



MATERNAL HEALTH AND NUTRITION IN PREGNANCY: AN INSIGHT

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ABSTRACT

Nutrition plays an important and definite role in the course of pregnancy for the maintenance of sound maternal health. To meet nutritional needs, pregnant women are encouraged to consume a diet rich in vegetables, fruits and whole grains and to take a daily vitamin and mineral supplement to guarantee adequate intake of iron and folic acid. Maternal weight gain is a necessary physiologic change during pregnancy. Interestingly the fetus, placenta and amniotic fluid account for less than half of the total amount of weight gained. Pregnancy is a period of rapid growth and cell differentiation, both for the mother and the fetus. Mother's diet should provide adequate nutrients so that maternal stores do not get depleted and the needs of the growing fetus

can be met without damaging mother's health. Adequate maternal nutrition plays a key role in normal pregnancy progress, optimal fetal development and normal birth weight of the fetus. Proper diet during pregnancy should provide an appropriate amount of energy and all essential nutrients, such as protein, fats, carbohydrates, vitamins and minerals. During pregnancy, additional energy is required for the growth and maintenance of the fetus, the placenta, and maternal tissues. Maternal micronutrient deficiency predisposes a mother to poor health, including infection, preeclampsia/eclampsia, and adverse pregnancy outcomes such as premature birth and intrauterine growth retardation. In this brief overview, we will briefly have a look at various Nutritional Implications in Pregnant women.

KEYWORDS: Nutrition, Proteins, Energy, Maternal Health.

INTRODUCTION

Nutrition plays an important and definite role in the course of pregnancy for the maintenance of sound maternal health. ^[1] It is vitally important to eat more healthy foods in pregnancy than at any other time in a women's life. If maternal reserves are adequate, the fetus is well protected. When nutritional status is poor and nutritional intake is less, then hormonal balance and maternal reserve is jeopardized. If pregnancy is healthy, the body undergoes many changes to allow for the growth of fetus and to prepare the mother for labour, delivery and lactation. Many of these changes increase the nutritional requirement of the mother. To meet nutritional needs, pregnant women are encouraged to consume a diet rich in vegetables, fruits and whole grains and to take a daily vitamin and mineral supplement to guarantee adequate intake of iron and folic acid. Maternal weight gain is a necessary physiologic change during pregnancy. Interestingly the fetus, placenta and amniotic fluid account for less than half of the total amount of weight gained. Most of the added weight is found in maternal reproductive tissue, fluid, blood and maternal fat stores, which serve as an energy reserve during pregnancy and lactation. It is a well- understood scientific concept that the nutritional status of the pregnant woman affects the outcome of the pregnancy, especially related to birth weight. Low birth weight is associated with an increased risk for infant deaths and developmental disabilities and seen more often in children from under nourished and under weight mothers. ^[2] Effect of malnutrition during pregnancy is well recognized. ^[3] Dietary habits differ from region to region. It also differs from culture to culture and custom to custom. The ill effects of malnutrition during pregnancy are well recognized. It can be avoided by adequate intake of nourishing foods. Maternal anemia is a burning national health problem and has been related to poor foetal outcome. Pregnancy is a time when metabolic changes in the mother were carefully regulated to provide optimum substrate to both mother and fetus. Anemia especially iron deficiency anemia has been considered as one of the main public health problem. ^[4] Iron deficiency anemia is one of the most prevalent nutritional deficiency disorders among women during pregnancy in the developing countries. The prevalence of anemia at global level is reported to be 55.9 per cent among the expectant mothers. ^[5] It is common for pregnant women to experience fluctuations in appetite and food intake due to change in hormonal balance and gastrointestinal tract as the fetus develops. During the first trimester and sometimes extending into later month of pregnancy, women suffer from morning sickness, nausea and vomiting which may decrease appetite and limit food intake. In addition, excessive vomiting may cause loss of water and electrolytes which leads to dehydration. Many pregnant women experience intense food cravings and food

aversions. In addition, the sense of taste and smell is frequently altered during pregnancy. These changes can lead to excessive consumption of certain foods or food groups and insufficient consumption of other foods. However, this is typically a concern only if the food that is frequently consumed contains lots of calories, fat less vitamins and minerals or if the women are unable or unwilling to eat any fruits or vegetables due to food aversion or altered taste. Constipation is common during pregnancy due to variety of factors including pressure exerted on the intestines by the enlarged uterus. Constipation is not only uncomfortable but it also leads to reduced appetite and food intake. Nutritional status during pregnancy is one of the most vital factors in obtaining a successful outcome of pregnancy in terms of healthy baby and maintenance of her own health. Maintenance of an optimum nutritional status of expectant mother is of utmost important because the overall development of a child is determined to a great extent by the type of nourishment it receives right from its conception. Various studies have revealed a direct relationship between maternal diet and the nutritional status of the newborn.^[6] Inadequate diets have been related to clinical problems during the course of pregnancy. It is evident from several research studies that inadequacy in the intake of food results in high incidence of nutritional disorders during pregnancy. Malnutrition including anemia is a major underlying cause of maternal morbidity and mortality. It is especially a grave problem for the pregnant women of teenage and multi-gravida with short interval between pregnancies. Moreover, considerable number of undernourished women ends in abortion, miscarriage or still births. A positive correlation between nutritional status and has also been reported by several researchers.^[7]

Maternal Dietary Consumption and Maternal Health

Maternal nutrition is an important factor responsible not only for the health of the baby, but also for the baby's long term growth.^[8] A pregnant mother has to meet her own needs and the needs of growing fetus. The nutrients needs are also increased in view of the development of maternal organs such as uterus, placenta and breast tissue and to build up body reserves to be utilized at the time of delivery and subsequently during lactation. Thus, the need for all the nutrients is increased during pregnancy, especially in the second and third trimesters. During the first trimester, since, there is no significant increase in the size of fetus and the mother's body is adjusting to the hormonal and physiological changes, a quantitative increase has not been suggested, though a qualitative improvement has been recommended during this period.^[9] The basis for the additional requirements during pregnancy is discussed below.

Energy: Calorie requirement during pregnancy is increased for maintaining the growth of the fetus, placenta and maternal tissues and for the increased basal metabolic rate.^[10] According to ICMR^[11], for a reference Indian Woman, whose body weight is 50kg, the total energy cost of pregnancy has been estimated to be approximately 73000kcal. This includes the energy expenditure during normal pregnancy as well as the energy needed for deposition of 4kg body fat to be utilized later during lactation. It has been estimated to meet the requirement of the increased energy expenditure alone; an extra amount of about 120kcal per day is required during second and third trimesters. However, this does not allow for deposition of body fat which is not only beneficial for the growth of the fetus and development of maternal tissues but it also helps to meet the increased energy demand during lactation. Further, the additional energy intake during pregnancy has shown to have a beneficial effect on the birth weight of infants also. Nutrition Advisory Committee has recommended an additional intake of 300kcal/day during 2nd and 3rd trimesters.^[9] In a study of nutritional status of pregnant women in Balasore District, Orissa, Sahoo et al.^[12] revealed that the average energy consumption of pregnant women was considerably low (13.58%) as compared to RDA. Even though the pregnant women took more cereal foods, still a deficit intake was observed. In a community-based study of dietary intake in third trimester of pregnancy and prevalence of LBW, Rao et al.^[13] also reported that the mean calorie intake during three dietary assessments was 1695± 182.8 kcal. They further revealed that the higher prevalence of LBW babies observed in pregnant women with mean calorie intake of less than 1500 kcal.^[13]

Protein: The promotion of optimal growth during pregnancy requires adequate supplies of energy and raw materials. Protein is essential because it forms the structural basis for all new cells and tissues in the mother and fetus. Vitamins and minerals participate in the biochemical reactions that build amino acids in to new protein molecules and maintain the structural and functional properties of the cells.^[14] Protein requirements during pregnancy have been assessed by ICMR^[11] using factorial method. Based on the gain in body weight of nearly 12kg in a normal, healthy, well nourished pregnant woman, the daily nitrogen deposited during three trimesters is estimated to be 0.1g, 0.5g and 0.9g respectively. After increasing this by 50% to convert the factorial values in to physiological value for nitrogen deposition, and accounting for an extra allowance of 25% for individual variation, the safe level of daily intake in terms of a high quality protein during the three trimesters works out to be 1.2g, 6.0g and 10.5g respectively. As indian diets are largely based on vegetable protein, having an

NPU of nearly 65, the additional level of intake during the latter half of pregnancy recommended by ICMR (1990) is 15g/day.^[9]

Fats and essential fatty acids: Essential fatty acids are crucial to fetal development, particularly for membranes and brain.^[15] Deficiency of essential fatty acids is unlikely in a dietary environment rich in lipids. However, their importance in neural development suggests that a deficiency during the critical period of brain development can occur under adverse dietary circumstances. The brain is 60% structural lipid; it universally uses arachidonic acid and docosahexanoic acid (dha) for growth, function, and integrity.^[14] So, the ICMR expert committee has suggested an intake of 30g of visible fat/day during pregnancy. This is based on studies indicating that linoleic acid requirement during this stage is 4.5 %. Of this, some of the essential fatty acid needs are met with, by the invisible fat; therefore, an intake of 12.5 % from visible fat (equivalent to 30g) has been estimated to meet the essential fatty acid requirement. This content of fat intake would also provide necessary energy density to their diets.^[9] Olsen et al.^[16] reported that the fish oil consumption increases birth weight. Weigel et al. also suggested that the higher dietary fat intake was associated with increased birth weight.^[17]

Calcium: During pregnancy, additional calcium is needed for the growth and development of bones as well as teeth of the fetus. In 1980, an inverse relationship was reported between calcium intake and hypertensive disorders of pregnancy. It was proposed that satisfactory calcium intake may be protective against elevation in blood pressure during pregnancy. The hypothesis was based on the observation that many Indians in Guatemala, who traditionally soak their corn in lime before cooking, had a high calcium intake and a low incidence of pre-eclampsia and eclampsia.^[14] Belizan et al.^[18] and repke and vi liar^[19] also suggested that calcium supplementation may reduce the incidence of gestational hypertension, preterm delivery and. Possibly, pre-eclampsia. Amount of calcium in a full grown fetus is 25 to 30g and most of this is deposited in the third trimester. This corresponds to an additional daily calcium need of 250 to 300mg during the last 100 days of pregnancy. ICMR (1990) has therefore, recommended a total of 1g of calcium/day which take care of the total calcium needs of the mother and the additional needs of pregnancy.^[9]

Iron: Increased iron is necessary for fetal growth, expansion of maternal tissues including the red cell mass, iron content of placenta and the blood losses during parturition. Additional iron is also required to build stores of iron in fetal liver to last for about 4-6 months after birth,

since the baby's first food-milk is deficit in iron. However, there is a saving of menstrual loss during pregnancy. Thus, the iron needs during pregnancy will include basal requirements of the woman and additional requirements of pregnancy. According to ICMR (1990), for a woman whose body weight is 50kg, basal iron requirement is 14 μ g/kg body weight/day. In addition to this normal basal requirement, 46 μ g /kg body weight/day is also required for meeting the extra needs of pregnancy. Thus, the total daily iron requirement during this period is 60 μ g /kg body weight/day, i.e., nearly 3mg of iron/day. Mean dietary iron absorption during pregnancy on a mixed cereal diet is 8%. Therefore, ICMR has suggested an amount of 38mg dietary iron/day. In a study of effect of different levels of iron supplementation on maternal iron status and pregnancy outcome, Mehta et al. (2004) observed that there was a linear correlation between maternal hemoglobin, serum ferritin and infant's birth weight and birth length. The highest level of iron supplementation had the heaviest and tallest infant.^[20]

Folic Acid: As pregnancy progresses, folate continues to play an important role, but after the early weeks of gestation the emphasis is focused on protecting the mother from developing folate deficiency of pregnancy. Maternal folate deficiency not only has consequences for the mother's own health, but has also been shown to result in fetal growth retardation, low birth weight and neonatal folate deficiency, with important implications for the health of the neonate and infant.^[21] During pregnancy, low content of dietary and circulating folate are related to increased risks of preterm delivery, low birth infant weight, and fetal growth retardation. A metabolic effect of folate deficiency is an increase of blood homocysteine. Likewise, the presence of maternal homocysteine concentrations have been associated both with increased habitual spontaneous abortion and pregnancy complications (e.g., placental abruption and preeclampsia).^[22] Therefore, ICMR (1990)^[11] has recommended an additional intake of 300 μ g apart from the normal requirement of 100 μ g making a total of 400 μ g /day.^[9]

Zinc: Zinc has an important role in pregnancy. Apart from being a component of insulin, enzyme systems (Carbonic anhydrase), it participates in the synthesis of nucleic acid-DNA and RNA-highlighting its significance in the process of reproduction.^[9] Research Studies on experimental animals and in humans show that severe zinc deficiency can have extreme effects on pregnancy outcome. Acute severe zinc deficiency leads to prolonged labour, teratogenesis, and embryonic or foetal death. Acrodermatitis enteropathica is an autosomal genetic recessive defect in zinc metabolism and causes a marked inhibition of zinc

absorption.^[23] The outcomes of pregnancies with acrodermatitis enteropatica ended in spontaneous abortion, anencephaly, achondroplastic dwarfism and low birth weight infants.^[24] The results are mixed and several adverse effects have been associated with low zinc status. These include congenital anomalies, reduced birth weight for gestational age and preterm delivery. Maternal complications include pregnancy-induced hypertension, pre-eclampsia, intrapartum haemorrhage, infections, and prolonged labour.^[25]

Vitamin A: Vitamin A requirement during pregnancy has been computed on the basis of vitamin A content of livers of the newborn. Additional intake of vitamin A required for this purpose works out to be about 25 µg /day throughout pregnancy. Since this constitutes a very small fraction of the recommended allowance for normal women, no additional dietary allowance during pregnancy has been suggested by ICMR (1990).^[9] The role of oxidative stress in the pathophysiology of pre-eclampsia and eclampsia have triggered the interest in the direct role of 3-carotene during pregnancy. Free radicals are proposed as the toxic elements that negatively affect maternal vascular function. Reactive radicals start peroxidation of lipids on cell membranes changing the structure of the cell wall and secondarily the normal function of the cell. Markers of lipid peroxidation are increased in plasma of women with pre-eclampsia, and the low concentrations of water-soluble and lipid-soluble antioxidants in plasma and placenta further suggest a state of antioxidant stress.^[26-28] In these studies lower levels of vitamin E, C and 3 carotene were also found to be associated with a higher risk of pre-eclampsia. Vitamin A and 3 carotene levels in the third trimester or at birth have also been found to be predictive of low birth weight and prematurity.^[29]

CONCLUSION

Pregnancy is a period of rapid growth and cell differentiation, both for the mother and the fetus. Consequently, it is a period when both are very susceptible to alterations in dietary supply, especially of nutrients which are marginal under normal circumstances. The period of intrauterine nourishment, growth and development is one of the most vulnerable periods which affect nutrition status of fetus. Mother's diet should provide adequate nutrients so that maternal stores do not get depleted and the needs of the growing fetus can be met without damaging mother's health. Adequate maternal nutrition plays a key role in normal pregnancy progress, optimal fetal development and normal birth weight of the fetus. Adequate maternal nutrition plays a key role in normal pregnancy progress and optimal fetal development. Proper diet during pregnancy should provide an appropriate amount of energy and all

essential nutrients, such as protein, fats, carbohydrates, vitamins and minerals. During pregnancy, additional energy is required for the growth and maintenance of the fetus, the placenta, and maternal tissues. Maternal micronutrient deficiency predisposes a mother to poor health, including infection, preeclampsia/eclampsia, and adverse pregnancy outcomes such as premature birth and intrauterine growth retardation. Deficiency of some elements such as calcium, iron and zinc in maternal diet can influence birth weight. Unfortunately, effective nutrition guidance in prenatal care is ignored and pregnant women during pregnancy are deprived of nutritional assessment programme. Nutrition guidelines should be improved and the importance of nutrition during pregnancy period should be highlighted. Maternal nutritional factors and consequently birth weight of neonates should be given in high priority.

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