INTRODUCTION
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"What a mother sings to the cradle goes all the way down to the coffin”

- English proverb

Pregnancy occupies a critical and unique place in the span of a woman’s life, which has both health and social importance for individuals, family and the whole of society. A greater proportion of Indian women belonging to low socio economic status is undernourished and a majority of them continue to be in a state of malnutrition throughout the period of pregnancy and lactation with no substantial improvement in their diet.

It has long been recognized that the risk of developing disease in adult life depends upon exposure to environmental risk factors, the inheritance of disease susceptibility gene and chance. However there are numerous examples in the field of genetics and epidemiology of conflicting data and research results that are difficult to interpret because studies have been underpowered and/or insufficiently well designed to measure the effects of risk factor accurately. For example, most epidemiological studies data have relied upon retrospective collection of environmental exposure, such as data on lifestyle events, drug history, pregnancy and nutrition (Stephen, 2004).

High prevalence of low birth weight, high morbidity and mortality in children and poor maternal nutrition of the mother continue to be major nutritional concerns in India. Although nationwide intervention programmes are in operation over two decades, the situation has not changed greatly. In addition, the Indian population is passing through a nutritional transition and is expected to witness higher prevalence of
adult non-communicable diseases such as diabetes, hypertension and coronary heart disease according to the theory of 'foetal origin of adult disease'. Clearly, there is a need for examining several issues of nutritional significance for effective planning of interventions (Rao, 2001).

The fertility of women and the size of the family have a definite impact on the longevity of the newborn. Malnutrition in the mother is often considered as an important regulator of human foetal growth. It is not only nutrition during present pregnancy but also childhood nutrition of women that influence the obstetric outcome.

The relation between the diet of the mother and the well being of the foetus and infant continues to be a matter of uncertainty and controversy. Maternal nutrition affects the child probably even before conception and certainly throughout pregnancy. The mother's preconception weight and nutritional status, and her weight gain during pregnancy affect foetal growth, birth weight and prenatal outcome. Poor nutrition even in the presence of reasonable maternal weight gain, may affect the incidence of congenital abnormality and growth. Observational studies have generated conflicting and uncertain results, because their results tend to reflect too many other aspects of pregnant women's life that vary with diet and nutrition. However it was observed that dietary restrictions could cause marked decrease in birth weight.

(UNITED NATION) According to UN statistics (2004), more than 500 million Asians do not get enough food to meet daily needs for nutritional well-being. Micronutrient deficiencies are especially serious: babies are born mentally retarded because of iodine deficiency, children go blind and die of vitamin
A deficiency, and enormous number of women and children are sapped by iron deficiency anaemia. At the same time, studies by the World Bank show that productivity losses due to various forms of malnutrition in low-income Asian countries constitute around 2-3% of Gross National Product of the world (in Bangladesh it is 8%). Studies also show that the benefits of reducing iron deficiency are in the range of US$ 40-50 per person -- and US$ 82-140 per pregnant woman – annually.

The World Health Organization estimates that 58% of pregnant women in developing countries are anaemic. In spite of the fact that most ministries of health in developing countries have policies to provide pregnant women with iron in a supplement form, maternal anaemia prevalence has not declined significantly, where large-scale programs have been evaluated (Galloway et al., 2002).

The state of maternal health in Asia is equally pathetic. A 2004 UNICEF study shows that India alone accounts for 22,000 maternal deaths from severe anaemia annually (Singhal, 2004).

Various studies have revealed that a number of maternal factors affect the birth weight of babies. Some of these factors are

- Age of the mother
- Maternal weight
- Maternal height
- Weight gained during pregnancy
- Inter pregnancy interval
- Haemoglobin level, and
- Maternal literacy level

Nutritional anaemia is another serious public health problem affecting women in reproductive age group and young children. Anaemia impairs
physical capacity hence productivity. Prevention and control strategies thus assume great importance in the content of national economy and development.

Nutritional anaemia is defined as a condition in which haemoglobin concentration is lower than normal as a result of a deficiency of one or more essential nutrients (WHO, 2005).

In general terms, to be classified as a nutritional anaemia, the two criteria met are:

(i) Lack of the nutrients that produce anaemia, and

(ii) Providing the nutrient to correct the anaemia. These criteria would dictate that the physiological anaemia of pregnancy does not fit this definition and that three nutritional anaemias could be observed during pregnancy: those due to deficiency of iron, folate and vitamin B12.

People who are anaemic develop symptoms caused by the inadequate delivery of oxygen to their body tissues. This can vary from simple fatigue to death according to the nature and severity of the anaemia.

The condition is far more common in women than in men.

There are three primary causes of anaemia and they are:

1. Reduced production of red blood cells, which may result from deficiency in nutrients or hormones, or from disease or other conditions.

2. Excessive destruction of red blood cells often a hereditary problem.
3. Excessive blood loss, such as that caused by gastrointestinal ulcers, heavy menstrual periods, or overdose of aspirin.

The most usual symptoms of anaemia are pallor, shortness of breath, low vitality, dizziness, and digestive disorders. Classification is based on the size of the red blood cells.

One form of anaemia classification is made on the basis of the appearance of the red blood cells on microscopic examination of a peripheral blood smear. If the cells are smaller than normal, the anemia is said to be microcytic; if they are normal size, normocytic; and if they are larger than normal, the anemia is classified as macrocytic. Other characteristics visible on the peripheral smear may provide valuable clues about a more specific diagnosis.

According to Mohan (2003) anaemia classification based on appearance of the red blood cells on microscopic examination of a peripheral blood smear are as following.

**Macrocytic anaemia**

The most common causes of macrocytic anaemia are a deficiency of either vitamin B12 or folic acid (or both) due either to inadequate intake or insufficient absorption. Pernicious anaemia is an autoimmune condition where the body lacks intrinsic factor, required to absorb vitamin B12 from food. Alcoholism can cause macrocytic anaemia.

**Normocytic anaemia**

Normocytic anaemia can be caused by acute blood loss, chronic disease or failure to produce enough red blood cells. Renal failure or liver failure causes normocytic anaemia. Certain hormonal deficiencies, like testosterone, can cause normocytic anemia. Lastly, sideroblastic anemia is
caused by abnormal production of red blood cells and can lead to hematologic malignancies.

Aplastic anaemia (bone marrow failure) is anaemia caused by the inability of the bone marrow to produce blood cells. Aplastic anaemia is much rarer than dietary deficiency or genetic defect anaemias.

**Microcytic anaemia**

The most common type of microcytic anaemia, and the most common cause of anaemia overall, is iron deficiency anaemia. Other causes of microcytic anaemia include haemoglobinopathies such as sickle cell anaemia and thalassemia.

Iron deficiency anaemia is caused when the dietary intake or absorption of iron is insufficient (Haemoglobin contains iron). In the United States, 20% of all women of childbearing age have iron deficiency anaemia, compared with only 2% of adult men. The principal cause of iron deficiency anaemia in premenopausal women is blood lost during menses.

In 2002, a survey by the national nutrition-monitoring bureau of the Indian Council for Medical Research had pointed out that 4% of pregnant women suffer from severe anaemia.

According to data available with the Nutrition Foundation of India, nearly 90% of adolescent girls, women and children in the country suffer from anaemia. The data has been obtained from a District Level Health Survey (DLHS) - Reproductive and Child Health (RCH) conducted by the Union Health Ministry and the Department of Women and Child Development in 2002-2003.
Iron deficiency anemia is the final stage of iron deficiency. When the body has sufficient iron to meet its needs (functional iron), the remainder is stored for later use in the bone marrow, liver, and spleen. Iron deficiency ranges from iron depletion, which yields little physiological damage, to iron deficiency anemia, which can affect the function of numerous organ systems. Iron depletion causes the amount of stored iron to be reduced, but has no effect on the functional iron. However, a person with no stored iron has no reserves to use if the body requires more iron. In essence, the amount of iron absorbed by the body is not adequate for growth and development or to replace the amount lost (Mohapatra et al., 1990).

The most common type of anaemia is iron-deficiency anaemia, which occurs when the body's need for iron increases, as during certain periods of childhood and in pregnancy, or when there is insufficient iron in the diet.

Anaemia may develop if the diet does not provide enough iron, protein, vitamin B₁₂ and other vitamins and minerals needed in the production of haemoglobin and the formation of erythrocytes. The combination of poor diet and chronic loss of blood makes for particular susceptibility to severe anaemia. In pregnancy, anaemia has a significant impact on the health of the foetus as well as that of the mother. Anaemia, especially if severe, may impair the oxygen delivery to placenta and foetus and interfere in normal intrauterine growth (Thangaleela and Vijayalkshmi, 1994).

When a person gets plenty of these nutrients in their food or when they have enough in their body stores, they can make new red blood cells as fast as the old cells wear out. But a person may not get enough nutrients in their food or their body stores may be low, or the need for new red
blood cells may increase. Then the body may not be able to make new red blood cells fast enough, and the person becomes anaemic.

In a typical gestation with a single foetus the maternal need for iron induced by pregnancy is 800-1000 mg. This amount of iron usually exceeds considerably the maternal body iron stores. Unless the difference between the amount of stored iron available to the mother and the iron requirements is made up by absorption of iron from the gastrointestinal tract during pregnancy, iron deficiency anaemia will develop.

According to studies carried out by Food and Nutrition Board and NIN (2003,) the lowest mean haemoglobin level was found among pregnant women (9.9g/dl), followed by preschool children (10.3 g/dl), lactating women (10.6 g/dl), and adolescent girls (11.1-11.2 g/dl). Overall prevalence of anaemia was found to be 67% among preschool children; 69% among 12-14 year old adolescent girls; 75% among pregnant women; and 78% among lactating women. (NFI, 2003)

Studies show that about 60-70% of pregnant women in India have haemoglobin levels lower than 11% and 50% of the mothers in the age range of between 15-45 years have haemoglobin values lower than 12% (Allen ,2000).

India's year wise maternal mortality rate showed an almost consistent decline from 468 to 190 over the decade. Almost all the deaths (95%) occurred among unbooked gravidas (Mukherjee, 2003). Indirect causes claimed 62.5% lives while 33.8% were due to direct obstetric causes and 3.6% deaths were due to coincidental causes. Severe anaemia was the largest killer, causing 31% of total deaths. Majority (65.6%) of deaths occurred in the postnatal period. Most of the deaths could have been
prevented by better community participation, antenatal care, iron-folate prophylaxis and timely medical care (Baul & Manjusha, 2004).

Studies conducted at NIN indicate that a low plasma vitamin A level in pregnant women during the third trimester of pregnancy is associated with a lowered maternal haemoglobin concentration and low increments in plasma progesterone content reflecting foeto-placental dysfunction (Pant 1998).

Maternal risk level affected the foetus and the newborn by the way of low birth weight (LBW), inadequate stores of nutrients and slow growth rate during infancy (Mercy et al., 1994) (El Guindi et al., 2004).

Most of the deaths were in young women (20-29 years) and primigravidae. Hypertensive disorders (27.4%) and haemorrhage (12.9%) were the leading direct causes, while anaemia (13.9%) was the main indirect cause. It was shown that from 1982-1987 period to 1997-2002 period there was a fall in the percentage of deaths due to hypertensive disorders, from 27.5% to 14.6%, peripartum sepsis from 13.7% to 7.3%, and ruptured uterus from 3.9% to nil, but there was a rise in deaths due to septic abortions from 9.8% to 14.0% and haemorrhage from 7.8% to 17.1%. Deaths within 24 hours of admission decreased from 60.8% (between 1982 and 1987) to 46.3% (between 1997 and 2002). It appears that even with resource constraints, improving peripheral services can reduce maternal mortality and individualized evidence-based appropriate interventions at referrals. However, the problems of anaemia and septic abortions need to be examined further (Chabra and Sirohi, 2004).

The main birth outcomes of interest were: low and very low birth weight, preterm and very preterm delivery, small-for-gestational age, stillbirth.
neonatal and prenatal mortality (Stephansson et al., 2000) (Harrington et al, 2002).

High prevalence of low birth weight, high morbidity and mortality in children and poor maternal nutrition of the mother continue to be major nutritional concerns in India. Although nationwide intervention programmes are in operation over two decades, the situation has not changed greatly.

The main objective of the study is an investigation into the relationship between outcome of pregnancy among anaemic and non-anaemic pregnant women.

The specific objectives were to find whether
a) There is a strong correlation between maternal anaemia and low birth weight babies.
b) Anaemic pregnant women have complicated pregnancy.
c) Nutritional awareness can help in improving maternal anaemic status.
d) Cereal based diet is predominant among anaemic pregnant women.
e) Higher literacy of pregnant women leads to lower the chance of maternal anaemia.
f) Higher the age of conception the chance of maternal anaemia is lower.

It was hypothetically assumed that
1. Nutritional awareness is low among anaemic pregnant women.
2. Anaemic mothers give birth to low birth weight babies.
3. Higher the age of marriage, higher is the complication but the chance of anaemia is lower.
Methodology in Brief

In the study, 1000 pregnant women were selected by survey method from high income and low-income groups between the age group of 20 to 40 years in the first trimester of pregnancy. The sample selected was from Thiruvananthapuram district, 500 numbers of pregnant women from Medical College and 500 numbers of pregnant women from Sree Uthradom Thirunal hospital.

In the first phase, anaemic and non-anaemic sample were located from the main sample. Among the 1000 sample group, 453 pregnant women were anaemic and 547 pregnant women were non anaemic in first trimester of pregnancy.

In the second phase out of the 453 anaemic pregnant women, 250 sub samples were selected by purposive random sampling for intensive study.

And in the third phase of the study the 250 samples were categorised into 125 experimental and 125 control groups by random sampling.

The tools used for the study consisted of a questionnaire for the main sample. The questionnaire consisted of three parts.

- Part I, consisted of socio economic background, educational status of the pregnant women and husband, income of the family, order of pregnancy, type of last delivery, age of first delivery, total number of pregnancies, complication in previous delivery, disorders during present pregnancy, medical supplementation taken during pregnancy, special foods taken and foods avoided.
• The part II of schedule consisted of anthropometrical details like weight before pregnancy, weight at pregnancy, weight in third trimester, height of the sample, birth weight of baby, birth length of baby, and question regarding feeding of colostrum.

For the sub sample weight in the second trimester was also taken.

• And part III of schedule consisted of dietary data of 24-hour recall of three consecutive days, biochemical analysis of blood in first trimester and clinical examination.

For the sub sample, in the questionnaire cum interview schedule dietary detail was collected for two consecutive days using food weighment method. A detailed sheet on the biochemical analysis of blood was done by cyanmethahemoglobin method. This was done for the first trimester, second trimester and third trimester of pregnancy. The stool analysis, done by smear technique, was collected from the hospital records.

Using an attitude scale nutritional awareness was recorded for planning a nutrition education programme and a booklet as hand out for the sub sample.

A nutrition education class on “Nutrition for Anaemic Pregnant Women” and a booklet on “Combating Nutritional Anaemia in Pregnancy” was developed by the researcher in regional language and handed out to 125 experimental group.
A pilot study was done to test the validity of the questionnaire cum interview schedule and reliability analysis was done. Item analysis of the attitude scale was also done.

**Scope of the study**

The present study attempts to bring out nutritional transition that Kerala population is passing through. In particular, maternal nutrition and foetal growth relationship as the age of marriage is high in Kerala.

The health indicators of Kerala are better, compared to other states in India, but the situation of nutrition in critical sectors and areas of population does not portray a rosy picture. There is widespread prevalence of malnutrition in the form of underweight, low birth weight, wasting, stunting, anaemia and other manifestations of micro nutrient deficiencies among different age groups of the population as a whole.

Kerala has been a role model in implementing programmes related to women and children. Certain new aspects are hidden behind the 90% institutional deliveries in Kerala (NFHS-II, 1998). The complications are hidden under caesarean delivery and declared a safe pregnancy outcome. The study hopes to bring out the differences for better intervention programmes in future for Kerala.