



Obesity in Pregnancy – Implications on Pregnancy Events

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Abstract

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BACKGROUND: Overweight and obesity are serious health problems in most developed countries. The percentage of young women with excessive weight who get pregnant continues to grow every year. This raises a concern about the risks of the mother and the baby during pregnancy and after birth.

AIM: This study aims to determine health risk for overweight mothers and especially the risk for preterm birth.

MATERIALS AND METHODS: This is a prospective and retrospective study taking place in the outpatient clinic of the University Hospital “Maichin Dom”. Our study included 105 pregnant women with BMI ≥ 25 kg/m² as a case group and 91 pregnant women with BMI within normal limits as a control group.

RESULTS: Mean BMI in the case group was 34.79 ± 3.71 kg/m² and 20.20 ± 2.24 kg/m² in the control group. Among 105 women in the case group, we registered 24.8% (n = 26) who gave birth before term. Preterm births among 91 women in the control group were registered in 17.6% (n = 16) patients. We found a significant correlation between increased BMI and the risk of increased systolic and diastolic blood pressure. Moreover, we found comorbidities in 43.8% of cases and 24.2% of controls.

CONCLUSION: Maternal overweight and obesity during pregnancy are associated with increased risks of preterm delivery and complications of pregnancy. Extra efforts should be made to help women lose weight before this important period of life.

Introduction

World Health Organization reports that 39% of adults aged 18 years and over were overweight in 2016, and 13% were obese. The prevalence of excess body weight in Bulgaria is similar. According to the National Statistical Institute of the Republic of Bulgaria, 40% of citizens above 15 years of age are overweight or obese. The statistics also show that 43% of Bulgarian women have BMI ≥ 25 kg/m².

Pregnancy-associated weight gain which is outside the recommended ranges is a serious risk factor for various adverse maternal outcomes, including pregnancy-associated hypertension, hyperglycemic disturbances, and HbA1c $\geq 6.5\%$ [1]. Other adverse effects of weight gain reported in the literature are anemia, bleeding, insulin resistance, intrauterine growth restriction (IUGR), and increased risk for preterm birth [2], [3]. Women with obesity are at risk for preterm birth but the exact relationship between different classes is still not clear [4]. A study among Swedish future mothers concluded that maternal overweight and obesity during pregnancy were associated with increased risks of preterm delivery, especially extremely preterm delivery [5].

Overweight may impact pregnancy in many different mechanisms some of which include abnormal growth of the fetus and the placenta, alteration in the transport of nutrients reaching the fetus, as well as changes in the normal metabolism. Weight gain is a key factor for the pregnancy outcome [3].

Different studies conclude that obesity and overweight have higher frequency among shorter, older, multiparous, lower-educated women, and in women with chronic diseases such as hypertension and diabetes [6], [7].

As the overweight prevalence is increasing in the last decades among young women in Bulgaria, we see it as a serious problem. We have conducted this survey I to gather more information about the outcomes of women's weight gain over their pregnancies.

Materials and Methods

Study design

This is a retrospective and prospective case-control study that is conducted using data from women

whose pregnancy was monitored in the outpatient clinic of the University Hospital of Obstetrics and Gynecology “Maichin Dom”, Sofia, Bulgaria.

Cases

Study cases are 105 pregnant patients of the clinic with overweight or obesity. Overweight is defined as BMI between 25 and 29.9 kg/m². Obesity is defined as BMI ≥30 kg/m².

Controls

Study controls are 91 pregnant patients of the Clinic with BMI ≤24.9 kg/m².

Data collection

Information was collected on women's age, height, weight, parity, and miscarriages at their first visit to the clinic. Weight and height were obtained under standardized conditions during the 12–14 week of pregnancy and were used to calculate BMI.

Women's blood pressure was obtained using an upper arm automatic blood pressure monitor at each visit after the 20 g.w. Following the recommendations of the European Cardiology Society, we considered gestational hypertension when women's blood pressure was systolic ≥140 mm Hg diastolic ≥90 mm Hg in two separate occasions at least 4 days apart with the exclusion of proteinuria. Patient's response to glucose was obtained using oral glucose challenge test (OGCT) with 50 g of glucose between weeks 24 and 28 of pregnancy.

Thyroiditis, chronic gastritis, and varicose veins were diagnosed before pregnancy, respectively, by an endocrinologist, a gastroenterologist, and a vascular surgeon. Thyroid function was monitored by measuring TSH, anti-TPO, and TgAb every four weeks. Dosage adjustments of levothyroxine were done when needed. Women having gastritis had the disease under control and none of them needed any specific procedures or treatment during pregnancy. Women having varicose veins were advised for lifestyle changes.

Other variables we have studied were a gestational week at birth, Apgar score at 1st and 5th min, and newborn's weight. Each birth before 37 weeks of gestation was classified as preterm. A birth between 37

and 41 weeks of gestation was classified as on-term birth, and after 41 gestational weeks – as a post-term birth.

Statistical analysis

Quantitative variables are presented as mean values (arithmetic mean and median), standard deviations, minimum and maximum values. Variable categories are presented by (n) and relative (%) possibilities. The form of the listed distributions of the quantitative variables is evaluated with a Kolmogorov–Smirnov test. Comparative analyzes with a normal distribution of quantitative variables in two independent groups were performed with t-test (independent-samples t-test), and in case the distribution was not normal, the Mann–Whitney test was used. The relationship between the two category variables was examined with a Chi-square test. Statistical significance is assumed at p values less than 0.05. The specialized Statistical Package for the Social Sciences (SPSS) version 19.0 was used to process the survey data.

Results

The study of 101 pregnant women with excess body weight and 91 pregnant women with normal body weight revealed differences in the prevalence of high blood pressure, preterm birth, newborn weight, and risk for comorbidities between cases and controls.

Obese women had higher weight (97.12 ± 11.11 kg), BMI (34.79 ± 3.71 kg/m²), and weight of their newborns (3176.78 ± 596.51 g) than women with normal weight – respectively, 53.89 ± 6.31 kg, 20.20 ± 2.24 kg/m², and 2989.98 ± 630.51 g. Table 1 summarizes the results. No significant difference was found in the age of the mothers in both groups. In our study, the maximum reported birth weight was 5030 g detected in the case group. Our study found a correlation between maternal obesity and the birth weight of their newborns. We found a significant difference between body weight and BMI in obese patients and the control group (p < 0.001).

There was a statistically significant difference in both the systolic and the diastolic blood pressure between the cases and controls (Table 2). We detected mean systolic

Table 1: Maternal age, BMI, and weight of the mother and the newborn baby in cases and controls

Parameter	Group	N	Mean	Median	SD	Min	Max	t	df	p
Maternal weight	Controls	91	53,89	54,00	6,31	32,00	66,00	-32,68	194	<0.001
	Cases	105	97,12	95,00	11,11	80,00	160,00			
BMI	Controls	91	20,20	20,20	2,24	14,69	24,97	-32,57	193	<0.001
	Cases	105	34,79	34,06	3,71	29,37	49,38			
Newborn weight	Controls	91	2989,98	3090,00	630,51	1180,00	4330,00	-2,03	194	0.044
	Cases	105	3176,78	3230,00	596,51	1480,00	5030,00			
Maternal age	Controls	91	29,43	29,00	6,06	15,00	47,00	-0,82	194	0.411
	Cases	105	30,20	31,00	6,93	17,00	48,00			

Analytical test used: Independent samples t-test.

Table 2: Comparison between a gestational week at birth, blood pressure, and Apgar score at 1st and 5th min between cases and controls

Parameter	Group	N	Mean	Median	SD	Min	Max	p
Gestational age at birth	Controls	91	37,99	38,00	2,30	31,00	42,00	0.51
	Cases	105	37,74	38,00	2,78	21,00	42,00	
Systolic blood pressure	Controls	91	113,24	110,00	11,84	90,00	150,00	<0.001
	Cases	105	124,93	120,00	14,61	90,00	160,00	
Diastolic blood pressure	Controls	91	71,54	70,00	8,05	60,00	100,00	<0.001
	Cases	105	78,01	80,00	8,92	60,00	95,00	
Apgar score at 1 min	Controls	91	6,91	7,00	1,16	3,00	9,00	0.82
	Cases	105	6,95	7,00	0,96	3,00	9,00	
Apgar score at 5 min	Controls	91	8,35	9,00	0,85	6,00	9,00	0.45
	Cases	105	8,27	8,00	0,87	6,00	9,00	

Analytical test used: Mann–Whitney test.

blood pressure in cases to be 124.93 ± 14.61 mm/Hg, while in controls, it was 113.24 ± 11.84 mm Hg. Mean diastolic blood pressure was 79.01 ± 8.92 mm Hg in cases and 71.54 ± 8.05 mm Hg in controls. Such a difference was not found when comparing gestational age at birth and Apgar score at the 1st and the 5th min.

In the case group, 39% (n = 41) of women were pregnant for the first time, while in the control group 53.8% (n = 49) were pregnant for the first time (Table 3). Consequently, more than one pregnancy was registered in 61% (n = 56) of cases and 46.2% (n = 42) of controls. About 20% (n = 21) of cases had one miscarriage and in the group of controls that percentage was 13.3% (n = 12) (Table 3). We found more than one miscarriage in 11.4% (n = 12) of cases and 13.3% (n = 12) of controls. No miscarriage was registered in 73.3% (n = 66) of controls and 68.6% (n = 72) of cases.

Table 3: Parity and miscarriages of cases and controls

Characteristics		Controls	Cases	All
Parity				
First pregnancy	n	49	41	90
	%	53.8	39.0	45.9
Second pregnancy	n	27	36	63
	%	29.7	34.3	32.1
Third pregnancy	n	8	20	28
	%	8.8	19.0	14.3
Forth pregnancy	n	5	6	11
	%	5.5	5.7	5.6
Fifth pregnancy	n	2	1	3
	%	2.2	1.0	1.5
Sixth pregnancy	n	0	1	1
	%	0.0	1.0	0.5
Number of miscarriages				
0	n	66	72	138
	%	73.3	68.6	70.8
1	n	12	21	33
	%	13.3	20.0	16.9
2	n	11	12	23
	%	12.2	11.4	11.8
3	n	1	0	1
	%	1.1	0.0	0.5

Analytical test used: Chi-square tests.

We found a significant difference in the preterm birth between cases and controls (Table 4). Preterm delivery was defined as a birth occurring before the

Table 4: Time of birth depending on the gestational age

Time of birth		Controls	Cases	Total	p
Preterm birth	n	16	26	42	0.018
	%	17.6	24.8	21.4	
On term	n	65	55	120	
	%	71.4	52.4	61.2	
Post-term birth	n	10	24	34	
	%	11.0	22.9	17.3	
Total	n	91	105	196	
	%	100.0	100.0	100.0	

Analytical test used: Chi-square tests.

27 g.w. About 24.8% (n = 26) of cases gave birth before term and 52.4% (n = 55) on-term. In the control group, the results show 17.6% (n = 16) preterm births and 71.4% (n = 65) on-term births.

We confirmed a significant difference when comparing comorbidities in cases and controls (Table 5). Comorbidities were detected in 43.8% (n = 46) of cases and in 25.2% (n = 22) of controls. High blood pressure was registered in 26.7% (n = 28) of our cases. We have assumed values for high blood pressure to be systolic blood pressure ≥ 140 mm Hg and diastolic blood pressure ≥ 90 mm Hg. We measured it in two separate occasions after the 20 weeks of gestation and with the exclusion of proteinuria. Studies show that high blood pressure, especially in obese patients is a high-risk factor for preterm birth.

Table 5: Comorbidities of pregnant women

Disease during pregnancy		Controls	Cases	Total	p
None	n	69	59	128	<0.001
	%	75.8	56.2	65.3	
High blood pressure	n	2	28	30	15.3
	%	2.2	26.7		
Thyroiditis	n	4	5	9	4.6
	%	4.4	4.8		
Gastritis	n	2	3	5	2.6
	%	2.2	2.9		
Varices	n	1	2	3	1.5
	%	1.1	1.9		
Others	n	7	8	15	7.7
	%	7.7	7.6		
Diabetes	n	6	0	6	3.1
	%	6.6	0.0		
Total	n	91	105	196	100.0
	%	100.0	100.0		

Analytical test used: Chi-square tests.

The most common thyroid pathology in pregnancy is Hashimoto thyroiditis. It was registered in 4.8% (n = 5) of cases and 2.2% (n = 4) of controls. Hypothyroidism during pregnancy has been associated with a higher incidence of miscarriage, intrauterine growth retardation, preterm delivery, and cognitive impairment in the offspring [8].

Gestational diabetes mellitus (GDM) is defined as any glucose intolerance with the onset or first recognition during pregnancy. We used a 50 g (OGCT) as a screening method for GDM at 24–28 weeks of gestation. It was registered in none of the cases and 6.6% (n = 6) of controls.

Discussion

Our study investigates the correlation between overweight in pregnant women and some complications concerning maternal and neonatal health. We examined the preterm delivery as one of the most serious consequences of mothers with $BMI \geq 25$ kg/m². We found that excessive body weight is a risk factor for preterm delivery [9]. Furthermore, we investigated some chronic diseases with higher frequency in obese women than in women with normal weight. Some of

these diseases are independent risk factors for preterm delivery. Our statistical analysis confirmed significantly higher systolic and diastolic blood pressure in cases compared to controls. We found association neither between maternal BMI and the age of delivery nor between the maternal BMI and Apgar score at 1st and 5th min. These findings emphasize the need for accurate monitoring of women with BMI above normal as they may be considered high-risk pregnancies.

Obesity during pregnancy is a disease that affects both the mother and the fetus. Many authors report a wide range of effects on the fetus, the newborn, and the child [10], [11], [12]. Short-term effects affect the prenatal and neonatal periods. Obesity increases the risk of fetal malformations, spontaneous, extremely preterm delivery, and stillbirth [10]. Comorbidities such as preeclampsia, gestational hypertension also affect fetal development and growth. Obese patients are at increased risk of primary Cesarean section. The higher the frequency of Cesarean section may affect the newborn due to the increased risk of respiratory disease, neonatal intensive care units (NICU) admissions, and longer length of hospital stay [13]. Josefson *et al.* established that obese women transfer less vitamin D to offspring compared to normal-weight women [12]. Increased adipose tissue reduces serum levels of vitamin D due to its sequestration into adipose tissue. This leads to less accumulation of vitamin D in the fetus.

We can say with a high degree of certainty that maternal obesity is associated with increased birth weight and increased neonatal adiposity [12]. A meta-analysis including 21 studies summarizes that maternal obesity increases the risk of fetal macrosomia [11]. Macrosomia is defined as birth weight greater than 4500 g, regardless of gestational age. In our study, the maximum reported birth weight was 5030 g. Our study found a significant correlation between maternal obesity and the birth weight of their newborns ($p = 0,044$). Other authors also report a similar relationship between these parameters [12], [13]. We found a significant difference between body weight and BMI in obese patients and the control group ($p < 0,001$). Moreover, no significant difference was found in the number of births and miscarriages. Of course, many more studies need to be done to help us understand these processes better.

Newborns of obese mothers have been found to have higher levels of leptin and interleukin 6 (IL-6) in the umbilical cord and higher insulin resistance [14]. Those are some of the long-term consequences of maternal obesity. Long-term metabolic effects may affect the health and well-being of the offspring. Increased birth weight is associated with an increased risk of obesity in childhood [14]. In addition to higher weight and BMI, higher systolic pressure was found in early childhood. Cesarean delivery increases the risk of chronic childhood illness – asthma, allergies, obesity, diabetes mellitus, and impaired intestinal microbiome [15], [16].

During the time of our investigation, we notice that young women do not pay enough attention and are not well informed about the risks overweight may bring. Our society is used to people with increasing weight and BMI and even tries to tolerate them. We think that preserving health is the most important value and we must try our best to educate people in this direction and find new methods to predict complications [17]. Women should understand the impact of their overweight over their birth potential. Help should be offered to all of them to decrease the possible risks.

Conclusion

Maternal overweight and obesity and underlying high blood pressure are risk factors for preterm delivery. Pregnancy is metabolic distress for all women, but those with obesity and high blood pressure have less potential to adapt to the changes. As a consequence, these women are at increased risk for other disorders and delivery before term. Therefore, obstetricians should advise their patients to make an effort for weight reduction, preferably before birth to prevent complications during pregnancy.

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