

## **Biochemical Assessment of Nutritional Status of Pregnant Anemic Women after a Nutritional Supplement**

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Pregnancy is a remarkable anabolic process. Lack of balanced diet and inadequate nutrition leads to complications. Present study aims to assess the nutritional status of pregnant anemic women along with the effect of nutritional deficiency on the general health with reference to weight, height, mid-arm circumference, hemoglobin percentage and serum protein level. Plan of trial included study of pregnant women in the age group of 20-35 years. Supplemented group was given indigenous form of nutritional input coupled with Iron and Calcium, while Control group was provided with only Iron and Calcium. Supplemented group (67.44%) shows rise in Hb% as compared 40% in Control group. Nutritional supplement plays a definite role and it affects maternal weight gain, intrauterine growth of fetus, birth weight and improving perinatal outcome.

**Key words :** Anaemia, Pregnancy, Nutritional Supplement, Protein, Haemoglobin

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### **Introduction**

Nutrition is a combination of processes by which living organisms receive and utilize the materials necessary for maintaining function, growth and renewal of its components. The aim of science of nutrition is to determine the kinds and amount of foods that promote health and well being. Pregnancy is a most remarkable anabolic process whereby out of food, vitamins, minerals and hormones, a healthy baby is born within nine months. The foetus is in a sense a parasite to the mother and draws its nourishment from her diet. If the nutrition of the mother is inadequate then her body reserves are drawn upon and depleted. To meet the various requirements of the growing foetus, the maternal system has to undergo certain remarkable changes in uterus, fallopian tubes, vagina, breast volume, composition of the blood, serum proteins, weight changes, basal metabolic rate, respiratory system, alimentary function, skeleton, skin, teeth, urinary system, nervous system and endocrine system etc. The signs and symptoms of pregnancy vary with its different periods, commonly called the first, second and the third trimester, each characterised by its specific symptoms. The incidence

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of prematurity may rise with a decrease in the nutritional status of pregnant woman. Low birth weight, low vitality and a large number of early deaths might be occurring among infants born to poorly nourished mothers. Improving the nutrition of mother even in the third trimester of pregnancy might improve the status of the infants. Some of the theories relating to nutrition that have been practised by physicians *viz.* the semistarvation of the mother with the view of a restriction of salt and fluids to reduce the incidence of toxæmia; and the theory that the maternal organism will produce a healthy baby regardless of the mother's own state of nutrition needs to be further looked into (Shank. 1970). All such preliminary reports warrant a careful physiological evaluation due to vast variation in the food and food habits. The database prepared from the present project possibly provides valuable preventive and remedial clues. One or more of the factors like biological immaturity (under 17 years of age ), low pre-pregnancy weight for height, poor nutritional status, smoking, certain medications, some infectious agents, complication of pregnancy, history of unsuccessful pregnancies in the mother enhance the risk of low-weight infant and the related neonatal mortality when these are coupled with poverty and unfavourable social environmental (CMN,FNB,1970). Many such factors give variable results region-wise.

The calorific value of dietary intake must equal the energy expended as heat and work, if body weight is to be maintained. When calorific intake is insufficient, body stores of protein and fat are catabolized, and when intake is excessive, obesity results. A balanced diet is defined as one which contains different types of food in such quantities and proportions that the need for energy, amino acids, vitamins, minerals, fats, carbohydrates and other nutrients is adequately met for maintaining health, vitality and general well-being. It also makes a small provision for extra nutrients to withstand short duration of leanness. For constructing balanced diet:

- Daily intake of protein should be met which accounts for 15-20% of dietary energy intake;
- Fat requirement 20-30% of total dietary energy intake;
- Carbohydrate rich in fiber ,rest of total dietary energy intake

## **Reproduction Cost Energy**

Pregnancy in total duration consumes 60,000 kilo calories, over and above normal requirements. Lack of a well-balanced diet during pregnancy has serious implications not only on the health of the mother but also on the intrauterine growth of the fetus especially at the critical period of development.

To have optimal maternal as well as perinatal outcome, nutrition in pregnancy should be well-maintained, proper emphasis to be given on balanced diet, nutritive value of food, bio-availability of food and trace elements. Postnatal convalescence and lactation is also affected by nutrition.

**Birth weight is an important parameter which represents perinatal outcome :** Present study is carried out to find overall incidence of nutritional problem in antenatal and postnatal patients and to evaluate the effect of nutritional supplementation (indigenous method in the form of special 'laddu') on maternal and perinatal outcome.

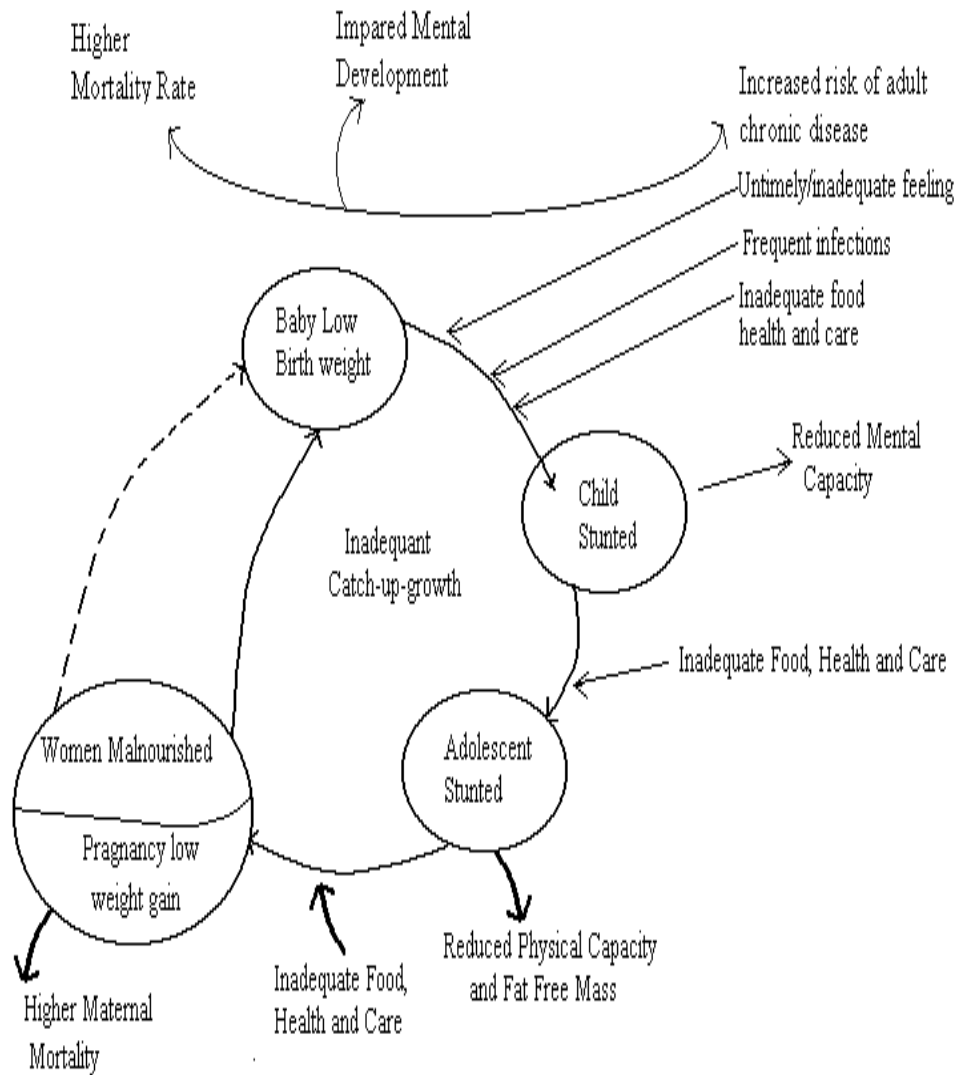
The word nutrition is derived from Nutricus – meaning to suckle at the breast. Nutrition signifies a dynamic process in which the food that is consumed is utilized for nourishing the baby.

During pregnancy there is an increased calorific requirement to fulfill –

- Increased growth of maternal tissues
- Growth of fetus
- Placental growth
- Increased BMR

Nutrition as an influence on the course and outcome of pregnancy is a subject of considerable current interest as evidenced by several recent reviews (Maternal nutrition and the Course of pregnancy – Summary report of Government Office 1970). During the course of pregnancy the maternal organism undergoes a remarkable series of physiologic adjustments in order to provide for fetal growth and development and at the same time preserve maternal homeostasis. Concomitantly the fetus exchanges materials with its mother across the placenta and modifies its own development by its maturing regulatory process.

## POOR NUTRITION THROUGHOUT THE HUMAN LIFE CYCLE<sup>1</sup>



<sup>1</sup> Adapted from ACC/SCN –appointed Commission on nutritional challenges of the 21<sup>st</sup> Century

### **Nutritional Status**

Dame Louise Mellory (1936) stated that nutrition of the expectant women affected not only them but also their children. He further concluded that the influence of diet was of paramount importance in the prevention of most of the complications of pregnancy. Good nutrition for pregnant women has a dramatic effect in reducing their mortality. Ebbs *et al* (1941) studied 400 poor pregnant women. In one group those women, where the diet was supplemented with food-stuffs, has fewer complications of pregnancy and lesser obstetrical risks than those maintained on the poor pre-natal diet. Burke *et al* (1943) studied the dietaries of 216 pregnant women. There was a significant relationship between the quality of pre-natal diet of mother and course of pregnancy.

### **Maternal Weight Gain**

Form an extensive review of the literature in 1944, Chesley found that the optimum maternal weight gain is 11 kg. However, a slightly larger amount 12.5 kg is suggested by Hytten and Leitch. Weight gain is at best a crude index of nutrition. All major studies have documented a positive correlation between maternal weight gain and optimum weight.

World Health Organization Report (1955) shows that when the diet of the mother is inadequate during pregnancy, not only her own health is affected but her neonates and infants are also under-weight at birth and show signs of deficiency afterwards.

### **ANAEMIAS**

World Health Organization study group on iron deficiency anemia (1955, 1963) has suggested that anemia can be considered to exist in the pregnant female when hemoglobin concentration is below 10 gms/100 ml and the committee agreed that this level might be accepted as a general indicator of the lower limit of physiological adjustment during pregnancy.

### **Role of Diet**

Rai, Rao and Klontz (1959) and Shankar (1962) studied the nutritional status of expectant mothers, reported a high incidence of anemia vitamin B complex deficiencies and hypoproteinemia among Indian mothers.

Venkatachalam (1962) in a dietary, clinical and biochemical investigation revealed that the majority of pregnancies of the low grade socioeconomic groups in South India underwent the nutritional stress of gestation without adequate protection either before or during pregnancy.

M.S. Radhika *et al* (2002) worked on the effects of vitamin A deficiency during pregnancy on maternal and child health & concluded that sub clinical Vitamin A deficiency is a problem during third trimester of pregnancy.

Hence present study is an attempt to record the nutritional status of pregnant anemic women with reference to-

- Effect of nutritional deficiency on general health with reference to weight, height and mid arm circumference.
- Hemoglobin percentage evaluation.
- Serum protein level monitoring.
- Effect of nutritional supplement in above mentioned group as indicated by improvement in general health, Hemoglobin % & serum proteins.

## **Materials and Method**

### **Trial Plan**

In the present study pregnant women aged 20-35 years at 16-36 weeks of gestation attending antenatal clinic as well as postnatal wards in Jay Prakash Hospital Bhopal were studied. There are two groups:

- a. Supplemented group
- b. Control group

### **A. Supplemented Group**

In this group nutritional supplement was given to more than 400 pregnant women but in present study only those women are enrolled who had taken the supplement regularly till delivery. The nutritional supplement specially prepared to provide the extra nutritional requirement of pregnancy. The product was packed in polyethylene bag in the form of 'laddu', which are indigenous form of nutritional supplementation. These laddus are given

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for 15 days and then she has to come again after 15 days to take next nutritional supplement for 12 weeks.

Each laddu weighs 50 gm of nutritional supplement. 100 gm of laddu has following composition:

<b>S.No.</b>	<b>Items</b>	<b>Quantity</b>	<b>Calories</b>
1.	Full fat Soya flour	35 gm	160 k. cal.
2.	Roasted wheat flour	10 gm	35 k. cal.
3.	Roasted gram flour	5 gm	20 k. cal.
4.	Ground nut	3 gm	30 k. cal
5.	Ghee	5 gm	45 k. cal.
6.	Jaggery	42 gm	165 k. cal
	Total		455 k. cal.

Total calories 455 k. cal. /2 laddu contains following composition, as indicated by dietician. The content break is as follows-

<b>Protein</b>	<b>21.00 gm</b>
Calcium	17.00 gm
Phosphorus	35.00 gm
Lysine	1.30 gm
Methionine	0.23 gm
Fat	13.00 gm
Linoleic acid	4.00 gm

Supplementary group is also asked to take 1 capsule of iron, 2 tablets of calcium per day. Follow-up period from April 2004 to July 2004

## **B. Control Group**

In this group,

- a. those pregnant mothers are enrolled who came once or twice for antenatal checkup in second half of pregnancy and took only iron and calcium tablets throughout pregnancy;
- b. Emergency cases or those pregnant mothers who never came for antenatal checkup even once.

## **Socioeconomic Status**

Socioeconomic status of respondents is determined by Kuppaswami's classification by noting (i) education, (ii) occupation, (iii) income of couple. (iv) Urban or semi urban area.

## **Antenatal Care**

This care was given in the clinics by residents. Checkups were done at every 4 weeks.

## **Data Records**

The following data were recorded in detail in printed Protocol:

1. Name, Age, Address
2. Obstetric history
3. Dietary history
4. Education/Occupation/Income of Couple
5. Height/Weight
6. Investigations –Hb%, blood grouping, urine-routine/microscopic, serum proteins.

## **Follow-up Records of Antenatal Patients**

- Maternal weight gain
- Fundal height



**Labour Record**

- Mode of delivery
- Complications, if any

**Neonatal Record**

- Neonatal weight at birth
  - Head circumference
  - APGAR score taken at 1 min and 5 min
- Total length of baby

**Purpose of these measurements is to -**

- a. To assess the baby size against known standard for population.
- b. To compare the size with estimated period.

**Follow-up Postnatal Periods**

**A. At discharge from hospital**

1. Of Mother :
  - Effect on postpartum convalescence
  - Improvement of anemia and hypoproteinemia
  - Effect on lactation
2. Of Baby :
  - Neonatal weight gain
  - Anthropometry
  - Weight
  - Length

**B. After 6 weeks at Second postnatal Visit**

1. Of Mother :
  - Weight gain
  - Effect on lactation
  - Hb(gm%)
  - Serum proteins
2. Of Neonate :
  - Weight gain

## Results

Compliance of cases was good throughout the study except that few cases reported loose motion and in some cases supplement was not accepted because of taste. Such cases are excluded from the study.

Observations were tabulated and analyzed which revealed the following features:

1. In supplementary group 67.44% patients show rise in Hb% between 1 gm% - 2gm%, while in control group only 40% patients show rise in Hb % more than 1 gm%. While in control group 51.42% cases show rise in Hb% less than 1 gm% with only iron supplementation, no decrease in Hb% was observed in supplementary group while control group shows 5.71% cases decrease in Hemoglobin.
2. In 70% cases of supplemented group rise in total serum proteins from 0.5 gm to 1.5 gm was observed. In 18% cases no change was observed, while in control group 71.41% cases showed decrease in serum proteins 0.5 to 1 gm.
3. In supplementary group 18.40% cases showed weight gain more than 5 kg and 61.80% cases showed weight gain 3 to 4 kg while 10.40% cases showed weight gain 2 to 3 kg or less than 2 kg in control group.
4. Birth weight was good in supplemented group as compared to control group. In 40.06% of supplemented group cases birth weight more than 2.5 kg was observed as compared to 14% cases in control group.
5. During study, it was observed that there is a positive relationship between nutritional supplement and maternal weight gain.

## **Discussion**

Abnormal cases of pregnancy are mostly the result of several factors, including environment and food habits. It is difficult to change the environment but it is relatively easy to change food habits. A number of factors influence food habits. These include, among others, educational and economic level of community, availability and cost of foods and social and cultural practices. Traditional beliefs influence profoundly the pattern of food eaten. In the present study 40 pregnant women who have moderate anemia at 28 weeks of gestation tried to cover the subject taking few aspects into consideration. While carrying out these investigation on the health status of pregnant women it was contemplated to follow up 35 women at random who had taken antenatal care at the hospital without the nutritional supplement.

The health status of 40 pregnant women was studied in relation to hemoglobin, serum proteins, mid arm circumference and effect of nutritional supplement on them and attempt was made to find the correlation of these factors with perinatal and maternal outcome. The cases under study belonged to ages between 20 to 35 years. The most frequent age group recorded was 20 to 24 years in which 27 or 62.79% women fell in supplementary group and 16 or 45.71 percent in control group. In the study of 1971 by Hytten and Leitch, they prefer iron supplementation as routine to prevent fall in serum iron concentration by Iron Prophylaxis .In our study the cases taken were of 6 to 8 mg/100 ml of Hemoglobin. We have given 200 mg of iron with nutritional supplement.

In supplemented group it was found that rise in Hemoglobin was 1 to 2 gm/100ml in 67.44% and 40% in control group, while less than 1 gm/100 ml was taken as no significant .in the present study it is found that there is an increase of 1 to 1.5 gm/100 ml of serum protein in 72.10% in supplemented group after 12 weeks of nutritional supplement (after 28 weeks of pregnancy) i.e. whatever decrease in serum proteins occurs in first

and second trimester of pregnancy it returns to non pregnant level after completion of third trimester of pregnancy after taking nutritional supplement (Table 1).

There was decrease in serum protein found in 67.1 cases in control group as compared to 4.65% in supplemented group (Table 2). In present study maternal weight gain for more than 5 kg is seen in 18.40% in supplemented groups and 2.85% in control groups, 3 to 4 kg maternal weight gain in 61.80% cases in supplemented group and 28.70 cases in control group. Less than 2 kg maternal weight gain in 9.20% of supplemented group and 40.80% of control group has been noticed (Table 3).

In supplemented group more than 70% patients show fetal weight gain of more than 1400gm (1.4 kgs) as compared to 30% in control group (Table 4).

The study shows that nutritional supplement has a good effect on fetal weight gain during intrauterine life.

**Mode of Delivery:** As such there no gross effect was observed in mode of delivery in both groups but definitely incidence of preterm labor was significantly more in control group. It was just more than double as compared to supplementary group.

**Bright Weight:** In supplementary group 40% cases have infant birth weight more than 2500gms (2.5kg) and in control group only 14% cases have infants weight more than 2500gms (2.5kg) rest are either low birth weight are very low birth weight babies.

The result of present study are in agreement with those from several other intervention studies, carried out in developing countries which demonstrated an association between maternal supplement and weight gain and infant birth weight .

**TABLE-1 : Effect on Hb% in Supplemented and Control Group**

<b>Change in Hb%</b>	<b>Supplemented Group</b>	<b>Control Group</b>
Increase (>1 gm% to 2 gm%)	67.44%	40.00%
No significant change (1 gm or 5 gm or no change)	32.54%	54.27%
Decrease (0.5 to 1gm %)	-	5.71

In supplemented group 67.44% shows rise in Hb% as compared to 40% in control group.

**TABLE-2 : Effect on Serum Proteins in Supplemented and Control Group**

<b>Change in Serum Proteins</b>	<b>Supplemented Group</b>	<b>Control Group</b>
Increase (> 1 gm% to 1.5 gm %)	72.10%	3.34%
No significant change (0.5 to 1 gm %)	18.64%	28.56%
Decrease	4.65%	67.1%

**Table-3 : Maternal Weight Gain**

<b>Weight Gain</b>	<b>Supplemented Group</b>	<b>Control Group</b>
≥ 5 kg	18.40%	2.85%
3 to 4 kg	61.80%	29.57%
2 to 3 kg	10.40%	28.70%
Less than 2kg	9.20%	40.80%

**Table-4 : Birth Weight Observed During Study**

<b>Birth Weight</b>	<b>Supplemented Group</b>	<b>Control Group</b>
> 3 kg	16.40%	10.12%
2.5 to 2.9 kg	37.20%	14.28%
2 to 2.4 kg	21.2%	31.40%
1.5 to 2 kg	10.60%	18.20%

A sizeable number of pregnant women were studied from various hospitals, dispensaries, Nursing Homes etc. in and around Jaipur city of Rajasthan. Various biometric parameters shall be recorded on a proforma with a detailed history and relevant investigations. The women of Rajasthan, on the basis of nutrition, were divided into various groups/zones based on its geography, (desert, wood-land etc.), socio-economy (rural and urban), type of food (calorie) intake (vegetarians and non-vegetarians), food habits (how much or how many times in a day taken) (Kulshreshtha, 2004). It has generally been observed that many rural and urban pregnant women in Rajasthan consume different diets during and after pregnancy for a normal labour and parturition etc. Perhaps this nutritional practice may account for the negligible number of Caesarean cases in rural areas in comparison to the urban ones (Kulshreshtha, 2004). Certain relationships based on various nutrients intake by pregnant women of the two zones of Rajasthan have been compared in a study, e.g., Protein, Calorie, Calcium intake in relation to habitat and income group. Hemoglobin percentage in relation to Habitat, Vitamin B12 and Folic acid intake have also been evaluated. Nutritional survey amongst a large sample of pregnant women show that only 20% of pregnant rural women belonging to economically weaker section and lower income groups of the Desert area had a normal calorie intake as compared to those of the Aravalli area (40%). It is presumed to have led to several kinds of complications amongst them. For example about 50% of rural women from desert zone had hemoglobin below 7% as compared to those of urban women of Aravalli and Desert regions (27.77% and 28.57%, respectively). This may have direct bearing with the vitamin C intake also;

the largest fraction of the women of desert area with anemic conditions (i.e. below 7% Hb percentage) did not have an adequate normal 40 mg/day vitamin C dose (i.e. approximately 79% of desert and 82% of Aravalli). This anemic condition (below 7% of hemoglobin) is also directly related to the Folic Acid and Protein intake as only 2% and 4% of women took the recommended doses (i.e. 400 mg/day and 65 gm/day, respectively). Below normal intake of protein has been noticed in approximately 40% women belonging to desert region. Cyanocobalamin intake also has contributed to their poor health with respect to their food habit as 81% and 66% vegetarian women of desert and Aravalli, respectively had below normal intake of cyanocobalamin (Kulshreshtha and Bhatia, 1997, 1999). Abortions caused by taking alcohol, tobacco-chewing and Bidi/Hukka/Cigarette smoking as also Parturition (Normal and Caesarian) in relation to various Income Groups, Birth weight in relation to Income Group and Congenital abnormalities in relation to Folic intake have also been discussed. Percentage of pregnant women taking various nutrients in normal amounts per day as well as involved under various relationships have been worked out based on I.C.M.R. (1998) and Gopalan *et al.* (1991). For Income Groups, classification given by HUDCO (1994) were followed.

### **Conclusion :**

- Pregnancy in total duration consumes 60,000 kilocalories over above normal requirements. If nutrition of mother is inadequate, then her body reserves are drawn up and are depleted.
- Nutritional supplementation has an advantageous role. It can be given in form of indigenously prepared special laddus in antenatal as well as postnatal periods.
- From this study, it is concluded that nutritional supplement in pregnancy has a definite role, it affects maternal weight gain, intrauterine growth of fetus, birth weight and improves perinatal outcome.

### **Acknowledgement :**

In the pursuit of the project work my contribution becomes microscopic as compared to that of my family members & friends. Words are poor expression of feelings but still I shall try to comprehend as far as possible. I am thankful to Dr. Mrs. Ratna Thakur, Dr. Mrs. Meenakshi Patel for their appreciable guidance & valuable suggestions during the course of this project work. I am thankful to my children Rahul and Rohit for their love and support in my endeavor. Last but not the least I am thankful to my husband Sanjay for his unfailing support & moral strength in completing this work.

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