

Utility of modified mid-pregnancy body mass index in predicting obstetric outcomes in Middle Eastern population

Abstract

Objective: To test the value of mid-pregnancy maternal body mass index (BMI) and weight gain in the second half of pregnancy in predicting pregnancy outcomes among Middle Eastern population where pre-gravid BMI was not available.

Methods: Retrospective analysis of the obstetric outcomes of 290 women with singleton pregnancies who were categorized into underweight (UW), normal weight (NW), overweight (OW) and obese (OB) according to the BMI at 24-28 weeks of gestation and compared with recommended pre-gravid values by Institute of Medicine (2009).

Results: The results showed that the gestational diabetes rate was significantly lower among the UW (2.4%) compared with the NW (8.8%, $p < 0.05$), the OW (14.3%, $p = 0.006$), and OB (20.5%, 0.001). The risk of having macrosomia was eight times higher among OW compared with NW women. The C-section rate was lowest among the UW group but there was no significant difference in terms C-section and low birth weight between groups. The obstetric outcomes among women whose weight gain was above the 90th and below the tenth centiles were not different.

Conclusion: The prediction of obstetric outcomes by mid-pregnancy BMI is comparable to pre-gravid BMI. The results are encouraging, and further larger studies are needed to confirm the applicability.

Keywords: mid-pregnancy body mass index, obstetric outcomes, maternal weight gain

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Synopsis: Predictive value of obstetric outcomes by second trimester body mass index is similar to pre-gravid BMI.

Abbreviations: NW, normal weight; OW, overweight; OB, obese; UW, underweight; BMI, body mass index.

Introduction

Maternal pre-gravid nutrition and gestational weight gain have been reported to have significant impact on pregnancy outcomes. The Institute of Medicine (IOM)¹ categorized women on the basis of their pre-gravid body mass index (BMI) and provided guidelines for optimal gestational weight gain (Table 1). Several studies have reported on the validity and applicability of these recommendations in predicting the outcomes of pregnancies.^{2,3} However, these recommendations are only applicable where the pre-gravid BMI is known and they are not applicable where the patient attends for the first time when the pregnancy is already advanced. The use of recalled pre-gravid in place of measured pre-gravid weight has produced different results.⁴ In our obstetric practice, as in other developing countries, many of the expectant mothers present for first prenatal visit in the second or third trimester when they feel assured of fetal viability. Furthermore, many of the expectant mothers have neither had a pre-gravid check nor can recall their pre-gravid body weight and for these reasons, the IOM recommendations are not directly applicable. The clinical usefulness of routine weighing of patients in the antenatal care remains controversial. While some studies^{5,6} found a correlation between changes in maternal weight during pregnancy and pregnancy outcomes, others⁷ found no such relationship and regard weight measurements as a source of unnecessary anxiety. It has also

been suggested that because maternal anthropometry differs by ethnic groups, different recommendations should be made for each ethnic population.⁸ Our obstetric populations are derived mainly from the Arabic and Asian stock, while the IOM recommendations are based on a predominantly Caucasian population.

Table 1 Recommended total weight gain ranges for pregnant women according to prepregnancy body mass index (BMI) (IOM 2009)

Prepregnancy BMI (kg/m ²)	Recommended weight gain	
	Kg	lb
<18.5, Underweight	12.5- 18.0	28-40
18.5-24.9, normal weight	11.5-16.0	25-35
25-29.9, overweight	7.0-11.5	15-25
≥ 30.0 obese	5-9	11-20

The purpose of this study was to explore the relationship between mid-pregnancy maternal BMI, changes in maternal weight gain in the second half of pregnancy and pregnancy outcomes among predominantly Arab and Asian population in order to test the hypothesis that the more readily available mid-pregnancy BMI is as predictive of pregnancy outcomes as the pre-gravid value.

Materials and methods

This was a retrospective cross-sectional study of deliveries conducted at our Hospital during the period 1st January to 31st December 2017. Routine prenatal clinical evaluation of women at first visit includes detailed history, height and weight measurement, complete physical examination, urine dipstick check, basic pregnancy

laboratory workup and initial obstetric ultrasound assessment of the fetus to confirm gestational age. Universal screening for gestational diabetes mellitus (GDM) with 75 gms. Oral glucose tolerance test (OGTT) is offered between 24-28 weeks gestational age. Maternal weight is obtained in normal clothing and recorded at each clinic visit. Detailed delivery data including course of pregnancy, gestational age, onset of labor, duration and method of delivery, newborn gender and birth-weight and complications are logged in the labor ward register.

Four hundred chart numbers of women who delivered during this twelve month period were randomly selected by choosing every fifth number in the record book. Using the inclusion criteria of women who had singleton pregnancies, initial visit before 24-28 weeks of gestation, at least four regular further follow-ups and delivery in the hospital, two hundred and ninety (290) were selected. Those who did not meet these criteria were de-selected. The information obtained from the charts included maternal age, parity, significant medical or obstetrical complications, body weight between 24-28 weeks of gestation and 6 weeks later. The obstetric outcomes analyzed were primary caesarean delivery, glucose intolerance (IGTT), GDM, hypertension, low birth weight (LBW) and macrosomia.

The IOM guidelines provide categories of women as underweight, normal, overweight and obese according to the pre-gravid BMI. The guidelines also recommend the ideal weight gain per week during pregnancy for each category. This information was used to derive the expected BMI of a mother in each of the categories at 24-28 weeks gestation (Table 2).

Table 2 Distribution according to BMI at 24-28 weeks gestation- age and parity

	No	Age (yrs + SD)	Parity
Underweight (BMI <25)	85	24.5+4.6	1.3+1.7
Normal weight (BMI 25-29.9)	103	26.0+5.0	2.0+2.3
Overweight (BMI 30-35)	63	28.2+6.0	2.9+2.6
Obese (BMI>35)	39	29.7 + 7.0	3.6+ 3.1
TOTAL	290	26.6+5.7	2.2+2.5

The derived BMI was used, in place of the pre-gravid weights, to categorize the patients into, underweight (UW), normal weight (NW), overweight (OW) and obese (OB). All data were logged using the SPSS Statistical package. Pregnancy outcomes of women in the

different categories were compared (Tables 3&4). The change in BMI per month was calculated for each patient using the difference between the weight at 24-28 weeks gestation and six weeks later. The differences were ranked into centiles. Pregnancy outcomes of patients with weight changes above 90th centile and those below 10th centile were respectively compared with those of patients in the 10th to the 90th centile range, (Table 5). Differences between groups were tested using the Student's t test and between proportions, using the Chi Square test. Yates correction was applied if the numbers were small.

Results

The medical records of 290 out of the 400 women provided information that met the inclusion criteria and these are the subjects of this study. Table 2 shows the clinical data among all the subjects at 24-28 weeks gestation. Although the parity, age appear to increase progressively, in the order UW<NW<OW<OB, the differences were not clinically significant. Table 3 shows the caesarean section rates and newborn weights whereas Table 4 compares the Glucose intolerance rates among these women. The low birth-weight (defined as birth weight less than 2500 gms. at completed 37 weeks gestation) rate was also not significantly different among the groups. There was no statistical difference in the rates of macrosomia (birth-weight greater than 4000 gm) among the women in the groups of UW, NW and OB. However, the women in OW group had significantly higher rates of macrosomia than the UW (14.3% vs 1.2 %, p=0.002) and NW (14.3% Vs 1.9%, p=0.003).

The caesarean section rate was lowest among the UW group, but the differences between groups were not statistically different. The gestational diabetes (GDM) rate was significantly lower among the UW (2.4%) compared with the NW (8.8%, p<0.05), the OW (14.3%, p=0.006), and OB (20.5%, 0.001). The GDM rate was also significantly (p=0.035) among the NW (8.8%) compared with the OB (20.5%), but not from the OW (14.3%, p=0.1). There was no significant statistical difference either in the rates of impaired glucose tolerance or in the rate of need for insulin to control diabetes among the groups. Twenty-eight (28) mothers were in the 10th centile and below and 44 were in the 90th centile and above of weight gain in the last half of pregnancy. There was no significant statistical difference in the rates of low birth-weight, caesarean section rate, abnormal glucose patterns, high blood pressure and macrosomia when these two groups were compared among each other and when compared with mothers in the 10th to 90th centile range.

Table 3 Distribution according to BMI at 24-28 weeks gestation- caesarean section and newborn weights

	No	C/S %	BW (g) + SD	Macrosomia* %	LBW %
Underweight (BMI <25)	85	9.4	3045+472	1.2	4.7
Normal weight (BMI 25-29.9)	103	11.7	3172+445	1.9	2.9
Overweight (BMI 30-35)	63	15.9	3398+598	14.3	0
Obese (BMI>35)	39	12.8	3275+443	2.6	2.6
TOTAL	290	12.1	3197+505	4.5	2.8

Underweight Vs Overweight p=0.002, Vs Obese p=0.04: Normal weight Vs Overweight, p=0.003

Table 4 Distribution according to BMI at 24-28 weeks gestation- abnormal blood sugar rates

	No	IGTT %	GDM* %	IDDM %
Underweight (BMI <25)	85	3.6	2.4	0
Normal weight (BMI 25-29.9)	103	1	8.8	1

Table continued...

	No	IGTT %	GDM* %	IDDM %
Overweight (BMI 30-35)	63	3.2	14.3	3.2
Obese (BMI>35)	39	1	20.5	1
ALL	290	2.1	9.6	1.3

*Under weight Vs Normal Weight (P<0.05), Vs Overweight p=0.006, Vs Obese p=0.001: Normal weight Vs Obese p=0.35

Table 5 Changes in BMI per month and pregnancy outcomes

BMI change/month	N	Age	Parity	LBW	C/S %	IGTT %	GDM %	IDDM %	HBP %	BW(g)	Macrosomia %
90th centile and above	30	23.9+4.7	1.4+2.3	3.3 (1)	6.7	3.3	0	0	6.7	3180+ 510	0
10th centile and below	44	26.0+4.9	2.1+2.6	0	6.8	4.5	9.1	0	4.5	3212+ 453	2.3

Discussion

Pre-gravid BMI and gestational weight gain impact on pregnancy and perinatal outcomes.^{2,3,9,10} Ogunyemi et al.,² reported that pre-gravid obesity (BMI ≥30) was associated with hypertensive disorders, GDM, caesarean delivery and high mean birth weight while low pre-gravid BMI (BMI ≤20) was associated with low birth weight (LBW) in the rural black population. Similar observations were made among the Japanese population.¹¹ Pre-gravid BMI has been shown to be associated with increased gestational hypertension, birth weight and neonatal fat mass, independent of OGTT values.¹²

Since many of the subjects presented for the first time in pregnancy, these authors have used recalled pre-gravid body weight in calculating the pre-gravid BMI. Although earlier studies reported that this method was valid,^{13,14} further data indicate that the use of measured pre-pregnancy weight on newborn size produces different results than does the use of recalled pre-pregnancy weight.⁴ Because the pre-gravid BMI is usually unavailable in most of our obstetric population, we have used the extrapolated ideal BMI at 24-28 weeks of gestation based on IOM recommendations on weight gain as surrogate reference for BMI. At 24-28 weeks gestation, women with BMI 30-35 (overweight) and BMI ≥35 (obese) were at higher risk of GDM and caesarean delivery. The risk of having macrosomic fetus was eight times higher among overweight women compared with normal weight women. These results are similar to previous observations using the pre-gravid BMI and perinatal outcomes^{2,3,8} and the results suggest that the mid-trimester BMI may be as predictive of these adverse pregnancy outcomes as pre-gravid BMI.

While the association between pre-gravid BMI and perinatal outcomes is well accepted, controversies still exist⁷ regarding gestational weight gain and its impact on pregnancy outcomes. Some authors have suggested that weight should be monitored during pregnancy regardless of the pre-pregnancy BMI.⁸ On the other hand, Mukarami et al.,¹¹ reported that weight gain during pregnancy did not show any significant influence on the perinatal outcomes and Dawes et al.⁷ have recommended that the maternal weight need be recorded only at booking and subsequent routine weighing of patients only serves to raise anxiety and should cease. The current study shows that no statistical differences in the rates of low birth-weight rate, GDM, glucose intolerance and macrosomia among women whose weight gain was above the 90th centile and those whose weight gain per month was below the tenth centile of in the 10th to 90th centile range. From the small sample size, it seems that weight gain during pregnancy was not predictive of these adverse pregnancy outcomes and measurement either pre-gravid or mid-pregnancy BMI predicts the adverse perinatal outcomes better than weight gain during pregnancy. This supports the position that maternal weight need be recorded only at booking.⁷

Conclusion

These data suggest that the second trimester BMI has similar predictive value as pre-gravid BMI for obstetric outcomes and be utilized for this purpose in planning the care of pregnant women where pre-gravid BMI is not available. The results are encouraging and further larger studies are needed to confirm the applicability.

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Conflicts of interest

Author declares that there is no conflict of interest.

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