ORIGINAL RESEARCH

A study on analysing the outcomes of maternal nutrition on infant's birth weight

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ABSTRACT

Background:Health & nutritional status of mother during & before pregnancy is considered to be strongly associated with pregnancy outcomes. Poor nutritional status & inadequate intake of food in pregnancy not only affect women's health but also effect birth weight & development of infant. The present study was conducting to analyse the outcomes of maternal nutrition on infant's birth weight.

Material and methods: The present cross-sectional study was conducted among 350 pregnant women. Socio-demographic characteristics and obstetrics information of the pregnant women were collected using pretested questionnaires. Anthropometric measurements were carried out using appropriate measuring instruments. All statistical analyses were performed using SPSS version 20. Multiple linear regressions analysis was also performed to explore independent effects of maternal factors. A p value< 0.05 was considered to be significant.

Results: In this study, the mean weight and height of pregnant women were 63.25kg and 156.32cm, respectively. Overall, the mean pre-pregnancy BMI of the study participants was 24.43kg/m^2. The study also revealed that the mean weight gain of the mothers was 9.45kg, within the weight gain range of 4–16kg. The mean maternal hemoglobin level was 11.76g/dL. Moreover, the mean total serum cholesterol level of the mothers was 187.32mg/dL. Maternal blood sample analysis also revealed that the mean total serum protein level was 5.70g/dL, with 81.42% and 18.58% of women having total protein level less than 6.7 g/dL and between 6.7 and 8.7 g/dL, respectively. In multivariate linear regression analysis, birth weight was significantly associated with parity, maternal BMI, weight gain during pregnancy, hemoglobin level.

Conclusion: The present study concluded that birth weight was significantly associated with parity, maternal BMI, weight gain during pregnancy, hemoglobin level. Therefore, nutritional status of the pregnant women should be improved to reduce the risk of low birth weight.

Keywords: nutritional status, hemoglobin level, pregnancy.

INTRODUCTION

Nutrition plays a major role in maternal and child health. Poor maternal nutritional status has been related to adverse birth outcomes; however, the association between maternal nutrition and birth outcome is complex and is influenced by many biologic, socioeconomic, and demographic factors, which vary widely in different populations.[1]Pregnancy is a crucial time for women to be well nourished. The added nutrient demands of fetal growth and development must be met in order to ensure optimal birth and growth outcomes. A suboptimal maternal diet and inadequate gestational weight gain during pregnancy increase risk for adverse health outcomes for both mother and child.[2-6] Maternal undernutrition and insufficient gestational weight gain (GWG) are key contributors to increased incidence of preterm birth (PTB), low birth weight (LBW) and poor fetal growth.[7,8] On the other hand, maternal obesity, adiposity and excessive GWG are associated with several issues in child birth and subsequent health of the child including caesarean section delivery, late antepartum death, excessive fetal growth, macrosomia and childhood obesity.[9-11] Thus, improving maternal nutritional status before conception and during pregnancy are essential to improve birth weight of newborns.[12] However, the association between maternal nutrition and birth outcome is influenced by different factors. Thus, understanding the relationship between maternal nutrition and birth outcomes is important to prevent adverse birth outcomes including LBW.[13]The present study was conducting to analyse the outcomes of maternal nutrition on infant's birth weight.

MATERIAL AND METHODS

The present cross-sectional study was conducted to assess the effect of nutritional status of pregnant mothers on birth weight of babies over the period of 3 months. All pregnant women were eligible for study if they were between the age of 18 and 37years, those with singleton term pregnancy (37– 42weeks) in labor and those who were volunteered to participate in the study. Pregnant women with history of taking tobacco, alcohol and drug abuse, history of chronic diseases, diagnosed as antepartum hemorrhage, oligohydramnios, fetal anomaly and still birth were excluded from this study. The total sample for the study was 350 pregnant women who fulfill the eligibility criteria and gave birth during study period. Before the data collection, ethical approval was obtained from Institutional Review Board (IRB) and then, written informed consent was obtained from all study participants. Socio-demographic characteristics and obstetrics information of the pregnant women were collected using pretested questionnaires. Anthropometric measurements were carried out using appropriate measuring instruments. Accordingly, measurements of height were made without shoes to the nearest 0.1 cm using erect height measuring device. Weight was measured using a weighing scale with light clothes and without shoes to the nearest 0.1kg. Maternal BMI was then calculated using height and weight (weight in kilograms divided by height in square meters). Maternal venous blood, approximately 8mL, was collected before delivery by experienced laboratory technician with appropriate aseptic techniques. Immediately after collection, 5mL of the blood sample was transferred to tubes for the preparation of serum. Serum was separated by centrifugation process at 3500r/min for 10min. One-milliliter aliquots of serum samples were obtained by centrifugation and tored at 2°C–8°C prior to processing. The serum samples were analyzed for the estimation of total protein and total cholesterol. Total protein was assayed using Biuret method19 and total cholesterol was assayed using cholesterol oxidase/ peroxidase colorimetric (ENDPOINT) method.20 Measurements of total cholesterol and total protein were performed on ECHO XPC automatic chemistry analyzer (Edif instruments, Italy). The hemoglobin level of pregnant women was determined from the whole blood using Sysmex XT 2000i hematology analyzer. The WHO categories of anemia for pregnant women were used for this study. All statistical analyses were performed using SPSS

version 20. Descriptive statistics were used to describe the sociodemographic characteristics of the study participants. Multiple linear regressions analysis was also performed to explore independent effects of maternal factors. The variables that were statistically significant in the multiple linear regression models were reported as the best predictors of newborn birth weight. The results of the analysis were presented with texts and tables. A p value< 0.05 was considered to be significant.

RESULTS

A total of 350 pregnant women were involved in this study. The mean age of the pregnant women was 27 years. In this study, about 42.85% of the women were nulliparous and 37.14% were multiparous. About 34.28% of the pregnant women were primigravida, 20% were second gravid, 16.57% were third gravid, 14.28% were fourth gravid and grand multigravidity was found in 14.85% women. The newborns in our study had a mean birth weight of 3.34±0.26kg. About 332 (94.85%) of them belonged to normal birth weight and the remaining 18 (5.14%) belonged to LBW. In this study, the mean weight and height of pregnant women were 63.25kg and 156.32cm, respectively. Overall, the mean pre-pregnancy BMI of the study participants was 24.43kg/m^2. The study also revealed that the mean weight gain of the mothers was 9.45kg, within the weight gain range of 4–16kg. Based on the pre-pregnancy BMI, 170 (48.57%) women had gestational weight gain within the recommended range. The remaining 150 (42.85%) and 30 (8.57%) women had low and high gestational weight gain, respectively. The mean maternal hemoglobin level was 11.76g/dL. Based on hemoglobin concentration, about 21.42% mothers had anemia with 78.57% mild and 21.43% had moderate anemia. Severe anemia was not found in this study. Moreover, the mean total serum cholesterol level of the mothers was 187.32mg/dL. Total cholesterol level less than 200mg/dL was recorded in 73.14% of women while 24.57% and 2.29% of women had cholesterol level between 200 and 239mg/dL and above 239mg/dL, respectively. Maternal blood sample analysis also revealed that the mean total serum protein level was 5.70g/dL, with 81.42% and 18.58% of women having total protein level less than 6.7 g/dL and between 6.7 and 8.7 g/dL, respectively. In multivariate linear regression analysis, birth weight was significantly associated with parity, maternal BMI, weight gain during pregnancy, hemoglobin level.

Table 1: Characteristics of pregnant women

Variables	N(%)
Age (years)	
≤27	190(54.28%)
≥28	160(45.71%)
Mean age (years)	27±6
Parity	
Nulliparous	150(42.85%)
Primiparous	50(14.28%)
Multiparous	130(37.14%)
Grand multiparous	20(5.71%)
Gravidity	
One	120(34.28%)
Two	70(20%)
Three	58(16.57%)
Four	50(14.28%)
≥Five	52(14.85%)

Table 2: Mean anthropometric and biochemical parameters of pregnant women attending delivery room

Measurements	Mean±SD
Height (cm)	156.32±3.65
Weight (kg)	63.25±6.43
Weight gain during pregnancy (kg)	9.45±2.32
Pregnancy body mass index (kg/m^2)	24.43±2.87
Pre-pregnancy body mass index (kg/m^2)	22.34±2.46
Hemoglobin (g/dL) 11.89 (1.41)	11.76±1.32
Total cholesterol (mg/dL)	187.32±23.54
Total protein (g/dL)	5.70±0.45

Table 3: Multiple linear regression model examining the associations between maternal risk factor variables and birth weight (kg) as an outcome

Maternal factors	Multiple regression model Beta coefficient	P-Value
Parity	0.137	0.012*
Hgb	0.035	0.043*
Total cholesterol	0.01	0.423
Total protein	0.028	0.822
Pre-pregnancy BMI	0.010	<0.001*
Weight gain	0.011	<0.001*

DISCUSSION

In developing world, lacking proper health system and resources, maternal educational may be of prime importance in the determination of health outcomes of mother and her infants. There is a need for nutrition supplementation to all pregnant women as well as low birth weight infants to insure optimum growth and better nutrients transfer to the offspring. For women who have had one or multiple children, adequate birth spacing (at least 2 years) is recommended, so that she can replenish their nutrients stores. A well nourished woman who begins her pregnancy with a rich nutrients reserve, can easily met the demand of her growing fetus without damaging her health, but it is also necessary that mother's diet provide adequate nutrients throughout the pregnancy so that maternal nutrients store do not get depleted.[14]

A total of 350 pregnant women were involved in this study. The mean age of the pregnant women was 27 years. In this study, about 42.85% of the women were nulliparous and 37.14% were multiparous. About 34.28% of the pregnant women were primigravida, 20% were second gravid, 16.57% were third gravid, 14.28% were fourth gravid and grand multigravidity was found in 14.85% women. The newborns in our study had a mean birth weight of 3.34±0.26kg. About 332 (94.85%) of them belonged to normal birth weight and the remaining 18 (5.14%) belonged to LBW. In this study, the mean weight and height of pregnant women were 63.25kg and 156.32cm, respectively. Overall, the mean pre-pregnancy BMI of the study participants was 24.43kg/m^2. The study also revealed that the mean weight gain of the mothers was 9.45kg, within the weight gain range of 4–16kg. Based on the pre-pregnancy BMI, 170 (48.57%) women had gestational weight gain within the recommended range. The remaining 150 (42.85%) and 30 (8.57%) women had low and high gestational weight gain, respectively. The mean maternal hemoglobin level was 11.76g/dL. Based on hemoglobin concentration, about 21.42% mothers had anemia with 78.57% mild and 21.43% had moderate anemia. Severe anemia was not found in this study. Moreover, the mean total serum cholesterol level of the mothers was 187.32mg/dL. Total cholesterol level less than

200mg/dL was recorded in 73.14% of women while 24.57% and 2.29% of women had cholesterol level between 200 and 239mg/dL and above 239mg/dL, respectively. Maternal blood sample analysis also revealed that the mean total serum protein level was 5.70g/dL, with 81.42% and 18.58% of women having total protein level less than 6.7 g/dL and between 6.7 and 8.7 g/dL, respectively. In multivariate linear regression analysis, birth weight was significantly associated with parity, maternal BMI, weight gain during pregnancy, hemoglobin level.

Factors such as poor maternal nutritional status before and during pregnancy, infant's low birth weight and small for gestational age, have been suggested to adversely affect the growth and cognitive development of the offspring.[15,16]

Several studies reported that maternal anthropometric parameters such as height, weight, BMI and gestational weight gain have strong association with birth weight of the baby.[17,18] When the maternal height and weight is appropriate, the better is the growth of the fetus and better is the birth outcome.[17] Women with normal BMI before pregnancy promised a better outcome for pregnancy itself and also for the outcome of baby birth.[19]

Sharma M et al planned a study to investigate the effect of maternal health on birth weight and to find out current status of incidence of low birth weight and to study the birth weight pattern and concluded that birth weight was low in undernourished pregnant women and women with low Hemoglobin level are at increased risk of having low birth weight babies. Maternal health during and before pregnancy is directly related to the birth weight of infant.[18]

Woldeamanuel GG et al assess the effect of maternal anthropometry and biochemical profile on birth weight of babies at Butajira Referral Hospital, Butajira, Ethiopia. This study has shown that nutritional status of pregnant women as indicated by maternal anthropometry and hemoglobin level was associated with birth weight of the baby.[20]

CONCLUSION

The present study concluded that birth weight was significantly associated with parity, maternal BMI, weight gain during pregnancy, hemoglobin level. Therefore, nutritional status of the pregnant women should be improved to reduce the risk of low birth weight.

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