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Research Article

**GLYCATED HEMOGLOBIN (HbA1c) AS A DIAGNOSTIC
MARKER FOR DIAGNOSIS OF DIABETES**DR. SHABBIR AHMAD WATTO¹, DR. RANA SAJID ALI KHAN², DR. TAHREEM MAQSOOD³

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Abstract:

Glycated hemoglobin (glycohemoglobin, HbA1c, hemoglobin A1c, A1c, or less commonly HbA1c, HgbA1c, Hb1c, etc.) is a form of hemoglobin (Hb) that is chemically linked to a sugar. Most monosaccharides, including glucose, galactose and fructose, spontaneously (i.e. nonenzymatically) bond with hemoglobin, when present in the bloodstream of humans. This crosssectional study was conducted among the patients presenting in the medical outdoor department of different hospitals. Name, age, gender and HbA1c levels were noted on a predefined proforma. All the data was entered and analyzed with SPSS Ver. 23.0. The quantitative variables were presented as mean and standard deviation. The qualitative variables were presented as frequency and percentages. A total of 60 patients were included in this study i.e., 30 males (50%) and 30 females (50%). The mean age of the patients was 34.32±5.50 years. Out of 60 patients, five patients had HbA1c values of >6.5% and the patients were labelled as diabetic.

Keyword: Glycated Hemoglobin (Hba1c)**Corresponding author:**

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INTRODUCTION:

Glycated hemoglobin (glycohemoglobin, HbA1c, hemoglobin A1c, A1c, or less commonly HbA1c, HgbA1c, Hb1c, etc.) is a form of hemoglobin (Hb) that is chemically linked to a sugar. Most monosaccharides, including glucose, galactose and fructose, spontaneously (i.e. non-enzymatically) bond with hemoglobin, when present in the bloodstream of humans. However, glucose is less likely to do so than galactose and fructose (13% that of fructose and 21% that of galactose), which may explain why glucose is used as the primary metabolic fuel in humans. The formation of the sugar-hemoglobin linkage indicates the presence of excessive sugar in the bloodstream, often indicative of diabetes. A1C is of particular interest because it is easy to detect. The process by which sugars attach to hemoglobin is called glycation. HbA1c is a measure of the beta-N-1-deoxy fructosyl component of hemoglobin. A1c is measured primarily to determine the three-month average blood sugar level and can be used as a diagnostic test for diabetes mellitus and as an assessment test for glycemic control in people with diabetes. The test is limited to a three-month average because the average lifespan of a red blood cell is four months. Since individual red blood cells have varying lifespans, the test is used as a limited measure of three months. Normal levels of glucose produce a normal amount of glycated hemoglobin. As the average amount of plasma glucose increases, the fraction of glycated hemoglobin increases in a predictable way. In diabetes, higher amounts of glycated hemoglobin, indicating poorer control of blood glucose levels, have been associated with cardiovascular disease, nephropathy, neuropathy, and retinopathy. Glycated hemoglobin is preferred over glycosylated hemoglobin to reflect the correct (non-enzymatic) process. Early literature often used glycosylated as it was unclear which process was involved until further research was performed. The terms are still sometimes used interchangeably in Englishlanguage literature. The naming of HbA1c derives from Hemoglobin type A being separated on cation exchange chromatography. The first fraction to separate, probably considered to be pure Hemoglobin A, was designated HbA0, and the following fractions were designated HbA1a, HbA1b, and HbA1c, in their order of elution. Improved separation techniques have subsequently led to the isolation of more subfractions (1-3). The objective of this study was to see the prevalence of diabetes by taking the levels of HbA1c among the patients presenting in the medical outdoor department.

MATERIAL AND METHODS:

This cross-sectional study was conducted among the patients presenting in the medical outdoor department of different hospitals. Name, age, gender and HbA1c levels were noted on a predefined proforma. All the data was entered and analyzed with SPSS Ver. 23.0. The quantitative variables were presented as mean and standard deviation. The qualitative variables were presented as frequency and percentages.

RESULTS:

A total of 60 patients were included in this study i.e., 30 males (50%) and 30 females (50%). The mean age of the patients was 34.32 ± 5.50 years. Out of 60 patients, five patients had HbA1c values of $>6.5\%$ and the patients were labelled as diabetic.

DISCUSSION:

The 2010 American Diabetes Association Standards of Medical Care in Diabetes added the $\text{HbA1c} \geq 48$ mmol/mol (≥ 6.5 DCCT %) as another criterion for the diagnosis of diabetes. Glycated hemoglobin testing is recommended for both checking the blood sugar control in people who might be prediabetic and monitoring blood sugar control in patients with more elevated levels, termed diabetes mellitus. For a single blood sample, it provides far more revealing information on glycemic behavior than a fasting blood sugar value. However, fasting blood sugar tests are crucial in making treatment decisions. The American Diabetes Association guidelines are similar to others in advising that the glycated hemoglobin test be performed at least twice a year in patients with diabetes who are meeting treatment goals (and who have stable glycemic control) and quarterly in patients with diabetes whose therapy has changed or who are not meeting glycemic goals. Glycated hemoglobin measurement is not appropriate where a change in diet or treatment has been made within 6 weeks. Likewise, the test assumes a normal red blood cell aging process and mix of hemoglobin subtypes (predominantly HbA in normal adults). Hence, people with recent blood loss, hemolytic anemia, or genetic differences in the hemoglobin molecule (hemoglobinopathy) such as sickle-cell disease and other conditions, as well as those who have donated blood recently, are not suitable for this test. Due to glycated hemoglobin's variability, additional measures should be checked in patients at or near recommended goals. People with HbA1c values at 64 mmol/mol or less should be provided additional testing to determine whether the HbA1c values are due to averaging out high blood glucose (hyperglycemia) with low blood glucose (hypoglycemia) or the HbA1c is more reflective of an elevated blood glucose that does not vary much throughout the day. Devices such as continuous blood

glucose monitoring allow people with diabetes to determine their blood glucose levels on a continuous basis, testing every few minutes. The supplies tend to be expensive, since the sensors must be changed at least every 2 weeks. Another useful test in determining if HbA1c values are due to wide variations of blood glucose throughout the day is 1,5anhydroglucitol, also known as GlycoMark. GlycoMark reflects only the times that the person experiences hyperglycemia above 180 mg/dl over a two-week period (4-6).

REFERENCES:

1. Bunn HF, Higgins PJ (July 1981). "Reaction of monosaccharides with proteins: possible evolutionary significance". *Science*. 213 (4504): 222– 4. doi:10.1126/science.12192669. PMID 12192669.
2. McPherson JD, Shilton BH, Walton DJ (March 1988). "Role of fructose in glycation and cross-linking of proteins". *Biochemistry*. 27 (6): 1901– 7. doi:10.1021/bi00406a016. PMID 3132203.
3. Miedema K (2005). "Standardization of HbA1c and Optimal Range of Monitoring". *Scandinavian Journal of Clinical and Laboratory Investigation*. 240: 61–72. doi:10.1080/00365510500236143. PMID 16112961.
4. Use of Glycated Haemoglobin (HbA1C) in the Diagnosis of Diabetes Mellitus: Abbreviated Report of a WHO Consultation. Geneva: World Health Organization. 2011. p. 2, Glycated haemoglobin (HbA1c) for the diagnosis of diabetes. Retrieved 2 December 2018.
5. Oliwia Witzczak, Trine B. Haugen (25 November 2014). "Glycated or glycosylated?". *Journal of the Norwegian Medical Association*. 134 (22): 2179. doi:10.4045/tidsskr.14.0172. PMID 25423986. Retrieved 5 December 2018. Hospitals should ensure that the correct term for HbA1c – glycated haemoglobin – is now to be found in laboratory manuals.
6. Peterson KP, Pavlovich JG, Goldstein D, Little R, England J, Peterson CM (1998). "What is hemoglobin A1c? An analysis of glycated hemoglobins by electrospray ionization mass spectrometry". *Clinical Chemistry*. 44 (9): 1951– 58. PMID 9732983.