Review of Literature
REVIEW OF LITERATURE

Nutrition is a basic determinant of health. Not only it influences the health of the population but poor nutritional status can also comprise the health of future generations. A chronically undernourished woman is more likely to give birth to an underweight baby, thereby perpetuating the intergenerational cycle of malnutrition (Ranchi low birth weight project, 2006).

In the words of Rousseau “Where there is no mother, there can be no child. Their duties are reciprocal; and if they are badly fulfilled on one side, they will be neglected on the other.” This quotation is very appropriate to the subject of adequate nutrition for each woman. The belief that a woman should eat better food and more food (for pregnant women) is an old one and has been held by both extremes – layman and the scientists (Fleck and Henrietta, 1971). But there has been a wide gap between the thought and the actual action.

Pregnancy is the period of rapid growth and cell differentiation; both for the mother and the foetus consequently. It is a period when both are very susceptible to alterations in dietary supply, especially of nutrients which are marginal under normal circumstances (Koksol, et al., 2007).

Pregnancy places increased iron demand on woman since it is needed to support the increase blood volume, the growth of the foetus and blood loss during child birth (Jain, 2007).

In order to understand the implications of maternal nutrition and other parameters responsible for prevalence of anemia with established relationship of maternal health and subsequent well being, the available literature can be conveniently reviewed under the following heads-
2.1 HAEMATOLOGICAL STUDIES

Blood is a connective tissue composed of formed elements and liquid plasma. It is primarily a medium for the carriage for oxygen, carbon di oxide, nutrients, hormones, anti-infective agents (e.g. antibodies) and other waste products.

The cellular elements of the blood are white blood cells, red blood cells, and platelets suspended in the plasma. More than 99% cells are RBC. The normal total circulating blood volume is about 80% of the body weight (5600 ml in a 56 kg man). About 55% of this volume is plasma, therefore, the viscosity of blood increases drastically as the hematocrit increase (Gyton, 1986).

Plasma proteins exert an osmotic pressure which influences the exchange of fluid between blood and other tissues. Plasma proteins also combine with many substances, e.g. iron, thyroxin and steroid hormones to form transportable complexes from which the active components are released at the appropriate sites (Thompson R.B., 1977).

The properties of haemoglobin allow the carriage of the large amount of oxygen needed for metabolic activities. The buffering power of haemoglobin is also an important factor in helping to maintain consistency of blood (Macfarlane R.G. et al, 1961).

2.2 PLASMA

Plasma is the part of extra cellular fluid of the body. It is almost identical to interstitial fluid found between the tissue cells except for one major difference i.e. plasma contains about 7 percent protein where as interstitial fluid contains as average of 2% protein. The reason for this difference is that plasma protein leaks only slightly through the capillary
bores into the interstitial spaces. As a result, most of the plasma protein is held in the circulatory system, which eventually returns to the circulation by the lymph vessels.

2.3 **RED BLOOD CORPUSCLE (Erythrocytes)**

The mature mammalian red blood cells or erythrocyte is highly specialized cell lacking such cytoplasmic organelles as nucleus, mitochondria, or the ribosomes. RBC is unable to synthesize new protein, carry out oxidative reactions or undergo mitosis.

The erythrocyte consists of a membrane surrounding a solution of protein and electrolytes.

1. **Shape** - Normal human erythrocyte is shaped like flattened, bilaterally indented sphere, a shape often referred to as “biconcave disc”. In fixed, stained blood smear, only the flattened surfaces are observed, hence the appearance is circular, with an area of central pallor corresponding to the indented regions.

2. **Size** - According to Price Jones, C. (1933) average normal value for red cell diameter is 7.2-7.4 μm. As 9.5 μm may be found in normal blood smears, but generally the greater variation in cell diameter is 3.5 μm (Donelson E.G. et al, 1963).

2.4 **HEMOGLOBIN**

Hemoglobin is chromoprotein and is present inside the R.B.Cs required for transfer of oxygen and carbon dioxide. It also behaves as a blood buffer (Chaudary, 1993).
2.4.1 **Synthesis**-

Since hemoglobin accounts for about 90% of the dry weight of the erythrocyte, the biosynthesis of hemoglobin is intimately related to erythropoiesis. Synthesis of hemoglobin begins in the erythroblasts and continues slightly even into the reticulocyte stage. (Gyton, 1986)

2.4.2 **Structure**-

Heamoglobin is a conjugated protein with molecular weight near 64,500 million daltons. It is tetramer consisting two pair of polypeptide chain. Each of four chains is attached to a highly coloured prosthetic group ‘haeme’ a complex iron and protoporphyrin. The protein portion of the molecule is called globulin. The hemoglobin molecule is roughly spherical with a maximum molecular diameter of about 6.4 nm (Wintrobe et al, 1974).

2.4.3 **Combination of Haemoglobin with oxygen**

Haemoglobin has a unique property to combine loosely and reversibly with oxygen. Oxygen does not combine with two positive valences of ferrous iron atom. Instead, it binds loosely with one of the six “co-ordination” valences of the iron atom. This is an extremely loose bond so that the combination is easy (Gyton, 1986).

2.5 **HAEMATOCRIT**

The percent of the blood cells are called the haematocrit. Thus if a person has a haematocrit of 40, 40 percent of the blood volume is cells and the remainder is plasma. The haematocrit of a normal man averages about 42, while that of normal woman averages about 38. These values vary tremendously depending upon whether or not the person has
anaemia, the degree of bodily activity and the altitude at which the person resides.

Blood haematocrit is determined by centrifuging blood in a calibrated glass tube known as haemtocrit. (Gyton, 1986).

2.6 ANAEMIA

Anaemia is a condition in which there is a reduction in a total circulating haemoglobin. Robinson and Lawler (1982) described the term anaemia as biochemically lowered hemoglobin levels, number of red blood cells and haematocrit.

According to Wintrobe et al. (1974) to understand anaemia it is useful to think of circulating red cells and the bone marrow. Anaemia is not a diagnosis in itself but merely an objective sign of presence of disease.

Symptoms in patients with anaemia depend on five factors.

1. The reduction in the oxygen-carrying capacity of the blood.
2. The degree of the change in total blood volume.
3. The rate at which (1) and (2) has developed.
4. The associated manifestation of the underlying disorder that resulted in the development of anaemia.
5. The capacity of the cardiovascular and pulmonary system to compensate for the anaemia.

Anaemia is a condition in which there is a diminished oxygen carrying capacity of the blood as result of a reduction in total
circulated haemoglobin and/or a reduction in red cell mass (Anita F.P., 1993).

The concentration of haemoglobin in the blood tends to be lower during pregnancy because on an average the plasma volume increases by about 50 percent and the volume of circulating red cell by about 20 percent (WHO study group, 1959). The resulting fall in haemoglobin concentration may be about 2gm/100 ml of blood.

2.7 ETIOLOGICAL CLASSIFICATION

Anaemia means a deficiency of red blood cells, which can be caused either by too repaid loss or too slow production of red blood cells.

1. Anaemia due to blood loss- According to E.F. Eckstein (1980) chronic blood loss due to excessive menstrual losses, repeated pregnancies, infections, malignancies, ulcer, frequent blood donation and use of tablet aspirin (One tablet results in mean blood loss of 5 ml.), may result in anaemia.

2. Anaemia due to deficiency of nutritional factors-

(i) Iron deficiency anaemia (IDA)- According to Eckstein (1980) in IDA the level of iron saturation of the circulating transferin is low and cannot be increased by liver stores, then the quantity of iron available for incorporation with haeme is decreased and the oxygen carrying capacity of blood which depends on haeme concentration is reduced (anaemic). Many reaction especially those energy producing reaction of krebs’ cycle require oxygen. Lack of oxygen prevents the reaction and result in a system slow down, hence the popular term, “tiered blood”.

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