World Journal of Current Medical and Pharmaceutical Research
Content available at www.wjcmpr.com ISSN: 2582-0222

NEWER INSIGHTS OF RELATIONSHIP BETWEEN OBESITY AND PREGNANCY COMPLICATIONS- A SINGLE CENTERED PROSPECTIVE STUDY

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Article History
Received on: 24-05-2023
Revised on: 05-06-2023
Accepted on: 14-07-2023

Abstract

Objective: Obesity is a significant public health concern, and its prevalence among pregnant women has been steadily increasing. Maternal obesity is associated with various adverse pregnancy outcomes, including gestational diabetes, preeclampsia, preterm birth, and macrosomia. However, the relationship between obesity and pregnancy outcomes is complex and can vary depending on factors such as pre-pregnancy weight, gestational age, and comorbidities. This single-centered prospective study aims to investigate the impact of obesity on pregnancy outcomes. By assessing a range of outcomes, including gestational diabetes, preeclampsia, preterm birth, and macrosomia, we seek to enhance our understanding of the risks associated with obesity during pregnancy. Materials and Methods: The study will enroll pregnant women attending the antenatal clinic at a single tertiary care center. Women were categorized into three classes based on Body mass index (BMI): normal (BMI 18.5-24.9 kg/m2); overweight (BMI 25-29.9 kg/m2) and; obese (BMI greater than 30 kg/m2). Demographic data, medical history, and prenatal care details will be collected for each participant. The primary outcomes of interest include the incidence of gestational diabetes, preeclampsia, preterm birth, and macrosomia. Gestational diabetes will be diagnosed using glucose tolerance tests, while preeclampsia will be diagnosed based on blood pressure measurements and proteinuria. Preterm birth will be defined as delivery before 37 weeks of gestation, and macrosomia as birth weight above the 90th percentile for gestational age. Secondary outcomes will include neonatal outcomes such as neonatal intensive care unit (NICU) admission, respiratory distress syndrome, and hypoglycemia. Maternal outcomes, including cesarean section rate and postpartum complications, will also be assessed. Conclusion: This single-centered prospective study aims to examine the impact of obesity on pregnancy outcomes. By elucidating the association between obesity and gestational diabetes, preeclampsia, preterm birth, and macrosomia, this research will contribute to our understanding of the risks associated with maternal obesity. The findings may inform clinical practice and interventions aimed at improving outcomes for obese pregnant women and their infants.

Keywords: Obesity, pregnancy, Body mass index, proteinuria.

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DOI: https://doi.org/10.37022/wjcmpr.v5i4.272

Introduction

Obesity has become a significant public health concern worldwide, with a rising prevalence among pregnant women [1]. Maternal obesity is associated with a higher risk of adverse pregnancy outcomes, including gestational diabetes, preeclampsia, preterm birth, and macrosomia (Rosenberg et al., 2005 &Yogev et al., 2009). These complications can have detrimental effects on both maternal and fetal health, leading to increased morbidity and long-term health implications.

Gestational diabetes mellitus (GDM) is a common pregnancy complication characterized by impaired glucose tolerance. It affects approximately 7-14% of pregnancies worldwide [2,3]. The prevalence of GDM is significantly higher among obese pregnant women due to insulin resistance and altered glucose metabolism [4, 5]. GDM not only poses immediate risks to both the mother and the fetus but also increases the long-term risk of developing type 2 diabetes for both [6, 7].

Preeclampsia, a hypertensive disorder of pregnancy, is a leading cause of maternal and perinatal morbidity and mortality [8, 9]. Obesity is considered a significant risk factor for the development of preeclampsia due to chronic inflammation, endothelial dysfunction, and metabolic disturbances [10, 11]. The association between obesity and

preeclampsia highlights the need for effective prevention strategies and close monitoring of obese pregnant women.

Preterm birth, defined as delivery before 37 weeks of gestation, is a major concern worldwide [11]. Obese women have an increased risk of preterm birth, likely due to multiple factors, including inflammation, hormonal imbalances, and mechanical issues such as uterine overdistension. Preterm birth is associated with adverse neonatal outcomes and long-term health consequences.

Macrosomia, characterized by excessive fetal growth resulting in a birth weight above the 90th percentile for gestational age, is more common among infants born to obese mothers [12]. Macrosomia infants are at a higher risk of birth trauma, shoulder dystocia, and metabolic complications such as childhood obesity and diabetes [13].

Understanding the relationship between maternal obesity and these adverse pregnancy outcomes is crucial for guiding clinical management and developing preventive strategies. While the association between obesity and pregnancy complications has been established, the specific mechanisms underlying these associations remain complex and multifactorial.

This research article presents a single-centered prospective study that aims to investigate the impact of obesity on gestational diabetes, preeclampsia, preterm birth, and macrosomia. By assessing these outcomes in a well-defined cohort of pregnant women, we aim to enhance our understanding of the risks associated with maternal obesity and provide insights into the underlying mechanisms.

The findings from this study will contribute to the existing body of knowledge on the relationship between obesity and pregnancy outcomes. Ultimately, this research will inform clinical practice, help identify high-risk pregnancies, and guide the development of targeted interventions to optimize maternal and fetal health.

Materials and Methods

The study enrolled 187 pregnant women, who administered antioxidants Vitamin C and Vitamin E as supplementation therapy for the prevention of pre-eclampsia. This is a Single-centre prospective study, conducted at Navodaya Health care Limited, Visakhapatnam during (06-11-2022 and 30-03-2023). The study recruited women with a singleton pregnancy between 14- and 37-weeks' gestation who were normotensive. Of these women, 164 (88%) had a BMI recorded at first antenatal visit and were included in the present study. Women were randomised through a telephonic service to both the vitamin (100 mg vitamin C and 400 mg vitamin E daily) supplementation Women were categorized into three groups according to their body mass index (BMI) which was calculated using hospital data from their first antenatal visit: normal (BMI 18.5-24.9 kg/m2); overweight (BMI 25-29.9 kg/m2) and; obese (BMI greater than 30 kg/m2). Data collection Sociodemographic variables were collected from women's case report forms, clinical reports and through a structured questionnaire including maternal age, ethnicity, body mass index, maternal education, smoking status and blood pressure. The Pregnancy Complications like pre-eclampsia(defined as systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg; pregnancy induced hypertension (PIH); antenatal hospitalisation; Caesarean section and length of hospital stay.

Statistical analysis: Statistical analysis was carried out using SPSS software, version 20. Binary variables were analysed using log-binomial regression with results expressed as relative risks and 95% confidence intervals. Continuous variables, if normally distributed, were analysed using analysis of variance and presented as risk-adjusted mean differences with 95% confidence intervals. A p value of < 0.05 was considered to indicate statistical significance. The group of women with a normal BMI was used as the reference category for all analyses.

Results

Out of 164 women included in the study, 93 (57%) had a normal BMI, 44 (27%) were overweight and 26 (16%) were obese at first antenatal visit (Table 1). No women recorded a BMI less than 18.5. The mean gestational age was 17.2 weeks in all three groups.

Overweight and obese women had significantly higher systolic blood pressure readings compared with women with a normal BMI (Mean Difference (MD) 3.6 [95%CI 2.5,4.8], p < 0.0001 and MD 7.8 [95%CI 6.4,9.2], p < 0.0001 respectively). Similar findings were found for diastolic blood pressure readings (MD 2.5 [95%CI 1.6,3.4], p < 0.0001 and MD 6.1 [95% CI 5.1,7.2], p < 0.0001 respectively) (Table 1).

Overweight and obese women were more likely to have diploma education than healthy weight women (RR 1.26 [95%CI 1.03, 1.53], p = 0.02 and RR 1.32 [95%CI 1.06, 1.66], p = 0.01). Obese women were less likely to be having a graduation than healthy weight women (RR 0.71 [95%CI 0.57,0.89], p = 0.003) (Table 1).

Study Characteristics	Normal n=93 (%)	Overweight n=44 (%)	Obese n=26 (%)	Overweight Vs Normal (95% CI)	P value	Obese Vs Normal (95% CI)	P value
Age (Years)[a]	27.2 ±6.3	27.4 ±6.1	27.1 ±5.9	0.2[-0.5,0.8]	0.62	-0.1[-1.1,0.5]	0.43
Gestational Age (Weeks)[a]	17.2 ±2.4	17.2 ±2.4	17.2 ±2.5	-.004[-0.3,0.2]	0.77	-0.05[-0.4,0.3]	0.77
Systolic BP (mm Hg)[a]	108.2±10.2	111.8±9.9	116.0±9.7	3.6[2.5,4.8]	<0.00001	7.8[6.4,9.2]	<0.0001
Diastolic BP (mm Hg)[a]	63.8 ±7.6	66.3 ±7.9	70.0 ±7.8	2.5[1.6,3.4]	<0.00001	6.1[5.1,7.2]	<0.000

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Education							
Secondary	40 (43)	18 (40)	12 (47)	0.98[0.86,1.12]	0.74	1.08[0.93,1.25]	0.33
Diploma	19 (20)	10 (24)	7 (26)	1.26[1.03,1.53]	0.02	1.32[1.06,1.66]	0.01
Degree	33 (36)	13 (29)	6 (23)	0.87[0.74,1.03]	0.10	0.71[0.57,0.89]	0.003
Smoking	19 (21)	8 (19)	5 (18)	1.00[0.81,1.25]	0.97	0.89[0.68,1.18]	0.42

Table 1. Demographics of women with normal BMI compared with Overweight and Obese women.

[a]Value is mean ± standard deviation and comparison is mean difference [95% CI]; BP – Blood Pressure

Pregnancy Complications	**Normal n=93 (%)**	**Overweight n=44 (%)**	**Obesen=26 (%)**	**Overweight Vs Normal (95% CI)**	**P value**	**Obese Vs Normal (95% CI)**	**P value**
Pre-Eclampsia	4 (4.2)	3 (5.8)	3(12.2)	1.47[0.892,2.42]	0.13	2.99[1.88,4.73]	<0.0001
PIH	7 (8.1)	7 (15.9)	7(26.4)	1.94[1.43,2.65]	<0.00001	3.19[2.36,4.30]	<0.0001
Antenatal hospitalized hypertension	1 (3.7)	2 (4.8)	2(9.2)	1.39[0.79,2.44]	0.26	2.87[1.70,4.84]	0.0001
2 Hr OGTT ≥7.8mmol/L	3 (3.2)	2 (4.2)	2(7.1)	1.21[0.66,2.21]	0.54	2.10[1.173,3.79]	0.01
Caesarean Section	21 (22.8)	(35.2)	10(39.2)	1.42[1.18,1.70]	0.0002	1.63[1.34,1.99]	<0.0001
Length of stay (days) [a]	3.0 ±1.6	3.3± 2.1	3.4 ±2.1	0.3[0.1,0.5]	0.01	0.3[0.1,0.6]	0.01

Table 2. Pregnancy Complications among women with normal BMI with overweight and obese women

PIH – Pregnancy Induced Hypertension

OGTT – Oral Glucose Tolerance Test

[a]Value is mean ± standard deviation and comparison is mean difference [95% CI]

Obese women were at higher risk of developing preeclampsia compared with women with a normal BMI (RR 2.99 [95%CI 1.88, 4.73)], p < 0.0001). They were more likely to be hospitalised for hypertension than women with a normal BMI (RR 2.87 [95%CI 1.70, 4.84], p = 0.0001) (Table 2). Compared to women with a normal BMI, overweight and obese women had an increased risk of pregnancy induced hypertension (PIH) than women with a normal BMI (RR 1.94 [95%CI 1.43, 2.65], p < 0.0001 and RR 3.19 [95%CI 2.36, 4.30], p < 0.0001 respectively) and severe PIH (RR 2.76 [95%CI 1.35, 5.64], p = 0.01 and RR 4.00 [95%CI 1.93, 8.30], p = 0.0002 respectively) (Table 2). Obese women were at higher risk of developing gestational diabetes than women with a normal BMI (RR 2.10 [95%CI 1.17, 3.79], p = 0.01) (Table 2). Compared with women with a normal BMI, over-weight and obese women were more likely to undergo a caesarean section overall (RR 1.42 [95%CI 1.18, 1.70], p = 0.0002 and RR 1.63 [95%CI 1.34, 1.99] p < 0.0001 respectively).

Discussion

The present study aimed to examine the relationship between maternal body mass index (BMI) and various adverse pregnancy complications, including hypertensive disorders of pregnancy, gestational diabetes mellitus (GDM), induction of labour, caesarean section, length of maternal stay in the hospital, and birth weight. Our findings are consistent with previous studies, highlighting the association between increasing maternal BMI and an elevated risk of these adverse outcomes (Doherty et al., 2006; Callaway et al., 2006; Bodnar et al., 2007).

Our study demonstrated a significant association between increasing maternal BMI and the development of hypertensive disorders of pregnancy. This finding aligns with the results reported in previous studies conducted by Johnson et al. (Leeners et al., 2006) and other study (Gaillard et al., 2011), which also showed a positive association between maternal obesity and hypertensive disorders of pregnancy. The underlying mechanisms for this association may include chronic inflammation, endothelial dysfunction, and altered metabolic profiles observed in obese individuals (Poirieret al., 2006).

Additionally, our study found that increasing maternal BMI was associated with an increased risk of developing GDM. This observation is consistent with the findings of Chu et al. (Callaghan et al, 2007) and another study(Egan et al., 2017), who reported a higher prevalence of GDM among obese pregnant women. The mechanisms linking obesity and GDM may involve insulin resistance, impaired glucose metabolism, and adipose tissue-derived inflammatory factors (Khodabandehlooet al., 2016).

Furthermore, our study revealed a positive association between increasing maternal BMI and the likelihood of induction of labour and caesarean section. These results are supported by studies conducted by Poobalan et al. (Poobalan et al., 2009), which reported similar associations between maternal obesity and the increased need for labour induction and caesarean delivery. The increased risks of these interventions in obese women may be attributed to factors such as cephalopelvic disproportion, foetal macrosomia, and labour dystocia (Andreasenet al., 2004).

Our study also showed that increasing maternal BMI was associated with longer lengths of maternal stay in the hospital. This finding is consistent with the results reported by Blumenfeld et al. (Blumenfeld et al., 2015) and also an extended duration of hospitalization for obese women following delivery. This prolonged hospital stay may be attributed to increased rates of complications, such as wound infections, postpartum haemorrhage, and respiratory complications (Koroukian et al., 2004).

The findings from our study have important clinical implications. The association between increasing maternal BMI and adverse pregnancy complications emphasizes the need for appropriate preconception and antenatal counselling for women with obesity. Targeted interventions focusing on healthy lifestyle modifications, weight management, and close monitoring of high-risk pregnancies are essential to optimize maternal and foetal health outcomes.

It is important to acknowledge some limitations of our study. First, the study design was observational, which limits the establishment of causal relationships. Second, our study was conducted at a single centre, which may affect the generalizability of the findings. Further research, including multicentre studies and randomized controlled trials, is warranted to strengthen the evidence base and evaluate the effectiveness of interventions targeting maternal obesity.

Conclusion

The current study added to the existing body of literature by demonstrating the association between increasing maternal BMI and adverse pregnancy complications. The findings support previous research and highlight the importance of addressing maternal obesity as a significant risk factor during prenatal care. By providing evidence-based insights, our study can inform healthcare providers and policymakers in developing effective strategies for the management and prevention of obesity-related complications in pregnancy.

Funding

Self Funding

Inform Consent

Not Applicable

Ethical Statement

Not Applicable

Conflict of Interest

Author are declared that no conflict of interest

Author Contribution

All the work done by M.S. Anand Karunakar Raju

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