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Determinants of Gestational Diabetes Mellitus among Pregnant Women Attending Antenatal Care in Eastern Ethiopia Health Facilities, Ethiopia: A Case Control Study

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Abstract

Background and Objective: Gestational diabetes mellitus is neglected threat to mothers and their child. Even though gestational diabetes mellitus is one of the leading non-communicable diseases in Ethiopia, common determining factors that link to it are poorly understood, particularly in the study area. For this reason, identifying common risk factors that have a direct relationship to gaps in gestational diabetes care would be crucial to stop the issue before it arises. To identify factors associated with gestational diabetes mellitus among pregnant women attending antenatal care at public Health facilities in Dire Dawa town 2021.

Materials and Methods: This study was conducted from April 01/04/2021 - May 20/ 05/2021 at four Health Centers and one Hospital in Dire Dawa city. Unmatched case control study was conducted on pregnant women who started ANC follow up. Totally 576 pregnant women which are 144 cases and 432 controls needed for study. Data were entered in to Epi-Data version 3.1 computer software and exported to SPSS statistical software version 22 for analysis. The descriptive analysis was done using numerical summary measures and the data was presented using frequency tables, figures and graphs. All covariates that was significant at p value < 0.25 in bivariate analysis was considered for further multivariable analysis to detect true predictors. To measure the strength of association between variables with pregnant women with gestational diabetes mellitus or without gestational diabetes mellitus, crude and adjusted odd ratios with 95% confidence interval will be calculated. Finally, level of statistical significance was declared at p-value < 0.05.

Results: Maternal age (age > 34) AOR = 4.41; 95% CI: 2.33 - 8.34), family history of diabetes (AOR = 2.56; 95% CI: 1.31 - 4.99), low physical activity (AOR = 2.83; 95% CI: 1.47 - 5.45) and inadequate dietary diversity (AOR =0.35; 95% CI: 0.21 - 0.57) were significantly associated with GDM.

Conclusion and Recommendation(s): Advanced maternal age, family history of diabetes mellitus and occupational status of pregnant women were identified as a risk factors for the occurrence of GDM, while having high physical activity and adequate maternal dietary diversity were revealed to protective factors for GDM. promote blood glucose level testing and strengthen gestational diabetes mellitus screening based on risk factors and putting preventive measures like be Physically active and adequate dietary diversity during pregnancy is helpful to prevent effects of GDM on the mother and newborn. The study's finding would be an input for decision makers to combat GDM.

Keywords: *Antenatal Ethiopia; Health Facilities; Gestational Diabetes Mellitus; Pregnant Women*

Abbreviations

ANC: Antenatal Care; APGAR: Appearance, Pulse, Grimace, Activity, Respiratory; BMI: Body Mass Index; BP: Blood Pressure; DM: Diabetes Mellitus; GDM: Gestational Diabetes Mellitus; HDP: Hypertension Disorder of Pregnancy; IDF: International Diabetic Federation; ICU: Intensive Care Unit; IUFD: Intrauterine Fetal Death; LB: Live Birth; LBW: Low Birth Weight; OR: Odd Ratio; PGDM: Pre-Existing Gestational Diabetes; T1DM: Type One Diabetes Mellitus; T2DM: Type Two Diabetes Mellitus

Introduction

According to the World Health Organization, gestational diabetes mellitus is a metabolic condition caused by a deficiency in insulin synthesis, decreased insulin action, or both. It is glucose intolerance discovered during pregnancy for the first time. There are two ways that insulin's ability to regulate blood sugar can be impacted. Pancreatic cells may experience an issue with insulin secretion, as in type I diabetes. The other is that insulin might not work well at encouraging glucose uptake. Insulin resistance is what is seen in type II diabetes and gestational diabetes [1]. Preexisting type 1 diabetes (complete insulin insufficiency), preexisting type 2 diabetes (defective insulin secretion or insulin resistance), and gestational diabetes mellitus (GDM) hyperglycemia that is first diagnosed during pregnancy [2].

The physiological changes of pregnancy put the human body in a state of carbohydrate intolerance. Pregnancy- specific hormones, such as human placental lactogen and the increased levels of cortisol and prolactin, increase the resistance to insulin and the demand for hormone increases to maintain homeostasis of blood glucose [3].

Globally diabetes prevalence is increasing rapidly estimated 381milion in 2013 to 422 million in 2016 living with diabetes [4,5]. Worldwide, 7% of all pregnancies are complicated by diabetes and causes for maternal and prenatal morbidity and mortality [1]. IDF estimate that 20.9 million or 16.2% of live birth women to women in 2015 had some form of hyperglycemia in pregnancy. One in seven births is affected by diabetes in pregnancy. Annually, more than 200,000 GDM cases worldwide [1,6].

Middle East and North Africa had the highest prevalence of GDM with a median estimate of 12.9% [7]. Evidence for the growing prevalence of diabetes in Africa, which is projected to double by 2030 as obesity, westernization of diets, and urbanization increases [8,9]. In Ethiopia based on some studies prevalence of gestational diabetes mellitus indicated that, in Gondar town and Wolaita zone stated the prevalence to be 12.7 and 4.2% of total pregnancies, respectively [10,11].

Currently, availability of factors like changes in life style, dietary habits, urbanization, physical inactivity, the tendency towards delayed marriage and older maternal age in different parts of the globe are making favorable ground and the prevalence of diabetes may very well be on the rise and it will have serious health consequences for mothers and children in low resource settings with poor obstetric care [12,13].

The health situation of pregnant mother with diabetes and her unborn child can be endangered with different levels of complications. These complications can lead to death in worst situations [14,15]. Gestational diabetes mellitus has also long-term public health importance. It contributes to the rising type 2 diabetes epidemic. It is a momentary phenomenon for the pregnant mother, but more than 50% of the women develop type 2 diabetes in future life and the tendency of their children to develop obesity as young children and type 2 diabetes later on is found to be higher [16].

Gestational diabetes mellitus is adversely affecting women and their babies during pregnancy, labor and delivery. It is associated with a higher incidence of maternal morbidity including miscarriage, cesarean deliveries, shoulder dystocia, birth trauma, hypertensive disorders of pregnancy (preeclampsia), traumatize labor, obstructed labor and subsequent development of types 2 diabetes. Perinatal and neonatal morbidities also increase; include macrosomia, congenital anomalies birth injury, hypoglycemia, IUFD, still birth, shoulder dystocia, respiratory distress polycythemia, and hyper bilirubinemia [17].

Adverse outcomes in pregnancies among women with diabetes are in most cases preventable by optimizing glycemic control. Early screening and treatment of mothers with GDM can minimize the complications for both mothers and their babies. Addressing GDM also constitutes a window of opportunity for early intervention and reduction of the future burden of type 2 diabetes [18]. However, in some of the poorest countries of the world, difficulties in accessing and receiving both maternity and general medical care increase the risks pregnant women to face complication of diabetes in pregnancy.so prevention strategies by knowing determinate factor which associated with GDM is effective mechanism for low-income country like Ethiopia.

In Ethiopia, although diabetes mellitus is recognized as one of the major non-communicable diseases, common determinant factors which relate with GDM are not well researched. By this reason identification of common risk factors that directly relate with GDM possible gaps would be important to prevent the problem on before the occurrence.

Materials and Methods

Study area and period

The study was conducted in Dire Dawa city administration which is located in 515 km to the east of Addis Ababa, Ethiopia's capital. Ethiopia's capital The Administration is divided into a total of 47 kebeles, of which 38 are rural kebeles and 9 are urban kebeles. According to the 2012 Intra-Censual Projection Survey (ICPS), the total population is 550,642, with 68 percent living in urban kebele and 32 percent living in rural kebele. The public health organizations which are involved in health care delivery include 1public referral hospital, 1 public district hospital and 8 public health centers. All health institutions provide maternal health service in addition to other service. The study was conducted from April 01/04/2021 - May 20/ 05/2021.

Study design

Facility based unmatched case control study design was conducted.

Source population

All pregnant mothers living in Dire Dawa City who were visiting Public Health facilities for ANC service considered as the source of population.

Study population

Selected pregnant mothers their gestational age 24 - 28 week and visiting in selected public Health facilities for ANC service during data collection period were considered as study population.

Cases: Pregnant mothers 24 - 28 weeks of gestation age who had GDM at in selected public health facilities of Dire Dawa town.

Controls: Pregnant mothers 24 - 28 weeks of gestation who did not have GDM at in selected public health facilities of Dire Dawa town.

Inclusion criteria

Pregnant women who were 18 years or older and with no known pre-existing or overt diabetes mellitus (DM) and their gestational age 24 - 28 week and visiting Dire Dawa public Health facilities for ANC service was include in study.

Exclusion criteria

Pregnant women who had chronic diseases (hypertension), took medications that may affect glucose metabolism such as steroids, β-adrenergic agonists, and anti-psychotic drugs was excluded.

Study variables

Dependent variable

Gestational diabetic mellitus among pregnant women.

Independent variables

- Socio-demographic variables: women's (age, marital status, educational status, occupation and family income.
- Measurements (MUAC, hemoglobin, blood pressure).
- Behavioral variables: caffeine, alcohol and smoking use.
- Previous history of (GDM, PIH, still birth, IUFD and spontaneous abortion), family history of type II DM.
- Physical activities and dietary diversification.

Operational definitions

- **Gestational diabetes mellitus (GDM)**: It is any degree of glucose intolerance detected for the first-time during pregnancy 24 to 28 weeks of gestation and must fulfilled the recommendation criteria listed by WHO [1].
- **Pre-gestational diabetes:** Diabetes diagnosed prior to onset of pregnancy. This can be type 1 or type 2 (1).

Sample size determination

Sample size estimation is determined using Epi Info version 7 software taking into account the following statistical assumptions: confidence level of 95% (2-sided), power of 80%, case to control ratio of 1:3, proportion of adequate nutrition diversity in control and case group was 7.2% and 17.9%, respectively [2]. The minimum sample size required for the study is 131 cases and 393 controls. When adding 10% non-response rate the final sample size become 144 cases and 432 controls.

Sampling procedure

The calculated sample size was proportionally allocated to the selected hospital and health centers based on their population size according to the average number of clients registered prior to the study period in the respective institutions. Then the number of pregnant women was taking from each selected health facilities.

Data collection procedures

A structured questionnaire was prepared in English and we be translated to Amharic, Afan Oromo and Afan Somali. The questionnaire was translated back to English to assure consistency. The translation and back translation of the questionnaire was checked by language experts. Qualified BSC midwifery nurse was involved in the data collection activity. Training was provided to data collectors aiming to familiarize the objectives of the study, data collection methods, ethical issues, and the contents of the questionnaire. The questionnaire was amended on the basis of a pretest to be carried out in a similar setting out of data collection site.

Baseline maternal and socio-demographic characteristics, behavioral and dietary diversity were collected using face-to-face interview. Blood pressure (BP), mid upper arm circumference (MUAC), were measured in accordance with WHO recommendation [3]. Dietary diversity will be assessed using a 24-hour food recall method by the food and nutrition technical assistance (FANTA) 2016 version woman's minimum dietary diversity measurement tool. The minimum dietary diversity score (MDDS) of four and less was categorized as inadequate dietary diversity [4]. The short form of the international physical activity questionnaire (IPAQ) tool was employed to assess the physical activities of the last seven days. Then using metabolic equivalents (MET-minutes per week) of the IPAQ scoring protocol, pregnant women was categorized into a high, moderate and low level of physical activity [5].

Laboratory assessment

Fasting blood glucose was performed for all pregnant women gestational age 24 - 28 week by plasma glucose testing, using a standard plasma-calibrated glucometer (HemoCue Glucose B-201+ (Sweden)) in accordance with new recommendations of WHO for GDM diagnosis [6]. The diagnosis of GDM is made when one or more of the values of plasma glucose level was met (Fasting: ≥ 92 mg/dL, 1h: ≥180 mg/dL; 2h: ≥ 153 mg/dL).

Data quality control

The quality of data was assured by applying properly designed and pre-tested questioner. The tool was pre-tested on Five percent of the sample size in one health center other than selected for the study one week before the actual data collection to establish its ability to elicit relevant information. In addition, Proper categorization, coding of the questions was made. Regular supervision and follow up was made by principal investigator and supervisor. In addition, regular check-up for completeness and consistency of the data was made on daily basis and checking of questionnaire consistency was made. Incomplete questionnaires were discarded and considered as none response rate.

Data analysis

The collected data were coded manually and entered by using Epi-data version 3.1 prior to analysis; the data was exported from Epi-data to SPSS Version 22 and were checked for missing values. Descriptive statistics and numerical summary measures were presented by using frequencies distribution tables and graphs (diagrams). Binary logistic regression was employed to examine the relationship between the independent variable with GDM and without GDM. Those variables with ($p \leq 0.25$) in the variable analysis will be entered into multiple logistic regression model. This helps to identify important determinants factors for dependent variable after controlling possible confounding factors. Variables with p-value < 0.05 will be considered as statistically significant with GDM and without GDM. Hosmer-Lemeshow goodness of-fit test will be used to test the fitness of model.

Ethical considerations

Ethical clearance was obtained from Dire Dawa University, ethical review board. Official letter was obtained from university Research Directorate and submitted to Dire Dawa health office. Official letter from Dire Dawa city health office was given to health center and Hospital. Finally written consent were obtained from each participant. Confidentiality was maintained by omitting any personal identifiers from the questionnaire and instead codes were assigned. The collected data was used only for research purpose. Participants diagnosed with GDM will be referred immediately (linked) to health care providers who are experts in managing GDM. Follow-ups will be assured through the public health facilities in close collaboration with experts and data collectors.

Results

Socio-demographic characteristics of study participants

The study included a total of 536 pregnant women, making the response rate 93%. The mean age of the pregnant women was 26.13 (SD ± 5.7) years. More than half of the participants (68.1%) were married, (51.3%) were from the Oromo ethnic group, and more than three forth of (78.5%) were Muslim and Orthodox in religion. Eighty-two (15.3%) women had no formal education, while about half (53%) of pregnant women were unemployed. More than One-fourth (26.1%) of pregnant women live on a family income of less than or equal to 2500 Ethiopian Birr per month (Table 1).

Variables		Non-GDM n (%)	GDM n (%)	Total (%)
Age in years	< 25	149 (37.1)	29 (21.6)	178 (33.2)
	25 - 29	128 (31.8)	29 (21.6)	157 (29.3)
	30 - 34	67 (16.7)	20 (14.9)	87 (16.2)
	> 34	58 (14.4)	56 (41.8)	114 (21.3)
Religion	Orthodox	155 (38.5)	44 (32.8)	199 (37.1)
	Muslim	166 (41.3)	56 (41.8)	222 (41.4)
	Protestant	70 (17.4)	31 (23.1)	101 (18.8)
	Others	11 (2.7)	3 (2.2)	14 (2.6)
Ethnicity	Oromo	199 (49.5)	76 (56.7)	275 (51.3)
	Amhara	120 (29.8)	40 (29.8)	160 (29.8)
	Tigre	57 (14.2)	12 (9.0)	69 (12.9)
	Gurage	26 (6.5)	6 (4.5)	32 (6.0)
Educational status	No formal education	65 (16.2)	17 (12.7)	82 (15.3)
	Primary school	119 (29.6)	50 (37.3)	169 (31.5)
	Secondary school	128 (31.8)	38 (28.4)	166 (31)
	Collage and above	90 (22.4)	29 (21.6)	119 (22.2)
Occupational status	Employed	203 (50.5)	49 (36.6)	252 (47.0)
	Non employed	199 (49.5)	85 (63.4)	284 (53.0)
Income status	<= 2500	111 (27.6)	29 (21.6)	140 (26.1)
	2501 - 4999	146 (36.3)	37 (27.6)	183 (34.1)
	>= 5000	145 (36.1)	68 (50.7)	213 (39.7)

Table 1: *Socio-demographic and economic characteristics of pregnant women attending ANC follow up at public health Facility in Dire Dawa, Ethiopia 2022 (n = 536).*

Clinical characteristics of study participants

The pregnant women's mean hemoglobin and random blood glucose levels were 11.9 (SD ± 1.1) and 109.2 (SD ± 16.7), respectively. The mean systolic blood pressure was 106 (SD ± 10.5) mmHg, and diastolic blood pressure was 66.7 (SD ± 8) mmHg. Nearly forty percent (38.8%) of the women were primigravida. Sixty-three (11.8%) had a family history of diabetes mellitus. Almost 13% of pregnant women were identified to have anemia. The previous history of abortion and stillbirth were reported among 17 (5.2%) and 12 (3.7%) of pregnant women respectively (Table 2).

A higher proportion of diabetes family history was revealed among women with GDM than non-GDM (20.9% vs. 8.7%). When pregnant women were compared in terms of anemia status, those with GDM were identified to have a higher proportion than non-GDM (18.7% vs. 10.9%) (Table 2).

Behavioral and lifestyle characteristics of pregnant mothers

Out of total participants, alcohol and coffee intake were reported by (17.5%) and (88.6%), respectively. Out of women who consumed coffee, only 105 pregnant women (22%) of them reported consuming one cups of coffee per day but remaining women consuming two

Variables		Non-GDM/Control n (%)	GDM/Cases n (%)	Total
Gravidity	One	162 (40.3)	46 (34.3)	208 (38.8)
	Two	105 (26.1)	40 (29.9)	145 (27.1)
	Three	72 (17.9)	23 (17.2)	95 (17.7)
	Four and above	63 (15.7)	25 (18.7)	88 (16.4)
History of abortion/IUFD	Yes	14 (5.2)	3 (3.4)	17 (5.2)
	No	226 (94.8)	85 (96.6)	311 (94.8)
History of Still birth	Yes	7 (2.9)	5 (5.7)	12 (3.7)
	No	233 (97.1)	83 (94.3)	256 (96.3)
History of confirmed PIH in previous pregnancy	Yes	10 (4.2)	7 (8)	17 (5.2)
	No	230 (95.8)	81 (92)	311 (94.8)
Family history of Diabetes	Yes	35 (8.7)	28 (20.9)	63 (11.8)
	No	367 (91.3)	106 (79.1)	473 (88.2)
Anaemia status	< 11 mg/dl	44 (10.9)	25 (18.7)	69 (12.9)
	≥= 11 mg/dl	358 (89.1)	109 (81.3)	467 (87.1)

Table 2: *Obstetric history of pregnant women attending ANC follow up at public health Facility in Dire Dawa, Ethiopia 2022 (n = 536).*

or more cup per day. Almost half of pregnant women (47.2%) reported having low physical activity, while only 22% pregnant women reported having high physical activity. Almost one-third pregnant women was reported that poor dietary diversity in their feeding behavior (Table 3).

High physical activity was reported to be higher among non-GDM than GDM pregnant women (24.9 vs. 12.7%). Similarly, inadequate dietary diversity was revealed to be higher among GDM when compared to non-GDM pregnant women (45.5 vs. 24.4%) (Table 3).

Variable		Non-GDM n (%)	GDM n (%)	Total
History alcohol intake during this pregnancy	Yes	70 (17.4)	24 (17.9)	94 (17.5)
	No	332 (82.6)	110 (82.1)	442 (82.5)
Type of alcohol	Local	50 (71.4)	19 (79.2)	69 (73.4)
	Bear	20 (28.6)	5 (20.8)	25 (26.6)
History of coffee intake	Yes	349 (86.8)	126 (94.0)	475 (88.6)
	No	53 (13.2)	8 (6.0)	61 (11.4)
Number cups of coffee per day	One cup	84 (24.1)	21 (16.7)	105 (22.1)
	Two cups	118 (33.8)	34 (27.0)	152 (32.0)
	Three cups	85 (24.4)	32 (25.4)	117 (24.6)
	Four and above	62 (17.8)	39 (31.0)	101 (21.3)
Physical activity status during pregnancy	Low	160 (39.8)	93 (69.4)	253 (47.2)
	Moderate	142 (35.3)	24 (17.9)	166 (31.0)
	High	100 (24.9)	17 (12.7)	117 (21.8)
Dietary diversity score	< 5 (Inadequate)	98 (24.4)	61 (45.5)	159 (29.7)
	≥ 5 (Adequate)	304 (75.6)	73 (54.5)	377 (70.3)

Table 3: *Behavioral characteristics of pregnant women attending ANC follow up at public health Facility in Dire Dawa, Ethiopia 2022 (n = 536).*

Factors associated with GDM among pregnant women

Results of the unadjusted binary logistic regression showed that advanced maternal age, employment status, Family monthly income, family history of DM, anemia (Hb < 11 g/dl), History of coffee intake in this pregnancy, level of physical activity and dietary diversity were associated with GDM. However, on multivariate logistic regression, variables GDM was independently associated with being advanced maternal age (age > 34) AOR = 4.41; 95% CI: 2.33 - 8.34), family history of diabetes (AOR = 2.56; 95% CI: 1.31 - 4.99), low physical activity (AOR = 2.83; 95% CI: 1.47 - 5.45) and inadequate dietary diversity (AOR =0.35; 95% CI: 0.21 - 0.57) were significantly associated with GDM (Table 4).

Variables		Non GDM n = (402)	GDM n = (134)	COR (95% CI)	AOR (95% CI)
Age in years	< 25	149	29	1	1
	25 - 29	128	29	1.16 (0.66- 2.05)	1.04 (0.55-1.96)
	30 - 34	67	20	1.53 (0.81- 2.90)	1.35 (0.65- 2.79)
	> 34	58	56	4.96 (2.88- 8.52)**	4.41 (2.33- 8.34)**
Occupational status	Employed	203	49	1	1
	Non-employed	199	85	1.77 (1.18 - 2.64)	2.06 (1.27 - 3.33)**
Family monthly income	< 2500 birr	111	29	1	1
	2501 - 4999 birr	146	37	0.97 (0.56 - 1.67)	0.98 (0.53 - 1.83)
	> 5000 birr	145	68	1.79 (1.10 - 2.96)*	1.54 (0.84 - 2.84)
Family history of Diabetes	Yes	35	28	2.77 (1.61 - 4.76)**	2.56 (1.31 - 4.99)**
	No	367	106	1	1
Anemia status	< 11 mg/dl	44	25	1.87 (1.09 - 3.18)*	1.90 (0.98 - 3.68)
	≥ 11 mg/dl	358	109	1	1
History of coffee intake in this pregnancy	Yes	349	126	2.39 (1.11 - 5.17)	
	No	53	8	1	
Number of cups coffee per day	One cup	84	21	1	1
	Two cups	118	34	1.15 (0.62 - 2.12)	1.06 (0.53 - 2. 10)
	Three cups	85	32	1.51 (0.80 - 2.82)	1.18 (0.58 - 2. 37)
	Four and above cups	62	39	2.52 (1.35 - 4.69)*	1.58 (0.77 - 3.27)
Physical activity status during pregnancy	Low	160	93	3.42 (1.92 - 6.07)**	2.83 (1.47-5.45)**
	Moderate	142	24	0.99 (0.50 - 1.94)	0.81 (0.38 - 1.73)
	High	100	17	1	1
Dietary diversity score	< 5	98	61	1	1
	≥ 5	304	73	0.38 (0.26 - 0.58)**	0.35 (0.21 -0.57) **

Table 4: *Bivariate and multivariable logistic regression analysis and predictors of GDM among pregnant women attending ANC follow up at public health Facility in Dire Dawa, Ethiopia 2022.*

***p-value < 0.001 *p-value < 0.05.*

Discussion

This study was conducted to identify the importance of determinant factors for GDM in a study of 134 women with GDM and 402 healthy women. In our study, age of women, occupational status of women, family history of diabetes mellitus, physical activity during pregnancy and dietary diversity were significant risk factors of GDM.

Maternal age is a significant contributor to the occurrence of gestational diabetes mellitus. In this study, pregnant women within the age group of above 34 had four times more likely to be GDM when compared with those women in the age group less than 25 years old. This is in line with a study done in Cameron and USA in the older women age group > 30 years were more likely to be GDM than Younger pregnant women [7,8]. This could be because, it is believed that as age increases the risk of developing chronic illnesses including diabetes increases. And as an individual develops one chronic illness the risk of developing another chronic illness increases which increases the risk to a higher level [9,10].

Unemployment was shown to have a significant statistical association with GDM. As revealed in this study, non-employed pregnant women were two times as high as the risk of developing GDM compared with the employed group. Further, evidence showed that employed adults were more likely to be physically active than non-employed and also employed pregnant women were physically active compared with the non-employed group [11].

Engaging in physical activity can reduce the risk of developing gestational diabetes mellitus (GDM) in pregnant women. According to a study, pregnant women who engage in low levels of physical activity during pregnancy were identified to have almost three times higher risk of developing GDM compared to those who engage in high levels of physical activity. This finding is consistent with studies conducted in Gondar town and Addis Abeba [12,13]. The increased level of physical activity during pregnancy can help reduce glucose levels, prevent weight gain, and enhance insulin sensitivity [14].

The risk of developing GDM was almost 2.5 times higher in pregnant women with a family history of diabetes compared to the counterpart. This finding agreed with study conducted in Florida which revealed the risk of GDM among women having a family history of diabetes was increased by two-fold [8]. Similarly, a study conducted in rural Tigray North Ethiopia and Wolita South Ethiopia revealed having family history of type two DM were more likely to be GDM [15,16]. This could be because GDM has a genetic component that may predispose individuals to develop glucose intolerance during pregnancy, and type II diabetes shares a common genetic background with GDM [17].

In this study, pregnant women with adequate dietary diversity were 64% less at risk of developing GDM than those with inadequate dietary diversity. The finding agreed with the study conducted in Gondar town, where pregnant women with inadequate dietary diversity were at risk of developing GDM [2]. This observation can be explained by the because inadequate dietary diversity decreases the chance of getting antioxidants in food consumed, which is important to prevent or delay B cell dysfunction in diabetes by protecting against glucose toxicity. Additionally, adequate dietary diversity will increase the probability of getting a high-fiber diet that controls blood sugar levels [18-33].

Limitations of the Study

In our study, assessment of physical activity was performed using a questionnaire, self-reports that were prone to recall bias. Second, pre-pregnancy anthropometric measurement and BMI were not determined among pregnant women which may be part of the determinant factors.

Conclusion

Advanced maternal age, family history of diabetes mellitus and occupational status of pregnant women were identified as a risk factors for the occurrence of GDM, while having high physical activity and adequate maternal dietary diversity were revealed to protective factors for GDM.

Recommendations

Based on the finding of this study, the following recommendations were made:

- Health care providers should promote blood glucose level testing and strengthen gestational diabetes mellitus screening based on risk factors and putting preventive measures in place is helpful to prevent long term effects of GDM on the mother and newborn.
- Should strength sustained health and nutrition education to the women, their families and communities regarding increased proper dietary practices and dietary diversification during their pregnancy time.
- Should closely work with health extension workers to increase awareness of pregnant women on how to improve their own nutritional status and being physically active.
- Should promote and support for healthy lifestyles in Dire Dawa, especially among pregnant women is essential to prevent maternal complication and adverse birth outcome.
- For further studies: Further in-depth researches are needed in different areas and on large scale in Ethiopia for full understanding of determinate factor for gestational diabetes.

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Conflict of Interest

The authors declare that they have no competing interests.

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