and women with extra GWG.[2,19,21] Rogozinska et al. shown that the likelihood of LGA increases twofold as GWG increases.[22] We discovered that SGA and lower GWG were related. It was demonstrated by Goldstein and Dzakpasu et al. that a lower GWG was substantially linked to a higher risk of SGA.[11,21] Studies by Rogozinska et al. and Guan et al. demonstrated that insufficient GWG substantially raises the risk of SGA. Goldstein et al,[19-22] demonstrated a correlation between low GWG and SGA.[2] Underweight mothers were shown to be at risk of giving birth to LBW kids but not SGA. Papazian et al. corroborate these results, demonstrating that newborns of underweight women are more likely than average to be born with low birth weight.[14] Dzakpasu et al. discovered a strong correlation between underweight and SGA, which is inconsistent with our findings.[21] This discrepancy is most likely brought about by the noticeably greater incidence of premature births among mothers who are underweight.

Similar to our study, Dahake and Shaikh also observed no significant correlation between GA and GWG.[17] We discovered that premature deliveries were a possibility for moms with insufficient GWG. Goldstein demonstrated that the probability of preterm birth was correlated with lower GWG.[11] According to Rogozinska et al., the likelihood of a preterm delivery increases twofold as GWG decreases.[22] Guan et al. and Goldstein et al. discovered that insufficient GWG considerably raises the probability of preterm birth. Contrary to our findings,[2,19] Dzakpasu et al. found that increased GWG was only significantly associated with premature birth.[21] We discovered that preterm birth was a possibility for moms who were underweight. According to Gennette, women who are underweight are more likely to give birth prematurely on their own.[23] Contrary to our findings, another study found that obesity and overweight before to pregnancy are linked to higher chances of premature birth.[16] Our research revealed that infants born to underweight and obese mothers were at risk of perinatal problems and NICU admission. According to Bouvier et al., ppBMI significantly influences the outcome of pregnancies.[18] Chen et al. and Goldstein et al. both found similar results.[11,16] Papazian et al. demonstrated that NICU admission rates were considerably greater when mothers were obese.[14] According to McCall et al., a low Apgar score at five minutes is linked to a high maternal BMI. According to our research; newborns whose mothers had both excessive and insufficient GWG were at risk of prenatal problems and NICU hospitalization. Goldstein and colleagues got similar results. According to Bouvier et al. (2011), managing gestational weight gain throughout the second trimester may help prevent some perinatal problems.[18] Our study found that moms who were obese or overweight had a higher chance of giving birth by caesarean section. Chen et al., Nkoka et al., and Bouvier et al.[16,18,24] established the same conclusions. Anthropometric parameters taken by mothers before or during pregnancy in South Asian women are linked to the manner of delivery, according to Slack et al. Thirteen According to McCall et al., CS is linked to high maternal BMI.[15] We found that moms who gained too much weight had a higher chance of giving birth via caesarean section. Bouvier et al., Goldstein et al., Kominiarek and Peaceman, and Guan et al. all established the same conclusions.[5,11,18,19] According to research by Rogozinska et al., there is a 5% rise in the likelihood of CS with rising GWG.[22] It has also been demonstrated by Goldstein et al. and Chen et al. that CS and high GWG are related.[2,16]

CONCLUSION

We draw the conclusion from this study that prenatal problems necessitating NICU stay and BW are predictors of GWG and ppBMI. Higher BW, LGA, incidence of CS, and NICU hospitalization are all linked to obesity. Underweight is linked to premature birth, LBW, and a greater risk of NICU admissions. Lower GWG is linked to greater rates of NICU admission, preterm birth, LBW, and SGA. Higher BW, LGA, and rates of CS and NICU hospitalization are linked to excess GWG. This suggests that in order for women of reproductive age to achieve a normal BMI at conception, diet and exercise treatments are important. In order to minimize pregnancy-related issues and deliver a healthy neonate with appropriate birth weight, the same is crucial during the whole pregnancy. Larger sample sizes and more research are needed to determine if obesity, increased GWG, and premature birth are related.

REFERENCES

1. Varghese JS and Stein AD. Malnutrition among women and children in India: Limited evidence of clustering of underweight, anemia, overweight and stunting within individuals and households at both state and district levels. Am J ClinNutr. 2019;109(4):1207-1215. https://doi.org/10.1093/ajcn/nqy374.
2. Goldstein RF, Abell SK, Ranasinha S, Misso ML, Boyle JA, Harrison CL, et al. Gestational weight gain across continents and ethnicity: Systematic review and meta-analysis of maternal and infant outcomes in more than one million women. BMC Med. 2018;16(1):153. https://doi.org.10.1186/s12916-018-1128-1
3. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 548: Weight gain during pregnancy. Obstet Gynecol. 2013;121(1):210-212. https://doi.org/10.1097/01.aog.0000425668.87506.4c
4. Rohatgi KW, Tinius RA, Cade WT, Steele EM, Cahill AG and Parra DC. Relationships between consumption of ultra - processed food, gestational weight gain and neonatal outcomes in a sample of US pregnant women. Peer J. 2017;5:e4091. https://doi.org/10.7717/peerj.4091.ecollection 2017
5. Kominiarek MA and Peaceman AM. Gestational weight gain. Am J Obstet Gynecol. 2017;217(6):642-651. https://doi.org/10.1016/j.ajog.2017.05.040
6. Bhalwar R. Metabolic syndrome: The Indian public health perspective. Med J Armed Forces India. 2020;76(1):8-16. https://doi.org/10.1016/j.mjafi.2019.12.001
7. Bitew ZW, Alemu A, Ayele EG, Tenaw Z, Alebel A and Worku T. Metabolic syndrome among children and adolescents in low and middle income countries: A systematic review and meta-analysis. DiabetolMetabSyndr. 2020;12:93. https://doi.org/10.1186/s13098-020-00601-8
8. OECD and WHO. Health at a Glance: Asia/Pacific 2020: Measuring Progress Towards Universal Health Coverage, Paris: OECD Publishing; 2020. https://doi.org/10.1787/26b007cd-en
9. Fenton TR and Kim JH. Asystematic review and meta-analysis to revise the Fenton Growth Charts for preterm infants.BMC Pediatr. 2013;13:59. https://doi.org/10.1186/1471-2431-13-59
10. Tela FG, Bezabih AM and Adhanu AK. Effect of pregnancy weightgain on infant birth weight among mothers attending antenatal care from private clinics in Mekelle City, Northern Ethiopia.PLoS One. 2019;14(3):e0212424. https://doi.org/10.1371/journal.pone.0212424
11. Goldstein RF, Abell SK, Ranasinha S, Misso M, Boyle JA, Black MH, et al. Association of gestational weight gain with maternal and infant outcomes. JAMA. 2017;317(21):2207-2225. https://doi.org/10.1001/jama.2017.3635
12. Li C, Zeng L, Wang D, Dang S, Chen T, Watson V, et al. Effect of maternal pre-pregnancy BMI and weekly gestational weight gain on the development of infants. Nutr J. 2019;18(1):6. https://doi.org/10.1186/s12937-019-0432-8
13. Slack E, Rankin J, Jones D and Hestlehurst N. Effects of maternal anthropometrics on pregnancy outcomes in South Asian women: A systematic review. Obes Rev. 2018;19(4): 485-500. https://doi.org/10.1111/obr.12636
14. Papazian T, Tayeh GA, Sibai D, Hout H, Melki I, Khabbaz LR, et al. Impact of maternal body mass index and gestational weight gain on neonatal outcomes among healthy Middle- Eastern females. PLoS One. 2017;12(7):e0181255. https://doi.org/10.1371/journal.pone.0181255
15. McCall SJ, Li Z, Kurinczuk JJ, Sullivan E and Knight M. Maternal and perinatal outcomes in pregnant women with BMI>50: An international collaborative study. PLoS One. 2019;14(2):e0211278. https://doi.org/10.1371/journal.pone.0211278
16. Chen CN, Chen HS and Hsu HC. Maternal prepregnancy body mass index, gestational weight gain, and risk of adverse perinatal outcomes in Taiwan: A population-based birth cohort study. Int J Environ Res Public Health. 2020; 17(4):1221. https://doi.org/10.3390/ijerph17041221
17. Dahake ST and Shaikh UA.Astudy to assess correlation between maternal weight gain and fetal outcome among primigravidae registered in antenatal clinics. J Family Med Prim Care. 2019;8(11):3554-3558. https://doi.org/10.4103/jfmpc.jfmpc.75619
18. Bouvier D, Forest JC, Dion-Buteau E, Bernard M, Bujold E, Pereira B, et al. Association of maternal weight and gestational weight gain with maternal and neonatal outcomes. J Clin Med. 2019;8(12):2074. https://doi.org/10.3390/jcm8122074
19. Guan P, Tang F, Sun G and Ren W. Effect of maternal weight gain according to the Institute of Medicine recommendations on pregnancy outcomes in a Chinese population. J Int Med Res. 2019;47(9):4397-4412. https://doi.org/10.1177/0300060519861463
20. Wang YW, Feng YH, Wu SS, Cai SY, Ma LK and Jiang Y. Effect of pre pregnancy body mass index and gestational weight gain on birth weight of infants: A prospective cohort study. Chin J Dis Control Prev. 2020;24(3):314-318. https://doi.org/10.16462/j.cnki.zhjbkz.2020.03.013
21. Dzakpasu S, Fahey J, Kirby RS, Tough SC, Chalmers B, Heaman MI, et al. Contribution of prepregnancy body mass index and gestational weight gain to adverse neonatal outcomes: Population attributable fractions for Canada. BMC Pregnancy Childbirth. 2015;15:21. https://doi.org/10.1186/s12884-015-0452-0
22. Rogozinska E, Zamora J, Marlin N, Betran AP, Astrup A, Bogaerts A, et al. Gestational weight gain outside the Institute of Medicine recommendations and adverse pregnancy outcomes: Analysis using individual participant data from randomised trials. BMC Pregnancy Childbirth. 2019;19(1):322. https://doi.org/10.1186/s12884-019-2472-7
23. Gennette S, Varlamov A and Eason R. Pregnancy outcomes in underweight versus ideal weight women at time of delivery. Obstet gynecol. 2017;129(5):69s-70s. https://doi.org/10.1097/01.AOG.0000514862.83623.0d
24. Nkoka O, Ntenda PA, Senghore T and Bass P. Maternal overweight and obesity and the risk of caesarean birth in Malawi. Reprod Health. 2019;16(1):40. https://doi.org/10.1186/s12978-019-0700-2

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