The usefulness of glycated hemoglobin (HbA1c) in the detection of Diabetes Mellitus

Abstract:

Background:*Health conditions like Diabetes mellitus sometimes affects serious to health due to unavailability of accurate check. But with advancements of diagnostics test like glycated hemoglobin (HbA1c) can save many lives to detect Diabetes Mellitus****.*

Objective: *In this study our main goal is to evaluate the accuracy of glycated hemoglobin (HbA1c.) in the diagnosis of Diabetes Mellitus.*

Methods: *The Tertiary Medical College, Bangladesh, outpatient department (OPD) conducted this cross-sectional study. Where information was gathered between January 2019 and January 2020.*

During the research, a total of 100 individuals were enrolled with contemporaneous FPG, OGTT and A1c findings and diabetes mellitus suspicion. Purposive sampling was used to acquire the samples according to the inclusion criteria.

Results: *Most of the patients in the research were aged 47 to 57. 30.8% of the population and the majority (60%) were male. 71% of diabetes patients were identified alone by A1c, followed by 66% by 2h OGTT, and 43% of diabetic patients were diagnosed solely by fasting plasma glucose (FPG). IFG was found in 58% of the patients, whereas OGTT found IGT in 20% of the patients, and A1c found IGT in 24% of the patients. The difference between A1c and OGTT in diagnosing glucose intolerance was statistically significant (P 0.0001).*

Conclusion: *This study's findings support the use of HbA1c as a screening tool for type 2 diabetes. Increasing access to diabetes care in Bangladesh may be made easier by using the HbA1c test, which is less onerous for patients than either FPG or oral glucose tolerance testing.*

Keywords: *glycated hemoglobin (HbA1c.), Diabetes Mellitus, fasting blood glucose****.***

Introduction

Over the next two decades, the number of diabetics will rise by around 7 million each year, from 285 million to 438 million. An FPG and 75-gram oral glucose tolerance test are currently required for the diabetes diagnosis. Acute glucose fluctuations and short-term lifestyle changes may affect the findings of these tests, which take a long time and involve fasting. [1-2] An HbA1c level greater than 6.5% indicates diabetes, while a level of 6.06.4 percent indicates "high risk" of developing the disease. The WHO's revised diagnostic guidelines are based on HbA1c levels. [3]

The American Diabetes Association (ADA) therefore suggested an A1c of 6.5 percent for the diagnosis of diabetes and 5.76.4 percent for those with the highest risk of getting the condition. 4 6.5 percent was proposed as a diagnostic criterion based on the risk of retinopathy at varied HbA1c levels. [5]

After collection, HbA1c tests are relatively stable at room temperature and well standardized, with little intra-individual variation. They are there whenever you want them, and no special preparation is needed on your part. [6] It's unclear whether this new criterion is right, and experts say it still hasn't been adopted by the global community. [7]

The major objective of this research is to determine the accuracy of glycated hemoglobin (HbA1c) in the diagnosis of DM.

Objective

General objective:

- To assess the efficacy of HbA1c for the detection of DM.

Specific objective:

- Clinical status of DM patients.
- To evaluate the accuracy of oral glucose tolerance test (OGTT) to diagnosis of DM.

Methodology

The Tertiary Medical College, Bangladesh, outpatient department (OPD) conducted this cross-sectional study. Where information was gathered between January 2019 and January 2020.

During the research, a total of 100 individuals were enrolled with contemporaneous FPG, OGTT and A1c findings and diabetes mellitus suspicion. Purposive sampling was used to acquire the samples according to the inclusion criteria.

All data were coded and entered into SPSS-25 for further analysis. The statistics used were both descriptive and inferential. Statistics used to describe data included frequency distribution, percent, mean, and standard deviation; graphs; tables; and figures; and inferential statistics.

Results

In table-1 shows age distribution of the study group where most of the patients were belong to 47-57 years. 30.8%.Mean ± SD of the age was **48±12.90** years. The following table is given below in detail:

Table-1: Age distribution of the study group

Age group	Percent
25-35 years	23.1
36-46 years	19.2
47-57 years	30.8
58-68years	19.2
>68years	7.7
Total	100

In figure-1 shows gender distribution of the patients wheremale percentage were higher than female. The following figure is given below in detail:

Comment [PERI1]: What inclusion criteria should be used?

Comment [PERI2]: Please explain the statistical test used to test the hypothesis to get the p value

Comment [PERI3]: How is the age group divided? What guidelines do you use for age categorization?

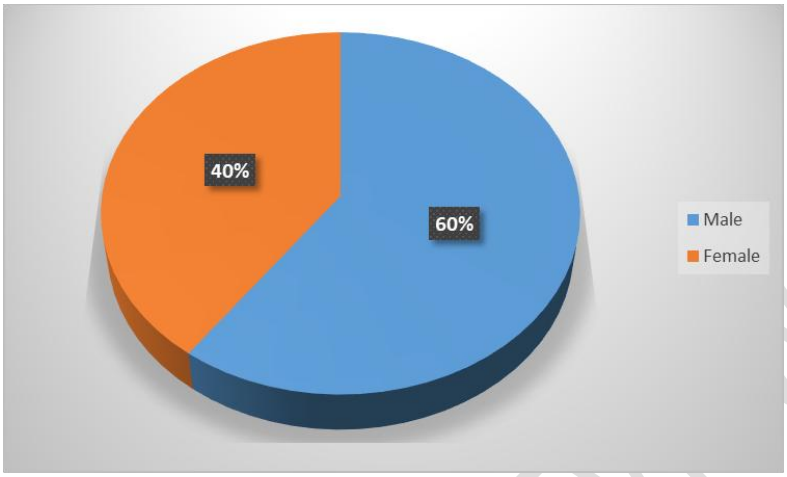

Figure-1: Gender distribution of the patients.

Table 2 illustrates the prevalence of diabetes according to diagnostic criteria, with 71% diagnosed alone by A1c, 66% diagnosed solely by 2h OGTT, and 43% diagnosed solely by FPG. If FPG is greater than 125mg/dl, then you are in the early stages of diabetes. If 2h-OGT is above 200 mg/dL, then you are in the advanced stages of diabetes. If your HbA1c is greater than 6.5 percent, then you are diabetic. If your IFG is greater than 7mmol/l, then you are diabetic. If your IGT 2-h OGTT is less than 200 mg/dL, then you are diabetic.
The following table is given below in detail:

Table-2: Percentage of diabetes on the basis of diagnostics criteria (N= 100)

	Diabetes, %	Non diabetics, %	P value
FPG	43	57	<0.05
2-h OGTT	66	46	
HbA1c	71	29	
IFG	58	42	<0.05
IGT 2-h OGTT	20	80	
IGT HbA1c	24	76	
IFG	61	39	<0.05
IGT 2-h OGTT	25	75	
IGT HbA1c	55	45	

As shown in Table 3, the distribution of all diabetes patients is based on FBG, 2-H OGTT, and HbA1c, and the difference between A1c and OGTT is statistically significant (P 0.0001).
The following table is given below in detail:

Table-3: Distribution of FBG, 2-H OGTT and HbA1c status in DM patients.

	Fasting blood Glucose mg/dL		2- h OGTT mg/dL		
	< 126	**≥ 126**	**< 140**	**140-200**	**>200**
A1C < 6.5	80%	65%	85%	20%	75%
A1C < 6.5	20%	35%	15%	80%	25%

Discussion

The broad adoption of hemoglobin A1c testing for diabetes diagnosis, according to a group of international diabetes specialists, should be the new "gold standard" for diabetes diagnosis. Diabetic issues may now be recognized early. [8] It's more convenient in regular clinical practice than the OGTT since it has less inter-individual variance and doesn't need fasting or food preparation. The World Health Organization's diabetes experts have endorsed the use of A1c as a diagnostic tool. [9]

Our results show that the A1c criteria has more diagnostic power than the FPG and the 2-hour OGTT. FPG and OGTT have poorer sensitivity, failing to detect 46% of diabetic individuals and 29% of those with prediabetes, respectively.

Out of the 100 patients examined, 58 percent had IFG, 20 percent had IGT after an OGTT, and 24 percent had IGT based on A1c, according to our research. One study revealed that HbA1c had high validity for detecting FPG-defined diabetes, with an AUROC curve of 0.92, which backed up our findings (95 percent CI 0.90 to 0.94). When HbA1c was less than 6.5% (140 mg/dL), sensitivity was 78.7% and specificity was 94.0%. [10]

Since short-term changes in medical problems such blood glucose levels after meals don't affect HbA1c as much, it's a better option.

As a result, it's clear that utilizing the A1c criterion can lead to lower rates of undiagnosed and total diabetes as well as diabetes risk than using prevalence estimates based on FPG or 2h glucose.

As previously stated, early detection and good treatment are important in preventing or delaying the chronic consequences of diabetes.

Diagnosing diabetes alone using FPG or OGTT might lead to numerous false negatives, which may raise the risk of diabetic complications. The diabetes epidemic has resulted in shorter life spans and higher mortality rates. [11]

Despite considerable advancements in hyperglycemia treatment, blood glucose monitoring, and glycemic control indicators, the majority of diabetic patients still suffer from severe vascular problems. [12] The ACCORD trial results also raise the question of whether or not extremely stringent glucose control is helpful to all diabetics, with ACCORD indicating that extremely rigorous glucose control increased mortality among type 2 diabetics with a high mortality risk. [13]

Conclusion

This study's findings support the use of HbA1c as a screening tool for type 2 diabetes. Increasing access to diabetes care in Bangladesh may be made easier by using the HbA1c test, which is less onerous for patients than either FPG or oral glucose tolerance testing.

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