

Prevalence of pregestational diabetes and its pregnancy outcome among mothers attending antenatal care at three teaching hospitals in Addis Ababa, Prospective follow up Study

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List of abbreviations

ANC	Antenatal Care
AOR	Adjusted odds ratio
APOs	Adverse pregnancy outcomes
CI	Confidence Interval
COR	Crude odds ratio
DM	Diabetes Mellitus
DKA	Diabetic ketoacidosis
EC	Ethiopian Calendar
FBS	Fasting Blood Sugar
FMOH	Federal Ministry of Health
GDM	Gestational Diabetes Mellitus
HgA1C	Glycosylated Hemoglobin
IDDM	Insulin Dependent Diabetic Mellitus
IDF	International Diabetes Federation
NICU	Neonatal Intensive Care Unit
NIDDM	Noninsulin-dependent diabetes mellitus
OHG	Oral hypoglycemic agents
OR	Odds ratio
PGDM	Pre-gestational Diabetes Mellitus
RBS	Random Blood Sugar
RDS	Respiratory Distress Syndrome
SAB	Spontaneous Abortion
SPHMMC	St.Paul's Millennium Medical College
SPSS	Statistical Package for the Social Sciences
SVD	Spontaneous Vertex Delivery
TAH	Tikur Anbessa Hospital
TMP	Trimester of pregnancy
WHO	World Health Organization

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Abstract

- **Background:-** Diabetes mellitus is a metabolic disorder of multiple etiologies characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. Diabetes affects 3-5% of pregnancies. It is unquestioned that pregestational—or overt—diabetes has a significant impact on pregnancy outcome. The embryo, the fetus, and the mother commonly experience serious complications directly attributable to diabetes.

Objective:- To assess the prevalence of pregestational diabetes mellitus and its pregnancy outcome in relation to the glycemic control at three teaching hospitals in Addis Ababa, Ethiopia from 1 January 2016 – 30 December 2016.

- **Methods:-** Prospective cohort study conducted at three teaching government hospitals in Addis Ababa, Ethiopia from 1 January 2016 – 30 December 2016.
- **Results:-** There were a total of 19,797 deliveries among these 80 were women with pregestational diabetes mellitus making prevalence of 0.4%. Out of the study population 39(48.8%) were women with type 1 diabetes mellitus and 41(51.2%) women with type 2 diabetes mellitus. Iatrogenic preterm delivery is high for fetal and maternal indications as 67% of labor is induced. There is statically significant relation between adverse pregnancy outcome and having preconceptional care with $p\text{-value}=0.033$

Conclusion:- There should be management guideline for follow up of patients with pregestational diabetes to have optimal pregnancy outcome. Encourage reproductive age diabetic women to have planned pregnancy and preconceptional care. Prospective cohort study should be conducted to see associations with other determinants like glycemic control.

- **Key Words:-** Pregestational diabetes mellitus; Pregnancy outcome, Preconceptional care

Background

Diabetes mellitus is a metabolic disorder of multiple etiologies characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both. It is caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced.⁽¹⁾

The prevalence of diagnosed diabetes among American adults has increased by 40 percent in 10 years and rose from 4.9 percent in 1990 to 6.9 percent in 1999 (Narayan and colleagues, 2003). More worryingly, it is estimated that this incidence will increase another 165 percent by 2050. To put this into perspective, the lifetime risk of diabetes in individuals born in 2000 is 33 percent for males and 39 percent for females! This increase primarily is due to type 2 diabetes, which is also referred to as diabetes.⁽²⁾

The increasing prevalence of type 2 diabetes in general, and in younger people in particular, has led to an increasing number of pregnancies with this complication (Ferrara and co-workers, 2004). Many women found to have gestational diabetes are likely to have type 2 diabetes that has previously gone undiagnosed (Feig and Palda, 2002). Indeed, the incidence of diabetes complicating pregnancy has increased approximately 40 percent between 1989 and 2004.⁽³⁾

Diabetes is now classified based on the pathogenic processes involved (Powers, 2008). Absolute insulin deficiency characterizes type 1 diabetes, whereas defective insulin secretion or insulin resistance characterizes type 2 diabetes. The terms insulin-dependent diabetes mellitus (IDDM) and noninsulin-dependent diabetes mellitus (NIDDM) are no longer used. Age is also no longer used in classification, because pancreatic β -cell destruction can begin at any age. Most

commonly, its onset is before age 30, but in 5 to 10 percent of affected individuals, onset is after age 30 years. Type 2 diabetes, although most typical with increasing age, also develops in obese adolescents.⁽²⁾

Due to the more severe fetal and maternal complications resulting from such diabetes mellitus antedating pregnancy, in 2013, the WHO has divided hyperglycemia in pregnancy as follows: (1) Diabetes in pregnancy: Pre-gestational diabetes or pregnancy occurring in a women with known diabetes, and Overt diabetes - diabetes first detected during pregnancy; and (2) Gestational diabetes mellitus.⁽⁴⁾

Statement of the problem

Diabetes is one of the medical conditions complicating pregnancy. It is estimated that by the year 2030 more than 360 million people will have diabetes mellitus ⁽⁵⁾ and as the burden of the disease increases the management of pregnancies complicated by DM will be part of the daily obstetric practice in many regions of the world.

Abnormalities in glucose regulation occur in 3-5% pregnancies. This prevalence may increase with new screening guidelines and obesity. Pregestational diabetes accounts about 10% of diabetes in pregnancy the rest are gestational.

Though the incidence of pregestational diabetes mellitus is lower it is prudent to study adverse pregnancy outcome because it is associated with high rate of miscarriage, preterm delivery, preeclampsia, perinatal mortality, congenital malformations and maternal mortality than gestational diabetes mellitus.

Exact incidence of diabetes is not known in Ethiopia however, more and more mothers are becoming pregnant in the presence of diabetes and are prone to have recurrent pregnancy loss, stillborn, babies with multiple congenital anomalies.

Significance of the study

1. To have baseline data on pregestational diabetes mellitus in our set-up
2. It can also be used as a reference for studies in this area.

Literature review

Advances in the care of pregnant women who have diabetes have improved, but not eliminated, the risk of morbidity and mortality in their infants. Therefore, the newborn care provider must plan and assess for the specific problems frequently encountered by the infant of a woman with diabetes.

It is unquestioned that pregestational—or overt—diabetes has a significant impact on pregnancy outcome. The embryo, the fetus, and the mother commonly experience serious complications directly attributable to diabetes. The likelihood of successful outcomes with overt diabetes is related somewhat to the degree of glycemic control, but more importantly, to the degree of underlying cardiovascular or renal disease.⁽²⁾

An infant of a woman with hyperglycemia has as much as 7.9% higher risk of having congenital malformations than infants born to mothers without diabetes. Complications vary based on the type of maternal diabetes, type 1 or type 2 diabetes versus Gestational Diabetes Mellitus (GDM) as well as the adequacy of maternal blood glucose control. A recent systematic review showed that pregnancies complicated by type 2 diabetes mellitus (T2DM) are associated with worse perinatal mortality and neonatal mortality than those complicated by type 1 diabetes mellitus (T1DM).⁽⁶⁾

In a retrospective cohort study done on Omani women, women with pregestational diabetes mellitus had a significantly higher incidence of pre-eclampsia ($p=0.022$), preterm deliveries ($p<0.0001$) and cesarean section ($p<0.001$). Neonatal complications such as RDS, neonatal hypoglycemia, neonatal jaundice and subsequent admission to NICU were significantly higher for neonates born to mothers with pregestational diabetes mellitus compared to those born to

mothers with gestational diabetes mellitus ($p < 0.001$).⁽⁷⁾ Also in a prospective cohort study done at Cairo university tertiary referral center it concluded that fetal outcome in women with GDM seems to be better than women known to be diabetic despite insulin control.⁽⁸⁾

In a large population based study done in Sweden to perform comparative analyses of obstetric and perinatal outcomes between type 1 diabetic pregnancies and the general obstetric population in Sweden between 1991 and 2003. In type 1 diabetes, preeclampsia was significantly more frequent (OR 4.47 [3.77–5.31]) as was delivery by cesarean section (5.31 [4.97–5.69]) compared with results for the general population. Stillbirth (3.34 [2.46–4.55]), perinatal mortality (3.29 [2.50–4.33]), and major malformations (2.50 [2.13–2.94]) were more common in type 1 diabetic than in control pregnancies. The risk of very preterm birth (≤ 32 gestational weeks) was also higher among type 1 diabetic women (3.08 [2.45–3.87]). The incidence of fetal macrosomia (birth weight ≥ 2 SD above the mean) was increased in the diabetic group.⁽⁹⁾

In a retrospective cohort study for women who delivered in King Khalid University Hospital during the period of January 1st to the 31st of December 2008. The pregnancy outcomes of the women with PDM were compared to the outcomes of all non-diabetic women who delivered during the same study period. The conclusion was pre-existing diabetes mellitus is associated with increased risk for C/S delivery, macrosomia, stillbirth, preterm delivery and low APGAR scores at 5 min.⁽¹⁰⁾

A population based study done in England, Wales on 2359 pregnancies to women with type 1 or type 2 diabetes who delivered between 1 March 2002 and 28 February 2003. The perinatal mortality and prevalence of congenital anomalies are high in the babies of women with type 1 or type 2 diabetes. The rates do not seem to differ between the two types of diabetes.⁽¹¹⁾

In a prospective evaluation of pregnancy outcomes in pregestational diabetes along the Atlantic seaboard 2006–2007. There were 104 singleton pregnancies. The stillbirth rate (25/1,000) was 5 times, perinatal mortality rate (25/1,000) 3.5 times, and congenital malformation rate (24/1,000) 2 times that of the background population. A total of 28% of women received prepregnancy care, 43% received prepregnancy folic acid, and 51% achieved an A1C $\leq$ 7% at first antenatal visit.⁽¹²⁾

A 1989 landmark study of 303 insulin-requiring pregnant diabetic women addressed the relationship of first-trimester Hemoglobin A1c (A1c) and spontaneous abortion or major malformations of fetus/infants that progressed beyond the first trimester. In an analysis of 127 Spanish women with pregestational diabetes, poor glycemic control, defined by glycohemoglobin A1C concentrations > 7 percent was associated with a threefold increase in the spontaneous abortion rate (Galindo, 2006).

Yang and associates (2006) chronicled the effects of overt diabetes on pregnancy outcomes in Nova Scotia from 1998 through 2002. They compared outcomes in 516 overtly diabetic women with those of 150,589 pregnancies in nondiabetic women.⁽¹³⁾

Table1:- Pregnancy Outcomes of Births in Nova Scotia from 1988 to 2002 in Women with and Without Pregestational Diabetes ⁽¹³⁾

Factor	Diabetic (n = 516) Percent	Nondiabetic (n = 150,589) Percent	p value
Gestational hypertension	28	9	$< .001$
Preterm birth	28	5	$< .001$
Macrosomia	45	13	$< .001$
Fetal-growth restriction	5	10	$< .001$
Stillbirths	1.0	0.4	.06
Perinatal deaths	1.7	0.6	.004

Pregestational diabetes mellitus is associated with increased risk for C/S delivery, macrosomia, stillbirth, preterm delivery and low APGAR scores at 5 min. ⁽¹⁰⁾

Pre-pregnancy care for women with pre-gestational type 1 or type 2 diabetes mellitus is effective in improving rates of congenital malformations, perinatal mortality and in reducing maternal HbA1C in the first trimester of pregnancy. Pre-pregnancy care might cause maternal hypoglycemia in the first trimester of pregnancy.⁽¹⁴⁾

To have prepregnancy care these women should have a planned pregnancy and their pregnancy outcome will be improved. In retrospective analysis patients with pregestational diabetes mellitus who planned their pregnancies achieves significantly better obstetric results compared with unplanned pregnancy group. Pregnancy planning should become a standard of obstetric and diabetic care in this group of patients.⁽¹⁵⁾

In a case-control study involving 400 women with DM who delivered between 2005 to 2009 at Malaysia, total of 305 women (76.25%) were gestational diabetes mellitus (GDM) on diet control, 79 (19.75%) were GDM on insulin and 16 (4%) were pre-existing DM. The mean body mass index of the women with diabetes was higher compared to the age-matched healthy women ($p < 0.001$). Approximately one-third of diabetic woman had no antecedent risk factor. About half of the women with diabetes ($n=205$, 51.3%) had unplanned pregnancy. Women with DM had greater risk of having spontaneous miscarriage and caesarean section (OR 1.4, 95% CI (1.2-1.7), OR 1.3, 95% CI (1.1- 1.5) respectively). Women with diabetes on insulin had higher risk of preterm delivery and caesarean delivery as compared to those with diet control, (OR 1.7, 95% CI (1.2- 2.5), OR 2.5, 95% CI (1.6-4.1) respectively). The incidence of macrosomia, low Apgar score, need for NICU admission, hypoglycaemia and respiratory distress syndrome (RDS)

were higher among women with diabetes as compared to healthy control, and especially in those on insulin. Women with higher HbA1c had significantly increased need for caesarean section and NICU admission with higher incidence of macrosomia and RDS. The overall outcome of women with diabetes especially with higher level HbA1c remained poor as compared to a normal pregnancy. ⁽¹⁶⁾

According to WHO in 2004 at least 171 million people worldwide had diabetes; this figure is likely to be more than double by 2030. WHO predicts 170% increase in the number of people with diabetes for the developing countries? In Africa, the prevalence of DM is increasing and the magnitude of the disease is progressing. ⁽¹⁷⁾

In a retrospective study done in Nigeria from 2008 upto 2012 at a tertiary university Port Harcourt teaching hospital the prevalence of pregestational diabetes was 1.45 per 1000 and that of gestational diabetes 6.96 per 1000. ⁽¹⁸⁾

In Ethiopia, according to WHO estimation, the number of diabetics cases in the year 2000 was 800,000 and this number is expected to increase to 1.8 million by the year 2030. ⁽¹⁷⁾

According to International Diabetes Federation, IDF 2012 report, the prevalence of DM in Ethiopia stands at 3.32 %. However, DM prevalence of as high as 8% has been reported in 2013 on HIV/AIDS patients taking HAART, in Ethiopia. Major DM related complications include: hypertension, neuropathy, and DM foot disease. The prevalence of these diseases has risen from 12.1%, 27.7%, and 1.7% in 1976-1997, to 34.1%, 29.5%, and 4.6 % respectively in 2005 to 2009. ⁽¹⁹⁾

Objectives

General Objective

To assess the prevalence of pregestational diabetes mellitus and its pregnancy outcome in relation to the glycemic control at three teaching hospitals in Addis Ababa, Ethiopia from 1 January 2016 – 30 December 2016.

Specific Objectives

1. To determine the prevalence of pregestational diabetes at three teaching hospitals in Addis Ababa from 1 January 2016 – 30 December 2016
2. To assess the glycemic control (FBS, 2-hour postprandial, HgA1C) of pregnant patients with pregestational diabetes mellitus at the three teaching hospitals in Addis Ababa.
3. To determine the maternal outcome of presentational diabetes mellitus
4. To determine the fetal and neonatal outcome of presentational diabetes mellitus

Methods and Materials

Method of study:- A prospective follow up study done at three teaching hospitals in Addis Ababa using a structured questionnaires and through card review.

Study Area

SPHMMC was first called St. Paul General Specialized hospital and was referral hospital in Addis Ababa under the Ethiopia Federal Ministry of Health (FMOH). Since 2007, it has become a medical college which is currently named St Paul Hospital Millennium Medical College. The department of obstetrics and gynecology is one of the departments in the hospital giving services at different areas. The service delivery sites are outpatient department, gynecology ward, maternity and labor ward, and operation rooms. Currently it has monthly delivery of more than 800.

Tikur anbesa specialized hospital opened in 1972 largest referral hospital in the country with more than 700 beds. It gives both undergraduate and postgraduate program as a school of medicine and the monthly delivery is more than 400.

Yekatit 12 hospital was established in 1945 EC and it is under Addis Ababa health bureau and an affiliate hospital for SPHMMC in the department of obstetrics and gynecology. Its monthly delivery is more than 400.

Study Setting

This is a hospital based study and was undertaken at the three teaching hospitals which give residency program under Addis Ababa University and Saint Paul's hospital millennium medical college in Addis Ababa, the capital city of Ethiopia.

Study Period

- A one year study conducted at the three teaching hospitals in Addis Ababa Ethiopia from 1 January 2016 to 30 December 2016.

Source

All pregnant mothers who had follow up and delivered at the three teaching hospitals in the study period.

Study Populations

- All pregestational diabetic mothers who had ANC follow up or deliveries at SPHMMC, TAH and Yekatit 12 in the specified time period.

Inclusion and exclusion criteria

Inclusion Criteria

- Mothers who are known diabetic and pregnant who have follow up or deliver at the three hospitals in Addis Ababa.

Exclusion criteria

- Mothers who are diagnosed to have diabetes for the first time during pregnancy.

Data collection procedures - A structured questionnaire was used to interview study participants. For administering the structured questionnaire, head nurses who were working at ANC clinics at the three hospitals filled the initial demographic data, attach the second part of the questionnaire on the clients' card and give a code and report to the principal investigator. The remaining data was filled by the person who attends the delivery. Chart collection and review at each hospital was made by the principal investigator so that information's about the study population will be complete.

Dependent variables

- Adverse pregnancy outcome

Independent variables

- Maternal age
- Type of diabetes mellitus
- Duration of diabetes
- Treatment of diabetes before pregnancy
- Preconceptional care
- Maternal blood glucose level
- Gestational age
- Birth weight
- Mode of delivery

Data Analysis: - Data entered to SPSS version 16 and analysis. Results are presented as percentages and comparison of the results was performed by the chi-squared test. All tests are two-sided and the level of significance will be set at $P < 0.05$. Bivariate analysis was done to see relationship b/n dependent and independent variables. Multivariate analysis was done to control the confounding variables and variables which had a p value of ≤ 0.2 in bivariate analysis were included.

Ethical consideration: - Confidentiality is kept throughout the study by using code numbers for each chart retrieved to avoid using names of patients from charts and charts were returned back to the record office after the necessary information was filled. Ethical clearance obtained from the institutional review board of SPHMMC. Permission obtained from the Saint Paul hospital's medical service vice provost office.

Dissemination of results:- The results of the research would be presented to relevant staffs and other members of the medical college and the hospital at the staff and student research workshop. Findings will also be presented on different conferences and professional society meetings such as the Ethiopian Society of Obstetricians and Gynecologists, Ethiopian public health association and Ethiopian Medical association annual conferences. The findings will also be published in a relevant scientific journal and disseminated online. The data will also be used as a base line for future similar studies and interventions.

Operational Definitions

Pregestational Diabetes mellitus:- Patients who were diagnosed at least 6 months prior to the current pregnancy.

Macrosomia: - Birth weight of 4000 grams or greater was taken to classify macrosomic babies.

Adverse pregnancy outcome definitions

The World Health Organization (WHO) defines a birth weight of <2,500 g as low birth weight and a delivery before 37 completed weeks of gestation as preterm birth. The WHO guidelines define APO as an event of low birth weight, preterm birth, stillbirth, or abortion. APO is a complex, multifactorial, physiological outcome in women, and despite decades of research, a clear causal mechanism for APOs has not been established. So in our study APOs means the above definition on WHO guideline plus maternal complications like hypertensive disorders of pregnancy. Presence of any of the following, low birth weight, preterm birth, stillbirth, or abortion, congenital anomaly, neonatal and maternal complications like hypertensive disorders of pregnancy was taken as an adverse pregnancy outcome.

Results of the Study

1. Sociodemographic characteristics of pregnant mothers with pregestational diabetes (Table II)

Over the study period (1 January 2016- 30 December 2016) there were a total of 19,797 deliveries at the three teaching hospitals and 80 were women with pregestational diabetes mellitus making prevalence of 0.4%.

In this study a total of 80 women with pregestational diabetes mellitus who fulfill inclusion criteria were analyzed. About one fourth of them (31.2%) had follow up and deliver at SPHMMC, 38 (47.5%) at Tikur anbessa hospital and the remaining 17(21.2%) at yekatit 12 hospital. Majority 71(88.8%) are from urban area, married 78(97.5%) and 89(98.8%) are educated.

When we see the age distribution of the women 62(77.5%) are between the age group of 20-35 years, 3(3.8%) were in age group of <20 years and 15(18.8%) are above age 35 years.

Thirty seven (46.2%) of them are housewife 36(45%) employed either self or government and the rest are unemployed. 63.8% of the study population were Orthodox by religion, 23.8% Muslim and the rest protestant.

2. Reproductive Performance

About 57(71.2%) have parity of one to four, 19(23.8%) are pregnant for the first time and the rest were grandmultipara (5%).

The percentage of type one and two diabetes is almost equivalent (39[48.8%] are type 1 and 41{51.2%} type 2) with duration of illness being less than 10 years in 67(83.8%). Fifty five (68.8%) of them are on insulin, 20(25%) on oral hypoglycemic agents and 6(6.2%) on dietary

management before the current pregnancy. In 46(57.5%) of the cases the current pregnancy is unplanned, half of them had preconceptional care.

Forty-one (51.2%) of the study populations had glucometer at home for monitoring of their blood glucose level.

Forty – two (52.5%) of the women were not on any form of contraceptive.

Table II- Sociodemographic characteristics of pregnant mothers with pregestational diabetes who had followed and delivery at three teaching hospitals in Addis Ababa from 1 January 2016 – 30 December 2016

Baseline characteristics	Frequency	Percent
Name of hospital		
St.Paul	25	31.2
Tikur anbesa	38	47.5
Yekatit 12	17	21.2
AGE (Years)		
<20	3	3.8
20-35	62	77.5
>35	15	18.8
Residency		
Urban	71	88.8
Rural	9	11.2
Marital status		
Married	78	97.6
Single	1	1.2
Divorced	1	1.2
Religion		
Orthodox	51	63.8
Muslim	19	23.8
Protestant	10	12.4
Occupation		
House wife	37	46.2
Employed	36	45
Unemployed	7	8.8

Educational Status		
Uneducated	1	1.2
Primary school	24	30
Secondary school	42	52.6
University	13	16.2
Reproductive performance		
Primigravida	19	23.8
1-4	57	71.2
Grandmultipara	4	5
Type of pregestational diabetes		
Type 1	39	48.8
Type 2	41	51.2
Duration of diabetes(In years)		
<10	67	83.8
10-20	12	15
>20	1	1.2
Type of therapy		
Insulin	55	68.8
Oral hypoglycemic agent	20	25
Dietary	5	6.2
Use of contraceptive		
Yes	38	47.5
No	42	52.5
Current Pregnancy		
Planned	46	57.5
Unplanned	34	42.5
Preconceptional Care		
Yes	40	50
No	40	50
Presence of glucometer at home		
Yes	39	48.8
No	41	51.2

3. Glycemic control during pregnancy (Table-III)

In this study 54(67.5%) of the mothers didn't have determination of HgA1C at least once during their pregnancy. HgA1C was determined for only 11 women in the first trimester (only 13.75%) and the mean HgA1C value was 8.6%. The mean FBS and 2 hour postprandial RBS in the first trimester of pregnancy was 98.3 and 154.9 respectively. HgA1C was determined for only 6 women in the second trimester (only 7.5%) with a mean value of 9.03%. The mean FBS

and 2 hour postprandial RBS in the second trimester of pregnancy was 100 and 144.3 respectively. HgA1C was determined for only 13 women in the third trimester (only 16.3%) and the mean is 7.2%. The mean FBS and 2 hour postprandial RBS in the third trimester of pregnancy was 98 and 142 respectively.

Table III:- The Average maternal Glycemic control of pregnant mothers with pregestational diabetes who had follow and delivery at three teaching hospitals in Addis Ababa from 1 January 2016 – 30 December 2016

Trimesters	FBS	2-Hour postprandial	Glycosylated hemoglobin
First	98.3	154.9	8.6%
Second	100	144.3	9.03%
Third	98	142	7.2%

4. Maternal, Fetal and Neonatal Complications (Table-IV)

Out of the 80 women 55(68.8%) didn't have any maternal complication. Ten women (12.5%) has preeclampsia, 11.2% chronic hypertension out of which two experience superimposed preeclampsia. Four (5%) women had gestational hypertension. Totally hypertensive disorder of pregnancy is the commonest maternal complication seen in our study. Two women have diabetic ketoacidosis (2.5%) and one end up with spontaneous abortion and the other with preterm labor. There were two women with diabetic nephropathy and one has intrauterine growth restriction and one woman with non proliferative diabetic retinopathy.

Out of the 80 deliveries 10 (12.5%) had fetal complications 3 stillborn (3.75%), 3 (3.75%) congenital anomaly and 4 (5%) spontaneous abortion.

Majority of pregnancy 67.1% were induced for fetal and maternal indications and 61.8% was Cesarean section. From the total c-section 38.3% were elective and 61.7% emergency. There were 6 instrumental deliveries (7.9%) and one birth injury elbow dislocation after forceps

delivery. Nearly one-third of them were preterm (30.3%) and majority in the normal birth weight range (73.7%), with 7(9.2%) of babies were macrosomic and low birth weight babies account for 17.1%.

More than half of neonates (53.4%) were referred to neonatal intensive care unit because of prematurity. Hypoglycemia, Jaundice, RDS and birth injury were seen in 6.8%, 4.1%, 10.9% and 1.4% respectively.

Table IV: - Maternal , Fetal and Neonatal Complications of mothers who had pregestational diabetes mellitus and had follow up and deliver at three teaching hospitals in Addis Ababa, January 1- December 30 2016

Outcome measures	Frequency	Percent
Maternal Comorbidities		
No comorbidity	55	68.8
Preeclampsia	10	12.5
Chronic Hypertension	9	11.2
Gestational hypertension	4	5
Diabetic ketoacidosis	2	2.5
Fetal complications		
Abortion	4	5
Congenital anomaly	3	3.75
Stillborn	3	3.75
No complication	70	87.5
Onset of labor		
Spontaneous	25	32.9
Induced	51	67.1
Mode of delivery		
SVD	23	30.3
Cesarean section	47	61.8
Instrumental	6	7.9
Gestational age at time of birth		
<37	23	30.3
≥37	53	69.7
Birth-weight		
<2500	13	17.1
2500-3999	56	73.7
≥4000	7	9.2

Table V: - Neonatal complications of pregnant mothers with pregestational diabetes who had follow up and delivery at three teaching hospitals in Addis Ababa from 1 January 2016 – 30 December 2016

Complications	Yes	No
Referral of neonate to NICU	39 (53.4%)	34 (46.6%)
Jaundice	3(4.1%)	70(95.9)
Hypoglycemia	5 (6.8%)	68 (93.2%)
Respiratory distress syndrome	8 (10.9%)	65 (89.1%)
Macrosomia	7 (9.2%)	69 (90.8%)
Birth Injury	1 (1.4%)	72 (98.6%)

Table VI: - Multivariate analysis of adverse pregnancy outcome in mothers with pregestational diabetes who had follow up and delivery at three teaching hospitals in Addis Ababa from 1 January 2016 – 30 December 2016

Baseline Characteristics	Adverse pregnancy outcome		COR	AOR	95% confidence interval	P-Value
	Yes	No				
Hospital						
SPHMMC and Yekatit 12	23	19	0.432	-	-	0.082
TAH	28	10	-		-	-
Type of PGDM						
Type 1	23	16	1.498	-		0.387
Type 2	28	13	-		-	-
Duration of PGDM						
≤10 Years	41	26	0.473	-	-	0.288
>10 years	10	3	-		-	-
Treatment before conception						
Insulin	32	23	0.439	-	-	0.129
OHG and dietary	19	6	-		-	-
Preconceptional care						
Yes	21	19	0.24	0.033	0.065,0.892	0.033
No	30	10	-		-	-
Presence of Glucometer						
Yes	28	11	3.76	-	-	0.069
no	23	18	-		-	-
3 rd trimester 2-hour postprandial						
≤120	10	4	1.488	-	-	0.616
>120	31	25	-		-	-
Maternal Age						
≤35 years	38	27	0.217	-	-	0.056
>35 years	13	2	-		-	-

Discussion:-

Pregestational diabetes mellitus is an important area of management of diabetes mellitus. It is now accepted that the best form of care in these pregnancies can be provided through specialised multidisciplinary clinics.⁽²⁰⁾

The prevalence of pregestational diabetes mellitus in this study was 0.4% which is closer to other data that preexisting diabetes complicates pregnancies at a rate of ~1-3 per 1,000 births. Prevalence of type 1 and 2 DM were reported as ranging from 0.20 to 0.70% in a systemic review entitled burden of diabetes mellitus during pregnancy in low- and middle-income countries ⁽²¹⁾. In study done at district hospital in Australia prevalence of PGDM was 0.63%.⁽¹²⁾ The prevalence of pregestational diabetes increased from 3.1 per 1000 births in 1996–98 to 4.7 per 1000 in 2002–04 ⁽²²⁾ driven mainly by a sharp increase in type II diabetes.

The mean age of the women was 30.6 years which is comparable to other studies 31.5 years, 28.5yrs+/- 2.2yrs. ^(10, 23) These shows that type 2 diabetes mellitus is being diagnosed in young age because of a change in life style and obesity. The mean age of mothers in our study is higher in type 2 mothers 32.7 years but for those of type 1 it was 27.4, in both cases it is lower than other studies. In the study by Hayfaa A Wahabi et al 35.3 ± 5 and 34.4 ± 6 , ⁽¹⁰⁾ A.A Sobande et al the mean age was 36.0 ± 3.2 and 30.5 ± 7 ⁽²⁴⁾ for type 2 and 1 respectively. Among patients with age ≥ 35 years 4(20%) are mothers with type 1DM and the rest 16 (80%) are women with type 2 DM.

Forty – two (52.5%) of the women were not on any form of contraceptive. This means it is difficult to institute preconceptional care like supplementation of folic acid, achieving glycemic control and assess end organ damage before conception unless we improve use of contraceptive among these clients.

The Confidential Enquiry in Maternal and Child Health reported that only 34% of women with diabetes had preconception counseling ⁽²⁵⁾, 28% in Atlantic seaboard 2006–2007 study ⁽¹²⁾ and in our study 50% of the clients had preconceptional care that may be explained because most of them are from urban area and has access to health care. The importance of having preconceptional care should be emphasized since it showed significant association with adverse outcome [OR(0.033), 95% CI(0.065,0.892), p=0.033].

In our study the glycemic control of the clients was poor in each trimester especially the 2-hour postprandial is >130 and it should be ≤120. The average HgA1C in our study at each trimester is higher than the target >7. Though we didn't show significant association between glycemic control and adverse pregnancy outcome due to small sample of study population, all hospital should have standard protocol to achieve good glycemic control. In the antepartum period one of the indicators of poor glycemic control is polyhydraminous and it was in 2.5% of the cases lower than other studies 11.3 %.⁽²⁴⁾

In this study adverse pregnancy outcomes are more commonly seen in type 2 diabetic mellitus than type 1, though not significant [OR (1.498), 95% CI (0.599, 3.746), P=0.387] like the study done in King Khalid University Hospital.⁽¹⁰⁾ The rate of spontaneous abortion is 5% which is closer to the study done in Sweden in which they used 532 pregnancies complicated by pregestational IDDM, SAB rate in these pregnancies was 7.7%.⁽²⁶⁾

Among all patients with pregestational diabetes, the risk of congenital anomalies is reported at 6% to 7%. There is a dose-response curve to these risks, with the highest risk observed among women who are poorly controlled in the periconceptional period and throughout pregnancy. Atlantic seaboard 2006–2007 study congenital anomaly was 2.4% ⁽¹²⁾ and in our study it is 3.75%. The stillbirth rate in women with PGDM from Australia is 2.8%, ⁽²⁰⁾ 2.5% in

Atlantic seaboard study ⁽¹²⁾ 3.4% in King Khalid University Hospital by Hayfaa A Wahab et al ⁽¹⁰⁾ and in our case 3.75%. The higher incidence of congenital anomaly and stillbirth rate in our study may be as a result of poor glycemic control.

The prevalence of cesarean deliveries has consistently been reported to be higher in pregestational diabetic pregnancies than in nondiabetic pregnancies in patients at specialized medical centers. Cesarean rates have been in the range of 24%-66% in diabetic patients, rates that were three to five times the rates in nondiabetic women. ^(27,123) Also in a prospective evaluation of pregnancy outcomes in pregestational diabetes along the Atlantic seaboard 2006–2007 the caesarean section rates were greater (43%) ⁽¹²⁾, in Omani study 60.3%, ⁽⁷⁾ in our study it is 61.8% which is high. Sixty-one percent of pregnancies were delivered by caesarean section on trends in prevalence and outcomes of pregnancy in women with pre-existing type I and type II diabetes. ⁽²²⁾ Also emergency c-section in our study is higher (61.7%) than other reports (25%). ⁽¹²⁾

According to Confidential Enquiry into Maternal and Child Health (CEMACH), 67% of women with DM had a higher incidence of caesarean section, which was mainly iatrogenic as a result of early induction of labour ⁽²⁵⁾. Induction of labour was done in 14 (60.8%) at district hospital in Australia ⁽²⁰⁾ which is closer to our result which is 67.1%.

Recent population-based data from Sweden revealed a 25% rate of preterm delivery (<37 weeks gestation) in women with IDDM, in Omani study also 25.9%, ⁽⁷⁾ 30.0% in our study slightly higher in type 1 diabetes mellitus. The higher percentage of preterm delivery in our study may be accounted to the poor glycemic control and iatrogenic intervention for fetal or maternal indications.

Eleven percent of the infants delivered to the diabetic mothers were macrosomic in King Khalid University Hospital Hayfaa A Wahabi et al, ⁽¹⁰⁾ 7.9% in Indian study, ⁽²⁸⁾ in Omani study also 10.3%, ⁽⁷⁾ but in our case it is 9.2%. Women with type 2 DM had a slightly higher frequency of large babies compared to type 1. There were two cases of intrauterine growth restriction one from each type of DM and the duration of DM is between 10-20 years.

The NICU referral were 48% in the Atlantic seaboard study ⁽¹²⁾, 56% in a study done at a district general hospital in Australia ⁽²⁰⁾, at a retrospective study in Nigeria it is 49% ⁽¹⁸⁾ comparable to our study (53.4%). In the above Australian study neonates were admitted to NICU mostly for hypoglycemia (7), jaundice (4), sepsis (4) and respiratory problems (4) ⁽²⁰⁾ and hypoglycemia (32%), polycythemia (14%), jaundice (5%), and respiratory distress (5%) in Atlantic study ⁽¹²⁾. In our study 6.8% for hypoglycemia, 4.1% for jaundice, 10.9% for RDS and one neonate admitted for birth injury with elbow dislocation after forceps delivery.

Pregnancy-induced hypertension/ preeclampsia was three times more common in women with PGDM (14%), ⁽¹²⁾ (11%) in Indian study,⁽²⁸⁾ 10.8% in study at tertiary hospital in Saudi Arabia,⁽²⁴⁾ in Omani cohort study 17.2% ⁽⁷⁾ which are comparable to our study (12.5%). As it seen in other studies type 1 diabetes is more often associated with preeclampsia and type 2 diabetes with chronic hypertension 60% and 66.7% respectively.

Incidence of diabetic ketoacidosis is low 1% to 2% mostly in type 1 DM. Though rate of maternal mortality secondary to DKA is not well known, but fetal mortality has been reported to be as high as 10%. In our study DKA diagnosed in 2 (2.5%) both were women with Type 1 DM pregnancy complicated with abortion and preterm labor.

Strength

The strength of our paper is that it is a prospective follow up study and selection of those hospitals where most of the clients had follow up and managed in these hospitals in the country.

One of the hospitals, Tikur Anbessa hospital is the national diabetic center in the country.

Being conducted in multicenter where there is multidisciplinary approach in the management of these clients and delivery of standard care.

Limitation

1. It would have been better if done as a comparative study with outcomes of non-diabetics to see significances of association.
2. Nature of the design and lack of data on important factors which could have influenced the outcome such as glycemic control, maternal body mass index.
3. This audit was the first of its kind in this particular health facility and, hence, no comparison could be made with local data.

Conclusion

The Prevalence of pregestational diabetes mellitus was found to be 0.4%. There is significant association between preconceptional care and adverse pregnancy outcome. The glycemic control was poor in each trimester with higher fasting, 2-hour post prandial and HgA1C level from the standard. Hypertensive disorders of pregnancy were commonest maternal complication 28.7% seen in our study and cesarean section is high accounting 61.8%. Premature delivery and high rate of neonatal intensive care referral.

Recommendations

Prospective cohort study should be conducted to see associations with other determinants like glycemic control. These hospitals should have management protocol advocating preconceptional care. There should be a standard format for follow up of glycemic control in patients with pregestational diabetes mellitus.

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Annex I:- Questionnaire Format

Part I:- Demographic characteristics

1. Name Of Hospital _____MRN_____ Code____EDD-----
2. Age_____
3. Place of residency
 - A. Rural
 - B. Urban
4. Marital status
 - A. Single
 - B. Married
 - C. Divorced
 - D. Separated
 - E. Widowed
5. Occupation_____
 - A. Employed
 - B. Unemployed
 - C. Housewife
 - D. Student
6. Religion _____
 - A. Orthodox
 - B. Muslim
 - C. Protestant
 - D. Catholic
 - E. Others
7. Highest Educational level attained
 - A. Uneducated
 - B. Primary school
 - C. Secondary school
 - D. University degree

Part II:- Reproductive Status

1. Parity
 - A. Primigravida
 - B. 1 to 4
 - C. Grandmultipara
2. Type of diabetes
 - A. Type I
 - B. TYPE II
3. Duration of diabetes in years
 - A. ≤ 10
 - B. 10-19
 - C. ≥ 20
4. Treatment of diabetes
 - A. Insulin
 - B. OHG
 - C. Dietary
5. Use of contraceptive
 - A. Yes
 - B. No
6. Was the pregnancy planned?
 - Yes
 - No
7. Does the client have pre-conceptional care?
 - Yes
 - No
8. Did the client have glucometry at home?
 - Yes
 - No

9. Maternal Glycemic control during pregnancy (Average)

Blood Glucose	First TMP	Second TMP	Third TMP
FBS			
2-hr Postprandial			
HgA1C			

10. Associated comorbidities A. Chronic Hypertension B. Pre-eclampsia

C. Others_____

11. Fetal complications A. Still birth B. Congenital anomaly

12. Gestational age at time of delivery

A. <37 wks B. 37- 38 Wks C. 38-40 Wks D. >40 Wks

13. Onset of labor

A. Spontaneous B. Induced

14. Mode of delivery

A. SVD B. Cesarean Section C. Instrumental

15. Birth weight (gm)

A. <2500 B. 2500- 3999 C. 4000- 4999 D. >5000

16. RBS of Neonate_____

17. Neonate send to NICU Yes_____ No_____

18. Neonatal complications (Tick all that apply)

A. Jaundice B. Hypoglycemia C. RDS

D. Macrosomia E. Birth injury F. Others_____

Annex II:- Consent Form

There is a research being conducted at three teaching hospitals in Addis Ababa on pregnancy outcome of clients who had pregestational diabetes. It is a one year study and all clients who are diabetic and got pregnant are candidates.

Whatever information you provide, will be kept strictly confidential and is to be used only for the purpose of the study. There is no harm predicted on participation of this study. But your participation is voluntary.

Do you have any questions?

Are you willing to participate?

Yes I agree

Signature of interviewee-----

አዲስ አበባ ውስጥ ባሉ ሦስት የማስተማሪያ ሆስፒታሎች የሚደረግ ሲሆን ዓላማውም የስኳር ታማሚ ሆነው ነፍሰጡር የሆኑ እናቶች የእርግዝናውን ውጤት ማየት ነው።

ጥናቱ ለአንድ ዓመት የሚደረግ ይሆናል።

የስኳር ህመምተኛ ሆነው ነፍሰጡር የሆኑ እናቶች በጥናቱ ተሳታፊ መሆን ይችላሉ።

በቃለ መጠይቁ ወቅት የሚሰጡ መረጃዎች ለጥናቱ ዓላማ ብቻ የሚውሉና ሚስጥራዊነቱ መላው በመላው የተጠበቀ ነው ።

ፊቃደኛ ከሆኑ እርስዎም በዚህ ጥናት ላይ ተሳታፊ መሆን ይችላሉ።

በዚህ ጥናት መሳተፍዎ በጽንሰ-ም ሆነ በርስዎ ላይ የሚያመጣው ተጽዕኖ የለም ።

ጥያቄ ካለዎት?

በጥናቱ ላይ ለመሳተፍ ፊቃደኛ ነዎት?

ስለ ትብብርዎ እናመሰግናለን

በቃለ መጠይቁ ተሰማምቻለሁ_____

Declaration

I, the undersigned declare that this thesis is my original work in partial fulfillment of the requirement for the postgraduate study in Ob-Gyn. I also declare that it has never been presented in this or any other university and that all resources and materials used in the thesis have been duly acknowledged.

Resident's Name: Dr Talema Aytenew

Signature:_____

Date of submission: Feb 17, 2017

This thesis has been submitted for examination with my approval as an advisor.

Advisor Name: Dr Delayehu Bekele

Signature:_____

Date of submission:- February 17, 2017