CHAPTER – I

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“The very best environment a baby to grow and thrive, is the mother’s body,”

(Dr. Nils Bergman)

“The pregnant woman is like a ship upon a stormy sea; full of white caps, and the good pilot who is in charge must guide her with prudence if he is to avoid shipwreck.”

(Francois Mauriceau)

I.1) Background of the Study

The WHO South East Asia Region (SEAR) accounts for nearly one fourth of world’s population. Interestingly, most countries in the Region have very young populations, with nearly 50% in the reproductive age group. Consequently the number of pregnant women and number of babies born annually are very large. An estimated 37 million child births take place annually. The region has about 180 million children under the age of five. Unfortunately, the region also accounts for more than 170,000 maternal deaths and over 3 million child deaths annually. These statistics make the issue of maternal, new born and child health a major priority for the region.\(^7\)

Of the estimated 130 million infants born each year worldwide, 4 million die in the first 28 days of life. Two thirds of the world’s neonatal deaths occur mostly in Asia. Three quarters of these deaths occur in first week and more than one quarter occur in the first 24 hours and they account for 40% of deaths under the age of 5 years, therefore efforts to achieve the UN Millennium Development Goal 4 of reducing child hood mortality by 2015 are focused on reducing neonatal deaths in high mortality countries.\(^2\)

In India, 7 out of 100 babies do not see their first birthday and nearly 65% of these deaths occur in the neonatal periods. These neonatal deaths are due to low birth weight,
asphyxia, prematurity and infection. The current neonatal mortality rate is 45/1000 live births.\textsuperscript{3}

In any community, mothers and children constitute a priority group. In sheer numbers, they comprise approximately 71.14\% of the population. In India, women of the childbearing age (15-44 years) constitute 22.2\% of the total population.\textsuperscript{4} A woman, though the embodiment of a life giver, is vulnerable to lose life in the process of creating another.

Pregnancy is a unique period that occurs in every woman’s life. Giving birth fulfils her desire as woman. Pregnancy is the initiating and sustaining of a new life, a time of growth. A woman’s past health experiences join with her present condition to lay the foundation for a new life.

A woman, being backbone of a family, plays pivotal role but her needs are rarely fulfilled. If family members do not recognize the demands of mother during pregnancy, she may not feel the joy of pregnancy, loses desire to take up medical and obstetrical help and may develop pregnancy associated risks which go unnoticed till her fetus and her own life is endangered. It is estimated that globally half-a women die due to pregnancy and childbirth.\textsuperscript{5}

Pregnancy and child bearing are usually associated with certain risks to the mother as well as fetus. Any pregnancy in which this risk is increased is said to be a “\textbf{high risk pregnancy}”. Thus a high risk pregnancy is one in which the life or health of the mother is jeopardized by a disorder coincidental with or unique to pregnancy. Identification of the high risk patients is critical to minimize maternal and neonatal mortality and morbidity. Known risk factors like smoking, poverty, inadequate nutrition, infections, sexually transmitted diseases, medical disorders, previous bad obstetrical and neonatal history etc which jeopardize the entire child bearing experience for the mother, fetus, neonate or family, can be used to identify high risk patients early in the prenatal course so that their pregnancy outcome is improved. Providing safe and effective care for a high risk patient requires a joint effort from all members of the health care team, with each member contributing unique skills and talents to provide optimum outcomes for mother and infant.
Pregnancy may be complicated by a variety of disorders and conditions that can profoundly affect the women and her fetus.\textsuperscript{6}

These factors lead to stunted growth due to mechanisms like low fetal oxygen delivery, placental insufficiency, effect of drugs, infections and poor diet.\textsuperscript{7}

Mufti\textsuperscript{8} conducted a study on 400 pregnant women attending LD Hospital, Srinagar. 200 women were with normal gestation and other 200 were with one or more risks. She reported high incidence of low birth weight (48.48%), preterm birth (24.24%), and birth asphyxia (39.4%). She further reported 50% of low birth weight among mothers with age less than 16, out of these babies 20.6% died in early neonatal period.

Nosseir et al\textsuperscript{9} carried out a cross sectional study on a sample of 900 pregnant women attending the Maternal and Child Health Clinic (MCH) in Alexandria to demonstrate the incidence of high risk pregnancy and to demonstrate the common risk factors among them. They found that the most frequently encountered risk factors were anaemia, age 35 plus, parity 5 and above, previous gynaecological surgery and history of previous still birth or neonatal death. They suggested that health workers at MCH clinics should screen and identify high risk pregnancy so that prompt care, information and advises would be given to such woman to safeguard their pregnancy.

Dutta and Dass\textsuperscript{10} conducted a study in West Bengal and reported 5% of pregnant women belong to high risk group and the birth of low birth weight babies among high risk group was reported as 67.2%.

Many advances in health services have occurred because of public health interventions. The quality of health care delivery system of a country is reflected by its maternal and perinatal mortality rates. Global observations show that in developed regions maternal mortality ratio averages 13 per 100,000 live births; in developing regions the figure is 440 for the same number of live births.\textsuperscript{11}

According to WHO, maternal mortality is currently estimated to be 529,000 deaths per year, a global ratio of 400 maternal deaths per 100,000 live births. Between 11-17% of maternal deaths happen during child birth itself, and between 50-71% in the postpartum period. About 45% of postpartum maternal deaths occur during the first 24 hours, and more than two thirds during the first week.\textsuperscript{4(p479)}
Perinatal mortality includes still births and early neonatal deaths. Approximately 3.3 million babies are stillborn each year worldwide.\textsuperscript{1}

In India, National Statistical Census Report estimated for the year 2010, stillbirth rate for whole country is about 10 per 1000 total births in 2005, 9 per 1000 total births in 2008 and 8 per 1000 total births in 2010 and perinatal mortality rate for India is about 40 per 1000 total births in 2005, 39 per 1000 total births in 2008 and 33 per 1000 total births in 2010. In India, the perinatal mortality rate and stillbirth rate varies from state to state. In Jammu and Kashmir, perinatal mortality rate and stillbirth rate has declined from 2005 to 2010 [Table 1].\textsuperscript{12}
**TABLE 1  Perinatal Mortality Rate and Stillbirth Rate in India.**

<table>
<thead>
<tr>
<th>India &amp; Bigger States</th>
<th>Perinatal Mortality Rate</th>
<th>Still Birth Rate</th>
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<tr>
<td>West Bengal</td>
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</table>

Source: Govt. of India Census (2010)

0* denotes negligible
Talsania and Lala\textsuperscript{13} evaluated antenatal risk scoring in prevention of preterm birth. Out of 696 deliveries, there were 71 preterm births, out of which 3 were among no risk group.

Worldwide, nearly four million newborns die within the first week of life due to maternal malnourishment, infection, anaemia etc which are leading factors for low birth weight and another three million are born dead. The perinatal mortality is less than 10 per 1000 total births in the developed countries while it is much higher in the developing countries (60/1000 in India).\textsuperscript{14(p605)}

Perinatal mortality rate closely reflects both the standards of medical care and effectiveness of social and public health measures. Inadequate prenatal care is recognized as one of the factors responsible for high maternal and perinatal deaths in developing countries.

Investment in health promotion during childbearing has the potential to make a significant difference not only in the health of individual woman and her infant, but in society as well. The strength of a society rests on the health of its mothers and infants.

The best environment for fetal growth and development is in the uterus of a healthy, well-nourished woman for 38 to 42 weeks. An under nourished, physically and socially unhealthy woman can give birth to a baby who may be weak, small and underweight i.e., less than 2500g. Malnourished mothers with poor nutrition reserve have a high incidence of low birth weight and growth retarded babies.\textsuperscript{3}

According to WHO, an infant whose birth weight is less than 2500g, irrespective of gestational age is termed as low birth weight” (LBW) baby. Previously the birth weight of 2500g or less was taken as index of prematurity without taking gestational age into account. But infants born at term or post term may weigh less than 2500g. Thus inclusion of all babies weighing less than 2500g, without due consideration to gestational periods, seems appropriate for low birth weight.\textsuperscript{14(p457)}

A baby who is born before 37 completed weeks of gestation is called preterm baby. These babies usually weigh 2500gm or less. Preterm baby constitutes two-thirds of low birth weight babies. The incidence of low birth weight is about 30-40\% in the developing countries; as such the incidence of preterm baby is about 20-25\%.\textsuperscript{14(p458)}
The low birth weight of a baby will occur either due to less than the expected rate of intrauterine growth or due to shortened gestational period and their risks for morbidity and mortality increase. The weight of an infant at birth, in relation to its gestational age, portrays to some extent, the effect of intra-uterine environment and maternal factors and it is the most crucial determinant of its chances for survival and freedom from morbidity.\textsuperscript{15}

The incidence of low birth weight is generally higher in those countries where the mean birth weight is low and as such varies from 5\% to 40\% of live births. In India one third of infants weigh less than 2500g. These low birth weight babies are vulnerable to biochemical, neurological and respiratory complications, resulting in high perinatal deaths of about 50\%, when the birth weight is less than 2000g.\textsuperscript{14(p457)}

According to Fanaroff\textsuperscript{7(p136-137)}, low birth weight infants are further divided into subgroups:

\textbf{Moderate low birth weight:} when infant’s birth weight is between 1500-2499g.

\textbf{Very low birth weight:} when infants weigh 1500g or less.

\textbf{Extremely low birth weight:} when infants weigh 1000g or less.

According to Ghai \textsuperscript{3} low birth weight infants have two clinical types:

\begin{itemize}
  \item Infants born before 37 weeks (preterm) as birth weight is a function of gestation and a preterm baby is expected to have less weight.
  \item Infants who have \textit{intra-uterine growth retardation} (IUGR). These babies are under nourished (or small) for a given gestation (date), therefore are called small for gestational age (SGA) or small for date (SFD) babies.
\end{itemize}

Birth weight of a new born depends on the duration of his stay in utero, and his interaction with the intra-uterine environment which depends on maternal characteristics including obstetrical and placental factors viz maternal malnutrition, closely spaced repeated pregnancies, severe anaemia, early age pregnancy, infections, smoking, heavy work load, toxaemia, chronic medical illness, pregnancy bleeding, previous low birth weight and poor economy.

There are many maternal factors associated with low birth weight. These include:
- Medical disorders e.g. anaemia, infections, severe diabetes, hypertension, cyanotic heart disease, renal disease.
- Pregnancy disorders e.g. pre-eclampsia, ante-partum haemorrhage, multifetal pregnancy, multiparity, hydramnios, previous bad obstetrical history.
- Maternal characteristic e.g.; low age (<20 years) or high age (>30 years), height less than 145cm, pre-pregnancy weight less than 50 kg, reduced weight gain, low literacy.
- Psychological and behavioural risk factors e.g. smoking, drug addiction, alcohol consumption, exposure to smoke, stress, poverty (low income and risky occupation), poor diet.

In an analysis from a birth cohort about determinants of infant mortality in Kashmir valley, the infant deaths occurred more in infants born to mothers with maternal complications like anaemia (41.1%), pre-eclampsia (2.2%), eclampsia (6.3%), diabetes mellitus (2.2%) and infections (3.3%). Prematurity was reported to be the cause of maximum deaths i.e. 54.5% in the early neonatal period and 24.7% during infancy.\(^\text{16}\)

Indicators of maternal disadvantage such as low education and poverty are known to be associated with decreased fetal growth.\(^\text{17}\)

Cigarette smoking or continued exposure to smoke filled environment (even if the mother does not smoke) is associated with fetal growth retardation and an increase in perinatal and infant mortality and morbidity. Smoking also increases the frequency of preterm labour and premature rupture of membranes.\(^\text{18}\)

**Tamim et al**\(^\text{19}\) reported that cigarette smoking carries a threat both to an expecting mother and new born and is most avoidable cause of premature morbidity and mortality and growth restriction. Tobacco products are responsible for 32,000-61,000 low birth weight infants (a key predictor of infant mortality), 14,000-26,000 newborns requiring admission to neonatal intensive care unit, 1900-4800 deaths from perinatal disorders, and 1,200-2,000 deaths from sudden infant death syndrome.

**Mc Commack et al**\(^\text{20}\) studied pregnancy outcome in women with antepartum bleeding in 2\(^\text{nd}\) half of pregnancy in Australia. They evaluated pregnancy outcome in women on their demographic characteristics, pre-existing medical conditions and smoking. Neonatal
outcome included low birth weight, birth asphyxia, NICU admission and risks of prenatal and neonatal deaths.

Small for gestational age babies and low birth weight babies were reported to born in Washington in women whose pregnancy was complicated by hepatitis C.\textsuperscript{21}

Premature rupture of membranes was found to be frequent cause of intrauterine infection, premature labour and birth of premature babies with low birth weight.\textsuperscript{22-24}

Stress, tobacco, drug and alcohol use, poor nutritional status and peridontal infections are found as associated risk factors for preterm with low birth weight.\textsuperscript{25}

In Chinese women, obesity has associated risks of adverse pregnancy outcome as preterm delivery and small for gestational age.\textsuperscript{26}

In Denmark Mortensen et al\textsuperscript{27} has found strong associations of maternal disadvantage i.e. age, education, poverty, unemployment and single parent with decreased fetal growth.

In developing countries like India, Arya\textsuperscript{28} indicated maternal malnutrition as cause of IUGR which leads to LBW.

Malhotra et al\textsuperscript{29} made a retrospective comparison of fetal pregnancy outcome of women with valvular heart disease and healthy women, cared for at tertiary care hospital at same time and found that women with valvular heart disease had higher incidence of surgical intervention during pregnancy so perinatal outcome was significantly worse resulting in increased rate of preterm baby and low birth weight.

Ramankutty\textsuperscript{30} made a preliminary exploration about why low birth weight is still a problem in Kerala. His findings indicated that the factors associated with low birth weight were low pregravid weight, short stature of mothers, weight gain of less than 3 Kg, low haemoglobin status of mother, maternal hypertension, young age, and gestational age less than 38 weeks.

Increased rate of low birth weight, preterm and perinatal deaths is reported in women with hypothyroidism. Bansal\textsuperscript{31}

Agarwal et al\textsuperscript{32} studied perinatal outcome in women with antepartum eclampsia. Results indicated increased rates of low birth weight in these women.
Zarger and Mir found that pregnancy complicated by threatened abortion and oligohydramnios restricted intrauterine growth of foetus and resulted in low birth weight of baby. The studies were conducted in Srinagar L D Hospital.

Amin and Imtiyaz and Ali et al have studied correlation of maternal factors like age, literacy, income, type of family, haemoglobin level and antenatal care on the nutritional status of pregnant women. They have revealed that malnourishment increased the risk of premature labour, intra-uterine growth restriction and low birth weight with increased perinatal, neonatal and infant morbidity and mortality.

Adequate nutritional intake during pregnancy is required for maternal and fetal tissue growth because deprived dietary intake by pregnant women results in poor pregnancy outcome which is reflected in higher prevalence of low birth weight. Sachdev and Chowdery

Poor nutrition hinders weight gain and causes intra-uterine growth restriction which is due to the result of preeclamptic toxaemia, anaemia, infection, placental insufficiency. Mirza

Malnourishment and smoking are found as important etiological factors for fetal growth retardation. Due to placental insufficiency which is associated with pregnancy induced hypertension, severe diabetes and anaemia, the fetus is deprived of essential nutrients needed for its growth. The retardation of fetal growth is further affected when mother is young or elderly and belongs to poor socio economic status. Arora

Low birth weight, whether result of prematurity or IUGR is an independent risk factor for neonatal deaths, because lower the weight at birth, higher the neonatal deaths. Hacker

“Low Birth Weight” is considered to be an important factor compromising healthy survival of infants. These infants are five times more likely to die in the perinatal period and three times more likely to die during infancy. Over 70% perinatal deaths, 90% neonatal deaths, and 50% infant deaths occur among low birth weight babies. Singh.

In the United States, the neonatal mortality accounts for almost two-thirds of infant deaths. Infants who are born light are at increased risk of neonatal and infant death.
Menihan, Phipps and Weitzen\textsuperscript{43} used a case control design to compare infants who died of sudden infant death syndrome (cases) with controls who did not. The two groups were matched by date of birth. It was found that low birth weight below 2000 or between 2000-2200g were significantly associated with infants who died of sudden infant death syndrome (p<0.05).

The predominant cause of early neonatal deaths was reported as prematurity (33%), asphyxia (24%) and low birth weight (13%).\textsuperscript{44}

Almost 15\% of neonatal deaths were caused by prematurity (<32 weeks gestation)\textsuperscript{45} and 16.8\% of neonatal deaths were caused by prematurity (<34 weeks gestation).\textsuperscript{46}

While analyzing the observational data to estimate population attributable risks, Bang et al\textsuperscript{47} concluded that most neonatal deaths occurred due to combination of preterm or intra-uterine growth restriction with other co-morbidities.

11.3\% from mild risk group, 14.08\% from moderate risk and 20\% from high risk group.

Among medical disorders which affect the entire child bearing period and endanger the life of the mother, fetus and neonate include \textit{anaemia, hypertensive disorders of pregnancy and diabetes.} These disorders during pregnancy have been associated with perinatal mortality. Perinatal deaths increase among these high risk group of women due to hypoxia, intrauterine growth restriction, prematurity and infections.\textsuperscript{(14p605)}

Thus there is need to identify such high risk pregnant women early in the prenatal course so that their pregnancy outcome is improved.

\textbf{Anaemia in pregnancy} is the most common haematological disorder. It is the reduction in the oxygen carrying capacity of the blood, which may be due to a reduced number of red blood cells or a low concentration of haemoglobin; or a combination of both.

According to a standard laid down by WHO, anaemia in pregnancy is present when the haemoglobin concentration in peripheral blood is 11g\% or less. However, because of haemodilution and socio-economic deprivation in developing countries, the level is brought down to 10g\%. The incidence of anaemia in pregnancy ranges from 40-80\% in the tropics compared to 10-20\% in the developed countries.\textsuperscript{14}
Anaemia is the commonest condition prevalent in most parts of world. Iron deficiency anaemia (IDA) is the most common form of malnutrition in the world and is the 8th leading cause of disease in women in developing countries.  

In India, the prevalence of iron deficiency anaemia (IDA) is perhaps highest in the world and includes 50% adult women and 80% pregnant women.  

Iron deficiency anaemia (IDA), a common complication associated with pregnancy causes a major health concern in developing world due to maternal mortality. According to WHO around 5,00,000 maternal deaths per year and 20,000,000 morbidity cases per year are attributed to iron deficiency anaemia. About 84% pregnant women are anaemic in India.  

Bhatia reported that anaemia in pregnancy has its roots in adolescence and may even be much earlier. An adult menstruating female looses about 50-80ml of blood during normal menstrual period; loss of each ml of blood leads to loss of 0.5mg of iron from the body, there she needs to absorb 2.0 mg of iron from food every day. The burden of pregnancy increases the prevalence of anaemia. There is also decrease in iron absorption during pregnancy due to decreased secretion of hydrochloric acid in the stomach.  

Low haemoglobin status (below 25th percentile i.e below 10.5gm)is associated with low birth weight of 16.7%.  

Kalaivani et al reported that prevalence of anaemia in India is higher among pregnant women. Even among higher income educated segments of population, about 30% of pregnant women were anaemic. Major factors responsible for anaemia included inadequate dietary iron, folate, low vegetable consumption, low vitamin B12intake and poor bioavailability of dietary iron from fibre. Indian diets are found responsible for high prevalence of anaemia and causes 40% of maternal deaths. There is 8-10 fold increase in maternal mortality rate when haemoglobin falls below 5g/dl. Maternal anaemia is also associated with poor intra uterine growth of fetus and increased risk of preterm birth and low birth weight rates. This in turn results in higher morbidity and mortality and higher infant mortality rate. A doubling of low birth weight rate and 2-3 fold increase in the perinatal mortality rates is seen when haemoglobin is less than 8g/dl. Intra uterine growth retardation and low birth weight inevitably leads to poor growth in infancy, childhood and adolescence and also contributes to low adult height.
Parental height and weight are determinants of intrauterine growth and birth weight. Thus maternal anaemia contributes to integration cycle of poor growth in offspring. Early detection and effective management of anaemia in pregnancy can lead to substantial reduction in undernutrition in childhood, adolescence and improvement in adult height.

Kumar stated that about two-thirds of pregnant women (65%) in India receive iron and folic acid tablets but only one-fourth consume them for the recommended period of 90 days thus there is need to educate and encourage pregnant women for intake of iron and folic acid during pregnancy.

Hypertension complicating pregnancy is one of the commonest disorders of pregnancy and is a leading cause of maternal and infant morbidity and mortality and contributes significantly to intra-uterine fetal growth retardation and death due to placental insufficiency and abruption placentae.

Hypertensive disorders of pregnancy greatly contribute to maternal and perinatal morbidity and mortality. It is estimated that hypertension complicates approximately 7% to 10% of all pregnancies. The prevalence is increased to as many as 20% to 40% of pregnancies in women with chronic renal disease, essential hypertension, diabetes mellitus etc.

Hypertension is defined as an elevation of systolic and diastolic pressures equal to or exceeding 140/90 mmHg. It is also termed as rise in systolic pressure of 30 mmHg or rise in diastolic pressure of 15 mmHg above the women’s baseline values. Bobak et al.

Hypertension is a sign of underlying pathology which may be pre-existing or appears for the first time during pregnancy and is one of the maternal factors that may complicate pregnancy and its outcome.

Maternal hypertension during pregnancy is well known to result in low birth weight. Due to reduced placental function, it can result in low birth weight, increased incidence of hypoxia in the antenatal and intra-natal period, intra-uterine death, preterm birth etc if disease worsens and needs emergency delivery. Thus the identification of this clinical entity and effective management play a significant role in the outcome of pregnancy, both for the mother and the baby.
Ross et al\textsuperscript{59} did a population-based cohort study to compare the risk factors for preeclampsia and gestational hypertension. They reported that preeclampsia affects 3 to 5 percent of pregnant women, initiated already during critical process of implantation and placentation shortly after conception. Clinical manifestation of preeclampsia such as hypertension and fetal distress results in medically induced preterm delivery.

Gupta et al\textsuperscript{60} conducted a study on pregnant women with hypertension to detect fetal growth at two tertiary care centers in India. The study revealed that the babies were born with reduced birth weight which he reported occur due to decreased placental circulation and insufficiency, depriving the fetus of essential nutrients.

Kuklina et al\textsuperscript{61} conducted a study in United States and reported that hypertensive disorders were directly related to severe obstetric morbidity. It was found that these women had higher ratio of complications such as antepartum haemorrhage, eclampsia, premature labour and caesarean delivery. The preterm neonates being asphyxiated and low birth weight had higher morbidity rates.

Vigil\textsuperscript{62} studied perinatal outcome in 154 women with severe chronic hypertension during the first half of pregnancy at Vietnam. They reported that 78\% women developed severe preeclampsia with mean weeks of 34.4±4.6 weeks. The average birth weight was 2329±10.11gm, 4 mothers had still birth, and there were 6 neonatal deaths which resulted in perinatal mortality of 11.4\% . 38 babies were admitted in NICU with average stay of 14.8 days. The study revealed that preterm deliveries and caesarean sections were common in severe preeclampsia, thus it was concluded that midwives care is important in prevention of complications in hypertensive pregnant mothers and keeping blood pressure under control in all pregnant women.

Diabetes Mellitus complicating pregnancy is another common risk factor contributing to perinatal, neonatal and infant morbidity and mortality. About 1-14 percent of all pregnancies are complicated by diabetes mellitus and 90 percent of them are gestational diabetes mellitus (GDM). Nearly 50\% of women with GDM will become overt diabetes (type-II) over a period of 5-20 years.\textsuperscript{14}

Diabetes is a systematic disorder of carbohydrate, protein and fat metabolism, characterized by hyperglycaemia. In mothers who experience vascular changes as a result of diabetic complication, there may be compromised utero-placental circulation. This
decreases the amount of oxygen available to the fetus and may contribute to intra-uterine growth retardation, small for gestational age and low birth weight. Preterm birth is related to fetal hypoxia. The maternal mortality rate is approximately 0.5%, however this rate is still five times that of non-diabetic pregnancies.

Diabetes is one of the commonest medical complications of pregnancy. It could antedate pregnancy or be identified for the first time during pregnancy when it is termed gestational diabetes mellitus (GDM). Sathya defined gestational diabetes as a condition when women who have fasting plasma glucose (FPG) ≥ 92 mg/dl but <126 mg/dl at any gestational age; glucose tolerance test (GTT) at 24-28 weeks—with at least one abnormal value: FPG ≥ 92 mg/dl but < 126 mg/dl One hour ≥ 180 mg/dl or two hour ≥ 153mg/dl

Diabetes in pregnancy is unique because of the diversity of problems that can affect the embryo/fetus beginning with conception. Maternal glucose control has been identified as an important event. The preponderance of evidence indicates that rigid glucose control will minimize the incidence of anomalies incurred before 9 weeks of pregnancy. Later events are related to fetal hyperinsulinemia. These include fetal macrosomia, respiratory distress syndrome, neonatal hypoglycemia, neonatal hypocalcemia, and neonatal hypomagnesaemia. Control of maternal metabolism can have a significant impact on each of the above. Finally, the long-term effects of maternal diabetes are as diverse as the pathogenetic events during pregnancy. Surprisingly, there is a significant transmission rate of 2% of type I diabetes if the mother was insulin-dependent diabetic, whereas the rate is 6% for the father. The Diabetes in Early Pregnancy Study showed that good maternal control was associated with normal neurodevelopmental outcome.

The prevalence of both obesity and gestational diabetes mellitus (GDM) is rising worldwide. The complications of diabetes affecting the mother include preterm labor, pre-eclampsia, nephropathy, birth trauma, caesarean section, and postoperative wound complications etc. Fetal complications include fetal wastage from early pregnancy loss or congenital anomalies, macrosomia, shoulder dystocia, stillbirth, growth restriction, and hypoglycaemia etc. The presence of obesity among diabetic patients compounds this complications.
As India is fast catching up with China to become the diabetic capital of the world, thrust is now on universal early testing in our populations at the first prenatal visit. Diabetes in Pregnancy Study Group India (DIPSI) has also suggested cost effective method of screening in resource-challenged communities. GDM offers an excellent opportunity for primary prevention of diabetes, as the mothers are at increased risk of future diabetes, predominantly type 2 diabetes, as are their children.64

Gestational programming is a process whereby stimuli or stresses occurring at critical or sensitive periods of fetal development, permanently change structure, physiology, and metabolism, which predisposes individuals to disease in adult life. If the stimulus happens to be glucose intolerance in pregnancy, it predisposes the offspring to an increased risk of developing glucose intolerance in the future. This vicious cycle is likely to influence and perpetuate the incidence and prevalence of glucose intolerance in any population.66

Fetuses exposed to a high glucose environment have other medical complications after delivery, including infant respiratory distress syndrome, cardiomyopathy, hypoglycaemia, hypocalcaemia, hypomagnesaemia, polycythemia and hyperviscosity.67 After birth, the high glucose disappears in infants, but they often have life-long increased risk of glucose intolerance and obesity.63

Yogev and Visser68 reported that children born to mothers with gestational diabetes have increased risk of early obesity, type-2 diabetes during adolescence and metabolic syndrome.

Pregestational diabetes is associated with more serious consequences for the fetus than the diabetes in second or third trimester of pregnancy.69 Women with pregestational diabetes who become pregnant are at increased risk of giving birth to a baby with a serious birth defect including cardiac, neurological and vascular.70

In Nigeria, UK, Olusanya etal71 found that birth outcome in subsequent pregnancies was effected by gestational diabetes including other factors such a previous pregnancy outcome, prematurity, short birth interval, antenatal check-ups, , smoking habits in pregnancies and indicated higher incidence of low birth weight.
Gestational diabetes mellitus is characterised by glucose intolerance of variable severity that begins or is first diagnosed during pregnancy and usually resolves not long after delivery. Though in most cases, diabetes disappears after delivery, recent research has shown that the number of women with the condition who go on to get full blown diabetes is increasing. Around 25% cases get type 2 diabetes within 15 years. Indians are in the high risk group.

An accurate estimation of the global incidence of gestational diabetes in many countries does not exist because of the lack of uniform standards in glucose tolerance testing around the world. Gestational diabetes is more frequent in certain ethnic groups than in general population. Dornhorst et al measured frequency of gestational diabetes in 11205 women consecutively attending a multiracial antenatal clinic in UK, and 0.4% white, 1.5% African, 3.5-7.3% Asian, 4.4% Indian, and about 1.4% mixed origin women were shown to have gestational diabetes. The rate of gestational diabetes was also shown to be 5-10 times higher in pregnant Asian women than in white women.

Gestational diabetes mellitus is a substantial and growing health concern. It has serious, long term consequences for both baby and mother. Early detection and intervention can greatly improve outcomes for women with this condition and their babies.

Although diabetes in pregnancy has previously been regarded as benign, some studies have recently reported that the consequences of not treating gestational diabetes causes increased perinatal morbidity associated with hyperglycaemia in pregnancy. Fortunately these complications seem to be lessened and outcome for women with this condition and her baby improved by screening, early detection and management of this condition.

Favourable outcome of diabetic pregnancy requires multidisciplinary approach involving the obstetrician, endocrinologist, neonatologist, nurse, nutritionist and social worker with commitment and active participation by the woman. Her compliance to frequent prenatal visits, strict adherence to dietary regimen, regular self monitoring of blood glucose level, frequent laboratory evaluation and intensive fetal surveillance helps in improvement in her pregnancy outcome. Therefore, preventive measures against type 2 diabetes should start during the intrauterine period and continue from early childhood throughout life. In this respect, detection of gestational diabetes mellitus (GDM), defined as carbohydrate
intolerance of variable severity with onset or first recognition during the present pregnancy becomes an important public health issue.

Greco et al\textsuperscript{76} reported that gestational diabetes is a major risk factor to affect the pregnancy outcome. Women need to be identified and screened by making them to have plasma tests done for glucose levels at fasting, post prandial and glucose tolerance. Detected cases of diabetics should be provided with verbal and written information about hygiene, diet, weight reduction, exercise, regular monitoring of blood sugar, weight, blood pressure and fetal monitoring.

Blackwell\textsuperscript{77} reported the effect of new guidelines on gestational diabetes. The exercise, controlled diet and insulin improved the outcome.

Growther et al\textsuperscript{78} reported that the early detection, prompt treatment of gestational diabetes with modified diet and weight control improves the pregnancy outcome.

Hare\textsuperscript{79} reported that pregnant women with diabetes need to undergo screening, early detection and management of this condition, regular checkups to have watch on their glycaemia levels. Regular blood and urine glucose monitoring are the major management goals to prevent from diabetic complications to her and her growing fetus. In the long run, it has improved the neonatal and infant outcome.

In a case control study of maternal recreational physical activity and risk of gestational diabetes, Dempsey et al\textsuperscript{80} reported that the risk got reduced by 49- 78\% in mothers who climb stairs daily than those who do not. The risk was also found reduced depending on the number of hours spends performing recreation, distance walked, pace of walking and energy expended.

Qadir\textsuperscript{16} while analysing determinants of infant mortality in Kashmir Valley reported that out of 41.1\% infants who were born to mothers with anaemia during pregnancy have resulted in infant mortality rate (IMR) of 65.6/1000 live births which was higher as compared to IMR of 25.6/1000 among infants born to non-anaemic mothers (58.9\%). Similarly IMR was 515.5/1000 live births among infants born to pre-eclamptic mothers and 181.8/1000 live births among infants born to diabetic mothers which was comparatively higher than infants born to non-pre-eclamptic and non-diabetic mothers.
In a study conducted to evaluate perinatal care among 100 high risk mothers in a selected hospital of Belgaum (Karnataka), Raddi\textsuperscript{81} found that among high risk mothers, 90% had anaemia, 30% had pregnancy induced hypertension and other risks included vaginal bleeding, cephalo-pelvic disproportion and previous LSCS. Preterm delivery was revealed in 14%, and neonatal admissions in NICU in 23%.

She also reported that 71% mothers did not receive adequate perinatal care even though they attended antenatal clinic and were not informed about simple measures to prevent high risk conditions like importance of rest and sleep, resting mostly in left lateral position, early admission for care, keeping watch on fetal wellbeing, prior arrangement for emergency transportation and finance, and information about admission of baby in neonatal intensive care unit (NICU) if required.

The pregnancy outcome in high risk mothers could be improved by providing adequate prenatal care in terms of health education for early detection of risks and preventing complications.

\textbf{Figure 1}  \hspace{1cm} Effects of risk factors of pregnancy on its outcome as low birth weight
1.2) NEED OF THE STUDY

Fetus grows at the cost of mother and a healthy mother can yield healthy baby. Any interruption in the normal progress due to malnourishment, anaemia or other factors, cause a threat to the unborn fetus who may become victim of prematurity, intra-uterine growth restriction and low birth weight.

About two thirds of the neonatal deaths are related to prematurity and majority of these deaths occur within 48 hours of birth. Neonatal mortality rate varies from 53/1000 live births for the least developed countries to about 5/1000 live births for the developed countries. In India about 50-60% of infant deaths occur within the neonatal period (first 28 days). Of these, more than half may die during the first week of birth, first 24 hours being the time of greatest risk. As the high concentration of neonatal deaths occur in early neonatal period, thus there is need to improve the antenatal care.

By reducing the birth of low birth weight infants, the health of infant improves. Although life saving techniques after birth have been perfected which has given low birth infants a better chance of survival, the number of low birth weight and preterm infants has not decreased. For decrease to occur, the risk factors associated with low birth weight and preterm birth must be reduced too.

It was found that low birth weight babies are at higher risk of early neonatal complications like birth asphyxia, sepsis, respiratory complications, intracranial haemorrhage with poor survival rate.

Low birth weight babies who are born before term are more prone to morbidities and neonatal risks. Anna reported that some of the disabilities persist in later life too in low birth weight.

Low birth weight is one of the predominant causes of neonatal death. These infants are deprived of early breast feeding as they are usually isolated from mother to get intensive care in hospital thus neonatal morbidity and mortality is seen high in these babies. 22% of all neonatal deaths can be reduced by early breast feeding. Edmound.

Alistair while studying neonatal mortality rate, reported 47% of all neonatal deaths and 65% of deaths were found in extremely low birth weight infants within first 24 hours of
life. Low weight at birth has been associated with increase in adult life morbidity, including cardiovascular disease and diabetes. Huxley et al.\textsuperscript{89}

Chaturvedi et al.\textsuperscript{90} conducted a study to see mortality trends of hospital admissions in a rural medical college hospital and revealed the prematurity as leading cause of neonatal mortality.

Bhavan and Raislay\textsuperscript{91} carried out an effectiveness trial aimed at assessing the impact of a package of home based intervention by appropriate trained village level worker to reduce neonatal mortality in different states of India viz Bihar, Rajashtan, Orissa, Maharashtra. They found that neonatal mortality constituted around 70\% of all infant deaths occurring in first day of life, about 21.5-39.5\% deaths in first 3 days and 70-80\% in first week of life. Prematurity and low birth weight was the predominant cause of neonatal mortality revealed in this study during first day of life.

Horbar\textsuperscript{92} studied trends in morbidity and mortality for every low birth weight infant between 1991-1999 and revealed that these babies were at greater risk of morbidity in early neonatal period, with increase in neonatal mortality, infant mortality and childhood mortality.

Low birth weight babies developed life threatening intra-ventricular haemorrhage, metabolic disorders, electrolyte and acid base balance disorders, haematological changes, jaundice and kernicterus.\textsuperscript{93}

Low birth weight babies are prone to get thermal instability due to poor insulation, paucity of fat and large surface area and they succumb to infection due to ineffective immunological responses. Respiratory abnormalities are a major cause of death in these tiny babies.\textsuperscript{94}

According to Park\textsuperscript{4} low birth weight is the single most important factor determining the survival chances of the child. The infant mortality rate is about 20 times greater for all low birth weight babies than other babies. Many of them become victims of protein-energy malnutrition and infection.

Low birth weight is one of the most serious challenges in maternal and child health in both developed and developing countries. Its public health significance may be ascribed to numerous factors viz its high incidence; its association with mental retardation and a
high risk of perinatal and infant mortality and morbidity; human wastage and suffering; the very high cost of special care and intensive care units; and its association with socio-economic underdevelopment.\textsuperscript{94}

Retinopathy of prematurity continues to be one of the most common morbidities in infants born before 26-30 weeks of gestation or born with very low birth weight. At least 30\% of preterm and under weight babies are at risk of developing blindness especially babies born at or before 32 weeks and babies who weigh below 1.6 kilograms.\textsuperscript{95}

Pradeep et al\textsuperscript{96} studied the primary causes of perinatal mortality and their relationship to birth weight, gestational weight and antenatal care in Medical College Hospital, Kottayam. They found that more than 85\% of the deaths occurred in low birth weight and preterm babies.

In a comparative study of four western countries, Saigal et al\textsuperscript{97} reported school outcomes in children who were extremely low birth weight. They found that cognitive and school difficulties were identified in all four cohorts. They showed that 72\% of adolescents who had less than 75g birth weight, 53\% who had birth weight between 75-1000g, and 13\% of controls who had normal birth weight had school difficulties. These difficulties were apparent even in children without neurosensory impairments and normal intelligence quotient. Their parents reported difficulties such as attention deficit and hyperactivity disorder.

Hack et al\textsuperscript{98} and Lefebvre et al\textsuperscript{99} identified that the cognitive disadvantage between very low birth weight and extremely low birth weight infants seem to persist into late adolescence and early adulthood. Their parents during their adulthood reported more difficulties than parents of control young adults born with normal birth weight. They further reported that very low birth weight adults had lower rates of educational achievements, employment and independent living.

Botting et al\textsuperscript{100} reported a higher prevalence of anxiety and depression as perceived by very low birth weight 12- year olds than those by controls who were born with normal birth weight.
In Sri Lanka, Choudhury\textsuperscript{101} has found that 22\% of infant deaths are due to low birth weight which were found associated with malnourishment, prematurity, intra uterine growth restriction and small for date babies.

Doyle etal\textsuperscript{102} reported more hospital readmissions and other health problems in neonatal period and in the first 1-2 years of life in children born with low birth weight. In late childhood they had greater needs for services such as physician’s visits, occupational or physical therapy, nursing or medical procedures and compensatory dependency than did children of normal birth weight. They further reported use of hearing aids by 5\% of low birth weight infants.

The infants born with low birth weight had lower growth attainment in weight and height than their normal birth weight counterparts during infancy and early childhood.\textsuperscript{103}

The growth failure during infancy followed by accelerated weight gain and crossing of BMI percentiles at adolescence can place the extremely low birth weight group at high risk for later cardiovascular diseases and type 2 diabetes.\textsuperscript{104}

Johansson\textsuperscript{105} used Swedish population based data by including four studies to study etiology and short and long term outcomes of very preterm birth. He identified 269 cases of pregnant women with very preterm birth and 301 controls with term delivery. During 1992-1998, 2,253 live born singleton infants were born very preterm whose infant mortality rates increased by decreasing gestational age and were found to be from 5\% at 31 weeks to 56\% at 24 weeks. He further reported from a cohort of 18,230 Swedish twins that rates of type 2 diabetes increased with decreasing birth weight. Twins with birth weight less than 2,000 grams had a two fold increase in the risk of type 2 diabetes than twins with birth weight from 2,500 to 2,999 grams When birth weight was used as a continuous measure, a 500 gram decrease in birth weight was associated with a 44 \% increase in risk.

Singer etal\textsuperscript{106} reported effects of low birth weight baby on the family stress. The parenting stress remained greater than for normal birth weight infants. Higher effect was associated with low family income, less parental education, and the severity of the child’s functional handicap.
Mori et al\textsuperscript{107} did a population based study of all low birth weight infants admitted to neonatal units in one region in Japan to predict their prognosis from Apgar score. It was found that a score of less than 5 at 5 minute appears to be a good predictor of neonatal mortality in infants with a birth weight between 1500g and 2499g (OR=17.59 at 95% CI).

Melamed et al\textsuperscript{108} did a retrospective study on all spontaneous, low-risk late preterm deliveries. Their short-term neonatal outcome was compared with a control group of full term deliveries in a 3:1 ratio (n=7434). They were found to be associated with an increased risk of neonatal morbidity, including hospitalization for more than 7 days (18.7% vs 1.9%, p<0.001), admission to NICU (19.7% vs 2.8%, p<0.001), respiratory distress syndrome (4.2% vs 0.1%, p<0.001), intraventricular haemorrhage (0.2% vs 0.02%, p<0.001), hypoglycaemia (6.8% vs 0.4%, p<0.001), and jaundice requiring phototherapy (18% vs 2.5%, p<0.001).

Joann et al\textsuperscript{109} conducted a study in California on children who were born preterm and have reported increased risk of cerebral palsy, developmental delay, mental retardation and seizure disorder in childhood for infants who were born at 34–36 weeks and risks increase with decrease in gestational age.

Norman\textsuperscript{110} did a systematic review of low birth weight infants which was revealed as a risk factor for hypertension, stroke and coronary artery disease in adults. Low birth weight baby born due to poor fetal growth or preterm result in different patterns of altered development of vascular system which becomes evident in infancy.

Infants who are born light are at increased risk of neonatal and infant death. Low weight at birth has been associated with increase in adult life morbidity, including cardiovascular disease and diabetes. Low offspring birth weight has also been associated with increased paternal and maternal morbidity.\textsuperscript{111}

Eilertsen et al\textsuperscript{112} made a case control study on women who were born preterm. They reported that 7.1% women developed diabetes and polycystic ovarian syndrome.

From above studies, it is clear that low birth weight causes mortality and morbidity among babies and also problems during adulthood. The birth of a healthy, full term infant is the hope of all prospective parents. The preterm birth and low birth weight which carries an increased risk of infant death and often both medical and financial
complications, is on the rise. Nursing Center\textsuperscript{113} recommended research directions for nurses to enhance delivery of a full term baby with normal birth weight which included educating before they plan pregnancy, supplementation of folic acid, vitamin C and E, intake of fresh fruits and vegetables, avoiding smoking, keeping record of menstrual period, get acquainted with signs of premature labour.

Low birth weight could be reduced if key interventions are applied during antenatal period. Antenatal care to women during pregnancy includes preventive services, risk approach, prenatal advice, specific health protection, mother-craft class for psychological preparation etc (48p572); thus there is a need for prevention program of low birth weight, which could be applied during antenatal period.

Generally for any gestational age, the lower the infant birth weight, the higher the neonatal mortality. Infant death rate drops steeply with increased birth weight. (48p572) Thus any program which aims to reduce incidence of low birth weight and which emphasize on high quality prenatal care for pregnant women with risks would go a long way in reducing perinatal and neonatal mortality.

Therefore screening and identifying high risk factors responsible for low birth weight and prematurity has become a high priority. Once the pregnant woman with high risk is identified, she needs comprehensive antenatal care, so the appropriate interventions can be instituted to prevent low birth weight. It is therefore imperative to implement and evaluate a low birth weight prevention program (LBWPP) to reduce the incidence of low birth weight babies because baby has every right to be born alive, safe and healthy.

Interventional programs conducted, have shown improvement in neonatal outcome. Committee of health promotion and disease prevention has focused on prevention of low birth weight. They have found that birth weight improves if prenatal care is supported with special related programs that go beyond routine services. These include flexible combination of educational and nutritional services and certain clinical interventions and home-care packages. Such studies have been conducted by many nurse and medical researchers. Bobak et al\textsuperscript{63} suggested that providing safe and effective care for the high risk pregnant women requires a joint effort from all members of health care team, with each member contributing unique skills and talents to provide optimum outcomes for mother and infant.
Prabha et al\textsuperscript{114} had conducted a study to find out the effect of antenatal care on maternal and fetal outcome. It was found that antenatal care was influenced by the literacy level and socio-economic status of women. The mothers with less formal education and low socio-economic status had poor perinatal outcome than mothers with high education and better socio-economic conditions (p<0.001). Thus there is need for vigilant antenatal care for all pregnant women.

Heater\textsuperscript{115} made a meta-analysis of nursing research studies and found that patient outcome were better in experimental group who were given nursing intervention as compared to the group who received routine care.

Grohar\textsuperscript{116} described nursing protocols for ante-partum home care. She reported that the knowledge of giving information about high risk factors and preventive measures, communication and collaboration skills were found important aspects of antenatal care in reducing complications in mother and fetus. She also suggested teaching on dietary habits, exercise, rest, and follow up as primary prevention of complications.

Stephie\textsuperscript{117} carried out a study to find out the effect of exercise during pregnancy on edema, placental perfusion and uterine cramping. The exercises recommended by physicians improve blood pressure and mood swings and lead to healthy pregnancy period. She further reported that exercise increases the placental perfusion, uterine cramping, and causes relaxation of pelvic muscles, improves tonicity of pelvic floor and helps in easy labour with less complications.

Maria\textsuperscript{118} assessed antenatal evaluation of the fetus by fetal movement monitoring and indicated that ‘count to 10’ fetal kick chart by ABCDE (A=0-15 mts, B=16-30 mts, C=31-45 mts, D=46-60 mts and E=.>60 mts) criteria helps to detect fetal distress early than just prescribing the fetal kick count chart. She recommended that woman should be asked to count fetal movements till she gets 10 kicks and note the time taken for these 10 kicks; if time taken is less than 15 minutes or exceeds 60 minutes, she needs to report immediately.

Studies have shown that promotion of antenatal health by prenatal education, free discussion, assurance, social support, supplementations etc. increases the self awareness, reduces stress, and helps to modify behaviour and prevent from birth of reduced weight babies.\textsuperscript{119}
Gupta and Gupta\textsuperscript{120} have advised for multidisciplinary approach during comprehensive review of heart diseases in pregnancy. They have stressed on recognition of risk factors, early diagnosis, close obstetrical and medical surveillance, prompt identification and treatment of complications, use of drugs, collaborative and coordinated care of women, education by midwives regarding rest, diet, proper sleep, stress reduction and behaviour changes so to reduce the rates of preterm babies.

Alexander and Kotelchuck\textsuperscript{121} assessed the role and effectiveness of prenatal care by studying its challenges and directions for future research. They emphasized that prenatal care has proven very effective in making the women knowledgeable about pregnancy, diet, immunization, fluids etc but women need to know about the growth and development of fetus and associated risks of pregnancy in order to be well prepared to go under timely intervention and receive a healthy child.

All-Nsour\textsuperscript{122} conducted a historical prospective study of 260 pregnant women with 28 weeks gestation or more who attended Al-Bashir Hospital, Iran for delivery. Structured home visits and telephone inquiries/interview were conducted for each pregnant woman to collect information about risk factors that occurred during antepartum period. Based on this information, mothers were assigned to a high risk or low risk group using antepartum risk evaluation forms. The prevalence of high risk pregnancies was 28.1\% and there was significant association of high risk pregnancy with neonatal low birth weight, low Apgar score, frequent admission to neonatal intensive care unit and prolonged stay over there. Neonatal mortality rate was 72.4/1000 of total live births.

Goldstein\textsuperscript{123} demonstrated that outcome of people’s health can be improved with the appropriate measures which can also produce real, long-term cost saving results. In a quarterly issue of preventive health, they added that prevention of premature and low birth weight babies saves lives and money, thus preventive medicine programs like ‘birth wait’ are perfect examples of the improved outcome and significant cost savings that can be achieved through identifying at risk populations and then engage them in community based programs that improve outcomes and utilization through one to one-interaction.

Bull etal\textsuperscript{124} did a study on prevention of low birth weight by assessing the effectiveness of smoking cessation and nutritional interventions. These interventions were part of antenatal care which was found more effective. Intensive interventions were needed in
heavy addicts. There was increase in birth weight of babies among pregnant women who quit smoking as a result of intervention.

**An interdisciplinary committee set by the UN Institute of Medicine**\(^{125}\) reported reduction in infant mortality and improved child health as a result of impact of special program offering prenatal care and related services on pregnancy outcome. It was found that prenatal care was most effective in reducing the chance of LBW among high risk women.

Greater numbers of pregnant women are at risk for poor pregnancy outcome. The prenatal period is a preparatory one, both physically in terms of fetal growth and maternal adaptations and psychologically in terms of anticipation of parenthood. Regular prenatal visits ideally beginning soon after the missed menstrual period offer opportunities to ensure the positive health of the expectant mother and her infant. Prenatal health supervision permits diagnosis and treatment of maternal disorders that may have pre-existed or may develop during the pregnancy.\(^{48}\)

It is revealed from the studies that the major contributor in two thirds of all infant deaths is low birth weight\(^{47}\) and there is strong association of high risk pregnancies with high incidence of adverse maternal and neonatal outcomes. The most promising measure for preventing low birth weight is to provide high quality prenatal care to all women. It is recommended in the studies that the health education for the mothers during pregnancy, including risk scoring system in clinical area, effective referral system, prenatal counseling and educating for hospital delivery etc. has proved beneficial in improvement of pregnancy outcome. Improved access to prenatal care has been regarded as a way to reduce prematurity and low birth weight rates. An important component of the quality antenatal care is appropriate, individualized nutritional and antenatal counseling for the pregnant women.\(^{63}\)

Maternal nutrition is one of the most important factors which influence the course of pregnancy. The growth of fetal tissues, products of conception and the metabolic alterations in pregnancy impose great stress and results in an increase of nutritional requirements in a pregnant mother. The adverse outcome of pregnancy is influenced by presence of high risk factor/s and her poor nutritional status as it affects the maternal weight which is a major indictor of birth weight.\(^{126}\)
Infants who weigh less than 2.5Kg at birth represent about 28% of all live births in India. More than half of these are born at term. As birth weight is conditioned by the health and nutritional status of the mother, the percentage of infants born with a low birth weight closely reflects the health status of the communities in which they are born.

Pregnancy is an especially good time to promote good nutrition, since most expectant women are highly motivated to change poor eating habits. Dietary counseling during pregnancy should focus on improving the quality of woman’s overall dietary intake and avoiding unnecessary weight gain, which could pose health risks to the mother in later life. The effects of under-nutrition on fetal development should be pointed out to the mother. This counselling should include information on the components of the recommended gain in weight. Much valuable information can be given by providing women with written pamphlets (information).

The importance of nutrition in a successful pregnancy was first realized during World War II when the parts of the Europe were blockaded and food supplies were depleted. The under-nutrition that occurred greatly affected the birth weight of infants whose mothers were in the second and third trimesters at the time of blockade. After the blockade was lifted, birth weights increased. It appeared that good maternal nutrition, not only during pregnancy but also before conception, affected both the mother’s and infant’s health.

There is mounting evidence that the addition of even a small amount of extra food by way of supplementation to the mother’s basic diet goes a long way in improving the birth weight of babies. In a controlled study in India, poor women were fed an additional 500 K Cal and 10g of protein during the last 4 weeks of pregnancy. Their infants birth weight were on an average 300g above those infants born to control group. Henrickson conducted a study on effect of pregnancy education and nutrition on pregnancy outcome. He indicated that the adequacy of nutrition was one of the influential factor to affect maternal and fetal health and advocated that if birth weight of baby is to be improved, women needs to increase her intake of adequate and balanced diet and adhere to the healthy practices of rest, sleep, relaxation and self-monitoring.

Adequate nutrition is recommended during pregnancy because it influences the pregnancy outcome. According to National Academy of Sciences, good maternal
nutrition and the importance of promoting healthful eating practices during pregnancy is utmost important to improve birth weight of baby by improving maternal weight and fetal growth. During gestation, nutrients are needed in greater amount and these nutrient needs are more qualitative than quantitative during the first trimester whereas last trimester of pregnancy is the period when most fetal growth occurs and nutrient needs have to be more qualitative and quantitative.

WHO\textsuperscript{130} recommends routine oral supplementation of 60mg elemental iron plus 400mcg folic acid daily for 6 months during pregnancy in areas where the prevalence of anaemia in pregnancy is <40%. In areas where the prevalence of anaemia in pregnancy is >40%, it recommends the same dosage for 6 months and continuing for 3 months postpartum.

Wise and Arcamone\textsuperscript{131} made a survey of adolescent views of healthy eating during pregnancy and the views were that nurses should find creative ways to teach healthy eating to pregnant women especially adolescents (<20 years) because their nutritional status can affect their pregnancy outcome. The babies will grow well when mother is nourished well. They further suggested that nurses are ideally positioned to provide prenatal nutritional education and they should find creative ways to teach them healthy eating.

Montgomery\textsuperscript{132} indicated that it is improvement of nutrition in pregnant adolescents to bring out fruitful pregnancy outcome in the form of full term infant with normal birth weight, and bringing less complications to mother.

Bhatnagar\textsuperscript{133} stated that improvement of socio economic status, avoiding teenage pregnancy, educating about health and safe pregnancy, early detection of high risk cases, adequate and timely management of complications, adequate facilities of antenatal, intranatal and neonatal care is seen to improve neonatal outcome

Major \textit{etal}\textsuperscript{134} reported that women who receive nutrition counseling and follow a diet that adequately meets the needs of their pregnancy by restricting carbohydrates to 35-40% of daily calories decreases maternal glucose concentration and maternal and fetal outcomes.

Franz \textit{etal}\textsuperscript{135} revealed that carbohydrate restriction of 30-33 daily calories by diabetic pregnant obese women (BMI >30) keeps the body weight under control.
American College of Obstetrics and Gynæcology\textsuperscript{136} recommended that physical exercise during pregnancy is recognized as safe practice as long as its intensity, duration and frequency are tailored to the requirement of each pregnant women.

Arena and Maffulli\textsuperscript{137} reported that light to moderate exercise is recommended for all women even those with sedentary life style who wish to engage in some type of physical activity during pregnancy.

Wang, Thomas\textsuperscript{138} and Beth Lewis\textsuperscript{139} has shown the effect of exercise during pregnancy on maternal outcome. They indicated brisk walking, jogging, home maintenance, kaegle’s exercise and reported the safety of these exercises during pregnancy in reducing risks of weight gain, preeclampsia, gestational diabetes, duration of labour and rates of caesarean section.

Gribble, et al.\textsuperscript{140} while studying the value of urine screening for glucose at each prenatal visit reported that it is easy way to keep watch on pregnancy and make it safe from diabetic complications by detecting it early and by timely care of pregnant women.

Mathews\textsuperscript{141} recommended that traditional therapies which include bed rest, low calorie and low salt diet and sedation should be adopted for hypertension which had revealed improved maternal and fetal outcome by 80%.

Gites et al\textsuperscript{142} reported that in the obstetric centre of California, nurses use variety of skills like listening, educating, counseling, triaging and helping women to change their life style during pregnancy, providing complex teaching and educating over telephone in prevention of preterm birth and low birth weight. In addition, screening of high risk cases and home management of patients improved outcome.

Mc Farlin and Barbara\textsuperscript{143} have advised that puzzle of prematurity can very well be solved by nurses when they educate women before they plan pregnancy and about early prenatal care during their pregnancy period. They stressed on importance of diet, exercise and healthy environment for having healthy baby.

Bradt J, Dileoc\textsuperscript{144} revealed that listening to music has calming effect in reducing high BP and reducing stress in both healthy and sick individuals.
Marsh et al\textsuperscript{145} described use of pamphlets, group skills, training etc as counseling styles to promote health habits and change life styles including smoking, weight control, exercise, alcohol use, work safety and stress management.

The above studies indicate that low birth weight is a cause of concern so efforts and interventions need to be focussed on prevention of lowbirth weight. Various intervention programmes on high risk pregnant mothers during the antenatal period can result in improvement of neonatal outcome; as indicated in above studies. Preterm birth and low birth weight is preventable, if the pregnant woman is cared during the entire pregnancy with special focus on risky duration of pregnancy i.e. from 20\textsuperscript{th} to 36\textsuperscript{th} week, educated and informed individually or in groups and is being cared in close collaboration with obstetrician, endocrinologist, nephrologist, physician and nutritionist where she would be encouraged for regular checkups and timely reporting of any dangers. Researcher felt that there was a need to conduct a study to find out effectiveness of low birth weight prevention program on high risk pregnant women to improve their maternal and neonatal outcome.

Although a lot of studies, as indicated above, have been carried out to assess the impact of preventive antenatal intervention programmes on maternal and fetal/neonatal outcomes, but there was no such study which focused on comprehensive program/package, thus the researcher felt the need to conduct a study on high risk group of women and assess the impact of special prenatal program (low birth weight prevention program) on pregnancy outcome with special reference to Jammu and Kashmir (J&K).

Although Studies conducted in J&K have determined relationship of maternal risk factors with low birth weight and their morbidities and mortalities, yet no intervention has been carried out as a preventive measure. During the personal experience of the researcher and during clinical posting of students, it was found that high risk group of pregnant women need special attention during antenatal period and there was no systematic protocol, being followed in antenatal clinics to address the needs of pregnant women with risk factors. Thus there was a need to identify high risk pregnant women and implement low birth weight prevention program (LBWPP) which goes beyond the routine prenatal care. It included flexible combination of education, antenatal care and nutritional services, careful screening and assessment of medical and behaviour risks, information about low birth weight and home care package to reduce these risks.
The present study focused on development and implementation of a comprehensive interventional package including following components:-

1) Information about low birth weight (audio-visual supported documentary).

   i. Antenatal and dietary counselling.
   ii. Demonstrations (testing and monitoring of weight, blood pressure, blood sugar, pelvic exercises).
   iii. Home care package in the form of information booklet.

The birth weight of babies can be improved when a woman is given extra and special care which is more comprehensive than the routine care; there is every possibility for her to reach term. Support at home is an important factor which needs to be emphasized during low birth weight prevention program (LBWPP) thus researcher has decided to call their husbands or significant others and counsel them; give them an information booklet which would help them in taking daily care and care during critical period.
I.3) STATEMENT OF THE PROBLEM

“A Study to Assess the Effectiveness of Low Birth Weight Prevention Program on Maternal and Neonatal Outcome of High Risk Pregnant Women in a Selected Hospital Of Kashmir.”

I.4) OBJECTIVES

- To compare the maternal outcome of high risk pregnant women of experimental group with that of control group of high risk pregnant women.
- To compare the neonatal outcome of high risk pregnant women of experimental group with that of control group of high risk pregnant women.
- To correlate maternal and neonatal outcome with selected risk factors of pregnant women.
- To associate maternal outcome with socio-demographic factors of high risk pregnant women.
- To associate neonatal outcome with socio-demographic factors of high risk pregnant women.

I.5) HYPOTHESES

\( H_1 \). There is significant difference in the maternal outcome of experimental group as compared to control group of high risk pregnant women after implementation of LBW prevention program at 0.05 level of significance.

\( H_2 \). There is significant difference in the neonatal outcome of experimental group as compared to control group of high risk pregnant women after implementation of LBW prevention program at 0.05 level of significance.

\( H_3 \). There is significant correlation of maternal outcome with selected risk factors of pregnant women at 0.05 level of significance.

\( H_4 \). There is significant correlation of neonatal outcome with selected risk factors of pregnant women at 0.05 level of significance.
H₅. There is significant association between maternal outcome and selected socio-demographic characteristics of high risk pregnant women at 0.05 level of significance.

H₆. There is significant association between neonatal outcome and selected socio-demographic characteristics of high risk pregnant women at 0.05 level of significance.

I.6) CONCEPTUAL FRAMEWORK OF THE STUDY

The conceptual framework formalizes the thinking process so that others may read and know the frame of reference basic to the research problem. It is a structure/context in which concepts are inter-related to describe relationship. Dossey et al(147p83)

Nursing theories identify and define interrelated concepts important in nursing and clearly state the relationship between and among these concepts. Theoretical frameworks of nursing provide a focus for nursing care activities. Through theory a multitude of facts are organized into a meaningful whole. Taylor148

From the review of literature, several ideas and information were collected. These concepts were presented in a framework based on Sister Callista Roy’s Adaptation Model

Roy focuses on the individual as a bio psychosocial adaptive system that employs a feedback cycle of input (stimuli), throughput (control process), and output (behaviours or adaptive responses). Berman et al149

Her theory is based on the idea that it is necessary to adapt to stressors and to achieve health as a state of balance or homeostasis. Stimuli in the environment can be focal (the immediate situation i.e. pregnancy), contextual (other current stimuli like risk factors e.g. anaemia, hypertension and diabetes, age, weight, socio economic status, gravidity, exposure to smoke and nutritional status) and residual stimuli (which are unclear to her e.g. her knowledge deficit about low birth weight, her beliefs, attitude, perceptions, previous experience, role of others). Throughput is the control process or coping mechanisms.

According to Roy there are two coping mechanisms: Regulator mechanisms, working mainly through autonomic nervous system and prepare the mother to cope with pregnancy and risks. Cognator mechanism, when she becomes aware of her risk factors and makes adaptive responses, searches for coping and information, seeks antenatal care.
The high risk pregnant woman requires modification which is promoted through implementation of low birth weight prevention program. This in turn affects her adaptive modes and changes one or all of her adaptive modes. There is change in physiological mode in the form of taking rest, good sleep, relaxing, reducing physical activity, self-protection, taking well-nourished and therapeutic diet etc. Change in role function mode at home/community is determined by active participation in home decisions and development of better status, respect and value in family. Change in self-concept mode includes promotion of self-esteem and sense of worth which is evident from her responses. The interdependence mode is promoted as she relates herself with significant others (her family and husband) and care providers. Her interactions with husband and others is promoted. Her activity is shared and she participates in her care plan.

When she shows positive responses, she is said to achieve health and there is good effect on her output.

Low birth weight prevention program was implemented on one group (Experimental) whereas control group received routine antenatal care. The program was evaluated from output (maternal outcome during pregnancy and neonatal outcome during intra partum period and early neonatal period of first 24 hours).

Both groups were assessed for maternal and neonatal outcome. Maternal outcome was determined by gain in weight/haemoglobin, control over blood pressure and blood sugar, absence of fetal distress, need for blood transfusion, any emergency hospitalization. Neonatal outcome was determined by mode of delivery, birth status, gestational age, birth weight, Apgar score, presence or absence of congenital defects, condition during early neonatal period.

Conceptual framework assumes that subjects in experimental group will have positive/better maternal and neonatal outcome like desired gain in weight/haemoglobin, good control over blood pressure and blood sugar, less incidence of operative delivery/fetal distress/need for blood transfusion/ and emergency hospitalization, baby born live with normal birth weight/ Apgar score/ gestational age, absence of congenital defects, and better neonatal period. Subjects in control group will have negative/poor maternal and neonatal outcome like poor gain in weight/haemoglobin, less or no control over blood pressure and blood sugar, increased incidence of operative delivery/fetal
distress/need for blood transfusion/ and emergency hospitalization, baby born dead/live with low birth weight/ asphyxia/ preterm, absence or presence of congenital defects, and poor neonatal period (figure 2).
Figure 2  Conceptual Framework based on Roy’s Adaptation Theory
I.7) Assumptions

The researcher assumes that:

1. The high risk pregnant women are prone to maternal and neonatal complications.

2. The impact of high risk factors of pregnancy will be controlled with implementation of low birth weight prevention program (LBWPP) thus will improve the maternal and neonatal outcome of high risk pregnant women.

I.8) Delimitations

The study is delimited to:

- Pregnant women with any one of the three risk factors i.e; anaemia, hypertension and diabetes.
- Pregnant women who regularly attend the antenatal clinic of selected hospital from registration till delivery.
- Pregnant women who are willing to participate.
- Pregnant women who attend all the sessions of low birth weight prevention program on the stipulated dates given by the researcher.

I.9) Operational Definition of Terms

1) **High Risk Women**: Pregnant women with any one of the three selected high risk factors like anaemia, hypertension and diabetes, who are prone to maternal and neonatal complications.
   a. **Anaemic women**: a pregnant women with haemoglobin level of less than 10g%
   b. **Hypertensive women**: a pregnant women with BP more than 120/80mmHg
   c. **Diabetic women**: a pregnant women with blood sugar more than 126mg/dl

2) **Low Birth Weight prevention program (LBWPP)**.

A comprehensive care package for the high risk pregnant women which includes:
i) Information about low birth weight and preterm baby including meaning, causes, preterm labour, dangers of low birth weight and prevention (audio-visual supported).

ii) Antenatal and dietary advises. e.g. needs of diet, weight gain patterns, importance of nutrients, dietary advices, iron, folic acid supplementation, consultation with nutritionist etc. Antenatal advises to be followed and points to be avoided.

Advises to be followed (Do’s) e.g. rest and sleep, safety at home, relaxation, hygiene, regular antenatal checkups, help of husband, care of associated problems, telephone calls, extra visits, follow up etc.

Points to be avoided (Don’ts) e.g. excessive fatigue, smoking, drugs, pollutants, long travel, jerky movement, heavy weight, long standing, high heels, infection, loneliness and loosing temper

iii) Demonstrations: e.g. testing and monitoring of weight, blood pressure, blood sugar, urine test for sugar, pelvic exercises, counting fetal movement

iv) Home care package in the form of information booklet for anaemia, hypertension and diabetes including information, warning symptoms about specific problem, care and preventive measures.

3) Maternal Outcome: It includes:
   - Positive/good outcome in terms of desired gain in weight and haemoglobin, good control over blood pressure and blood sugar, less incidence of fetal distress, need for blood transfusion, and emergency hospitalization.
   - Negative outcome in terms of poor gain in weight and haemoglobin, less or no control over blood pressure and blood sugar, increased incidence of fetal distress, need for blood transfusion, and emergency hospitalization.

4) Neonatal Outcome: It includes:
   - Positive/good outcome in terms of less incidence of operative delivery of baby, birth of live and full term baby with normal birth weight and Apgar score, absence of congenital anomalies, better neonatal period.
   - Negative outcome in terms of more incidence of operative delivery of baby, birth of dead baby or a live baby with low birth weight/asphyxia, preterm, presence of congenital anomalies, poor neonatal period.
I.10) ORGANIZATION OF REPORT

Chapter I dealt with introduction of the study including its background, need for the study, statement of the problem, objectives of the study, hypotheses, conceptual framework, assumptions, delimitations and operational definition of terms.

Chapter II is devoted to review of literature relevant to the study.

Chapter III deals with methodology used for the study.

Chapter IV presents analysis and interpretation of data.

Chapter V presents discussion related to findings.

Chapter VI describes summary, findings, conclusions, nursing implications, limitations and recommendations.