CHAPTER 1
INTRODUCTION

Creating offspring is one of women most respected achievements and joys. Unfortunately, this act of procreation in many countries has become the most dangerous period in life. Over half a million women around the world die during pregnancy and childbirth (WHO, 2004). Maternal mortality remains high in many developing countries. The pregnancy is beset with high incidences of miscarriages, pre-term deliveries, low birth weight and birth trauma, which causes danger to the chances of continued existence of the newborn. The high mortality risk of pregnancy together with a low survival chance of the newborn, makes the pregnancy a major investment for many women.

The pregnancy is a period of increased metabolic demands mainly due to changes in the women’s physiology and the requirements of the growing foetus (Adair et al., 1985). However, during pregnancy, metabolic changes occur that protect the mother and her pregnancy through an increased metabolic efficiency. The foetus is also relatively protected at the cost of the nutritional status of the mother (Prentice et al., 1983, Lecntig et al., 1975b, Mc Donald et al., 1981, Adair and Pollit 1985, Mora et al., 1979).

Many a times, the poor quality of diet and inadequate intake, combined with increased nutrient requirements for placental and fetal growth, may lead to micronutrient deficiencies in pregnancy and contribute to higher rates of low birth weight
These deficiencies can also exist because of lack of knowledge about adequate prenatal nutrition, or dietary taboos associated with pregnancy (Fawzi et al., 1997).

During this period, the deficiency of iron and vitamin A has determinable effect on the health of both pregnant women (PW) and her growing foetus (Hallberg, 1988).

Nutritional anaemia and vitamin A deficiency are among the major nutritional problems of pregnancy which coexists in developing countries, especially among the pregnant and lactating women as well as in children. More than 40% of pregnant women around the world are anaemic due to iron deficiency (Llewellyn, 1965). Iron, therefore, contributes to the largest prevalence of micronutrient deficiencies. Iron deficiency is recognized to increase the risk of mortality among anaemic women on the account of hemorrhage and infections. Hemorrhage accounted for approximately 25% of all maternal deaths in developing countries (Allen, 2000a). Iron deficiency anemia is characterized by a defect in haemoglobin synthesis, resulting in red blood cells that are abnormally small (microcytic) and contain decreased amount of haemoglobin (hypochromic) (Steer, 2000) and it is the most common hematological disorder during pregnancy.

Eighty seven per cent of pregnant women were found to be anaemic in one of the studies, conducted in India (Allen, 2000a). The figures for the prevalence of Anaemia in other South Asian countries varies: Bangladesh 77%, Bhutan 59%, Nepal 65% and Sri Lanka 60% (Dreyfuss, 1998). India contributes to about 80 per cent of maternal deaths due to Iron Deficiency Anaemia (IDA) in South Asia. The studies have shown that in pregnancy IDA
results in maternal and perinatal mortality, (Llewellyn, 1965) premature delivery, low birth weights and poor foetal iron stores (Lechtig et al., 1975b). Low foetal nutrient stores and low birth weight may partly be caused by inadequate nutrition of their mothers during pregnancy (Waterlow and Schurch, 1994; Frongillo, 1999). Latent iron deficiency is recognized to alter brain iron content and neurotransmitters irreversibly in foetal life and postnatal babies (Allen, 2000b).

Vitamin A is also an important micronutrient affecting the health of pregnant women and foetus. Vitamin A is important for maintaining normal growth and development, regulating cellular proliferation and differentiation and maintaining visual and reproductive functions. Vitamin A deficiency in pregnancy is associated with depressed immune function leading on to increased infectious morbidity and cause intrauterine growth retardation as well as night blindness, low birth weight including anaemia in newborn (Semba et al., 1997). Poor maternal Vitamin A status affects its concentration in breast milk as well (Beaton et al., 1983) and is a risk factor for earlier onset of Vitamin A Deficiency (VAD) in infants (Lumey, 1992). However, high doses of Vitamin A in early pregnancy can be teratogenic as well (Beard, 2000).

The studies have shown that vitamin A deficiency is widespread throughout the developing countries. There was an estimation of 7.2 million pregnant women with Vitamin A (VA) deficiency (serum retinol < 0.7 mol/l) of whom 6 million are night blind (West, 2002), a condition attributable to VAD (Christian, 2002). A high maternal prevalence of low VA status (based on serum retinol < 1.05 mol/l) during pregnancy is found
to be 22.0% in Africa and 24.3% in South Asia). Vitamin A deficiency has long been recognized in much of South and Southeast Asia (India, Bangladesh, Indonesia, Vietnam, Thailand and the Philippines) by the common presentation of clinical cases of xerophthalmia or night blindness, mostly in the later half of the pregnancies (Hallberg, 1988). Prevalence of clinical and sub-clinical VAD in India is highest among the world.

The surveys reported VAD prevalences in pregnancy is as follows: 8 to 16% in rural Nepal (Dali et al., 1999); 0.6 to 2.8% in Sri Lanka; and 1% in a national vitamin A survey of Bangladesh (WHO, 1999).

A substantial reduction (40%) in pregnancy-related mortality was observed among the women who received Vitamin A or β-carotene supplements on weekly basis, before, during and after pregnancy (West et al, 1999). Vitamin A supplementation of women before and during pregnancy has been shown to reduce maternal night blindness and mortality. (West et al., 1999; Christian et al., 1998) and improve serum retinol levels in infants. A study conducted in a region with high prevalence of vitamin A deficiency in rural Nepal showed that maternal mortality from pregnancy was reduced by 40% with weekly vitamin A supplements and 49% with weekly β-carotene supplements (Christian, 2000). The relationship between the vitamin A status of pregnant women and that of their newborn infants is indicated by association of serum retinol levels during pregnancy with fetal liver retinol concentrations and by the high correlation of vitamin A concentrations between cord and maternal serum (Shah and Rajlakshmi., 1984; Shah et al., 1987). In addition, Vitamin A supplementation of pregnant women has been shown to increase
cord levels of vitamin A (Panth et al., 1990).

Vitamin A appears to be involved in the pathogenesis of anaemia through diverse biological mechanisms via modulation of hematopoiesis, by enhancement of growth and differentiation of erythrocyte progenitor cells and through the mobilization of iron stores from tissues (Bloem, 1995). Enhancement of immunity to infectious diseases (Thurnham, 1993; Semba, 1998) and hence, the reduction of the anaemia of infection (Means, 2000).

Various studies shed light on an interrelationship between these two conditions.

An association between serum retinol and haemoglobin concentration in pregnant women has been reported, suggesting that vitamin A deficiency results in decreased haemoglobin synthesis. The studies carried out among pregnant women proposed that Vitamin A supplementation alone during pregnancy can increase haemoglobin concentrations (Suharno et al., 1993). In West Java, Indonesia, 251 anaemic pregnant women were randomly allocated to receive iron (60 mg/day), Vitamin A (2.4 mg RE/day), iron (60 mg/day) plus vitamin A (2.4 mg RE/day) or placebo for 8 weeks. After supplementation, the number of women who were not anaemic in the iron, vitamin A, Vitamin A plus iron and placebo groups was 68, 35, 97, 16%, respectively.

Other studies have also explored the use of vitamin A combined with iron and or folate (Panth et al., 1990; Chawla and Puri, 1995). In a population with a high prevalence of iron deficiency anaemia, weekly Vitamin A supplementation reduced anemia by 9% during pregnancy and postpartum compared with controls. In Indonesia, pregnant women who received weekly
Vitamin A and iron supplementation had a greater increase in haemoglobin than women who received weekly iron or daily iron (Muslimatun et al., 2001).

There was an accompanying decrease in serum ferritin among women who received vitamin A and iron, suggesting to vitamin A supplementation increased the utilization of iron for hematopoiesis. Rush et al. (1999) noticed that anaemia and vitamin A deficiency in pregnancy are common and contribute significantly to maternal mortality and morbidity in developing countries.

Therefore, the present research study has been taken with the following objectives:

- To gauge the prevalence of Iron and β- carotene deficiency during pregnancy.
- To assess the impact of iron supplementation alone as well as in combination with β-carotene on pregnancy outcomes like complications of labour and delivery, gestational age, birth weight and head circumference.
- To examine the effect of above supplementation on iron status postpartum.
- To determine iron and β- carotene contents in commonly edible foods.