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"Prevalence of abnormal glucose tolerance among pregnant women undergoing oral glucose tolerance test (OGTT)"

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ABSTRACT

Background: Gestational Diabetes Mellitus is defined as glucose intolerance of variable severity or hyperglycemia occurring for the first-time during pregnancy but the glucose intolerance reverting back to normal after the puerperium. GDM is one of the leading causes of mortality and morbidity for both the mother and the infant worldwide. Previous history of GDM, antenatal depression, family history of diabetes, low physical activity, overweight and/or obese women and inadequate dietary diversity might be the factors associated with GDM.

Aim of the study: To assess the prevalence of gestational diabetes mellitus in pregnant women attending UCBMSH during the study period.

Methods: This was a hospital-based cross-sectional study carried out over 8 months extending from October 2021 to May 2022 at UCBMSH. All females underwent a 50-g GCT between 24 - 28 weeks of gestation. A result for the 50-g GCT was considered positive at ≥140mg/dl followed by 100-g OGTT. The diagnosis of GDM was carried out according to the Carpenter Coston Criteria. A detailed clinical history was collected and recorded. Data were analyzed using SPSS version 20.

Result: Out of 149 pregnant women, 9 patients were diagnosed as gestational diabetes mellitus during the period of study. The prevalence of gestational diabetes mellitus was 6.04% in this cross-section study.

Conclusion: Screening of Diabetes mellitus in the Second trimester of pregnancy is an important investigation to be done to prevent the mother and the fetus from many upcoming complications of diabetes. The selective GCT screening strategy was highly effective and revealed 6.04% of GDM prevalence.

Keywords: Gestational diabetes mellitus, 50-g glucose challenge test, Prevalence, oral glucose tolerance test.

INTRODUCTION

Background

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels [1].

In 1997, ADA issued new diagnostic and classification criteria [2]; in 2003, modifications were made regarding the diagnosis of impaired fasting glucose (IFG) [3]. The classification of diabetes includes four clinical classes.

- Type 1 diabetes (results from β-cell destruction, usually leading to absolute insulin deficiency)
- Type 2 diabetes (results from a progressive insulin secretory defect on the background of insulin resistance)
- Other specific types of diabetes due to other causes, e.g., genetic defects in β-cell function, genetic defects in insulin action, diseases of the exocrine pancreas (such as cystic fibrosis), and drug or chemical induced (such as in the treatment of AIDS or after organ transplantation)
- Gestational diabetes mellitus (GDM) (diagnosed during pregnancy) [3]

Gestational diabetes mellitus (GDM) is defined as any degree of glucose intolerance with onset or first recognition during pregnancy [4]. GDM increases the risk of adverse maternal and perinatal outcome and also increases risk of future diabetes to the mother and their child [5]. The major morbidities associated with infants of diabetic mothers include respiratory distress, growth restriction, polycythemia, hypoglycemia, hypocalcemia, and hypomagnesemia, and congenital malformations [6]. Perinatal outcomes associated with poor glycemic control in mothers are associated with as high as 42.9% mortality [7].

Women with GDM are up to six times more likely to develop type 2 diabetes than women with normal glucose tolerance in pregnancy [8,9]. Children of women with GDM are more likely to be obese and have IGT and diabetes in childhood and early adulthood [10,11].

GDM prevalence varies widely depending on the population studied, age, and the diagnostic test employed. In Turkey, the prevalence ranges from 1.2% to 4.48% according to the criteria of NDDG and C&C [12]. In 2019-2021, the pooled global standardized prevalence of GDM was 14.0 %. The regional standardized prevalence of GDM was 7.1% in North America and Caribbean, 7.8% in Europe, 10.4% in South America and Central America, 14.2% in Africa, 14.7% in Western Pacific, 20.8% in South-East Asia and 27.6% in Middle East and North Africa. The standardized prevalence of GDM in low-, middle- and high-income countries were 12.7%, 9.2% and 14.2% respectively [13]. The prevalence may range from 1-14% of all pregnancies [14]. A study from Nepal found that 3.67% of pregnancies had positive screening test values and 0.66% were diagnosed having Gestational Diabetes [15].

The main aim of our study is to observe the feasibility of using the 50gm GCT (glucose challenge test) for all the pregnant women attending UCBMSH, obstetric OPD, to determine the prevalence of GDM in pregnant women and to observe the maternal and fetal outcome among those having an elevated GCT level and gestational diabetes.

Statement of problem

Gestational diabetes is a significant problem in the United States, occurring in about 7% of all pregnancies [16]. However, gestational diabetes has been found in up to 14% of all pregnancies [17]. Recently, it has been documented that there are more than 200,000 pregnancies that are complicated by gestational diabetes each year [16]. Also, there was a 122% increase in the prevalence of gestational diabetes between 1989 and 2004 [18]. Other studies have shown an increase in gestational diabetes between 16% and 127% in different races over the past 20 years [19]. The increase in gestational diabetes may be attributed to a modification in the diagnosis standards. These modifications include an increase in the number of women screened for gestational diabetes and the lowering of the plasma glucose threshold needed to make a diagnosis of gestational diabetes. However, with such a large increase in the prevalence of gestational diabetes, the increase in obesity has been suggested as a valid reason for the increase in gestational diabetes [19].

People suffering from diabetes, in urban areas are more than that in the rural area. In a developing country like India due to proper lack of resources and clinical investigation, the pregnant women have to bear serious consequences putting their life at a stake. Initiatives have to be taken for the pregnant women for proper investigation for the type of screening that would identify the disease on time. Thus, help to save the lives of two. The nutritional status of women must be checked; particularly those of childbearing age and correlate with GDM [20]. Reports claim that 40-66% of

early pregnancy can detect GDM; however conflicting studies on glucose screening made it difficulty in detecting GDM on time [21].

MATERIALS & METHODOLOGY

The present study was a hospital-based cross-sectional study and the target population was a pregnant woman of reproductive age (15-49 years) visiting the antenatal clinic at UCBMSH. The study population was pregnant women between 24 and 28 weeks of gestation who are coming to the UCBMSH for their antenatal check-ups. All the population attending UCBMSH will be studied, that will meet the inclusion criteria will be enrolled in the study. The entire research project is expected to be completed within 8 months 2021 October- to 2022 May. Non-probability convenient sampling technique will be used in the study.

Sample collection

After taking consent from the participants, about 5ml of venous blood sample will be collected from patients using aseptic technique into a clot activator tube (Yellow capped vial). The serum sample will be separated by centrifugation and utilized for analysis of different parameters. The test GCT and OGTT is measured by The Dimension® RxL Max® Integrated Chemistry System.

Diagnostic criteria used

We depend on the method adopted by the UCBMS hospital for screening GDM. All pregnant women of gestation age between 24 and 28 weeks have to go for 50gm GCT. If the result of GCT ≥ 140mg% then had to undergo 100 gm OGTT & plasma glucose is estimated at 0,1,2 and 3 hours. The GDM was diagnosed after performing OGTT based on Carpenter-Coustan criteria. According to CC criteria if any 2 values meet or exceed FPG > 95 mg/dl, 1 hr. PG > 180 mg/dl, 2 hr. PG > 155 mg/dl and 3 hr. PG > 140 mg/dl.

Each sample will be encoded with identification number. Findings will be entered manually into database. Analysis will be done by using tools of SPSS 20.

RESULTS

Table 1: Age distribution among pregnant women (n=149)

Variables	Frequency	Percentage (%)
Age group		
≤19 years	8	5.4
20-24 years	49	32.9
25-29 years	56	37.6
30 and above	36	24.2
Median (IQR) = 26(7) , Min/Max = 18/38		

In this study 149 out-patient pregnant women were enrolled from department of Obstetrics and Gynecology, UCBMSH. The overall median (IQR) age of pregnant women in this study was 26 (7) year. Among them, teenagers age group were 8 (5.4%), young adult age group were 49 (32.9%), and the age group between 25-29 and 30 & above were 56(37.6) & 36(24.2) respectively with minimum and maximum range was 18 & 38 respectively **(Table 1)**.

Table 2: Association between GCT status and some independent variables among pregnant women (n=149)

Variable	GCT status		χ^2
	Normal (%)	Abnormal (%)	P-value
Body Mass Index			
Normal	29(72.5)	11(27.5)	0.735
Others	82(75.2)	27(24.8)	
Age group			
<=25	48(82.2)	9(15.8)	**0.032****
Above 25	63(68.5)	29(31.5)	
Parity			
Primiparous	35(67.3)	17(32.7)	0.140
Others	76(78.4)	21(21.6)	
History of past illness			
Yes	9(52.9)	8(47.1)	**0.030****
No	102(77.3)	30(22.7)	
History of diabetes			
Yes	38(77.6)	11(22.4)	0.549
No	73(73.0)	27(27.0)	

*** Significant association*

Among 149 study population, 29(72.5%) have normal BMI and others have 82(75.2%). The normal age group less than equal to 25 was 48(82.2%) & above 25 was 63(68.5%). The study population includes 35(67.3%) normal primiparous and 76(78.4%) others. Among them 9(52.9%) women gave the history of past illness & 102(77.3) had no history of past illness. Women gave the history of diabetes mellitus in their family was 38(77.6%), whereas 73(73.0%) had no history of diabetes in their family. Age group and history of past illness in association with GCT status were found statistically significant & Others were not statistically significant. **(Table 2**).

Table 3 : Descriptive analysis of Glucose tolerance test among pregnant women (n=149)

Test	Mean ± SD	Min/Max	Normality test
GCT	152 (22)**	141/301	Not normal
FBG	86.7 ±5.7	78/96	Normal
OGT1 Hrs.	173.3 ± 33.6	122/228	Normal
OGT2 Hrs.	142.3 ± 27.7	89/184	Normal
OGT3 Hrs.	100 ± 29.6	43/152	Normal

*** denotes Median (IQR), SD denotes standard deviation*

Normality test was done shapiro wilk test at 5% level of significance

Among the study population, the mean Fasting blood glucose level, oral glucose tolerance test after one hours, two hours and three hours was 86.7±5.7, 173.3±33.6, 142.3±27.7 and 100±29 with minimum & maximum range of 78/96, 122/228, 89/184 and 43/152 respectively. Except GCT all follows normality test in which the median of GCT was 152(22) with minimum and maximum range 141/301 **(Table 3)**.

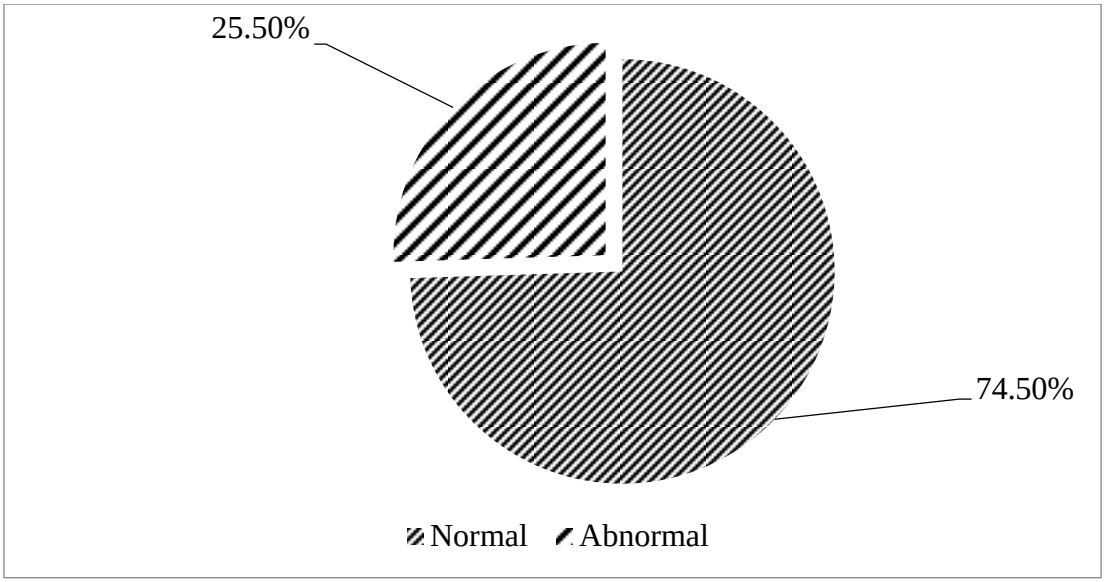

Figure 1 : Level of GCT status values among pregnant women attending UCBMSH (n=149)

Among the 149 study population, according to Carpenter and Coustan Criteria the level of normal & abnormal GCT among pregnant women attending UCBMSH was 111(74.50%) & 38(25.50%) respectively **(Fig 2)**.

Table 4 : Comparative study of blood sugar level between Normal and OGTT patients of 1,2, and 3 hours respectively

		OGTT		
	FBG	**1hrs**	**2hrs**	**3hrs**
Normal	22	12	15	21
Abnormal	1	11	8	2

Among 149 study population, only 23 have done OGTT in which normal and abnormal fasting blood glucose was 22(95.70%) & 1(4.30%), OGTT after 1hrs. was 12(52.20%) & 11(47.80%), after 2hrs. was 15(65.20%) & 8(34.80%) and after 3hrs. was 21(91.30%) & 2(8.70%) respectively **(Table 4)**.

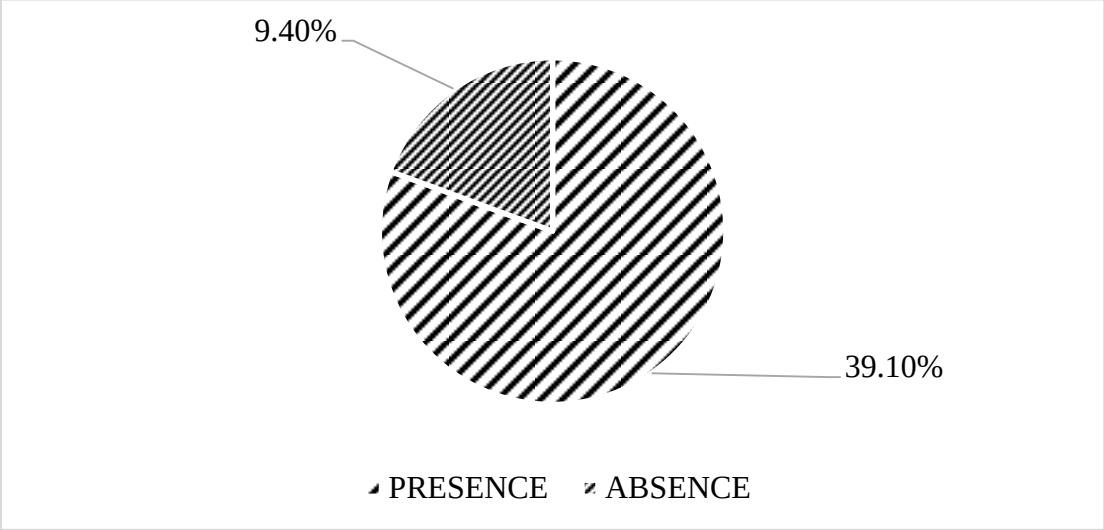

Figure 2: Status of GDM among pregnant women who have done OGTT test at UCBMSH (n=23)

Among 149 study population, only 38 pregnant women have abnormal GCT in which only 23 have done OGTT test. Among 23 population the presence of and absence of GDM was found 9(39.10%) & 14(60.9%) respectively. The prevalence of GDM among 149 population was found to be 9(6.04%) **(Fig 2)**.

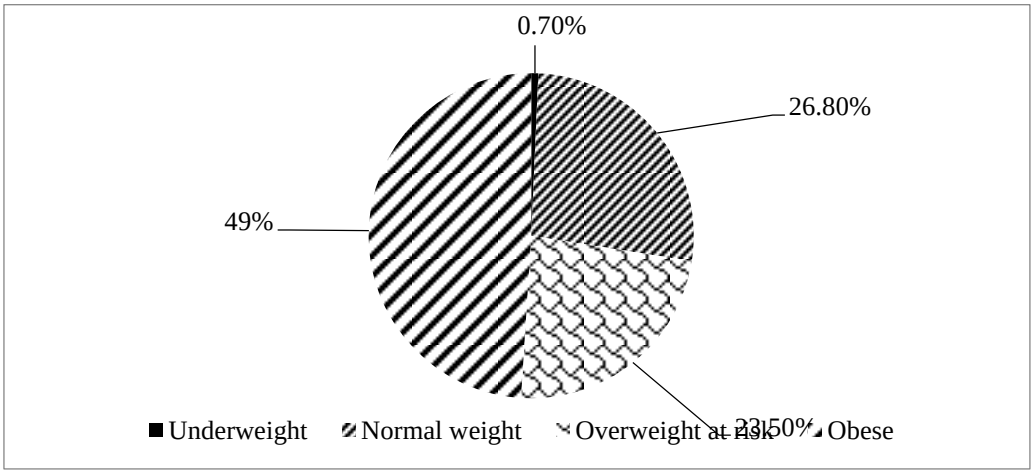

Figure 3 : Current status of BMI category among pregnant women attending at UCBMSH (n=149)

Among the study population the mean±*SD* of BMI was 25.51±4.98. The study population includes 1(0.70%) underweight, 40(26.8%) normal weight, 35(23.50%) Overweight at risk and 73(49%) Obese **(Fig 3)**.

Table 5: Association between GDM status and some independent variables among pregnant women attending UCBMSH (n=23)

Variable	GDM status		fisher exact test P-value
	Presence (%)	Absence (%)	
Body Mass Index			
Normal	1(16.7)	5(83.3)	0.340
Others	8(47.1)	9(52.9)	
Age group			
<=25	3(60.0)	2(40.0)	0.343
Above 25	6(33.3)	12(66.7)	
Parity			

Primiparous	4(40.0)	6(60.0)	1.000
Others	5(38.5)	8(61.5)	
History of past illness			
Yes	2(40.0)	3(60.0)	1.000
No	7(38.9)	11(61.1)	
FH of diabetes			
Yes	1(43.3)	6(85.7)	0.176
No	8(50.0)	8(50.0)	

Among 23 study population, 1(16.7%) have normal BMI and others have 8(47.1%). The age group less than equal to 25 was found 3(60.0%) & above 25 was found 6(33.3%). The study population includes 4(40.0%) normal primiparous and 5(38.5%) others. Among them 2(40.0%) women gave the history of past illness & 7(38.9%) had no history of past illness. Women gave the history of diabetes mellitus in their family was 1(43.3%), whereas 8(50.0%) had no history of diabetes in their family. GDM status with others independent variable were not statistically significant using fisher exact test **(Table 5**).

CONCLUSION

In our cross-sectional study of 149 subjects according to Carpenter and Coston Criteria GCT followed OGTT in pregnant women attending UCBMSH, the overall prevalence of GDM was found to be 9(6.04%).

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Conflicts of interest

The authors declared no conflicts of interest.

Ethical approval

Ethical approval was obtained from the Institutional Ethical Committee (IEC) of Uttaranchal P.G College of Biomedical science and hospital Dehradun, Uttarakhand, India.

Author Contribution

All authors contributed equally and significantly to this paper. All authors have read and approved the final version of the manuscript

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