GESTATIONAL DIABETES MELLITUS: PREVALENCE, ASSOCIATED FACTORS AND PREGNANCY OUTCOME IN WOMEN ATTENDING ANTENATAL CLINIC AT MUHIMBILI NATIONAL HOSPITAL

by the
ational
women
of the

Julieth Johnson Kileo, MBBS

MMed (Obstetrics and Gynaecology) Dissertation
Muhimbili University of Health and Allied Sciences
November, 2010

CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by the Muhimbili University of Health and Allied Sciences the dissertation entitled: "Gestational Diabetes Mellitus: Prevalence , associated factors and pregnancy outcome in women attending Antenatal Clinic at Muhimbili National Hospital" in partial fulfillment of the requirements for the degree of Masters of Medicine in Obstetrics and Gynaecology.

SUPERVISOR: DR. FURAHA AUGUST

.....

SIGNATURE

Date.....29/11/10.....

CO-SUPERVISOR: PROFESSOR HANS MGAYA

.....

SIGNATURE

Date.....25/11/2010.....

DECLARATION

I declare that this dissertation is my own work and it has not been submitted for any diploma or degree in any other University.

Candidate's signature .....

Date 25/11/2010

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DEDICATION

I dedicated this work to my parents Mr Johnson T.Kileo and Mrs Anna W. Kileo. I also dedicate this work to my Husband Manase S. Mariki whose moral and material support were vital for the accomplishment and lastly to my beautiful children Janice, Justin and Jayden.

ABSTRACT

Background: Gestational diabetes mellitus (GDM) is a substantial and growing health concern in many parts of the world. It also has serious, long-term consequences for both baby and mother, including a predisposition to obesity, metabolic syndrome, and diabetes later in life. Early detection and intervention identifies women with high risk and offers primary prevention for women with this condition and their babies. The prevalence may range from 3-19% of all pregnancies depending on the population studied and the diagnostic tests employed. There is no recent study which has been done to find the prevalence of GDM and associated factors in our country.

Objective: To determine the prevalence of GDM associated factors and pregnancy outcome in women attending Antenatal Clinic at Muhimbili National Hospital.

Methodology: A structured questionnaire was used to obtain participants' particulars including demographic characteristics including age of patients, marital status, gravidity and gestation age. Information on associated factors was also collected which included previous obstetric history and history of diabetes in the family. Blood samples for Random Blood Glucose (RBG) measurement was taken from all participants and 2hrs oral glucose tolerance test was done to those participants who were found to have impaired RBG. The diagnosis of GDM was obtained using WHO criteria. The pregnancy outcome of among women with GDM was also looked upon.

Results: A total of 549 participants were interviewed and examined 61(11%) had impaired RBG. Out of them, 2hrs OGTT was done in 59 participants and 27(45.8%) were found to have GDM. The overall prevalence of GDM was found to be 4.9% (27/549).

It was noted that among investigated factors participants with history of diabetes in the first degree relatives were three times likely to have GDM than those with no family history of

diabetes in the first degree relatives (OR=2.5; 95%CI: 1.14-5.51). All other variable were not significant in bivariate analysis.

Out of 549 participants 505(92%) delivered within the study period. Clients with GDM 26/27(96.3%) delivered during the study period.

Delivery of big baby was found to have significantly positive association with GDM (p-value <-0.001). Delivery of still birth as well as premature baby did not show association with GDM. Delivery by caesarean section 12/186(6.5%) was high for GDM though this was not statistically significant.

Conclusion and recommendation: There is relatively high prevalence of GDM in women attending antenatal clinic at Muhimbili National Hospital. This is a preventable disease, so efforts should be initiated to stop further increase in its prevalence.

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ACRONYMS

ANC	Antenatal Clinic
DAL	Daily Activity Level
ENND	Early Neonatal Death
FBG	Fasting Blood Glucose
GDM	Gestational Diabetes Mellitus
GIGT	Gestational Impaired Glucose Tolerance
GA	Gestational Age
HABGT	History of Abnormal Glucose Tolerance
IGT	Impaired Glucose Tolerance
IUFD	Intrauterine Fetal Death
MNH	Muhimbili National Hospital
OGTT	Oral Glucose Tolerance Test
PMTCT	Prevention of Mother to Child Transmission of HIV infection
RBG	Random Blood Glucose
SVD	Spontaneously Vaginal delivery
T2DM	Type 2 Diabetes Mellitus

USA	United States of America
WHO	World Health Organization

DEFINITION OF TERMS

1. Fetal macrosomia (Big baby) was defined as fetal birth weight ≥ 4kg.

2. Prematurity was defined as an infant delivered before completion of 37weeks of gestation.

3. Still birth was defined as an infant born with no heart beat and who does not respond to ventilation and oxygenation.

4. Early Neonatal Death was defined as a death of the baby within the first 7 days after birth.

5. Intrauterine Fetal Death was defined as fetal death occurring antepartum after 28 weeks of gestation.

6. Third degree tear was defined as injury to the perineum involving posterior vaginal wall and tear of the perineal body including both external and internal anal sphincter.

7. Abortion was defined as expulsion from its mother of an embryo or fetus who is less than 28 weeks of gestation age.

8. Daily activity level was defined as the amount of physical work associated with the individual's typical daily routine.The following categorization was adopted. [30]

Very Light; Seated and standing activities, painting, driving, laboratory work, typing, Sewing, ironing, playing cards, playing musical instruments.

Light: Walking on a level surface at (4-4.8kph), garage work, carpentry, house cleaning, restaurant trades, child care, golf, sailing, table tennis.

Moderate: Walking (5.6-6.5kph), weeding and hoeing, carrying a load, cycling, skiing, tennis, dancing.

Heavy: Walking with a load uphill, tree felling, heavy manual digging, basketball, climbing, football, soccer.

The participants were asked the activities they performed routinely and grouped in appropriate categories.

1. BACKGROUND

1.1 Background Information

Gestational Diabetes Mellitus (GDM) is emerging as a serious public health problem.It is defined as "carbohydrate intolerance of variable severity with onset or first recognition during the present pregnancy". This definition applies regardless of whether insulin is used for treatment or the condition persists after pregnancy. It does not exclude the possibility that the glucose intolerance may have existed before the pregnancy. Thus, women with GDM include women with type 1 or type 2 diabetes first discovered in pregnancy, as well as those who develop carbohydrate intolerance during the pregnancy. Women with plasma glucose levels that do not meet diagnostic criteria but are higher than normal are variously referred to as having" impaired glucose tolerance," "borderline diabetes," or" carbohydrate intolerance"[1, 2, 3]

GDM is an asymptomatic condition, identified by diagnostic testing after initial screening. It is an unusual condition in that it is not a clinical entity, but rather a pregnancy-related condition treated on the basis of laboratory findings. Although it has been studied extensively for more than 30 years, there is no consensus on specific screening strategies, criteria for screening, or even whether diagnosis and treatment have an effect on fetal outcome [6]

The current definition of GDM, "carbohydrate intolerance of variable severity with onset or first recognition during pregnancy", was first proposed by the National Diabetes Data Group (NDDG) in 1979, although that group used the term "diabetes impaired glucose tolerance (IGT)" rather than "carbohydrate intolerance of varying severity." The latter term was introduced at the Second International Workshop-Conference on Gestational Diabetes in1985.The Significance of this change is that it acknowledges the uncertainty regarding the most appropriate diagnostic criteria. Currently, the World Health Organization (WHO) does not consider that different diagnostic criteria are appropriate for the pregnant versus the nonpregnant state, preferring instead to use the same definitions of diabetes and IGT for both situations. This approach is consistent with the concept that there should be a single definition

for diabetes in all populations, since adjustment of criteria upward or downward to maintain a stable proportion of each population as abnormal does not appear to be biologically appropriate. In general, individuals with diabetes who come from populations with higher prevalence are as likely to encounter complications as those from low-prevalence populations[7]

The number of cases of diabetes worldwide has increased significantly in the last decade. The prevalence of GDM may range from 1-14% of all pregnancies depending on the population studied and the diagnostic tests employed. GDM may develop at any time during pregnancy [8] Characteristically, the incidence of GDM reflects the incidence of Type 2 Diabetes Mellitus(T2DM) in the background population, which is a warning that a rapid increase in the incidence is to be expected concomitant with the already observed increase in the incidence of T2DM.[26] Furthermore, intrauterine exposure to the metabolic environment of maternal diabetes, or GDM, is associated with increased risk of altered glucose homeostasis in the offspring, beginning in childhood and producing a higher prevalence of GDM in the next generation with all burdens and complications being associated with this disease. It is reasonable to conclude that more newborn infants each year are being exposed to the metabolic environment of diabetes during intrauterine development as a result of changing incidence and demographics of diabetes and pregnancy [9]

Several factors have been associated with GDM. They include overweight (prior to pregnancy),family history of diabetes (first-degree relative), previous abnormal glucose tolerance, previous unexplained stillbirth, previous large baby, polycystic ovarian syndrome, age over 25 years and member of ethnic group of high prevalence. Glycosuria (more than one occasion),polyhydramnios, suspected large fetus are among other factors which develops during pregnancy Studies have shown that using these factors to screen for GDM is relatively inefficient since a large proportion of the population has factors present and a significant number of those with GDM do not have such factors [10, 11]

Numerous studies have demonstrated that women with GDM manifest increased rates of still births, perinatal mortality, macrosomia and congenital malformations.[9,12] In order to minimize

the complications associated with GDM in developed countries, all pregnant women, regardless of history for GDM are screened and managed appropriately. It is commonly recommended that the glucose challenge be administered at 24-28 weeks of gestation however a number of investigators have explored the effect of advancing gestation on screening test function.[12] Hong et al. performed a cross-sectional study of 999 prenatal patients, administering the glucose screening test at the first prenatal visit. There was an increasing likelihood of gestational diabetes as pregnancy progressed; suggesting that the screening test performed early in pregnancy is likely to miss affected individuals.

The worldwide epidemic of glucose intolerance predicted by the latest WHO studies will undoubtedly increase the burden of gestational diabetes, especially in the developing countries.[13] The WHO expert group recommended that all pregnant women or those with risk factors should be screened at the beginning of third trimester of pregnancy using oral glucose tolerance test (OGTT), that is, blood glucose 2-hr after 75g oral glucose load. This is recommended both for screening and diagnosis.[7]

1.2 LITERATURE REVIEW

Several studies have been done to determine the prevalence of GDM and its associated factors as well as its effect to the fetus. The prevalence of gestational diabetes mellitus varies world wide it also varies in direct proportion with the prevalence of type 2 diabetes in a given population or ethnic group. Given that the number of people with diabetes worldwide is expected to increase at record levels through 2030 it is therefore reasonable to examine the real prevalence of GDM in our country.

Researchers in American, European and Asian settings have reported 3-6%prevalence.[14.] There are ethnic differences in the prevalence of GDM. In the U.S.A, Native Americans, Asians, Hispanics, and African-American women are at higher risk for GDM than non-Hispanic white women. In Australia, GDM prevalence was found to be higher in women whose country of birth was China or India than in women whose country of birth was in Europe or Northern Africa. GDM prevalence was also higher in Aboriginal women than in non-Aboriginal women. In Europe, GDM has been found to be more common among Asian women than among European women.[15]However in Colorado USA a study done by Dabelen et al 2004 showed that, the prevalence of GDM among (Kaiser Permanente Colorado) KPCO members doubled from 1994 to 2002 with significant increases in all racial/ethnic groups. Mother's age and ethnicity other than non-Hispanic white were all significantly associated with GDM.[14] In Oregon USA it was indicated that approximately 4% of Oregon pregnancies are complicated by GDM, with Asian/Pacific Islander and Hispanics having the greatest incidence of GDM. Significant predictors for GDM were pre-pregnancy body mass index>25 kg/m^2, racial/ethnic minority group membership, and maternal age>25 years[16].

In New South Wales, Australia, Vibeka et al 2008 found the prevalence of GDM had increased by 45% from 3.0 to 4.4% in the study done between 1995 and 2005. Increasing age was strongly associated with GDM, with women aged >40 years than in women in their early 20s. Parity was associated with a slightly reduced risk. There was no association between smoking and GDM.[17]

They are several associated factors for developing GDM.In addition for determining the prevalence other studies have also looked upon some of these factors. In a study done in UK the prevalence of GDM among the subjects was 1.8% and it was increased with the mother's age and decreased with the duration of pregnancy[18]. In Kuwait the prevalence rate of gestational diabetes mellitus was found to be 3.7%.Positive family history of diabetes mellitus in first degree relative and past history of GDM in previous pregnancy was found to have highest percentage of association. Past history of abortion, macrosomia and of stillbirths had least percentage of association[7].

Furthermore in Iran, a study that was done by Nezard and collegues in 2007 revealed that out of 114 women 3.9–5.6% had GDM. Women with GDM had a significantly higher parity and body mass index than non-diabetic women. They were also more likely to have a family history of diabetes and a history of poor obstetric outcome. Almost 24% were younger than 25years old, and 14.0% had no recognizable risk factor for diabetes. The cesarean section delivery, macrosomia and still birth were all significantly higher in women with GDM than non-GDM controls[19].

Similar results for prevalence and associated factors were found in South India (Tamil Nadu), GDM was detected in 739 (17.8%) women in urban, 548 (13.8%) in semi urban and 392 (9.9%) in rural areas. Most were detected in first visit and the remaining 28% in subsequent visits. A significant increase in the prevalence of GDM was observed with family history of diabetes, increased maternal age and BMI. Women with less physical activity shows a greater association with GDM, however it was not statistically significant.[20]

A study done in third-trimester pregnant rural women residing in the Central Region of Limpopo Province, South Africa showed that the prevalence of gestational impaired glucose tolerance (GIGT) and GDM was 8.8%.Women with GIGT/GDM were significantly older and had more children compared with women with a normal response to the OGTT.[21]

In Africa as well several studies have shown that GDM exists in pregnant women. In a rural village of Northern Ethiopia GDM was found to be 3.7% according to the WHO definition. There was no statistically significant difference in age, gravidity, body mass index and blood pressure in pregnant with and without gestational diabetes mellitus.[22]In the cohort observation study done in Nigerian pregnant women, GDM prevalence was 2.98 per 1000 pregnancies. Maternal age and gestational age at diagnosis were 31.0 ± 2.4 years and 23.88 ± 8.2 weeks respectively. Pre-eclampsia 26.7%, mid-trimester abortions 6.7%, intrauterine fetal death(IUFD) 6.7% were the major antenatal complications[23]

A study done in Uganda investigating the outcome for mothers with GDM showed that the mode of delivery were similar in both groups but genital injuries were more common among mothers with GDM. The indications of Caesarian section in mothers with GDM were two times more likely to be due to big babies and obstructed labour. The babies for mothers with GDM were more likely to be macrocosmic, still born, and have shoulder dystocia than those of normal mothers[24].

In Tanzania there is no recent study of determining the prevalence of GDM reported so far, In 1991 a study was done by Swai et al whereby Oral glucose tolerance tests (75 g) were performed in 189 pregnant women in rural Tanzania. The 2-h glucose levels were found to be close to WHO recommendations but lower than those reported for Caucasians. The prevalence of diabetes and IGT was found to be zero in the pregnant group.[25]

Similarly another study done in 1993 on urban population of Tanzania, 89 pregnant women without diabetes where recruited; 58 had 75g OGTT during the 1st, 2nd and 3rd trimester and postpartum. They found that fifteen (26%) of the 58 women showed a decrease or unchanged 2-h blood glucose during the course of pregnancy, 5(9%) showed an increase and no clear pattern was seen in 38(67%).Values for fasting glucose showed similar trends. They concluded that women during pregnancy in an urban African setting show little change in glucose tolerance as compared in women in developed world where glucose tolerance worsens and in a rural African environment it tends to improve.[26]

1.3 PROBLEM STATEMENT

Due to accelerated population growth, urbanization and high prevalence in obesity and inactive lifestyle in developing countries including Tanzania GDM population is projected to grow. The risks for the infants of a GDM mothers are macrosomia, birth injuries such as shoulder dystocia, bone fracture and nerve injuries, hypoglycemia and hyperbilirubinaemia. Mothers are also at increased risk of developing pre-eclampsia and have an increased chance of need for induction of labour and caesarian section. In addition 50% of women with GDM are expected to develop T2DM within 5years of the index pregnancy.

The above factors cause increase in morbidity as well as mortality for the mothers as well as for the fetuses.

The magnitude of GDM in Tanzania is not well documented and no recent study has been done to know the prevalence of GDM and its associated factors. It is important therefore to know the current situation of GDM in our country and how big is the problem. This will help clinicians to counsel and manage expectant mothers accordingly.

1.4 RATIONALE OF THE STUDY

Despite the documented increase in the magnitude of GDM as well as its complication and risks, little attention is given to this problem especially in the developing countries where resources are limited and need prioritizations.

The primary aim of this study is to document the recent prevalence of GDM in Dar es salaam, Tanzania. This will show the public health importance of the problem and enable health system to prioritize resources for screening and managing GDM at all levels to prevent associated complications.

2. STUDY OBJECTIVES

2.1 Broad objective

To determine the prevalence of GDM associated factors and pregnancy outcome in mothers attending antenatal clinic at Muhimbili National Hospital

2.2 Specific objectives

1. To determine the prevalence of GDM in pregnant women attending ANC at MNH by demographic and reproductive characteristics.

2. To determine the proportion of women with factors associated with GDM among pregnant women attending ANC at MNH.

3. To describe the pregnancy outcome of among women with GDM attending ANC at MNH.

3. METHODOLOGY

3.1 Study setting

The study was conducted in the Antenatal clinic and labour ward of Muhimbili National Hospital which is a tertiary hospital receiving clients from Dar es Salaam and Coastal regions. The hospital is the largest in the country and also serves as a teaching hospital for the Muhimbili University of Health and Allied Science. There was an average of about 120 pregnant women who attended antenatal clinic daily at MNH from Monday to Friday. These included public and private patient. Several services are routinely provided at antenatal clinic including PMTCT, screening for risk factor like hypertension, malaria, anaemia, venereal diseases and urinary tract infections. However there are other services which are not routinely provided including screening for GDM. Approximately 20-40 deliveries are conducted per day in the labour ward. Staffs of different carder are available at MNH include the consultants, specialists, resident doctors, registrars, intern doctors and midwives. They work together as a team to care for the patients.

3.2 Study design

Descriptive cross-sectional study was conducted for six months from 1st September 2009 to 28th February 2010.

3.3 Study population

Pregnant women aged 18years and above with 24weeks of GA or more who were attending ANC at MNH.

3.4 Exclusion criteria

Exclusion criteria: Pregnant women who are known diabetic

Very sick women

Patients who fit the inclusion criteria but refused to participate in the study.

3.5 Sample size

The sample size of this study was determined by the following formula,

$$n=Z^2 p(100-p)/e^2$$

Where, n=Sample size required

Z=Critical value (1.96)

P=Estimated prevalence of GDM, where in this study I took the average prevalence of the 2 studies[21,22] 8.8% and 3.7% done in South Africa and Northern Ethiopia respectively i.e.; (8.8+3.7)/2=6.25

e=Marginal error on p (2.5%)

10%= Anticipated non-response

It follows that;

$$n=1.96\ 6.3(100-6.3)/2.5 + 10\%$$

=363+10 %(363)

=363 + 36

=399≈400

Thus the minimum sample size was 400 pregnant women.

3.6 Sampling technique

Patients were selected using a Systematic sampling. The average number of pregnant mothers attending at ANC was estimated to be 120. Then every 3rd patient was selected until the last patient who attended clinic on that particular day was reached. Simple random sampling was used to select the 1st patient at the beginning of each day. This was done by requesting the 1st and 2nd patient who arrived early at antenatal clinic to pick up 2 folded papers marked yes and no. The patients who picked the paper with a yes mark were the starting point.

3.7 Research assistants and training

Two research assistants (nurse midwives with experience in caring diabetes patients) assisted in counseling and data collection. Prior to the study they underwent a two days training course conducted by the main researcher where they were educated on the purpose of the study, how to select patients, consent form administration, counseling and taking blood for measuring RBG and 2hrs OGTT as well as filling the questionnaire.

3.8 Pilot study

This was done two weeks prior to data collection to test the practicability of the questionnaire. Modification was done whenever necessary; thereafter the questionnaire was easily administered and brought up the intended information.

3.9 Data collection procedure and Research tools

In the recruitment phase, the principal investigator did group counseling and the introduction of the study for all pregnant women who attended the ANC clinic. Those who fit the inclusion criteria were selected. The selected pregnant women included both the public and private patients. Those who agreed to enter the study were taken aside and one to one counseling was done again. Informed consent was given and a Swahili structured questionnaire with open and close ended questions were administered to them by the principal investigator and research assistants. After completion of the interview, participants were requested to give blood sample for single random blood glucose (RBG) measurement.

For these consenting women blood sample was taken from the patients left index finger by a prick using Acc-Check Softclix® lancets (German) after cleaning the finger with antiseptic swab. This was then measured using a one touch glucometer machine (Accu-Check Compact Plus meter,(Germany) which gave results within 5seconds. Individual were categorized of having impaired RBG or Normal RBG using the original cut-offs depending upon when the women had there last meal. Impaired RBG was taken as 6.4 mmol/L if a meal was taken less than 2hours ago and 5.8 mmol/L if a meal was taken more than 2hours ago.[10]

Women found to have impaired RBG were given an appointment to come for OGTT within a minimum of 3 days. They were instructed to eat there regular diets and fast on the night prior to the appointment day for testing (not to eat anything after 10 o'clock night with exception to water). All appointment were scheduled at 8 o'clock in the morning.

Pregnant women who came for their appointment were tested by either the principal investigator or the two research assistants. A finger prick capillary blood sample was taken from the patients left index finger on arrival under aseptic condition and tested by using the same one touch glucometer machine (Accu-Check Compact Plus meter-Germany). Then patients were given a bolus of 75g glucose mixed in a glass of water (250ml) to drink and the

blood tested again after 2hrs. The diagnosis of GDM was according to WHO criteria where the values are as follows;

Diabetes (GDM)

A fasting capillary blood glucose of ≥6.1 mmol/L (110mg/dl) and/or_ a value 2 h after a 75 g OGTT of≥11.1 mmol/ -(200mg/dl)

Impaired glucose tolerance (IGT)

A fasting value of <6.1 mmol/L(110mg/dl) and_ a value 2 hrs after a 75 g OGTT of ≥7.8mmol/L(140mg/dl)But<11.0 mmol/(200mg/dl).

Impaired fasting glycaemia (IFG an addition to the previous classification)

A fasting value of ≥5.6mmol/l and <6.1 mmol/L(110mg/dl)

Gestational Diabetes by WHO now encompasses both Gestational Impaired Glucose tolerance (GIGT) and Gestational Diabetes Mellitus (GDM) which were previously regarded as separate entity.

Participants who were unable to come were rescheduled but after 3 consecutive failures of visit the candidate was excluded from the study.

Enrollment was done to all pregnant women who were tested and there ANC card was marked for easy identification especially in the labour ward during delivery Those who were found to have GDM they were counseled and referred to Diabetic clinic. Depending upon their glycemic level they were given either medication (i.e. insulin) or advised on nutritional therapy. They were also instructed to come and deliver at MNH. Those clients who decided to deliver in another hospital for some reason the principal investigator contacted them through there telephone number and went to the places they deliver to gather all needed information.

The recruited clients who came for delivery at the labour ward were attended by the labour ward staffs as other patients. The staff that happens to attend the client was requested to fill in the structured questionnaires and they had to fill pregnancy outcome and the mode of delivery. The questionnaires were kept in an area which was easily accessible to the labour ward staffs. They also had a mark similar to the first part of questionnaire for the particular client. The healthy mother and her baby at the end of the study were taken care as usual by postnatal and neonatal clinic respectively. The affected women after delivery they continue to attend diabetic clinic while there babies were taken to the neonatal ward for further care and management.

3.10 Variables

Independent variables are:-

Socio-demographic characteristics: age, marital status, education, gestation age, gravidity.

Factors associated with development of GDM are: History of DM in the family, poor obstetrics outcome in the previous pregnancy including abortion, IUFD, big baby, prematurity, Third degree tear and history of abnormal glucose tolerance in the previous pregnancy.

Dependent variable:

Gestational Diabetes Mellitus (GDM)

3.11 Data quality control, management and analysis

The principal investigators counterchecked for completeness all the questionnaires daily before the clients were discharged. Incase of any missing data participants were contacted again. The information obtained (Questionnaires and case record forms) were entered into the computer using the Statistical Package for Social Sciences (SPSS) version 16.The descriptive

statistics was computed, the t-test and chi2 was used to compare means and proportions respectively. All factors associated with developing GDM were analyzed by bivariate. All significant and non significant variables were included in multivariate logistic regression analysis. The results were reported as OR and 95% CI. The p value of less than 0.05 was considered statistically significant.

3.12 Ethical clearance

Ethical clearance was sought and obtained from the University Ethical Committee and permission to conduct a study was sought and obtained from the clinical director of MNH. Each participant gave an informed consent by filling a special consent form before participating in a study. Explanation of the purpose and nature of the study was given including confidentiality of the information obtained and that the study would do no harm to the participants.

Participants were informed on the benefit of the study, including the knowledge of individual's risk of developing GDM which can later on develop into T2DM if not treated. Those found to have GDM where provided with education on the side effects of the disease and they were referred to diabetic clinic where they got proper treatment. Participants were free not to participate in the study if they wished so and there decision would not deny them the right of being treated properly.

4. RESULTS

A total of 549 pregnant women were interviewed and examined. 61 (11.1%) were found to have impaired RBG out of which 59(10.7%) had undergone OGTT. Among 59 participants who underwent OGTT, 27(45.8%) were diagnosed with GDM.

The overall prevalence of GDM for women attending ANC at MNH was 4.9%. **Figure 1 shows the distribution of pregnant mothers in the study group.**

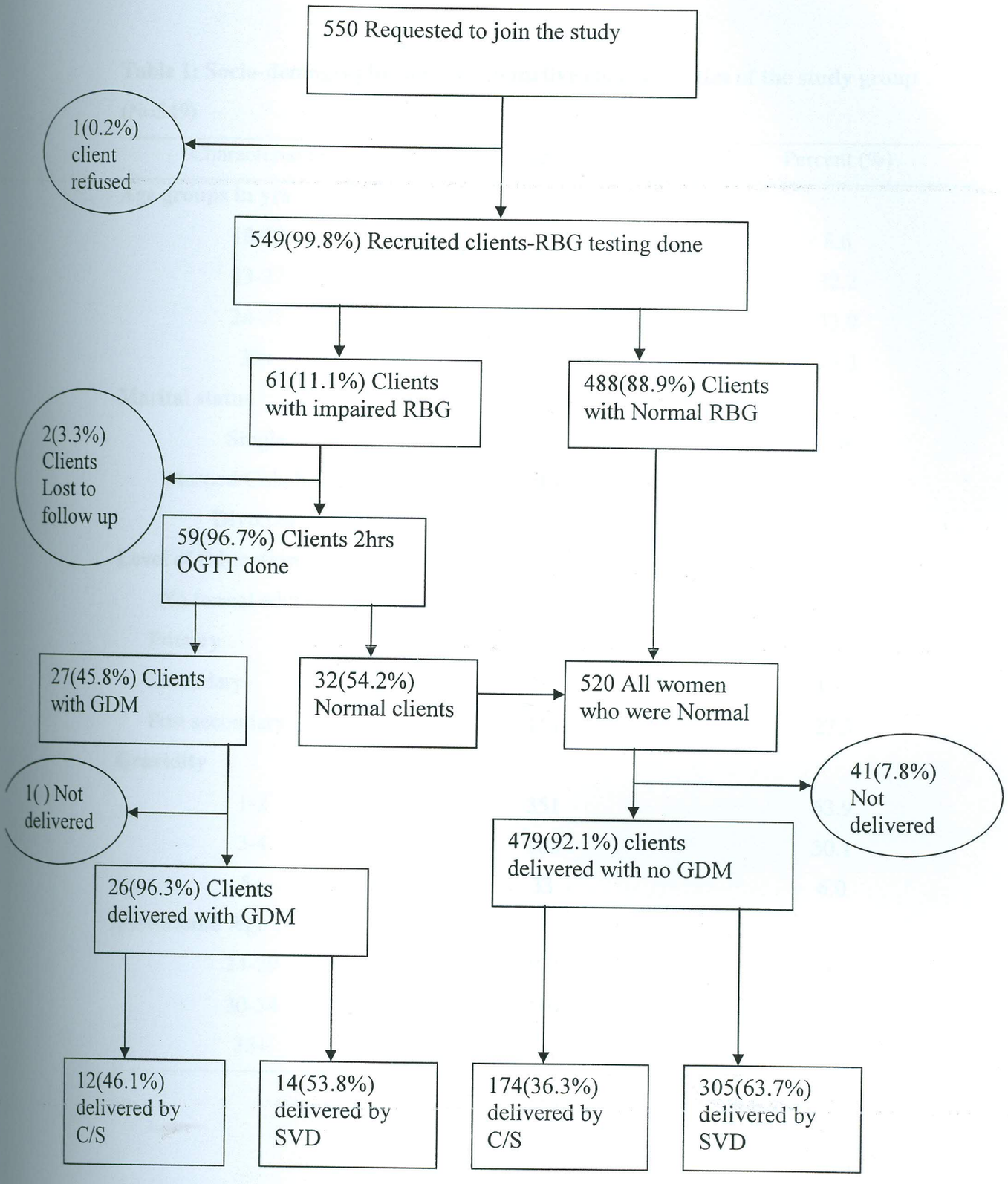


Fig1: Distributation of pregnant mothers in the study group

Table 1: Socio-demographic and reproductive characteristics of the study group (N=549)

Characteristics	Number	Percent (%)
Age groups in yrs		
18-22	47	8.6
23-27	177	32.2
28-32	186	33.9
33+	139	25.3
Marital status		
Single	47	8.6
Married/Cohabiting	501	91.2
Divorcee	1	0.2
Level of Education		
No formal education	11	2
Primary	140	25.5
Secondary	247	45.0
Post secondary	151	27.5
Gravidity		
1-2	351	63.9
3-4	165	30.1
5+	33	6.0
Gestational Age		
24-29	129	23.5
30-34	219	39.9
35+	201	36.6

Table1 shows socio-demographic and reproductive characteristics of 549 participants. The participants were relatively young with a mean age of 28.9(SD ±4.95)years with a range of 18-46years.The age group 18-24 constitutes the minority47/549(8.6%) while the age group 28-32 was the majority of them188/549 (3.9%).

Looking on the gravidity two third 351/549(63.9%) of the participants were gravida 1-2, with very few 33/549(6%) had gravida 5 and above.

Table 2: Prevalance of GDM by demographic and reproductive characteristics in the study group. (N=549)

Characteristics	Total	Number GDM	Percentage GDM	P-value
Age groups				
18-22	47	1	2.13	
23-27	177	6	3.39	0.33
28-32	186	13	6.99	
33+	139	7	5.04	
Type of service				
Public clinic patient	164	4	2.44	0.08
Private clinic patient	385	23	5.97	
Gestation Age				
24-29	129	4	3.10	
30-34	219	17	7.76	0.04
35+	201	6	2.99	

Table 2 shows that the prevalence of GDM was increasing with age being the highest among the age group 28-32years 13/186(6.99%).Age group 18-22years was the lowest with only 1/47(2.1%) in the study group. These findings were not statistically significant with p value 0.33.

Regarding type of service the prevalence for Private clinic participants was higher with 23/385(5.97%) compared with that for public clinic participants which was 4/164(2.44%).This was not statistically significant with p value 0.08. The finding remains statistically not significant after univariate analysis where it was found that there was a 54% reduction in odds of having GDM in public clinic participants with p value 0.09.

Increasing in gestation age to the participants was found to correlate with increase in the prevalence of GDM .The highest prevalence 17/219 (7.76%) was found in the gestation age of 30-34 with only 4/129(3.1%) at gestation age of 24-29. These findings were statistically significant with p value 0.04.

Table 3: Factors associated with GDM by Logistic regression in the study group. (N=549)

Associated factors	Total	Number GDM	Crude Odds Ratio. (95% CI)	Adjusted Odds Ratio. (95% CI)
History of DM				
Yes	138	12	2.5(1.14-5.51)	2.4(1.09-5.26)
No	411	15		
DAL				
Very light and Light	310	15	0.9(0.45-2.13)	0.8(0.46-2.77)
Moderate	239	12		
IUFD				
Yes	19	1	0.9(0.12-7.48)	0.8(0.09-6.57)
No	361	20		
ENND				
Yes	17	1	0.9(0.14-8.49)	0.9(0.11-7.67)
No	363	20		
Big baby				
Yes	34	2	0.9(0.24-4.83)	0.9(0.24-5.08)
No	346	19		

* Values do not tally to 549 because of primigravida clients who have no previous obstetrics history. (n: 169)

Key: DAL-Daily Activity Level, IUFD-Intrauterine Fetal Death, HABGT-History of abnormal glucose tolerance, ENND-Early Neonatal Death.

Factors associated with GDM among the study group.

Table 3 shows different factors that could influence GDM. In bivariate analysis participants with history of diabetes in the family were three times likely to have GDM than those without history of diabetes in the family (OR 2.5:95% CI 1.14-5.51).All other variables were not significant in bivariate analysis. This finding remains statistically significant after multivariate analysis where participants with history of diabetes in the family were more likely to be associated with GDM than those without history of diabetes in first degree relative (OR 0.01:95% CI 1.44-8.72).

Table 4. Pregnancy outcome of women in the study group. (N=505)

Outcome	No GDM n(%)	GDM n(%)	P-value
Big weight of the baby.			
Yes(>4kg)	16(76.2%)	5(23.8)	<0.001
No(<4Kg)	463(95.7%)	21(4.3)	
Still birth			
Yes	7(100%)	0	0.5*
No	472(94.8%)	26(5.2)	
Prematurity			
Yes	11(100%)	0	0.4*
No	468(97.7%)	26(5.3)	
Mode of delivery			
Vaginal delivery	305(95.6%)	14(4.4)	0.4
Caesarian birth	174(93.5%)	12(6.5)	

*Fisher's exact test was used.

The pregnancy outcome of women as related to GDM in the study group

Out of 549 participants 505(91.9%) had delivered by the end of the study. Among the 27 with GDM 26(96.3%) had delivered. Fig 1.

The mean birth weight to those participants with GDM was higher 3.75(SD±0.38) Kilograms than those with no GDM 3.16(SD±0.52) kilograms.

Table 4 shows the expected associated factors of pregnancy outcome of women in the study group. The participants with GDM were found to delivered big babies 5/21(23.8%) while only 21/484(4.3%) did not deliver babies with big weight. This finding was statistically significant p value < 0.001.

Regarding mode of delivery caesarian birth 12/186 (6.5%) was more frequent in participants with GDM than vaginal delivery 14/319 (4.4%). Fig1. However this finding was not statistically significance p value 0.4

5. DISCUSSION

This study was aimed on looking at the prevalence of GDM and the associated factors. Furthermore this study describes the pregnancy outcome of women identified to have GDM.

The overall prevalence of GDM in this study was found to be 4.9%. This was contrary to previous studies[25, 26] done in this country which reported GDM to be non-existent. This relatively high prevalence rate could partly be explained by changes in life style and the fact that the study was urban based and also most of the patients in this study were attended as private patients and deemed to be financially stable. The prevalence rate of GDM in developed countries ranges from 3–19% thus this study shows that even developing countries Tanzania being one of them is not spared.[34] This also correlates to other studies done in different part of Africa. [22, 23]

The mean age at which GDM was found in this study was 28.9 years and it is similar to other studies elsewhere.[10, 11,17] However in our study the results were not statistically significant because of age disparity with few patients found in the age group below 22yrs.

Increasing gestation age in this study was found to be associated with GDM with the highest at gestation age 30-34. This is however in contrast to the study done here in Tanzania in urban setting were they found no changes of glucose level as pregnancy advances[26]. This could be explained by the differences in the lifestyle of individual in the previous study. But findings of the present study were also similar to the study done in Nigeria and elsewhere[23]. This was a positive finding in this study as it proves that testing women at earlier gestation age would likely miss a large number of patients with GDM.

In this study past history of abortion, still birth and abnormal glucose tolerance in the previous pregnancy did not show any association with GDM which is in contrast to the study done by Sultan et al [7] where they found a highest association of GDM with previous abnormal glucose tolerance and least association with previous history of abortion and still birth. This could be

explained by the fact that measurement of blood glucose in pregnant mothers is not routinely done in our country so most of the mothers didn't have any idea wheather they had normal or abnormal blood glucose in the past pregnancy. Regarding abortion and still birth there could be due to other causes which were more associated to this problems and not GDM.

Level of activity has been documented to influence glucose metabolism as well as obesity which are the predictors for GDM.The study done by Zhang and colleagues reported that Women who spent 20 h per week or more watching television and did not do any vigorous activity had a higher risk of developing GDM than women who spent less than 2 h per week watching television and did physical activity.[33]Performing less physical activities was found to decrease GDM in the study done in India.[20] Our study did not show association of GDM and performing less or moderate physical activities. The statistical variation could partly due to differences in the tool used to assess physical activities.

Obesity which is determined by the mothers' prepregnant weight is well known to be the predictor of GDM. In this study we were unable to estimate the obesity .This is because almost half of our patients came for the first time to MNH for ANC checkup when they were in there early third trimester. At this time there weight would have been already affected by there pregnancy state. Most of the mothers had there first trimester booking weight at different clinics so we were unable to use them for calculation in determining obesity.

Delivery of macrosomic babies (wt>4kg) in this study was found to have significant association with GDM. This finding was similar to the other studies where they found macrosomia to be highly significant in GDM.[19, 24] This explains why we had more caesarian section delivery as compaired to vaginal delivery. In spite of GDM patients receiving treatment, there was still an increased risk of macrosomia, and if this was due to fetal hyperinsulinemia as a result of maternal hyperglycemia, treatment with insulin should obliterate this risk. There could be additional factors involved in the pathophysiology of macrosomia, which may be related to lipid metabolism or other factors.[35]

In this study there was greater association of caesarian section delivery with GDM than vaginal delivery .This was similar to the study done in Uganda.[24]However the result in our study was not statistically significant. This could be due to difference in methodology of comparing caesarian section and indication for performing caesarian section.

There was no association of delivery babies who were premature and or with congenital anomalies with GDM in this study. This was different from other studies. [7, 19, 24] T he result can be influenced by the fact that majority of patients were discovered with GDM when they were in there early third trimester and probably that was the time when metabolic derangement have started to occur. At third trimester organogenesis is already completed

In our study third degree tear did not show any association with GDM which was incontrast to the study done in Uganda. The finding were however not statistically significant. Due to the fact that we had high rate of caesarian section which could explained why these injuries did not show any association.[24]

6. CONCLUSION

This study revealed relatively high prevalence of GDM for pregnant women attending Antenatal Clinic at MNH.

GDM is now a problem which was not there 15 years ago following results of other studies done in this country.

Among the factors associated with GDM history of diabetes in the first degree relatives was found to be the major predictor of GDM in this study.

7. LIMITATION OF THE STUDY

This study examined and interviewed pregnant mothers at ANC. The best part while doing this study was the fact that the response from pregnant mothers was very good. However i encountered the following limitation,

There might have been recall biased on asking clients previous obstetric history. However probing questions and sequencing of events were done which we believe might have minimize the bias.

8. RECOMMENDATION

GDM is a problem in our country. There is now a need of employing a routine screening for GDM in all pregnant mothers at gestation age 24-29 and if negative repeat again at gestation age 30-34. This will help us identify most of the mothers with GDM and help them getting a professional help as to prevent them from developing T2DM which is a great public health importance.

There is a need to do further studies which could look upon the following questions.

-What is the prevalence of GDM by using other method of screening?

-How does a diet affect the GDM?

-What is the percentage of patient with GDM will further develop T2DM after 5-10years of follow up in our country?

9. REFERENCES

1. Professor K.G.M.M. Alberti and Professor Zimmer P.Z. Definition, Diagnosis and Classification of Diabetes Mellitus and its Complications.1999.Report of a WHO consultation

2. WHO Consultation: Definition, diagnosis and classification of diabetes mellitus and its complication: report of a WHO consultation. Part 1: Diagnosis and classification of diabetes mellitus, Geneva, WHO/NCD/NCS/99.2,World Health Organization; 1999.

3. The Expert Committee on the Diagnosis and Classification of Diabetes Mellitus; Follow up report on the diagnosis of Diabetes Care 2003, 26;3160-3167.

4. Report of the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. Diabetic Care 2000; 1183-1197

5. Carr C. Evidence-based diabetes screening during pregnancy J Midwifery Women Health 2001; 46:152–8

6. Aubert R. Diabetes in America, 2nd edition, Diane publishing, 1995, 35; 703-718

7. Al-Sultan F.A, Anan G.D, Ahmed S.AS. Clinical Epidemiology of Gestational Diabetes in Kuwait. Kuwait Medical Journal 2004, 36 (3):195-198.

8. Zeck W, McIntyre HD. Gestational Diabetes in Rural East Africa; A call for action J Womens Health (Larchmt). 2008 ;17:403-11

9. Gabbe SG, Mestman JH, Freeman RK, Anderson VG and Lowensohn RI. Management and outcome of class A diabetes mellitus, Am. J Obstet. Gynecol. 127 (1977), 465–469

10. Maresh M. Screening for gestational diabetes mellitus, Seminars in Fetal & Neonatal Medicine .2005. 10; 317-323.

11. Hoffman L, Nolan C, Wilson D.J, Oats J.JN and Simmons D. Gestational diabetes mellitus -- management guidelines, Published in MJA 1998; 169: 93-97

12. Jovanovich L and Peterson CM. Pregnancy in the diabetic women: Guidelines for a successful outcome. Endocr. Metab. Clinic N. Am.J 1992, 433–456.

13. King H. Epidemiology of glucose intolerance and GDM in woman of child bearing age. Diabetes Care 1998; 21: 9-13

14. Dabelea D, Janet k, Bergeon S, Hart C.L, Bischoff K.J, Haman R.F et al. Increasing Prevalence of Gestational Diabetes Mellitus (GDM) Over Time and by Birth Cohort Diabetes Care 2005; 28:579–584

15. Ferrara A. Increasing Prevalence of Gestational Diabetes Mellitus A public health perspective. Diabetes care 2007; 30, 2.

16. Hunsberger M.L. (2007) An assessment of risk factors for gestational diabetes mellitus (GDM) and provider practices for post-GDM care. Ph.D. dissertation, Oregon State University, United States -- Oregon. Retrieved December 28, 2008, from Dissertations & Theses: Full Text database. (Publication No. AAT 3253160).

17. Vibeke A, Van der Ploeg H.P, Wah Cheung N, Huxley R.R, Bauman A.E. Sociodemographic Correlates of the Increasing Trend in Prevalence of Gestational Diabetes Mellitus in a Large Population of Women Between 1995 and 2005. Diabetes Care 2008; 31; 2288-93.

18. Janghorbani M, Stenhouse E, Jones RB, Millward A. Gestational Diabetes in Plymounth U.K; prevalence, seasonal variation and associated risk factors. J reprod Med 2006; 51; 128-34

19. Nezhad A.H, Maghbooli Z, Vassigh A, Larijani B. Prevalence of gestational diabetes mellitus and pregnancy outcomes in iranian women.Taiwan J Obstet Gynecology 2007; 46:236–241

20. Seshiah V, Balaji V, Balaji MS, Paneerselvam A, Arthi T, Thamizharasi M et al. Prevalance of gestational diabetes mellitus in South India(Tamil Nadu) a community based study J Assoc Physicians India. 2008; 56:329-33.

21. Mamabolo RL, Alberts M, Levitt NS, Delemarre-van de Waal HA and Steyn NP. Prevalence of gestational diabetes mellitus and the effect of weight on measures of insulin secretion and insulin resistance in third-trimester pregnant rural women residing in the Central Region of Limpopo Province, South Africa, Diabetic Med 2007; 24(3);233-239 .

22. Seyoum B, Kiros K, Haileselase T and Leole A. Prevalence of gestational diabetes mellitus in rural pregnant mothers in northern Ethiopia. Diabetes Res Clinical. Practice. 1999; 46:247-251

23. Wokoma F.S, John C.T., Enyindah C.E. Prevalance of gestational diabetes mellitus in Nigerian pregnant women,Trop. J Obstet. Gynaecology 2001;18:56-60

24. Odar E, Wandabwa J, Kiondo P. Maternal and fetal outcome of gestational diabetes mellitus in Mulago Hospital, Uganda African Health Sciences 2004; 4: 9-14

25. Swai AB, Kitange HM, McLarty DG, Kilima PM, Masuki G, Mtinangi BL and Alberti KG, No deterioration of oral glucose tolerance during pregnancy in rural Tanzania. Diabetes Med. 1991, 8; 254–257.

26. Lutale JK, Ajustesen, Swai AB, Alberti KG and McLarty DF. Glucose Tolerance during and after pregnancy in nondiabetic women in an urban population in Tanzania; Diabetic Care. 1993;575-577

27. Lacy T, gomella, Cunningham D.M, Eyal F, Zenk K.E. Neonatology Management,Procedure, on-call problems,Diseases and Drugs,5th edition, McGraw-Hill 2004,NewYork

28. Dutta DC text book of obstetrics including perinatology and contraception, 6th edition, 2004, New central book agency, India.

29. Creasy R.K, Resnik R, Iams J.D, Lockwood C.J, Moore T.R, Greasy and Resniks Maternal- Fetal Medicine Principles and Practices, 6th edition,Saunders,2009.Philadelphia.

30. RJL Systems, Body Composition users guide 2.1, 2008, RJL System, Michigan USA

31. Haroush B.A, Ygev Y, Hod M. Epidemiology of Gestational Diabetes mellitus and its association with type 2 Diabetes. Diabet Med 2004, 21:103-113

32. Jimenez M.JJ, Bueno C.A, Luna-del-Castillo J, Garcia M.M, Lardelli C.P, Calvez V.R. Prevalence of gestational diabetes mellitus: variation related to screening strategy used. Eur J Endocrinol 2002, 146:831-837

33. Zhang C, Solomon CG, Manson JE, Hu FB. A prospective study of pregravid physical activity and sedentary behaviors in relation to the risk for gestational diabetes mellitus. Arch Intern Med 2006; 166: 543–48.

34. Dornhorst A and Beard RW. Gestational diabetes: a challenge for the future. Diabetes Med.1993,10; 897–905

35. Ersanli ZO, Damci T, Sen C et al. Lipid metabolism alterations in patients with gestational diabetes mellitus associated fetal macrosomia. *Ann 1st Super Sanita* 1997; **33**: 411–415.