OMO International Journal of Sciences

Available online at: https://survey.amu.edu.et/ojs/index.php/OMOIJS/issue/archive

Vol. 4 Issue. 2, December , 2021, pages: 75~85

ISSN(Print): 2520-4882 :ISSN(Online):2709-4596

Full-length Research Article

Assessment of the Prevalence of Gestational Diabetes Mellitus and Associated Factors among Women Attending Antenatal Care at Arba Minch Town Public Health Facilities, Southern Ethiopia

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Abstract

Gestational diabetes mellitus (GDM) is a high blood sugar condition that some women acquire during pregnancy which could have devastating effects on both the mother and baby if left untreated. In most of the developing countries including Ethiopia, women are rarely screened for GDM during ANC visits. It was previously estimated that gestational diabetes occurs in four to nine percent of pregnant women in Ethiopia. So, the aim of this study was to assess prevalence of GDM and associated factors among women attending antenatal care at Arba Minch town public health facilities. Institution based cross sectional study design was employed among 380 pregnant women's visiting antenatal care clinic. Women were enrolled if they had fulfilled inclusion criteria during the study period. Data was collected using a pre-test structured interviewer administered questionnaire September 2019 to November, 2019. Descriptive statistics was done. Results were summarized and presented by tables, charts and graphs. The prevalence of GDM was 7.1%. Nearly one-third of the respondents, 247(65%) had two or more pregnancies, with mean gestational age of 25 weeks. Half of the respondents, 187(49.2%) were multi-para. Of 380 pregnant women, 53(13.9%) had previous history of stillbirth. Maternal age, educational level, parity, history of having macrocosmic baby, previous history of GDM and family history of type II DM were associated with GDM. Older ages, low educational level, grand multipara, having macrosomic baby and history of type II diabetes mellitus were factors associated with increased risks of gestational diabetes mellitus. Therefore, to enhance maternal and child health, improving screening, treatment, and prevention strategies for gestational diabetes mellitus is necessary.

Keywords: Diabetes mellitus; Pregnancy; Diagnosis; Glucometer

Received: 15 June, 2021; Accepted: 05 September, 2021; Published: December, 2021

1. INTRODUCTION

Sub Saharan Africa (SSA) has the highest maternal mortality in the world, with the majority of maternal deaths being attributed to haemorrhage, infections, obstructed labour and hypertension (Khan *et al*., 2006). Estimated at 676 deaths per 100,000 live births (Hogan *et al.*, 2010), maternal mortality in Ethiopia is more than three times of the worldwide average. Gestational diabetes mellitus (GDM), though it is never listed as a cause of maternal death, significantly increases the risk for all common maternal killers and yet is rarely addressed in resource-constrained settings (ENHAT-CS, 2015).

GDM is a high blood sugar condition that some women acquire during pregnancy and it usually starts halfway through the pregnancy between the 24th and 28th week of pregnancy (Christenson *et al*., 2001). Placental hormones and increased fat deposits causes insulin resistance during pregnancy which will block insulin action to bind its receptors that is why this condition causes high level of glucose in pregnant women (Carr *et al*., 1998).

It is a public health problem that currently affects a large part of the female population and has short- and long-term consequences for the fetus and the mother causing macrosomia, preeclampsia, polyhydramnios, fetal macrosomia, birth trauma, perative delivery, neonatal metabolic complications and perinatal death. Development of obesity and diabetes in offspring during childhood and later development of diabetes mellitus in the mother are also related with GDM (Anderson *et al*., 2003). Approximately 7% of all pregnancies are complicated by GDM, resulting in more than 200,000 worldwide cases annually and the prevalence may range from 1% to 14% of all pregnancies depending on the population studied and the diagnostic tests employed (Kirkman and Schaffner, 2012). Ferrara reported that GDM prevalence has increased by 10 to 100% in several ethnic groups during the past 20 years (Ferrara, 2007).

Gestational diabetes is also becoming a public health concern in Sub-Saharan Africa (SSA). A study in rural South Africa reported a prevalence of GDM of 1.5% and impaired glucose tolerance (IGT) of 7.3% (Mamabolo *et al*., 2007)). According to WHO 2016 report, more than half of 16, 000 deaths attributable to high blood glucose in Ethiopia were women in reproductive age group (WHO, 2018). In an Ethiopian rural community, GDM prevalence was 3.7% (Seyoum *et al*., 1999). It was previously estimated that gestational diabetes occurs in four to nine percent of pregnant women in Ethiopia, but these data are scant and old. An estimated 80 percent of cases remain undiagnosed (IDF, 2016).

GDM has to be identified timely in order to avoid risk and complication to the mother and the child. In a developing country like Ethiopia due to proper lack of resources and clinical investigation the pregnant women have to bear serious consequences putting their life at a stake (Bhattarai *et al.*, 2007)). With the current prediction of increasing type 2 diabetes cases, even at a younger age, which could be related to GDM, controlling GDM would be of potential benefit to reduce the health care burden for treating people with type 2 diabetes, which is a costly lifetime condition. The International Diabetes Federation recognizes identification

and treatment of GDM as a global priority (IDF, 2016). Therefore, the aim of this study was to assess prevalence GDM and associated factors among women's attending ANC in study area.

2. METHODS AND MATERIALS

2.1. Study design and setting

Institution based cross sectional study design was conducted from September to November 2020 in Arba Minch town public health facilities, Gamo Zone, Southern Ethiopia in SNNPR. The town consists of estimated total population of 98,000 with an area of 514 sq.kms and located at the altitude of 1200 to 1400 meters above sea level. There are one General Hospital, one Primary Hospital, two health centers, and different level of private health facilities. Among these, Arba Minch General Hospital provides different health services and has a total of 470 beds and more than 400 staffs working in it. The ANC follow up clinic has a total of around 1000 pregnant women who is on the follow up and it gives services to around 40-50 pregnant women per day. The health centers also have ANC follow up clinic.

2.2. Source population

Source populations were all pregnant women who undertook antenatal care follow up service during the study period in Arba Minch General Hospital, Secha and Arba Minch Health centers.

2.3. Study population

The Study populations were selected pregnant women who came to antenatal care service in Arba Minch General Hospital, Secha and Arba Minch Health centers during the period of study. Those pregnant women with lost chart, incomplete information, who were unable to respond and who were less than eighteen years of age were excluded from the study.

2.4. Sample Size Determination

Sample size was determined by using single population proportion formula taken from research done on prevalence of Gestation Diabetes Mellitus among Pregnant Women in Tigray region is 13 % (ENHAT-CS, 2015). Assuming 5% degree of precision or margin of error, 95% confidence interval, and 10% non-response rate, the final sample size was 383.

2.5. Sampling procedures

To achieve the desired sample size, all pregnant women who came for antenatal care were selected by systematic random sampling method until the required sample size was met during the study period. Equal number of sample size was selected from Arba Minch Genral Hospital, Secha and Arba Minch Health centers. By dividing the total source population to study population, the k value is 4.

2.6. Operational Definition

Gestational diabetes mellitus: - is a glucose intolerance with onset or first recognition during pregnancy with fasting 5.1-6.9 mmol/L or 1hr: ≥10.0 mmol/L or 2hr: 8.5-11.0 mmol.L.

Glucose intolerance is a pre diabetic state of hyperglycemia that is associated with insulin resistance and increase risk of cardio vascular pathology.

2.7. Method of Data Collection and Instrument

The data were collected using semi-structured interviewer administered questionnaire adapted from previous studies. The questionnaire was further modified after a pretest on other similar population undertaking 5 % of the total sample size outside the study area. The questionnaire was original prepared in English and translated to Amharic. It was further translated back from Amharic to English and comparisons were made on the consistency of the two versions. Two days training was given for data collectors and a supervisor. Blood samples were collected from each respondent and tested for random blood glucose in each public health facilities laboratory by following standard methods. 75 gm oral glucose administered, capillary glucose level was measured at 0hr and 2hr using HemoCue Glucose and GDM was diagnosed based on revised WHO criteria.

2.8. Data Processing and analysis

Data were entered, coded, and cleaned after checking for completeness and consistency, into EpiData version 3.1 and exported to SPSS version 21.0 software for analysis. Mean, median and standard deviation were calculated for continuous variables whereas proportion was calculated for categorical variables. Results were summarized and presented in tables, charts and graphs. Chi-square test was also used to see the association between variables.

3. RESULTS

3.1. Socio-Demographic Characteristics

The data were collected from 380 pregnant women giving a response rate of 99%. About 217 (57.1%) of them were aged below 25 years and 26 (6.8%) were aged greater than 35 years. Majority of the respondents, 325 (85.5%) were married, 10 (2.6%) were not married, 4 (1.0%) were widowed and the rest 11 (3.0%) were divorced. Most of, 130 (34.2%) study participants attended primary education and 76 (20%) participants educational level was college level and above. Concerning their family size, 210 (55.3%) of the study participants lived in families of more than five members while the rest 270 (71.1%) lived in families of five or less members (Table 1).

Table 1: Socio-demographic characteristics of pregnant women who attend antenatal care service in public health institutions in Arba Minch Town, Southern Ethiopia, 2020.

Variables	Category	Frequency (n)	Percent (%)
Maternal Age	18-25	217	57.1
	26-35	137	36.0
	>35	26	6.8
Religion	Orthodox	272	71.6
	Protestant	92	24.2
	Others*	16	4.2
Occupation	Housewife	161	42.4
	Governmental employee	126	33.2
	Student	44	11.6
	Merchant	32	8.4
	Others**	17	4.4
Marital Status	Married	325	85.5
	Not married	40	10.5
	Widowed	4	1.0
	Divorced	11	3.0
Educational Level	No formal education	124	32.6
	Primary	130	34.2
	Secondary	50	13.2
	College and above	76	20
Family size	Up to 5 members	270	71.1
	>5 members	110	28.9
Family income	500 birr or less	208	54.7
	>500 birr	172	45.3

***Muslims, Catholic, Adventist,* ** farmer, private

3.2. Lifestyle and behavioral characteristics

Out of the total respondents, 285 (75%) engaged in low level physical activity, 81 (21.3%) performed moderate physical activity and the rest 14 (3.7%) participants had intensive physical activity experience. Of the 380 study participants, 64 (16.8%) of mothers had no history of alcohol intake while 9 (2.4%) were smokers. Majority of pregnant women in the study had history of coffee intake. History of chat chewing was also reported among 19 (5%) of participants.

3.3. Obstetric characteristic of participants

Concerning basic obstetric characteristics, GDM Screening was carried out at 12-32 gestational weeks. Nearly one-third of the respondents, 247(65%) had two or more pregnancies, with mean gestational age of 25 weeks. Half of the respondents, 187(49.2%) were multi-para. Of 380 pregnant women, 53(13.9%) and 43(11.3%) had history of stillbirth and history of abortion, respectively while caesarean section rate was 56 (14.7%) (Table 2).

3.4. Medical and drug history of participants

Other medical and drug histories of the participants were assessed. Among a total respondent, 32 (8.4%) had history of GDM in the family, 21 (5.5%) had history of type 2 diabetes mellitus in the family, 87 (22.9%) have history of systolic/diastolic blood pressure (Table 2).

Table 2: Table 2: Selected obstetric and medical history of pregnant women who attend antenatal care service in public health institutions in Arba Minch Town, Southern Ethiopia, 2020.

Characteristics	Categories	Frequency (n)	Percent (%)
Gestational age in weeks	20	74	19.5
	24	56	14.7
	28	68	17.9
	32	83	21.8
	36	99	26.1
Parity	Nulliparous	64	16.8
	Primipara	69	18.2
	Multipara (2-4)	194	51.1
	Grand multipara (>5)	53	13.9
Gravidity	Primigravida	61	16.1
	Multigravida	319	83.9
History of macrocosmic baby (n=319)	Yes	71	22.2
	No	248	77.8
History of still birth (n=319)	Yes	45	12.1
	No	274	72.1
History of abortion (n=319)	Yes	67	21
	No	252	79
History of caesarean section (n=319)	Yes	60	18.8
	No	259	81.2
History of GDM (n=372)	Yes	19	5.9
	No	300	94.1
Family history of type II DM (n=380)	Yes	57	15
	No	323	85

3.5. Magnitude of Gestational Diabetes Mellitus

A total of 27 women were diagnosed for gestational diabetes mellitus. This according to 2017 International Association of Diabetes and Pregnancy Study Group (IADPSG) diagnostic criteria resulted in a GDM prevalence of 7.1% with 95% CI (5.3, 9.1) with a mean of 0.42 and standard deviation of ±0.48 (Figure 1).

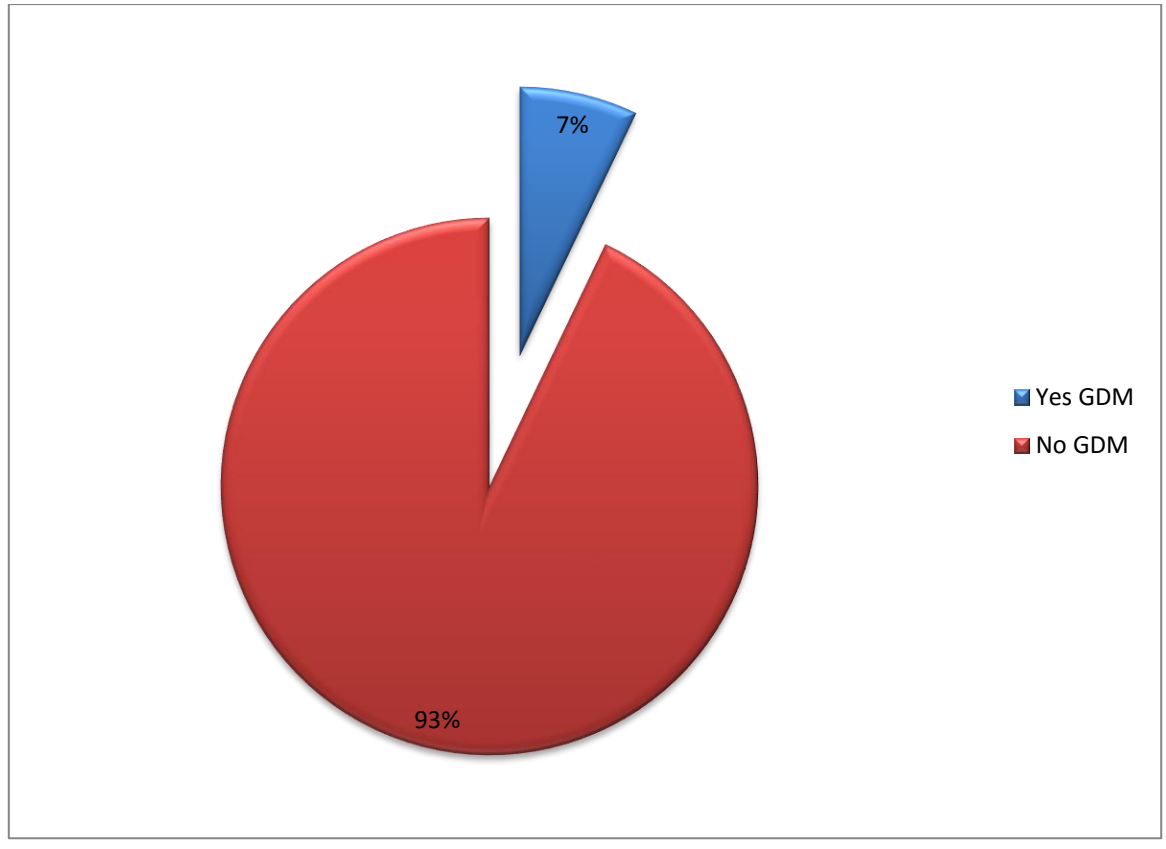

Figure 1: Prevalence of gestational diabetes mellitus among pregnant women who attend antenatal care service in public health institutions in Arba Minch Town, Southern Ethiopia, 2020.

3.6. Risk factors associated with gestational diabetes mellitus

Binary logistic regression model was used to identify factors associated with GDM. Accordingly, maternal age, marital status, educational level, family size, level of physical activity, parity, history of having macrocosmic baby, history of abortion, previous history of GDM and family history of type II DM were associated with GDM.

In a multivariate logistic regression model, macrosomic baby (AOR: 1.88; 95% CI: (1.11,2.45)), educational level (AOR:2.0; 95%CI: 1.42–2.81), maternal age (AOR: 1.78; 95%CI: 1.11,2.45), parity (AOR: 2.02; 95%CI: 1.41,2.13), previous history of GDM (COR: 1.5; 95%CI: 1.11, 2.03), family history of type II diabetes mellitus (COR:2.22; 95%CI: 1.48,3.20) were identified to be significantly associated with GDM (Table 3).

Table 3: Factors associated with GDM among pregnant women who attend antenatal care service in public health institutions in Arba Minch Town, Southern Ethiopia, 2020.

Variables		**Non-GDM N (%)**	**GDM N (%)**	**COR (95% CI)**	**P -value**	**AOR (95% CI)**	**P-value**
Maternal Age	19-25	213(98.2)	4(1.8)	1	<0.001	1	0.026
	26-35	127(92.7)	10(7.3)	0.55(0.35, 0.85)		1.24(0.01,2.47)	
	>35	13(50.0)	13(50.0)	0.38(0.29, 0.52)		1.78(1.11,2.45)	
Marital Status	Married	313(96.3)	12(3.7)	1	0.673	1	0.328
	Not married	27(67.5)	13(32.5)	0.74(0.51, 0.07)		1.01(0.73,2.19)	
	Divorced	9(81.8)	2(18.2)	0.98(0.35, 2.69)		0.56(0.30,1.39)	
Educational Level	No formal education	113(91.1)	11(8.9)	1	<0.05	1	<0.0001
	Primary	122(93.8)	8(6.2)	1.4 (1.07, 1.84)		1.1(0.23, 2.06)	
	Secondary	45(90)	5(10)	1.59(1.18, 2.15)		1.5(1.02,2.21)	
	College and above	73(96.0)	3(4.0)	1.74(1.33, 2.28)		2 (1.42–2.81)	
Family size	Up to 5 members	255(94.4)	15(5.6)	1	0.10	1	0.96
	>5 members	98(89.0)	12(11.0)	0.91(0.55, 2.34)		1.14(0.02,2.47)	
Parity	Nulliparous	61(95.3)	3(4.7)	1	<0.01	1	0.0028
	Primipara	64(92.7)	5(7.3)	1.09(0.82, 1.45)		2.02(1.41,2.13)	
	Multipara (2-4)	182(93.8)	12(6.2)	1.49(0.71, 1.99)		1.52(0.75,2.23)	
	Grand multipara (>5)	46(86.8)	7(13.2)	1.81(0.85, 2.20)		2.95(1.66,3.68)	
	Yes	52(73.2)	19(26.8)	1	<0.001	1	<0.002

Variables		**Non-GDM N (%)**	**GDM N (%)**	**COR (95% CI)**	**P -value**	**AOR (95% CI)**	**P-value**
History of macrocosmic baby	No	240(96.8)	8(3.2)	2.07(1.52, 2.62)		1.88(1.11,2.45)	
History of still birth	Yes	38(84.4)	7(15.6)	1	2.76	1	0.35
	No	254(92.7)	20(7.3)	1.06(0.60, 1.51)		0.91(0.48,1.49)	
History of abortion (n=372)	Yes	57(85.1)	10(14.9)	1	0.83	1	0.79
	No	235(93.2)	17(6.8)	0.87(0.10, 1.63)		0.89(0.05,1.70)	
History of caesarean section	Yes	54(90.0)	6(10.0)	1	1.04	1	0.47
	No	238(91.9	21(8.1)	0.93(0.04, 1.82)		1.6 (1.10, 2.32)	
History of GDM	Yes	16(84.2)	3(15.8)	1	<0.01	1	0.003
	No	276(92.0)	24(8.0)	1.5(1.11, 2.03)		3.6 (2.25,5.20)	
Family history of type II DM	Yes	45(78.9)	12(21.1)	1	0.025	1	<0.001
	No	308(95.3)	15(4.7)	2.22 (1.48,3.20)		1.9 (1.11, 2.18)	

GDM- gestational diabetes mellitus, AOR-adjusted odd ratio, COR-crude odd ratio

4. DISCUSSION

This study was conducted to determine the prevalence of GDM and associated factors among women attending antenatal care at Arba Minch town, Southern Ethiopia. The prevalence of diabetes mellitus in this study was 7.1% with 95% CI (5.3, 9.1), which was higher than the studies in rural northern Ethiopia (3.7%) (Seyoum *et al*., 1999). This discrepancy was due to study setting and study design difference. The later study was conducted in rural area of northern Ethiopia where the predisposing factor for gestational diabetes mellitus was relatively lower. In contrast to our study, the result of study conducted in Southern Nation Nationality People Region was higher (26.2%) (Eskinder *et al*., 2019). The difference may be due to utilization of improved diagnosis technique, variation in residency and difference in participant's trimester.

Pregnant women who attended college and above had two-fold less odds of developing of the problem during the pregnancy at the moment. This finding was in line with those of studies in Gondar town public health facilities, Northwest Ethiopia (Achenefi *et al*., 2019). Pregnant women who were grand multipara had three times more chance to develop GDM than nulliparous. This

finding was inconsistent with evidence in Hadiya Zone public Hospitals (Yilma *et al*., 2020). This might be because of the similarity in living standards and lifestyles of the families sharing the related risk factors and demographics distribution of families.

Pregnant women with previous history of macrocosmic baby had two times higher GDM than their counterparts. Women with previous history of GDM had three times higher GDM compared to women without history of GDM while women with family history of type II DM were two times more likely to develop GDM than their counterparts. This finding was not consistent with the study conducted in Tigray region, northern Ethiopia but, the result was strongly supported by other studies conducted in southern and northern, Ethiopia (Eskinder *et al*., 2019; Achenefi *et al*., 2019). The reason for inconsistency could be explained by the difference in the study population since the result of study in Tigray region was among pregnant women living with HIV/AIDS and additionally the study setting includes rural residents and was conducted in health centres only.

5. CONCLUSION

The overall prevalence of diabetes mellitus was 7.1%. Older ages, low educational level, grand multipara, having macrosomic baby and history of type II diabetes mellitus were factors associated with increased risks of gestational diabetes mellitus. To enhance maternal and child health, improving screening, treatment, and prevention strategies for gestational diabetes mellitus is necessary.

Ethical approval and consent to participate

Ethical clearance was obtained from Arba Minch University College of Medicine and Health Sciences to conduct the study. Zonal administrative of Gamo Zone Health departments was communicated for support letters and different facilitation of data collection was communicated for administrative support. Written consent was obtained from the respondents and confidentiality was assured for any information provided. The right of the respondent to withdraw from the interview or not to participate is respected. In case pregnant women with complicated gestational diabetes found during data collection time, the data collector communicated with the physicians and appropriate treatment was given.

Acknowledgment

The authors of this research thank all participants of the study and Arba Minch University for financial support.

Conflict of interest

All authors have no financial, personal or other conflict of interest.

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