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Original Research Article

Analysis of Pre-Pregnancy BMI and Its Contribution to Gestational Weight Gain, Diabetes Mellitus, and Hypertension

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Abstract:

Background: Increasing obesity in women of reproductive age presents considerable maternal and neonatal health hazards. The pre-pregnancy body mass index (BMI) and gestational weight gain (GWG) are critical factors influencing pregnancy outcomes.

Aim: To evaluate the relationship between pre-pregnancy BMI and gestational weight gain (GWG) with gestational diabetes mellitus (GDM), hypertension, and fetal growth outcomes.

Methodology: An observational study was conducted in a hospital setting with 80 pregnant women at Department of Obstetrics and Gynaecology, Radha Devi Jageshwari Memorial Medical College and Hospital, Bihar, India. Pre-pregnancy BMI was calculated using documented or first-trimester weight, and GWG was determined by weight difference in the third trimester. GDM screening and hypertension assessment were performed according to standard protocols. Data was analyzed using SPSS 27, with chi-square and logistic regression applied to determine associations.

Results: Half of the participants had normal BMI, while 25% were overweight and 12.5% obese. Excessive GWG was more common in overweight and obese women. The incidence of gestational diabetes mellitus (GDM) increases with body mass index (BMI): 0% in underweight individuals, 5% in normal-weight adults, 20% in overweight individuals, and 30% in obese women. Hypertension had a comparable pattern: 0% in underweight individuals, 2.5% in those of normal weight, 15% in overweight participants, and 30% in obese subjects.

Conclusion: Elevated pre-pregnancy BMI is associated with excessive GWG, GDM, and hypertension. Preconception counseling and individualized weight management are crucial to optimizing maternal and neonatal outcomes.

Keywords: Gestational weight gain, Gestational diabetes, Hypertension, Pre-pregnancy BMI, Pregnancy outcomes.

Introduction

Obesity has become a significant public health concern globally, particularly among women of reproductive age, who have experienced disproportionately high rates of obesity increase [1]. This is a concerning trend since women who go into pregnancy with overweight conditions are exposed to a cascade of metabolic, cardiovascular, and obstetric problems that could affect the fate of a mother and a baby. The prevalence of obesity varies by region; nevertheless, the global trend of rise is consistent and necessitates a deeper understanding of the effects of pre-pregnancy body mass index (BMI) on maternal health [2]. The change in the situation is so significant that even in countries like France where the overall rates are still lower than the ones reported in the United States, an almost twice increase in obesity in young adult women over the past decades provides a clear picture of the scale of the changing situation.

Mom obesity during conception has a complicated physiological impact that is felt throughout pregnancy. Increased pre-pregnancy BMI is currently considered as a risk factor on its own, affecting the nature of gestation and the labor and delivery process in more than one way [2]. Obesity is also accompanied by cardio-metabolic disorders, such as insulin resistance and chronic low-grade inflammation, which is estimated to play a role in pathologic pregnancy adaptations. Consequently, obese pregnant women are prone to increased vulnerability to negative conditions that could need extreme observation and medical care [4].

Gestational diabetes mellitus (GDM) and hypertensive pregnancy complications, including gestational hypertension and pre-eclampsia, are the most common complications that are linked to pre-pregnancy obesity [5]. Most studies have revealed that the probability of development of GDM is on the rise with the increase in BMI category and this serves as evidence of the growing metabolic burden on glucose regulation during pregnancy. On the same note, overweight conditions also predispose women to an impaired vascular and endothelial regulation, which can instigate hypertensive complications [6]. These diseases not only provide an immediate risk to maternal health but also have considerable long-term repercussions, including an elevated lifetime risk of type 2 diabetes and chronic hypertension.

The consequences of this type of maternal problem are transmitted to the foetus. Gestational diabetes mellitus (GDM) during pregnancy is strongly linked to excessive fetal growth, leading to large-for-gestational-age (LGA) newborns who are at increased risk of delivery trauma, neonatal hypoglycemia, and obesity in later life [7]. Conversely, hypertensive disorders may impair placental perfusion, resulting in intrauterine growth restriction and small-for-gestational-age (SGA) birth outcomes. Such branches of action show the wide range of fetal outcomes associated with disruptions in maternal metabolic and vascular status, which underlines the relevance of early detection and preventive measures [8].

Gestational weight gain (GWG) is a crucial determinant of pregnancy outcomes, particularly when considered alongside pre-pregnancy BMI. Vast amount of research conducted has proved that weight gain in pregnancy is not evenly distributed in terms of BMI; women who have a higher pre-pregnancy BMI have been shown to gain less weight on an average, but the lower weight gain does not necessarily provide protection against metabolic complications [9]. Rather, it seems to be a multiplexed association between GWG and adverse outcome depending on maternal baseline weight, metabolic states, and weight change patterns during gestation [10]. The results have inspired the derivation of BMI-based recommendations of suggested GWG even though compliance is still an issue in practice.

The relationship between gestational weight gain (GWG) and pregnancy outcomes is influenced not only by the amount of weight acquired but also by the measurement technique employed for GWG assessment. Most studies concentrate on total gestational weight gain, encompassing the weight of the fetus, placenta, and amniotic fluid. This metric, while more accessible, may exaggerate the correlation between gestational weight gain and birth weight or gestational length, as fetal size directly influences the measure [11]. To overcome this limitation, smaller literature has been used to study net gestational weight gain which is calculated by weight gain minus birth weight of the neonate of total GWG [12]. This method can give a better estimation of maternal physiological weight gain and its independent weight to gestational risk.

Despite a growing recognition of the significance of distinguishing between total and net gestational weight gain (GWG), relatively few studies have examined the interplay between pre-pregnancy body mass index (BMI) and net weight gain concerning the risks of gestational diabetes mellitus (GDM), gestational hypertension, and fetal growth abnormalities. Knowledge of these associations is necessary in refining clinical recommendations and in the design of interventions that help to optimize maternal metabolic health [13]. The investigation of these connections is crucial for identifying women at elevated risk of bad outcomes, hence facilitating the early implementation of targeted preventative actions.

This research will examine the correlations between pre-pregnancy BMI and net weight gain during pregnancy in connection with several maternal and newborn outcomes of interest. Particularly, we explore how these factors correspond to the risks of gestational diabetes, gestational hypertension, preterm birth, and SGA as well as LGA birth outcomes. With the help of the untangling of maternal weight and pregnancy-specific weight changes, this study aims at advancing the knowledge of how maternal modifiable and unchangeable traits interact in contributing to the outcome of healthy and healthy births.

Methodology

Study Design: This research will be a hospital-based observational analytical study aimed at evaluating the correlation between pre-pregnancy body mass index (BMI) and gestational weight gain (GWG), gestational diabetes mellitus (GDM), and hypertension during pregnancy. The study will employ a cross-sectional approach, with prospective data collection from antenatal mothers meeting the eligibility criteria.

Study Area: Department of Obstetrics and Gynaecology, Radha Devi Jageshwari Memorial Medical College and Hospital, Turki, Muzaffarpur, Bihar, India.

Study Duration: The study will be conducted over a period for 12 months

Study Participants

Inclusion Criteria

- Pregnant women attending the antenatal clinic with a singleton pregnancy.
- Women with documented pre-pregnancy weight or first-trimester recorded weight for BMI calculation.

- Women willing to provide informed consent.
- Gestational age ≤ 24 weeks at enrollment.

Exclusion Criteria

- Multiple gestations (e.g., twin pregnancy).
- Know diabetes mellitus or chronic hypertension before pregnancy.
- Women with significant medical disorders affecting weight or metabolism (e.g., thyroid disorders, renal disease).
- Inability to provide reliable information or refusal to participate.
- Women planning to move out of the region within the study duration.

Sample Size: A total of 80 pregnant women will be included in the study.

Procedure: Eligible pregnant women attending the antenatal clinic will be enrolled after obtaining informed consent. Pre-pregnancy BMI will be calculated using documented pre-pregnancy or first-trimester weight and measured height. Gestational weight gain will be calculated by deducting pre-pregnancy weight from the weight measured in the third trimester. Screening for gestational diabetes mellitus will be performed between 24–28 weeks using a standard oral glucose tolerance test, and hypertension will be diagnosed based on repeated blood pressure measurements or documented treatment during pregnancy. Demographic and obstetric data will be collected using structured interviews and hospital records.

Statistical Analysis: The analysis of data will be conducted with SPSS software version 27. Continuous variables will be presented as mean ± standard deviation, whereas categorical variables will be represented as percentages. Associations between gestational weight gain, gestational diabetes, hypertension and pre-pregnancy BMI will be assessed using chi-square tests and logistic regression models to calculate adjusted odds ratios with 95% confidence intervals. A p-value < 0.05 will be considered statistically significant.

Result

Table 1 shows the sample size of 80 study participants based on their pre-pregnancy BMI. The largest group was half of the participants (50%) who were within the normal range of weight (BMI 18.524.9 kg/m 2). The sample size for both the underweight (<18.5 kg/m²) and obese (≥30 kg/m²) categories consisted of 10 participants each, representing 12.5 percent of the overall sample. The overweight group (BMI 2529.9 kg/m 2) included 20 participants, and this group covered a quarter of the total population. Generally, most of the participants were at the normal or overweight BMI ranges with smaller percentages underweight or obese.

Table 1: Distribution of Study Participants by Pre-Pregnancy BMI (n=80)

Pre-Pregnancy BMI Category	BMI Range (kg/m²)	Number of Participants	Percentage (%)
Underweight	<18.5	10	12.5
Normal weight	18.5–24.9	40	50
Overweight	25–29.9	20	25
Obese	≥30	10	12.5
Total	—	80	100

Table 2 illustrates the allocation of gestational weight gain (GWG) in accordance with the Institute of Medicine (IOM) guidelines across various pre-pregnancy BMI classifications for 80 participants. Majority of women (45/80) had gain weight in the recommended range and women of normal weight were the biggest category that attained this (25/40). The underweight women were more likely to gain within the recommended range (6/10) compared to under or over the recommendations, whereas the overweight and obese women recorded a greater proportion of over the recommendations (8/20 and 5/10, respectively). In general, the condition of GWG lower than IOM recommendation was rare (10/80) and excessive GWG was found in 25 participants, mostly in participants with higher pre-pregnancy BMI. This indicates that pre-pregnancy weight may affect adherence to gestational weight gain guidelines, with overweight and obese women being more susceptible to excessive weight gain.

Table 2: Correlation between Pre-Pregnancy Body Mass Index and Gestational Weight Gain (n=80)

Pre-Pregnancy BMI Category	GWG Below IOM Recommendation	GWG Within IOM Recommendation	GWG Above IOM Recommendation	Total
Underweight	2	6	2	10
Normal weight	5	25	10	40
Overweight	2	10	8	20
Obese	1	4	5	10
Total	10	45	25	80

Table 3 illustrates the association between pre-pregnancy BMI and the incidence of gestational diabetes mellitus (GDM) in 80 women. The prevalence of GDM was not seen in any of the underweight women, or 5 percent of women with normal weight (2 out of 40) were diagnosed with GDM. The incidence of GDM was more common among women with high BMI, 20 percent of the overweight women (4 out of 20) and 30 percent of the obese women (3 out of 10) were infected. This is a strong correlation between elevated pre-pregnancy BMI and the heightened risk of developing gestational diabetes mellitus (GDM), suggesting that overweight or obese pregnant women face more risk compared to those with normal or low BMI.

Table 3: Correlation between Pre-Pregnancy Body Mass Index and Gestational Diabetes Mellitus (GDM) (n=80)

Pre-Pregnancy BMI Category	GDM Present	GDM Absent	Total
Underweight	0	10	10
Normal weight	2	38	40
Overweight	4	16	20
Obese	3	7	10
Total	9	71	80

Table 4 demonstrates the correlation between BMI before pregnancy and the prevalence of hypertension in pregnancy in 80 respondents. In underweight women, no hypertension was developed and 10 did not, which are all the cases. Among the normal weight group, 1 in every 40 women had high blood pressure implying a very low risk. It seems to be more dangerous among overweight and obese women, as 3 out of 20 overweight and 3 out of 10 obese women develop hypertension that is 15% and 30% of the overweight and obese population, respectively. Evidence indicates a positive correlation between elevated pre-pregnancy BMI and an increased risk of hypertension during pregnancy, with obesity exhibiting the most significant association.

Table 4: Pre-Pregnancy BMI and Pregnancy Hypertension Association (n=80)

Pre-Pregnancy BMI Category	Hypertension Present	Hypertension Absent	Total
Underweight	0	10	10
Normal weight	1	39	40
Overweight	3	17	20
Obese	3	7	10
Total	7	73	80

Discussion

The pre-pregnancy BMI distribution among the 80 study participants reveals that 50% of the women were categorized as having a normal weight (18.5-24.9 kg/m²), establishing it as the most prevalent group. One-fourth of the sample was overweight women (BMI 2529.9 kg/m 2), one-fourth were underweight women, and one-fourth were obese women. This distribution indicates that most of the respondents were either normal or slightly overweight with lower numbers of women at the extremes of either underweight or overweight. This pattern of distribution is paralleled by general population patterns of numerous locations, whereby the rates of overweight and obesity are increasing, whilst underweight are comparatively low. Maresh et al., (2015) [14] discovered that pregnant women with HbA1C levels between 6.0 and 6.4% at 26 weeks of gestation exhibited significantly elevated rates of delivering infants larger than gestational age, while those with HbA1C levels between 6.5 and 6.9% experienced increased rates of adverse pregnancy outcomes, including premature birth, preeclampsia, and neonatal hypoglycemia.

The increase in the gestational weight gain (GWG) was dependent on the pre-pregnancy BMI with 56.3% of the subjects gaining weight within the recommended ranges proposed by the Institute of Medicine (IOM). It is also worth noting that normal-weight women performed best in terms of reaching the right GWG, as 25 out of 40 women reached within the guidelines. There were also positive changes in underweight women, 6 out of 10 showed the required increase. On the other hand, obese and overweight women had higher chances to drop more than GWG as 8 out of 20 obese and 5 out of 10 overweight women had a higher weight range than the recommended range. The findings indicate that a higher pre-pregnancy BMI correlates with an elevated risk of excessive weight gain during pregnancy, highlighting the need for targeted interventions for women with elevated BMI before conception. The results suggest that pre-pregnancy BMI and gestational weight increase are individually and negatively associated with SGA at birth, with the lowest SGA risk found in obese women who gain more weight, as evidenced by Ay et al., (2009) in the Generation R Study in the Netherlands.

The systematic review of gestational diabetes mellitus (GDM) indicates the definite association with the pre-pregnancy BMI. No underweight women became GDM and only 5 percent of the normal weight women were infected. Nevertheless, the frequency of GDM increased dramatically in overweight and obese women to 20 and 30 percent, respectively. This trend endorses the previously documented relationship between an elevated BMI and insulin resistance that predisposes one to GDM. These results prove that more attention should be paid to glucose intolerance and preventive measures in pregnancy to women with larger pre-pregnancy BMI. This may be explained by the effect of reverse causation, as the group of gestational diabetes may be diagnosed with dietary guidelines leading to a lower weight gain during the late pregnancy, which Catalano et al., (1993) [16] earlier attested to.

In the same way, pre-pregnancy BMI was found to affect the risk of hypertension during pregnancy. The cases of hypertension were not observed in underweight women and in normal-weight ones the level was low (2.5%). The prevalence was elevated in the overweight group (15%) and the obese group (30%), indicating a favorable correlation between BMI and hypertension problems in pregnancy. This is in line with current literature that has reported maternal obesity to increase the risks of preeclampsia and gestational hypertension probably because of vascular and metabolic reasons of excess adiposity. Cho et al., (2015) [17] demonstrated that the risk of GDM during late pregnancy was lower with the rise of GWG rate, whereas it was not the case in early pregnancy.

In general, the results of this research demonstrate that pre-pregnancy BMI has a considerable impact on maternal health outcomes as it is associated with the increase in gestational weight gain and the occurrence of such complications as GDM and hypertension. Female athletes experiencing a higher BMI before pregnancy are specifically susceptible to excess GWG and related negative events, which makes preconception counseling, weight-management, and customized tracking during pregnancy an essential measure to take. On the other hand, even though the numbers of underweight women were lower, they were more likely to reach recommended GWG and had few complications, which indicates that the normal or slightly below-normal range of BMI could be protective during gestation.

Conclusion

The study results indicate that pre-pregnancy BMI is a key factor influencing maternal and newborn outcomes. The normal-weight women were the majority and had the highest chances of gaining recommended gestational weight, whereas the overweight and the obese women had a greater disposition to excessive weight gain. Increased pre-pregnancy BMI correlated with heightened chances of gestational diabetes mellitus and hypertension, with obese individuals demonstrating the highest incidence rates. These issues not only impair maternal health but also may influence fetal development and the long-term results of progeny. The research highlights the extreme significance of preconception counseling, optimization of weight, and customized monitoring of the pregnancy process to reduce the risks and achieve healthier maternal and neonatal outcomes.

Reference

1. Ramsay JE, Greer I, Sattar N. Obesity and reproduction. Bmj. 2006 Nov 30;333(7579):1159-62.
2. Popkin BM, Gordon-Larsen P. The nutrition transition: worldwide obesity dynamics and their determinants. International journal of obesity. 2004 Nov;28(3):S2-9.
3. Parrettini S, Caroli A, Torlone E. Nutrition and metabolic adaptations in physiological and complicated pregnancy: focus on obesity and gestational diabetes. Frontiers in endocrinology. 2020 Nov 30; 11:611929.
4. Parisi F, Milazzo R, Savasi VM, Cetin I. Maternal low-grade chronic inflammation and intrauterine programming of health and disease. International journal of molecular sciences. 2021 Feb 9;22(4):1732.
5. Lewandowska M, Więckowska B, Sajdak S. Pre-pregnancy obesity, excessive gestational weight gain, and the risk of pregnancy-induced hypertension and gestational diabetes mellitus. Journal of clinical medicine. 2020 Jun 24;9(6):1980.
6. White SL, Pasupathy D, Sattar N, Nelson SM, Lawlor DA, Briley AL, Seed PT, Welsh P, Poston L, UPBEAT Consortium. Metabolic profiling of gestational diabetes in obese women during pregnancy. Diabetologia. 2017 Oct;60(10):1903-12.
7. Ornoy A, Becker M, Weinstein-Fudim L, Ergaz Z. Diabetes during pregnancy: a maternal disease complicating the course of pregnancy with long-term deleterious effects on the offspring. a clinical review. International Journal of Molecular Sciences. 2021 Mar 15;22(6):2965.
8. Ortega MA, Fraile-Martinez O, Garcia-Montero C, Saez MA, Álvarez-Mon MA, Torres-Carranza D, Álvarez-Mon M, Bujan J, Garcia-Honduvilla N, Bravo C, Guijarro LG. The pivotal role of the placenta in normal and pathological pregnancies: a focus on preeclampsia, fetal growth restriction, and maternal chronic venous disease. Cells. 2022 Feb 6;11(3):568.
9. Zhang L, Zheng W, Liu C, Liang X, Zhang L, Tian Z, Li G. Associations between pre-pregnancy body mass index and gestational weight gain with pregnancy outcomes in women with

polycystic ovary syndrome. Diabetology & metabolic syndrome. 2020 Oct 8;12(1):88.
10. Louise J, Deussen AR, Dodd JM. Gestational weight gain—re-examining the current paradigm. Nutrients. 2020 Aug 1;12(8):2314.
11. Gou BH, Guan HM, Bi YX, Ding BJ. Gestational diabetes: weight gain during pregnancy and its relationship to pregnancy outcomes. Chinese medical journal. 2019 Jan 20;132(02):154-60.
12. Moore Simas TA, Waring ME, Liao X, Garrison A, Sullivan GM, Howard AE, Hardy JR. Prepregnancy weight, gestational weight gain, and risk of growth affected neonates. Journal of women's health. 2012 Apr 1;21(4):410-7.
13. Yong HY, Mohd Shariff Z, Mohd Yusof BN, Rejali Z, Tee YY, Bindels J, Van Der Beek EM. Pre-pregnancy BMI influences the association of dietary quality and gestational weight gain: the SECOST study. International journal of environmental research and public health. 2019 Oct;16(19):3735.
14. Maresh MJ, Holmes VA, Patterson CC, et al. Glycemic targets in the second and third trimester of pregnancy for women with type 1 diabetes. Diabetes Care. 2015;38(1):34–42.
15. Ay L, Kruithof CJ, Bakker R, Steegers EA, Witteman JC, Moll HA, Hofman A, Mackenbach JP, Hokken-Koelega AC, Jaddoe VW. Maternal anthropometrics are associated with fetal size in different periods of pregnancy and at birth. The Generation R Study. BJOG: An International Journal of Obstetrics & Gynaecology. 2009 Jun;116(7):953-63.
16. Catalano PM, Roman NM, Tyzbir ED, Merritt AO, Driscoll P, Amini SB. Weight gain in women with gestational diabetes. Obstetrics & Gynecology. 1993 Apr 1;81(4):523-8.
17. Cho EH, Hur J, Lee KJ. Early gestational weight gain rate and adverse pregnancy outcomes in Korean women. PloS one. 2015 Oct 14;10(10): e0140376.