

## THE NUTRITION LINK WITH REPRODUCTION

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### **Abstract**

The human body is made up of nutrients. This makes the food we eat and its reflection on our nutritional status and health especially crucial. Nutrition thus is a very important determinant of our biological and social welfare throughout the various stages of the human life cycle. This makes it necessary for us to show very practical commitment to ensuring the adequacy of the quality and quantity of food in our communities, in our cherished bid to prevent the incidence of disease, and thus promote the health of the public. The focus of this presentation is on the physiological changes that occur during the reproductive years, and their implications on nutritional needs. Specific nutrition-related problems, the various methods for assessing the nutritional status of individuals in their reproductive years, and the nutritional determinants of pregnancy outcome will be discussed. Recommendations for the improvement of the nutrition of people in their reproductive years will be made.

### **Introduction**

Nutrition is a fundamental pillar of human life, health and development across the entire life span. From the earliest stages of fetal development, at birth, through infancy, childhood, adolescence, and on into adulthood and old age, proper food and good nutrition are essential for survival, physical growth, mental development, performance and productivity, health, and well-being. In effect, it is an essential foundation of human and national development.

The human body is made up entirely of nutrients. For example, the skin is made of proteins; the bones contain calcium; blood quality is maintained with the presence of protein, iron, minerals, vitamins; muscles and nails contain protein; hair has zinc, the eyes need Vitamin A for optimal function; and the brain which also contains protein, fat, and fat-related compounds, among others.

Nutritional needs and priorities change during the human life cycle. For example, the relative nutritional needs of a pregnant or lactating woman will be markedly different from those of a man of the same age. Such differences lead to differences in the priority and nature of dietary recommendations for the different lifestyle groups. Healthy, well-fed women have the best chance of having healthy babies and of lactating successfully after the birth. The current thinking in nutrition is the life cycle approach, which emphasises good nutrition throughout life. That means we should not only think about nutrition during pregnancy and lactation.

Recommendations for protein intakes during pregnancy are based on data on nitrogen balance during pregnancy, theoretical estimates of the amounts of protein deposited in the fetus, placenta and maternal tissues, evidence that women with intakes throughout pregnancy that are higher than estimated needs have more successful pregnancies, and evidence that there is increased risk associated with low protein intakes (Guthrie 1989). The Recommended Daily Allowance (RDA) for protein is about 46 g/day at 11 years; this increases to about 60 g/d during pregnancy (30.4 % increase; NRC, 1989). Severe protein restriction during fetal life is associated with a decrease in the number of cells in tissue at the time of birth. This can retard the development of the brain.

The next critical nutrient that impacts on reproduction is calcium, which is required for strong bones, among others. Although the infant's bones are poorly calcified at the time of birth, teeth begin to calcify at 5 months of gestation (Guthrie 1989; Naismith 1980). Thus an appreciable amount of calcium is involved in fetal development. This amounts to approximately 7 mg/d for the first trimester, 110 mg/d in the second, and 350 mg/d in the third trimester. It is estimated that 9g of fetal calcium comes from the mother's bones. Therefore, there should be extra calcium stored in the mother's bones during pregnancy to meet this need. The RDA for calcium is about 800-1200 mg/day.

The iron nutrition for adolescents is particularly critical. This is because they are actively growing in size and have increasing blood volume. It is particularly critical for females because of the periodic loss of blood (with iron) that they normally experience, as part of their body's preparation for conception.

Infants are born with haemoglobin levels of 16-22 g/dl of blood and with a supply of iron to last from 3 to 6 months (Guthrie 1989; Morgan 1988). To achieve these levels the mother must transfer about 300 mg of iron to the fetus during gestation. Beyond needs for fetal growth, iron is also required for the placenta, for the formation of haemoglobin and to replace maternal iron losses in skin, hair, and sweat. It has been observed that about 60-80% are anemic (i.e. Hb < 11g/dl) during pregnancy (WHO, 2000). This is the result of the changes that occur (e.g. blood volume increases without corresponding increase in hemoglobin concentration).

Iodine deficiency also has an effect on reproduction. Intakes of iodine that prevent goitre under normal circumstances frequently prove inadequate during pregnancy, leading to goitre in the expectant mother. When the mother has goitre, the chances of the child developing goitre increases by about 10 times (Guthrie 1989). Iodine deficiency in the mother can also lead to unfavourable pregnancy outcomes such as still births and low birth weight. Its RDA goes from 150 ug/day at 11y to 200 ug/day during pregnancy (about 33% increase; NRC 1989). Its deficiency effects are more pronounced in females and has serious implications on reproduction.

The importance of zinc in reproduction has been demonstrated (McGanity et al. 1994). It has its most profound influence on rapidly growing tissues, and its effect on reproduction is significant. In humans, the mother transfers about 150 mg of zinc to the fetus by the time of birth. Maternal zinc deficiency is clearly associated with low birth weight infants and is often the cause of central nervous system problems. It also increases the risk of prolonged labour, intra- and postpartum hemorrhage, and hypertension (LINKAGES 1999). Zinc-deficient men have shown retarded gonadal development and impaired sexual maturity. Zinc deficiency causes fetal wastage, malformations, and difficult labour (Hurley and Shrader 1975). In a double-blind zinc trial (Cherry et al., 1989) in low-income, pregnant adolescents thought to be at risk for poor zinc status, subjects were randomly assigned to receive 30 mg zinc or placebo. Infants of normal-weight mothers given zinc had reduced rates of pre-maturity and assisted respiration. Also, underweight multiparas given zinc had longer gestational lengths than did subjects given the placebo.

Folic acid and vitamin B12 are key nutrients that are related to reproduction. They help in the maturation of red blood cells and the synthesis of DNA and RNA. Because these components increase rapidly during growth, it is necessary that their intake should increase during pregnancy. The deficiency of folic acid has been associated with neural tube defects (NTD's).

Vitamin A is essential for vision, cellular differentiation, embryonic development, reproduction, growth, the immune system, and reproduction. Its deficiency impairs the immune

The thought of reproduction makes us think about women more than men. That is not surprising, considering the fact that the complexity of the biology/physiology of females makes them more nutritionally vulnerable than males. However, the nutrition of males is as important as that for females. This is because just as females, they also need nutrients and energy to maintain the integrity of their body function to facilitate reproduction.

### Recommendation

In order to achieve our cherished objective of ensuring favourable pregnancy outcomes (i.e. healthy normal birth weight babies and healthy mothers) we need to identify and eliminate as many risk factors as possible, by careful evaluation. First, we must ensure that there is enough good food that is affordable to all, especially those who are nutritionally vulnerable by virtue of socio-economic status, gender, and physiological condition. For example, women of reproductive age must eat well to protect their own health and establish reserves for pregnancy and lactation. There should be variety in the food supply to ensure that we have enough micro nutrients in our diets.

Second, we must provide and make maximum use of our facilities for both formal and informal education. This will increase literacy rates, and make more people economically viable. There is evidence to show that formal education generally is associated with lower morbidity and mortality. Last, but not the least, we should realise that nutritional problems can only be solved with a multidisciplinary approach. This calls for extra dedication and close cooperation among us (i.e. academia, policy makers, and NGO's ), and better appreciation of the importance of nutrition in disease prevention, social welfare, and public health.

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system and increases severity of illness. Deficiency also increases risk of anaemia and maternal death, as well as inhibit the biological utilization of iron.

The role of vitamin E in promoting normal reproduction and reducing the number of spontaneous abortions and stillbirths has been observed in animals (Guthrie 1989). So far, such role of vitamin E has not been observed in humans. However, it potentially will be beneficial to women who have had repeated spontaneous abortions or failure to conceive.

Energy is needed for the body's basal metabolism as well as physical activity. During pregnancy, there is additional need because of added maternal tissues and growth of the fetus and placenta. To meet the requirement for energy during pregnancy and lactation, the body stores 2-4 kg of fat over the course of pregnancy. A recent review of studies concludes that increased caloric intake among severely undernourished (<45 kg and BMI<23) could lead to increases in birth weight (Rasmussen 1998). In a study in the Gambia, (Ceesay 1997) the number of low birth weight babies declined by almost 40 percent among pregnant women who received high-energy biscuits which provided about 1,000 kcal/day after 20 weeks of pregnancy (Naismith 1980). A survey involving 10,000 women showed that the chances of having a low birth weight baby was inversely related to maternal weight gain in pregnancy. Of women who gained less than 7 kg during pregnancy, about 15% had LBW babies; with 7-12 kg weight gain, around 8% had LBW babies; with 12-16 kg weight gain around 4% had LBW babies; women who gained 16+ kg only around 3% had LBW babies.

The risk of having a LBW baby also seems to be inversely related to maternal weight at the onset of pregnancy. In one study (Morgan 1988) the heaviest 10% of women had only one-third (2.3%) the incidence of LBW babies of the lightest 10%. Studies in Guatemala (Naismith 1980) have also shown that women who were marginally nourished, with typical unsupplemented intakes of 1600 kcal had significantly heavier babies and less LBW babies when they were given food supplements prior to conception and throughout the pregnancy. A similar study (Naismith 1980) in Taiwan with women whose unsupplemented intake was higher (2000 kcal/d), showed no significant effect on average birth weight.

### **Maternal anthropometry and pregnancy outcome**

There is an inverse correlation between infant mortality rate and birth weight; low birth weight babies (i.e. <2.5 kg) have higher mortality. Thus, birth weight of babies is a useful, objective and quantitative measure of pregnancy outcome. This suggests that anything which restricts fetal growth is liable to be detrimental to the chances of the baby's survival and subsequent well being. The ideal outcome of to pregnancy is not only a healthy baby but also a healthy mother who is nutritionally well prepared to lactate (i.e. "successful reproduction").

Maternal weight is sensitive to the acute nutritional stresses during pregnancy, and provides the most general impression of fetal growth. Maternal nutritional status both prior to and during pregnancy is a critical determinant of pregnancy outcomes for both the mother and the infant. Research findings suggest that taken together, maternal nutritional factors (e.g. low caloric intake, gestational weight gain, pre-pregnancy weight, height, etc.) are the most important established determinants of intrauterine growth retardation in developing countries. Pre-pregnancy weight is also an important determinant of birth weight.

Other anthropometric indicators that have been employed to assess risk are height, and upper arm circumference, Body Mass Index (BMI), and Waist-to-Hip Circumference Ratio (WHR) to indicate the amount and distribution of fat in the body.

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