



Pediatric Diabetes Program

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Hemoglobin A1c

Hemoglobin A1c (HbA1c) Blood Test

The HbA1c blood test – also called glycosylated hemoglobin, glycohemoglobin or A1c, estimates the average blood sugar over the previous 2-3 months.

What does the A1c test measure?

Normally, some of the glucose (sugar) in the bloodstream attaches itself to proteins in our body. Hemoglobin, which is part of our red blood cells, is one of those proteins. This process is called glycosylation and is permanent. Once the sugar is attached to the hemoglobin, it stays there for the life of the red blood cell, which is about 100 days (3 months). The higher the level of blood sugar, the more sugar attaches to hemoglobin and the higher the percent of hemoglobin which is glycosylated (HbA1c). This is why the results are given as a percentage (for example. 7.5 %).

Why is this test performed?

The HbA1c test is a way to assess blood glucose control over time. It represents an “average” blood glucose level over the previous 100 days. However, it does not replace the need for home blood glucose monitoring on a daily basis.

What should the Hemoglobin A1c be?

Normal ranges vary slightly depending on the laboratory being used. In general, the normal range of HbA1c is 4 % to 6 % in people without diabetes. However, in children with diabetes, we aim for a slightly higher level in order to keep a safety margin to avoid hypoglycemia.

The American Diabetes Association (2009) has set age appropriate targets for HbA1c, which include:

Child's Age (in years)	Blood glucose goal range	A1c
Toddlers and Preschoolers (0 – 6 years)	100 - 200	under 8.5% (but over 7.5%)
School Age (6 – 12 years)	90 - 180	under 8 %
Adolescents and Young Adults (13 years – 19 years)	90 - 150	under 7.5 %
Adults	80 - 150	under 7 %

What if my HbA1c is out of target range?

An elevated HbA1c suggests that the average blood sugar levels are too high, which increases the risk of the long term complications of diabetes such as eye, kidney, nerve and heart disease. These

problems develop slowly over time. Each 1 percent reduction in the HbA1c reduces the risk of complications by up to 30 percent. In adults with diabetes, HbA1c levels < 7 % dramatically reduces the risk of complications. If the HbA1c falls below the target range, there may be increased frequency or severity of low blood sugar reactions and insulin dosing adjustments may be necessary.

How often should the test be done?

Generally, the HbA1c test is performed every three months. The HbA1c test can be done in the UCSF Pediatric diabetes clinic by using a fingerstick blood sample or the test can be performed in the lab by doing a blood draw from a vein.

Following is a chart showing the HbA1c (%) and the corresponding Estimated Average Blood Glucose (eAG). This chart will give you an estimation of your average blood sugar over the previous three months.

A1c vs Equivalent Average Glucose Values

BG (mg/dL) = [A1C (%) × 28.7] - 46.7			
A1C (%)	Average Glucose (mg/dL)	A1C (%)	Average Glucose (mg/dL)
5.0	97	9.6	229
5.2	102	9.8	235
5.4	108	10.0	240
5.6	114	10.2	246
5.8	120	10.4	252
6.0	125	10.6	258
6.2	131	10.8	263
6.4	137	11.0	269
6.6	143	11.2	275
6.8	148	11.4	280
7.0	154	11.6	286
7.2	160	11.8	292
7.4	166	12.0	298
7.6	171	12.2	303
7.8	177	12.4	309
8.0	183	12.6	315
8.2	189	12.8	321
8.4	194	13.0	326
8.6	200	13.2	332
8.8	206	13.4	338
9.0	212	13.6	344
9.2	217	13.8	349
9.4	223	14.0	355

Adapted from: A1C-derived average glucose study group (2008). *Diabetes Care*, 31(8), 1473-1478