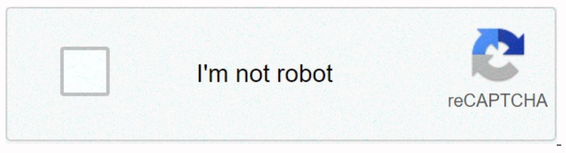

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Fructosamine a1c conversion chart

Blood sugar level to a1c conversion. What a1c equals diabetes. A1c to bgl conversion. Difference between a1c and fructosamine.

Skip to Main Content Skip Nav Destination Pathophysiology/Complications| January 01 2003 Serum fructosamine is formed by nonenzymatic glycosylation of serum proteins, predominantly albumin.

Name Date

MATH CONVERSION CHART – AREAS

METRIC CONVERSIONS					
1 sq centimeter	=	100 sq millimeters	1 sq cm	=	100 sq mm
1 sq meter	=	10,000 sq centimeters	1 sq m	=	10,000 sq cm
1 hectare	=	10,000 sq meters	1 ha	=	10,000 sq m
1 sq kilometer	=	100 hectares	1 sq km	=	100 ha
1 sq kilometer	=	1 million sq meters	1 sq km	=	1,000,000 sq m

STANDARD CONVERSIONS					
1 sq foot	=	144 sq inches	1 sq ft	=	144 sq in
1 sq yard	=	9 sq feet	1 sq yd	=	9 sq ft
1 acre	=	4840 sq yards	1 acre	=	4840 sq yd
1 acre	=	43,560 sq feet	1 acre	=	43,560 sq ft
1 sq mile	=	640 acres	1 sq mi	=	640 acres

METRIC -> STANDARD CONVERSIONS					
1 sq centimeter	=	0.15500 sq inches	1 sq cm	=	0.15500 sq in
1 sq meter	=	10.76391 sq feet	1 sq m	=	10.76391 sq ft
1 sq meter	=	1.19599 sq yards	1 sq m	=	1.19599 sq yd
1 hectare	=	2.47105 acres	1 ha	=	2.47105 acres
1 sq kilometer	=	0.386102 sq miles	1 sq km	=	0.386102 sq mi

STANDARD -> METRIC CONVERSIONS					
1 sq inch	=	6.4516 sq centimeters	1 sq in	=	6.4516 sq cm
1 sq foot	=	929.0304 sq centimeters	1 sq ft	=	929.0304 sq cm
1 sq foot	=	0.09290 sq meters	1 sq ft	=	0.09290 sq m
1 sq yard	=	0.83613 sq meters	1 sq yd	=	0.83613 sq m
1 acre	=	0.40469 hectares	1 acre	=	0.40469 ha
1 sq mile	=	258.99881 hectares	1 sq mi	=	258.99881 ha
1 sq mile	=	2.589988 sq kilometers	1 sq mi	=	2.589988 sq km

[1, 4] The degree of protein glycation is proportional to the concentration of plasma glucose over the lifetime of the protein.
Albumin, the most common serum protein, typically accounts for 80% of all fructosamine. Because a half-life of serum albumin is 14-21 days, serum fructosamine generally reflects the state of glycemic control for the preceding 2-3 weeks. The half-life of hemoglobin A1c (HbA1c) is much longer than that of albumin (the half-life of a red blood cell is 120 d), and glycohemoglobin measurement reflects average glycemic control over 3-4 months. [4] HbA1c and fructosamine are highly correlated. The relationship between the fructosamine level and the HbA1c level can be present as a linear regression analysis, [4] as follows: HbA1c = 0.017 X fructosamine level (µmol/L) + 1.61 In practice, fructosamine testing refers to a laboratory test for diabetes management that it is rarely used in clinical practice (simple blood glucose monitoring or HbA1c testing are preferred). However, the main advantage of the test is that it can detect overall changes in blood glucose control within a few weeks rather than months (like HbA1c). Fructosamine can also be useful when the HbA1c measurement may be unreliable. Testing of serum fructosamine is indicated for monitoring of glycemic control in the following circumstances: Effect of the change (< 6 wk) in diet, exercise, or medication When a narrow time frame is required, such as for ascertaining glycemic control at the time of conception in diabetic women who recently became pregnant Conditions in which HbA1c may be unreliable, such as hemoglobinopathy (eg, sickle cell disease), hemolytic anemia, or recent blood loss A study by Mendes et al indicated that in pregnant women with gestational diabetes mellitus, neonatal complications, as well as newborn respiratory disorders, are more likely to exist in the presence of higher maternal fructosamine and glycated albumin levels. According to the investigators, these glycemic markers are better indicators of these complications than HbA1c. [7] A study by Connor et al involving Hispanic and non-Hispanic white women with invasive breast cancer found the mortality risk to be higher in the presence of diabetes and elevated fructosamine levels. The likelihood of all-cause mortality was more than twice as great, and the risk of breast cancer–related death over four times higher, in study subjects with raised fructosamine than in those with normal levels. [8] A study by Shohat et al indicated that fructosamine levels are a prognostic indicator for patients undergoing total hip arthroplasty (THA). The investigators reported that in patients with fructosamine levels above 293 µmol/L, the adjusted odds ratios for periprosthetic joint infection and readmission were 6.37 and 2.68, respectively, compared with individuals with lower levels. Among the theories as to why this glycated protein can predict outcomes in THA, it has been suggested that fructosamine levels reflect glucose fluctuations that are themselves associated with pro-inflammatory protein activation and excessive oxidative stress. [9] All conditions that affect serum albumin production (eg increased or decreased turnover) may affect the reliability of fructosamine assay, such as the following: Hepatic diseases (eg, cirrhosis) High levels of ascorbic acid interfere with the fructosamine assay. Patients should abstain from ascorbic acid supplements for a minimum of 24 hours prior to sample collection. Figure 1. Linear regression equation based on Cohen et al “Discordance between HbA1C and Fructosamine: Evidence for a glycosylation gap and its relation to diabetic nephropathy”The Equation is based on a study by Cohen et al titled “Discordance between HbA1C and Fructosamine : Evidence for a glycosylation gap and its relation to diabetic nephropathy”The authors estimated both HbA1C and fructosamine in 153 patients with a mean age of 47 years, of which 46% had type 1 diabetes and 47% type 2 diabetes.
A plot of measured HbA1C was compared to measured fructosamine.

Relative Fructosamine Conc.	measured total-gly	Measured glycated	calculated total	gly/total
1.0	0.065	0.027	0.092	0.029
1.0	0.067	0.028	0.095	0.029
2.1	0.056	0.037	0.093	0.040
2.1	0.052	0.037	0.089	0.042
3.3	0.045	0.058	0.103	0.056
3.3	0.049	0.045	0.094	0.048
4.4	0.040	0.053	0.093	0.057
4.4	0.038	0.054	0.092	0.059
5.5	0.033	0.063	0.096	0.066
5.5	0.030	0.072	0.102	0.071

The regression line for the cohort was HbA1C = 0.017 x Fructosamine + 1.61.
The r value was 0.78.Formula Fructosamine to HbA1C conversionHbA1c = 0.017 X fructosamine level (mmol/L) + 1.61Fructosamine to a1c conversion chartGlucose (mg/dl)A1C%Fructosamine (Alarcon et al)Fructosamine (Cohen et al)905212.5199.41206250258.21507287.5317.031808325375.852109362.5434.6724010400493.4927011437.5552.3230012475611.1333013512.567036014550728.7739015587.5787.6Formula for HbA1C to Fructosamine conversionFructosamine (mmol/L) = (HbA1c – 1.61) x 58.82What is fructosamine?Fructosamine is the product of the nonenzymatic glycation of protein (glucose bound to protein). It should be seen as an umbrella term for circulating proteins that have undergone glycation. Albumin, the predominant circulating protein, is measured in the fructosamine assay, although it can also be independently measured as “glycated albumin”In contrast to glycated hemoglobin, which may be valid for assessing glycemic control up to the preceding three months before the test, the glycated albumin (or fructosamine) is only valid for the preceding three weeks. Unfortunately, fructosamine, just like glycated hemoglobin, is also subject to various limitations.
The result is unlikely to be reliable in hypoproteinemic states (nephrotic syndrome, severe liver disease, protein-energy malnutrition, protein-losing enteropathy), pregnancy, uremia, or hyperlipidemia.Current Diagnostic Criteria for DiabetesThe current diagnostic criteria involve the utilization of either plasma glucose or glycated hemoglobin in establishing the diagnosis of diabetes mellitus.
Although fructosamine is not an accepted tool in diagnosing diabetes mellitus, it can be used for monitoring the disease in clinical scenarios where the clinician expects limited utility of glycated hemoglobin.Glycated hemoglobin (HbA1c) value ≥6.5% (i≥48 mmol/mol)Fasting plasma glucose (FPG) ≥126 mg/dL (≥7.0 mmol/L)2-hour plasma glucose ≥200 mg/dL (≥11.1 mmol/L) after an oral glucose tolerance test (OGTT) using a 75 g anhydrous glucose loadRandom plasma glucose ≥200 mg/dL (≥11.1 mmol/L) in the setting of hyperglycemic symptoms (polyuria, polydipsia, unintentional weight loss).Current diagnostic criteria for prediabetesPrediabetes is a progressive and highly variable clinical entity that leads almost universally to diabetes mellitus if left untreated.HbA1c range of 5.7-6.4% (39-46 mmol/mol)Fasting plasma glucose between 100-126 mg/dL (5.6-6.9 mmol/L)2-hour plasma glucose between 140-199 mg/dL (7.8-11.0 mmol/L) after an oral glucose load (75grams of anhydrous glucose)Monitoring of diabetes mellitusFor nonpregnant adults, the goal of diabetes treatment is to aim for the following glycated hemoglobin and capillary glucose targets.HbA1c value <7.0% (<53 mmol/mol)Preprandial capillary plasma glucose between 70-130 mg/dL (3.9-7.2 mmol/L)Peak postprandial capillary plasma glucose <180 mg/dL (<10.0 mmol/L).Conditions that can affect the clinical utility of glycated hemoglobinA simple rule of thumb for recalling the causes of either falsely high or low glycated A1c is to recognize the conditions that alter the life span of red blood cells. Since glycated hemoglobin measures how long the red blood cell is exposed to continuing glycation in the setting of significant hyperglycemia, conditions that alter the life span of a red blood cell can impact the final value of this diagnostic test.Patients with blood loss, either acutely or chronically, experience a depletion of red blood cells, which will falsely lower glycated hemoglobin. A similar scenario occurs in patients with hemolytic anemia. Since the spleen is important in the clearing of old (senescent) red blood cells, in patients with a large spleen, a state of “hypersplenism” occurs whereby red cells are removed from circulation at a much faster rate than usual. This also causes a falsely low glycated hemoglobin.Red blood cell transfusion can lead to a falsely high glycated hemoglobin if it is stored in a high dextrose-containing medium or low due to a delusional of circulating red blood cells. To further complicate matters, hemoglobin variants and significant vitamin C ingestion may result in either falsely high or low A1c depending on the assay technique.Falsely high A1cFalsely low A1cDecreased red cell turnover (iron, B12, or folate deficiency)Acute (e.g., hemolysis of variable etiology) or chronic blood loss anemiaSplenectomy (spleen clears senescent erythrocytes)Splenomegaly (storage diseases, infections, etc.)Uremia (false detection of carbamyl-hemoglobin)End-stage renal disease (chronic anemia, decreased red cell survival due to uremic toxicity)Hypertriglyceridemia Hypervitaminosis E (impairs glycation)HyperbilirubinemiaRibavirin (hemolytic anemia)Hyperglycation (physiologic variant)Pregnancy (decreased red cell lifespan, dilutional effect, especially in the second trimester and increased erythropoietin production)Chronic opioid dependence Lead toxicity Alcohol abuse disorder Since glycated hemoglobin A1c is fraught with various limitations, in certain clinical situations the use of an alternative method of monitoring diabetes mellitus may be required.ReferencesRadin MS. Pitfalls in hemoglobin A1c measurement: when results may be misleading. J Gen Intern Med. 2014 Feb;29(2):388-94.Wendy O. Henderson, MD, Mary H. Parker, PharmD, FASHP, FCCP, BCPS, BCCP and Bryan C. Batch, MD, MHS. Cleveland Clinic Journal of Medicine February 2021, 88 (2) 81-85Robert M. Cohen, Yancey R. Holmes, Thomas C. Chenier, Clinton H. Joiner; Discordance Between HbA1c and Fructosamine: Evidence for a glycosylation gap and its relation to diabetic nephropathy. Diabetes Care 1 January 2003; 26 (1): 163–167.Lorena Alarcon-Casas Wright, Irl B. Hirsch; The Challenge of the Use of Glycemic Biomarkers in Diabetes: Reflecting on Hemoglobin A1C, 1,5-Anhydroglucitol, and the Glycated Proteins Fructosamine and Glycated Albumin. Diabetes Spectr 1 August 2012; 25 (3): 141–148. If you are like me and get the Fructosamin tests instead of the more commonly done HbA1c, because for some of us, HbA1c measurement is not a reliable marker of glycaemic control in diabetics with any condition associated with shortened red blood cell life span, worry not. I finally found a formula that you can use to get an accurate usable conversion, instead of the Usual tables that doesn't always work due to your values sometimes falling in between tables. HbA1c = 0.017 X fructosamine level (µmol/L) + 1.61. Last edited: Nov 13, 2018