

## Calculating the ACP Guidelines in Terms of mg/dl

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### Abstract

New ACP guidelines recommend HbA1c values up to 8.4% as standard. In this study we tried to translate HbA1c into plasma glucose level so that patient and clinician can easily know the corresponding value for glucose and know if their medication is needed to taper down.

**Keywords:** HbA1c; Glucose; ACP Guidelines; Diabetes

### Abbreviations

ACP: American College of Physicians; ACCORD: Action to Control Cardiovascular Risk in Diabetes; UKPDS: The UK Prospective Diabetes Study; VADT: Veteran's Affairs Diabetes Trial; DCCT: Diabetes Control and Complications Trial

### Introduction

According to a recent estimate of International diabetes federation, South East Asia region, there were 72,946,400 cases in India in 2017 and 425 million people in world which is going to be 151 million by 2045 [1]. Excess weight, particularly abdominal obesity causes or exacerbates cardiovascular and metabolic risk factors, including hypertension, dyslipidemia, and T2DM. These risk factors synergistically increase the likelihood of morbidity and mortality of CVD which leads to rising healthcare costs [2].

Old patients with diabetes have a higher risk of common geriatric syndromes, including frailty, cognitive impairment and dementia, urinary incontinence, traumatic falls and fractures, disability, side effects of polypharmacy, which have an important impact on quality of life and may interfere with anti-diabetic treatment [3]. Because of all these factors, clinical management of type 2 diabetes in elderly patients currently represents a real challenge for the physician [3]. Actually, the optimal glycemic target to achieve for elderly diabetic patients is still a matter of debate [3]. The best glucose control, as A1c to be pursued in a single patient with a balance between early side effects and future benefits is a highly debated issue [4].

Guidelines are not concordant on A1c value, leaving clinician without clear indications and generating concern in patients and doctors [4]. Treatment of hyperglycemia/hypoglycemia is not free of complications, and might, by itself, lead to increased mortality, poor quality of life, and increased cost [4]. A tailored A1c value for each patient should be the best strategy allowing to establish a strict control [2]. With the introduction of new ACP guidelines 2018 [5], definition of diabetic and non-diabetic has been changed in terms of HbA1c level. This new guideline states that lowering glucose level and achieving the Hb1Ac level below 6%, which was earlier considered as standard, may cause harm to patients including increasing chances to death. According to new guidelines standard Hb1Ac can be up to 8.4%. It also encourages clinicians to reduce the medication for those patients whose HbA1c level is less than 6.5%. In this article we attempted to convert HbA1c level to corresponding glucose level to make patient easy to take decision about their medication.

## ACP guidelines

Following are the guiding statements of ACP guidelines with their interpretation.

**Guidance Statement 1:** Clinicians should personalize goals for glycemic control in patients with type 2 diabetes on the basis of a discussion of benefits and harms of pharmacotherapy, patients' preferences, patients' general health and life expectancy, treatment burden, and costs of care.

**Interpretation:** According to this statement, choice of glycemic target and percent of glycemic control for a particular patient should be personalized considering various criteria's like age, risk for hypoglycemia, weight gain, other complications, cost of medication etc. Without doing comprehensive assessment, making an attempt to lower the glucose level with medication and achieving the target of HbA1c below 6% can increase the chance of mortality by 22 percent, which is supported by the finding of ACCORD trial [6].

**Guidance Statement 2:** Clinicians should aim to achieve an HbA<sub>1c</sub> level between 7% and 8% in most patients with type 2 diabetes.

**Interpretation:** Various trials have shown that clinicians should try to achieve target range than achieving absolute value. Many trials have shown that maintaining HbA1c below 6 did not reduce cardiovascular complications over a period of treatment but in turn produced adverse health effects. This statement is based on the results of UKPDS (The UK prospective diabetes study) trial [7] and VADT (Veteran's Affair Diabetes Trial) [8] where it was seen that the maintaining HbA1c target near 8% and 8.4% respectively is more beneficial for the patients in comparison to trying to achieve a target of HbA1c less than 6%.

**Guidance Statement 3:** Clinicians should consider deintensifying pharmacologic therapy in patients with type 2 diabetes who achieve HbA<sub>1c</sub> levels less than 6.5%.

**Interpretation:** More intensive control of HbA1c i.e. towards 6.5% leads to hypoglycemic state, which in turn results in more adverse events than in the less intensive groups which has been supported by many studies. In one study, very intensive control resulted in an increased risk for death [9].

**Guidance Statement 4:** Clinicians should treat patients with type 2 diabetes to minimize symptoms related to hyperglycemia and avoid targeting an HbA<sub>1c</sub> level in patients with a life expectancy less than 10 years due to advanced age (80 years or older), residence in a nursing home, or chronic conditions (such as dementia, cancer, end-stage kidney disease, or severe chronic obstructive pulmonary disease or congestive heart failure) because the harms outweigh the benefits in this population.

**Interpretation:** In VADT, it was seen that trying to control the blood sugar levels with medication/insulin among the patients older than 80 yrs and especially with the chronic conditions like heart diseases, Chronic Obstructive Pulmonary Disease (COPD), cancer and dementia, led to increased risk of death and other adverse affects. So, for patients older than 80 years, medication/insulin given only, if it leads to symptomatic relief like reduction in abnormally high frequency of urination, lessening of fatigue etc.

## Translating HbA1c value in to mean plasma glucose level

As glucose level is monitored in terms of mg/dl everywhere and all earlier trials talk glucose level in terms of mg/dl, therefore, HbA1c needs to be translated in this worldwide accepted unit. We made an attempt to translate HbA1c into mg/dl and mmol/L using a formula obtained from a study [10] which will enable patients to access their glucose level corresponding to Hb1Ac level. This conversion is based on Diabetes Control and Complications Trial (DCCT) data. This data was analyzed using regression analysis which produced following relationship between mean plasma glucose and HbA1c:

$$\text{Average Blood Glucose (mg/dl)} = (35.6 \times \text{HbA1c}) - 77.3$$

$$\text{Average Blood Glucose (mmol/L)} = (1.98 \times \text{HbA1c}) - 4.29$$

\*Add 10% for capillary blood sample

Putting HbA1c value 8.4 in the above formula glucose level comes 222 mg/dl and 12.35 mmol/L. This blood sugar value (222 mg/dl) is with the assumption that you take the blood sample from the vein. However, at home setting while using the standard glucometer, you take the blood sample from the capillary (finger tip). The capillary blood on an average shows blood sugar approximately 10% higher than the blood sample from vein [11], so at home setting the target blood sugar should be less than or equal to

$222+10\% = 244$  mg/dl and  $12.34+10\% = 13.5$  mmol/L

Using the above formula, 6.5 % HbA1c translates to 170 mg/dl or 9.4 mmol/L. This means while on diabetes medication/insulin, if your average blood sugar drops below 170 mg/dl or 9.4 mmol/L, then you need to taper down the medication/insulin.

### Conclusion

Using the above formula we can conclude that normal blood sugar level (blood sample taken from capillary) is up to 244 mg/dl or 13.5 mmol/L and if blood sugar is 170 mg/dl or 9.4 mmol/L or below, medication/insulin can be reduced.

### Conflict of Interest

None.

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