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The effect of body mass index on maternal and neonatal health in term pregnancies: a cross-sectional study in Turkey

Ayşe Daştan Yilmaz[1*], Kıymet Yeşilçiçek Çalik[2] and Mehtap Budak[3]

Abstract

Backgroud and objective Maternal obesity and gestational weight gain (GWG) are important determinants of maternal and neonatal health outcomes. This study aimed to investigate the effects of prepregnancy body mass index (PPBMI) and GWG on maternal and neonatal outcomes in Türkiye.

Methods This prospective cross-sectional study was conducted in a public hospital in Turkey between December 2021 and December 2022. A total of 1137 women between the ages of 19 and 45 who had singleton and live births and had complete medical records were included in the study using simple random sampling. Data were collected using medical records and a structured interview form. PPBMI and GWG were calculated from self-reported weight and height data. Kruskal-Wallis, Mann-Whitney U, and binary logistic regression tests were used to analyze the data.

Results Among the participants, 4.7% were underweight, 61% had a normal weight, 27.6% were overweight, and 9.9% were obese on the basis of PPBMI. According to the Institute of Medicine (IOM) GWG guidelines, 17.2% had insufficient GWG, 55.1% had adequate GWG, and 27.8% had excessive GWG. Overweight women had significantly increased odds of gestational diabetes mellitus (OR = 0.479, $p = 0.024$), genital tract infections (OR = 2.15, $p = 0.000$), urinary tract infections (OR = 2.42; $p = 0.011$), elective cesarean delivery (OR = 8.62, $p = 0.035$), macrosomia (OR = 9.15, $p = 0.031$), and low APGAR (Appearance, Pulse, Grimace, Activity, Respiration) scores (< 7 at 5 min) (OR = 0.20, $p = 0.000$). Obese women also showed higher odds of elective cesarean (OR = 9.56; $p = 0.030$) and macrosomia (OR = 8.27, $p = 0.044$). Underweight women had higher odds of neonatal hospital stay > 5 days. Insufficient GWG was associated with increased risks of low birth weight (OR = 0.46, $p = 0.013$), third-trimester bleeding (OR = 0.45, $p = 0.016$), and neonatal hospitalization > 5 days (OR = 0.44, $p = 0.003$), while macrosomia risk was lower (OR = 2.06, $p = 0.001$).

Conclusion PPBMI and GWG are significant predictors of maternal and neonatal health outcomes. Elevated PPBMI and inappropriate GWG are associated with increased risks of gestational diabetes, macrosomia, cesarean delivery, low APGAR scores, low birth weight, and prolonged neonatal hospitalization. These findings highlight the critical role of routine assessment and management of maternal weight status and weight gain during prenatal care in reducing preventable complications for both mothers and their newborns.

*Correspondence:
Ayşe Daştan Yilmaz
ayse.yilmaz@erzincan.edu.tr

Full list of author information is available at the end of the article

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Introduction

Obesity is one of the most pressing public health challenges worldwide, with profound implications for individual health, quality of life, and healthcare systems. The World Health Organization (WHO) defines obesity as an abnormal or excessive accumulation of body fat that poses significant health risks [1]. Body mass index (BMI), which is calculated by dividing weight (kg) by the square of height (m^2), is the most widely used anthropometric measure to assess obesity [2]. However, BMI has notable limitations, as it does not account for variations in fat distribution or differentiate between fat and lean body mass [3].

According to the WHO's international classification, BMI values below 18.5 are categorized as underweight, values between 18.5 and 24.9 as normal weight, values between 25.0 and 29.9 as overweight, and values of 30.0 or above as obese [1]. In pregnancy, obesity is defined by additional criteria, including a BMI ≥ 30 kg, a body weight exceeding 91 kg, or a weight 110–120% above the ideal weight [4]. The 2023 Türkiye Health Survey reported that 23.6% of women and 16.8% of men in Türkiye are obese, highlighting the urgency of addressing obesity, particularly among women of reproductive age [5].

Obesity in reproductive-aged women has significant implications for maternal and neonatal health. It arises from a complex interplay of genetic predispositions, environmental influences, unhealthy dietary patterns, and insufficient physical activity [6]. Additional sociocultural, psychological, and biochemical factors further compound this risk [7]. During pregnancy, maternal obesity is associated with a range of adverse outcomes. Antepartum complications include gestational diabetes mellitus (GDM), preeclampsia, stillbirth, and hypertension [8–10]. Intrapartum complications, such as cesarean delivery, preterm birth, and labor dystocia, are also more common [11]. The risks for fetuses include macrosomia, hypoxia, low APGAR scores, and neonatal intensive care unit (NICU) admission [12] Postpartum, maternal obesity increases the risk of hemorrhage, infections, breastfeeding difficulties, depression, and long-term metabolic dysfunction [12, 13]. Maternal overweight/obesity before pregnancy significantly affects preschool children's weight, with two main factors mediating this effect [14].

These complications not only affect individual health but also contribute significantly to the public health burden. Maternal obesity has been strongly linked to higher rates of cesarean deliveries, NICU admissions, and gestational hypertensive disorders [15]. Despite its profound impact, evidence-based strategies for managing obesity during pregnancy remain underdeveloped. This gap poses challenges for healthcare providers aiming to mitigate the risks associated with maternal obesity.

This study makes a significant contribution to the existing literature by concurrently examining the effects of both prepregnancy body mass index (PPBMI) and gestational weight gain (GWG) on a comprehensive range of maternal and neonatal health outcomes in a large sample of term pregnancies in Türkiye. Unlike many previous studies that address these variables in isolation or in limited clinical contexts, this research offers an integrated analysis that captures the cumulative risks associated with abnormal BMI and GWG categories. Additionally, the study incorporates real-world hospital data—including labor and postpartum outcomes—collected through both patient interviews and medical records, enhancing its clinical relevance. By identifying specific maternal and neonatal risks associated with inadequate, adequate, or excessive GWG in different BMI categories, the findings support the development of targeted, evidence-based prenatal care strategies tailored to maternal weight profiles. The study also responds to the need for context-specific data from low- and middle-income countries, where such research is still scarce.

The study was guided by the following research questions: What are the PPBMI and GWG rates? How does PPBMI affect maternal and neonatal health outcomes? And how does GWG impact maternal and neonatal health outcomes? The study aims to explore the associations between maternal weight parameters and perinatal health indicators, thereby contributing to improved clinical strategies in prenatal care.

Methods

Study design and setting

This prospective cross-sectional study was conducted in Türkiye between December 2021 and December 2022. The study population included all pregnant women who presented to the delivery room of a state hospital during this period. Sample size calculations were performed via OpenEpi software and data from the previous year ($n = 2264$). A sample size of 726 participants was determined on the basis of a 95% confidence interval, a 3% type-1 error rate, a 50% prevalence assumption, and both the "design effect" and "cluster" values set to 1. Ultimately, 1,137 pregnant women were included in the study through simple random sampling. This study followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [16].

Participant eligibility

Women aged 19–45 years, with one live baby and whose complete medical records were accessible, were included in the study. The exclusion criteria included women with mental illnesses, previous cesarean deliveries, multiple pregnancies, and intrauterine stillbirths and those who were unwilling to participate. Women with no weight change during pregnancy, preexisting diagnoses of diabetes or hypertension, or uncontrolled diabetes and blood pressure despite diet or medical treatment were also excluded. A final sample of 1,137 deliveries was analyzed.

Anthropometric data collection and categorization

PPBMI was calculated using participants' self-reported prepregnancy weight and height, following the formula BMI = kg/m^2. The participants were categorized into four BMI groups on the basis of WHO classifications: underweight (< 18.5 kg/m^2), normal weight (18.50–24.99 kg/m^2), overweight (25.00–29.99 kg/m^2), and obese (≥ 30.00 kg/m^2).[1] GWG was determined by subtracting prepregnancy weight from weight at delivery and classified according to the 2009 IOM guidelines: 12.5–18 kg for underweight, 11.5–16 kg for normal weight, 7–11.5 kg for overweight, and 5–9 kg for obese women [17].

Maternal and neonatal outcomes

Maternal outcomes included GDM, genital tract infections, urinary tract infections, reduced fertility, elective and emergency cesarean sections, retained placenta, placenta previa, placental abruption, preeclampsia/eclampsia, third-trimester bleeding, deep vein thrombosis (DVT), mechanical difficulties during sexual intercourse, depression, labor induction, normal vaginal delivery, instrument-assisted delivery, shoulder dystocia, prolonged labor, perineal tears, and postpartum hemorrhage.

The neonatal outcomes examined were breastfeeding initiation immediately after birth, stillbirth, neonatal hypoglycemia, macrosomia (> 4000 g), low APGAR scores (< 7 at the 5th minute), neonatal resuscitation needs, neonatal intensive care unit (NICU) admissions, low birth weight (< 2500 g), and neonatal hospitalization exceeding five days.

Maternal and neonatal outcome data were collected by the primary investigator through face-to-face interviews using a structured data collection form. Supplementary clinical information—including delivery characteristics, postpartum complications, hospital stay duration, and labor stage durations—was retrieved from patients' medical records. Anthropometric measures, such as prepregnancy PPBMI and GWG, were calculated based on self-reported prepregnancy weight and recorded delivery weight. All data were collected and classified by the researcher in accordance with standard clinical protocols to evaluate the impact of PPBMI and GWG on maternal and neonatal health outcomes.

Data analysis

The data were analyzed via IBM SPSS Statistics for Windows, version 22. Frequencies and percentages are presented for categorical variables, whereas means and standard deviations are used for numerical variables. The normality of the data was assessed via kurtosis and skewness coefficients (± 2), which indicate a nonnormal data distribution. Consequently, nonparametric tests, including the Kruskal–Wallis and Mann–Whitney U tests, were employed. Binary logistic regression analysis was performed to identify factors influencing maternal and neonatal health outcomes. Statistical significance was set at a p-value < 0.05, with a 95% confidence interval.

Results

Sociodemographic and obstetric characteristics

After applying the exclusion criteria, 536 women were excluded, leaving 1137 participants for statistical analysis (Fig. 1). The mean age of the participants was 27.95 ± 5.61 years (range: 19–44). The detailed sociodemographic and obstetric characteristics are presented in Table 1.

Effects of PPBMI on maternal and neonatal outcomes

Logistic regression analyses revealed significant associations between PPBMI and various maternal and neonatal outcomes (Table 2). Compared with underweight women, overweight women had increased odds of gestational diabetes mellitus (OR = 0.479), genital tract infection (OR = 2.15), urinary tract infection (OR = 2.42), elective cesarean delivery (OR = 8.62), macrosomia (OR = 9.15), and low APGAR scores (< 7 at the 5th minute; OR = 0.20). Similarly, obese women were at greater odds for elective cesarean delivery (OR = 9.56) and macrosomia (OR = 8.27) than underweight women were. Among normal-weight women, higher odds were observed for low APGAR scores (< 7 at the 5th minute; OR = 0.38) than for underweight women ($p < 0.05$). PPBMI was not significantly associated with reduced fertility, retained placenta, low birth weight, NICU admission, or neonatal resuscitation requirement ($p > 0.05$).

Table 3 highlights a statistically significant difference in weight gain during pregnancy across PPBMI categories ($p < 0.05$). Post hoc analyses indicated that underweight and normal-weight women gained more weight than their overweight and obese counterparts did. Additionally, postpartum hospital stay duration varied significantly by PPBMI ($p < 0.05$), with obese women having longer hospital stays than normal-weight women. The labor stage durations also differed significantly ($p < 0.05$); post hoc analysis revealed that normal-weight women

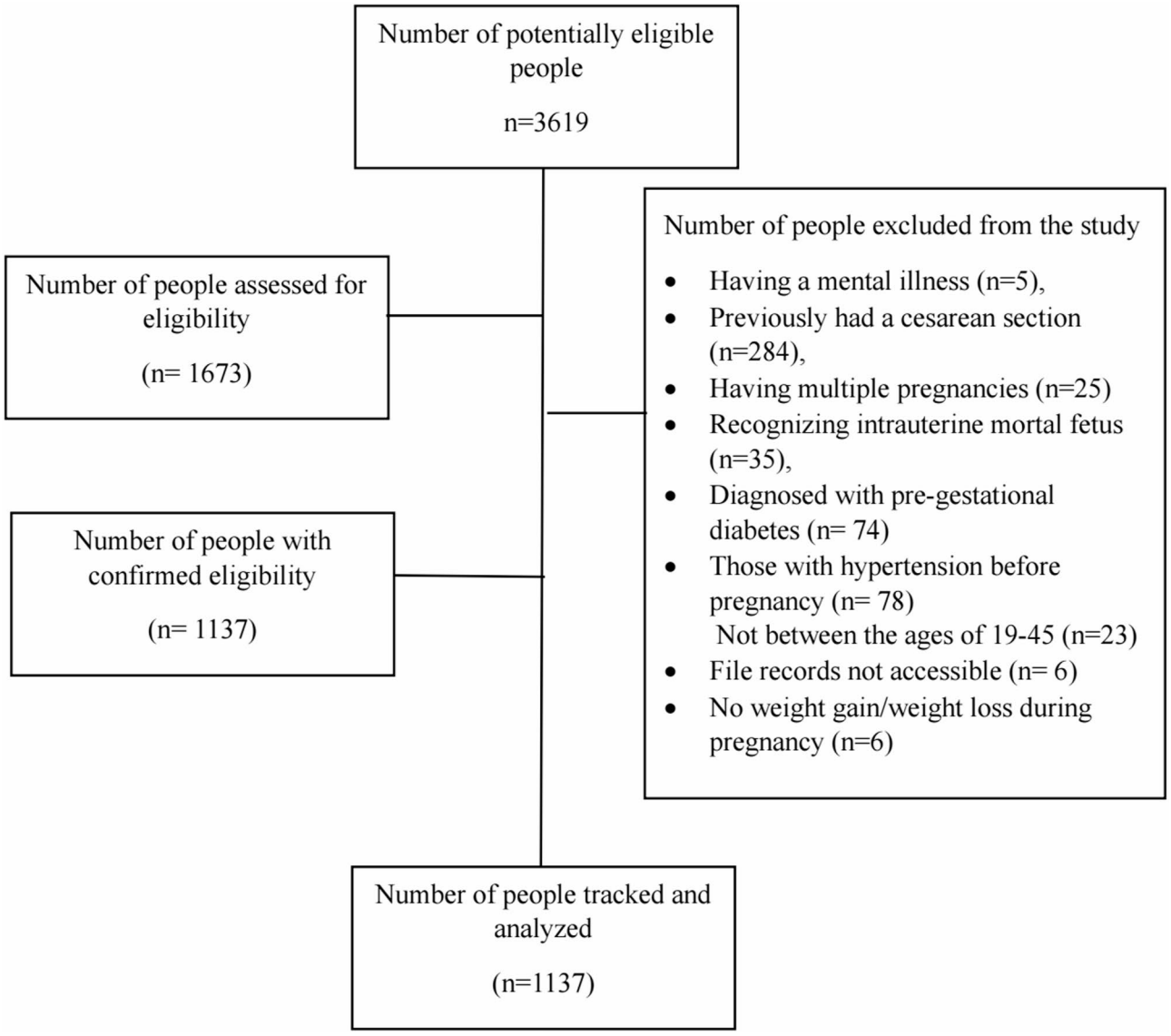

Fig. 1 Flowchart of the study population

had longer labor durations than overweight and obese women did.

Effects of GWG on maternal and neonatal outcomes

The logistic regression results for GWG and health outcomes are shown in Table 4. Compared with adequate GWG (OR = 0.48) and excessive GWG (OR = 0.45), insufficient GWG was associated with increased odds of third-trimester bleeding while reducing the odds of macrosomia (OR = 2.62). Compared with excessive GWG, insufficient weight gain was linked to higher odds of third-trimester bleeding (OR = 0.45), low birth weight (OR = 0.46), prolonged neonatal hospitalization (> 5 days; OR = 0.44), and lower odds of macrosomia (OR = 2.06) ($p < 0.05$). Adequate GWG reduced the odds of low birth weight by 0.46 times compared with insufficient GWG ($p < 0.05$).

GWG did not significantly predict immediate breastfeeding initiation after delivery, stillbirth, or neonatal resuscitation need ($p > 0.05$). Prepregnancy weight differed significantly across GWG categories ($p < 0.05$), with post hoc analysis showing that women with insufficient GWG had higher prepregnancy weights than those with adequate or excessive GWG.

Discussion

This study highlights the critical impact of PPBMI and gestational weight gain (GWG) on maternal and neonatal health outcomes, emphasizing their role as significant risk factors in pregnancy management.

Table 1 Sociodemographic and obstetric characteristics of the participants

Characteristics		*n*	%
Age (years)	19–25	413	36.3
	26–34	548	48.2
	35–44	176	15.5
Educational Level	Primary School Graduate	328	28.8
	Middle/High School Graduate	525	46.2
	University Graduate	284	25.0
Marital Status	Married	1125	98.9
	Single	12	1.1
Employment Status	Employed	227	20.0
	Unemployed	910	80.0
Place of Longest Residence	Village	193	17.0
	Town	258	22.7
	City	686	60.3
Income Level	Low Income	239	21.0
	Middle Income	858	75.5
	High Income	40	3.5
Health Insurance	Yes	927	81.5
	No	210	18.5
Family Type	Extended Family	231	20.3
	Nuclear Family	906	79.7
Planned Pregnancy	Yes	876	77.0
	No	156	13.7
	Unplanned but later desired	105	9.2
Total Number of Pregnancies	1	435	38.3
	2 or more	702	61.7
Total Number of Births	1	482	42.4
	2 or more	655	57.6
Living Children	1	24	2.1
	2 or more	1113	97.9
Lifetime Smoking Status	Yes	221	19.4
	No	916	80.6
Current Smoking Status	Yes	63	5.5
	No	1074	94.5
Significant Illness During Pregnancy	Yes[a]	272	23.9
	No	865	76.1
Chronic Disease	Yes[b]	123	10.8
	No	1014	89.2
Pre-Pregnancy BMI	Underweight (< 18.5)	54	4.7
	Normal (18.5–24.9)	694	61.0
	Overweight (25.0–29.9)	276	24.3
	Obese (≥ 30)	113	9.9
GWG	< 8 kg (Low)	195	17.2
	8–15.9 kg (Normal)	626	55.1
	≥ 16 kg (High)	316	27.8
Descriptive Statistics			
Variable	**Mean ± SD**	**Min–Max**	
Age (years)	27.95 ± 5.61	19–44	
Age at First Pregnancy (years)	23.31 ± 3.90	19–39	
Pre-Pregnancy Weight (kg)	63.29 ± 11.90	40–113	
GWG (kg)	12.54 ± 5.35	1–30	

[a]Significant illnesses include hypotension (9), clotting disorders (10), COVID-19 (49), miscarriage risk (49), thyroid conditions (19), anemia (56), Rh incompatibility (6), oligohydramnios (18), hyperemesis gravidarum (21), allergies (6), edema (16), and vaginal bleeding (25). [b] Chronic diseases include thyroid conditions (37), migraine (7), hypothyroidism (11), Hashimoto's thyroiditis (5), anemia (30), asthma (30), epilepsy (1), polycystic kidney disease (2), and hypercholesterolemia (1)

PPBMI and GWG rates

Among the participants, 4.7% were underweight, 61.0% were normal weight, 27.6% were overweight, and 9.9% were obese, with an average GWG of 12.54 ± 5.35 kg. A total of 17.2% of the women gained insufficient weight, 55.1% gained adequate weight, and 27.8% gained excessive weight according to the IOM guidelines. Notably, overweight and obese women slightly exceeded the recommended GWG levels, which is consistent with findings from large-scale studies [9, 17, 18]. This discrepancy underscores the challenges of adhering to GWG recommendations and highlights the need for tailored interventions to optimize weight gain during pregnancy on the basis of PPBMI.

Maternal and neonatal outcomes

PPBMI was significantly associated with various maternal and neonatal outcomes. Overweight and obese women are at increased risk of GDM, genital and urinary tract infections, elective cesarean delivery, and macrosomia. In line with previous studies [11, 12, 19–28], overweight and obese women also experienced increased odds of adverse neonatal outcomes, such as low APGAR scores (< 7 at the 5th minute). Underweight women had lower odds of low Apgar scores at the 5th minute but higher odds of neonatal hospitalization exceeding five days. This contrast highlights the need to maintain a balanced PPBMI to minimize adverse neonatal outcomes.

The association between maternal obesity and fetal growth anomalies, including macrosomia and large-for-gestational-age infants, was evident in this study [11, 29]. These outcomes are linked to delivery complications, neonatal morbidity, and congenital anomalies, such as neural tube defects [29]. However, contrary to some prior studies [30–32], this research did not find significant associations between maternal obesity and postpartum hemorrhage, neonatal resuscitation, or respiratory distress. These differences may reflect population-specific factors, healthcare disparities, or methodological variations.

Table 2 Distribution of participants by PPBMI and GWG categories

Variables	BMI Category	B	SE	Wald	*p*	Odds Ratio (OR)	95% CI (Lower)	95% CI (Upper)
Gestational Diabetes Mellitus (No/Yes)	Underweight	-	-	17.847	0.000	-	-	-
	Normal	-19.247	5419.619	0.000	0.997	0.000	0.000	-
	Overweight	-0.735	0.325	5.109	0.024	0.479	0.253	0.907
	Obese	0.210	0.332	0.400	0.527	1.234	0.644	2.365
Genital Tract Infection (No/Yes)	Underweight	-	-	16.072	0.001	-	-	-
	Normal	0.537	0.348	2.383	0.123	1.711	0.865	3.386
	Overweight	0.765	0.209	13.469	0.000	2.150	1.428	3.235
	Obese	0.394	0.228	2.971	0.085	1.482	0.947	2.319
Urinary Tract Infection (No/Yes)	Underweight	-	-	11.203	0.011	-	-	-
	Normal	0.615	0.393	2.457	0.117	1.851	0.857	3.995
	Overweight	1.028	0.404	6.492	0.011	2.796	1.268	6.167
	Obese	0.885	0.435	4.144	0.042	2.423	1.033	5.683
Elective Cesarean Delivery (No/Yes)	Underweight	-	-	6.618	0.085	-	-	-
	Normal	1.880	1.017	3.420	0.064	6.553	0.894	48.061
	Overweight	2.154	1.024	4.424	0.035	8.622	1.158	64.183
	Obese	2.258	1.043	4.687	0.030	9.563	1.238	73.848
Macrosomia (No/Yes)	Underweight	-	-	11.763	0.008	-	-	-
	Normal	1.614	1.018	2.513	0.113	5.025	0.683	36.981
	Overweight	2.214	1.024	4.679	0.031	9.153	1.231	68.050
	Obese	2.112	1.047	4.072	0.044	8.265	1.063	64.289
APGAR Score < 7 at 5 min (No/Yes)	Underweight	-	-	24.943	0.000	-	-	-
	Normal	-0.964	0.311	9.607	0.002	0.381	0.207	0.702
	Overweight	-1.594	0.364	19.154	0.000	0.203	0.100	0.415
	Obese	-0.403	0.368	1.205	0.272	0.668	0.325	1.373
Neonatal Hospitalization > 5 Days	Underweight	-	-	21.786	0.000	-	-	-
	Normal	-1.290	0.316	16.649	0.000	0.275	0.148	0.512
	Overweight	-1.300	0.350	13.787	0.000	0.273	0.137	0.541
	Obese	-0.615	0.376	2.675	0.102	0.540	0.258	1.130

Prior to the binary logistic regression analysis, the chi-square and Kruskal–Wallis tests revealed no significant associations between BMI and several maternal and neonatal outcomes ($p > 0.05$). These included maternal outcomes such as preeclampsia/eclampsia, placenta previa, abruptio placentae, other third-trimester bleeding, deep vein thrombosis, mechanical difficulties during intercourse, depression, labor induction, normal vaginal delivery, instrumental delivery, cesarean delivery, and emergency cesarean delivery. Neonatal outcomes, such as shoulder dystocia, prolonged labor, perineal tear, postpartum hemorrhage, immediate breastfeeding initiation, stillbirth, and neonatal hypoglycemia, were not significantly related to BMI. These results suggest that BMI may not be a key determinant of these outcomes, indicating the influence of other factors in shaping these maternal and neonatal health parameters

Table 3 Maternal and neonatal outcomes according to PPBMI (Continuous Variables)

Variables	BMI category	*n*	Mean	SD	Test*	*p* value
Weight Gain During Pregnancy (kg)	Underweight (< 18.5)	55	15.91	19.56	$x^2KW = 41.319$	0.000
	Normal (18.5–24.9)	693	13.33	5.96		
	Overweight (25.0–29.9)	276	11.46	5.66		
	Obese (> 30)	113	9.41	7.65		
Postpartum Hospital Stay (days)[a]	Underweight (< 18.5)	55	1.98	1.83	$x^2KW = 8.802$	0.032
	Normal (18.5–24.9)	692	1.86	1.39		
	Overweight (25.0–29.9)	275	1.95	1.33		
	Obese (> 30)	113	2.13	1.60		
Duration of Labor (hours)[a, b]	Underweight (< 18.5)	35	7.03	6.89	$x^2KW = 22.008$	0.000
	Normal (18.5–24.9)	443	8.55	6.70		
	Overweight (25.0–29.9)	165	6.25	5.32		
	Obese (> 30)	69	7.75	4.96		
Pre-Pregnancy Weight (kg)	Weight Gain < 8 kg	195	67.63	15.55	$x^2KW = 16.975$	0.000
	Weight Gain 8–15.9 kg	625	62.40	11.43		
	Weight Gain ≥ 16 kg	317	62.19	10.11		

*Kruskal–Wallis analysis was used to determine statistical significance among groups. [a] Data were obtained from patient records. [b] Includes the total duration of the first and second stages of labor

Table 4 Logistic regression analysis of the association between GWG and Maternal–Neonatal outcomes

Variables	GWG Category	B	SE	Wald	*p*	Odds Ratio (OR)	95% CI (Lower)	95% CI (Upper)
Third-Trimester Bleeding	< 8 kg	-	-	8.108	0.017	-	-	-
	8–15.9 kg	-0.733	0.284	6.651	0.010	0.481	0.275	0.839
	≥ 16 kg	-0.808	0.337	5.762	0.016	0.446	0.230	0.862
Immediate Breastfeeding Initiation	< 8 kg	-	-	6.226	0.044	-	-	-
	8–15.9 kg	-0.254	0.170	2.231	0.135	0.776	0.556	1.082
	≥ 16 kg	0.080	0.191	0.178	0.673	1.084	0.746	1.575
Low Birth Weight	< 8 kg	-	-	7.204	0.027	-	-	-
	8–15.9 kg	-0.154	0.249	0.380	0.537	0.858	0.527	1.397
	≥ 16 kg	-0.781	0.315	6.147	0.013	0.458	0.247	0.849
Macrosomia	< 8 kg	-	-	15.320	0.000	-	-	-
	8–15.9 kg	0.964	0.326	8.750	0.003	2.622	1.384	4.965
	≥ 16 kg	0.724	0.211	11.734	0.001	2.064	1.363	3.123
Stillbirth	< 8 kg	-	-	8.679	0.013	-	-	-
	8–15.9 kg	0.650	0.490	1.760	0.185	1.916	0.733	5.008
	≥ 16 kg	-2.118	1.099	3.713	0.054	0.120	0.014	1.037
Neonatal Hospitalization > 5 Days	< 8 kg	-	-	8.968	0.011	-	-	-
	8–15.9 kg	-0.371	0.221	2.811	0.094	0.690	0.448	1.065
	≥ 16 kg	-0.814	0.272	8.963	0.003	0.443	0.260	0.755
Neonatal Resuscitation Need	< 8 kg	-	-	9.788	0.007	-	-	-
	8–15.9 kg	0.913	0.538	2.883	0.090	2.492	0.869	7.150
	≥ 16 kg	-0.785	0.769	1.041	0.308	0.456	0.101	2.060

According to the results of the chi-square and Kruskal–Wallis tests conducted prior to binary logistic regression analysis, the following variables were not significantly associated with GWG ($p > 0.05$): GDM, preeclampsia/eclampsia, genital tract infections, urinary tract infections, placenta previa, abruptio placentae, deep vein thrombosis, decreased fertility, mechanical difficulties during intercourse, depression, induction, normal vaginal delivery, instrumental delivery, cesarean delivery, elective cesarean, emergency cesarean, shoulder dystocia, prolonged labor, retained placenta, perineal tear, postpartum hemorrhage, gestational age, APGAR score < 7 (at the 5th minute), NICU admission rate, neonatal hypoglycemia, postpartum hospital stay duration, and total labor duration

Influence of GWG

GWG has emerged as a critical factor influencing maternal and neonatal health. Insufficient GWG reduces macrosomia rates but increases the risks of third-trimester bleeding, low birth weight, and prolonged neonatal hospitalization. Conversely, excessive GWG was linked to higher rates of macrosomia, which is consistent with the literature [33–34]. While GWG did not significantly affect outcomes such as breastfeeding initiation, stillbirth, or neonatal resuscitation, these findings underscore the multifactorial nature of these outcomes and the need for a holistic approach to prenatal care.

PPBMI influenced GWG, with underweight and normal-weight women gaining more weight than their overweight and obese counterparts. This aligns with findings from meta-analyses showing that obese women often struggle to gain adequate weight during pregnancy [10, 33]. However, the variability in GWG patterns among obese women underscores the importance of personalized nutritional counseling and weight management strategies to optimize outcomes for both mothers and children.

Implications for practice

These findings emphasize the need to integrate PPBMI assessments and GWG monitoring into routine prenatal care. Personalized interventions tailored to a woman's PPBMI and nutritional needs can mitigate the risks associated with maternal obesity and GWG deviations. These strategies are critical for reducing complications such as GDM, macrosomia, and low birth weight while improving neonatal outcomes. Additionally, the study highlights the necessity of global standardization in PPBMI and GWG classifications to enhance research comparability and clinical practice.

Strengths and limitations

The strengths of this study include the inclusion of both nulliparous and multiparous women, a large sample size, and adjustments for potential confounders. Data collection relied on patient interviews and medical records rather than birth certificates or vital statistics, enhancing the accuracy and reliability of the findings. This allowed for a comprehensive investigation of the relationships among PPBMI, GWG, and maternal and neonatal outcomes via the 2009 IOM guidelines.

However, the study has several limitations. First, the findings may not be generalizable beyond the population studied. Second, self-reported prepregnancy weight is subject to recall bias, potentially leading to underestimation or overestimation of PPBMI and GWG. These limitations should be considered when the findings are interpreted.

Conclusions

This study demonstrated the profound influence of PPBMI and GWG on maternal and neonatal health outcomes. Higher maternal PPBMI was associated with increased risks of GDM, macrosomia, low APGAR scores, genital tract infection, urinary tract infection, elective cesarean, and postpartum hospital stay, whereas insufficient GWG was linked to increased risks of third-trimester bleeding, low birth weight, and neonatal hospitalization (>5 days). These findings underscore the urgency of addressing maternal obesity and optimizing GWG to improve pregnancy outcomes.

By providing insights into the complex interplay between PPBMI, GWG, and various maternal and neonatal outcomes, this study contributes to a growing body of evidence emphasizing the importance of weight management in pregnancy. The findings support the development of targeted, evidence-based interventions and healthcare policies aimed at reducing preventable complications and promoting optimal health for both mothers and their newborns. Future research should explore the long-term effects of maternal weight trajectories on child development and refine clinical guidelines to address obesity and weight gain more effectively during the perinatal period.

Abbreviations

ACOG	American College of Obstetricians and Gynecologists
APGAR	Appearance, Pulse, Grimace, Activity, Respiration
BMI	Body mass index
PPBMI	Prepregnancy body mass index
DVT	Deep vein thrombosis
GDM	Gestational diabetes mellitus
GWG	Gestational weight gain
IOM	Institute of Medicine
NICU	Neonatal intensive care unit
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
WHO	World Health Organization

Supplementary Information

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Supplementary Material 1

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Author contributions

ADY: conceptualization, investigation, methodology, data curation, writing, original draft, formal analysis. KYÇ, MB: conceptualization, investigation, methodology, supervision, formal analysis, writing, review and editing.

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Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The authors confirm that all procedures involving human participants were conducted in accordance with the ethical standards of the relevant clinical research ethics committee and with the principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Erzincan Binali Yıldırım University Clinical Research Ethics Committee (Approval No: 2020/09–20) and the Erzincan Mengücek Gazi Training and Research Hospital Administration (Approval No: E-76728045-044).Written informed consent was obtained from all participants prior to data collection. The authors further affirm compliance with institutional policies regarding the confidentiality and publication of patient-related data.

Consent for publication

Ethical approval and institutional permission were obtained for this study. All participants were informed both verbally and in writing, and written informed consent was obtained before data collection. Additionally, written informed consent was obtained for the publication of anonymized data.

Competing interests

The authors declare no competing interests.

Author details

[1]Refahiye Bahar Yildirim Health Services Vocational School, Department of Medical Services and Techniques, Erzincan Binali Yildirim University, Erzincan, Turkey
[2]Faculty of Health Sciences, Department of Nursing, Department of Obstetrics and Gynecology, Karadeniz Technical University, Trabzon, Turkey
[3]Angio Intensive Care Unit, Erzincan Binali Yildirim University, Mengücek Gazi Training and Research Hospital, Erzincan, Turkey

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