

Patient's Name : Anita Sandhwar`  
Age/Sex : 59 Years /Female  
Referred by : C/o. Dr At Doorstep



Ref.No. : HL-10309-21  
Reg. Date : 15/09/2021 14:30  
Collection. Time : 15/09/2021

## Hb A1c - Fact file

Glycohaemoglobin is being used with increasing frequency to monitor long term blood glucose control and compliance in patient with diabetes mellitus. It provides an index of mean concentration of blood glucose ( eAG - estimated average glucose ) during the preceding two to three months. It complements more traditional measures of glucose control such as blood and urine glucose level.

The term " Glycohaemoglobin / Glycosylated haemoglobin / Hb A1c " refers to a series of minor haemoglobin components that are **stable adducts formed by haemoglobin with various sugars**. The reaction between haemoglobin and sugar is an example of a nonenzymatic condensation of glucose with free amino groups on the globin (NH<sub>2</sub> terminal valine of B chain ). The process is slow , continuous and irreversible.

Human erythrocytes are freely permeable to glucose , **Within each erythrocyte GHb is formed from haemoglobin at the rate which depends on the ambient concentration of glucose. Higher the prevailing ambient level of blood glucose , higher the GHb**

The level of Hb A1c at any point of time is contributed to by all circulating erythrocytes , from oldest ( 120 days ) to the youngest RBCs. Hence Hb A1c is a **" weighted average " of glucose during the preceding three months** , near preceding 30 days contributes substantially more to the level of Hb A1c than do glucose level 90 -120 days earlier..

**There is very predictable relationship between Hb A1c and eAG ( estimated average glucose / weighted average glucose ).**

A formula based on linear regression analysis sponsored by ADA , EASD , IDF is  $eAG ( mg / dl ) = ( 28.7 * Hb A1c ) - 46.7$  replacing the older one  $eAG ( mg / dl ) = ( 35.6 * Hb A1c ) - 77.3$  recommended by DCCT .

**Post lunch and bedtime glucose correlate well with Hb A1c** ( data of full 7 point glucose profile by capillary blood ). Fasting glucose correlates less well and with increasing Hb A1c and average glucose ( eAG ) from 7 point profile , it underestimate both the values.

Any cause of shortened red cell survival will reduce exposure of red cells to glucose with consequent decrease in GHb values e.g. haemolytic anaemias like Hb S , Hb C Harlem , Hb E , Hb D . Chronic blood loss , Acute recent blood loss , etc. A falsely low GHb test results are also be noted in c/o high Hb F samples . Thalassemia major , HPFH and othe conditions. ( Hb F > 10 % ) . Glycated Hb F is not detected by assay as it does not contain the glycated B chain that characterizes Hb A1c.

A falsely elevated GHb test results can be caused by " labile GHb " - an acutely generated reversible nonenzymatic linked glucose intermediary product present after heavy meal . Few medical condition may cause falsely elevated Hb A1c , like uremia , chronic excessive alcohol intake and hypertriglyceridemia. Thalassemia minor causing imbalance between the synthesis of a and b chain causes falsely elevated values. Chronic iron deficiency anaemia in which there is an increased erythrocyte life span can raise GHb falsely. Gestational diabetes may falsely increase or decrease Hb A1c Studies even relate Hb A1c values with temperature / seasonal variation . Values are higher in cooler months and lower in warmer months ( June - July ).

## IS SPECIFIC PATIENT PREPARATION IS NECESSARY ?

In any case , **no fasting sample is required at all . Avoid alcohol intake and heavy meal before the assay**

Hb A1c results are to be reported by clinical laboratories world wide in SI units ( mmol / mol - no decimals ) or derived NGSP units ( % - one decimal ) . using IFCC - NGSP master equation,

An international expert committee that includes representatives from American Diabetes Association ( ADA ) , International

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Diabetes Federation ( IDF ) , and European Association for the Study of Diabetes ( EASD ) has **officially endorsed the Hb A1c as the Diagnostic test for the Diabetes . Cut off is  $\geq 6.5$**

#### WHY HB A1c IS CLINICALLY IMPORTANT

According to DCCT , a linear relationship is documented between the lowering Hb A1c / eAG and prevention of chronic complications . If Hb A1c is maintained at or about the upper level of normal , it can reduce app. 75 % retinal ( eye ) 60 % neuronal ( nervous system ) and 35 % renal ( kidney ) complications.

A reliable at-risk marker for assessing possible development of complications  
An excellent mean to assess , encourage and reinforce individual patient compliance  
An indicator for additional diagnostic tests such as Urine Microalbumin  
A meaningful Mean Blood Glucose ( MBG ) / estimated Average Glucose ( eAG ) relationship  
An useful method to judge the efficacy and effectiveness of intervention strategies.

#### WHAT ARE THE ADA RECOMMENDATIONS TO PREVENT COMPLICATED DIABETES

- \* Perform the A1c test at least two times a year in patient who are meeting treatment goals and have stable glycemic control
- \* Perform the A1c test quarterly in patient whose therapy has changed or who are not meeting glycemic control.
- \* Use of point-of-care testing for A1c allow for timely decisions on therapy changes when needed.

#### GLYCEMIC GOAL IN ADULT BY ADA.

To reduce microvascular and neuropathic complications of type 1 and type 2 diabetic patients - **below or around 7 %**

#### REFERENCES ( Data published by )

1. American Diabetic Association ( ADA )
2. Internationa Diabetic Federation ( IDF )
3. European Association for Study of Diabetes ( EASD )
4. American Association of Clinical Endocrinologist
5. National Glycohaemoglobin Standardization Programme ( NGSP )
6. Diabete Control and Complications Trial ( DCCT )
7. A Journal of Disease metabolism

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## PLASMA GLUCOSE / BLOOD SUGAR - URINE SUGAR ESTIMATION

TESTS	RESULTS	UNITS	BIOLOGICAL REF INTERVAL
<b>PLASMA GLUCOSE</b>			
PP2BS ( Postprandial blood sugar at 2 hrs )	240	mg / dl	Less than 145

## URINE ACETONE

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## URINE ANALYSIS

**SPECIMEN** : Random

### PHYSICAL EXAMINATION

### RESULT

### NORMAL

Quantity ( ml )	10	600 - 2500 / 24 hrs
Colour	Pale yellow	Pale yellow
Appearance	Clear	Clear
Reaction ( PH )	6.0	5.0 - 8.5
Sp. Gravity	#####	1.000 - 1.030

### CHEMICAL EXAMINATION

Protein	Absent	0 - 0.1 gm / 24 hrs
Sugar ( Glucose )	Absent	Absent
Ketone	Absent	Absent
Bilirubin	Absent	Absent
Urobilinogens	Normal	0 - 04 mg / 24 hrs
Bile Salts	Absent	Absent
Bile Pigments	Absent	Absent
Occult blood	Absent	Absent

### MICROSCOPIC EXAMINATION / HPF

Pus Cells	1 -- 2	0 - 1
Red Blood Cells	Absent	Absent
Epithelial Cells	1 -- 2	2 - 3
Casts ( / lpf )	Not seen	
Crystals	Not seen	

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