

Quick Facts: HEMOGLOBIN VARIANTS



Hemoglobin, Hemoglobin Variants and the Prevalence of Common Variants

Hemoglobin molecules in red blood cells transport and distribute oxygen to cells throughout the body. Hemoglobin is composed of two portions – heme (iron component) and globin (protein chain). Hemoglobin variants occur when mutations in the globin genes result in changes in the globin protein chain. Hemoglobinopathy is the condition characterized by the presence of hemoglobin variants in the blood. The most common hemoglobin variants are HbS, HbC and HbE.

Hemoglobin Type	Prevalence
Hemoglobin S (HbS)	8.3% of African Americans 1% of Hispanics
Hemoglobin C (HbC)	2.3% of African Americans (West African descent)
Hemoglobin E (HbE)	30% of Southeast Asians
Hemoglobin D (HbD)	2% of North Indians and descendants from Pakistan and Afghanistan
Hemoglobin F (HbF)	1.5% of patients have a persistence of fetal hemoglobin ranging from 2-12% HbF ¹

How do Hemoglobin Variants Affect A1C Results?

There are a variety of methods used to measure A1C and most methods are susceptible to interference from variant hemoglobins such as HbS and HbC. This interference may cause an abnormally high or low A1C result.

When Should a Healthcare Provider Suspect that a Diabetic Patient has a Hemoglobinopathy?

Healthcare providers and clinical laboratories need to be aware of the effects of hemoglobin variants upon A1C test results. A healthcare provider should suspect the presence of a hemoglobinopathy if the blood glucose monitoring results have a low correlation with A1C results, the A1C result is different than expected, the A1C result is more than 15% or if a patient's A1C test result is radically different from a previous test result following a change in the method for measuring A1C.¹

Clinical Implications of Hemoglobinopathy

In patients with hemoglobinopathy, A1C testing may result in high or low readings that can lead to the over-treatment or under-treatment of their diabetes. Patients suspected of having a hemoglobinopathy should have at least one A1C test using an HPLC or boronate affinity methodology in order to rule out the presence of variant hemoglobins.² Further information regarding factors that influence A1C test results can be obtained from the National Glycohemoglobin Standardization Program (NGSP) website at <http://www.ngsp.org/prog/index.html>.

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Reference Articles

Smaldone A. Glycemic Control and Hemoglobinopathy: When A1C May Not Be Reliable. *Diabetes Spectrum* 21:46-49, 2008.

Sacks DB, Bruns DE, Goldstein DE, Maclaren NK, McDonald JM, Parrott M. Guidelines and recommendations for laboratory analysis in the diagnosis and management of diabetes mellitus. *Clin Chem* 48: 436-472, 2002.

Sacks D. Hemoglobin Variants and Hemoglobin A1C Analysis: Problem Solved? *Clin Chem* 49: 1245-1247, 2003.

Note: Your A1CNow+® Specialist can provide you with abstracts of the above articles upon request.

¹ <http://diabetes.niddk.nih.gov/dm/pubs/hemovari-A1C/index.htm>

² Sacks D. Hemoglobin Variants and Hemoglobin A1C Analysis: Problem Solved? *Clin Chem* 49: 1245-1247, 2003.