CHAPTER – V

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“It is woman’s basic right to achieve optimal health throughout pregnancy and childbirth for themselves and their new born” (WRA, 2007)\textsuperscript{372}

Birth weight of new born depends on the duration of his in-utero stay and his interaction with intra-uterine environment where it grows at the cost of mother. The best environment for fetal growth and development is in the uterus of a healthy, well-nourished woman for 38 to 42 weeks. The fetus is exposed to complex phenomenon through the maternal environment where multiple factors influence its normal growth and development. The normal health status of a mother put forth a favourable outcome. On the contrary, a pregnancy which may be complicated by any medical or behavioural disorder, profoundly affect the health of a woman and her growing fetus. Such women deliver the baby before completion of appropriate gestational period (preterm) or if born at appropriate gestational period (full term) are usually weak and underweight i.e., less than 2500g. The presence of risk factors further complicates the situation.

The 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) on pregnant women with anaemia, hypertension and diabetes in order to reduce the incidence of low birth weight babies. The objectives of the study are:

\begin{itemize}
  \item To compare the maternal outcome of high risk pregnant women of experimental group with that of control group of high risk pregnant women.
\end{itemize}
• To compare the neonatal outcome of high risk pregnant women of experimental
group with that of control group of high risk pregnant women.
• To associate maternal outcome with selected risk factors of pregnant women.
• To associate 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.

The present study was a quantitative research study and to achieve the objectives, quasi
experimental research approach with time series non-equivalent -control group design
was used. The study included low birth weight prevention program as independent
variable and maternal and neonatal outcome as dependent variables.

The final study was conducted from first September 2011 to 31st August 2012 on 291
high risk pregnant women with anaemia, hypertension and diabetes. The initial/baseline
assessment was done for both experimental and control group of study subjects at 16
weeks of gestation. Intervention was administered systematically only on experimental
group during 16th and 20th weeks of gestation. Following the administration of
intervention, assessment and observation was done monthly at 24, 28, 32 and 36 weeks
of gestation to assess maternal outcome among both experimental and control group.
Both the experimental and control groups were observed for neonatal outcome during
intrapartum period and within 24 hours of delivery.

In distribution of socio-demographic characteristics i.e. age, socio-economic status,
exposure to smoke, nutritional status, number of living children and gravidity (table 7,
figures 5-10), there was no significant difference between the experimental and control
group except for number of living children which indicated the homogeneity in the
sample and it helped to compare the outcome measures. Mufti8, Qadir16 and Ali85 in
their studies obtained similar observations. Present study indicates high percentage of
moderate exposure of subjects to smoking which are higher than NFHS-2374 figures
which reports that only 10% women were exposed to smoke. The result could be change
in trend in the lifestyle of women for past 10 years.
Present study indicates high percentage of subjects had average nutritional status. Amin and Imtiyaz\textsuperscript{35} and Ali\textsuperscript{36} have studied correlation of maternal factors like age, literacy, income, type of family, Hb level and antenatal care on the nutritional status of pregnant women and have found that majority of women had average nutritional status.

Most of the socio-demographic characteristics are in conformity to demographic characteristics of J&K state as reported in NFHS-2\textsuperscript{373}, NFHS-3\textsuperscript{374} and census figures of 2009\textsuperscript{375}.

Both the groups were assessed for clinical profile, family profile and clinical status during past and present pregnancy (table 8 and 9). The findings indicated that there were many similarities in the findings between the two groups.

\textit{Distribution of Three Risk Factors of Pregnancy (Anaemia, Hypertension & Diabetes)}

In distribution of subjects among experimental group and control group according to the risk factors during pregnancy (table 10; and figure11 and12), there were almost similar number of subjects with different risk factors i.e anaemia, hypertension and diabetes in experimental and control group.

Mufti\textsuperscript{8} in her study at Srinagar reported similar incidence of these risk factors i.e. anaemic subjects (low risk category-36.5%), hypertensive subjects (moderate risk category-48.5%) and diabetic subjects (high risk category -15%). Present study indicates high percentage of anaemic and hypertensive subjects whereas Sunderka and Kacchap\textsuperscript{154} reported only 12.5% of high risk pregnancy when they identified high risk pregnancy by a scoring system and studied its correlation with perinatal outcome.

Nosseir\textsuperscript{9} reported anaemia as most frequently encountered risk factor while screening high risk pregnancy among mothers attending MCH centers in Alexandria thus is consistent with the present study.

Salima etal\textsuperscript{376} conducted a study in Sumbal block; district Bandipora, Srinagar to study prevalence of anaemia in pregnant women. They reported anaemia as risk factor of pregnancy, most prevalent in Kashmir.
Based on the objectives of the study, the findings discussed are as follows:

1. The first objective of the study was to compare the maternal outcome of high risk pregnant women of experimental group with that of control group of high risk pregnant women.

**Maternal outcome** was based on assessment of physical and physiological parameters; and maternal problems assessed at various weeks of gestation.

**Comparison of physical and physiological parameters between experimental group and control group of subjects at various weeks of gestation.**

These parameters included weight, haemoglobin, blood pressure, fasting blood sugar, fundal height, fetal heart rate and fetal movements which were assessed at 16\(^{th}\) weeks of gestation, and then every month for both the groups from 24\(^{th}\) - 36\(^{th}\) weeks of gestation after implementing intervention i.e. low birth weight prevention program (LBWPP) for experimental group only.

**Body weight**

The mean weight of experimental group was found to be higher i.e., (X=58.70±9.35 to 67.87±10.09) as compared to the control group i.e., (X=55.47±8.28 to 63.97±9.0). The mean weight at various gestational weeks after implementation of low birth weight prevention program as per high risk category was found to be higher in experimental group than control group in all the three high risk categories such as anaemia, hypertension and diabetes.

Following studies are consistent with the findings of present study.

**Claesson**\(^{320}\) conducted a case control intervention study on weight gain restriction for 504 obese pregnant women in San Francisco. The study indicated a significant and desired weight gain in intervention group as compared to the group who did not attend intervention programme.

**Spong**\(^{377}\) evaluated pregnancy outcome for 8,293 pregnant women including first time mothers in US at multiple sites. She reported normal weight gain among 17.5% women who attended counselling sessions during pregnancy. **Amin and Ali**\(^{35}\) reported
cumulative weight gain of 8.60Kg among pregnant women in Srinagar. The weight gain was found higher among women with good nutritional status.

**Haemoglobin**

The mean haemoglobin level of experimental group was found to be higher i.e., $(X=9.71\pm1.662$ to $11.57\pm1.26)$ as compared to the control group i.e., $(X=9.46\pm1.689$ to $10.10\pm1.32; p<0.001)$.

The mean haemoglobin level at various gestational weeks as per high risk category was found to be higher in experimental group than control group in subjects with anaemia and hypertension whereas in case of diabetes, the mean haemoglobin level in experimental group and control group at 16 weeks, 24 weeks 28 weeks and 36 weeks did not show any significant difference.

Similar observations were reported in the findings of a study on weight gain patterns during pregnancy conducted at Srinagar by Kousar. She reported that increase in weight and haemoglobin was highest in mothers who had adequate intake of calories and proteins.

Piers in a study of well nourished Indian population demonstrated that dietary caloric intake close to ICMR recommendations had shown a positive effect on weight gain and increase in haemoglobin and the increment increase was observed only in second and third trimester as followed in the present study.

Rang and Darbari conducted a study in PHC and found satisfactory gain in haemoglobin after dietary orientation and iron supplementation. Similar observations were made by Bodole when they studied association of fetal growth with diet intake, haemoglobin and antenatal care.

Simona et al reported that haemoglobin in gestational diabetic mothers had shown significant increase after iron supplementation.

**Blood Pressure:**

The mean blood pressure among experimental group and control group at 16-32 weeks did not vary, however at 36 weeks of gestation, the subjects in experimental group had lower blood pressure $(X=120.31\pm7.05)$ than control group $(X=123.99\pm17.07)$. However in
hypertensive and diabetic subjects, the mean blood pressure was found normal among experimental group subjects who followed therapeutic diet, adhered to advises and exercises etc as compared to the control group subjects who had high blood pressure levels (p<0.05). In anaemic subjects, the mean blood pressure in both the groups was within normal limits as the anaemia in pregnancy is found to be associated with low blood pressure. These findings are supported by Fretts who in their study on effects of antenatal care on preeclampsia among pregnant women, found that blood pressure was under control and incidence of preeclampsia also decreased from 13.1 to 1.2/1000 live births by increased prenatal visits.

Similar findings were indicated by the study of Stephie who studied the effect of exercise during pregnancy on edema, placental perfusion and uterine cramping among pregnant women with hypertensive disorders and found that the women who did light exercises have shown control in their blood pressure levels and mood swings.

Gupta and Gupta made comprehensive review of heart diseases in pregnancy and found reduce in the high blood pressure levels, controlled glycaemic levels during pregnancy, normal fetal heart among a group of pregnant women on whom midwives and obstetricians focussed 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 regarding rest, diet, proper sleep etc.

Mathews and Mahendra conducted a study in Karnataka on diabetic pregnant women and found that comprehensive antenatal care with education has reduced high glycaemia levels, increased haemoglobin and improved fetal growth.

**Fasting Blood sugar level**

The mean fasting blood sugar level was found normal in experimental group of diabetic subjects i.e., (X=183.71±50.44 to 107.57±12.51) as compared to the control group subjects i.e., (X=248.56±55.18 to 155.89±39.66). Mean fasting blood sugar in both the groups of anaemic and hypertensive subjects was within normal range. Present study findings are supported by Grohar who carried teachings on dietary habits, exercise, rest and follow ups on prevention of maternal complications among a group of pregnant women with gestational diabetic mellitus (GDM). His findings revealed...
statistically significant change in maternal weight, haemoglobin, blood pressure and glycaemia levels after implementation of intervention.

The findings of Mattoo\textsuperscript{318} also are consistent with findings of present study. She studied effectiveness of planned health education program among women with gestational diabetic mellitus (GDM) on knowledge, stress, glycaemia level, maternal and perinatal outcome. She reported that GDM mother’s glycaemia level at 30, 32, 34 and 36 weeks (after administration of planned health education programme-PHEP at 28 weeks of gestation) was found normal in experimental group as compared to control group (p<0.05). She reported increase in mean weight (66.37-68.91Kg), mean haemoglobin (11.3 -11.9g%); decrease in mean blood pressure (116.2/76.2-118.7/78.2mmHg) and mean blood sugar (90.1-87.9mg/dl) in experimental group. Mean fundal height and mean fetal heart rate was similar in both groups (not significant) which again agree with the findings of present study.

\textit{Fundal Height}

The mean fundal height of subjects at various weeks of gestation did not show any significant difference between the experimental and control group. These findings were consistent with the findings of study conducted by Gardosi and Francis\textsuperscript{167} who did a controlled trial of fundal height measurements and they reported low fundal height in anaemic pregnant women who were below 20 years of age. The findings of Notkin etal\textsuperscript{360} also agree with present study finding. They studied effectiveness of interventions to improve diet and weight gain among adolescent gravidas and reported that pregnancy in adolescents who received diet counselling had better pregnancy period, increase in weight, gain in haemoglobin and gain in fundal height.

Julnes\textsuperscript{382} used resource mothers programme on high risk adolescents to promote a high level of perinatal care and she found favourable gain in weight, haemoglobin, fundal height and better perinatal outcome when assessments were done on following gestational weeks of intervention.

\textit{Fetal Heart rate}

The mean fetal heart rate varied at various weeks of gestation among the groups but was within normal limits. However, even if the mean fetal heart rate among subjects with
diabetes was normal but there was significant difference in the total estimated means of fetal heart rate between experimental group and control group of diabetic subjects only (p<0.001). **Mattoo**\(^3\) reported that gestational diabetic mellitus (GDM) mother’s fetal heart rate at various weeks (after administration of PHEP at 28 weeks of gestation) was found to be statistically non-significant between experimental group and control group.

**Fetal movement**

Fetal movement was present in all the experimental group of subjects whereas in control group subjects, it was absent in 2(3.33%) subjects during 32\(^{nd}\) weeks and in 15(10.56%) subjects during 36\(^{th}\) weeks of gestation which was statistically significant (p<0.01).

Following studies are consistent with the findings of present study.

**Mattoo**\(^3\) reported that gestational diabetic mellitus (GDM) mother’s fetal movement at 30, 32,34 and 36 weeks (after administration of PHEP at 28 weeks of gestation) was found to be statistically significant at 0.05 level and non-stress test was normal (i.e. reactive) in experimental group as compared to control group.

**Henrickson**\(^1\) reported that adequacy of nutrition has affected maternal and fetal health in terms of weight gain, increase in haemoglobin, fetal weight gain appropriate to gestational age and normal birth weight baby among pregnant women who were given nutritional intervention.

Thus it is evident that the mean weight and haemoglobin of experimental group was found to be higher. Mean blood pressure and mean fasting blood sugar level of experimental group was normal as compared to the control group. This indicates the effectiveness of Low birth weight prevention program. These findings insist that when a high risk pregnant women is given verbal and written information, she adheres to self care activities and have desirable changes in physical and physiological parameters.

**Comparison of maternal outcome between experimental group and control group.**

Maternal outcome variables included gain in weight, control over blood pressure, control over blood sugar, absence of fetal distress, need for blood transfusion, any emergency hospitalization and maternal outcome during pregnancy.
**Gain in Weight**

Majority of subjects in experimental group (91.95%) gained weight normally as compared to subjects in control group (54.93%; p<0.01).

The findings are consistent with study conducted by Kousar\(^{349}\) who studied weight gain patterns during pregnancy in Srinagar and reported that total weight gain was seen best in mothers taking ≥2200Kcal/day i.e 8.20±2.22Kg and it was highest in mothers who consumed proteins more than RDA (>59g/day) i.e. 8.92±1.8Kg. Similar observations were also reported by Johnston and Kandell\(^{383}\), Suser\(^{220}\), Cogswell et al\(^{384}\), Dawes and Grudzinskas\(^{385}\).

Amin and Ali\(^{35}\) reported that anaemic women with haemoglobin level <10g% had comparatively less weight gain than non-anaemic women thus these findings are in conformity with findings of present study.

Thangaratinam, et al\(^{386}\) reported similar results during their study on evaluating the effect of dietary and lifestyle interventions in pregnancy on maternal and fetal weight. They reported that dietary intervention resulted in gaining the weight normally without any excessive gain and these patients had normal blood pressure and blood sugar levels.

**Control over Blood Pressure**

Post intervention assessment showed good control over blood pressure among majority of subjects in experimental group (73.83%) as compared to subjects in control group (64.79; p<0.01). The study subjects with anaemia and diabetes did not show any significant control over blood pressure between experimental and control group however the subjects with hypertension in experimental group showed a significant control in blood pressure as compared to control group (OR=69.48; p<0.01). It is because anaemic and diabetic subjects irrespective of experimental or control group were normotensive at baseline assessment and continued to have normal trend throughout the gestational period. These findings are consistent with findings of Wen Shi Wu et al\(^{322}\) who reported that continuous use of iron and folic acid supplementation with antenatal advises reduced the rate of preeclamptic toxaemia in hypertensive pregnant women thus their blood pressure remained under control.
These findings are further supported by following studies:

Kramer and Kakuma\textsuperscript{111} reported that energy and protein intake in pregnancy helped in increase of placental perfusion and kept blood pressure under control in hypertensive women. Kramer and Mc Donald\textsuperscript{387} reported that exercises in pregnant women have controlled the weight gain and blood pressure who studied aerobic exercise for women during pregnancy.

Mathew’s\textsuperscript{141} reported that traditional therapy for hypertension like bed rest, low calorie and low salt had controlled the high levels of blood pressure in mothers with pregnancy induced hypertension (PIH) and improved the maternal-fetal outcome.

Duckbitt and Harrington\textsuperscript{388} did a systematic review of controlled studies of risk factors for preeclampsia and observed uncontrolled blood pressure in hypertensive mothers who didn’t seek any intervention and advice. They further reported that high blood pressure was found associated with fetal distress.

Sushila\textsuperscript{5} studied effectiveness of self-care strategies on pregnancy induced hypertension (PIH), maternal and perinatal outcome among primigravidae in Chennai. She reported that complication with PIH were more in control group (11.3%) than study group (3.2%) and blood pressure was under control with adherence to self-care strategies.

Magnussen\textsuperscript{190} made a study on hypertensive disorders in pregnancy and subsequently measured cardiovascular risk factors. They found that blood pressure remained under control in women on whom counselling measures were attempted early in pregnancy, and who used therapeutic diet of low salt and low calorie.

\textit{Control over Blood Sugar}

There was good control over blood sugar among majority of subjects in experimental group (98.66%) as compared to subjects in control group (87.32%). The subjects with anaemia and hypertension in experimental group did not show any significant control over blood sugar than the control subjects whereas experimental group subjects with diabetes indicated a significant control (OR=69.73; p<0.01). It may be because subjects with anaemia and hypertension irrespective of experimental or control group had blood sugar levels within normal limits at baseline assessment and continued to have normal trend throughout the gestational period. These findings are supported by study of
Mattoo\textsuperscript{318} who reported that gain in weight and haemoglobin had shown no significant difference between experimental and control group whereas more number of experimental group of gestational diabetic mellitus (GDM) women (86.4\%) attained normal blood pressure and glycaemia levels thus fetal distress was not evident in them and they had significantly shown better maternal outcome during labour. Reece etal\textsuperscript{215} also reported controlled blood sugar levels in gestational diabetic mellitus (GDM) mothers who were screened in pregnancy and who availed continuous antenatal services. Berkowitz\textsuperscript{194} studied maternal characteristics, neonatal outcome and time of diagnosis of gestational diabetes in America. They reported that the mothers who had undergone special educational and dietary classes and who have come for regular antenatal check up, and timely monitoring of blood sugar had shown controlled glycaemia levels with advancement of gestational period and better perinatal and neonatal outcome.

\textit{Absence of Fetal Distress:}

Present study had shown that fetal distress was absent among majority of subjects in experimental group (85.91\%) as compared to subjects in control group (47.89; OR=31.89; P<0.01). The findings of the study of Maria\textsuperscript{118} reported similar results during their study on antenatal evaluation of the fetus by fetal movement monitoring and fetal kick count chart. She reported that incidence of fetal complications were reduced to 88\% by recommending self fetal monitoring. Similarly Mattoo\textsuperscript{318} also reported similar results by showing no evidence of fetal distress in experimental group of gestational diabetic mellitus (GDM) women (86.4\%) who attained normal blood pressure and glycaemia levels.

\textit{Need for Blood Transfusion}

Experimental group subjects needed 2.99 times less blood transfusions than control group subjects (P<0.01). Among study subjects with anaemia in experimental group, need for blood transfusion was 3.18 times less than the control subjects (p<0.01). Study subjects with hypertension and diabetes in both experimental and control group did not need any blood transfusion. Similar findings have been revealed by the study of Gupta\textsuperscript{389} who made comparison between experimental group and control group of anaemic pregnant women after iron supplementation and dietary counselling and observed that anaemic pregnant women in control group needed more admissions in hospital for blood
transfusion, due to fetal distress or early rupture of membranes however experimental group needed no transfusions after iron supplementation and dietary counselling. Studies of Piers\textsuperscript{378}, Rang and Darbari\textsuperscript{360} and Bodole\textsuperscript{160} showed similar results.

**Emergency Hospitalization**

In study subjects of experimental group with anaemia and hypertension, there was significantly less need of emergency hospitalization as compared to the control subjects (p<0.01). Similar observations were made by Gupta et al\textsuperscript{389}, Reece\textsuperscript{215} and Sushila\textsuperscript{5}.

**Maternal outcome during pregnancy**

The maternal outcome during pregnancy was better among experimental group subjects than control group subjects (OR=4.12 and 63.82; p<0.01). Subjects with anaemia did not show any significant difference in the maternal outcome during pregnancy between the experimental and control group. The maternal outcome during pregnancy was good in experimental group subjects with hypertension (61.55 times) and diabetic subjects (79.86 times) as compared to control group subjects (p<0.01).

These findings are supported by studies of:

**Chandra and Agarwal\textsuperscript{164}** who studied nutritional aspect of women with special reference to pregnancy and reported fetal distress and birth of premature distressed baby more in women with inadequate dietary intake who needed emergency hospitalization for blood transfusions and due to fetal distress.

**Siega\textsuperscript{286}** did a systematic review of maternal weight gain according to the Institute of Medicine Recommendations: birth weight, fetal growth, and postpartum weight retention and reported statistically significant difference among study and control group in terms of gain in haemoglobin, control over blood pressure, fetal distress and overall maternal outcome.

**Agarwal\textsuperscript{32}** studied maternal and perinatal outcome in women with antepartum eclampsia at a tertiary care hospital in Delhi and found better maternal and perinatal outcome in women when they were screened early; got regular antenatal check up and when they were provided with verbal and written information.

**Johansson\textsuperscript{105}** studied etiological aspects and short and long term outcomes in very preterm birth babies and reported good control over blood pressure in hypertensive and diabetic subjects after intervention.
Comparison of neonatal outcome between experimental group and control group of subjects.

2. The second objective of the study was to compare neonatal outcome of high risk pregnant women of experimental group with that of control group of high risk pregnant women.

Neonatal outcome variables included mode of delivery, birth status of baby, gestational age, birth weight, Apgar score, presence or absence of congenital anomalies and early neonatal condition.

*Mode of Delivery* in present study indicated that majority of subjects in experimental group (79.87%) delivered babies by normal vaginal delivery as compared to control group (55.63%; p<0.01). *Sushila* also observed higher number (42.7%) of operative interventions in control group than study group (19.7%).

*Birth Status* in present study indicated that majority of subjects in experimental group (97.31%) delivered live babies without distress as compared to control group (49.29%), whereas majority of subjects in control group delivered live babies with distress (40.14%). As many as 10.56% of subjects in control group delivered still birth. Subjects with hypertension and diabetes in control group delivered still births 26.88 times and 57.72 times greater than the experimental group (OR= 26.88 and 57.72; p<0.001). *Chandra and Agarwal* reported birth of premature and distressed baby more in women who had inadequate dietary intake. They also reported increased incidence of caesarean section. Similar observations were made by *Bodole*.

*Gestational Age* Present study revealed that majority of subjects in experimental group (87.25%) and control group (67.71%) delivered full term babies. The estimated odds ratio (OR=1.85) indicate that experimental group subjects delivered full term babies only 1.85 times more than control group subjects. As many as 18.31% and 3.52% subjects in control group delivered both preterm and very preterm babies respectively as compared to experimental group (12.75%). This indicates the effectiveness of intervention. Diabetic subjects did not show any significant difference in the gestational age between
the experimental and control group. Josje\textsuperscript{191} studied the outcome of pregnancy in mothers with pregnancy induced hypertension (PIH) who didn’t follow antenatal advises and counselling and reported 27% of preterm birth in PIH mothers who were not exposed to any intervention, and 18% of preterm births in normotensive mothers.

**Birth Weight** Present study revealed that majority of subjects in experimental group (83.22%) delivered normal birth weight babies as compared to control group (66.90%), and as many as 22.54% and 10.56% subjects in control group delivered low birth weight and very low birth weight babies thus showing that intervention was effective.

It is also indicated in present study that majority of hypertensive and diabetic subjects in experimental group (81.82% and 85.71% respectively) delivered normal birth weight babies as compared to subjects in control group (52.73%, and 44.45% respectively) Hypertensive subjects in control group delivered very low birth weight babies 4.65 times and diabetic subjects in control group delivered large babies (>3 Kg) 38.79 times greater than the experimental group subjects (OR= 26.88 and 57.72, p<0.001). Anaemic subjects did not show any significant difference in the birth weight of baby between the experimental and control group subjects.

Following studies are consistent with present study. Patroci\textsuperscript{309} studied number of antenatal visits and perinatal outcome and reported a significant association between the number of antenatal visits and low birth weight at the level of p<0.001, and also had association with delivery by caesarean section. The more the mother made antenatal visits, the less was the incidence of operative deliveries and low birth weight.

Xiao\textsuperscript{185} while examining the effect of preeclampsia on fetal growth among 155 women and found that it is associated with a 3.8 fold increase in the risk of low birth weight babies (p<0.01) and it increased the risk of small for gestational age by 3.6 times.

Berkowitz\textsuperscript{194} reported delivery of full term baby with normal birth weight (p<0.05) among diabetic women who had followed regular antenatal plan. Similar observations are made by China\textsuperscript{201} in Singapore and Coetzee and Levitt\textsuperscript{394} when they investigated the neonatal outcome in maternal diabetes.

**Apgar Score:** Study indicated that majority of subjects in experimental group (83.22%) delivered babies with normal Apgar score (8-10) as compared to control group (47.89%), whereas most of the subjects in control group delivered babies with mild asphyxia-
Apgar score between 4-7 (32.39%) or severe asphyxia-Apgar score <4 (19.72%). Thus intervention was effective on experimental subjects. Mani\textsuperscript{306} conducted a study to evaluate the effects of relaxation technique on maternal and neonatal outcome in a selected group of antenatal primipara mothers in selected hospital of West Bengal and reported more number of normal deliveries among experimental group whose babies had higher mean Apgar score at birth as compared to control group.

Dodds\textsuperscript{392} conducted a population based retrospective cohort study to evaluate maternal and neonatal outcome in women with hyperemesis in pregnancy associated with preeclampsia. The findings revealed that study group was reported to have less caesarean deliveries, baby with good Apgar score, normal birth weight and appropriate for gestational age than control group.

**Congenital Anomalies** It is evident from the findings of present study that majority of babies in experimental group (95.30%) and control group (84.51%) did not have any congenital anomaly, however comparatively, majority of subjects in control group delivered babies with mild congenital anomaly (10.56%) or severe congenital anomaly (4.93%). Among diabetic subjects in experimental group, majority of babies did not have any congenital anomaly (85.71%) as compared to control group (44.45%). However most of control group subjects (33.33%) delivered babies with mild congenital anomaly and 22.22% delivered babies with severe congenital anomaly. This indicates that intervention may have helped in preventing occurrence of congenital anomaly among experimental group.

Study conducted by Mattoo\textsuperscript{318} is consistent with the findings of present study. She reported that presence of congenital anomalies in experimental and control group had shown statistically significant difference at 36 weeks of gestation among gestational diabetic mothers (GDM) mothers. Similar observations were made by Batra and Sharma\textsuperscript{393} who reported 20% more caesarean births among diabetic women who had no exposure to antenatal education. She further reported higher incidence of neural tube defects among babies of these mothers.

**Early Neonatal condition** It was evident from the findings of present study that majority of babies in experimental group (90.60%) had good condition during early neonatal period of first 24 hours as compared to babies in control group (62.68%). The difference
in the neonatal outcome between experimental and control group can be attributed to low birth weight prevention program (LBWPP).

The above findings are supported by following studies.

Thailamlong\textsuperscript{324} made a systematic review of nursing interventions to prevent preterm birth. She found that pregnancy was prolonged among high risk group of women by making home visits, telephone calls, seeking family care giver, providing psychological support and using relaxation techniques.

The systematic reviews conducted by Villar \textit{et al}\textsuperscript{305} reported that routine iron supplementation prevented maternal anaemia in experimental group and babies were born at term with normal birth weight who had satisfactory outcome as compared to control group. Similar observations were made by Ross\textsuperscript{391} who studied the health impact of a nurse midwife programme which had improved the gestational age and birth weight of baby.

3. The third objective of the study was to associate maternal outcome with selected risk factors of pregnant women.

\textit{Association of Maternal Outcome Variables with Risk Factors of Pregnancy}.

The findings revealed significant association of \textit{gain in weight} with diabetic subjects than anaemic subjects which may be probably due to high glycaemic levels. The highest association of \textit{control over blood pressure} was observed in hypertensive subjects (OR=3.079; CI=1.030-9.202) and diabetic subjects (OR= 4.704; CI=1.350-16.394) as anaemic subjects are subjected to low blood pressure levels. Hypertensive and diabetic subjects needed \textbf{fewer blood transfusions} than anaemic subjects which may be attributed to low haemoglobin levels in anaemic subjects.

No significant association of control over blood sugar, fetal distress and emergency hospitalization was observed in subjects of any risk category.

4. The fourth objective of the study was to associate neonatal outcome with selected risk factors of pregnant women.

\textit{Association of Neonatal Outcome with Risk Factors of Pregnancy}:
The findings revealed that hypertensive subjects delivered less preterm and low birth weight babies than anaemic subjects thus their neonates showed good neonatal condition in early neonatal period of 24 hours. This may be due to low haemoglobin levels in anaemic subjects which reduces the nutritional reserves of mother and may lead to preterm delivery of baby who has usually birth weight less than normal. These findings are consistent with following study findings:

**Fazili**[^83] made a hospital based study on epidemiological correlates of neonatal mortality in Srinagar and **Shah**[^347] studied epidemiological correlates of low birth weight. They detected a strong association of severity of pregnancy related risks including anaemia with adverse maternal and perinatal outcome.

**Pandya and Hazra**[^395] made similar observations while studying feto-maternal outcome in severe anaemia. They found that severely anaemic subjects have shown high incidence of need for blood transfusion, poor weight gain, poor pregnancy and neonatal outcome, high rates of low birth weight and preterm births.

**Mir**[^34] studied pregnancy outcome in oligohydramnios. The study was conducted in Lalla Ded hospital at Srinagar. She associated oligohydramnios with uncontrolled blood pressure and preeclampsia and reported similar results as present study findings which revealed low association of birth weight and gestational age with hypertension.

5. The fifth objective of the study was to associate maternal outcome with socio-demographic characteristics of high risk pregnant women.

**Association of Maternal Outcome Variables with Socio-demographic Characteristics**

The association of socio-demographic characteristics of high risk pregnant women included age, socioeconomic status, nutritional status and gravidity and it was estimated by Multivariate Logistic Regression. These socio-demographic variables were categorized into three groups.

According to **age**, pregnant women were categorized into pregnant women below 20 years, pregnant women between 20-30 years and pregnant women above 30 years. According to **socio-economic status (SES)**, pregnant women were categorized as per the score they obtained on socio-economic scale: pregnant women with low SES (score-7-
22), pregnant women with middle SES (score-23-34), and pregnant women with high SES (score-35-50).

According to nutritional status, pregnant women were categorized as per the score they obtained: pregnant women with good nutritional status (score=25-35), pregnant women with average nutritional status (score=15-24), and pregnant women with fair nutritional status (score=<15).

According to gravidity, pregnant women were categorized into three groups: primigravida, second gravida, and multi gravida (>3).

**Gain in Weight** There was highest association of gain in weight in subjects with good nutritional status (OR=5.48; CI=1.262-23.803) than subjects with fair nutritional status.

Significant association of gain in weight was observed in subjects with age group of 20-30 years (OR=0.308; CI=0.121-0.783) in comparison to age group of > 30 years of subjects (p<0.05). The study indicated no significant association of weight gain with socio economic status and gravidity of subjects.

It is evident that nutritional intake remains a major attribute to influence weight gain especially in middle socio-economic class. Thus dietary counseling during pregnancy is essential aspect to improve pregnancy outcome and attributes to the effectiveness of low birth weight prevention program.

The findings are consistent with the findings of following studies.

Kousar\textsuperscript{350} reported that only maternal age, haemoglobin and dietary calorie intake were found to have significant effect on weight gain (p<0.001). It was reported that 26% mothers belonged to <20 years of age and had the lowest weight gain of 7.08 ± 1.85Kg. As the age advanced the weight gain also increased being 7.83 ± 2.01Kg in the 21-25 years age group and 9.16 ± 2.05Kg in the 26-30 years age group. With regard to socio economic class, maximum weight gain has been seen in mothers belonging to SES class I i.e.; 10.6 ± 2.6Kg; and the least weight gain in mothers who belonged to SES class IV i.e;7.09 ± 0.18Kg. Henrickson\textsuperscript{128} also reported low weight gain in women with poor nutritional status.
Banerjee et al\textsuperscript{283} and Bell\textsuperscript{213} also reported low weight gain in lower age group and lower SES class of pregnant women. Similar observations were also observed by School et al\textsuperscript{397}, Abrams and Sevin\textsuperscript{398}, Petridou et al\textsuperscript{399} and Ekbald and Grennan\textsuperscript{400}.

The findings of the study conducted by Mattoo\textsuperscript{318} and Catalano\textsuperscript{195} are also consistent with the findings of present study. They found that weight gain is significantly associated with age of diabetic pregnant women.

Similar observations are made by the study of Jakobsson\textsuperscript{282} and Banerjee et al\textsuperscript{283}, Elisabeth\textsuperscript{404}, Carr\textsuperscript{405}, Mortenssen et al\textsuperscript{27}, Chappell\textsuperscript{406}, Beryerlein\textsuperscript{396}, and Bateman\textsuperscript{192} who reported weight gain, control over BP/ blood sugar level, fetal condition and overall maternal condition in pregnancy is significantly associated with the age of pregnant women irrespective of risk category. Lower the age of women, poor is the weight gain. Higher/ lower social class is seen equally responsible for adverse maternal outcome.

Johnson et al\textsuperscript{407} also reported similar results while studying pregnancy outcomes in women with weight gain above or below the 2009 Institute of Medicine guidelines (IOM). The weight was found gaining normally or more depending on the caloric intake. It was also found related to age of mother at conception. Lower age was found associated with low nutritional reserves.

Deborah and Bechtel-Blackwell\textsuperscript{408} observed similar results and reported that the experimental group gained significantly higher weight in third trimester than control group since calorie intake was maintained for experimental group thus these findings are in conformity with the findings of present study. Their study was related to a computer-assisted self-interview and nutrition assessment in a pregnant adolescent African American population to compare the effect of nutrition education intervention with the standard dietitian consultant on gestational weight gain patterns.

Control over Blood Pressure The study indicated no significant association of control over blood pressure with age, socio economic status, nutritional status and gravidity of subjects.

Klemmensen\textsuperscript{412} did a prospective study among 257346 women in Denmark on intake of vitamin C and E and risk of preeclampsia and reported strong association of low or high age and primigravidity with increased incidence of severe preeclampsia, eclampsia or HELLP syndrome. Their findings were not consistent with the findings of present study.
Similar results were observed in studies conducted by Osterdal\textsuperscript{402}, Wen Shi Wu et al\textsuperscript{322} and Yangzom et al\textsuperscript{403} who too found no association of age, SES, nutritional status and gravidity with control over blood pressure.

**Control over Blood Sugar** No significant association of control over blood sugar was seen in experimental group, with age, socio economic status, nutritional status and gravidity of subjects.

Study of Smith et al\textsuperscript{265} also reported no association of very young or very high age in diabetic women with maternal outcome.

Berkowitz\textsuperscript{194} while studying maternal characteristics and neonatal outcome and gestational diabetes, reported that younger women developed diabetic complications and had adverse effect on the perinatal outcome though their findings too are not-significant.

Similar results were observed in studies conducted by Gunatilake and Perlow\textsuperscript{292} who studied effects of obesity (with hypertension and diabetes) on the pregnancy outcome.

**Absence of Fetal Distress** The study indicated no significant association of fetal distress with age, socio economic status, nutritional status and gravidity of subjects.

**Need for Blood Transfusion** The study indicated no significant association of need for blood transfusion with age, socio economic status, nutritional status and gravidity subjects.

The observations made by Singh\textsuperscript{346}, Villar et al\textsuperscript{305} and Yangzom et al\textsuperscript{403} are similar to the findings of present study. They reported that blood transfusion was needed by woman with low haemoglobin irrespective of their age group so age has no significance for need of blood transfusion. Their findings reveal that fetal distress is not associated with age, socio economic status, though nutritional status and gravidity of mother is found to have some effect to produce fetal distress

**Emergency Hospitalization** The study indicated no significant association of emergency hospitalization with age, socio economic status, nutritional status and gravidity of subjects.

The overall findings of present study showed that age and nutritional status of mother is strongly associated with weight gain.
6. The sixth objective of the study was to associate neonatal outcome with socio-demographic characteristics of high risk pregnant women.

**Association of Neonatal Outcome Variables with Socio-demographic Characteristics**

**Mode of delivery** The study indicates significant association of mode of delivery with subjects of high socio economic status who delivered babies 4.712 times more by caesarean section than low socio economic subjects (p<0.05) which may be related to their sedentary life style. The study indicates no significant association of mode of delivery with age, nutritional status and gravidity of subjects.

**Birth Status** The highest association of live babies was seen in subjects with middle socio economic status in comparison to low socio economic status. No association of birth status was seen in experimental group, age, nutritional status and gravidity of subjects.

These findings are consistent with the findings of the studies conducted by Agarwal, Goswami and Tempe\(^{32}\), Mortenssen etal\(^{27}\), and Mori etal\(^{107}\) who reported that babies born with distress, by caesarean section belonged to either high socio-economic class or low socio-economic class.

**Gestational Age** There was highest association of birth of full term babies in subjects with middle socio economic status and who were primigravidae.

Subjects with middle socio economic status delivered 2.699 times more full term babies than low socio economic subjects (p<0.05) which may be probably due to good nutritional status in middle class.

Primigravida subjects delivered 2.296 times more full term babies than multigravida subjects (p<0.05) and second gravida was significantly associated with low birth weight which indicates that high parity leads to delivery of baby who is preterm and has low birth weight.

The study indicates no significant association of gestational age with age and nutritional status of subjects.
Melamed et al.\textsuperscript{108} support the present study and reported that fetuses of hypertensive mothers with low socio-economic class and with multiple gravidity developed distress and they were compelled to be born in emergency.

**Birth Weight** There was highest association of normal birth weight with subjects who were second gravida (p<0.05).

Second gravida subjects delivered 2.517 times more babies with normal birth weight than multigravida subjects (p<0.05). The study indicates no significant association of birth weight of baby with age, socio economic status and nutritional status of subjects.

The study conducted by Banerjee et al.\textsuperscript{283} showed similar results and found high rates of low birth weight more in women between age of 15-19 years and mean birth weight was 2.30Kg and who were multi-gravidae. Similarly Johansson\textsuperscript{105}, Mercer\textsuperscript{22} and Mortenssen et al.\textsuperscript{27} had found significant association of baby’s birth weight and gestational age with the age and gravidity of mother. Their findings had revealed that mother’s lower age and high parity was associated with low birth weight and preterm delivery of baby and the incidence was found to become double fold in mothers who were anaemic. This finding is further supported by Roy and Chakraborty\textsuperscript{159}.

Similar observations were also made by Bodole\textsuperscript{160} who studied fetal growth associated with diet intake; and Harrison\textsuperscript{409} studied growth during pregnancy in Nigerian primigravida.

Anaemic mothers with poor dietary intake delivered prematurely as reported by Yangzom et al.\textsuperscript{403}

These findings are comparable with the findings of Gupta\textsuperscript{60}, who detected fetal growth restriction with severe preeclampsia though it was not associated with the SES of hypertensive pregnant women.

The present study findings are also endorsed by Mir\textsuperscript{34} Qadir\textsuperscript{16} and Pushparaj and Maheshwari\textsuperscript{364} who have shown significant association of socio-economic status, gravidity and nutritional status with mode of delivery, birth status, gestational age and birth weight.
Apgar Score The study indicates no significant association of Apgar score with age, socio economic status, nutritional status and gravidity of subjects. Similar observations were obtained in the studies conducted by Sheiner\(^{410}\), Briley, Flangan, Lewis\(^{411}\) and Barakat, Lucia, Ruiz\(^{412}\) who reported mean birth weight of babies born to high risk pregnant mothers was 2071g;, Apgar score <4 at 1 minute in 14% babies.

Early Neonatal Condition Present study indicates that the neonates born to subjects with good nutritional status had good condition during early neonatal period of 24 hours than neonates born to subjects with fair nutritional status. The data reveals no significant association of early neonatal outcome with age, socio economic status and gravidity of subjects. These findings are consistent with the findings of Haakstad, Bo\(^{413}\), Hopkins et al\(^{414}\), Khaledah etal\(^{415}\), Ong etal\(^{416}\) and Hui etal.\(^{417}\) They all in their study reported that nutritional status and socio-economic condition of mother has strong association with the birth weight and overall neonatal condition.

Gravidity was seen to affect the subsequent pregnancy outcome. This is reported by Chappell\(^{406}\) who studied chronic hypertension in pregnancy, risk factors for preeclampsia and adverse pregnancy outcome. They have found uncontrolled blood pressure in their subsequent pregnancies.

The increase in parity increases the blood pressure especially in high risk pregnant women as reported by Bateman\(^{192}\). The findings of present study are further supported by the study of Gupta etal\(^{60}\), Raju\(^{418}\), Coetzee, Levitt\(^{394}\) and Di Cianni\(^{202}\).