

The Effect of Pre Pregnancy Body Mass Index and Gestational Weight Gain on Pregnancy Outcomes

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Abstract: The purpose of this study was to investigate the role of pre pregnancy body mass index (BMI) and gestational weight gain on pregnancy outcomes. **Material & Methods:** This study was prospective cross-sectional study. Subjects consisted of 1351 pregnant women who referred to childbirth to Besat Hospital in Sanandaj (the capital of Kurdistan province in the West of Iran). Subjects were chosen based on three factors: singleton term pregnancy, having medical records, and referring to the health care center up to the 12th week of pregnancy. Data collection was done through questionnaires. **Results:** The incidence of overweight (BMI>26) was thirty-eight percent. Investigating the effect of BMI on maternal complications and specifying odds ratio showed that chance of maternal complications in subjects with an BMI of 26.1 – 29; (CI = 95%; 0.58 – 3.16) is 1.36 times higher than, in those with a normal BMI and for women with BMI >29; (CI95%; 1.05 – 2.99) is 1.77 times more than normal BMI. Furthermore Study showed that the odds ratio for neonatal complications among women with BMI 26.1 – 29; (CI = 95%; 0.40 – 3.84) is 1.25 times higher than women with normal BMI and for women with BMI>29; (CI95%; 0.25-2.23) is 0.75 times more than normal BMI. Chi-square test proved a significant statistical relation between childbirth method and BMI (P < 0.05). **Conclusion:** The results of the study showed that weight and BMI before pregnancy as important factors affecting maternal and neonatal complications. [Farzaneh Zaheri, Roonak Shahoei, Abdorrahim Afkhamzadeh, Farangis Khosravy, Fariba Ranei. **The Effect of Pre Pregnancy Body Mass Index and Gestational Weight Gain on Pregnancy Outcomes.** *Life Sci J* 2013;10(6s):662-668] (ISSN:1097-8135). <http://www.lifesciencesite.com>. 104

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Introduction

Weight gain and obesity are introduced as one of the most crucial health problems in reproductive age. In recent years, there has been an increasing rate of obesity among public and women in their pregnancy age (1, 2). One of the factors affecting the pregnancy outcome is body mass index (BMI) and the amount of weight gain during pregnancy (3, 4). According to the conducted studies, the lowest rate of mortality in pregnancy period is related to women who have a normal BMI before pregnancy (5). A lot of studies have shown that pregnancy diabetes, preeclampsia, emergency Caesarian section, postpartum hemorrhage, wound infection, preterm labor, infant macrosomia, stillbirth, neonatal death, low Apgar, and the infant's hospitalization in ICU are more common among obese mothers (6 – 13). Moreover, the first and second stage of childbirth is longer among obese women. Also, there is more motivation for oxytocin stimulation, increasing failed induction, initial Caesarian, using forceps and vacuum are observed among obese women (14, 15). In addition to the above problems, babies born to

obese mothers have a lower Apgar score which can cause neonatal distress to increase and result in longer stay of babies in the hospital (16). The prevalence of disability in breastfeeding among obese women is resulted from the inability in responding the beginning of prolactin hormone secretion in women with abnormal weights. Inability to breastfeed leads to more consumption of formula and an increase in the obese babies born to mothers with abnormal weight (17, 18). The study conducted in Korea by Cho *et al* (2001) showed that the weight before pregnancy and obesity compared to extreme weight gain during pregnancy can result in inhospitable maternal outcomes (11). A study was conducted in Swede in order to assess the effects of gestational weight gain in different BMIs on maternal and neonatal outcomes showed that the effects of weight gain in pregnancy period on pregnancy consequences vary and are dependent on mother's BMI (19).

Kominiarek *et al* (2010) have studied 228668 singleton pregnant women. The results of their study showed that there is a significant relation

between BMI and delivery type (20). Rowlands *et al* (2010) study showed the risk of diabetes, blood pressure, and preeclampsia is respectively two and three times higher in overweight women and obese ones compared to women with normal weight. Moreover, overweight women are prone to Caesarian section and post partum hemorrhage (21). Previous studies have concentrated on the effects of weight gain or obesity pre pregnancy on the consequences of pregnancy; however, there has been a limited number of studies investigating the effects of pre pregnancy BMI and during-pregnancy weight gain on prenatal outcomes in Asian women. By classifying the modified BMI, experts of WHO have suggested that prevalence of obesity in Asian countries is lower than that of Arabic nations (11). Studies conducted in Iran have showed a prevalence of 25 and 28 percent for obesity and overweight, respectively (22). Moreover, the results from research conducted in Iran have showed that obese or overweight pregnant women are more prone to multiple pregnancy, preeclampsia, non-cephalic presentation, fetal death, and Caesarian delivery compared to other women (23, 25). Despite the abundance of research investigating pregnancy outcomes in obese women, no study has been done regarding this issue in Sanandaj. Therefore, we aimed to investigate the role of pre pregnancy body mass index (BMI) and gestational weight gain on pregnancy outcomes.

Method and Materials

In this prospective cross-sectional study, subjects included pregnant women attending Be'sat Hospital, Sanandaj (the capital of Kurdistan province) for childbirth. The number of subjects was 1354 who were selected in randomized. The researcher visited the delivery ward of Be'sat Hospital three times a week over a period of three weeks in order to collect the related data. The visits were paid in the morning shift. Subjects were chosen based on three factors: having 37-to-40-week singleton term pregnancy, having medical records, and referring to the health care center up to the 12th week of pregnancy. The exclusion criteria were women with more than four pregnancies and experiencing preterm delivery. After the subjects were selected, necessary explanations were made and prior written consent was taken from the subjects, required data was collected through a questionnaire. The questionnaire had two sections. The first section was pertinent to demographic information such as age, education, employment status, number of pregnancy, pre-pregnancy weight, height, and BMI. The second section was about childbirth outcomes for the baby and the mother. Based on the information documented in the patients'

medical records and their profile, the answers to the questions were recorded in the questionnaire. Validity and reliability of the instrument were tested through computing Cronbach coefficient. The reliability of the instrument was computed to be ($r = 0.92$) which is acceptable. Based on their BMI (weight kg / height² m) the subjects were divided into four groups including slim women (BMI < 19.8), normal weight women (BMI = 19.8-26), high weight women (BM = 26.1-29), and obese women (BMI > 29). Mother's weight during the whole period of pregnancy was computed by subtracting the mother's initial weight from her weight while delivery. Based on their weight gain during pregnancy, the subjects were classified into four groups whose weight gain was above 5 kilograms, 5.9-9.9 kilograms, 14.99-15 kilograms, and above 15 kilograms.

The present study investigated the effect of BMI and weight gain during pregnancy on prenatal outcomes and these consequences have been analyzed regarding maternal and fetal complications. Maternal complications included hypertensive disorder, premature rupture of membrane, pregnant diabetes, placenta abruption, failure of progress, and childbirth method. Neonatal complications included cephalo pelvic disproportion, fetal distress, meconium release, and low Apgar. Hypertensive disorder was defined as blood pressure above 140/90. Based on WHO index and glucose tolerance test, pregnant diabetes was 75 grams. Failure of progress was defined as dilatation of the cervix below 1 centimeter per hour if the women had adequate uterine contractions. Fetal distress was defined as abnormal heart rate of embryo which was checked using monitoring device. Meconium release was defined as thick meconium. Low Apgar was considered 5 minute Apgar score <7.

Results

Obesity prevalence (BMI > 26) was 38 percent among the studied subjects (See Table 1).

Table 1. Percentage of study population by body mass index

BMI	N	%
<19.8	108	8
19.8-26	731	54
26.1-29	285	21
>29	230	17
Total	1354	100

Table 2. Characteristics of the study population

	BMI<19.8	BMI 19.8-26	BMI=26.1-29	BMI>29
	N= 108	N=731	N=285	N=230
-Maternal Age	N (%)	N (%)	N (%)	N (%)
<=20	22 (14.9)	94 (63.5)	20 (13.5)	12 (8.1)
21-25	39 (9.4)	264 (63.5)	63 (15.1)	50 (12)
26-30	31 (6.8)	240 (52.3)	105 (22.9)	83 (18.1)
31-35	16 (6.7)	100 (41.8)	69 (28.9)	54 (22.6)
>35	0 (0)	33 (35.9)	28 (30.4)	31 (33.7)
- Parity				
Nuliparous	75 (10.44)	444 (61.84)	123 (17/14)	76 (10.58)
Multiparous	33 (5.19)	287 (45.13)	162 (25.47)	154 (24.21)
- Maternal Education				
Illiterate	6 (7.6)	29 (36.1)	21 (26.6)	23 (29.1)
Primary school	58 (9.1)	318 (50.1)	128 (20.2)	131 (20.6)
High school	39 (8.1)	292 (60.6)	94 (19.5)	57 (11.8)
University	5 (3.2)	92 (58.2)	42 (26.6)	19 (12)
- Occupation				
Housewife	105 (8.4)	665 (53.2)	262 (20.9)	219 (17.5)
Clerk	3 (2.9)	66 (64.1)	23 (22.3)	11 (10.7)
- Made of delivery				
Vaginal delivery	79 (9.5)	480 (57.9)	151 (18.2)	119 (14.4)
Cesarean section	29 (5.5)	251 (47.8)	134 (25.5)	111 (21.1)
- Weight gain (kg)				
<5	2 (2.4)	31 (36.5)	23 (27.1)	29 (34.1)
5-9.99	35 (8.4)	197 (47.1)	93 (22.2)	93 (22.2)
10-14.99	47 (8.1)	345 (59.5)	111 (19.1)	77 (13.3)
=>15	24 (8.9)	158 (58.3)	58 (21.4)	31 (11.4)

Table 2 presents mothers' characteristics based on their BMI. Obesity was observed to be higher in elder housekeeping women, with elementary education, and multi parities. Chi square test showed that there is a significant relation between these variables and BMI status ($P < 0.05$). Table 3 presents frequency distribution of overweight during pregnancy based on BMI. Average during-pregnancy weight gain has dropped as the mother's BMI has increased. A total number of 525 had Caesarian section 37.4 percent of which was emergency Caesarian. Chi square test showed a significant relation between childbirth method and BMI ($P < 0.05$) (See Table 4). Table 5 presents maternal and neonatal complications based on BMI. Chi square test proved that there was a significant statistical relation between maternal complications and BMI ($P < 0.05$). Investigating the effect of BMI on maternal complications and specifying odds ratio showed that chance of maternal complications in subjects with a BMI of 26.1 – 29; CI = 95%; 0.58 – 3.16 is 1.36 times higher than those with a normal BMI ($P < 0.05$).

Moreover, mothers with a BMI of above

29; CI = 95%; 1.05 – 2.99 are 1.77 times more prone to such complications compared to those with a normal BMI. Therefore, BMI has a significant effect on maternal complications ($P < 0.03$). The results of the study also showed that there is a significant statistical relation between neonatal complications and BMI ($P < 0.05$). Investigating the effect of mother's BMI on neonatal complications and specifying odds ratio showed that chance of neonatal complications in subjects with a BMI of 26.1 – 29; CI = 95%; 0.40 – 3.84 is 1.25 times higher than those with a normal BMI ($P < 0.693$). Moreover, it was observed that chance of neonatal complications in subjects with a BMI of above 29; CI = 95%; 0.25 – 2.23 is equal to those with a normal BMI. Therefore, mother's BMI has a significant effect on neonatal complications ($P < 0.6$). There is no significant relation between low Apgar (lower than 7) and mother's BMI.

Table 3. Gestational Weight gain Categories based on maternal body mass index class

Body mass Index	Gestational weight gain categories (Kg)	N%	Mean gestational weight gain
<19.8	<5	2 (1.9)	11.40(4.12)
	5-9.99	35 (32.4)	
	10-14.99	47 (43.5)	
	=>15	24 (22.2)	
19.8 – 26	<5	31 (4.2)	11.36 (4.25)
	5-9.99	197 (26.9)	
	10-14.99	345 (47.2)	
	=>15	158 (21.6)	
26.1 – 29	<5	23 (8.1)	10.73 (4.90)
	5-9.99	93 (32.6)	
	10-14.99	111 (38.9)	
	=>15	58 (20.4)	
>29	<5	29 (12.6)	9.22 (4.76)
	5-9.99	93 (40.4)	
	10-14.99	77 (33.5)	
	=>15	31 (13.5)	

Table 4. Mode of childbirth by maternal body mass index

Body Mass Index \ Childbirth Method	<19.8		19.8-26		26.1- 29		>29		Total	
	N	%	N	%	N	%	N	%	N	%
Vaginal	79	9.5	480	57.9	151	18.2	119	14.4	829	100
Cesarean	29	5.5	251	47.8	134	25.5	111	21.1	525	100

Table 5. Maternal and Neonatal complications by maternal BMI

complication	Body Mass Index			
	< 19.8	19.8-26	26.1-29	>29
- Maternal complications				
Hypertension Disorder	---	19 (38.8%)	13 (26.5%)	17 (34.7%)
PPROM	7 (20%)	19 (54.3%)	3 (8.6%)	6 (17.1%)
Gestational diabetes	---	15 (48.4%)	8 (25.8%)	8 (25.8%)
Placenta Abruption	1 (11.1%)	5 (55.6%)	2 (22.2%)	1 (11.1%)
Failure of progress	---	---	1 (50%)	1 (50%)
Cesarean section	12 (6.3%)	111 (58.1%)	35 (18.3%)	33 (17.3%)
- Neonatal Complications				
CPD	2 (5.7%)	22 (62.9%)	6 (17.1%)	5 (14.3%)
Fetal Distress	1 (10%)	5 (50%)	2 (20%)	2 (20%)
Thick meconium	4 (8.5%)	28 (59.6%)	6 (12.8%)	9 (19.1%)
Low APGAR Score	---	1 (100%)	---	---

Discussion

Prevalence of obesity is extensively increasing all over the world. This increase is remarkable in pregnant women. Nowadays, obesity has been introduced as the most common risk pertinent to mother's death in developing countries. Obesity and overweight can result in adverse pregnancy, childbirth, and neonatal outcomes (1). The results of the study showed that there is relation between mother's initial BMI and her demographic information (age, parity, education, and occupation). It was observed that there was a significant relation

between increase of BMI and increase in number of mother's parity. Previous studies have also showed that obesity in multiparous women is higher than nulliparous women (2, 3, 4, & 5). Research showed that there was also a significant relation between increase in BMI and level of education. Women with higher levels of education had lower BMI. Study conducted by Park *et al* (2011) showed that there is a significant relation between obesity and low level of education (26). A study conducted on Tunisian women concluded that women's level of obesity drops as their level of education increases. Therefore,

this theory was made that women with higher educations have different attitude toward obesity since they are better aware of diets and habits causing obesity (27). The results of the study proved that there is a coefficient between mother's initial BMI and her weight gain during pregnancy. As BMI increased, average weight gain during pregnancy decreased. However, the results of study conducted by Tabandeh *et al* (2007) showed that as mother's BMI increased, weight gain during pregnancy increased (28). The results conducted by Kashanian *et al* (2008) showed that mother's weight gain during pregnancy was considerably lower in obese women, which is consistent with the results of our study (29). This finding can be due to the fact that all examined wards were provided with pregnancy health care and instruction and nutrition trainings. The present study showed that mother's BMI increase can result in adverse consequences for both the mother and the neonate. As the previous studies showed that women with a BMI higher than 26 are more prone to prevalence of maternal complications such as blood pressure disorders, premature rupture of membrane, pregnancy diabetes, placenta abruption, failure of progress, and need for caesarian compared to those with a normal BMI (7-12). Our study concluded that maternal complications in mothers with a BMI more than 29 are 1.7 higher than those with a normal BMI (95% CI; 1.05-2.99). This study also proved the relation between BMI increase and blood pressure disorders (10-13). In a study, it was estimated that one unit increase in BMI in nulliparous women can enhance the risk of preeclampsia (CI 95%; 1.06-1.08) and premature preeclampsia (CI 95%; 1.05-1.08) about 7 and 6 percent, respectively (30). The study showed that the degree of pregnancy diabetes is higher in obese and overweight women compared to those with a normal BMI. A recent meta-analysis explained the relation between pregnancy diabetes and BMI. It has been estimated that compared to women with a normal BMI, the risk of pregnancy diabetes is 2 and 4 times higher in over weight and obese women, respectively (30). The result showed that compared to women with a normal BMI, the number of Caesarian section is higher in overweight and obese women because they suffer blood pressure disorders, fetal distress, failure of progress, and CPD. Demont-Hein rich *et al* (2009) showed that the highest percentage of Caesarian section is observed among women with a high BMI more than those with a normal one (13). In their study conducted in Saudi Arabia, El-Gilany and Hammad (2010) have also proved that there is an increase of Caesarian section among mothers with a high BMI and that the lowest percentage of Caesarian section is related to mothers with a low BMI. It has also been showed that there is

a significant statistical relation between delivery type and BMI (31). Baksh *et al* (2005) believe that women with a BMI higher than a normal level are 6 times more prone to Caesarian section because of cephalopelvic disproportion and failure of progress (14). Kominiarek *et al* (2010) have reported that there is a significant statistical relation between BMI and childbirth method (20). Moreover, the results of the present study showed that prevalence of neonatal complications such as cephalopelvic disproportion, fetal distress, and meconium release are more common among women with a BMI higher than 26 compared to those with a normal level of BMI. The results also showed that neonatal complications among women with a BMI higher than 29 were 75 percent higher than those with a normal BMI (CI = 95%; 0.25-2.23). Cephalopelvic disproportion in overweight and obese women is because of fetus size increase and soft tissue dystocia is due to accumulation of fat in the mother's pelvis (30).

In their study, Seligman *et al* (2006) have showed that weigh gain in the beginning of pregnancy is accompanied with the risk of meconium release in vaginal delivery (32). This is in agreement with the findings of the present study. Accumulation of abdominal fat in obese women can mechanically result in failure of progress. If delivery lasts too long, fetoplacenta perfusion can be affected and fetal distress will be resulted (33). Stepean *et al* (2006) have concluded that in neonatal ten-minute Apgar less than 8 is not common among obese women (34). However, Ratikainen *et al* (2006) have stated that low five-minute Apgar and Caesarian section are common among obese women (35). In the present study, no relation between neonatal five- and ten-minute Apgar and mother's BMI was observed. The results of the study showed that pre pregnancy BMI has a significant role in producing maternal and neonatal complications; and this finding is in line with the findings of previous studies. The results also showed that mother's BMI increase causes maternal complications such as blood pressure disorder, pregnancy diabetes, premature rupture of membrane, placenta abruption, failure of progress, cephalopelvic disproportion, fetal distress, and meconium release to increase. Therefore, women with a high BMI need more care during pregnancy and childbirth which requires high expenses. In this regard, training, nutrition and health consultation, and reaching appropriate weight before pregnancy and even at the time of marriage should be highlighted which cause mother and her infant's health to enhance. One of the limitations of the study is that it only includes women who visited health centers to be treated during their pregnancy; however, it includes no information on those who have not received any treatment.

Moreover, due to limited number of subjects, assessment of rare complications caused by BMI increase was impossible.

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