

## HbA1c IN DIABETIC PATIENTS: WHY IT IS IMPORTANT?

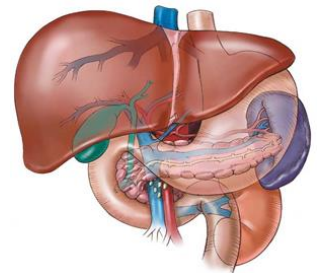


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In living beings, both humans and animals, energy is necessary for all bodily functions. This energy is obtained from the food we eat. As humans, about 80% of our food consists of carbohydrates in the form of starch and sugars. During digestion, starch and sugars are converted to glucose and get absorbed into the blood through the intestine. However, the level of glucose in the blood is maintained at a particular level by a very delicate mechanism which is controlled mainly by two organs in the body, viz. the pancreas and the liver.

The pancreas is the organ dealing with glucose control in the body by producing the hormone insulin, in certain specialized cells known as  $\beta$  cells (Beta cells), another specialized type cells known as  $\alpha$  cells (Alpha cells) produce the hormone known as Glucagon which

acts in a way contrary to insulin. Insulin is produced in response to the level of glucose in the blood after meals. This hormone by acting in the liver and various other sites in the body keep the blood glucose at the normal level of 70 - 120 mg/dl.



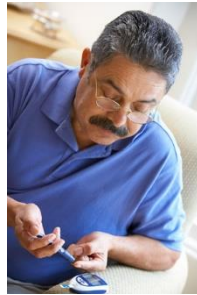
The excess glucose in the blood is stored in the liver and other organs as reserves, to be used whenever required. When the blood glucose level is low Glucagon is produced by the ' $\alpha$  cells' in the pancreas to convert the glycogen and fat in the reserves to glucose, to maintain the normal blood glucose level. Whenever there is any problem in the production of insulin in the pancreas, or any problem in the proper functioning of insulin which is produced, the disease Diabetes results. There are three (3) main types of Diabetes recognized in humans.

- (1) Type 1 Diabetes (insulin dependent diabetes)
- (2) Type 2 Diabetes (Diabetes mellitus)
- (3) Gestational Diabetes (Diabetes in pregnancy)

👑 In Type 1 Diabetes, the particular  $\beta$  cells which produce insulin in the pancreas, gets destroyed gradually after birth or sometimes later and there is no production of insulin. The reason for this occurrence is not fully understood. However, the condition can occur in about 3 - 5% of live births in the population. These children (patients) will have to depend on insulin from outside for their survival.



👑 In Type 2 Diabetes, the insulin producing cells in the Pancreas function normally but the amount of insulin is not sufficient or the Insulin does not function properly. The disease occurs during adult life and is spreading like an epidemic in the world today. Many reasons for the occurrence of the disease are known and it could be avoided largely.



👑 Gestational diabetes (GDM) occurs during pregnancy and disappears after the birth of the child. This type of diabetes could occur about once in 25 pregnancies or 4% of pregnancies in the population. The condition could lead to problems like development of



of overweight/deformed babies and difficulties during delivery. However, the mother and the child could develop Type 2 diabetes later in life.

Hemoglobin in our blood corpuscles has many functions, of which the most important is the transport of Oxygen from the lungs to all organs in the body for their vital functions. In a healthy person new blood cells (red blood corpuscles) are continuously produced in the bone marrow and some other organs in the body as a normal function. However, when the hemoglobin in the red blood cells is exposed to glucose in the plasma a certain change known as **glycosylation** or **glycation** takes place and this amount could be measured. The higher the concentration of glucose in the plasma or longer the blood corpuscles are exposed to higher glucose levels, more glycosylation of hemoglobin take place. This can happen in all three types of Diabetes. The life span of a red blood corpuscle in a normal person without any blood disease is about 120 days. The Hemoglobin component in the blood can be divided into many parts, of which the main ones and their average concentration are given below. When the 'A' portion in the hemoglobin is glycosylated it is referred to as 'A1'.

Blood glucose level (BGL) in patients with diabetes is assessed either by measurement of blood glucose directly, or by measuring the glycosylated hemoglobin 'HbA1c' in the blood.

Measurement of blood glucose directly will give the amount of glucose in the blood at the time the blood

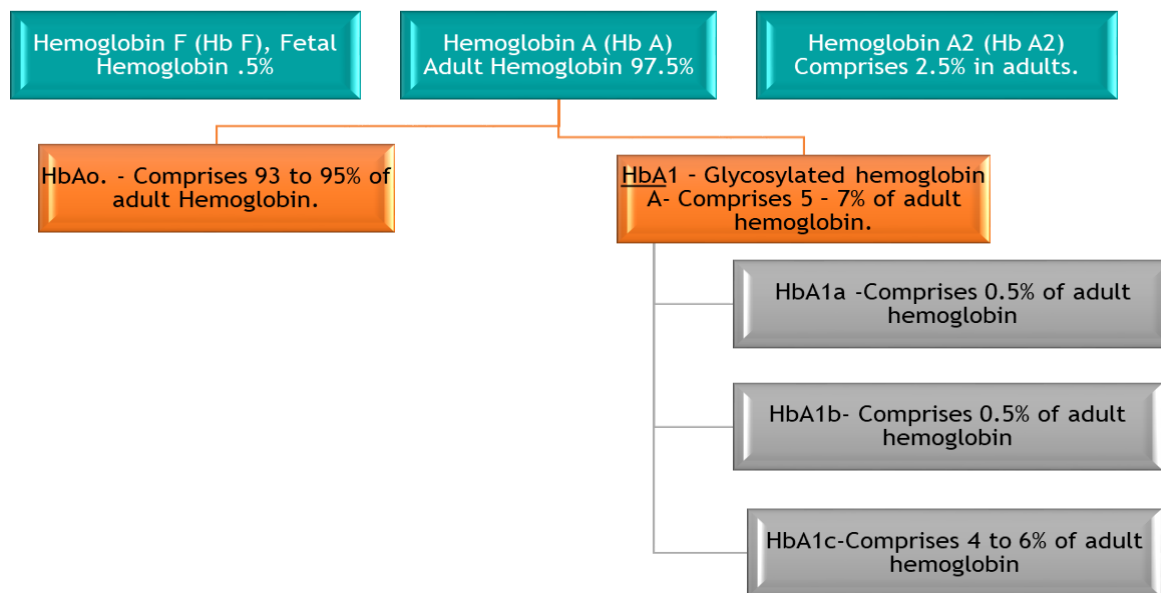


is taken and it will be related to meals. It can be high, shortly after a meal or may be low few hours after the meal or when a person is hungry. However, the HbA1c value which results due to the changes which occur in

the hemoglobin in the blood of a person with diabetes reflects the average daily blood glucose (sugar) level

during the last 8 - 12 weeks. Also, blood for this test could be drawn at any time irrespective of the meals.

**In a normal person without any diabetes or blood diseases, the Hemoglobin in the blood cells is made up of 3 main varieties of hemoglobins:**



Longer the micro vascular tissues in the kidneys, retina of the eye, peripheral vascular system and practically all the other organs in the body are exposed to higher glucose concentrations more and more damage could occur. Some of these damages are irreversible.

Glycosylated or Gyrated hemoglobin is progressively formed as hemoglobin in the red blood cells get exposed to glucose in the plasma. Glycosylated hemoglobin known as HbA1 comprises of 3 sub-sections HbA1a, HbA1b and HbA1c. HbA1 and its sub-fractions can be measured by various laboratory methods, but generally only HbA1c is reported. It has been proved that there is a very close relation between the micro vascular complications and the

level of glycosylated hemoglobin in people with Type 1 and Type 2 diabetes. Clinicians use this HbA1c value results to assess the risks to micro vascular systems mainly in the kidneys, retina and peripheral blood vessels to avoid complications by improving the glycemic control.

The blood glucose level taken 8 - 10 hours after last meal (dinner) is known as the Fasting Blood Sugar (FBS). In a normal person or in a diabetic patient whose disease is well controlled either by lifestyle modification or medications or a by a combination of both, the FBS value should be 70 - 110 mg/dl and the HbA1c value should be below 6.5 mg/dl.

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