Pattern of Prevalence of Gestational Diabetes Mellitus and Its Impact on Outcomes of Pregnancy

By

P. Nirmala

A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE AND HIGHER EDUCATION FOR WOMEN (DEEMED UNIVERSITY), COIMBATORE - 641 043

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE

IN FOOD SERVICE MANAGEMENT AND DIETETICS

MAY 1997

PATTERN OF PREVALENCE OF GESTATIONAL DIABETES MELLITUS AND ITS IMPACT ON OUTCOMES OF PREGNANCY

By

P.NIRMALA

A Thesis submitted to the Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore - 641 043.

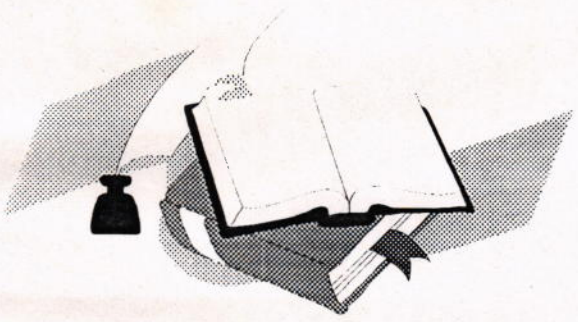
In partial fulfilment of the requirements for the Degree of Master of Science in Food Service Management and Dietetics

May 1997

Certified as *Bonafide* Research Work

Signature of the
Head of the Department

Signature of the
Guide



ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

The investigator wishes to express her deepsense of gratitude to **Dr.(Mrs.) RAJAMMAL P.DEVADAS, M.A., M.Sc., Ph.D. (Ohio State), D.Sc. (Madras), Hon. D.H.L. (Oregon State), Hon. D.H.L. (Ohio State), Hon. D.Sc. (C. Azad Agri. University, Kanpur), Hon DSC (University of Ulster, Northern Ireland)**, Chancellor of Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for providing the opportunity to conduct this study.

With deep respect and reverential gratitude the investigator wishes to thank **Dr.(Tmt.) PARVATHI SASWARAN, M.S., (Colombia), Ph.D. (Madras)**, Professor and Head of the Department of Food Service Management and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for her dynamic guidance, valuable suggestions, constant encouragement and keen interest during the course of this study.

The investigator records her deep sense of gratitude and indebtedness to **(Tmt.) UMA MAGESHAWARI, M.Sc., (Bharathiar), M.Phil. (Avinashilingam)**, Lecturer in Food Service Management and Dietetics, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for her incessant guidance, constant encouragement and valuable suggestions, at each step of this study.

The investigator express her heartfelt thanks to **Dr.(Mrs). LAKSHMI SANTA RAJAGOPAL, M.S. (Tennessee), Ph.D. (Madras)**, Vice Chancellor, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for her help rendered during the course of this study.

The investigator is thankful to **Dr. (Mrs.) SAROJA PRABHAKARAN, M.A., Dip in Ed., Ph.D., (Mother Teresa)**, Registrar, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for the facilities provided for the smooth conduct of the study.

The investigator thanks are due to **Dr.(Tmt.) USHA CHANDRASEKAR, M.Sc. (Madras), Ph.D. (Purdue)**, Dean, Faculty of Home Science, Avinashilingam Institute for Home Science and Higher Education for Women (Deemed University), Coimbatore, for giving her complete consent for the conduct of the study.

The investigator expresses her profound gratitude to **Mr.T.Veerandra Singh**, Chief Dietitian of Osmania General, Hospital Hyderabad, for his patient help, without whom this study would not have been completed successfully.

The investigators sincere thanks are also due to **Dr.Shyam Sunder**, M.D.,D.M., M NAM, Professor and Head of the Department of Endocrinology, Osmania General Hospital Hyderabad, **Dr.Bipin Kumar Sethi**, Endocrinologist, Department of Endocrinology, Osmania General Hospital Hyderabad,

Dr.Chandrasekhar, MD, DM, Endocrinologist, Government Meternity Hospital, Hyderabad and **Dr.(Tmt.) Christy Ganapathy**, MD, DGO, Gynecologist, Sheela Hospital, Coimbatore and **Dr.Asha Rao**, MD DGO, Gyneocologist, Rao Hospital, Coimbatore, **Dr.M.Sivaprakash**, Immunologist, National Institute of Nutrition, **Mr.T.Samuel,** Dietician, Government Meternity Hospital, Hyderabad, **Mr.Soma Reddy**, Dietician, Niloufer Hospital for Women and Children, Hyderabad for their valuable and patient cooperation in carrying out this study.

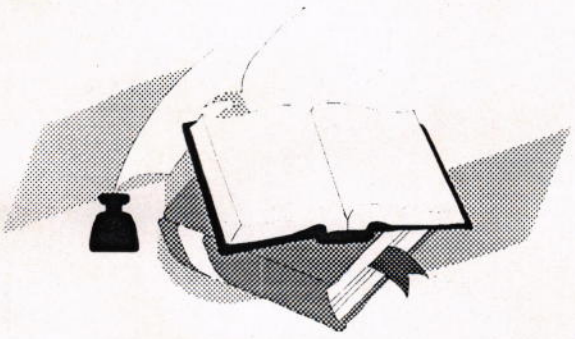
The author places her grateful thanks to the subjects for full co-operation rendered thereby facilitating the conduct of the study.

A special note of thanks to **Mr.S.C.Krishnamurthy** who helped the investigator to complete the study successfully.

The author expresses her deep sense of gratitude to her family members for their moral support and encouragement to carry out the study successfully.

The researcher expresses her deep appreciation to her friends for offering their help at the most crucial times.

Above all the author thanks God Almighty for His Manifold Mercies showered on her for the successful completion of this study.



CONTENTS

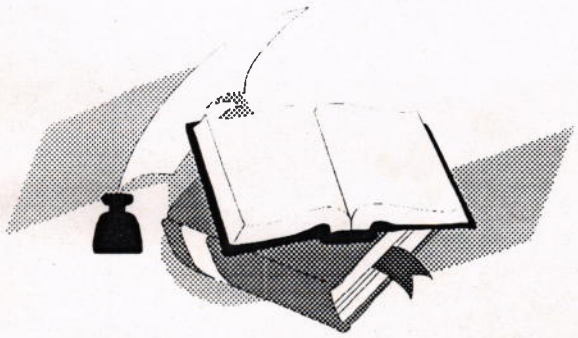
CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

LIST OF APPENDICES



INTRODUCTION

I. INTRODUCTION

The crucial time where the health of a woman is tested is during her motherhood. Health alone determines the well being of the mother, the foetus, the infant and the child and in turn the optimum health of the next generation.

All pregnancies and deliveries are potentially at risk. A pregnancy is said to be normal only in retrospect that is when the mother has passed safely through pregnancy, labour, and puerperium with the healthy baby. In certain categories of pregnancies, the mother, the foetus or the neonate are at an increased risk. Health action (1995) warns that 10 to 30% of the pregnancies belong to this category and account for 75 to 80% of the perinatal morbidity and mortality.

Every year half a million women die in the third world countries from complications of pregnancy and child birth. More maternal deaths occur in India in one week than in the whole of Europe in one year (Kumar **et al.**, 1994).

According to Ravindran (1997) women working in hazardous industries end up with gynaecological problems like dysmennorhea, leucorrhea, premature and still births, high rates of neonatal infant and maternal mortality prolapse of the uterus and miscarriages.

The major causes of maternal deaths are anaemia, bleeding, toxemia, puerperal sepsis and abortions. Maternal deaths in India are unacceptably high. Indian women on an average undergo 6 to 7 pregnancies resulting in 5 to 6 live

births of whom 4 to 5 survive. As Devadas (1994) states the maternal mortality rate is estimated to 400-500 per 1,00,000 live births which is 50 times higher than any other developed country.

At present nearly 4 women out of thousand deliveries in India die due to maternal causes (Health Action, 1995). According to Nagoankar **et al.** (1996) the cumulative maternal mortality rate for the period of 1990-1994 among the hospital deliveries was reported as 2.7/1,000 live births.

Among many complications a mother might undergo during her pregnancy, gestational diabetes an endocrine disorder, is one of the complications which causes increased foetal wastage and requires the services of an obstretician, endocrinologist, dietitian and a paediatrician.

Diabetes mellitus during pregnancy is very difficult to be managed and increases appreciably the risk of pregnancy complications and hence obstretician today screen pregnant women for blood sugar levels in addition to other blood parameters because of the potential significance with regard to long term health of the mother and the consequences of the foetus and the new born.

Seven million infants die annually because of complications that develop during pregnancy and poor management during delivery (Abouzhar **et al.**, 1993). The foetal mortality rate related to gestational diabetes had become negligible from a rate of 60-70% during 1900-1922, it

had fallen steeply during the 70's and had since been falling further (Dorothy, 1996).

In the pre insulin era, diabetic mother had less than 40% chance of having a live baby. Data from kings college hospital, London shows that while the prenatal death rate for diabetic pregnancies was 226/1,000 in 1951-60, it had dropped to 37/1,000 in 1971-80 (Wattkins, 1990).

With the advancement in medical knowledge and improved technology in the evolution of newer insulins. Since 1920, insulin delivery systems, which coincide with the advent of glycosylation haemoglobin assays, self monitoring of blood glucose and clearly active medical intervention in diabetic pregnancies, the maternal and infant mortality rates with diabetes mellitus have steadily declined, approaching those of non-diabetic women in well controlled pregnancies (Catalono, 1995).

Pregnancies complicated by overt diabetes mellitus have been associated with a perinatal mortality rate 5-10 times that of the non-diabetic population. Sudden intrauterine and neonatal deaths due to prematurity, trauma or congenital malformations account for much of the perinatal wastage. Considerable success in reducing prenatal mortality rate has been achieved by careful control of maternal diabetes and a liberal policy of cesarean sections to eliminate traumatic complications (Ranade **et al.**, 1989). Control of blood glucose has been shown to be important not only in prevention of acute complications of diabetes, like

hypoglycemia and hyperglycemia but in the prevention of fetal mortality and morbidity.

The extent of use of health services during pregnancy, at the time of delivery and during the post partum period are important factors in preventing most of the complications and health problems associated with child bearing. Counselling women referred for gestational diabetes with regard to balancing food with insulin or oral hypoglycemic agents and exercise is very essential. The increased emphasis on maintaining blood glucose to normal ranges in gestational diabetic mothers has focussed attention on the role of diet. Hence, diet counselling will have a good impact on monitoring the blood glucose levels in normal ranges.

As there is limited data available on the prevalence rate of gestational diabetes in India, the present study was undertaken to throw light on the prevalence of gestational diabetes and its impact on the outcomes of pregnancy.

The objectives of the study are To :

A. study the pattern of prevalence of gestational diabetes mellitus in selected hospitals over the study period.

B. elicit the details of background information of the target mothers.

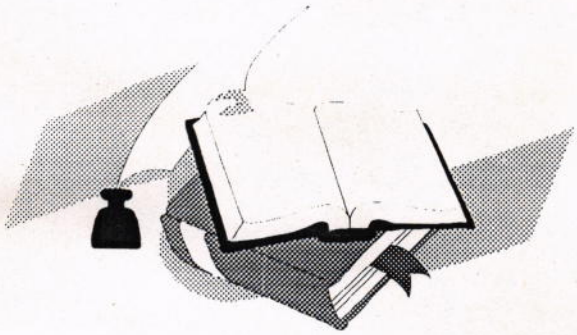
C. measure height and weight of the target subjects.

D. estimate of blood glucose, blood pressure and haemoglobin of the target mothers.

E. quantify day's food intake of the target mothers.

f. Study the outcomes of pregnancy and problems encountered by the new born.

g. counsel the target mothers on dietary aspects.



REVIEW OF LITERATURE

II. REVIEW OF LITERATURE

The literature pertaining to the study on pattern of prevalence of gestational diabetes mellitus and its impact on outcomes of pregnancy are reviewed under the following headings.

A. The present scenario of Gestational Diabetes Mellitus

B. Complications encountered by the Gestational Diabetic Mothers.

C. Gestational diabetes mellitus and outcomes of pregnancy

D. Diet and insulin therapy as management strategy of gestational diabetes mellitus

A. THE PRESENT SCENARIO OF GESTATIONAL DIABETES MELLITUS

GLOBAL SCENARIO

Gestational diabetes mellitus is diagnosed in approximately 90,000 women in the U.S. every year (Metzger, 1991). About 3.5% of all pregnant women or 70,000 to 1,000,000 women per year were affected by diabetes (Catalono, 1995).

According to Fagen **et al.** (1995) diabetes is present in one in 500 women of child bearing age and the prevalence of diabetes in pregnancy has been reported to be 0.1 to 2.7%. With active screening for diabetes in the pregnant population the incidence of abnormal glucose tolerance is 0.7 to 13.7% depending on the diagnostic criteria applied. Weller (1996) points out that gestational diabetes affects 3 to 6 per cent of all pregnancies.

In Industrialized nations gestational diabetes mellitus occurs in about 3% of pregnancies. In majority of cases glucose intolerance return to normal postpartum, but

the life time risk for impaired glucose tolerance and NIDDM is substantially increased (WHO Technical Report, 1994).

In German speaking countries 1-2% of pregnant women develop gestational diabetes mellitus requiring insulin treatment, while 0-8% have metabolic disturbances which make diet treatment advisable (Weiss **et al.**, 1989).

According to Green **et al.** (1993), the incidence of gestational diabetes was significantly higher for chinese and Hispanic women that for black and non-Hispanic white women.

According to Engelgau **et al.** (1995) in the year of 1988 when a study conducted to determine the prevalence of pregnancy complicated by diabetes in a representative sample of US population, diabetes was present in congruent to 1,54,000 (4%) of all pregnancies in the US. Gestational diabetes accounted for 1,35,000 of such pregnancies, non-insulin dependent diabetes mellitus for 12,000 and insulin dependent diabetes mellitus for 7,000.

According to Temez Perez (1993) the prevalence of Gestational diabetes Mellitus in an out patient clinic in north eastern Mexico during a two year study period was 6% had Gestational diabetes and 1.4% had one abnormal value. Gestational diabetes mellitus prevalence rate was higher in his study than in the only paper on Gestational diabetes prevalence reported in Mexico (3.9%).

According to Vercellini (1993) in a 2 year study period at Italy, in delivered women (above or equal to 40 years old with control < 30 years old) Gestational diabetes and chronic hypertension were the only more frequent

antepartum complications (2.4%) in cases with control (0.3%) (3.4% Vs 0.3%) respectively.

During 3 years of continuous screening for Gestational diabetes mellitus in the country of Uppsala, Sweden 1.2% (133 pregnant women) were diagnosed as Gestational diabetes (Sunchag **et al.**, 1991).

ASIAN SCENARIO

According to Raghuram (1989) diabetes occur in about 1% of pregnant women.

According to Sugarman (1989) maternal diabetes in pregnancy of 4.6% when women with pre-existing diabetes or documented, Gestational diabetes during a previous pregnancy were excluded, the prevalence of Gestational diabetes during the study period was 3.4% among Navojo Indian women in north western New Mexico.

The prevalence of Gestational diabetes mellitus by screening 25,997 pregnant women in a 2 year period at Bangkok, Thailand was 2.02% (Serirat **et al.**, 1995).

According to Rizvi **et al.** (1992) an oral glucose tolerance test on 2,230 consecutive women attending the antenatal clinic at the Agakhan University Medical centre in Karachi, Pakisthan revealed a prevalence for the entire population of 3.5% of Gestational diabetes and 1.9% of impaired glucose tolerance test based on the modified O'Sullivan Criteria.

The incidence of glucose intolerance among pregnant women is being increasingly reported in India. At AIIMS (All India Institute of Medical Sciences), the

incidence had increased from 0.8% in 1979-83 to 3% in 1985-89. This increase was mainly due to the improved detection of Gestational diabetes (Deorari **et al.**, 1985; Deorari **et al.** 1991). The incidence was reported as 0.48 and 2.1% in earlier studies.

Recent Indian figures are available from the Institute of Reproduction Medicine in Calcutta (unpublished data 1992), one hundred diabetes pregnancies were identified among the attendees of an infertility clinic, of which 16 were on insulin, 2 were on sulphonylureas and 82 were on diet alone (Chatterjee, 1993).

B. COMPLICATIONS ENCOUNTERED BY THE GESTATIONAL DIABETIC MOTHERS

According to Metzger (1993) women with Gestational diabetes were believed initially to be at risk for both type I and type II diabetes mellitus in later life, the available evidence now suggests these women are primarily prone for type II diabetes.

According to Boden (1996) important short term consequences of GDM are perinatal complications, and long term complications includes an increased rate of development of maternal non-insulin diabetes mellitus.

A review by American diabetes Association, diabetes care and educational dietetic practice group (1995) says that both the mother and the infant are at risk, when Gestational diabetes mellitus, is undetected or remain untreated. Before institution of aggressive screening and management for Gestational diabetes mellitus 6.4%. Perinatal mortality rate for pregnant women with untreated Gestational

diabetes mellitus was observed in women older than the age of 25 years. This compares with a 1.5% rate in pregnant women with normal glucose tolerance.

Diabetic retinopathy is the most common chronic complications associated with diabetes mellitus, it affects 20% to 30% of diabetic women in the reproductive age group (Reece **et al.**, 1996).

Gestational diabetes are at increased risk for adverse birth outcomes compared with low risk controls. Class A_2 diabetes mellitus and fetal macrosomia with its attendant risks are equally prevalent among patients with and without risk factors for gestational diabetes mellitus (Weeks, 1994).

The incidence of edema-proteinuria hypertension syndrome (EPH-syndrome), premature rupture of membranes, fetal macrosomia operative deliveries and perinatal morbidity were higher in women with gestational impaired glucose intolerance (GIGT)/gestational diabetes mellitus (GDM) than in women without GIGT/GDM (Sun **et al.**, 1995). Pregnancy complicated by diabetes is relatively frequent event and may result in fetal embryopathy (Osses **et al.**, 1995).

O'Sullivan has shown women developing gestational diabetes are at increased risk of diabetes mellitus in later life. Although women with gestational diabetes were believed initially to be at risk for both type I and type II diabetes mellitus in later life the available evidence now suggests these women are primarily at increased risk for type II diabetes. As such, the development of gestational diabetes

in women with normal glucose tolerance may serve as a paradigm for the pathogenesis of type II diabetes mellitus in later life in these at risk population (Catalono, 1995).

C. GESTATIONAL DIABETES MELLITUS AND OUTCOMES OF PREGNANCY

The infant of the diabetic mother is a prime example of the problems that may exist in the neonate secondary to maternal diseases (diabetes). From a developmental stand point, the normal neonate is in a transitional state of glucose homeostasis. The foetus is completely dependent on its mother for glucose delivery and the adult is considered to have precise control of glucose homeostatic, since plasma glucose concentration is regulated to a fine degree. The precarious nature of this situation emphasized by the numerous problems associated with neonatal hypoglycemia and hyperglycemia during this period of life (Cowett, 1985).

In normal human pregnancies, 2-3% of new born have a congenital anomaly. Major anomalies (ie.,) those that require surgery for fetal or the psychologically disastrous affect 1% of pregnancies. In diabetes the incidence of major anomalies ranges between 7.5% and 12.9% (Chatterjee, 1993).

The morbidity and mortality was lesser in infants of gestational diabetes mothers compared to infants of preconceptional diabetic mothers. Hypoglycemia was documented in 50%, polycythemia in 20%, birth asphyxia in 18%, respiratory distress syndrome and hypocalcemia in 14% each, transient tachypnea of the new born in 12%

hyperbilirubinemia in 8%, congenital anomalies in 4%, and cardiomyopathy, birth trauma and maximum aspiration in 2% each. The overall mortality was 20%. Infants born to mothers on oral hypoglycemic agents had a poor outcome (Rande **et al.**, 1989).

Maintenance of near normoglycemia by the mother during pregnancy or while attempting to become pregnant and subsequently during pregnancy has been reported to improve the outcome of offspring (Key **et al.**, 1987, Miodonth, **et al.**, 1988, Damm, **et al.**, 1989, Steel, **et al.**, 1990).

The new born infant of a diabetic mother is typically larger than those born to non-diabetic mothers. The over weight of the new born is mainly due to deposition of fat. The foetus is premature in development and functional capacity although big by birth (Koski **et al.**, 1990). Fetal macrosomia, defined as greater than 90th percentile for weight occurs in 25% to 42% of pregnancies in diabetic women as compared with 8% to 14% in control populations (Kitzmiller, 1986).

Macrosomic infants of diabetic women suffer increased morbidity and mortality from unexplained death in utero, birth trauma, hypertrophic cardiomyopathy, vascular thrombosis, neonatal hypoglycemia, hyperbilirubinemia, erythrocytosis and respiratory distress (Peterson **et al.**, 1997).

One or more abnormal glucose tolerance test (GTT) values were associated with comparably elevated incidence of large for gestational age (LGA) infants in patients with poor glycemic control. Achievement of recommended glucose

control decreased adverse outcomes to near normal levels (Bassaw, **et al.**, 1993).

According to the studies conducted by diabetes complications central trial (DCCT), the careful observation has now demonstrated a range of anomalies including growth retardation and malformation (Frankel, 1980, Reece, 1986). Many of these have been reproduced experimentally in animals with chemically induced or generally inbred diabetes or **in vitro** (Erikinsson, 1984). Fetal macrosomia is due to fetal hyperinsulinaemia stimulated by maternal hyperglycemia.

Neonatal hypoglycemia results from exaggerated insulin release following delivery, due to foetal betal cell, hyperinsulinism from maternal hyperglycemia. The consequences of the fuel mediated effect on intrauterine development are not limited to the foetal and neonatal period, but may lead to persistent impairment of insulin secretion and higher risk of developing obesity at a young age (John, 1993).

The fetal malformation may be related not only to hyperglycemia and the resultant alterations in metabolism but also to hypoglycemia (Reece **et al.**, 1984).

Roberts and patterson (1989) reported on a 20 year experience involving 1,528 pregnancies of diabetic women, of these 571 had type I diabetes and 957 had gestational diabetes. The perinatal mortality rate fell from 15.2% to 2% in those with type I diabetes and from 6.7% to 0.5% for those with gestational diabetes. The authors related the improved in mortality to better glucose control. They

reported as have other, that the major outstanding problem related to the persistently high incidence of congenital malformations.

Nordlander **et al.** (1993) opines that elevated factors that influence neonatal morbidity in gestational diabetes. Perinatal morbidity was significantly more frequent in women with gestational diabetes 23% than in control group (13%).

Infants of diabetic mothers have been known to be risk for cardiovascular problems because of structural cardiac defects or myocardial dysfunction from hyperviscosity, hypoxia or congestive cardiac failure manifesting respiratory distress syndrome, tachypnea or tachycardia. Earlier reports of cardiac evaluation both clinical and echocardiographically in neonates born to overt and gestational diabetic mothers revealed myocardial hypertrophy. (American college of obstetrician and Gynaecologists, Technical Bulletin, 1995).

D. DIET AND INSULIN THERAPY AS MANAGEMENT STRATEGY OF GESTATIONAL DIABETES MELLITUS

The management strategies for gestational diabetes mellitus vary across the world. The common goal is to reduce the perinatal morbidity and mortality that is associated with gestational diabetes mellitus control of maternal blood glucose level (Fagen **et al.**, 1995).

The medical management of pregnant diabetics has undergone multiple changes over the past several year resulting in improved perinatal outcomes. Obviously, insulin has been the therapeutic main stay in the treatment of

diabetes mellitus. Diet therapy antedates insulin and has been utilized probably as long as the existence of diabetes mellitus itself. Recently, an increase in dietary fibre has become fashionable, with claims of improved metabolic control, and in some cases, even replacing insulin therapy. Exercise is another therapeutic consideration now in vogue. In recent years, more and more women are participating in sports and exercise chance both prior to and during pregnancy. Therefore the safety and advisability of such activity in pregnancy is of vital importance (Winn **et al.**, 1989).

Management of gestational diabetes studies shows that normal glucose levels were achieved by diet in (Group I) and diet + insulin in (Group II). Blood glucose values were found to be higher in group I than group II (Heins, 1993).

The goal of treatment of maintenance of euglycemia is to decrease infant mortality and morbidity and the sequelae of the disease in the mother (Ferris **et al.**, 1988).

Insulin therapy

The use of insulin is now widely recommended when nutrition management does not consistently maintain a normal fasting, plasma glucose level of less than 5-8 mmol/L and or 2 hour post prandial plasma glucose 6.9 mmol/L (Metzger, 1991).

The goal of insulin therapy is to stimulate the normal acute release of pancreatic insulin is to mimic the normal model, twice daily injections of a combination of short and intermediate acting insulin are usually needed.

Women are asked to monitor their blood glucose levels at least 5 times per day through out the course of pregnancy overnight fasting blood glucose values < 5.27 mmol/L and 2 hour post prandial values < 6.6 mmol/L are the target (Gabbe, 1985).

Insulin is employed in subjects with gestational diabetes who have a fasting plasma glucose of greater than 140 mg/dl and/or a HbA1 greater than 8% on their initial visit or subjects uncontrolled on diet alone (post prandial blood sugar > 160 mg/dl). Current treatment includes, human insulins and pen devices as they are more convenient, acceptable and surprisingly more economical as the dosage requirements are less than those administered by conventional syringes. Most subjects are well controlled on split mixer regimens as they provide more flexibility in managing diabetes in the gravid state (Nadeem, **et al.** 1993).

Diet therapy

Nutrition intervention is considered as the corner stone of treatment for all women with gestational diabetes mellitus. The American diabetes association advocates that all women with gestational diabetes mellitus receive nutrition counselling by a dietitian when possible. The registered dietitian's most crucial and important goal is achieving normal blood glucose levels while maintaining appropriate nutritional status and adequate dietary intake for fetal growth and development (Fagen **et al.**, 1995).

The aims of nutritional therapy in pregnant diabetics are

1. the attainment of recommended weight gain in pregnancy.
2. facilitate meticulous control of diabetes with a view to obviate complications of pregnancy, nd
3. ensuring a successful outcome of pregnancy (Nadeem **et al.**, 1993).

Wechter **et al.**, (1993) says that the incidence of foetal macrosomia in gestational diabetes can be kept equal to that of general population by a program of intensive diet therapy (ie., placed on 1800 to 2000 kcal American Diabetes Association diet) and home glucose monitoring with insulin being, used only therapeutically not prophylactically. During the first trimester of pregnancy, 30 kcal/kg of the desirable body weight and during second trimester and third trimester, 35 kcal/kg of the desirable body weight is recommended. Through out pregnancy diet should contain 1.5-2.0 g of protein per kg body weight. It is advisable that total gain in the body weight should not exceed 12 kgs (Raghu Ram, 1993).

The incidence or severity of glucose intolerance of pregnancy can be prevented by nutrient supplementation, morbidities associated with this disease (pregnancy loss, fetal macrosomia, hypoglycemia, hyperinsulinaemia and hypocalcemia) can be minimised (Peterson, 1996). Specific nutrients are needed to preserve pancreatic function and/or increase insulin sensitivity are chromium, magnesium, potassium and pyridoxine (Peterson, 1996). In a study conducted by Peterson (1996), they randomised 24 gestational diabetic women into a group that received

chromium supplementation (4 ug/kg/day chromium as chromium pocolinate, the RDA for pregnancy) and into a group that received placebo. The fasting plasma glucose and insulin level were significantly lower in the chromium supplemented group after 8 weeks of therapy.

Gestational diabetic women are predisposed to magnesium deficiency mediated by glucosuria and impaired intestinal absorption secondary to iron supplementation (Babior **et al.**, 1986). Magnesium deficiency parallel potassium deficiency because they are both intracellular cation.

Pancreatic intracellular potassium is important for insulin secretion obligatory urinary potassium losses may therefore further impair maternal pancreatic insulin secretion. Magnesium supplementation, in doses of 1-3 g of magnesium salts, are recommended as an adjunctive therapy for the prevention of pregnancy induced hypertension (PIH), there recommendations might also improve glucose intolerance in gestational diabetic women (Spatling **et al.**, 1988, Whelton **et al.**, 1989).

Supplementation with pyridoxine in the 2nd and 3rd trimester at a time when prolactin has reached blood levels greater than 200 mg/ml may improve glucose tolerance in women with gestational diabetes. Spelcacy **et al.** noted a pyridoxine deficiency associated with gestational diabetes (Peterson, 1996).

A fibre enriched diabetic diet (40-50 grams of fibre/day) given to the pregnant diabetic patients as it

facilitates glycemic control and blunts hunger pangs by providing carbohydrates with low caloric density. These in turn, helps to restrict weight gain in pregnancy (Nadeem **et al.**, 1993).

Normoglycemia needs to be maintained with normal weight gains of 11-18 kg depending on maternal body mass index, moderate exercise and a diet providing 35 kcal/kg ideal body weight which is close to recommended composition of the diet should be 20% protein, < 30% fat and > 50% carbohydrate. With appropriate reduction in saturated fat and cholesterol and increase in dietary fibre (Hagay, **et al.,** 1992).

Nutritional counselling strategies

The importance of customising nutrition counselling to patients needs is well acknolwedged in the literature (Hauestein **et al.**, 1987; Park's **et al.**, 1986; Curry, 1986; Hooeltzel, 1986; Danesh **et al.**, 1986; Hugher, 1986). Of the particular interest is the model developed by Mason **et al.** (1982) centres the dyanamics of nutritional counselling services serves on the knowledge and skills needed to satisfy the clients needs, wants and values. According to this conceptual frame work, clients receive counselling services as the effective behaviour is presented in terms that they can understand, in a pleasant manner, and make the diet seems easy to follow.

The registered dietitians plays a vital role in the education of women with gestational diabetes. Dietary management of gestational diabetes in these women requires application of nutrition, medical, obstructive and behaviour

knowledge. The behaviour changes that the dietitian is able to facilitate during pregnancy will also be important in the postpartum period, when the goal is often shifted to losing weight for prevention of future diabetes. Pregnancy offers a unique opportunity to begin to educating pregnant women about the importance of healthful diet and to enable them to see the result of proper dietary adherence (Fagen **et al.**, 1995).

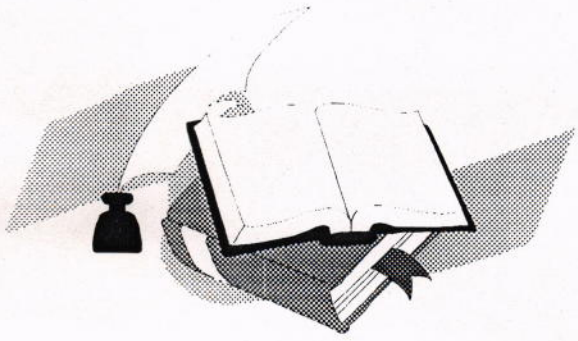
Schnelder (1982) states that nutritional counselling and education are recognised as key elements in educational programmes. The effectiveness of these programmes is directly related to the ability to produce changes in the patients eating habits. The nutritional counsellors serve as a behaviour change agent by completing a three part process for individual. These involves assessing nutritional needs, constructing a appropriate meal plan and providing initiation and follow up counselling.

It has been recognised that dietary advice plays an important role in the successful management of all diabetics. The patients should be offered a clear idea of their dietary needs and should received individual dietary advice because personal attention by the health care member increases the encouragement and leads to better management of the diseases (British Diabetic Association, 1992).

Among the various methods adopted to counsel patients one of the method is individual counselling, which is considered to be superior among the other methods. According to Shaw (1982) counselling may effective by

individual services and by good practical approaches of demonstration.

According to the National Institute of Nutrition (1993) the diabetics should be educated on the nature of the diseases and possibility of development of acute and long term complications of the conditions if the blood sugar is not kept under control. Adequate basic information enables to understand the importance of following the instructions on diet, excerice and drugs.



METHODOLOGY

III. METHODOLOGY

The methodology followed for the study on "Pattern of Prevalence of Gestational Diabetes Mellitus and its impact on outcomes of pregnancy" is discussed under the following headings.

A. Identification of the target pregnant mothers and finding the prevalance rate of gestational diabetes

B. Study on the background information of the target mothers.

C. Measurement of height and weight of the target mothers

D. Estimation of blood glucose, blood pressure and haemoglobin of the target mothers

E. Quantification of day's food and nutrient intake

F. Study the outcomes of pregnancy and problems of the infant

G. Counsel the selected mothers on dietary aspects

A. Identification of the patients and finding the prevalance rate of gestational diabetes

The study on prevalence of Gestational Diabetes Mellitus (GDM) among pregnant women was carried out at Hyderabad and Coimbatore. Three popular maternity hospitals namely, Government Maternity Hospital (GMH), Fernandez Maternity Home (FMH), Niloufer Hospital for women and children (N.H.W.C) and 2 Government hospitals namely, Osmania General Hospital (O.G.H), St.Theresa's General Hospital (S.S.H) and one private Endocrinology clinic (S.S.C) were selected at Hyderabad. Over a period of one month in all the six hospitals, the pregnant women who were screened as Gestational diabetics, and the mothers with gestational diabetes who delivered during this period were identified. O'sullivan and Mahan's criteria for diagnosing

glucose intolerance during pregnancy have been considered as gold standard. They recommended 100 gms glucose load, with estimation of blood glucose and plasma glucose at fasting 90 mg/dl, 105 mg/dl, 1 hour 165 mg/dl or 190 mg/dl, 2 hours 145 mg/dl or 165 mg/dl and 3 hours 125 mg/dl or 145 mg/dl respectively. If any two of the plasma glucose values exceed the cut-off values the test is considered positive (O'sullivan **et al.**, 1964). Based on this test from a total of 1,047 pregnant mothers 27 mothers had gestational diabetes while diabetic pregnant mothers were 5 and among those 27 gestational diabetics 11 mothers had delivered their babies.

At Coimbatore in two private hospitals namely Sheela Hospital and Rao Hospital were selected to carry out the study for a period of one month. Of the 540 pregnant women who reported to the hospitals, 5 were identified as gestational diabetics. Table I presents details on the mothers identified.

For comparison of outcomes of pregnancy in between gestational diabetic mothers and normal mothers, 5 normal pregnant women who delivered during the study period were selected at coimbatore within the same age group and income level.

TABLE I

DETAILS ON PREVALENCE OF DIABETESIN PREGNANCY IN THE SELECTED HOSPITAL DURING SURVEY PERIOD OF ONE MONTH

Name of the Hospital	No.of pregnant women reported	No.of diabetic pregnant mothers	No.of GDM* women	No.of GDM* mothers delivered	No.of Normal Pregnant women delivered
HYDERABAD					
Government Maternity Hospital	450	2	4	4	
Fernandez Maternity Home	150	1	7	2	
Niloufer Hospital for women and children	392	NIL	3	1	
Osmania General Hospital	55	NIL	NIL	1	
St.Theresa's General Hospital (Seen only in-patients)	-	NIL	1	1	
Private Endocrinology Clinic (Referral cases)	-	2	2	1	
COIMBATORE					
RAO HOSPITAL	240	NIL	NIL	4	3
SHEELA HOSPITAL	300	NIL	NIL	1	
MEENAKSHI CORPORATION HOSPITAL					2

* Gestational Diabetes Mellitus

Gestational Diabetes Mellitus (GDM) as pointed out by Cathey Fagen (1995) is diabetes that occur only during pregnancy and remits back after delivery, whereas the mothers who were preconceptual diabetics and conceived are known as diabetic pregnant women. Gestational diabetes

mellitus is defined as "carbohydrate intolerance of variable severity with onset or first recognition during the current pregnancy". Women with gestational diabetes mellitus, typically have normal carbohydrate tolerance before pregnancy and their carbohydrate tolerance returns to normal after delivery (Second International Workshop on Gestational Diabetes, 1985).

The selected cases were grouped as group I which included the mothers who were diabetic and pregnant, while group II had gestational diabetic mothers and gestational diabetic mothers who delivered their babies were in group IIIa and non diabetic mothers who delivered their babies were group IIIb.

B. STUDY ON THE BACKGROUND INFORMATION OF THE TARGET MOTHERS

A well framed interview schedule (Appendix I) was used to collect the information from the subjects on socioeconomic status like age, occupational status, educational status, total monthly income and family size. According to Kothari, C.R. (1996) "An interview schedule is one which is generally filled out by the research worker or the enumerator who can interpret questions when necessary".

C. MEASUREMENT OF HEIGHT AND WEIGHT OF THE TARGET MOTHERS

Body measurements like height and weight of the selected subjects were taken using standardised procedures of Jelliffee (1991). Height was recorded to the nearest of 0.1 cm using a stadiometer, the person bare foot with her heels against the upright bar of the scale standing erect. Weight was measured using spring balance with the patients

barefoot, the balance being checked every time before use, with standard weight in the range of 0.5, 1.0 or 2.0 kgs to ensure accurate measurement (Jelliffee, 1991). Weight gain for each month of the subjects also recorded from their respective medical records, during the term. Data on prepregnancy weight was obtained from the medical records of the subjects which was recorded by the concerned gynaecologist when they came for their initial check up, soon after conceiving. Individual height, weight and body mass index was presented in Appendix VII.

Prepregnancy body mass index was computed using the formula

$$BMI = \frac{\text{Weight in kilograms (kg)}}{\text{Height in meter square } (m^2)}$$

Based on the prepregnancy body mass index of the subjects, they were graded as normal and obese using the world health organization, Geneva Classification (1995).

D. ESTIMATION OF BLOOD GLUCOSE, BLOOD PRESSURE AND HAEMOGLOBIN OF THE TARGET MOTHERS

Blood glucose, blood pressure levels and haemoglobin status of the selected subjects were obtained from the medical records of the respective subjects.

The tests conducted for pregnant mothers usually include estimation of blood pressure, haemoglobin levels, test for HIV and test for HBS Ag. Blood glucose levels estimation are recommended to those pregnant mothers who have strong family history of diabetes, bad obstretics history of previous (still births, abortions, intrauterine

deaths etc.) and if urine sugar is positive. For patients who have positive results for urine sugar, glucose tolerance test (GTT) based on O'sullivan and Mahan criteria (O'sullivan **et al.**, 1964) is carried out for confirmation and diagnosis of Gestational Diabetes Mellitus and are referred to an endocrinologist.

The blood glucose level of the subjects both fasting and post prandial were estimated by using the glucometer by the hospital laboratory technician which works by the glucose oxidase principles (Drash, 1989) (Appendix II) fortnightly by the respective endocrinologist. The values of blood sugar for each month during the term of the mothers who delivered their babies were obtained from the medical records maintained by the hospital laboratories (Appendix VIII).

The blood pressure of the patients was estimated with the help of spygmomanometer and was carried out by the nurse and recorded (Appendix IX).

Haemoglobin was estimated by the cyanometh Haemoglobin method for the subjects (Appendix III) for every month of the term in the clinical laboratory of the hospitals and this was taken from the respective medical records. Individual haemoglobin values are presented in Appendix X.

E. QUANTIFICATION OF DAY'S FOOD AND NUTRIENT INTAKE

Nutrition during pregnancy has an important bearing on maternal and fetal well being and hence the details on the dietary pattern of the selected subjects were

obtained by administration of a 24 hour recall survey format for three consecutive days. According to Guthrie (1989) "In the 24 hour recall method, subjects are interviewed by a interviewer who asks them to describe the kinds and amount of food consumed in the previous 24 hours". For collecting accurate information on dietary pattern, a 24 hour recall survey format was administered for three consecutive days to five diabetic mothers, 16 gestational diabetic mothers and 16 gestational diabetic mothers who delivered their babies and five non diabetic mothers who delivered their babies. From the days mean food intake, the nutrient intake was computed using the food composition tables ICMR (1993).

F. STUDY THE OUTCOMES OF PREGNANCY AND PROBLEMS OF THE INFANT

The details on outcomes of pregnancy was elicited from sixteen mothers (eleven mothers in Hyderabad and five mothers in Coimbatore) who are gestationally diabetic but have delivered their babies during the study period.

An interview schedule (Appendix IV) was administered to the Gestational Diabetes Mellitus mothers and with the help of the nurse the details were elicited regarding their labour.

Post delivery management approach towards Gestational Diabetes in terms of blood sugar levels, treatment undergoing and dietary modifications were also elicited by the interview schedule framed earlier which was used to elicit prepregnancy details.

The details, about the lactation outcomes were also obtained in terms of breast feeding practice, colostrum

feeding, use of galactogogues, and blood sugar level before and after feeding with the help of a well framed interview schedule (Appendix V).

According to Fagen (1995) and Jacobson (1989) untreated gestational diabetes is associated with many of the neonatal morbidities that are found in patients with pre-gestational diabetes. Macrosomia, hypoglycemia, hypocalcemia, polycythemia, hyperbilerubenemia, congenital anomalies risk in infants of mothers with gestational diabetes appears to be no different from that of mothers without diabetes.

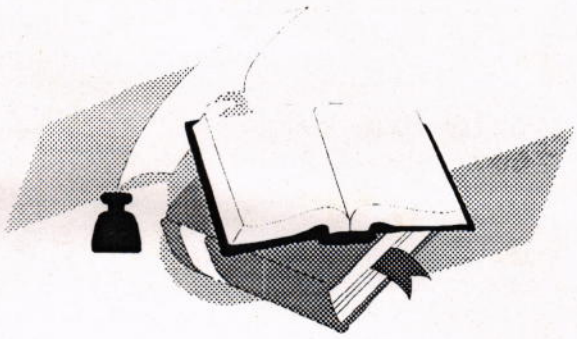
Hence the details on the problems of the infant born to gestationally diabetic mothers were elicited in terms of birth weight, length, blood glucose levels soon after birth and other complications like macrosomia, hypoglycemia, hypocalcemia, congestive heart failure, polycythemia, respiratory distress syndrome (RDS) and congenital anomalies were obtained with the help of the nurse by using a well framed interview schedule (Appendix VI). Individual birth weight and crown heel length of newborns are presented in Appendix (XII).

G. COUNSELLING THE SELECTED MOTHERS ON DIETARY ASPECTS OF DIABETES

Five diabetic mothers, 16 gestational diabetic mothers and gestational diabetic mothers who were in their last stage of pregnancy and delivered their babies at Hyderabad and Coimbatore were counselled on dietary aspects that has to be followed during pregnancy for diabetes to create awareness regarding gestational diabetes mellitus and

Plate 1. COUNSELLING OF GESTATIONAL DIABETIC MOTHER ON DIETARY ASPECTS

complications and role of diet. Each patient was counselled individually for a period of half an hour once and diet counselling was done with the help of visual aids like household measures (Spoons, Katoris and tumblers) were used. A hand out (Appendix XII) which included the information about the causes, complications, diet instructions, and food exchange list for diabetics and gestationally diabetic was also given to the subjects who were counselled. The details were presented in the handout were translated into local languages to those subjects who were unable to understand English. Diet prescription for a day were given to the target mothers.



RESULTS AND DISCUSSION

IV. RESULTS AND DISCUSSION

The results and discussion of the study on "PATTERN OF PREVALENCE OF GESTATIONAL DIABETES MELLITUS AND ITS IMPACT ON OUTCOMES OF PREGNANCY" is discussed under the following headings.

A. Prevalance of gestational diabetes mellitus over the survey period

B. Background information and details on pregnancy of the target mothers.

C. Body mass index (BMI) of the target mothers

D. Blood Glucose, Blood Pressure and Haemoglobin profile of the target mothers

E. Management strategies and details on dietary practices

F. Details on outcomes of pregnancy of gestational diabetic mothers and non diabetic mothers

G. Problems encountered by neonates of gestational diabetic mothers.

H. Creating awareness on dietary aspects

A. Prevalence of gestational diabetes mellitus over the survey period

The prevalence of gestational diabetes among target mothers was found to be 32 of 1047 pregnant mothers at Hyderabad in the six hospitals over the one month survey period. The rate of prevalence at Coimbatore was found to be 5 of 540 pregnant mothers over a period of one month in two hospitals.

B. Background information and details on pregnancy of the target mothers.

The elicited details on the background information of the target mothers are discussed and the following table II gives details on the age distribution.

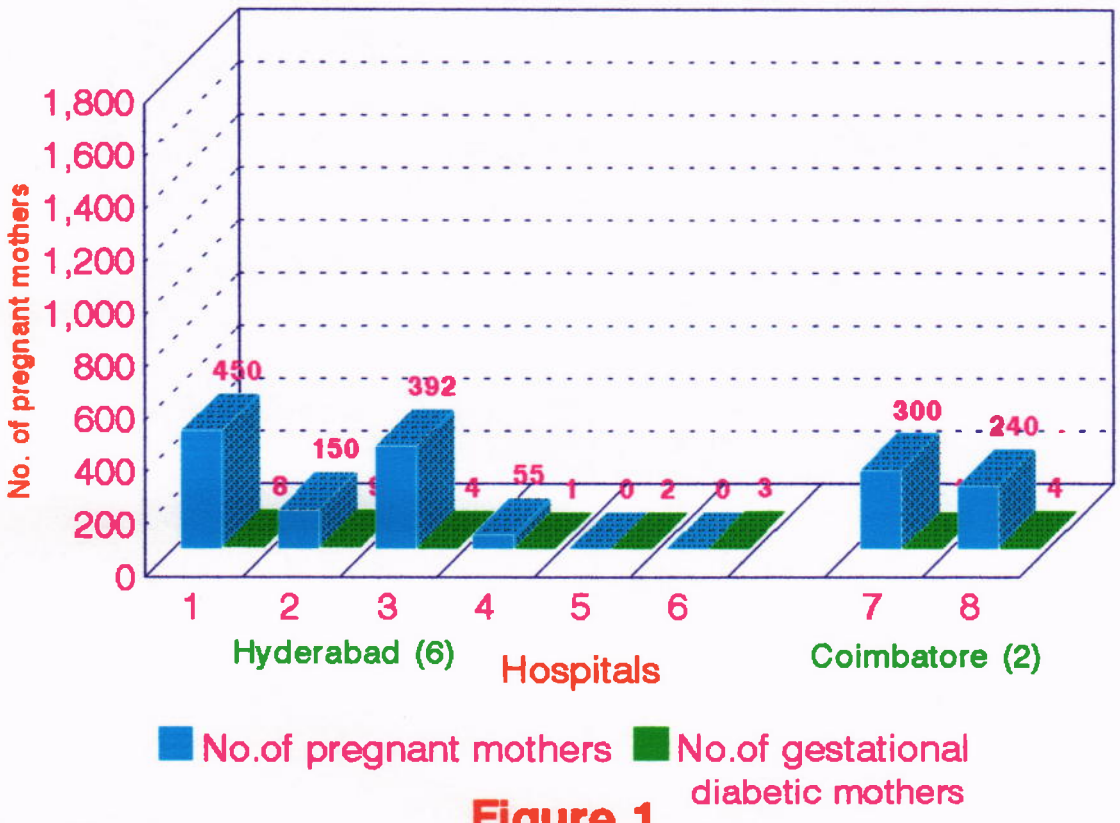


Figure 1

Prevalence pattern of gestational diabetes mellitus in selected hospitals at Hyderabad and Coimbatore

TABLE II
DETAILS ON AGE DISTRIBUTION OF TARGET MOTHERS

DETAILS OF TARGET MOTHERS	AGE IN YEARS			
	< 20	20-25	25-30	> 30
Group I (n=5)*	NIL	3	2	NIL
Group II (n=16)#	1	5	4	6
Group III				
a. (n=16)@	NIL	2	6	8
b. (n=5)&	NIL	1	1	3

* - Diabetic pregnant mothers
\# - Gestational diabetic mothers
@ - Gestational diabetic mothers who had delivered their babies.
& - Non diabetic mothers who had delivered their babies.

Majority (13) of the pregnant mothers were in the age range of 25-30 yrs. Six gestational diabetic mothers in (group II) were above 30 years and in group III (a) six were in the age range of 25-30 yrs age while 8 mothers were above 30 yrs. The pattern of distribution clearly, shows that increasing maternal age is one of the risk factor for diabetes in pregnancy as supported by studies of Stewart (1994).

TABLE III
EDUCATIONAL AND OCCUPATIONAL STATUS OF THE TARGET MOTHERS

Details of target mothers	Educational status				Occupational status			
	Illiterate	Primary school	High school	College	Housewife	Office going	Professionals	Coolie
Group I (n=5)	NIL	2	1	2	4	1	NIL	NIL
Group II (n=16)	2	2	3	9	15	1	NIL	NIL
Group III								
a. n=16	3	4	1	8	9	1	5	1
b. n=5	NIL	3	2	NIL	5	NIL	NIL	NIL

The above table III outlines the educational and occupational status of the target mothers. Majority of the target mothers ie., (37) were educated while only five (ie., two in group II, and three in group III (a)) were illiterates.

The occupational status shows that five mothers were professionals while majority ie., (33) were housewives. A coolie mother who was 24 years belonging to group III (a) had gestational diabetes mellitus indicating the incidence to be present among the younger adult also

TABLE IV
MONTHLY PERCAPITA INCOME OF THE TARGET MOTHERS

Details of target mothers	MONTHLY PERCAPITA INCOME IN RUPEES							
	250-500	501-750	751-1000	1000-2000	2000-3000	3000-4000	4000-5000	> 5000
Group I (n=5)	Nil	1	1	3	NIL	NIL	NIL	NIL
Group II (n=16)	3	1	1	3	3	2	2	1
Group III								
a. n=16	1	4	3	3	NIL	1	NIL	4
b. n=5	Nil	1	1	1	NIL	NIL	NIL	2

It is evident from the above table IV that (17) of the mothers had a montly percapita income below Rs.1,000/-. and seven mothers were having a monthly percapita income above Rs. 5000 as their spouses were working in abroad.

TABLE V
FAMILY SIZE OF THE TARGET MOTHERS

Details of target mothers	NUMBER OF FAMILY MEMBERS			
	2-4	4-6	6-8	5 & above
Group I (n=5)	2	2	1	NIL
Group II (n=16)	12	3	1	NIL
Group III				
a. n=16	8	5	1	2
b. n=5	3	2	NIL	NIL

From the above table V it can be elicited that a family size of 2-4 members was more prevalent revealing the increasing trend of families adopting small family norm in the present day. Only a very minor group ie., two families in group III (a) had a large family size above eight members.

B. Details on pregnancy of the target mothers

The details on pregnancy of the gestational diabetic and non diabetic mothers are discussed as follows.

TABLE VI
PARITY AND GESTATIONAL TERM OF DIABETIC PREGNANT MOTHERS

PARITY	Group I (n=5) GESTATIONAL TERM	
	I TRIMESTER	II TRIMESTER
PRIMIPARA (n=1)	NIL	1
MULTIPARAE		
2nd pregnancy (n=1)	1	NIL
3rd pregnancy (n=3)	1	2

The above table VI reveals the parity and gestational term of the group I (ie., mothers who are diabetic and pregnant). Only one mother was primipara and four were multiparae, one in her 2nd pregnancy and three in their 3rd pregnancies. The primipara mother was in her II trimester, whee as the mothers being multiparae were in I and II trimesters. None of the target mothers were in their late trimester and hence outcomes of pregnancy was unable to be obtained during the study period.

TABLE VII
PARITY AND GESTATIONAL TERM OF THE GESTATIONAL DIABETES MELLITUS PREGNANT MOTHERS

PARITY	Group II (n=16) GESTATIONAL TERM		
	I TRIMESTER	II TRIMESTER	III TRIMESTER
PRIMIPARA (n=5)	1	3	1
MULTIPARAE (n=11)			
2nd pregnancy (n=3)	NIL	2	1
3rd pregnancy (n=4)	NIL	2	2
4th pregnancy (n=1)	NIL	NIL	1
5th pregnancy (n=2)	NIL	1	1
11th pregnancy (n=1)	1	NIL	NIL

Table VII reveals the parity and gestational term of gestational diabetic mothers. Five mothers were primiparae and among them three were in the third trimester. Totally 11 mothers were multiparae gravadae and among these 10 mothers were in their 2nd and 3rd trimester. One mother was in her 11th pregnancy in first trimester diagnosed for gestational diabetes only in the 11th pregnancy. She had seven live children.

According to Stewart (1994) repeated pregnancies is one of the predisposing causes to gestational diabetes.

FAMILY HISTORY OF DIABETES

A high risk factor of diabetes namely heridity was noticed in 21 of the pregnant mothers. Among those who had family history, both maternal and paternal lineage was noticed.

As Weeks **et al.** (1994) points out family history of diabetes is one of the risk factors of gestational diabetes mellitus.

TABLE VIII
POINT OF DETECTION OF DIABETES MELLITUS
DURING THE GESTATIONAL TERM IN THE TARGET MOTHERS

DETAILS	POINT OF DETECTION OF DIABETES MELLITUS MONTHS OF PREGNANCY								
	I TRIMESTER			II TRIMESTER			III TRIMESTER		
	1M	2M	3M	4M	5M	6M	7M	8M	9M
Group II (n=16)	-	2	3	NIL	4	3	1	4	NIL
Group III a. n=16	-	2	3	2	NIL	3	3	1	2

The details given in the Table VIII were only for group II and III (a) : gestational diabetic mothers who had delivered, because group I mothers were diabetic pregnancies and group III (b) were non diabetic mothers.

From the above table it is evident that majority (12) of the mothers were diagnosed as Gestational diabetics in 2nd and 3rd trimester but 10 mothers ie., five from group II and five from group III were detected in Ist trimester which made them to start treatment earlier for diabetes control and to under go safe motherhood.

PRENATAL CARE TAKEN BY THE TARGET MOTHERS

Of the 37 target mothers, three diabetic mothers, nine gestational diabetic mothers in their second trimester were immunised with Tetanus toxoid I dose and one diabetic mother, five gestational diabetic mothers in third trimester and 16 gestational diabetic mothers who delivered their babies were immunised by both the doses of Tetanus toxoid I and II. The reamining three mothers ie., one diabetic mother and two gestational diabetic mothers who were in their first trimester are waiting to receive the doses of Tetanus toxoid in the subsequent trimester.

Thirty eight mothers used calcium, iron, folic acid and B complex supplements as prescribed by their respective gynaecologist. Ten of these mothers availed the supply of iron and folic acid supplements in the maternal and child health care unit. According to Khan (1993) if pregnant women take 100 tablets of iron and folic acid during pregnancy, particularly in third trimester infant death due to low birth weight can be reduced.

Exercise

The details of exercise pattern indicated that only three out of 32 gestational diabetic mothers ie., one from group II and two from group III performed exercise such as walking regularly. Exercise particularly valuable during pregnancy and therefore a prospective mother should continue all reasonable exercising to which she is accustomed.

Fagen **et al.** (1995) points out the major metabolic benefits of exercise are related to its ability to enhance insulin sensitivity which will improve glucose control.

HEALTH PROBLEMS OF THE TARGET MOTHERS

Of the details collected on health problems encountered by the target mothers 20 of the pregnant mothers reported of having nausea, vomitting, constipation and four had reported of other health problems like leg pain, dizziness and getting fatique easily. Out of these 20 mothers, six had reported of constipation alone which might be due to compression of the large intestine by the enlarged uterus which hampers free bowel movement which is common in pregnant women.

OUTCOMES OF PREVIOUS PREGNANCY

Sixteen of the target mothers had undergone abortions, intrauterine deaths and still birth of the new borns in their earlier pregnancies. The most commonly noticed problem was abortions where 11 mothers had experienced among 16 mothers. Among the 16 mothers three mothers from group I (diabetic pregnant mothers), three from group II (gestational diabetic mothers) and 10 from group IIIa (gestational diabetic mother who delivered their babies) and only one mother from group IIIb (non-diabetic mother). This repeated pregnancies, history of abortions still births, intrauterine deaths might be one of the causes for gestational diabetes mellitus in present pregnancy.

In non diabetic mothers, one mother had experienced three abortions and one intrauterine death and she had delivered a healthy baby in her present 5th pregnancy.

C. BODY MASS INDEX OF THE TARGET MOTHERS

From the height and weight of target mothers, body mass index was computed and given in the following table.

TABLE IX

BODY MASS INDEX OF THE TARGET MOTHERS (PREPREGNANCY STAGE)

DETAILS	*BODY MASS INDEX (PREPREGNANCY STAGE)						
	< 16	16.0-16.99	17.0-18.49	18.5-24.99	25-29.99	30-39.99	> 40
Group I (n=5)	1	NIL	NIL	2	1	NIL	1
Group II (n=16)	1	NIL	-	10	3	1	NIL
Group III							
a. n=16	NIL	1	NIL	11	3	NIL	1
b. n=5	1	1	1	NIL	2	NIL	NIL

* Source : WHO TECHNICAL REPORT 847, 1995. 'Physical status- The use and interpretation of Anthropometry

In order to find out the relation between prepregnancy weight and outcomes of pregnancy, the body mass index was computed and the above table IX outlines that a majority of the target mothers ie., two, 10 and 11 from groups I, II and III respectively were having normal body mass index ie., 18.5-24.99. Only one mother from group I and one from group III (a) was over weight ie., the body mass index was above or equal to 40. Among the group III (b) three mothers were under weight. Among these three women, two mothers delivered babies with birht weight of 2.25 kg and 2.8 kg.

In a study carried out by Jennifer Synder **et al.** (1994) increased prepregnancy body mass index, gestational weight gain before diagnosis and the magnitude of macrosomia

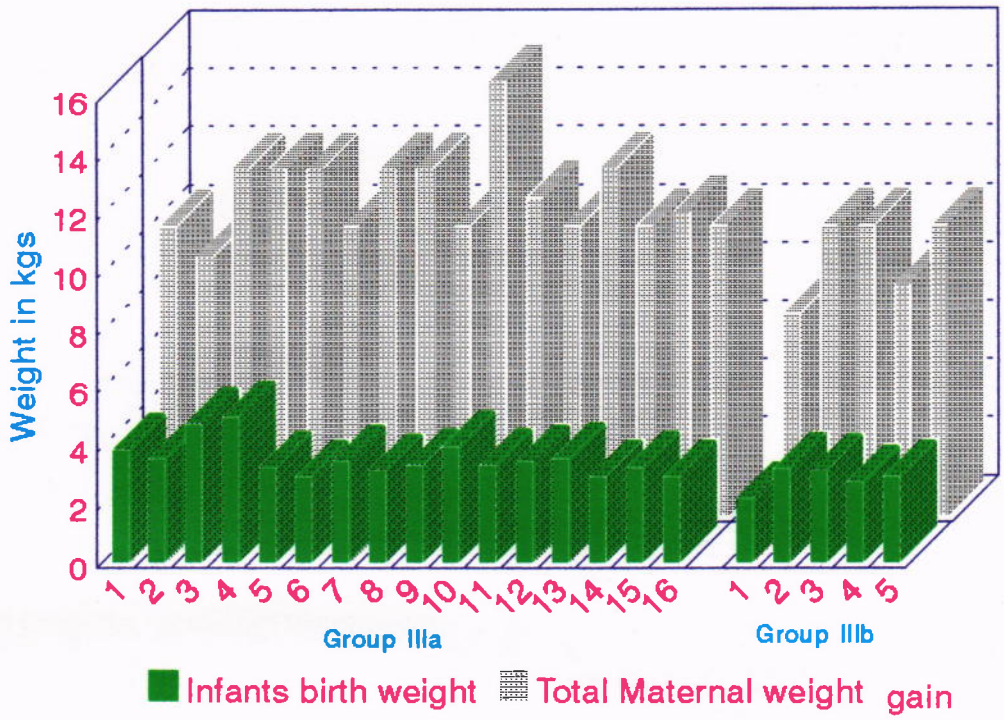
is greater in obese and over weight women than in normal under weight women with gestational diabetes, but in contrast our results showed that the women who were with normal body mass index (18.5-24.99) had delivered heavier babies weighing more than four kg. The statistical analysis shows that body mass index of pregnant mothers of group IIIa had negative correlation with birth weight of new borns.

TABLE X
ASSOCIATION OF WEIGHT GAIN OF THE PREGNANT MOTHERS WITH BIRTH WEIGHT OF NEW BORNS

Details of target mothers	Total maternal weight gain (kgs)	Infant birth weight (kgs)
Group IIIa (n=16)		
1	10.00	3.90
2	9.00	3.60
3	12.00	4.80
4	12.00	5.00
5	12.00	3.30
6	10.00	3.00
7	12.00	3.50
8	12.00	3.20
9	10.00	3.40
10	15.00	4.00
11	11.00	3.40
12	10.00	3.50
13	12.00	3.60
14	10.00	3.00
15	10.50	3.30
16	10.00	3.00
Group IIIb (n=5)		
1	7.00	2.25
2	10.00	3.25
3	10.00	3.20
4	8.00	2.80
5	10.00	3.00

It is evident from the above table X those mothers who had a maternal weight gain more than 10 kg had their new

Figure 2
Association of maternal weight gain with infants birth weight



Group IIIa - Gestational diabetic mothers who delivered their babies

Group IIIb - Non-diabetic mothers who delivered their babies

born with birth weight above 3.5 kgs. The mothers who had a maternal weight gain of 12 kgs and 15 kgs had macrosomic babies with birth weight of above four kgs.

In non-diabetic mothers three mothers had ideal weight gain of 10 kgs and had their new borns birth weight above three kgs. The mothers who had less maternal weight gain had low birth weight babies.

The statistical analysis shows that gestational maternal weight gain in relation to birth weight of new borns among gestational diabetic mothers was not significant whereas for non-diabetic mothers it was significant at five per cent level.

Raghuram **et al.** (1993) say that total weight gain during pregnancy should ideally not exceed 12 kg. Pezzarossa **et al.** (1996) point out there is a strong relationship between maternal gestational weight gain and neonatal birth weight and weight gain more than nine kg makes a relative risk of macrosomia two fold higher in gestational diabetes mothers than in normal mothers.

D. BLOOD GLUCOSE, BLOOD PRESSURE AND HAEMOGLOBIN PROFILE OF TARGET MOTHERS

The blood glucose, blood pressure and haemoglobin profile are presented in the following tables

TABLE XI
MEAN BLOOD GLUCOSE LEVELS OF THE TARGET MOTHERS

DETAILS	MEAN BLOOD GLUCOSE LEVELS					
	I TRIMESTER		II TRIMESTER		III TRIMESTER	
	F.B.S.	P.P.B.S.	F.B.S.	P.P.B.S.	F.B.S.	P.P.B.S.
Group I (n=5)	116	169.4	87.6	135.1	100	106.6
Group II (n=16)	138.5	197.6	106.1	135.5	92.9	159.1
Group III (n=16)	97.5	178.7	99.5	161.6	99.5	182.9
F ratio between groups	1.97 (NS)	0.30 (NS)	1.22 (NS)	2.55 (NS)	0.25 (NS)	0.23 (NS)

* Carpenter and Coustan Recommendation 1982 & 1984.
* Fasting 95 mg/dl 2 hours 155 mg/dl
F.B.S. - Fasting blood sugar
P.P.B.S. - Post prandial blood sugar
NS - Not significant

The above table XII reveals the mean blood glucose levels of the target mothers for each trimester. All the mothers had fasting and two hr post prandial blood glucose levels above normal (fasting 95 mg/dl) during 1st trimester. During the 2nd trimester group II and III mothers had fasting blood glucose level above normal and was lower in the final trimester due to reason that these mothers were undergoing insulin and dietary treatment. The two hour post prandial levels which was high during the early stages, was lower in the later stages. Only three of the pregnant mothers had fasting and post prandial blood glucose level above normal at the time of delivery, hence were given insulin as predelivery precaution. Statistical analysis

reveals that F ratio for blood glucose levels between groups is not significant.

Chatterjee (1993) says that the levels of blood glucose, are safe for the fetus are not known with certainity.

TABLE XII

MEAN BLOOD PRESSURE LEVELS OF THE TARGET MOTHERS

DETAILS	MEAN BLOOD PRESSURE LEVEL											
	I TRIMESTER				II TRIMESTER				III TRIMESTER			
	S	SD	D	SD	S	SD	D	SD	S	SD	D	SD
Group I (n=5)	125	16.73	77	11.4	134	9.14	80	4.12	120	7.07	80	Nil
Group II (n=16)	127	8.94	76	4.47	127	8.52	71	3.48	119	9.20	80	1.41
Group III (n=16)	114	8.16	78	6.39	135	6.59	82	7.86	120	7.34	80	7.61
(n=5)	120	7.07	80	4.47	120	2.68	81	NIL	120	7.15	84	2.82
F ratio between the groups	2.84 (5.%)		1.87 (NS)		0.52 (NS)		1.22 (NS)		0.57 (NS)		0.32	

SD - Standard deviation
S - Systolic D - Diastolic
NS - Not significant
WHO 1978 (Normal 120/80 mm/Hg)

For the mothers in groups I and II the systolic blood pressure was above normal during first and 2nd trimester but lowered in final trimester due to the therapy rendered. In group III mothers the systolic blood pressure was above normal in second trimester but was lowered in first and final trimester. Non diabetic mothers of the group III (b) had normal systolic and diastolic blood pressure throughout the gestational term.

The statistical analysis reveals that F ratio of mean blood pressure between groups was significant at five per cent level during first trimester (systolic blood pressure) and remaining blood pressure levels were not significant.

In both group I and group III those who had pregnancy induced hypertension, were having greater BMI (ie., above 25) falls under overweight side, except two mothers).

As Suhonen **et al**. (1994) opines that the frequency of chronic hypertension, pregnancy induced hypertension and preeclampsia was higher in gestational diabetic mothers when compared with healthy mothers.

TABLE XIII

HAEMOGLOBIN STATUS OF THE TARGET MOTHERS

DETAILS	MEAN HAEMOGLOBIN LEVELS IN g/100 ml					
	I TRIMESTER	SD	II TRIMESTER	SD	III TRIMESTER	SD
Group I (n=5)	10.8	0.82	10.8	0.84	11.1	0.77
Group II (n=16)	12.3	1.02	12.3	1.16	11.4	1.09
Group III						
a. n=16	11.3	1.06	11.4	0.96	11.0	0.99
b. n=5	10.6	0.99	10.2	0.45	9.9	0.62
F ratio between the groups	1.33 (NS)		3.14 (5%)		3.60 (5%)	

* Source : WHO TECHNICAL REPORT 1989 (Acceptable level 11 g/100 ml)
NS - Not significant

From the above table XIII it is evident that the haemoglobin status of the target mothers shows that in group

II the haemoglobin status was above 11 g/dl which was above the acceptable level. In group III (b) non diabetic mothers haemoglobin level was below normal in 3rd trimester, taking into account of the haemodilution the desirable level should be 11g/100ml as per WHO norms. This table XIII reveals that as the pregnancy term progresses towards the last trimester, haemoglobin status will decrease due to increase in the amount of circulating blood volume and decrease in haemoglobin status. The statistical analysis reveals that haemoglobin levels in between the groups during second and third trimesters was significant at five per cent level.

E. MANAGEMENT STRATEGIES AND DETAILS ON DIETARY PRACTICES OF THE TARGET MOTHERS

Of the target mothers, 30 mothers were totally undergoing diet and insulin therapy and seven were under diet control alone.

Of the details collected about management strategy towards the control of diabetes mellitus during pregnancy from the target mothers, 30 mothers were undergoing insulin therapy of which 15 were taking insulin once daily and 15 twice daily. Both long acting and short acting insulins were taken in split doses by the mothers those who were taking insulin twice daily. Seven of the selected mothers (gestational diabetic mothers) were kept under strict diet control alone for controlling blood glucose levels.

DIETARY PRACTICES OF THE TARGET MOTHERS

Thirty nine of the target mothers were non vegetarians. The details collected from all the target

mothers show that only nine of the mothers were following modifications in their diet even after delivery as they were cautious about getting diabetes mellitus in their later life.

Of the details collected on the type of foods avoided during pregnancy from the pregnant mothers all mothers except non diabetic mothers avoided sugars, sweets, oily foods, tubers, and restricted fruits, preserved foods, non vegetarian foods and had taken other vegetables and milk liberally. Three pregnant mothers in group III (a) avoided foods like gingelly seeds, papaya and brinjal as they believed that these foods are heat producing foods.

TABLE XIV

MEAN FOOD CONSUMPTION OF THE TARGET MOTHERS

	MEAN NUTRIENT INTAKE									
Food stuffs (gms)	Group I (n=5)	% of deficit or excess PREGNANT Mothers	Group II (n=16)	% of deficit or excess	Balanced diet for pregnant women RDA ICMR 1989	Group IIIa (n=16)	% of deficit or excess LACTATING Mothers	GroupIIIb (n=5)	% of deficit or excess	Balanced diet for lactating ICMR 1989 RDA
Cereals	156.4	-61.1	181	-54.75	400	166.4	-64.00	141.0	-64.75	400
Pulses	30.75	-56	28	-50.9	55	35.2	-41.6	32.4	-46.6	60
Greenleafy vegetabels	32	-78.6	46	-69.3	150	31.3	-79.1	20	-86.6	150
Other vegetables	136	+172	117.5	+135	50	137.5	+170	84	+68	50
Roots and tubers	50	+66.6	50.7	+66.6	30	52.2	+4	60	+20	50
Fruits	30	nil	40.6	+35.3	30	50.75	+70	60	+100	30
Milk	346.6	+73	340.5	+70	200	424	+69.0	335	+34	250
Fats and oils	22	+10	24.3	+20	20	22.5	+40	20	+33.3	30
Sugars and Jaggery	NIL	nil	NIL	nil	30	NIL	nil	30	-25	40
Fleshy food	30.5	nil	38.7	+26.6	30	28.2	-33.3	63.3	+111	30

The mean food intake of the target mothers elicited by a 24 hour recall survey for three consecutive days shows that the mothers had low intake of cereals, pulses, green leafy vegetables, while the intake of other vegetables, roots and tubers, fats and oils and fleshy foods were satisfactory. The intake of milk and milk products was found to be high when compared with ICMR 1989 recommended daily allowances. needless to say, the intake of sugar was nil as the mothers were diabetics. The intake of milk and milk products was high as milk is believed to be wholesome food specially for pregnant mothers. Which help in the good development of foetus.

The percentage of cereal intake was 61 per cent and 54.75 per cent deficit for group I and group II mothers respectively. Whereas it was 60 and 64.75 per cent deficit among group IIIa and IIIb mothers. Pulses intake was also deficit in all the three groups ie., 56 per cent, 50.9 per cent in group I and group II mothers and 41.6 per cent, 46.6 per cent deficit in group IIIa and b mothers respectively. There was a large percentage of deficit shown in intake of green leafy vegetables among all the groups of mothers. Remaining food stuffs intake was shown excess percentage in all the groups of mothers.

TABLE XV
MEAN NUTRIENT INTAKE OF THE TARGET MOTHERS

NUTRIENTS	MEAN NUTRIENT INTAKE					
	Group I (n=5)	Group II (n=16)	Balanced diet for pregnant women RDA ICMR 1989	Group III a(n=16)	Group III b(n=5)	Balanced diet for lactating ICMR 1989 RDA
	PREGNANT mothers			LACTATING mothers		
Energy (Kcal)	1209	1140	2175	1380	1392	2425
Protein (g)	38.2	41.5	75	42.8	40.72	85
Fat (g)	45	43.5	30	51.8	48	45
Carbohydrate (g)	162.9	191.5	-	170	180.2	-
Fibre (g)	20	21.5	40	25	15.0	40
Iron (mg)	8.3	9.1	38	12.2	6.4	30
Ascorbic acid (mg)	58.2	67.4	40	73.6	39.7	80
Zinc (mg)	4.4	8.7	15.5	6.7	3.5	19
Chromium (ug)	127.6	136.6	65.0	92	33.7	65
Magnesium (mg)	265.1	237.1	-	247.3	165.4	-

The mean nutrient intake of the target mothers show a deficit in the intake of major nutrients like energy, protein and minor nutrients like iron, zinc and also fibre. The low intake of fibre was due to low consumption of green leafy vegetables. Fat intake was more than RDA by all the three groups. Chromium intake was above the RDA in all the three groups except in group III (b) non diabetic mothers. A defecit in calories was noticed because majority of the diabetic and gestational diabetic pregnant mothers were put on 1200-1600 Kcal diet by their respective endocrinologist and dietitian.

F. DETAILS ON OUTCOMES OF PREGNANCY OF THE GESTATIONAL DIABETIC MOTHERS AND NON DIABETIC MOTHERS

Details on outcomes of pregnancy are given only for those target mothers who delivered their babies during the study period which was 16 for gestational diabetes

mellitus mothers and five of non diabetic mothers, for comparision of outcomes of pregnancy. As the neonates born to non diabetic mothers did not have any complications, the results for this aspect is not indicated.

DELIVERY OF GESTATIONAL DIABETIC AND NON-DIABETIC MOTHERS

Fourteen mothers underwent cesarean section while one mother underwent a premature delivery in 7th month as she had obstructive urinopathy and oedematous all over the body which complicated her pregnancy, while for one mother the delivery was by forceps. One mother had still born infant with birth weight of five kg.

Among the five non diabetic mothers group III (b) three had underwent cesarean section and two had normal delivery.

A recent report by Parrish **et al**. (1994) indicated that cesarean delivery rates in non-diabetic women increased from 4.2 per cent in 1970 to a peak of 17.5 per cent in 1988. Another report indicates that the US cesarean delivery rate has stablised at 23.6 per cent after increasing for two decades (King **et al**., 1994). London **et al**. (1990) says that a recent survey of obstreticians and maternal-fetal sub-specialist reported rates of cesarean delivery above 50 per cent in women with insulin dependent diabetes mellitus.

The period of delivery for the gestational diabetes mellitus mothers ie., group III (a) was 30 minutes to 45 minutes, while for the non diabetic mothers who had normal delivery was 15 minutes to 30 minutes.

The gestational diabetic mothers only experienced complications when compared with the non diabetic mothers

during delivery. One mother suffered from shoulder dystocia (impaired labour, often referring to the excessive size of the embryo or to its abnormal position within the uterus (Robert **et al.**, 1962) as the baby birth weight was five kg and was still born, while one mother had undergone the complications of shoulder destocia with hydramnios, pregnancy induced hypertension and one had only hydramnios. One mother had experienced post maturity, cedhalopelvic disproportion and uterine inertia.

Predelivery treatment ie., just 1/2 hr before delivery, insulin was administered, to only three mothers as their blood glucose levels was above normal and had poor control during pregnancy.

DETAILS ON BLOOD GLUCOSE LEVELS OF THE TARGET MOTHERS SOON AFTER DELIVERY

As all the gestational diabetic mothers soon after delivery were checked, 12 of the mothers out of 16 gestational diabetes mellitus delivered mothers had normal random blood glucose level (80-120 mg/dl) which is usually seen in gestational diabetic mothers, whereas four of the mothers had above normal level of random blood glucose levels. Two mothers among these four were advised to continue insulin therapy and one put on oral hypoglycemic drug with diet restriction.

According to Roberts and Patterson (1994) women above or equal to 35 years and with gestational diabetes are substantially more likely to have an operative delivery, induced labour, and or spudural anaesthesia. As Weeks **et al.**

say that pregnant mothers with high risk factors for diabetes have a chance to undergo of cesarean section, neonatal macrosomia, shoulder dystocia and hydramnios.

NUTRITIONAL STATUS, BLOOD GLUCOSE LEVELS OF THE NEW BORNS

The details about the crown heel length, birth weight and blood glucose levels of the new born of gestational diabetic mothers are discussed as follows.

TABLE XVI
NUTRITIONAL STATUS OF THE NEW BORN

DETAILS	BIRTH WEIGHT IN KILOGRAM					
	MALES			FEMALES		
	< 3 kg	3-4 kg	> 4 kg	< 3 kg	3-4 kg	> 4 kg
Gestational diabetic mothers new born (n=16)	NIL	5	1	NIL	9	1
Non-diabetic mothers new born (n=5)	1	1	NIL	1	2	NIL

Among 16 babies delivered nine were female children with a birth weight of 3-4 kg while five were males in the same category. Two babies delivered by the gestational diabetic mothers were above four kg. The majority of babies crown heel length ranged from 35-40 cms. Among five babies delivered by non-diabetic mothers none of the babies were macrosomic and two females and one male were with a birth weight of 3-4 kg and one male and one female were underweight with a birth weight of below three kg.

Pizzarasso **et al.** (1996) points out that prevalence of macrosomia was higher in gestational diabetic mothers and the neonates birth weight difference above 50th

percentile value was higher in new borns of mothers with gestational diabetes. As pointed out by Wasrat **et al.** (1994) those women who were untreated impaired glucose tolerance during pregnancy had heavier babies which supports our results as those mothers who had heavier babies had diagnosed gestational diabetes only during their 9th month.

TABLE XVII
BLOOD GLUCOSE LEVELS (mg/dl) OF THE NEW BORN

DETAILS	BLOOD GLUCOSE LEVELS (NORMAL 30-80 mg/dl)		
	< 30	30-40	> 40
Group III			
a. GDM mothers (n=15)	2	NIL	13
b. Non-diabetic (n=5)	NIL	NIL	5

GDM - Gestational diabetes mellitus

A rapid fall in plasma glucose concentration following delivery is characteristics of the infant of the gestational diabetes mellitus and diabetic mothers. Glucose values less than 35 mg/dl in term neonates and less than 25 mg/dl in preterm neonates are abnormal and may ocur within 30 minutes of clamping the umblical vessel (Cowett, 1995).

Hence, from the above table XVII it is evident that only two new borns of the gestational diabetic mothers had experienced hypoglycemia ie., blood glucose level below 35 mg/dl (normal 30-80 mg/dl) which was asymptomatic but occurs within 30 minutes of the birth. The new borns with hypoglycemia were treated with immediate infusion of 12.5 per cent or 5 to 10 per cent dextrose solution in order to maintain normoglycemic state. A majority ie., 13 of the new

borns of gestational diabetic mothers and of all five of the non-diabetic mothers new borns were noromoglycemic.

DETAILS ON LACTATION OUTCOMES OF DELIVERED MOTHERS DETAILS ON BREAST FEEDING

All the mothers except three, (in group III (a) ie., gestational diabetic mothers) of both the groups ie., gestational diabetic and non-diabetic mothers breast fed their new borns and except those three mothers who have not fed their babies due to inadequate milk production. Only four mothers fed colostrum to their new borns and only one gestational diabetic mother experienced hypoglycemic episodes associated with giddiness soon after feeding her new born.

Fagen **et al.** (1995) points out that Breast feeding is not contraindicated for women with recent gestational diabetes. Two studies shown improved glycemia with lactation. In a study of women with recent gestational diabetes, the fasting and two hr post prandial glucose levels improved in lactating women compared with non lactating mothers.

G. PROBLEMS ENCOUNTERED BY NEONATES OF GESTATIONAL DIABETIC MOTHERS

TABLE XVIII

COMPLICATIONS	NEW BORNS OF GESTATIONAL DIABETIC MOTHERS (n=16)
MACROSOMIA	2
HYPOGLYCEMIA	2
HYPER BILERUBENEMIA	3
POLYCYTHEMIA	1
IDIOPATHIC *RDS	1

* RDS - Respiratory distress syndrome

The above table provides details on complications associated with gestational diabetic mothers by their new borns. Three new borns of gestational diabetic mothers suffered with complications of macrosomia, hypoglycemia, hyperbilerubenemia, polycythemia and idiopathic respiratory distress syndrome.

Two new borns were macrosomic of which one was still born with a birth weight of 5 kg and one was live with a birth weight of 4.8 kg which had suffered with other complications like hypoglycemia, hyperbilerubenemia and idiopathic respiratory distress syndrome.

Next major problem encountered by these new borns was hyperbilerubenemia (infantile jaundice) other than hypoglycemia and polycythemia.

There were many studies which supports our results as Raghuram **et al.** (1993) states that new born of the diabetic mothers is typically heavier than infant born to non-diabetic mothers.

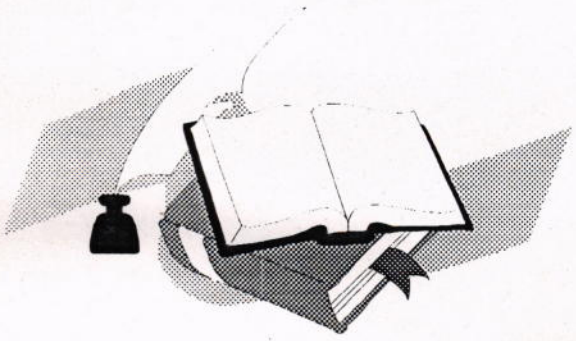
Menon (1993) points out that polycythemia is common in infant of diabetic mothers which may be related to placental insufficiency which causes hypoxia and increased erythropoietin.

William (1989) states that respiratory destress syndrome is due to lack of production of surfactants.

However, our results show that majority of the gestational diabetic mothers, ie., 14 had normal healthy babies ie., good outcome as they were detected and treated from earlier months.

H. CREATING AWARENESS ON DIETARY ASPECTS

The target mothers ie., gestational diabetic and diabetic mothers were counselled on dietary modification that has to be followed for diabetes during pregnancy. A hand out was prepared which included the information about the causes, complications of gestational diabetes and diet to be followed, food exchange lists. Counselling was done by showing household measures such as (tumblers, bowls, spoons). Diet counselling was done once for a period of half an hour. Eventhough counselling impact was not evaluated due to time factor, awareness was created among these mother about the role of diet in strict control of diabetes during pregnancy.



SUMMARY AND CONCLUSION

V. SUMMARY AND CONCLUSION

Among many complications a mother might undergo during her pregnancy, gestational diabetes, an endocrine disorder is one of the complications which causes increased foetal wastage and requires the services of an obstretician, endocrinologist, dietitian and a paediatrician.

To study the problems associated with gestational diabetes and also the outcomes, the present study entitled "Pattern of prevalence of gestational diabetes mellitus and its impact on outcomes of pregnancy" was undertaken with the main objective of knowing the prevalence of diabetes mellitus among pregnant women, their health status, dietary practices and the complications encountered by the mother and neonates and their management strategy towards gestational diabetes mellitus.

Six hospitals in Hyderabad and two hospitals in Coimbatore were selected by selective sampling and the prevalence of diabetes mellitus among the reported 1,047 pregnant women in Hyderabad and 540 pregnant women in Coimbatore. Totally 27 gestational diabetics, five diabetic mothers were identified at Hyderabad while at Coimbatore five gestational diabetic mothers were identified. For comparison of the outcomes of pregnancy, five non diabetic pregnant mothers were selected at Coimbatore within the same age group and income level. The results reveal:

- Ten mothers with gestational diabetes mellitus were in the age group 25-30 years and 14 mothers were above 30 years age.

- Thirty seven of the mothers were educated and only five were illiterate and majority ie., 33 were housewives and nine were working mothers. Seventeen 17 had a monthly percapita income below Rs.1,000 and seven had above Rs.5,000.
- Small family norm was prevalent and only two mothers had a large family.
- Parity and gestational term of mothers showed that 14 were multiparae in the 2nd and 3rd trimester and six were in primiparae. Among gestational diabetic and diabetic pregnant mothers who delivered their babies 17 were multiparae and four were in primiparae.
- Twenty one gestational diabetic mother had both maternal and paternal lineage indicating family inheritance of diabetes.
- Regarding the term of diagnosis as gestational diabetes mellitus twelve were diagnosed in 2nd and 3rd trimesters, whereas 10 mothers were detected in Ist trimester itself.
- The prenatal care taken by the 42 mothers showed that 12 mothers were immunised with tetanus toxoid I dose and 21 mothers who delivered were immunised with both the doses of tetanus toxiod I and II. Majority of 38 mothers used calcium, iron, folic acid and B complex supplements. Only three mothers performed exercise regularly.
- Nausea, vomiting, constipation, dizziness and fatigue, leg pain were commonly expressed by majority of the mothers.

- Seventeen (13 gestational diabetic mothers, three diabetic mothers and one normal mother) of the mothers had experienced abortion, intrauterine deaths and still births in their earlier pregnancies.
- Twenty three mothers were having normal body mass index ranging from 18.4-24.99 and only two were having body mass index above 40 ie., over weight.
- The gestational maternal weight gain in relation to birth weight of new borns among gestational diabetic mothers was not significant whereas for non diabetic mothers it was significant at 5 per cent level.
- Blood glucose level (fasting and post prandial) of all the mothers 37 mothers (gestational diabetic and diabetic mothers) was above normal during first and second trimester, but was lowered during last trimesters due to the treatment undertaken by them.
- Blood pressure was above normal in diabetic and gestational diabetic mothers in first and 2nd trimester but was lowered in 3rd trimester due to the treatment undergone. Non diabetic mothers had normal blood pressure level.
- Anaemia was noticed among the non-diabetic mothers during third trimester. Whereas the diabetic and gestational diabetic mothers had a haemoglobin level of 11 g/dl which is an acceptable value during pregnancy.
- Thirty mothers were undergoing diet and insulin therapy and two were under diet control alone.

- The mean food and nutrient intake elicited by 24 hour recall survey for three consecutive days showed that all the mother had low intake of cereals, pulses, green leafy vegetables which was reflected in their deficient levels for major nutrients like energy, protein and minor nutrients like iron, zinc and fibre. Intake of other vegetables, roots and tubers, fats and oils and fleshy foods was satisfactory. The intake of milk was found to be high and the intake of sugar was nil as the mothers were diabetic.
- Eighteen mothers underwent cesarean section and one mother delivered by forceps and two had underwent normal delivery. The period of delivery for cesarean section was 30 minutes and normal delivery was 15 to 30 minutes.
- For three mothers as a pre-delivery treatment insulin was administered half an hour before delivery as their blood glucose levels were above normal at the time of delivery.
- Sixteen gestational diabetic mothers had normal random blood glucose level after delivery and only four mothers had above normal.
- Nine female and five male new borns were in the birth weight range of 3-4 kg and two babies ie., one male and one female were macrosomic.
- All the mothers except three mother had breast fed their new borns.
- Macrosomia, Hypoglycemia, Hyperbilirubinemia, polycythemia and idiopathic respiratory distress

syndrome were the complications encountered by the three new borns of the gestational diabetic mothers.

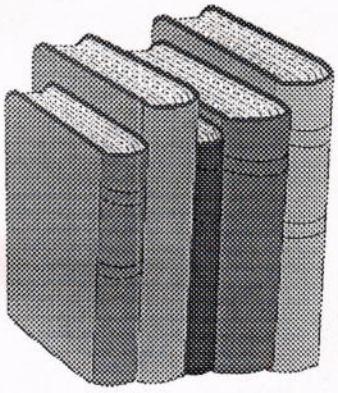
Conclusion

The present study indicated that the percentage of prevalence of diabetes mellitus in pregnancy as three per cent and 0.9 per cent in Hyderabad and Coimbatore respectively, and the limited samples studied. It complicates the pregnancy and may cause foetal wastage. Hence, all pregnant mothers should be screened for diabetes mellitus soon after conceiving and start the necessary treatment for undergoing a safe motherhood.

The future research should be directed to screen mothers for diabetes mellitus when they come for initial check up after conceiving. The prevalence rate will be more authentic and this will create awareness among mothers to go for corrective measures. This will help preventing pregnancy complications and foetal wastage. Thus a safe motherhood would be assured.

Future in-depth research could be undertaken to follow the gestational diabetic mothers throughout the term after detection and atleast three months of lactation to pin point the complications and lactation performance.

Long term studies could be undertaken to assess the performance of the offspring of gestational diabetic mother.



BIBLIOGRAPHY

BIBLIOGRAPHY

Abouzhar, C., "Excessive Hazards of pregnancy and child birth in the third world". World Health Forum 1993, Vol.3, No.1, pp.19

The American Journal of Obstretricians and Gynecologists. Technical Bulletin, May, 1995 No.92.

American College of Obstetrician and Gynaecologists, TEchnical Bulletin, 1995.

Babior, B.M., Peters, W.A., Briden, P.M., Cetulo, C.L., "Pregnant Women's absorption of iron from prenatal supplements". Journal of Reproduction Medicine 1989, 30 : pp.355-357.

Bassaw, B., Ataullah, I., Rnopnarinesingh, S., Sirjusing, A. "Diabetes in Pregnancy" Obstetrics and Gynaecology 1993, March 81 (31) : pp.344-348.

Boden, G. "Fuel metabolism in pregnancy and gestational diabetes mellitus". Obstetrics and Gynaecology Clinics. 1996, March : 23 (1); pp.1-10.

British diabetic Association. 1992.

Bulletin of the World Health Organisation - 1994. No.3, pp.32-35.

Carpenter, M.W., Coustan, D.R., "Criteria for Screening tests for gestational diabetes: American Journal of Obstetrics and Gynaecology". 1984, 150 : pp.836-42.

Catalano, P.M., "Diabetes in Pregnancy". Diabetes Edited by Cowett, R.M; Nestle Nutrition Workshop Series 1995, Vol.35 : pp.119-129.

Catalano, P.M. "Carbohydrate metabolism and gestational diabetes" - clinical obstetrics and Gynaecology, 1994. March 37 (1) : 25-38.

Chatterjee, S. "Maternal and Fetal metabolism During Normal and Diabetic Pregnancy". Proceedings of the Second Novo Nordisk, Diabetes update. 1993, No.4, 22-27.

Coustan, D.R. "Screening and diagnosis of gestational diabetes". Bailleres Clinical Obstetrics, Gynaecology, 1991; 5 (2); pp.293-313.

Coustan, D.R., Imarah, J., "Prophylactic insulin treatment of gestational diabetes reduces the incidence of macrosomia, operative delivery and birth trauma". American Journal of Obstetrics and Gynaecology, 1984, 150; pp.836-42.

Cowett, R.M. "The infant of Diabetic Mother". Diabetes : Nestle Nutrition Workshop Series, Vol.35, 1995, pp.149-165.

Curry-Baetley, K. "The art and science of listening. Top Clinical Dietetics 1986; 1 (1) : 13-42.

Damm, P., Molstted-Pedersen, L., "Significant decrease in congenital malformations in selected new born infants of an unselected population of diabetic women"; American Journal of Obstetrics Gynaecology, 1989; 161 : pp.1163-7.

Danish, S.H., Lang, D., Smicklar-Wright, H., Laquatra, F. "Nutrition Counselling Skills". Continuing education for the dietitian. Top Clinical Diet, 1986 1 (1) : 25-32.

Deorari, A.K., Kabra, S.K., Paul, U.K., Singh, M. "Perinatal outcome of infants born to diabetic mothers". Indian Pediatrics, 1991 28 : 1274-1275.

Deorari, A.K., Menon, P.S.N., Gupta, N., Singh, M. "Outcome of infants born to diabetic women". Indian Journal of Pediatrics, 1985, 22; pp.375-378.

Devadas, R. "Literacy as a means of Empowerment of women to achieve Nutritional Goals". The Indian Journal of Home Science, 1994, No.2, 55-56.

Dooley, S.L., Metzger, B.E., Cho, N.H. "Gestational diabetes Mellitus. Influence of race on disease prevalence and perinatal outcome in a U.S. Population"; Diabtes 1991, December; 40 supplement 2 : pp.25-9.

Dorothy, R.H. "Pregnancy women need counselling on Diabetes". The Hindu, 1996, pp.2-4.

Drash, A. "Diabetes Mellitus - Diagnosis and treatment". The Physicians guide to Type II diabetes; American Diabetes Association (1989), 173-189.

Eriksson, U. Congenital Malformations in diabetic animal models; a review. Diabetes Res. 1984 1 : 57-64.

Fagen, C., King, J.D., Erick, M. "Nutritional Management in Women with Gestational Diabetes Mellitus : A review by American Diabetic Association's Diabetes Care and Education dietetic practice group". Journal of American Dietetic Association, 1995, Vol.95; No.4, pp.460-67.

Fagen, C. "Gestational Diabetes Mellitus". Diabetes Education 1991, 17 No.6, 447-8.

Ferris and Reece, E.A. "Maternal Nutrition in Lupus and Diabetes. American Journal of Clinical Nutrition, 59 (2) (S) Feb. 1994 (Suppl.) p.4685-4695, 470S.

Freinkel, N. "Banting Lecture 1980 : Of pregnancy and Progeny". Diabetes 1980 : 29; pp.1023-35.

Freinkel, N., Metzger, B.E., Phelphs, R.L. "Gestational diabetes Mellitus". Diabetes 1935, 34 (supplement 2) : pp.1-7.

Gabbe, S.G., "Pregnancy in Diabetes : Reducing the Risks" case presentation, Hospital Practice, Jan. 15, 1995, pp.67-78.

Gopalan, C., Ramasastri, B.V. and Balasubramanian, S.C., REvised and update by Narasinga Rao, Y.G., Deosmale and Pant, K.C. "Nutritive Value of Indian Foods", National Institute of Nutrition, Indian Council of Medical Research, 1993.

Green, J.R., Pawson, L.G., Schumacher, L.B., Perry, J., Kretchmer, N. "Glucose tolerance in pregnancy! Ethic variation and influence of Body Habitus". Clinical Obstetrics and Gynaecology, 1993, 5 No.7, pp.92-96.

Guthrie, A.H., Robin, S., Bagby., "Introductory Nutrition in Pregnancy and Lactation". 7th Edition, 1989. p.719.

Hagay, Z., Weissman, A., "Management of diabetic pregnancy complicated by cornary artery disease and neuropathy". Obstetrics and Gynaecology clinics. North America 1996, March, 23 (1) :pp. 205-20.

Hauestein, D.J., Schiller, M.W., Hurley, R.S., "Motivational techniques of Dietitians counselling individuals with Type II diabetes". Journal of American Dietetic Association, 1987; 87. pp.37-42.

Health Action "Make motherhood safe" June 1995, Vol. 8: 6 pp. 4-12.

Hooeltzel, K.E. "Counselling methods for dietitians". Top Clinical Nutrition, 1986; (1) pp. 33-42.

Hugher, B.A., "Nutrition Interviewing and counselling in Public Health, the North Carolina Experience". Top Clinical Nutrition, 1986; 1 (1) : 43-50.

Jacobson, J.D., Cousin, M. "a population based study of maternal and perinatal outcome in patients with gestational diabetes". American Journal of Obstetrics and Gynaecology, 1989, 161. pp.981-986.

Jelliffee, D.B., "The Assessment of Nutritional Status of the community" (Switzerland : World Health Organisation (WHO) Publication, 1991). pp.242.

John, L. "Current concepts in Diabetes Mellitus" Diabetes and pregnancy, 1991, 2, pp. 99-105.

Jovanovic-Peterson, L., Peterson, C.M. "Vitamin and Mineral deficiencies which may predispose to glucose intolerance of pregnancy". Journal of American College Nutrition, 1996, Feb. 15 (1) : pp. 14-20.

Key, T.C., Guiffrida, R., Moore, T.R., Predective value of early pregnancy glycohemoglobin in the insulin treated diabetic patient". American Journal of Obstetrics and Gynaecology 1987; 156 : 1096-100.

Khan, N. "Health Care during pregnancy". World Health Organisation, 1992, 3 No.3, pp.71-72.

Khan, M.C. "Nutrition during pregnancy". Bagbiller Publications, 1993, No.1, pp.78-79.

King, D.E., Lahiri, K., "Socioeconomic factors and the odds of vaginal birth after cesarean delivery. JAMA 1994; 272 : pp. 524-9.

Kitzmiller, J.L., Combs, C.A. "Diabetic Nephropathy and Pregnancy" Obestetrics and Gynaecology - clinic North America, 1996 March 23 (1) : pp. 173-102.

Kitzmiller, J.L. "Macrosomia in infants of diabetic mothers; characteristics, causes, prevention In -: Jovanovic, L., Peterson, C.M., Funhrmann, K. (eds). Diabetes and pregnancy : Tetralogy, toxicology and treatment. New York. Praeger 1986 : pp. 85-120.

Koski, M.N., Kandaraki, E., Liaow, P.C., "Child Bearing women and Diabetes". Herald of Health 1990, 3 No.12 pp.27-30.

Kothari, C.R., "Research Methodology". Methods and Techniques 2nd edition". Methods of Data Collection". 1996, pp.129-130. Wishcoaprakashan. New Delhi.

Kumar, R., Singh, M.M., Kaur, A., Kaur, M., Sharma, K.R., Bhatia, C. "Reproductive Health Behaviour of Rural Women". Indian Institute of Management. 1994, 3. No.7. pp.72-74.

London, M.B., Gabbe, S.G., Sachs, L. "Management of diabetes mellitus and pregnancy : a survey of obstetricians and maternal - fetal specialists. Obstet. Gynaecology 1990, 75 : pp. 635-90.

Mason, M., Wenberg, B.G., Weish, P.K. The dynamics of clinical dietitians. 2nd Edition. New York : NY : John Wiley and Sons, 1982.

Maternal Anthropometry and Pregnancy Outcomes. A WHO collaborative study - The Scientific Journal of WHO Geneva Supplement to Vol.73, 1995. The Bulletin of the WHO, p.7.

Menon, P.S.N., "New born of a Diabetic Mother - What to expect and How to Manage". Proceedings of the Second Novo Nordisk Diabetes Update, 1993, No.4, pp.93-100.

Metzger, B. "Summary and recommendations of the Third International workshop - coference on Gestational Diabetes Mellitus". Diabetes, 1991 : 40 (Suppl 2); pp.197-201.

Metzger, B.E. "Organising committee - summary and recommendations of the Third International workshop - coference on Gestational Diabetes Mellitus". Diabetes, 1991, 40 (Suppl 2); pp.197-201.

Miodunik, M., Mimounl, F., Dignam, P.S., "Major Malformation in infants of IDDM women : vasculopathy and earlyu first trimester poor glycemic control". Diabetes care 1988, 11 : 713-8.

Montoro, M.W., Myers, V.P., Mestman, J.H., Yu, Y. Anderson, B.G., Goldestt, "Outcome of pregnancy in diabetic keto acidosis". American Journal of Perinatology, 1993. Jan. 10 (1) : 17-20.

Nadeem, R., and Hemali, M. "The optimal management of Diabetes in pregnancy". Proceedings of the Second Novo Nordisk Diabetes Updata. 1993. No.4, pp.309.

Nadeem Rais, Hemali Majithia, "The Optimal management of Diabetes in pregnancy". Proceedings of the SEcond Novo Nordisk Diabetes Update 1993, pp.87-88.

Nagaonkar, A.S., Keskhar, M.V., Tamb, M.P. "Study on maternal death in Tertiary care Hospital". Indian Medical Gazzette. Vol.No.5, May 1996, p.152.

Navlor, C.D., Sermer, M., Chen, E., Sykora, K. "Cesarean delivery in relation to birth weight and gestational glucose tolerance : pathophysiology or practice style. Toronto Trihospital Gestational Diabetes Investigators. Journal of American Medical Association, 1996, Apr.17. 275 (15) : pp. 1165-70.

Norlander, F., Hansol, V., Person, B. "Factors Influencing neonatal mortality ingestational diabetic pregnancy". British Journal of Obstetrics and Gynaecology, 1989, 96, pp. 671-8.

Nutrient Requirements and Recommended Dietary Allowances for Indians. A report of the Expert Group of ICMR, Indian Counsil of Medical Research, ICMR 1995, p.71, 83.

Osses, N., Sobrevia, L., Cordova, C., Jarvic, S.M., Yudilevich, D.L. "Transport and metabolism of adenosine in diabetic human placenta". Reproduction and fertility development. 1995, 7 (6) : pp. 1499-503.

O'Sullivan, J.B., Mahan, C.M. "Criteria for the oral glucose tolerance test in pregnancy, Diabetes, 1964, 13 : pp.278-285.

Parks, S.C., Moody, D.L., "A marketing model : application for dietetic professions". Journal of American Dietetic Association, 1986, 86 : 37-43.

Parrish, K.K., Holt, V.L., Easterling, T.R., Connell, F.A., Lo Geifo, J.P. "Effect of changes in maternal age, parity and birth weight distribution on primary cesarean delivery rates". JAMA 1994 : 271 : pp. 443-7.

Pederson, J., Molsted, Peterson, L., Anderson, B. "Assessors of fetal perinatal mortality in diabetic pregnancy". Diabete, 1990, No.30, p.447.

Pezzarossa, A., Orlandi, N., Baggi, V., Dazz, D., Ricciarelli, E., Coppola, F. "Effects of maternal weight variations and Gestational Diabetes Mellitus on neonatal Birth weight". Journal of Diabetes complications, 1996, Mar.-April 10 (12) : pp. 78-83.

Raghuram, T.C., "Diabetes Mellitus". National Institute of Nutrition, Hyderabad, 1988, pp.7.

Raghuram, T.C., Swaran Pasricha, Sharma, R.D., "Diet and Diabetes". National Institute of Nutrition Indian Counsil of Medical Research, Hyderabad, 2nd edition, 1993. p.13.

Ramulu, R., Nair, R., Kalyansundar. "Laboratory techniques", National Institute of Nutrition, Hyderabad, 1983, pp. 42, 256, 171, 172, 173.

Ranade, A.V., Merchant, R.H., Bajaj, R.T., Joshi, N.C., "Infants of diabetic mothers : An analysis of 50 cases". Indian Pediatrics, 1989, 26 : pp.366-370.

Ravindran, V. "Death at the work place". The Hindu Magazine, 1997, March 9, pp.2 and 5.

Reece, E.A., Homko, C.J. "Assessment and Management of pregnancies complicated by pregestational and gestational diabetes mellitus". Journal of Association Academic Minor Phys. 1994, 5 (3) : 87-97.

Reece, E.A., Homko, C.J., Hagay, Z., "Diabetic retinopathy in pregnancy", Obstetrics and Gynaecology Clinics. North America, 1996, March 23 (1) : pp.161-171.

Reece, E.A., Hobbins, J.C. "Diabetic embryopathy : Pathogenesis, Prenatal diagnosis and prevention. Obstetritics and Gynaecology Survey 1986 : 41 : 325-35.

Report of WHO expert committee, "Physical status the use and Interpretation of Anthropometry". WHO Technical Report Series 854, WHO Geneva, 1995, pp.450-452.

A Review by American Diabetes Association diabetes care and educational dietetic Practice group 1993.

Rizvi, J.H., Ragul, S., Malik, S., Rehamuhullah, A., Khan, M.A. "Experience with screening for abnormal glucose tolerance in pregnancy, maternal and paternal outcome". Asia Oceania Journal of Obstetrics and Gynaecology. 1992, Jun 18 (2) : pp.99-105.

Roberts, A.B., Patterson, N.S. "Pregnancy in women with diabetes mellitus, twenty years experience : 1968-1987, NZ Med. J. 1990, 103 : pp. 211-3.

Roberts, C.L., Algert, C.S., March, L.M., "Delayed child bearing are there any risks Medical Journal of Australia 1994, May 2; 160 (9) : pp.539-44.

Roberts, E., Rothen Berg, M.D. F.A.C.S. Medical dictionary and Health Manual, 1962, p. 101.

Schnelder, S. "Feeding the elderly". The American Journal of Clinical Nutrition". 1982, Vol.26, No.10, pp.1150-1152.

Serirat, S., Decrochanawong, C., Sunthornthepuaraket, T., Jinayan, S., "Gestational Diabetes Mellitus", Journal of Medical Association. Thailand 1992, Jan.975, (6) : pp. 315-9.

Shaw, R., "Diabetic therapy". Journal of Diabetic Association of India, 1982, Vol.XXII, No. pp.88.

Dr.Shyam Sundar, P. "Guidelines for Diabetic Control". Diabetic Diet Exhibition. 1995.

Spatling, L., Spatting, G. "Magnesium supplementation in pregnancy". a double-blind study. British Journal of Obstetrics and Gynaecology, 1988, 95 : pp. 120-125.

Spellacy, W.N., Bohi Schram, J.C., Birk, S.A., McCreary, S.A. "Control of human chorionic somato mammotrophi levels during pregnancy". Obstetrics and Gynaecology, 1991, 35 : p. 567.

Steel, J.M., Johnstone, F.D., Hepburn, D.A., Smith, A.F., "Can Pregnancy care of diabetic women reduce the risk of abnormal babies? British Medical Journal 1990, 301 : pp. 1070-4.

Stewart, M., Taylor, R. "Gestational Diabetes Mellitus". Professional-care-mother and Child, 1994. June-July, 4 (5) : pp.136-8.

Sugarman, J.R. "Prevalence of Gestational Diabetes in a Navajo Indian Community". Western Journal of Medicine, 1989, 150 (5) : pp.548-581.

Suhonen, L., Teramo, K., "Hypertension and pre clampsia in women with Gestational Glucose Intolerance". Department of Obstetrics and Gynaecology, 1994, 72, No.4, pp. 269-272.

Sun, B., Wang, X., Song, Q., Wang, Y., Xue, L., Wahg, C., Zuan, Z., Zhang, Y., Niu, P. "Prospective studies ont he relationship between the 50 g glucose challenge test and pregnant outcomes". China Medical Journal of English, 1995 Dec. 108 (12) : pp. 910-3.

Sunehag, A., Berne, C., Lindmark, G., Ewald, L. "Gestational diabetes, Perinatal outcome with a policy of liberal and intensive insulin therapy". Uppsala Journal of Medical Science, 1991, 96 (3) : pp.185-98.

Synder, J., Donald, K.G. and Koskl, G.K. "Predictors of infant Birth weight in Gestational Diabetes". American Journal of clinical Nutrition 59 Vol.94, No.6, June. pp.1409-1414.

Temez Perez, H.E., Rodriguez Ayala, M., Trevi Nottern Andez, M., Espinosa Compos, J., Salasgalindo, L.R., Barquet Barquet, J., Pacz Jimenez, F.J. "Experience with a screening program for gestational diabetes". Review on Invested Clinic, 1993, Sep.-Oct., 45 (5) : pp. 453-6.

Trudeau, E., Dube, L., "Moderators and determinants of satisfaction with diet counselling for patients consuming a therapeutic diet". Journal of American Dietetic Association, 1995. Vol.95, No.1, pp.34.

UN World Population Prospectus. 1990. New York. Un Department of International Economic and Social Affairs. 1991.

Venkatachalam, P.S., Rebello, L.M., ICMR Special Report series No.41. "Nutrition for Mother and Child". 4th edition, National Institute Nutrition, 1996. pp.7, 9, 11, 23.

Vercellini, P., Zuliani, G., Ragnoni, M.T., Trespidi, L., Oldani, S., Cardinale, A., "Pregnancy at forty and over : a case-control study". European Journal of obstetrics and Gynaecology and Reproduction Biology, 1993, Mar., 48 (3) : pp.191-5.

Wattkins, P.J., "ABC of Diabetes". 2nd edition. British Medical Journal, London. 1990, pp.41-43.

Wechther, D.J., Kaufmann, R.C., Amankwabi, K.S., Rightmire, D.A., Eardley, P., Verhalst, P., Zinzile, M., Young, V., Singleton, J.A., Simpson. "Prevention of neonatal macrosomia in Gestational diabetics by the use of intensive dietary therapy and home glucose monitoring". American Journal of Perinatology (1991) 8 (2) : pp. 131-134.

Weeks, J.W., Major, C.A., de Veciana, M., Morgan, M.A., "Gestational diabetes : does the presence of risk factors influence perinatal outcome?". American Journal Obstetrics and Gynaecology 1994 Oct. 171 (4) : pp. 1003-7.

Weiss, P.A.M., Hoffmann, H.M.H. (Gestational Diabetes), Gestational diabetes In Hochrisiko Chwanger Schaft, Diagnosis Therapie, 1989 : pp.31-39.

Weller, K.A. "Diagnosis and Management of gestational diabetes". American family physician, 1996, May I. 53 (6) : pp.2053-7, 2061-2.

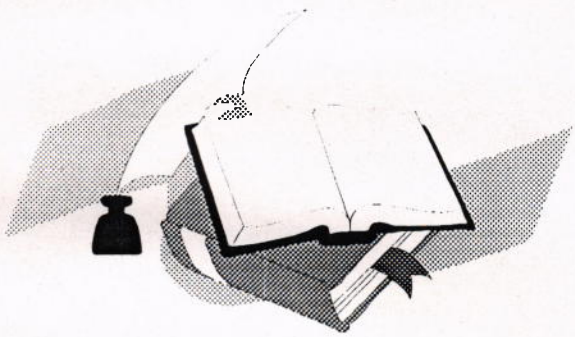
Whelton, P.K., Klag, M.J., Magnesium and blood pressure review of the epidemiologic and clinical trial experience. American Journal of Cardiology, 1989, 63 : 26G-30G.

Williams, Williams Obstetrics, Cuningham, Mac. Donald Gant. 1989, 19th edition, 807-810.

Winn, H.N. and Reece, E.A. "Interrelationship between insulin, dietary fibre, and exercise in the management of pregnant diabetics". Obstetrical and Gynaecological Survey 1989, Vol.44, No.10, Williams and Wikkins.

World Health Organisation (WHO) Report "Nutrition Monitoring and Association". 1989.

WHO Technical Report Series "Prevention of Diabetes Mellitus". - Report of a WHO study group WHO Geneva 1994, pp.33, 34, 35.



APPENDICES

APPENDIX - I

AVINASHILINGAM DEEMED UNIVERSITY

INTERVIEW SCHEDULE FOR ELICITING THE BACKGROUND INFORMATION OF THE PREGNANT WOMEN

1. GENERAL INFORMATION

NAME OF THE SUBJECT :

Age :

Educational status :

Occupation :

If occupied income level :

Total monthly income :

Height (cm) :

Prepregnancy weight (kg) :

2. FAMILY SIZE

Number of members in the family								
Children			Adults			Elderly		
Age	Male	Female	Age	Male	Female	Age	Male	Female

FAMILY HISTORY OF DIABETES :

3. DETAILS OF GESTATIONAL DIABETES

A. PARITY	B. TRIMISTER	C. KNOWN DIABETIC
FIRST	FIRST	GDM
SECOND	SECOND	NEWLY DETECTED
THIRD	THIRD	DETECTED IN THE
AND ABOVE		PREVIOUS PREGNANCY

IF GDM, STAGE OF DETECTION :

FIRST TRIMISTER

SECOND

THIRD

E. SYMPTOMS NOTICED :

F. IF SECOND PREGNANCY WERE THE ABOVE SYMPTOMS NOTICED EARLIER

YES/NO

G. ABORTION H. STILL BIRTHS I. INTRAUTRINE DEATHS

(3)

GENERAL HEALTH STATUS

A. ARE THERE ANY DIGESTION AND ELIMINATION DIFFICULTIES :

NAUSEA

VOMITING CONSTIPATION OTHERS

B. DO YOU TAKE MEDICINES REGULARLY DURING PREGNANCY?

YES/NO

IF YES INDICATE THE MEDICINES

C. DO YOU EXERCISE REGULARLY

YES/NO

IF YES, INDICATE THE TYPE AND DURATION OF EXERCISE

D. IMMUNIZATION SCHEDULE

PLEASE TICK THE FOLLOWING WHICH HAS BEEN ADMINISTERED

16-20 WEEKS TETANUS TOXOID DOSE

28-36 WEEKS TETANUS TOXOID DOSE

---

(4) LAB DATA DETAILS

PARAMETERS	3M	4M	5M	6M	7M	8M	TILL TERM
BLOOD GLUCOSE (mg/dl)							
BLOOD PRESSURE							

DIASTOLIC
(mm/Hg)

SYSTOLIC (mm/Hg)

HAEMOGLOBIN
(gms/dl)

WEIGHTGAIN (kg)

---

(5) MANAGEMENT APPROACH OF GDM

A) ARE YOU ON INSULIN YES/NO

IF YES, MENTION THE TYPE OF INSULIN AND FREQUENCY OF INSULIN INTAKE

B. ARE YOU UNDERGOING ANY NATURAL THERAPY YES/NO

IF YES, MENTION

C) ARE YOU TAKING ANY SPECIAL ORGAL HYPOGLYCAEMIC AGENTS FOODS

YES/NO

IF YES, MENTION

(6) DIETARY PRACTICES

A) VEGETARIAN

B) NON-VEGETARIAN

C) LIST THE FOODS AVOIDED RESTRICTED LIBERALLY TAKE

AVOIDED	RESTRICTED	LIBERALLY TAKEN

D) 24-HOUR RECALL SURVEY TO FIND OUT THE FOOD AND NUTRIENT INTAKE FOR THREE CONSECUTIVE DAYS

DAY	MEAL	MENU	QTY & WT OF COOKED FOOD	RAW EQUIVALENT

APPENDIX - II

ESTIMATION OF BLOOD GLUCOSE USING THE GLUCOMETER, WHICH WORKS BY THE GLUCOSE OXIDASE PRINCIPLE (DRASH, 1989)

PRINCIPLE OF THE GLUCOMETER

A glucometer is an instrument used to test the blood sugar level. It works by the glucose oxidase principle, where the aldehyde group of glucose is oxidised by glucose oxidase to give glucomic acid.

Special strips called haemoglucostix are used to given an approximate estimation of glucose in blood. A large drop of blood drawn through a disposable syringe is placed on the printed side if the strip, which is coated with a semi-permeable membrane through which the glucose passes on the paper. After few seconds the strip is introduced into the glucometer, and the reading read in two minutes, the wavelength varies according to intensity of glucose in the blood.

APPENDIX - III

ESTIMATION OF HAEMOGLOBIN BY CYANOMETHEMOGLOBIN METHOD

Estimation of haemoglobin by this method is recommended by 10th international Hematology congress and WHO expert committee on nutritional awareness. This method measures not only oxy haemoglobin but also carbon monoxide haemoglobin and methemoglobin except sulphahaemoglobin with filter type photoelectric calorimeter. The single relatively broad band of cyamethaemoglobin in the green spectral region has a distinct advantage. This method can be modified to determine haemoglobin in dry blood (or) filter paper also. Only disadvantage is that it involves the use of a solution of cyanide, but the concentration is 50 mg/litre which is 1/4 of the lethal dose. Hence, it seems that proper handling of this reagent constitutes a negligible hazard.

PRINCIPLE

Haemoglobin is converted into cyanmethaemoglobin by the addition of potassium cyanide and ferricyanide. The colour of cyanmeth haemoglobin is read in a photoelectric carlorimeter at 540 nm against a standard solution. Since cyanide has the maximum affinity for haemoglobin, this method estimates the total haemoglobin in the blood.

PROCEDURE

1. Exactly 0.02 ml of blood is collected from the subject by using standardised haemoglobin pipette on small filter paper.

2. The stained portion of the filter paper is cut and transferred into the test tube containing 5 ml of the drabkin's solution.
3. 10 minutes time is allowed for the formation of cyanmethaemoglobin and the contents are vigorously mixed by shaking the test tube.
4. The solution obtained is read in haemoglobinometer.
5. 5 ml of drabkin solution is used as blank.

Standard haemoglobin (g/100 ml)

For pregnant women

	Deficient	Low	Acceptable
2nd trimester	< 9.5	9.5 to 10.9	> 11.0
3rd trimester	< 9.0	9.0 to 10.4	> 10.5

WHO criteria for the diagnosis of Anaemia = < 11

APPENDIX - IV

INTERVIEW SCHEDULE FOR ELICITING THE EFFECT OF GDM ON OUTCOMES OF PREGNANCY

1. TERM OF THE LABOUR

   FULL TERM

   PREMATURE

   IF PREMATURE DELIVERY, HOW MUCH PREMATURE?

   INDICATE THE MONTH OF PREGNANCY

2. INDICATE WHETHER THE DELIVERY WAS

   NORMAL

   CAESAREAN

   FORCEP DELIVERY

3. TIME TAKEN FOR LABOUR

4. TYPE OF PREDELIVERY PRECAUTIONS TAKEN WITH REGARD TO GDM

   INSULIN - TYPE FREQUENCY

   ORAN HYPOGLYCAEMIC DRUGS

   OTHERS

5. ANY COMPLICATIONS DURING DELIVERY YES/NO

   IF YES, WHAT WERE THE COMPLICATIONS?

POST DELIVERY MANAGEMENT APPROACH

1. BLOOD GLUCOSE LEVELS

   FIRST WEEK

   SECOND WEEK

   THIRD WEEK

2. TREATMENT UNDERGOING AFTER DELIVERY

   INSULIN

   ORAL HYPOGLYCAEMIC DRUGS

   OTHERS

A. IF INSULIN - TYPE OF INSULIN

FREQUENCY OF INSULIN INTAKE

B. IF ORAN HYPOGLYCAEMIC DRUGS

TYPE OF DRUGS

DOSAGE

3. DO YOU FOLLOW ANY MODIFICATIONS IN YOUR DIET YES/NO

IF YES, MENTION THE TYPE OF MODIFICATIONS

APPENDIX - V

INTERVIEW SCHEDULE TO ELICIT INFORMATION FROM LACTATING MOTHER WHO WERE GESTATIONALLY DIABETIC

1. GENERAL INFORMATION

   NAME OF THE SUBJECT

   AGE

   EDUCATIONAL STATUS

   OCCUPATION

   HEIGHT (cms)

   WEIGHT (kgs)

2. INFORMATION ON LACTATION

A. DO YOU BREAST FEED YOUR INFANT? YES/NO

B. DID YOU FEED COLOSTRUM TO YOUR INFANT? YES/NO

C. WHEN DID YOU START BREAST FEEDING YOUR CHILD AFTER DELIVERY

D. INDICATE THE NUMBER OF TIMES YOU BREAST FEED YOUR INFANT?

E. DO YOU FEEL THAT BREAST MILK IS ADEQUATE FOR YOUR INFANT? YES/NO

F. DO YOU TAKE ANY GALACTOGOGUE? YES/NO

   IF YES, INDICATE WHETHER

   DRUMSTICK LEAVES

   GARLIC

   ONION

   GHEE

   ANY OTHER COMMERCIAL FORMULA?

G. DO YOU BECOME HYPOGLYCAEMIC AFTER YOU FEED YOUR INFANT?

YES/NO

H. HOW DO YOU ASSOCIATE IT?

I. WHAT IS THE IMMEDIATE MEASURE YOU TAKE DURING HYPOGLYCAEMIC EPISODE?

BLOOD GLUCOSE LEVELS OF THE MOTHER

BEFORE FEEDING (mg/dl)

AFTER FEEDING (mg/dl)

J. ARE YOU ON INSULIN? YES/NO

IF YES, INDICATE TYPE AND FREQUENCY

APPENDIX - VI

INTERVIEW SCHEDULE TO ELICIT DETAILS REGARDING THE PROBLEMS OF THE INFANT OF GESTATIONAL DIABETIC MOTHER

1. SEX THE CHILD
2. BIRTH WEIGHT (kgs)
3. LENGTH (cms)
4. BLOOD GLUCOSE LEVEL (mg/dl)
5. TREATMENT GIVEN FOR MAINTENANCE OF NORMAL LEVEL OF BLOOD GLUCOSE
6. ARE THERE PROBLEMS OF
   - MACROSOMIA
   - HYPOGLYCAEMIA
   - HYPOCALCAEMIA
   - HYPERBILIRUBINEMIA
   - POLYCYTHEMIA
   - RENALVEIN THROMBOSIS
7. ARE THERE ANY CONGENITAL ANOMALIES
   - CLEFTLIP & PALATE
   - IDIOPATHIC RESPIRATORY DISTRESS SYNDROME
   - CARDIOMEGALY & CONGESTIVE HEART FAILURE

APPENDIX - VII

INDIVIDUAL HEIGHT, WEIGHT AND BODY MASS INDEX OF TARGET MOTHERS

Group III (a)		Height (cm)	Weight (kg)	Body mass index
	1.	156	50	20.8
	2.	162	75	28.6
	3.	159	55	21.8
	4.	148	41	19.5
	5.	156	48	19.7
	6.	158	62.5	26
	7.	160	78	30.4
	8.	156	71	29.5
	9.	165	59	21.8
	10.	159	59	23.6
	11.	162	75	28.6
	12.	156	48	19.5
	13.	153	39	16
	14.	165	68	32.8
	15.	168	59.5	21
	16.	150	48	21.3
	1.	150	38	16.8
	2.	156	62	25.4
	3.	156	36	14.7
	4.	159	48	18.9
	5.	156	66	27.1
Group I (n=5)	1.	168	67	23.7
	2.	162	80	30.5
	3.	156	63	25.9
	4.	158	40	16
	5.	150	53	23.5
Group II	1.	157	59	23.9
	2.	158	75	16
	3.	161	43	16.6
	4.	160	50	19.5
	5.	162	64	24.4
	6.	162	80	30.5
	7.	165	59	21.6
	8	145	43	20.4
	9.	152	55	20.9
	10.	159	64	25.3
	11.	159	69	27.3
	12.	157.5	50	20.1
	13.	156	70	28.8
	14.	157.5	58	23.3
	15.	148	51	24.2
	16.	148	42	19

APPENDIX - VIII

INDIVIDUAL BLOOD GLUCOSE VALUES OF THE TARGET MOTHERS

GROUPS	3M		4M		5M		6M		7M		8M		9M	
	F.B.S	P.P.B.S	F.B.S	P.P.B.S	F.B.S	P.P.B.S	F.B.S	P.P.B.S	F.B.S	P.P.B.S	F.B.S	P.P.B.S	F.B.S	P.P.B.S
GROUPI														
1.	135	210	-	-	-	-	-	-	-	-	-	-	-	-
2.	175	197	69	146	74	101	84	94	116	188	104	129	81	101
3.	80	110	78	110	-	-	-	-	-	-	-	-	-	-
4.	-	-	-	-	80	110	130	250	115	230	-	-	-	-
5.	100	210	80	110	-	-	-	-	-	-	-	-	-	-
GROUPII														
1.	115	150	-	-	-	-	-	-	-	-	-	-	-	-
2.	150	200	80	120	80	120	100	140	100	140	-	-	-	-
3.	150	215	150	210	130	200	150	210	-	-	-	-	-	-
4.	-	-	-	-	135	165	135	165	-	-	-	-	-	-
5.	-	-	-	-	-	-	-	-	-	-	88	130	98	160
6.	-	-	-	-	-	-	105	226	66	158	84	150	-	-
7.	-	-	-	-	-	-	-	-	-	-	100	168	-	-
8.	-	-	-	-	110	168	80	130	-	-	-	-	-	-
9.	175	267	95	243	87	126	104	142	150	250	79	150	-	-
10.	-	-	-	-	-	-	90	167	80	125	82	138	-	-
11.	-	-	-	-	-	-	180	192	89	125	-	-	-	-
12.	-	-	-	-	84	156	82	125	-	-	-	-	-	-
13.	-	-	-	-	-	-	106	178	-	-	-	-	-	-
14.	-	-	-	-	-	-	-	-	-	-	95	170	84	131
15.	82	122	90	180	82	122	82	122	-	-	-	-	-	-
16.	159	234	-	-	-	-	-	-	-	-	-	-	-	-
GROUPIII a. n=16														
1.	-	-	-	-	-	-	95	179	89	157	70	108	106	178
2.	-	-	-	-	-	-	-	-	-	-	110	185	90	171
3.	-	-	-	-	-	-	-	-	-	-	-	-	200	350
4.	-	-	-	-	-	-	-	-	-	-	-	-	95	182
5.	-	-	-	-	-	-	-		-	-	-	-	76	102
6.	-	-	-	-	-	-	140	225	115	180	118	235	95	135
7	-	-	99	179	89	155	75	110	90	120	85	120	85	120
9.		-	112	223	82	192	69	165	87	222	70	88	80	130
10.	-	-	-	-	-	-	165	245	250	365	160	220	95	170
11.	-	-	-	-	85	108	85	110	90	125	82	120	85	125
12.	-	-	96	186	145	320	117	230	85	123	80	120	85	125
13.	81	164	65	110	60	110	95	186	82	120	85	135	82	120
14	90	130	95	145	95	145	105	156	90	177	105	195	75	100
15.	110	215	95	138	98	142	101	158	97	130	105	142	115	154
16.	110	216	115	234	96	168	112	213	89	142	97	102	85	132

APPENDIX - IX

INDIVIDUAL BLOOD PRESSURE VALUES OF THE TARGET MOTHERS

GROUPS	3M		4M		5M		6M		7M		8M		9M	
	SYS	DYS	SYS	DYS	SYS	DYS	SYS	DYS	SYS	DYS	SYS	DYS	SYS	DYS
GROUP I (n=5)														
1.	120	80	-	-	-	-	-	-	-	-	-	-	-	-
2.	160	100	140	80	120	80	120	70	140	80	120	80	120	80
3.	120	80	140	80	-	-	-	-	-	-	-	-	-	-
4.	140	90	140	90	130	80	140	90	110	80	-	-	-	-
5.	130	70	-	-	-	-	-	-	-	-	-	-	-	-
GROUP II (n=16)														
1.	120	80	-	-	-	-	-	-	-	-	-	-	-	-
2.	110	80	120	70	120	80	120	80	140	84	-	-	-	-
3.	120	80	110	70	140	80	140	82	-	-	-	-	-	-
4.	110	80	110	80	110	80	110	80	-	-	-	-	-	-
5.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
6.	120	80	120	80	120	80	120	80	120	80	120	80	-	-
7.	120	80	120	80	120	80	120	80	110	80	110	80	-	-
8.	120	80	120	80	120	80	120	80	-	-	-	-	-	-
9.	140	80	140	80	140	80	120	80	120	80	120	80	120	80
10.	120	80	120	80	120	80	120	80	110	80	-	-	-	-
11.	110	70	130	80	130	80	140	80	130	80	-	-	-	-
12.	120	70	120	80	120	70	110	70	-	-	-	-	-	-
13.	140	80	140	80	140	80	140	80	-	-	-	-	-	-
14.	110	80	110	80	120	80	110	80	130	80	120	80	120	80
15.	120	80	130	90	130	90	130	90	-	-	-	-	-	-
16.	120	70	-	-	-	-	-	-	-	-	-	-	-	-
GROUP III (a) n=16														
1.	120	80	120	80	120	80	120	80	110	70	110	70	120	80
2.	130	90	130	90	120	80	130	90	130	90	140	90	120	80
3.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
4.	120	80	120	80	120	80	120	80	120	80	110	80	110	80
5.	140	80	140	110	130	90	130	90	130	90	110	140	140	110
6.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
7.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
8.	130	100	130	100	130	100	130	100	130	100	130	100	130	100
9.	120	80	120	80	120	80	130	80	130	100	120	80	150	85
10.	140	80	130	90	130	90	150	100	140	90	150	90	130	90
11.	110	80	120	80	110	80	120	80	110	80	120	80	120	80
12.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
13.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
14.	110	70	110	70	110	70	110	70	110	70	110	70	110	70
15.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
16.	120	80	120	80	120	80	120	80	120	80	120	110	120	90
b. (n=5)														
1.	110	90	120	80	120	80	120	80	120	80	120	80	120	80
2.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
3.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
4.	120	80	120	80	120	80	120	80	120	80	120	80	120	80
5.	130	90	130	80	120	80	130	80	140	90	140	90	130	80

APPENDIX X

INDIVIDUAL HAEMOGLOBIN VALUES OF THE TARGET MOTHERS

GROUPS	3M	4M	5M	6M	7M	8M	9M
GROUP I (n=5)							
1.	11	11	11	11	-	-	-
2.	11.1	11.1	11.1	11.1	11.1	11.1	11.1
3.	12	12	-	-	-	-	-
4.	10	10	10	10	10	-	-
5.	10.1	10	-	-	-	-	-
GROUP II (n=16)							
1.	10.5	-	-	-	-	-	-
2.	11.1	11.2	11.2	11.2	11.1	-	-
3.	12	12.2	12	12	-	-	-
4.	10	10	9.5	9.7	-	-	-
5.	10	10	10	10.1	10.2	10.1	10.1
6.	10.2	10.2	10.3	10.5	10.5	10.9	-
7.	11.5	12	12.1	12	12	12	-
8.	12	12	12	12	-	-	-
9.	13	13	13	13.1	12.1	12.5	-
10.	13.2	13.2	13.2	13.2	13.2	13.2	-
11.	13	13	13	13	13	-	-
12.	11.2	11.1	11.2	11.1	-	-	-
13.	12	12.2	12	12	-	-	-
14.	11.5	12	12	12	12	12	12.1
15.	12	13	13	13	-	-	-
16.	11.2	-	-	-	-	-	-
GROUP III (a) n=16							
1.	11	10.9	11.5	11	11.5	11.5	12
2.	11.3	11.5	11.3	10.9	10.9	10.9	10.9
3.	13.5	13.5	13.5	13.5	13.5	13.5	13.5
4.	11.1	11.1	11.1	10.9	10.9	10.9	11.1
5.	10.9	10.9	10.9	10.9	10.9	10.9	10.9
6.	10.2	10.2	10.1	10.2	10.1	10.1	11
7.	11.2	11.2	11.2	11.2	11.1	11.2	11.2
8.	10.1	10.1	10.1	10.1	10.1	10.1	10.1
9.	13	13	13	13	13	13	13
10.	10.2	10.2	10.4	10.4	10.4	10.4	10.4
11.	12	12	12	11.5	10.5	9.8	10.2
12.	12	12	11.9	11.9	11.9	10.5	11
13.	11.4	11.8	10.9	11.8	11.8	11.8	12
14.	11	11.2	11.5	11.9	12.5	12.6	11.5
15.	13	13	12.2	10	10	10.5	10.5
16.	10	10	10	10	10	10	10
(b) n=5							
1.	11.2	11.0	10	9.4	9.4	9.4	10.4
2.	10.5	10.2	10	10.1	9.4	9.5	10
3.	11	11	11	11	11	11	11
4.	10.4	10.4	10.4	10.4	10.4	10.4	10.4
5.	10.2	10.2	10	9.4	9.4	9.5	10

APPENDIX XI

INDIVIDUAL WEIGHT GAIN OF TARGET MOTHERS

Diabetic pregnant women

Group I (n=5)	Trimester I	II Trimester			III Trimester		
	3m kg	4m kg	5m kg	6m kg	7m kg	8m kg	9m kg
1	1	1	-	-	-	-	-
2	-	-	-	-	8	-	-
3	1	1	1	-	-	-	-
4	1	-	-	-	-	-	-
5	1	-	-	-	-	-	-
Group II (n=16) **Gestational diabetic mother**							
1	1	-	-	-	-	-	-
2	-	-	-	-	5	-	-
3	-	-	5	-	-	-	-
4	-	-	-	-	-	-	8
5	-	-	-	-	5	-	-
6	-	-	-	-	-	14	-
7	-	-	-	6	-	-	-
8	-	-	-	2.6	-	-	-
9	-	-	-	-	-	-	14
10	-	-	-	-	-	8	-
11	-	-	-	-	10	-	-
12	-	-	-	6	-	-	-
13	-	-	-	10	-	-	-
14	-	-	-	6	-	-	-
15	1	-	-	-	-	-	-
16	-	-	-	-	-	-	11

APPENDIX XII

TOTAL WEIGHT GAIN OF THE DELIVERED MOTHERS

Group IIIa (n=16)	Total weight gain
Gestational diabetic mothers	
1	10
2	9
3	12
4	12
5	12
6	10
7	12
8	12
9	10
10	15
11.	11
12	10
13	12
14	10
15	10.5
16	10
Group III (b) (n=5)	Non diabetic mothers
1	7.0
2	10
3	10
4	8
5	10

APPENDIX XIII

NEW BORN INDIVIDUAL CROWN HEEL LENGTH

Gestational diabetic mothers babies (n=15)

Group III (a)

Males	Females
1. 36 cm	3. 36 cm
2. 40 cm	5. 43 cm
3. -	6. 35 cm
4. Maurted baby	7. 42 cm
8. 44 cm	12 35 cm
9. 45 cm	13.40 cm
10.43 cm	14.36 cm
11.40 cm	15.41 cm
	16.35 cm

Group III (b)

Non-diabetic mothers new born

1. 30 cm	4. 42 cm
2. 34 cm	5. 34 cm
3. 35 cm	

APPENDIX XIV

NEW BORN INDIVIDUAL BIRTH WEIGHT

Gestational diabetic mother's babies (n=16)

Group III (a)

Males	Females
1. 3.9kg	3. 4.8 kg
2. 3.6 kg	5. 3.3 kg
4. 5.0 kg	6. 3.0 kg
9. 3.4 kg	7. 3.5 kg
10.4.0 kg	8. 3.2 kg
11.3.4 kg	12. 3.5 kg
16.2.25 kg	13. 3.0 kg
	14. 3.3 kg
	15. 3.0 kg

Group III (b)

Non-diabetic mothers new born

1. 2.25 kg	2. 3.25 kg
5. 3.0 kg	3. 3.2 kg
	4. 2.8 kg