Effect of Pregnancy Weight Gain in Normal Weight Women before Conception on Foetomaternal Outcomes

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ABSTRACT

BACKGROUND

Maternal weight gain during pregnancy plays very important role in the outcomes of pregnancy. The study aims to show the relation between gestational weight gain in women with normal prepregnant weight and foetal as well as maternal complications during delivery.

METHODS

Healthy women (n= 300) with normal weight before pregnancy (body mass index 19.5-25.5 Kg/m^2) were randomly selected. Maternity records gave information on age, parity, education, height, prepregnant weight, gestational weight gain, smoking, gestational hypertension, diabetes, preeclampsia, mode of delivery, delivery complications, neonatal birth weight etc. Chi square and one-way ANOVA were used in the univariate analysis of the association between gestational weight gain and adverse outcomes (low birth weight, IUGR, preterm labor, preeclampsia, cesarean). Multiple logistic regression analysis was also used, while controlling the following factors: age, parity and education.

RESULTS

The mean weight gain in pregnancy was 9.89 ± 2.68 Kg. (mean ± standard deviation). The mean birth weight was 2.94 ± 0.94 Kg. (mean ± standard deviation). A low weight gain (≤7.5 Kg) in pregnancy was highly associated with increased incidence of low birth weight baby ($p<0.01$), IUGR and cesarean delivery. A high weight gain (>12 Kg) was significantly associated with increased incidence of preeclampsia, cesarean delivery, and foetal macrosomia ($p<0.01$).

CONCLUSIONS

Efforts should be made to attain proper weight gain and avoid low weight gain to optimize the birth outcome as well as to avoid maternal complications like preeclampsia.

KEYWORDS

Pregnancy Outcomes, Body Mass Index, Weight Gain

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BACKGROUND

Pre-pregnancy weight and weight gain during pregnancy have been shown to affect infant and maternal outcomes.[1] Consequently, various recommendations about pregnancy weight gain have been made.[2] For example, a gain of 11.5-16 Kg is recommended for pregnant women who start pregnancy with a normal pre-pregnant BMI (i.e., 19.8-26).[3] On contrary, as per suggested by Feig and Naylor,[4] the pre-conceptional normal weight women should not gain more than 11.4 Kg, because of high adult obesity in Western countries. However, recent report showed that the most women of normal weight pre-conceptional revert back their normal weight within 1-2 years post-delivery, irrespective of pregnancy weight gain.[5] High weight gain in gestational period has been associated to gestational complications like hypertension, diabetes and preeclampsia; hazards in delivery[6,7,8,9,10] and macrosomia.[11] More data is required about pregnancy weight gain among mothers of normal weight before conception and how it is correlated to adverse outcome in pregnancy delivery. The co- relation has to be investigated in populations of high birth weight and high gestational weight gain. This data will be helpful to optimise pregnancy weight gain for betterment of foetomaternal outcome. The correlation between maternal obesity and adverse pregnancy outcomes has been well described in obstetric and public health literature. Most effective weight gain in gestational period is a controversial issue, because of its relation to optimal neonatal outcome, better health later in life, normal adult weight, and non-obesity, and better wellbeing in pregnancy and delivery with a minimal hazard.[12,13,4,6,7] Even after 10 years since the Institute of Medicine report was revealed, a large number of study reports have continued to address that gestational weight gain is not only correlated to birth weight but also other outcomes related to labor, delivery, and maternal post-partum weight status.[3] A significant relationship has been reported between maternal pre-pregnancy weight gain and birth weight of new born and less maternal weight gain is considered to be one risk factor for LBW that may require to intervene. A wide variation in maternal weight gain is also seen in women with a normal outcome.[14] In fact, net weight gain is underweight women is strongly related to birth weight, whereas in overweight women net weight gain is only marginally related to birthweight.[15]

The aim of the present study was to investigate the relationship between gestational weight gain among women of normal weight before pregnancy and complications in pregnancy and delivery in terms of neonatal outcomes (i.e. LBW, prematurity, foetal distress etc.), preeclampsia, preterm labor, mode of delivery in a tertiary hospital - R. G. Kar Medical College Hospital, Kolkata, West Bengal.

METHODS

A cohort of 300 newly pregnant women was enrolled in our prospective study. The pregnant women were observed and body weight of them was measured in Antenatal clinic as well as after admission in maternity ward in R. G. Kar Medical College Hospital, Kolkata between 2016 and 2017. In the beginning of research, the 1st day of last menstrual period (LMP) was recorded and suspected pregnancy was confirmed by pregnancy test.

Inclusion Criteria

1. Pregnant mothers booked in 1st trimester. (Less than 10 weeks pregnancy, based on LMP & sonography)
2. Pregnancies continued beyond 28th wks. of gestation.
3. Singleton pregnancy.
4. Maternal age 18-40 yrs.

Exclusion Criteria

1. Short stature and excessive tall mothers.
2. Patients having diabetes, multiple pregnancy, hydramnios, foetal deaths.
3. Patients with systemic disorders like renal, pulmonary, cardiac and thyroid disorders.

The data were described by values of mean and standard deviation as well as percentages. Weight gain was modelled as numerical variable. Chi square and one way ANOVA were performed. $p<0.05$ was considered significant. Logistic regression analysis was also used to examine the relationship between weight gain and outcomes of pregnancy. In logistic regression analysis, data were adjusted for age, height, parity, gestational length, and birth weight.

RESULTS

A total of 300 pregnant women participated in this study. Mean age of the women was 24.25 ± 4.09 years (mean ± standard deviation). Most of them, 150 (50%) were between 21-25 year, 20% was less than 19 and 8% was more than 31 years. 57% was nulliparous, 43% was multiparous. A total 20.4% had no education, 66.2% had finished high school and only 13.4% educated in the university. We couldn't find any significant differences between weight gain and education levels. The mean neonate birth weight was 2.94 ± 0.43 Kg (mean ± standard deviation). The mean maternal weight gain was 9.89 ± 2.68 Kg. (mean ± standard deviation). Among 300 women, 12.6% (n=38) having total weight gain ≤7.5 Kg., 66.7% (n=200) having total weight gain 7.5-12 Kg and 20.7% (n=62) having weight gain of >12 Kg.

Birth weight is directly related to maternal weight gain in pregnancy. Here max. incidence of low-birth weight (50%) was seen when the maternal total weight gain was <7.5 Kg which is statistically significant (p= <0.0001) and the incidence of LBW is least (3.2%) when the total weight gain was >12 Kg. Incidence of macrosomia is highest when total weight gain was >12 Kg. (Table-1). Birth weight was found to be normal in 90.5% when weight gain was 7.6-12 Kg.

Total Weight Gain During Pregnancy (Kg)	<2.5 Kg. n (%)	2.5-4.0 Kg. n (%)	4 Kg. n (%)	Total (n)
≤7.5	19 (50.0%)	19 (50.0%)	0 (.0%)	38 (100.0%)
7.6-12	19 (9.5%)	181 (90.5%)	0 (.0%)	200 (100.0%)
>12	2 (3.2%)	54 (87.1%)	6 (9.7%)	62 (100.0%)
Total	40 (13.3%)	254 (84.7%)	6 (2.0%)	300 (100.0%)

Table 1. Incidence of Low Birth Weight in Different Weight Gain Groups during Pregnancy

Chi-square=74.5, p<0.0001, ⋅=74.5

Birth weight is directly related to maternal weight gain in pregnancy. Here max. incidence of low-birth weight was seen as the maternal weight gain was <7.5 Kg which is statistically significant and the incidence of LBW is least when the weight gain was >12 Kg. Analysis of variance (ANOVA) of mean birth weight between groups of different weight gain during pregnancy was highly significant (F=33.66, p<0.001). Mean birth weight in normal weight gain (7.6- 12) Kg group was 2.953 ± 0.376 Kg Analysis of variance (ANOVA) of mean birth weight between groups of different weight gain during pregnancy was highly significant (F=33.66, p<0.001).

Total Weight Gain During Pregnancy	N	Mean Birth Weight	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum Birth Weight	Maximum
≤7.5	36	2.51281	.306526	.051088	2.40909	2.61652	1.735	3.072
7.6-12	200	2.95337	.376314	.026609	2.90089	3.00584	2.125	4.000
>12	62	3.18839	.481201	.061113	3.06618	3.31059	2.275	4.244
Total	298	2.94904	.434228	.025154	2.89954	2.99854	1.735	4.244

Table 2. Comparison of Mean Birth Weight in Different Weight Gain Groups during Pregnancy

Total Weight Gain During Pregnancy (Kg)	Foetal Complications: Normal Foetal Outcomes n (%)	IUGR n (%)	Fetal Distress n (%)	Total (n)
≤7.5	25 (65.8%)	10 (26.3%)	3 (7.9%)	38 (100.0%)
7.6-12	172 (86.0%)	15 (7.5%)	13 (6.5%)	200 (100.0%)
>12	58 (93.5%)	2 (3.2%)	2 (3.2%)	62 (100.0%)
Total	255 (85.0%)	27 (9.0%)	18 (6.0%)	300 (100.0%)

Table 3. Association between Total Maternal Weight Gain and Foetal Complications

Chi-square=17.81 p<0.001 (IUGR)
Fetal distress (chi-square=1.86, p>0.05).

Total Weight Gain During Pregnancy (Kg)	Pregnancy Complications: No Complications n (%)	Pre-Eclampsia n (%)	Preterm Labour (PTL) n (%)	Total n (%)
≤7.5	30 (78.9%)	4 (10.5%)	4 (10.5%)	38 (100.0%)
7.6-12	171 (85.5%)	20 (10.0%)	9 (4.5%)	200 (100.0%)
>12	44 (71.0%)	18 (29.0%)	0 (.0%)	62 (100.0%)
Total	245 (81.7%)	42 (14.0%)	13 (4.3%)	300 (100.0%)

Table 4. Association between Total Maternal Weight Gain and Pregnancy Complications

Chi square= 13.16, p<0.001 (PE), Chi square= 1, 26 (Yates correction), p>0.05 (for PTL).

Incidence of IUGR was maximum (26.3%) when total maternal weight gain was <7.5 Kg which statistically significant. But there is no statistically significant association between total maternal weight gain and foetal distress. Its incidence is least (3.2%) when maternal weight gain >12 Kg. A clear and significant relationship was seen between abnormal maternal weight gain with very high incidence of forceps and caesarean section. Highest incidence of caesarean section (26.3%) and (27.4%) was found when maternal weight gain was ≤7.5 Kg and >12 Kg. respectively. There was also significantly high incidence of forceps delivery (15.8% and 11.3%) in ≤7.5 Kg. and >12 Kg. weight gain group respectively.

Maternal Weight Gain (Kg.)	Mode of Delivery (MOD): Forceps	LSCS	Normal Delivery	Total
≤7.5	6	10	22	38
	15.8%	26.3%	57.9%	100.0%
7.6-12	6	19	175	200
	3.0%	9.5%	87.5%	100.0%
>12	7	17	38	62
	11.3%	27.4%	61.3%	100.0%
Total	19	46	235	300
	6.3%	15.3%	78.3%	100.0%

Table 5. Mode of Delivery in Comparison to Total Maternal Weight Gain in Pregnancy

For forceps= Chi-square=16.65, p<0.001, For LSCS= Chi-square=19.80, p<0.0001

A clear and significant relationship was seen between abnormal maternal weight gain with very high incidence of forceps and caesarean section. Highest incidence of caesarean section (26.3%) and (27.4%) was found when maternal weight gain was ≤7.5 Kg and >12 Kg. respectively. There was also significantly high incidence of forceps delivery (15.8% and 11.3%) in ≤7.5 Kg. and >12 Kg. weight gain group respectively.

DISCUSSION

Several evidences consider that weight gain have significant relationship with poor pregnancy outcomes.[16] However weight gain in most pregnant women is not within IOMs ranges.[3] In our series the mean maternal weight gain was 9.89 ± 2.68 Kg which is beyond IOMs ranges for women of normal weight before pregnancy (11.5-16.0 Kg). The frequency of pregnancy-delivery complications for women of normal weight before pregnancy, was highest among women gaining ≤7.5 Kg in pregnancy & it was observed that low birth weight was directly related to low total gestational weight gain. The incidence of low birth weight (50%) and intrauterine growth restriction (26.3%) was highest when weight gain was ≤7.5 Kg which is statistically significant. Its incidence declined gradually as the weight gain increased. It was only 3.2% amongst those with weight gain >12 Kg. The WHO collaborative study (1995) also showed good foetal &maternal outcomes with maternal weight gain ranging between 10-14 Kg with a mean of 12 Kg.[17] Gogoie Gourangie et al (2007) & Zahra Ekta et al (2005) also reported a steady decrease in the incidence LBW as mean pregnancy weight gain increases.[18,16] While Line Rode et al (2005) observed that maternal weight gain strongly affected the infant birth weight in normal & under-weight women but less so in overweight & obese women.[19] Low weight gain between 20-28wks of gestation were found to be moderate predictors of preterm delivery by Kelly et al, WHO (1995).[20] M.S Kramer (1995) reported that low prepregnant BMI & low rate of gestational weight gain may lead to shortened gestation by

increasing the risk of idiopathic preterm labour.[21] The relation between low rate of pregnancy weight gain and increased risk of preterm birth was illustrated by Camincheal.[22] But in our study there was no significant association between maternal weight gain and preterm birth as well as foetal distress.

In our present series incidence of preeclampsia have been found to have significant relationship with maternal weight gain during pregnancy. The incidence of preeclampsia rose with increased weight gain in normal weight women before pregnancy. This is in accord with the view of Cedergren[23] (2006) & Inga Thorsdottir et al (2002).[24] Though G.Theron (2003) reported sudden weight gain spurt to be far from reliable sign of impending pre- eclampsia.[25] Incidence of both forceps delivery (15.8%) & caesarean section (26.3%) in our study was significantly high among low weight gain group (<7.5 Kg) & was again high (11.3% & 27.4% respectively) when weight gain was >12 Kg. This is corroborated by the study of Aisha Langford et al[26] (2008) & A.Sherrard et al (2007). While N.J Sebire et al (2001) reported caesarean rate for very obese as 20% compared to nearer 10% for the normal weight group.[27] Again Zahra Ekta et al (2005) observed lowest rate caesarean section in women with BMI<19.8.[16]

In our study no relationship was noticed with still birth and maternal weight gain. Aisha Langford et al[26] (2008) & Stephenson O et al[28] (2001) also reported no association between gestational weight gain & peri- natal death. Though an increased risk of late foetal death was observed in women with higher prepregnant weight by N.J Sebire et al (2001) & Stephenson O et al (2001).[27,28]

CONCLUSIONS

Abnormal weight gain during pregnancy can complicate the delivery & create severe maternal & foetal complications which in turn are associated with increase in healthcare costs. So, Efforts should be made, and attention should be paid, especially to the women with very low pre-pregnancy weight and low weight gain groups to attain appropriate weight gain to avoid complications of mother and neonate.

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