

A study to assess correlation between maternal weight gain and fetal outcome among primigravidae registered in antenatal clinics

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ABSTRACT

Context: Inadequate prenatal weight gain is a significant risk factor for adverse maternal and fetal outcomes. Nutrient intake and weight gain during pregnancy are the two main modifiable factors influencing maternal and infant outcomes. **Aim:** To assess the social and demographic factors affecting weight gain of pregnant women and to determine the correlation between maternal weight and fetal outcome. **Setting and Design:** Observational prospective study. **Materials and Methods:** Two different groups and settings of populations were studied, one enrolled in the antenatal clinic of a tertiary care hospital (sample size 197) and the other suburban antenatal clinic located in a slum community (sample size 97) of the same metro city. **Statistical Analysis:** Chi-square test, Fisher's exact test, and Pearson's correlation coefficient were used for analysis. **Result:** In the tertiary care hospital, 16.75%, 75.13%, and 8.12%, whereas in the suburban hospital 47.42%, 46.39%, and 6.19% primigravidae gained less than or equal to 8, 8.1–16 kg, and more than 16 kg weight, respectively. In the tertiary care hospital, the percentages of preterm birth, low birth weights, special attention needed, and no immediate cry after birth were 5.1%, 19.80%, 4.1%, and 4.1%, respectively, while in the urban health center they were 9.3%, 41.24%, 21.65%, and 11.3%, respectively. A significant association was found between maternal weight gain and birth weight of neonate and special attention needed by baby in both groups. **Conclusion:** Monitoring the maternal weight during the antenatal period epidemiologically determines the strength of association between maternal weight gain and birth weight of child.

Keywords: Correlation, fetal, maternal, outcome, primigravidae

Introduction

The percentage of low birth weight in the developing countries is more than double the percentage in the developed countries.^[1] Low birth weight, birth weight less than 2500 g,^[2] and perinatal mortality are important public health problems in the developing countries particularly in the Indian subcontinent, where the low birth rate is 30%.^[3] Adequate weight gain is related to optimal perinatal outcome.^[4]

A metropolitan city has population in high-end areas of the city with modern health facilities and there are others in slums. This study was carried out to determine the correlation between maternal weight gain and fetal outcome in two different groups of populations.

Materials and Methods

Step 1: Ethical clearance was obtained from the Institutional Review Board of the College after submitting the protocol and subsequently answering all their queries.

Step 2: Permission was obtained from the Head of Department of Obstetrics and Gynaecology for conducting the study after giving detailed explanation of all the procedures.

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Step 3: Study design: An observational prospective community-based study was conducted in two groups: group 1 in a tertiary care hospital antenatal clinic and group 2 in a suburban antenatal clinic for 1 year 6 months (August 2015–May 2016). The sampling method used was convenient sampling, that is, all women registered in that duration were included in the study. The sample size of group 1 was 197 and group 2 was 97.

Pregnant women registered within 12 weeks of pregnancy in the antenatal clinic were included in the study. A prevalidated semi-structure questionnaire was prepared in accordance with the study objectives. After obtaining informed consent and establishing rapport, the interviews were conducted in the most common spoken local language in that area. Information regarding sociodemographic characteristics, marital details, antenatal care (ANC), nutrition, weight, and height was obtained from participants on a predesigned questionnaire. Weight measurements were done at two ANC visits, namely, first during the first trimester before 12 weeks of pregnancy and second during the third trimester when the women came for delivery. The maternal weight gain was defined as the difference between the maternal weight recorded for each woman at the delivery unit and the maternal weight recorded at the first prenatal visit within 12 weeks of pregnancy. The study subjects were contacted within 3 days of delivery. After delivery, follow-up of the mother and the new born was done during their hospital stay in both groups. Fetal outcomes, that is, birth weight, cry after birth, terms of gestation completed, congenital anomalies, and intensive care admission needed within 3 days of hospital stay were recorded.

Statistics

The results were analyzed using SPSS software version 17. Tests applied were percentages, mean, average, Chi-square test, Fisher's exact test, and Pearson's correlation coefficient.

Results

The mean age of the study subjects in the tertiary care antenatal clinic was 24.38, whereas in the suburban clinic was 23 years. The study subjects in the tertiary care hospital predominantly belonged to Hindu religion [125 (63.5%)], whereas the study subjects in the urban health center predominantly belonged to Muslim religion [62 (63.9%)] [Table 1].

The mean weight of the study subjects in the tertiary care antenatal clinic was 49.18 kg with an average weight gain of 10.4 kg, and in the suburban antenatal clinic it was 46.96 kg with an average weight gain of 8.96 kg. In the tertiary care antenatal clinic 33 (16.75%) women gained less than or equal to 8 kg, 148 (75.13%) gained weight in the range of 8.1–16 kg, while 16 (8.12) gained more than 15 kg weight during pregnancy. In the suburban antenatal clinic, 46 (47.42%) women gained less than or equal to 8 kg, 45 (46.39%) gained weight in the range of 8.1–16 kg, while 6 (6.19%) gained more than 16 kg weight during pregnancy.

In the tertiary care hospital, 10 (5.1%) of 197 and in the urban health center 9 (9.3%) of 97 women delivered before completing 37 weeks of gestation. In the tertiary care hospital, of 197, 8 (4.1%) respondent babies and in the urban health center 11.3% respondent babies did not cry immediately after birth. The

Table 1: Socioeconomic and demographic information

Variable	Range	Tertiary care antenatal clinic	Suburban antenatal clinic
Age (years)	≤20	20 (10.2%)	21 (21.6%)
	21-25	111 (56.3%)	63 (64.9%)
	26-30	48 (24.4%)	13 (13.4%)
	>30	18 (9.1%)	0 (0%)
Religion	Hindu	125 (63.5%)	23 (23.7%)
	Muslim	51 (25.9%)	62 (63.9%)
	Christian	12 (6.1%)	7 (7.2%)
	Others	9 (4.6%)	5 (5.2%)
Education	Primary	46 (23.4%)	48 (49.5%)
	Secondary	98 (49.7%)	41 (42.3%)
	Higher secondary	30 (15.2%)	2 (2.1%)
	Graduate and above	14 (7.1%)	0 (0%)
Occupation	Unskilled	27 (13.7%)	16 (16.5%)
	Skilled	7 (3.6%)	0 (0%)
	Semiprofessional	5 (2.5%)	0 (0%)
Per capita income	≤3000	73 (37.1%)	41 (42.3%)
	3001-6000	101 (51.3%)	53 (54.6%)
	6001-9000	18 (9.1%)	3 (3.1%)
	>9000	5 (2.5%)	0 (0%)
Socioeconomic classification (Kuppuswamy)	Upper middle	15 (7.6%)	0 (0%)
	Lower middle	62 (31.5%)	42 (43.3%)
	Upper lower	120 (60.9%)	55 (56.7%)

average birth weight in the tertiary care hospital was 2.95 kg, while in the urban health center it was 2.76 kg. Of 197 women in the tertiary care hospital, 39 (19.80%) gave birth to low birth weight, that is, below 2.5 kg. Compared with the tertiary care center women, about double the percentage of women [40 (41.24%)] gave birth to low birth weight babies (less than 2.5 kg) in the urban health center. In the tertiary care hospital, 8 (4.1%) babies of 197 needed special attention, that is, neonatal intensive care unit admission, compared with the urban health center where it was about four times more [21 (21.65%), out of 97 babies needed special attention]. No congenital anomalies occurred in the babies of respondents of any of the groups. All newborns of the tertiary care hospital were BCG-vaccinated. While in the urban health center there were 2 (2.1%) newborns not vaccinated within the postdelivery hospital stay [Table 2].

On applying the Chi-square test, a significant difference was found between the cry of baby immediately after birth, birth weights of neonates, and special attention needed to newborn between group 1 and group 2, while no significant difference was found in the gestational age completed at the time of delivery between the study subjects of two groups.

On applying Fisher's exact and Chi-square tests, a significant association was found between the maternal weight gain and birth weight of the neonate and special attention needed by baby in both groups 1 and 2. There was no significant association found between the maternal weight gain and terms of gestation

completed and cry immediately after birth [Tables 3 and 4]. Pearson's coefficient was found to be 0.564 and 0.401 in groups 1 and 2, respectively, showing that the maternal weight gain and birth weight were found to be positively correlated in both the groups [Figures 1 and 2].

Discussion

In our study, the mean age of the patients in the tertiary care hospital study subjects was 24.38 years, whereas that in the suburban clinic was 23 years. The study subjects in the tertiary care hospital predominantly belonged to Hindu religion, that is, 125 (63.5%) followed by 51 (25.9%) who were Muslims. While the study subjects in the suburban health center predominantly belonged to Muslim religion, that is, 62 (63.9%) followed by 23 (23.7%) Hindu.

In the tertiary care hospital, 16.75% women gained less than or equal to 8 kg, 75.13% gained weight in the range of 8.1–16 kg, while 8.12 gained more than 15 kg weight during pregnancy. In the urban health center, 47.42% women gained less than or equal to 8 kg, 46.39% gained weight in the range of 8.1–16 kg, while 6.19% gained more than 16 kg weight during pregnancy. In the tertiary care hospital, 10 (5.1%) out of 197 and in the urban health center 9 (9.3%) out of 97 women delivered before completing 37 weeks of gestation. A significant association was found between the birth weight of the baby and special

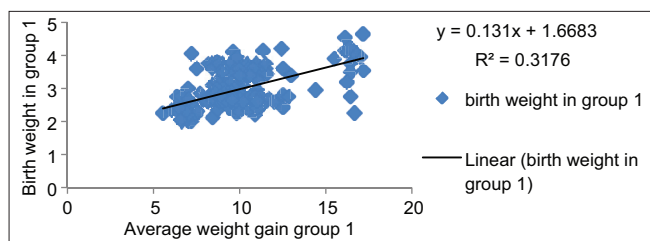


Figure 1: Correlation between maternal weight gain and birth weight in the tertiary care hospital. Coefficient of determination (R^2) = 0.3176, Pearson's coefficient (r) = 0.564

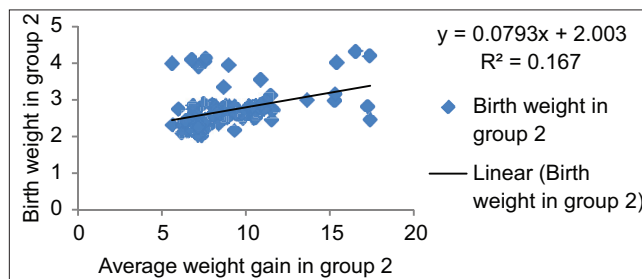


Figure 2: Correlation between average maternal weight gain and birth weight in the suburban hospital. Coefficient of determination (R^2) = 0.167, Pearson's coefficient (r) = 0.401

Table 2: Fetal outcome at delivery in group 1 and group 2 (N1=197, N2=7)

Variable	Range	Tertiary care hospital	Urban health center
Terms of gestation completed	More than or equal to 37 weeks	187 (94.9%)	86 (88.66%)
	Less than 37 weeks	10 (5.1%)	11 (11.34%)
Cry immediately after birth	Yes	189 (95.9%)	86 (88.7%)
	No	8 (4.1%)	11 (11.3%)
Birth weight of neonate	Less than 2.5kg	39 (19.80%)	40 (41.24%)
	2.5-3.99 kg	143 (72.59%)	48 (49.48%)
	More than or equal to 4 kg	15 (7.61%)	9 (9.28%)
Special attention needed	Yes	8 (4.1%)	21 (21.65%)
	No	189 (95.9%)	76 (78.35%)
Congenital anomalies	Yes	0	0
	No	197 (100%)	97 (100%)
BCG vaccination given	Yes	197 (100%)	95 (97.9%)
	No	0	2 (2.1%)

Table 3: Relation between maternal weight gain and fetal outcome at delivery in group 1 (N1=197)

Fetal outcome in tertiary care hospital	Maternal weight gain		χ^2	P
	≤8 kg	More than 8 kg		
Terms of gestation completed			0.080	1
≥37 weeks	31	156		
<37 weeks	2	8		
Cry of baby immediately after birth			0.108	1
Yes	32	157		
No	1	7		
Birth weight of baby			4.575	0.032
<2.5 kg	11	28		
≥2.5 kg	22	136		
Special attention needed to newborn			6.881	0.034
Yes	3	2		
No	30	162		

Table 4: Relation between maternal weight gain and fetal outcome urban health center (N2=97)

Fetal outcome in urban health center	Maternal weight gain		χ^2	P
	≤8 kg	More than 8 kg		
Terms of gestation completed			0.609	0.531
≥37 weeks	42	44		
<37 weeks	4	7		
Cry of baby immediate after birth			0.252	0.752
Yes	40	46		
No	6	5		
Birth weight of baby			54.859	<0.001
<2.5 kg	28	12		
≥2.5 kg	18	39		
Special attention needed to newborn			8.896	0.034
Yes	16	5		
No	30	46		

attention required by the baby and maternal weight gain in both the groups. No significant association was found between the gestational age completed by the baby and maternal weight gain in both the groups.

Similar findings were obtained in the study conducted by Shrivastava and Bobhate,^[5] wherein out of 183 subjects, 112 (61.20%) subjects were in the age group of 18–25 years and the mean age was 23.8 years in urban slums of Mumbai. A total of 290 pregnant women were enrolled in the study by Joshi and Pai,^[6] wherein the women belonged to the age groups of 15–19 years (14.82%), 20–24 years (42.07%), 25–29 years (28.62%), and more than 30 years (14.49%). The study by Shrivastava and Bobhate^[5] depicted that there were 71 (38.79%) women who belonged to Hindu religion and 112 (61.20%) belonged to Muslim religion. These study findings were similar to our urban health center study subjects. In a study by Joshi and Pai,^[6] 31% women gained inadequate weight,

51.3% gained adequate weight, while 17.8% gained excessive weight, which was similar to our tertiary care center study subject findings. In a study by Firdaus *et al.*,^[7] 71% women gained poor weight, 39% women gained ideal weight, and 18% women gained excessive weight during pregnancy. In a study by Arora *et al.*,^[8] 28.4% women gained low weight, 38.5% had normal, and 33.1% had high maternal weight gain. The findings in the last two studies differ from our study findings which may be due to the difference in the sociodemographic and racial differences. Unlike our study, in a study by Alwani *et al.*,^[9] there was a significant association of maternal weight gain with preterm labor. This difference may be due to the socioeconomic and racial differences. Similar to our study, Mamun *et al.*^[10] found that excessive weight gain during pregnancy is associated with greater birth weight in the babies, and Tsai *et al.*^[11] found that a low birth weight was strongly associated with low weight gains (<10 kg). Flick *et al.*^[12] found a significant relation between neonatal intensive care unit admission and maternal obesity similar to our study. Similar to our study, in a study by Lin *et al.*^[13], the maternal weight gain was associated with neonatal intensive care unit admission and neonatal birth weight. In a study by Abide *et al.*^[14] also, the maternal weight gain was associated with neonatal intensive care unit admission and neonatal birth weight which were similar to the findings of our study. Tela *et al.*^[15] also found a significant association between maternal weight gain and neonatal birth weight like our study.

There is a need for developing practical insights among healthcare providers for provision of comprehensive need-based customized maternal and child health care at primary care level.

The study findings may lead to identification of an appropriate tool for assessment of predicted foetal outcome and may support healthcare providers to plan interventions during the antenatal, intranatal, and postnatal periods, thereby preventing undue maternal and child health morbidities. In this way, a sense of preparedness would be achieved where in the preventive steps would be undertaken earlier, the quality of referrals would improve, and the need for up gradation of ANC and postnatal care postnatal care would be prioritized. This can also be used as a guidance tool by the families.

In this context, it is possible to develop measurement maternal weight gain during the antenatal period as a “community-based diagnostic tool” for prediction of probable outcome of the expected child, prior to delivery as weight gain is a very simple tool easy to calculate. This will enable the medical officers at the primary care level in the rural areas in particular to plan clinical interventional measures for safe delivery and childhood survival if unfavorable measurements are observed.

Strength and limitations

The study included the population living in high-end areas of the city with modern health facilities and others who live in the slums, not being able to access even the basic health facilities.

All women (e.g. high-risk pregnancy) were not included in the study. This may present as a limitation in generalizing the results of this study to the whole population.

Conclusion

The variable maternal weight gain is consistently influencing the extrapolation for expected birth weight. This implies that monitoring the maternal weight during the antenatal period epidemiologically determines the strength of association between maternal weight gain and birth weight of child. The correlation between maternal weight gain and birth weight will be a supportive aid to gear up preparedness for neonatal and advanced medical care services linked with the place of delivery. This will be of relevance because the Ultrasonography (USG) facilities are not available at primary health centers and subcenters.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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