

Relation of Birth Weight with Maternal Pre-pregnancy Weight and Weight Gain during Pregnancy

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ABSTRACT

Introduction: Birth weight is an important factor which determines the outcome in neonate and also affects the chances of survival. There is a need to identify the modifiable factors which can impact the birth weight.

Aim: To evaluate the relation of pre-pregnancy weight of the mother and gestational weight gain with the birth weight of the baby among the study population.

Materials and Methods: This prospective study was done during August 2006 to December 2008. It comprised of 100 pregnant women. After registration with a positive pregnancy test, patients were enrolled and examined and then followed up till delivery. Maternal weight was monitored using same digital scale and the neonatal weight was measured within 30 minutes of the delivery of the baby. All the newborns were weighed with the same weighing machine for neonates. This study was attempted to correlate maternal pre-pregnancy

weight to foetal weight and maternal weight gain during pregnancy to foetal weight.

Results: The pre-pregnancy weight of the study subjects had a range from 35 Kg to 74 Kg (mean 51.93 ± 8.62) with gestational weight gain range from 7 to 20 Kg (mean 11.33 ± 2.55) throughout pregnancy. Foetal weight ranged from a minimum of 2 Kg to maximum of 3.7 Kg with mean weight being 2.88 ± 0.32 Kg. There was a direct proportion observed between birth weight and pre-pregnancy weight as well as between birth weight and gestational weight gain.

Conclusion: Pre-pregnancy weight of mother being an important determinant of birth weight of baby, the women of reproductive age group need to be counselled regarding its significance. Gestational weight gain is an important determinant of birth weight of baby and mothers should be advised regarding recommended weight gain ranges during the antenatal visits.

Keywords: Birth weight determinants, Gestational weight gain, Low birth weight

INTRODUCTION

Birth weight is known to influence neonatal outcome and is a very important determining factor of chance of survival of the newborn. Also, birth weight is associated with the maternal anthropometry [1-4]. A large epidemiological study has stated that the maternal growth prior to pregnancy has a much more influence on birth weight than her socioeconomic conditions during the period of pregnancy [5]. Foetal size and weight at birth are also influenced by the placental volume and the rate of placental growth and this effect is mediated by the pre-pregnancy maternal weight and gestational weight gain [4]. Present study analyses the pre-pregnancy weight of the mother and gestational weight gain in relation to the birth weight of the baby in subjects attending the Obstetrics and Gynaecology Department.

MATERIALS AND METHODS

This prospective study was done in the Department of Obstetrics and Gynaecology at a tertiary care centre in South India, during August 2006 to December 2008. Information sheet regarding study protocol and objectives was provided to subjects. Informed consent was taken from all participants before enrolment. The ethical guidelines were followed and the study was conducted as per Declaration of Helsinki guidelines and ICMR guidelines.

The study comprised of 100 pregnant women enrolled as per convenience sampling and no formal sample size calculation was done. After registration with a positive pregnancy test, patients were enrolled and examined and then followed up till delivery.

Inclusion criteria: Females between the age of 20-35 years, patients with known dates or dating scan, regular antenatal check-up visits, full term delivery.

Exclusion criteria: Teenage or elderly primigravida (<20 years or >30 years), previous Lower Segment Caesarean Section (LSCS) delivery, multiple gestations, high risk pregnancy, any major medical illness, pregnancy after treatment of infertility or any known congenital foetal anomaly. Self reported pre-pregnancy weight was recorded.

Maternal weight was monitored using same digital scale. Weight was measured with light clothing, without footwear to the nearest 100 gram with an electronic weighing scale (EQUINOX, Model EB6171, India).

Gestational weight gain calculation was done by subtracting maternal pre-pregnancy weight from the maternal weight before delivery. The digital scale was standard and calibrated (The neonatal weight was measured within 30 minutes of the delivery of the baby. All the newborns were weighed with the same weighing machine for neonates. We attempted to correlate maternal pre-pregnancy weight to foetal weight and maternal weight gain during pregnancy to foetal weight. Linear regression analysis was done for birth weight against pre-pregnancy weight as well as birth weight against gestational weight gain.

STATISTICAL ANALYSIS

Linear regression analysis for birth weight against pre-pregnancy weight showed that equation was $Y = 0.04463 \times X + 2.378$ with significant deviation from horizontal and a p-value of 0.0002.

Linear regression analysis for birth weight against gestational weight gain showed that equation was $Y = 0.007114 \times X + 2.515$. However, the p-value was just above significance value i.e., 0.0549.

Average Birth Weight (Kg)	Average Birth Weight (Kg) (Mean±SD)	Average Gestational Age (Weeks)	Number of cases	Pre-pregnancy Weight (Kg) (Mean±SD)
<2.5	2.29±0.16	38.14±0.19	07	48.71±7.3
2.5-3	2.78±0.15	38.45±0.87	65	51.2±8.75
>3	3.28±0.19	38.68±0.77	28	54.43±8.29

[Table/Fig-1]: Comparison of average birth weight in relation to pre-pregnancy weight in study cohort.

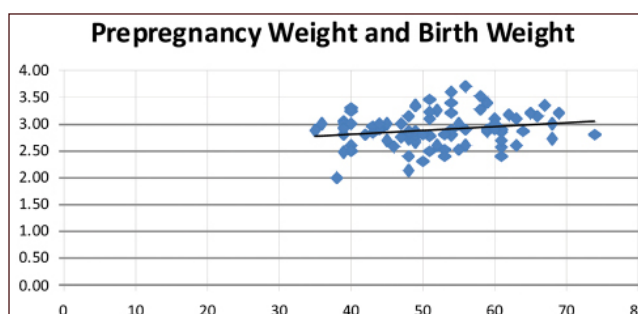
Average Birth Weight (Kg)	Average Birth Weight (Kg) (Mean±SD)	Average Gestational Age (Weeks)	Number of cases	Gestational Weight Gain (Kg) (Mean±SD)
<2.5	2.29±0.16	38.14±0.19	07	9.86±1.95
2.5-3	2.78±0.15	38.45±0.87	65	10.99±2.59
>3	3.28±0.19	38.68±0.77	28	12.46±2.25

[Table/Fig-2]: Comparison of average birth weight in relation to gestational weight gain in study cohort.

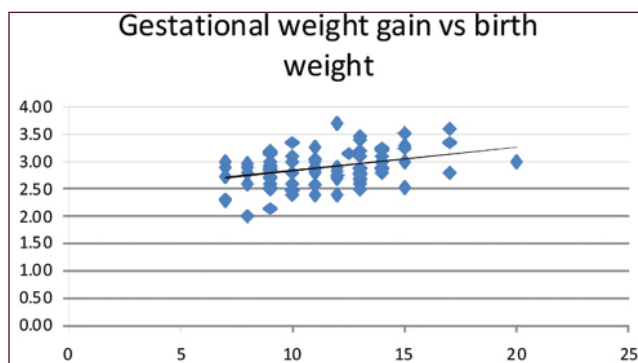
RESULTS

The pre-pregnancy weight of the study subjects had a range from 35 Kg to 74 Kg (mean 51.93 ± 8.62) with gestational weight gain range from 7 to 20 Kg (mean 11.33 ± 2.55) throughout pregnancy. Foetal weight ranged from a minimum of 2 Kg to maximum of 3.7 Kg with mean weight being 2.88 ± 0.32 Kg. All the subjects were followed up during study period with no loss to follow-up and there were no cases that were excluded at later stages. So, there was no missing data.

This study had 62 primigravida and 38 multigravida patients. Most of the primigravida were between 20-29 years of age. Average weight gain throughout pregnancy in them was around 11-12 Kg with foetal birth weight ranging from 2 to 3.7 Kg. Pre-pregnancy weight varied from 35 to 68 Kg. Multigravida patients were mainly in between age group of 30-35 years.



[Table/Fig-3]: Scatter plot showing birth weight in relation to pre-pregnancy weight in study cohort.



[Table/Fig-4]: Scatter plot showing birth weight in relation to gestational weight gain in study cohort.

Average weight gain during pregnancy was around 10-11 Kg and foetal birth weight ranged from 2.1-3.4 Kg. The weight gain in primigravida patients was slightly more than multigravida patients. Three groups were made for comparison: Group 1: Birth weight of baby less than 2.5 Kg; Group 2: Birth weight of baby between 2.5 Kg and 3 Kg; Group 3: Birth weight of baby more than 3 Kg.

The average gestational age was not much different among the groups. [Table/Fig-1 and 2] describe the birth weight in relation

to pre-pregnancy weight and gestational weight gain. [Table/ Fig-3 and 4] are the scatter plots of birth weight in relation to pre-pregnancy weight and gestational weight gain. There was a direct proportion observed between birth weight and pre-pregnancy weight as well as between birth weight and gestational weight gain.

DISCUSSION

The study results reflect that there was a direct proportion observed between birth weight and pre-pregnancy weight as well as between birth weight and gestational weight gain. The average gestational age was not much different among the groups.

Abubakari A et al., studied the determinants of birth weight of baby among the population from Ghana in Africa and reported that Body Mass Index (BMI) of the mother before pregnancy and the weight gain during pregnancy were the most important determinants of birth weight of baby after controlling for the gestational age. They suggested that gestational weight gain being modifiable risk factor, the mothers should be advised regarding its importance and assisted in maintaining it within physiological range [6]. Frederick IO et al., reported that body mass index of the mother before pregnancy had an independent and positive association with birth weight of baby after adjusting for the confounders. Also, there was two times higher risk of low birth weight baby in mothers with gestational weight gains less than the median. On the other side, risk of macrosomia also increased with an increasing pre-pregnancy weight and weight gain during pregnancy [7]. Recent study by Soltani H et al., mentioned that women in West Sumatra, Indonesia begin pregnancy with a less than optimal weight and also most of them gain inadequate weight during pregnancy according to Institute of Medicine recommendations. Inadequate weight during pregnancy was related to poor pregnancy outcomes like small for gestational age and prematurity. They further highlighted that much needed attention needs to be given by the researchers, policy and decision makers towards the facilitation and development of interventions which are culturally sensitive and improve the nutritional status as well as health of the mothers and babies [8]. Saliyu HM et al., evaluated large data from Missouri over 8 years and found that women with a low or normal pre-pregnancy weight should be advised to maintain moderate level of weight gain during pregnancy so as to reduce the risk for preterm birth. Further, they observed that severity of low pre-pregnancy weight had a direct association in a dose-response pattern with preterm birth which signifies the importance of counselling prior to conception for women of reproductive age group regarding the importance of maintaining normal weight prior to pregnancy [9]. Pan Y et al., evaluated data from large, prospective, population based cohort study i.e., National Free Preconception Health Examination Project

(NFPHEP) in China during 2010-2012 and observed that as the average pre-pregnancy weight decreased; there was a significant increase in the prevalence of underweight individuals in a very large population. The abnormal pre-pregnancy body mass indices were associated with increased risks of adverse outcomes of pregnancy [10].

In a study from Chennai, Bhavadharini B et al., analysed pregnancy outcomes in relation to maternal BMI and weight gain from a retrospective data of 2728 women attending antenatal clinics and private centres in Chennai and reported that there was a high risk of adverse outcomes among overweight and obese women who gained more than recommended weight as per Institute of Medicine guidelines. Normal weight and overweight women who gained less than recommended weight had a higher risk for preterm birth and low birth weight of baby. They suggested that preconception counselling is needed for awareness and advice regarding importance of maintaining normal weight and maintaining gestational weight gain within recommended guidelines [11]. Vinturache A et al., study done recently ascertained that maternal obesity is an independent factor which renders the pregnancy at risk for preterm delivery [12]. Papazian T et al., also assessed the prepregnancy BMI and gestational weight gain impact on neonatal outcomes in Middle Eastern and Arab populations and found that gestational weight gain below recommended guidelines as per Institute of Medicine and low prepregnancy BMI was associated with higher risk of low birth weight babies [13]. The results are in line with the notion that prepregnancy BMI plays a genetic role in determining the foetal growth as highlighted by earlier research [14-19].

Present study results when assessed in the light of available literature reinforce the importance of preconception counselling for the maintenance of normal body weight prior to pregnancy and also the significance of maintaining gestational weight gain within recommended guidelines.

LIMITATION

Limitations include a small sample and convenience sample which may not be representative of the reference population. BMI was not included in analysis. Also, demographic features, educational status, social status, nutritional care, occupation and food supplements data which may confound the results were not recorded. Similarly, the data taken from antenatal visits should be evaluated with caution as the gestational age and pre-pregnancy weight data is taken in a retrospective manner.

CONCLUSION

Pre-pregnancy weight of mother being an important determinant of birth weight of baby, the women of reproductive age group need to be counselled regarding its significance. Gestational

weight gain is an important determinant of birth weight of baby and mothers should be advised regarding recommended weight gain ranges during the antenatal visits.

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