

# Effects of Maternal Health and Nutrition on Birth Weight of Infant

Megha Sharma<sup>1</sup>, Sunita Mishra<sup>2</sup>

<sup>1</sup>Research scholar, Department of Human Development & Family Studies, School for Home Science, Babasaheb Bhimrao Ambedkar University (A Central University) Lucknow, India

<sup>2</sup>Dean & Head, Department of Human Development & Family Studies, School for Home Science, Babasaheb Bhimrao Ambedkar University (A Central University) Lucknow, India

**Abstract:** *Background-* Poor nutritional status and inadequate food intake during and prior to pregnancy not only effects women's health but also have negative impacts on growth and development of fetus. The birth weight of infant is a powerful predictor of growth and survival of infant and is dependent on maternal health and nutritional status. Maternal nutritional status, pre-pregnancy weight, body-mass-index (BMI), and gestational weight gain all are strongly associated with fetal growth and development. So improving maternal nutrition prior to conception and during pregnancy are potential strategies to improve birth weight. *Objectives-* This pilot study was planned 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. *Methodology -* A total of 80 mother-infant pairs delivered in a sub-district hospital of Lucknow were interviewed. Anthropometric measurements, including maternal weight, height, body-mass -indexes, total weight gain in pregnancy and infant's birth weight were recorded and all mothers were interviewed for their bio-social variables. Statistical analysis was done by using SPSS method to compare the risk factors and to analyze the effect on birth weight. *Results-* A total of 63.33% (50) new born were low birth weight, and rests 36.66% were normal. 68 % (34) of low birth weight was due to preterm birth and only 32 % were due to IUGR. Nearly half of the mothers of low birth weight babies had low body mass index during and before pregnancy. Mean birth weight was about 2.463gms. Low birth weight and maternal Hemoglobin status was dependent to each other. BMI and birth weight were also significantly associated. *Conclusion:-* We 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. So health policies should aimed at early detection and effective management of under nutrition to reduce the burden of Low birth weight and there is a need to focus attention on better maternal nutrition and education on birth spacing, early pregnancy, family planning and nutrition.

**Keywords:** Body-Mass-Index, Gestational weight, Micro-nutrients, Hemoglobin, Bio social variable

## 1. Introduction

Low birth weight is a major public health problem, particularly prevalent in developing countries. It is one of the important causes of high infant mortality rates. The incidence of low birth weight is high in India, despite adoption of many health policies for bringing it down. The estimated proportion of low birth weight in India is about 7-8%. It contributes to 60-80 % of all neonatal deaths.

World Health Organization has been defined low birth weight as a birth weight of an infant less than 2500 grams. It is further divided in to three categories as –

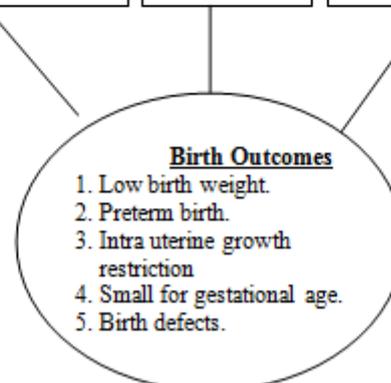
1	Low birth weight-	1500gms.-2500gms.
2	Very low birth weight-	1000gms-1500 gms.
3	Extremely low birth weight	<1000 gms.

It may be either due to preterm birth (i.e. before 37 weeks of gestation) or due to Intra Uterine Growth Restriction (IUGR).

## Determinants of Low Birth Weight and Birth outcomes:

### Medical Health   Social & Mental Health   Life Style

<ol style="list-style-type: none"> <li>Poor weight gain in pregnancy.</li> <li>Previous history of prematurity or LBW infant</li> <li>Maternal malnutrition.</li> <li>Chronic or pregnancy induced Hypertension</li> <li>Urinary tract infection.</li> <li>HIV infection.</li> <li>Multiple birth</li> <li>Placental dysfunction.</li> </ol>	<ol style="list-style-type: none"> <li>Lower educational status.</li> <li>Advanced maternal age.</li> <li>Short inter-pregnancy interval</li> <li>1st parity</li> <li>Low socio-economic status.</li> </ol>	<ol style="list-style-type: none"> <li>Tobacco use during pregnancy.</li> <li>Heavy alcohol use in Pregnancy.</li> <li>Inadequate antenatal Care.</li> </ol>
--	---	--



## 2. Maternal Health and Nutrition

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. Nutritional status of mother is strongly related to the birth weight of infant. Energy, fatty acids and micronutrients deficiency, have all been implicated in causing LBW in infants.

In many developing countries, majority of LBW is due to IUGR, Which may cause by:

- Low nutrients intake
- High nutrients loss.
- Placental dysfunction
- Maternal infection.
- Increased nutritional requirement..

### 2.1 Effect of Maternal Anthropometry

Anthropometry of mother including pre-Pregnancy weight, BMI, total maternal weight gain all are most important and have strong association with fetal growth.

- Low pre-pregnancy weight & poor weight gain in pregnancy are important predictors of IUGR.
- Many researchers have found that pre-pregnancy weight <40 kgs & total weight gain < 5 kgs is a useful cutoff to predict LBW.

### 2.2 Ideal Weight Gain

The progressive weight gain in pregnancy, reflects the growth of fetus, enlargement of lactating organ and increase in body fluid volume. The usual weight increase is considered to be about 25% of the initial body weight. Therefore if a normal pregnant woman has to gain on an average 25% of her initial body weight, she should put on over 10 kgs weight during pregnancy.

a) Ideal Weight Gain = 25% of the initial body weight (approx 10 kgs)

b) Lower body weight gain is probably due to-

- Smaller gain in cell mass & extra cellular fluid.
- Greater loss of body fats due to inadequate intake of protein & calories.

### 2.3 Effects of Micronutrients

In developing countries there exist a lifetime low intake of micronutrients, so it is important to reserve this low level of micronutrients before conception, but increased intakes shortly before and during pregnancy may also helps to increase birth weight and survival of infants. Trace elements, fetal tissues and blood are correlated with infant's weight and head circumference.

#### 2.3.1 Vitamin B12

It is reported that the prevalence of vitamin B12 deficiency is high in Indian population. Vitamin B12 deficiency has a potential role in elevating plasma homocysteine level in pregnancy and implicated for adverse pregnancy outcomes as low birth weight. (Kramar, MS1987)

#### 2.3.2 Iron

It is estimated that about 50% of women are still Iron deficient in India. Since Iron requirement is increased in pregnancy from 0.8-0.5mg/day in 3<sup>rd</sup> trimester. Average requirement in entire gestation is approx 4.4-5 mg /day. Poor iron status may affect immune function and thus increase host susceptibility to "genital tract infection" and also increase oxidative stress of placenta. Low hemoglobin status causes chronic hypoxia. (Murphy, J 1986) A supplementation of 60 mg of ferrous iron and 0.4 mg of folic acid /day significantly increased the birth weight. To obtain a maximum effect on birth weight iron supplementation should be started in early pregnancy. (Muthayya, S 2006) Iron and folic acid deficiency in early pregnancy is associated with neurological defects. Iron deficiency anemia has been shown to be associated with LBW and preterm babies & poor iron status may affect immune function & increase susceptibility to infections. (Supplementation of 60 mg of ferrous iron & 250µgm of folic acid twice a day is recommended)

#### 2.3.3 Essential fatty acids

These are structural components of lipid membrane & needed for neural tissues development and are correlated with weight and head circumference of infant at birth. DHA (docosahexanoic acid) and Arachidonic acid are essential long chain PUFA (poly unsaturated fatty acids) that are important structural components of lipid membrane of brain and central nervous system and are very critical for normal growth and development. The developing human fetus accumulates as much as 400 mg DHA/week in last trimester, most of which is incorporated in to the structural lipid of developing brain. So it is important that maternal micronutrient status and supply is adequate to support fetal requirement and the adequate consumption of food source rich in both DHA and AA may be important to maintain their status in pregnancy. DHA has an effect on endothelium and improves the membrane receptor activity through the improvement in membrane fluidity, so these fatty acids may increase fetal growth rate by increasing placental blood flow.

### 2.4 Macronutrients Supplementation

During pregnancy the fetus is entirely dependent on maternal nutrients intake & store, specially fats & protein for energy, so low intake of fat & energy implies a risk on poor nutrients availability to the fetus.

Many evidences has demonstrated that macronutrients (protein, energy) supplementation was associated with increase in maternal weight and mean birth weight and decrease in number of low birth weight babies. It is established that for undernourished women an additional 100 kcal/day throughout the pregnancy can increase birth weight by about 100 gms and the risk of IUGR would be halved. (WHO.1995) Fat deposition in early pregnancy acts

as a reserve for increased calorie demand throughout the pregnancy, which explained the important effect of supplementation on birth weight and IUGR.

### 2.5 Dietary intake of Nutrients

Dietary requirements are different during early and late pregnancy. Micro nutrients and protein required in early pregnancy whereas calorie and other nutrients later. A paradigm shift from effort to improve size at birth to efforts to improve fetal growth and development. Pregnant women can adapt a wide variety of food intake both in quality and quantity. The relative contribution of calories and protein to increase birth weight depends on the limiting nutrients of home diet. The baby of women who has low pre pregnancy weight, poor diet, low level of replacement of home diet by supplements, low physical activity in pregnancy and poor health status will show larger increase in birth weight/unit of supplementation.

### 3. Objectives

- To study the birth weight pattern.
- To investigate the effect of maternal health on birth weight.
- To find out current status of incidence of low birth weight.

### 4. Methodology

A total of 80 mother-infant pairs delivered in a sub-district hospital of Lucknow were interviewed. Anthropometric measurements, including maternal weight, height, body-mass index, total weight gain in pregnancy and infants birth weight were recorded and all mothers were interviewed for their bio-social variables, previous history of prematurity or low birth weight, complications and illness during pregnancy, details of antenatal care, dietary routine, type of physical activity and any morbid condition during and before pregnancy. Birth weight and sex of the new born, hemoglobin level of mother during and before pregnancy, pre-pregnancy weight and total maternal weight gain were sourced from the delivery register available in the hospital.

### 5. Diet Survey

The dietary assessment of the subjects was done and food intakes were obtained using 24-hour recall method. Probing questions were used to help the subjects to remember all foods consumed normally. The information about the quantity of raw material for cooking as well as cooked food was recorded in terms of household measures/ numbers/ to find out the quantum of raw food intake. Dietary pattern was graded normal, good and poor, as the subject were followed 6 meal pattern and nutrients consumption were considered satisfactory and not satisfactory on the basis of consumption of food stuffs from each food groups in enough quantity. Statistical analysis was done by using SPSS method to compare the risk factors and to analyze the effect on birth weight. A chi-square test was used to determine whether there was a significant association between BMI, Hemoglobin status, and birth weight.

### 6. Results

Among the 80 respondent studied a total of 63.33% (50) new born were low birth weight, and rest 36.66% were normal. 68 % (34) of low birth weight was due to preterm birth and only 32 % were due to IUGR. I also found that about 71 % mothers have low hemoglobin level (<11mg/dl) during and before pregnancy and they were undernourished. Nearly half of the mothers of low birth weight babies had low body mass index during and before pregnancy. Mean birth weight was about 2.463gms. Low birth weight and maternal Hemoglobin status was dependent to each other. BMI and birth weight were also significantly associated.

**Table1:** Relationship between Low Birth Weight and Maternal Hemoglobin status.

HB level of Mother	Low Birth Weight (n=50)		X <sup>2</sup>
	Preterm Birth	IUGR	
<11 mg/dl	30		4.5
>11 mg/dl	4		
Total	34		

$P=0.005$ ,  $X^2$  Tab.=7.879

**Table2:** Relationship between Low Birth weight and BMI (Body Mass Index)

Body Mass Index of mothers	Low Birth weight(n=50)		X <sup>2</sup>
	Preterm Birth	IUGR	
BMI<19.5 Kg/m <sup>2</sup>	14		1.979
BMI>19.5 Kg/m <sup>2</sup>	20		
Total	34		

$P=0.005$ ,  $X^2$  Tab.=7.879

### 7. 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.

As the Results showed Pre pregnancy BMI and BMI in pregnancy both are significantly associated with birth weight of infant. So gradual weight gain in pregnancy is an important indicator of the proper growth and development of the fetus and can be used as a predictor of low birth weight of infant.

Abrams and Selvin (1995) also reported that low maternal weight gain in 2<sup>nd</sup> trimester (<5.7 kgs) was associated with decreased birth weight ranging from 48-248

gms.(Cessay,SM.1997) Many researchers have found that using a pre-pregnancy weight of less than 40 kgs and weight gain less than 5 kgs is a useful cutoff to predict the women who deliver a low birth weight baby.

As shown in table. 1 maternal Hemoglobin level has strong association with both preterm birth and intra uterine growth restriction. Murphy et.al (.1986) also found that the frequency of low birth weight was high in women with very low Hemoglobin level during 3<sup>rd</sup> and 2<sup>nd</sup> trimesters. Scholl and Hediger(1994) reported that iron deficiency anemia early in pregnancy was linked to low birth weight and preterm deliveries.

A community based trial in rural Gambia showed that macro nutrient supplementation significantly increase the birth weight by 136 gms.(Vallset,SE.2000) Over the whole year supplementation reduced the prevalence of low birth weight from 17-11.1%.

## 8. Conclusion

Prevalence of low birth weight was found 63.33 % and of prematurity was 68 %. We 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. So health policies should aimed at early detection and effective management of under nutrition to reduce the burden of Low birth weight and there is a need to focus attention on better maternal nutrition and education on birth spacing, early pregnancy, family planning and nutrition. The control of associated risk factors specially additional dietary intakes, proper utilization of antenatal care need to be addressed on priority basis to reduce the incidences of low birth weight.

## References

- [1] Murphy, J.1986 Relation of Hb level in 1<sup>st</sup> and 2<sup>nd</sup> trimester to outcomes of pregnancy. The Lancet,may 3.
- [2] Kramer, MS.1987 Determinants of LBW, Methodological assessment and metaanalysis. Bull.of WHO, 65(5)663-737.
- [3] ACC/SCN (1991) controlling iron deficiency .ACC/SCN work shop. Nutr. Policy discussion paper no-9.
- [4] Naidu,A.N. Rao,N.P. BMI: A measure of nutrients store in Indian population. Eur.J. Clin.Nutr.1994; 48(supl3):S131-40.
- [5] Scholl, T.Hedigar, M.1994 Anemia and Iron deficiency anemia complication. Data on pregnancy outcomes. Am.J.Clin.Nutr.59 (Suppl):492S-501S.
- [6] Abrams,B.Selvin,S.Maternal weight gain pattern and birth weight. Obstet.gynecol1995; 86:163-9.
- [7] WHO, Maternal anthropometry and pregnancy outcomes. Bull. World Health Org.1995; 73(supl1):1-98.
- [8] Cessay,SM.Prentice,AM.Cole,TJ.Fourd,F.Weaver,LT.P askit,EM. Effect on birth weight and perinatal mortality Dietary supple.in rural Gambia. BMJ1997; 315:786-90.
- [9] Vallset,SE.Refsum,H.Irgens,LM.Emblem,BM. Plasma total Hcy,Preg. Complication and adverse outcomes: Am.J.Clin.Nutr.2000; 71:962-8.

[10] Allen,LH. Biological mech.that might underlie iran suppl.on maternal Hb status in pregnancy. Am.J.Public Health2002; 92:288-93.

[11] Muthayya, S. Kurpad, AV.Duggan, C.Bosch, RJ.Dwarkanath, P. Mahasankar, A. Maternal B12 status is a determinant of IUGR in south Indian .Eur. J.Clin.Nutr.2006,60:791-801.

## Author Profile



**Megha Sharma** is a research Scholar in Department of Human Development & Family Studies School for HSc. BBAU Lucknow, India



**Prof. Sunita Mishra** is Dean & Head of Department, Human Development & Family Studies School For HSc. BBAU Lucknow, India