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Prevalence of Gestational Diabetes Mellitus among Pregnant Women at Zawia Region

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Abstract: Background: *GDM has emerged as a global public health concern. The global effect of gestational diabetes is growing and both mothers and infants are doubly burdened by the disease.* ***Objective:*** *The aim of the study was to assess the prevalence and outcomes of gestational diabetes mellitus and evaluate the impact of age, obesity, and other risk factor in prevalence of GDM in Libyan women from Zawia region.* ***Methods:*** *Cross sectional study was conducted from June, 2021 to September, 2021 at selected antenatal care clinics in Zawia city/Western Libya among a randomly selected sample of 100 eligible pregnant women. Data were collected using a pretested questioner. assess the prevalence of GDM done by using the one-step 75-g Oral glucose tolerance test (OGTT) protocol, with plasma glucose measurement taken when patient is fasting and at 1 and 2 hour after taking glucose dose and identify associated risk factors among pregnant women attending antenatal care clinics.* ***Results:*** *The prevalence of GDM among the study population was 19%. Factors that affect prevalence of GDM were age of pregnant woman and weight of patients.* ***Conclusions:*** *The prevalence of GDM among the study population is higher than some of previous reports and less than others. This implies that these women and their newborns might be exposed to increased risk of immediate and long term complications from GDM including future risk of GDM and Type II Diabetes Mellitus.*

Keywords: Gestational Diabetes Mellitus, Prevalence, Factors that affect prevalence of GDM, Oral glucose tolerance test.

1. Introduction

The term diabetes describes a group of metabolic disorders characterized and identified by the presence of hyperglycemia in the absence of treatment. The heterogeneous aetio-pathology includes defects in insulin secretion, insulin action, or both, and disturbances of carbohydrate, fat and protein metabolism. The long-term specific effects of diabetes include retinopathy, nephropathy and neuropathy, among
other complication. (1)
The three main types of diabetes are type 1 diabetes (T1D), type 2 diabetes mellitus (T2D), and gestational diabetes mellitus (GDM). **(2)** .
Gestational Diabetes Mellitus (GDM) is defined as any glucose intolerance with the onset or first recognition during pregnancy. This definition helps for diagnosis of unrecognized pre-existing Diabetes also. Hyperglycemia in pregnancy is associated with adverse maternal and prenatal outcome. It is important to screen, diagnose and treat Hyperglycemia in pregnancy to prevent an adverse outcome. There is no international consensus regarding timing of screening method and the optimal cut-off points for diagnosis and intervention of GDM **(3).** The prevalence of GDM is debatable, because it is variable worldwide, depending on the population, human race and the diagnostic criteria defined by each country. International Diabetes Federation estimates that 16% of the children born alive in 2013 all around the world had complications due to hyperglycemia during pregnancy. It is believed that this prevalence will increase because of the growth of risk factors, mainly obesity and lifestyle. Approximately 90% of the diabetes cases in pregnant women are considered GDM. The prevalence of GDM is higher in Asian, Latin-American and Indian women **(4).** Screening of GDM is important because it aims to identify women who are at high risks to develop the disease, in order to reduce or avoid risks to maternal and fetal health Screening for GDM is carried out by identifying the risk factors. The parameters that determine the greatest risk to disease are: previous GDM, family history of diabetes mellitus, overweight or obesity, increased maternal age. Given these factors, the woman is required to fasting blood glucose, which should be held in early pregnancy **(4).** There are both fetal and maternal complications associated with GDM. Fetal complications include macrosomia, neonatal hypoglycemia, perinatal mortality, congenital malformation, hyperbilirubinemia, polycythemia, hypocalcemia, and respiratory distress syndrome Macrosomia, defined as birth weight > 4,000 g, occurs in ~ 20–30% of infants whose mothers have GDM. Maternal factors associated with an increased incidence of macrosomia include hyperglycemia, high BMI, older age, and multiparity. This excess in fetal growth can lead to increased fetal morbidity at delivery, such as shoulder dystocia, and an increased rate of cesarean deliveries **(5).**

2. Objectives

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The aim of the study was to assess the prevalence and outcomes of gestational diabetes mellitus and evaluate the impact of age, obesity, and other risk factor in prevalence of GDM in Libyan women from Zawia region.

3. Material and methods:

3.1. Study groups:

This study was conducted on total number of 100 pregnant women, who visit the maternity and child clinics in their 24-28 weeks of gestation, in Zawia city (Zawia central lab, Diabetes and Endocrinology center, Dream clinic, Family clinic, and Asaria medical clinic) during the period of June to September 2022.

The objectives and procedures were verified to all subjects as they express their consent and willingness to contribute to this study. Laboratory measurement. Venous blood samples were collected after at least 8 h of fasting in the morning and later after 1 hour and 2 hours after 75g of glucose oral dose. Laboratory measurements included routine blood test,(HbA1c), OGTT (fasting blood glucose (FBG), 1 hr 2 hr after75g of glucose oral dose.)

HbA1c , FBS ,GTT was measured using an Cobas Integra 400 plus which made in Germany.

3.2. Questionnaire:

Information's were taken from each subject about, family history of diabetes and other diseases and number of pregnancy and previous diagnosis with gestational diabetes ,also contained general information: Name, Age, residence, and Clinical profile, treatment, inherited history, if they suffer from any disease.

Patients were interviewed at the Zawia central lab, Diabetes and Endocrinology center, Dream clinic, Family clinic, and Asaria medical clinic. All interviews were conducted face to face by the primary investigator who would explain the questions that participants may find difficult. All participants gave an informed consent prior to participation.

3.3. Equipment and Disposables:

The following list of equipment and consumables were used to perform different experiments and measurement.

1- Cobas Integra 400 plus: for measurement FBS, HBA1C ,GTT 1hr , GTT 2hr.
2- ICHROMA II -2016-made in Korea for measurement HBA1c.
3- Centrifuge LSC4810-2015.
4- Pipettes (5µl, 75µl, 100µl, 1000µl) and disposable tips.
5- Plain Blood tube.
6- Fluoride oxalate blood tube.
7- EDTA blood tube.
8- Disposable sterile syringe 5 ml.

3.4. Gestational diabetes diagnosis:

It was diagnosed using the One-step strategy by performing a 75-g Oral glucose tolerance test (OGTT) protocol, with plasma glucose measurement taken when patient is fasting and at 1 and 2 h, at 24–28 weeks of gestation.

Subsequently, the diagnosis of GDM was made when any of the following plasma glucose values were met or exceeded:

– Fasting: 92 mg/dL (5.1 mmol/L)
– 1 h: 180 mg/dL (10.0 mmol/L)
– 2 h: 153 mg/dL (8.5 mmol/L)

3.4.1. Preparing the patient for the test

- The patient advised be on normal or high carbohydrate intake for 3 days before the test.
- The patient has been notified to be fast for 10 hours and not exceeding 16 hours.
- The test was performed on the morning (hormonal diurnal).
- While the test is in progress, patients should refrain from exercise, eating, drinking (except tab water), and smoking.
- Blood sample collected in the morning after fasting and later after 1 hour and 2 hours after 75g of glucose oral dose.

3.5. Reagents for Glucose:

Reagents from COBAS INTEGRA \ Cobas closed systems (Germany) were used.

3.6. Reagents for HBA1c:

Reagents from COBAS INTEGRA \ Cobas closed systems (Germany) were used.

3.7 Blood Samples:

After approximately 8 hours fasting period, 5 ml of venous blood samples were withdrawn with dry sterile syringe for all subjects. The blood was divided into 2 tubes; 2 ml in fluoride oxalate tube for fasting blood glucose measurement, 1 ml in ETDA blood tube, for HBA1C. Immediately all blood samples were centrifuged at 2000 r.p.m for 10 minutes to obtained plasma. And later after 1 hour and 2 hours after 75g of glucose oral dose blood samples were collected.

The stability of glucose in specimens is affected by storage temperature, bacterial contamination, and glycolysis. Plasma or serum samples should be separated from the cells or clot within 30 minutes of being drawn. Specimens that cannot be separated from the cells within 30 minutes should be placed on ice or refrigerated.

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When blood is drawn and stands un-centrifuged at room temperature, the average decrease in serum glucose is ~ 7% in 1 hour. This decrease is the result of glycolysis. (Even NaF does not prevent glycolysis within the first few hours when left at room temperature.) The rate of in vitro glycolysis is higher in the presence of leukocytosis or in patients with increased hematocrits.

3.8. Laboratory measurements:

Blood Glucose and HBA1C were measured by automated methods using Cobas Integra 400 plus instrument.

3.11. Statistical Analysis:

Statistical analysis was performed using SPSS package version 25 (Statistical Package for the Social Sciences). The result was expressed as mean ± SD. Standard descriptive statistics, correlation coefficients, and significance tests were calculated. Differences between mean values were evaluated by Student's t-test. Also for Correlation of GDM with various risk factors and outcomes we used Pearson Correlation. A P-value of less than 0.05 was considered to represent a statistically significant difference between groups.

4. Results.

4.1. The Study Group.

The mean age and weight of study group was 29.6 ± 6.12, 34.1± 5.8, &30.47±6.304 year and 76.2± 10.4, 85.9± 9.79 & 78.07±10.947 kg for non diabetic, diabetic, and total, respectively (Table. 1& Figure.1).

Table 1. Age and Weight of study group (Non diabetic / Diabetic).

Variable	**AGE** (N=100) **Mean ± SD**	**WEIGHT** (N=100) **Mean ± SD**
Non Diabetic	29.6 ± 6.12	76.2± 10.4
Diabetic	34.1± 5.8	85.9± 9.79
Total	30.6± 6.30	78.07± 10.94

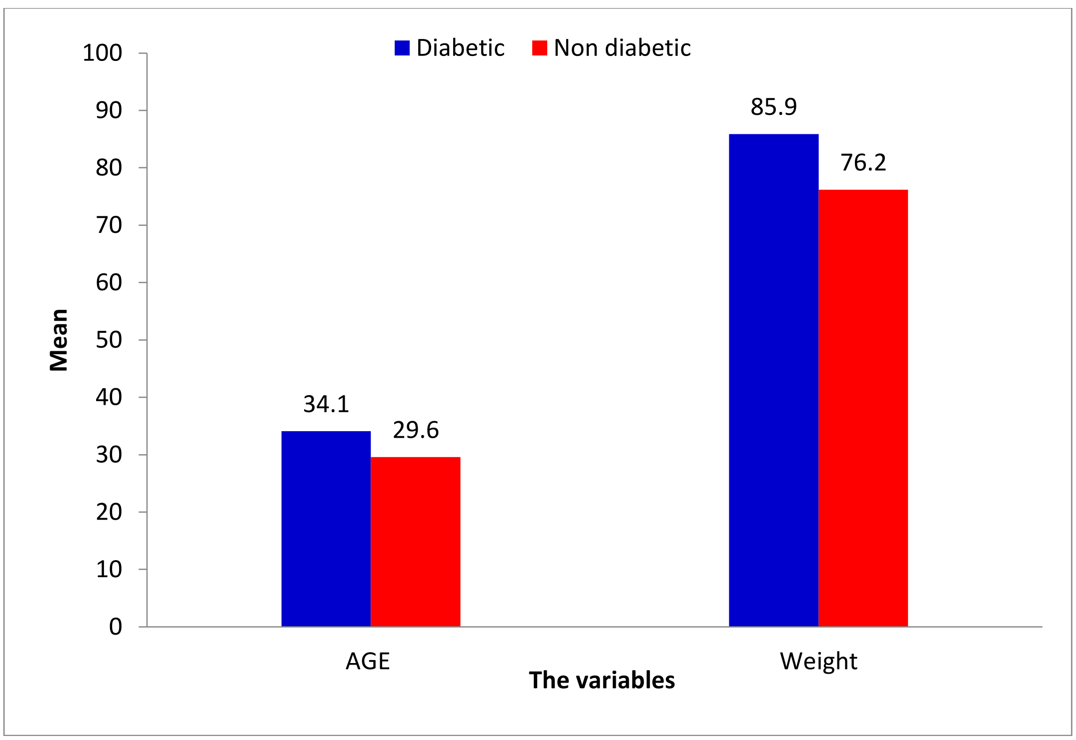

Figure.1. Age and Weight of study group.

4.2. Prevalence of Gestational Diabetes Mellitus

As shown in Figure.2, of the 100 patients eligible for this study,19 had gestational diabetes according to WHO criteria, which indicated a prevalence of 19% whereas 81 (81%) were non-GDM patients.

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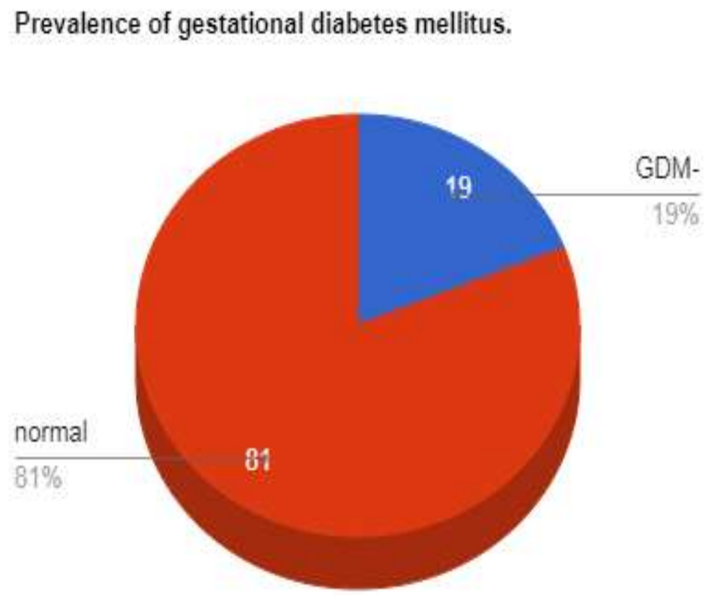

Figure 2. Prevalence of Gestational Diabetes Mellitus.

4.3. Risk Factors Associated With Gestational Diabetes Mellitus.

Table 2. shows some risk factors that associated with GDM such as previous history of gestational diabetes, Family history of DM type2, and Obesity (Figures 3-5).

Table.2. Risk Factors Associated With Gestational Diabetes Mellitus.

Variables		Non Diabetic	Diabetic(GDM)	Total
Family History of DM Type2	NO	33	8	41
	YES	48	11	59
Obesity	NO	64	11	75
	YES	17	8	25
GDM Before	NO	81	10	91
	YES	0	9	9

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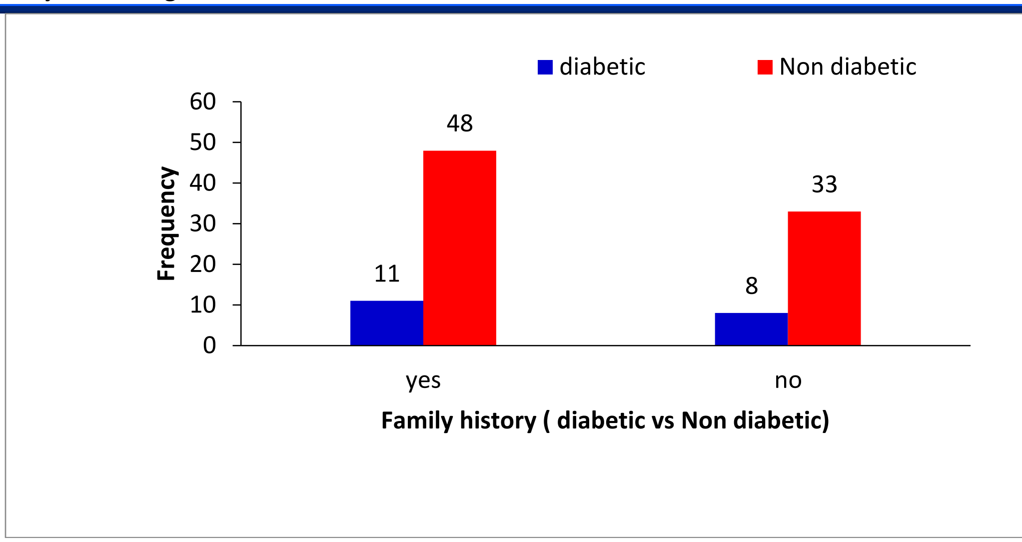

Figure.3 family history of DM in study group

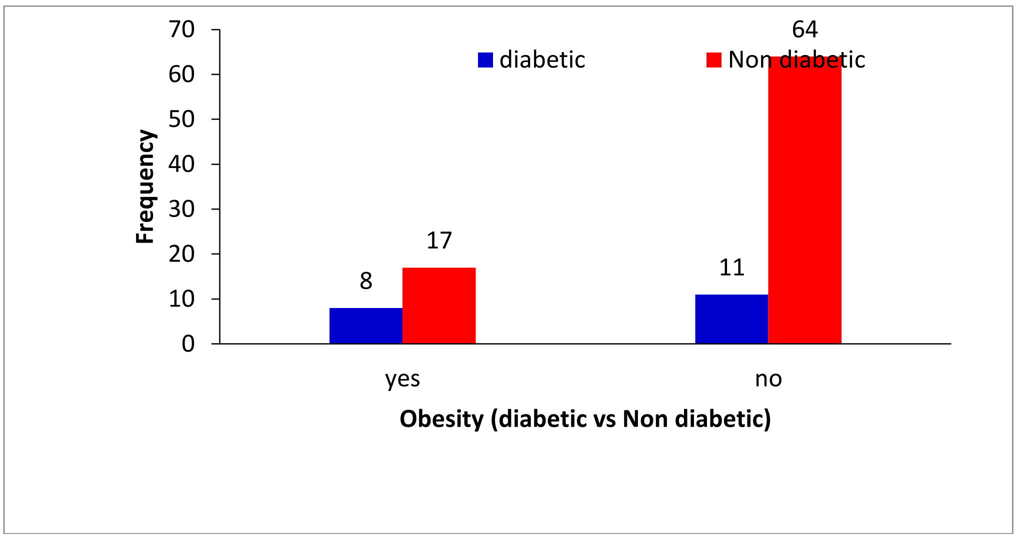

Figure.4 obesity in study group

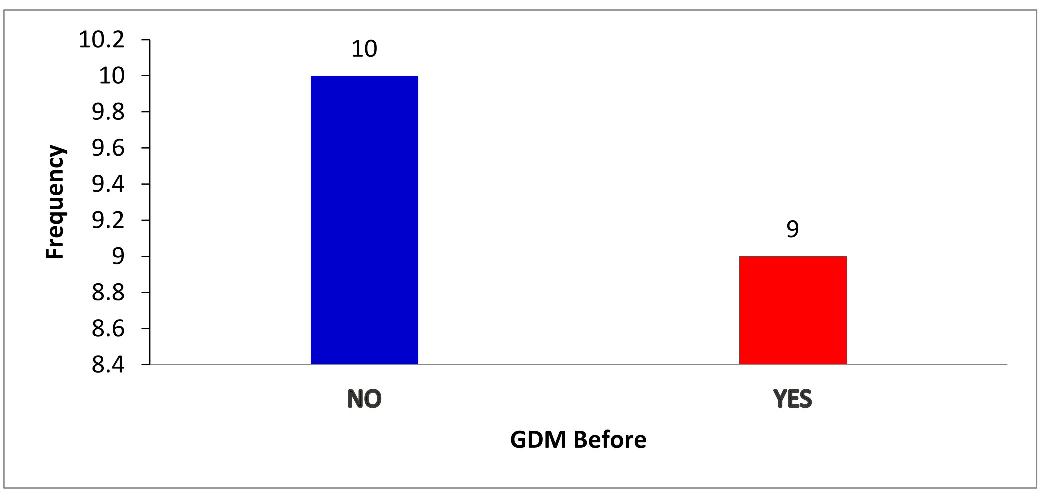

Figure.5 GDM history in study group

4.4. Outcomes of maternal and the newborns.

Table.3. shows some of outcomes of maternal newborns after delivery.

Table.3. Outcomes of maternal and the newborns

Variable		Non Diabetic		Diabetic(GDM)		Total
Develop DM type2	NO	81	100%	8	42%	89
	YES	0	0%	11	58%	11
Stillbirth	NO	79	97.5%	19	100%	98
	YES	2	2.5%	0	0%	2
Newborn have jaundice	NO	45	55.5%	7	36.8%	52
	YES	36	44.5%	12	63.2%	48

4.5. Variation of HbA1c , FBS ,GTT1h and GTT2h in GDM patients and non-diabetic women.

Table .4. & figure.6. showed a significant increasing in HbA1c , FBS ,GTT1h, and GTT2h levels in pregnant women with GDM compared to non-diabetic pregnant women (P=0.032, 0.000, 0.006, and 0.000), respectively.

Table.4. Comparison of mean HbA1c , FBS ,GTT1h and GTT2h in GDM patients and non-diabetic women.

Variables	HBA1C mean± st.d	FBS mean± st.d	GTT1h mean± st.d	GTT2h mean± st.d
Non Diabetic	**5.31 ± 0.463**	**83.91 ± 15.99**	**114.38 ± 25.9**	**96.9 ± 22.0**
Diabetic	**6.02 ± 0.53**	**136.7±31.2**	**206.68±43.3**	**186.7±58.87**
p-value	**0.032***	**0.000***	**0.006***	**0.000***

*: significant at 0.05

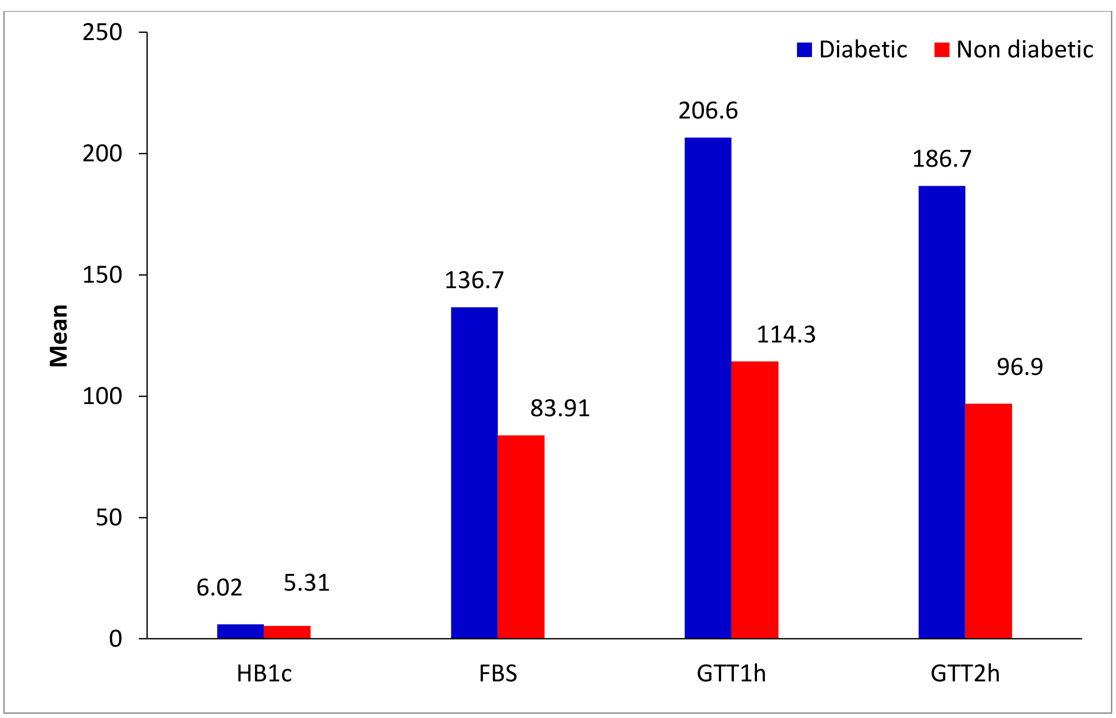

Fig .6. Comparison of mean HbA1c , FBS ,GTT1h and GTT2h in GDM patients and non-diabetic women.

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4.6. Correlation coefficient between GDM and some risk factors.

The study revealed significant correlation between GDM and family history of DM type2, age of woman, and weight of patient (P= 0.017, 0.042, 0.001) respectively (Table.5).

Table .5. Correlation coefficient between GDM and some risk factors.

Correlation	Family History of DM	Age	Weight	Number of Pregnancies	Other Disease
GDM	0.471	0.39	0.576	0.28	0.226
P-VALUE	0.017*	0.042*	0.001*	0.063	0.089

*: significant at 0.05

5. Discussion.

This study was performed in 100 pregnant women with gestational period between 24 and 28 weeks who were attending regular antenatal clinic(Zawia central lab, Diabetes and Endocrinology center, Dream clinic, Family clinic, and Asaria medical clinic) during the period of June to September 2022. The aim of this study was to assess the prevalence of gestational diabetes mellitus (GDM) in Libyan pregnant women in the Zawia Region and further to identify population-specific risk factors for GDM. A diagnostic 75 g oral glucose tolerance test (OGTT) was performed according to world health organization (WHO) criteria.

GDM, one of the most common medical complications during pregnancy, is defined as carbohydrate intolerance of variable degree with an onset or first recognition occurring during pregnancy and some factors are believed to increase the risk of developing it.(6,7) GDM has emerged as a global public health concern (8). It has been associated with short-term and long-term adverse health outcomes for both mothers and their newborns (9).

The main aim of this study was to determine the prevalence of GDM in the Zawia Region of Western Libya, as well as to establish GDM risk factors. 100 pregnant women between the gestation ages of 24 and 28 weeks were tested for gestational diabetes mellitus using the World Health Organization's (WHO) guidelines.

This study showed a significant increasing in HbA1c , FBS ,GTT1h and GTT2h levels in pregnant women with GDM compared to non-diabetic pregnant women. In women with GDM, there are several possible processes that conspire to cause severe insulin resistance in muscle, liver and adipose tissue, such as the presence of subclinical inflammation, the increase of placental hormones, reduced adiponectin secretion and excess lipolysis (10).

In the present study, the overall prevalence of gestational diabetes mellitus was 19%, previous study estimated that GDM affects around 7–10% of all pregnancies worldwide (11) while other study found that the pooled prevalence of 16 countries of Middle East and North Africa (MENA) region was 13% and a high prevalence observed in Iran and Saudia Arabia 36.3% and 21.6% respectively. (12)

The pooled prevalence of GDM in Africa was 13.61%, and 14.28% in the sub-Saharan African region. The prevalence was highest in Central Africa 20.4%, and lowest in Northern Africa 7.57% sub- regions (13). The overall prevalence of GDM in Yemen was 5.1%, Bangladesh was 35%,Ghana was 8.5%,Iran was 11.5%, New Zealand was 6.2%, Pakistan was 3.45%, German was 13.2%, and Ethiopia was 16.9%. (14-21) However the prevalence is difficult to estimate as rates differ between studies due to prevalence of different risk factors in the population, such as maternal age and BMI, prevalence of diabetes and ethnicity among women. This difference could be also because of the use of different diagnostic criteria and the lack of consensus regarding the use of diagnostic criteria for GDM which might have largely contributed to the heterogeneity of GDM prevalence.

Our study revealed significant correlation between GDM and family history of DM type2, age of pregnant woman, and weight of patient (P= 0.017, 0.042, 0.001) respectively which agree with Turkish study found that Gestational diabetes mellitus was positively associated with advanced maternal age ($p < 0.001$), pre-pregnancy body mass index ($p < 0.001$), cessation of cigarette smoking ($p < 0.001$), excessive weight gain during pregnancy ($p = 0.003$), previous history of GDM ($p < 0.001$).(22) As same as that in Indian study which found that, the prevalence of gestational diabetes increased with age, from 1.0% at age 15 to 19 years to 2.4% at age 35 years or older. The age-adjusted prevalence of gestational diabetes was higher among women with a body mass index of 27.5 or greater compared with women with a body mass index of less than 18.5.(23) The age of patients is found to be an important factor that determines the prevalence of GDM, this could be because, it is believed that as age increases the risk of developing chronic illnesses including diabetes increases(6). In addition, weight of pregnant woman is found to be an important factor that determines the prevalence of GDM. This is because, obesity is very known risk factor for other chronic illnesses including diabetes mellitus especially as part of the metabolic syndrome. Therefore, as weight of the pregnant women increases the risk of insulin resistance increases which in turn increases the risk of developing GDM. This is fueled by the global rise in the prevalence of obesity and unhealthy behaviors including poor diets and physical inactivity (24,25)

6. Conclusion

This study conclude that, the prevalence of GDM among pregnant women in Zawia city Western Libya was 19%. This finding is higher compared to many other countries. This implies that these women and their newborns are exposed to increased risk of immediate and long term complications from GDM including future risk of GDM and T2DM to the mother. Our study showed that major factors that affect prevalence of GDM were age of pregnant woman and weight and family history of type2 DM. Therefore, from the findings of this study. We recommend to give special attention for those pregnant women whose age is 30 years and above and whose BMI is above the normal range. Screening of GDM should be part of routine of maternity and neonatal clinics follow up for mothers. Health facilities can at least do FBS at the first maternity and neonatal clinics visit and 24–28 weeks of pregnancy. Professional societies and the Ministry of Health need to develop a protocol on screening of mothers for GDM. Authors recommend to conduct further study in large sample size and cover wide area including additional relevant risk and personal (behavioral) factors.

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