ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Original Research Article

Study on the determinants of pregnancy outcome

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How to cite this article: Eyad AlShammari, Rafia Bano, Shahida Banu, S. Bushra Fatima, Asma Sattam. Study on the determinants of pregnancy outcome. IAIM, 2015; 2(6): 160-171.

Available online at www.iaimjournal.com

Received on: 03-06-2015 **Accepted on:** 14-06-2015

Abstract

Objectives: Adequate nutrient intake during pregnancy is important to fetal and maternal health. The purpose of this study was to investigate the factors affecting pregnancy outcome and to provide basic data to promote more favorable pregnancy outcomes.

Material and methods: Data were collected from 100 pregnant women at two hospitals in Hail region of Saudi Arabia. Demographic characteristics, anthropometric measurements and health related habits were obtained using a questionnaire at the hospital visit soon after the delivery. Data on pregnancy outcomes, including birth weights and gestational ages, were obtained from hospital records. Birth weights were divided into three groups, a low birth weight group (birth weight <2.5 kg), a normal birth weight group (2.5 - 3.9 kg) and a high birth weight group (≥4 kg).

Results: The Socioeconomic status was significantly with the birth weight ($p<0.05$), with high birth weight group babies belonging to high income group and low birth weight babies from lower income groups only. Weight and BMI of the mothers before pregnancy, total weight gain during pregnancy and hemoglobin levels were found to be significantly correlated with the birth weight.($p<0.05$). Few health related habits and risk factors were significantly different among the three groups. Birth weight or sex of the baby was not significantly affected by gestational age.

Conclusion: Birth weight remained an important factor affecting the neonatal infant and childhood mortality and morbidity. Low birth weight babies are more likely to have disabilities in four of developmental delay, poor growth and mental disabilities. For reducing the prevalence of low birth weight, public health strategy needs to focus attention on better maternal nutrition and education.

Key words

Pregnancy, Fetal and maternal health, Birth weight, Gestational age.

ISSN: 2394-0026 (P)
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Introduction

Maternal nutrition is an important factor responsible not only for the health of the baby, but also for the baby's long term growth [1]. Pregnancy outcomes are affected by other factors as well as nutrient intake. These factors are age, occupation, family, pregnancy experiences and morning sickness [2, 3]. Maternal anthropometric measurements, smoking, alcohol consumption, coffee consumption, stress and physical activity are also factors affecting pregnancy outcome [4].

Previously, research was performed addressing fetal programming which results from the adaptive changes in gene expression patterns that occur in response to stressors such as poor maternal nutritional status, leading to the altered growth of specific organs and systems during their most critical time of development [5]. Indeed, the prenatal environment exerts profound influences on the development of an organism, and stressful events during pregnancy can induce alterations in the fetal environment resulting in early and long-term structural and functional consequences [6, 7].

Therefore, nutrition is an important health determinant that can affect the course of pregnancy and its outcomes. Optimal nutritional status during pregnancy is reflected not only in the improved health of the mother but also in the improved health of the baby [8, 9]. Birth weight is a possible crucial factor in perinatal mortality and retarded child development, both physical and mental [1, 7]. Variation in birth weight occurs in last trimester and is influenced to a great extent by factors in the maternal environment.

Birth outcomes

At birth, most babies weigh 6 to 8 pounds. Low birth weight refers to infants who weigh less than 5.5 pounds (2.5 kg) at birth. Most normal babies weigh 5.5 pounds by 37 weeks of gestation. Intrauterine growth restriction refers to delayed growth within the uterus, which then leads to low birth weight. Some babies are just small and happen to weigh less than 5.5 pounds at birth, just like some adults are smaller than others. Though this is considered low birth weight, in these cases, it is not abnormal or a cause for concern [10].

Low birth weight may be suspected before delivery if the size of the mother's uterus is small, or if a small fetus is shown by ultrasound. The fetus may appear symmetrically small, or have a head that is of normal size for gestational age but an unusually small abdomen. Although the overall size of the fetus or infant is small, the organ systems are appropriately mature for gestational age. If the mother is small, it may be normal for her to have a small fetus [10].

How is Low Birth Weight identified?

Low birth weight (LBW) is defined as a birth weight of a live born infant of less than 2,500 g (5 pounds 8 ounces) regardless of gestational age [11]. Subcategories include very low birth weight (VLBW), which is less than 2000 g. Normal weight at term delivery is 2500–4000 g (5 pounds 8 ounces – 9 pounds 4 ounces) and above than normal category as >4000g [11].

Prenatal care is very important since few women carrying infants with delayed growth experience any symptoms. The most common symptom is simply a feeling that the baby is not as big as it should be. Because of this lack of symptoms, your health care provider should carefully measure your abdomen during each prenatal visit. If the measurements do not increase sufficiently over time, a follow-up exam will most likely include an ultrasound. The ultrasound can determine more precisely the gestational age of your baby and whether or not there is intrauterine growth restriction. Low

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

birth rate is also determined when your newborn is examined after delivery. If your baby's weight and length fall below the 10th percentile for his age, then he is considered to be low birth weight [10].

Striking variation exists in LBW prevalence within Asia: the highest rates are in South Asia and the lowest in East Asia [12]. In East Asia, the proportion of LBW ranges from 5% to 10%, with the exception of Thailand, where an estimated 36% of all infants are LBW [13]. In South Asia, the problem is most acute with up to 50% of all neonates having LBW [12].

According to different researches birth outcomes are dependent on the following factors.

- Pre-existing maternal disorders
- Physical and social characteristics
- Age
- Problems in previous pregnancies (e:g, spontaneous abortions)
- Problems that develop during pregnancy
- Problem that develop during labor and delivery

Keeping all the above mentioned factors in mind the present study was formulated to investigate the factors affecting pregnancy outcome and to provide basic data to promote more favorable pregnancy outcomes.

Materials and methods

One hundred and twenty three pregnant women participated in the present study, but only 100 women who could provide information on birth weight, gestational age and other related parameters were included in the analyses. The data collection was initiated in January 2015. Women who consented to participate were recruited from the two hospitals – Hail General Hospital as well as the Maternity and Children Hospital in Hail Region of Saudi Arabia.

Demographic characteristics, anthropometric measurements and health related habits were collected by individual interviews using a questionnaire at the hospitals visit soon after the delivery. The demographic characteristics were age, occupation status, type of family, socioeconomic status, pregnancy experiences and morning sickness. Weight-gain during pregnancy was calculated by subtracting the pre-pregnancy weight from the pregnancy weight at the end of pregnancy, in the last trimester. The pre-pregnancy BMI was calculated using the measured height and self reported pre-pregnancy weight. The health related habits surveyed were tea and coffee consumption, house hold jobs done, hours of mid day rest and night sleep and level of physical activity. Other questions included in the questionnaire were regarding parity, spacing between present and previous child, tetanus toxoid vaccination, iron and calcium supplementation and number of ANC visits during pregnancy. Blood pressure was taken for at least three days (minimum two times/ day) and the average was noted. Presence of anemia or any other chronic illness was ascertained from the medical records and file of the patient.

Information on sex of the baby, birth weight and gestational age was obtained from hospital records after delivery. The birth weights were divided into three groups according to the WHO standard (Bulletin of the World Health Organization, 1995): a low birth weight group (birth weight<3.1 kg), a normal birth weight group (3.1-3.6 kg), and a high birth weight group (>3.6 kg). Gestational age was divided into tertiles according to the gestational age of the subjects: group 1 (<38.53 week), group 2 (38.53-40.00 week) and group 3 (>40.00 week).

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Statistical analysis

The statistical analysis of data was conducted using SPSS for Windows version 17.0. The statistical differences among the three groups were analyzed by ANOVA. The results presented are the mean with standard deviations. The Chi-square test was used to test the significance of the distribution rate within the groups and the results presented are the total number and percentages. Results were considered significant if $p<0.05$.

Results

Based on the ICD; 10th version (11) standards (2.5 - 4 kg), birth weight was divided into four groups: very low birth weight group (<2 kg) the low birth weight group (birth weight 2 - 2.5 kg), the normal birth weight group (2.5 – 3.9 kg) and the high birth weight group (≥ 4 kg) (ICD, 10-2010). The subjects' ages were between 18 and 45 years. No significant differences were found in mean age, occupation status, education of mother and familial relation with husband among the groups (**Table - 1**). Alternatively on the other hand the correlation between age group of the mother and the birth weight categories was found to be statistically significant. The socio economic status, type of family, and education of father was found to be significantly correlated with the birth weight categories ($p<0.05$). The correlation between sex of the baby and birth weight was found to be highly significant ($P=0.000$). The very low birth weight and low birth weight babies were mostly (82% of the total low birth weight) females. Whereas 100% of the high birth weight babies were males.

The results of the mean anthropometric measurements along with the SD were as per **Table - 2**. Height and mean age of the mother were not significantly different among the groups. The pre pregnancy weights of the very low birth weight group, low birth weight group, normal birth weight group and high birth weight group were 50.0 ± 0 kg, 58.19 ± 15.9 kg , 68.9 ± 12.5 and 74.4 ± 13.4 kg, respectively. The weight gain in pregnancy weight was significantly higher in the high birth weight group than the low birth weight group ($p<0.005$). Also positive significant differences were found in pre-pregnancy BMI, weight of placenta after birth and the anthropometric measurements of the baby, showing an increasing trend with increasing Birth weight whereas, the mean years of spacing between the present and present child was not significantly different among the 4 groups.

Health related characteristics and habits level of physical activity and regular exercise was not significantly different among the groups. (**Table - 3**) On the other hand the prevalence of chronic illness and history of menstrual cycle was found to be significantly correlated with birth weight.

Mean differences in the anthropometric measurements according to the sex of the baby were as per **Table - 4**. Results clearly show that all the variables except for gestational age for the male babies were found to be significantly higher than their female counter parts ($P<0.05$).

Discussion

Mean birth weight of singleton normal pregnancies in this study is 3.1 kg. The weight distribution showed that 22% of the newborn were low birth weight, weighing <2.5 kg which is less than 33.3% and 29.9% reported from other parts of the world [14, 15], but is very high as compared with the developed countries [16]. A comparatively lower incidence (21.3%) was also reported from Nigeria [17, 18], but these studies included multiple pregnancies, prematurity, preeclampsia, whereas the present study included singleton uncomplicated pregnancies delivering at term. Of the various factors responsible for low birth weight (LBW) in our

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

subjects malnutrition was perhaps the most contentious that was in line with the findings of other workers in this field [19-21]. According to one research study [20] on Asian and European mothers, if Asian mothers have a high nutritional status in the second trimester of pregnancy, they can achieve their full genetic potential for intra-uterine growth that is a rate comparable to the Europeans.

In the present study morning sickness did not affect pregnancy outcomes. However, Yu and Yoon [22] reported that nutrient intakes in early pregnancy are reduced as a result of morning sickness. Coad, et al. [23] found significantly lower energy and fat intakes in women who suffered from morning sickness, and women who experienced morning sickness during pregnancy had significantly lower intakes of protein, carbohydrates, fiber, vitamin E and D, B vitamins (excluding folic acid), iron and zinc. They suggest, therefore, that interventions are needed to alleviate the symptoms in pregnant women who suffer from morning sickness.

One of the anthropometric measurements, pregnancy weight, also affected birth weight. In most studies, being overweight is an important risk factor indicating possible pregnancy complications [24], the greater the weight gain, the greater the risks [25]. Women who are underweight may also be at risk for adverse pregnancy outcomes [26-27]. The result of these studies is in accordance with the results of present study showing a significant correlation between weight gain in pregnancy and pregnancy outcome. Thus, it is especially important to follow the weight gain recommendations. Pregnant women should seek counselling and extra support to ensure appropriate weight gain.

Prenatal stress is associated with a number of adult diseases, including cardiovascular and related disorders. The mechanism underlying this relationship is thought to be exposure of the fetus to components of the stress response [28, 29]. According to Kim and Lee [30], stress management is important for pregnant women because stress may lead to reduced nutrient intakes.

Women who exercise during pregnancy have reduced risks of gestational diabetes, hypertensive disease, preeclampsia and preterm birth [31, 32], and no study has found any negative effects of moderate exercise on pregnancy outcomes in a healthy pregnancy. In the results of the present study, physical activity did not affect pregnancy outcomes. We think, however, that increasing physical activity levels and finding ways to eliminate stress are important for pregnant women. This may increase the consumption of foods.

A strong relationship was found between anemia and LBW in the present study as well as other previously done studies [33]. The findings were in agreement with other studies of anemic pregnant women carried out in Pakistan [34] and Syria [35]. Women can develop iron deficiency anemia from the loss of blood during menstruation and from repeated pregnancies; it can also be caused by a lack of iron in the diet. During pregnancy, women may develop anemia because the growing fetus draws upon the mother's iron for the development of red blood cells and other tissues. Due to the natural decrease in hemoglobin level during pregnancy, the hematocrit measurement should be carried out prior to pregnancy. Intake of iron supplements during pregnancy was also found to have a protective effect with respect to LBW. This is consistent with the findings of some other studies on iron supplementation and pregnancy outcome [36]. Iron supplementation during pregnancy protects a woman from becoming anemic because the required amounts

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

may not be supplied from dietary intake during this period.

Conclusion

Pregnancy outcomes remained an important factor affecting the neonatal and infant mortality and morbidity. Low birth weight babies are more likely to have disabilities in form of developmental delay, poor growth and mental disabilities. For reducing the prevalence of poor pregnancy outcomes, public health strategy needs to focus attention on better maternal nutrition and education. Interventional programs should be encouraged not only in health sectors but in all those sectors concerned with social development and social welfare programs. Women should be educated and encouraged for regular ANC checkups, which augments the detection of these risk factors at the earliest to improve the weight of a newborn. Good nutrition during pregnancy would result in increased birth weight.

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ISSN: 2394-0034 (O)

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Source of support: Research deanship, university of Hail, KSA
Conflict of interest: None declared.

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Table – 1: General demographic characteristics of the population.

VARAIBLES	VLBW	LBW	NBW	HBW	P Value
Age of mother					
15 – 19	0	3	0	0	**0.002*** **
20 – 24	1	7	12	0	
25 – 29	0	3	22	3	
30 – 34	0	2	21	0	
35 – 39	0	3	15	3	
>40	0	3	3	2	
Sex of the baby	**VLBW**	**LBW**	**NBW**	**HBW**	
Male	0	3	36	5	**0.000*** **
Female	1	18	37	0	
Working status					
Working	1	17	53	4	**0.59**
Non working	0	4	20	1	
Socio Economic Status					
Low	1	16	10	0	**0.000*** **
Middle	0	5	28	2	
High	0	0	35	3	
Type of family					**0.003****
Joint	1	20	71	1	
nuclear	0	1	3	4	
Education of mother					
Illiterate	0	5	7	2	**0.126**
Primary	0	3	17	0	
Secondary	0	9	20	0	
Higher education	1	4	29	3	
Education of father					
Illiterate	0	0	1	0	**0.048***
Primary	0	10	9	0	
Secondary	0	7	33	2	
Higher education	1	4	30	3	
Family relationship with husband					
Yes	1	10	22	3	**0.148**
No	0	11	51	2	

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Table – 2: Anthropometric characteristics of the mother and new born baby.

Mean Variables	VLBW	LBW	NBW	HBW	P Value
Age (years)	24±0.0	27.4±8.2	29.9±5.6	32.4±7.4	0.22
Height of mother (cm)	158±0.0	156.14±3.3	158.62±4.5	158.2±1.3	0.135
Pre pregnancy weight(kg0	50±0.0	58.19±15.9	68.95±12.5	74.4±13.4	0.004***
Pre pregnancy BMI	20±0.0	23.7±6.16	27.3±4.7	29.68±5.0	0.011**
Hemoglobin	12.1±0.0	10.9±1.18	12.14±1.4	12.46±0.66	0.004***
Total weight gain	7±0.0	5.05±1.11	8.95±3.4	10.4±5.6	0.000***
Head circumference of baby	30±0.0	33.4±1.3	34.86±1.3	36.2±1.3	0.000***
Weight of baby	1.7±0.0	2.29±0.15	3.22±0.27	4.34±0.23	0.000***
Height of the baby	45.0±0.0	47.29±1.8	50.03±2.05	53.2±4.3	0.000***
Weight of placenta	400±0.0	489±68	643.5±91.7	929±186	0.000***
Birth Spacing (yrs)	0.00±0.0	2.31±2.4	2.32±1.73	4.2±2.2	0.115

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Table – 3: The health-related habits of the three groups according to birth weight.

Variables	VLBW	LBW	NBW	HBW	P Value
History of chronic illness					**0.000*** **
HTN	0	1	0	0	
Diabetes	0	1	1	3	
Asthma	0	2	1	0	
None	1	17	71	2	
Morning sickness					
Yes	0	10	39	4	**0.417**
No	1	11	34	1	
Pattern of menstrual cycle					
Regular	0	18	65	5	**0.003*** **
Irregular	0	2	6	0	
Heavy bleeding	1	1	3	0	
Any previous LBW delivery					
Yes	0	4	5	1	**0.33**
No	1	17	68	4	
Tetanus Toxoid vaccination					
Yes	0	1	25	0	**0.022** **
No	1	20	48	5	
Iron and Calcium Supplementation during pregnancy					
Yes	1	10	55	5	**0.034** **
No	0	11	18	0	
Exercise done in pregnancy					
Never	1	16	42	4	**0.112**
1-2 times/week	0	5	6	1	
3-4 times/week	0	0	11	0	
Daily	0	0	14	0	
Mid day rest					
Never	0	5	17	2	**0.006** **
1-2 times/week	1	3	2	0	
3-4 times/week	0	2	17	0	
Daily	0	11	37	3	

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Table – 4: Mean anthropometric measurements according to the gender.

Variables	Male	Female	P value
Birth weight	3.29±0.54	2.89±0.49	0.000***
Height of the baby	50.5±2.6	48.7±2.3	0.001***
Head circumference	35.2±1.4	34.1±1.5	0.000***
Weight of placenta	669±155.7	586.3±98.7	0.002***
Total weight gain of mother	9.0±3.9	7.59±3.2	0.049*
Gestational age	38.4±1.49	38.09±1.4	0.275