

Does A1c Pass the Transparency Test in Understandability as a Biomarker of Diabetes?

Diabetes is a frequent title in the PRHSJ, as well it should be, since at 16.1% incidence, the island is among the highest in the nation (1). Articles evaluating the severity of the condition often use the biomarker A1c (2-4). The point of the following editorial, written in a satirical fashion, is the use of medical jargon, incomprehensible to the general public, when a much more understandable option is available.

“My A1c is under seven.” How many times have we heard this joyfully exclaimed in television commercials? These proclaimers couldn’t be more pleased –they have reached diabetic heaven. I asked myself, what does A1c have to do with diabetes? Breaking it down we find a big letter “A”, a number “1” and a little letter “c.” Perhaps it is an abbreviation. Googling revealed that it could be “Airman, first class.” Okay, but why under seven and seven what-ers. I believe any airman worth his aviation certificate should be above seven, whatever that is. So, A1c must mean something else. I heard of A1 steak sauce. Perhaps this might be a Canadian or Colombian variety. However, since A1c is determined from a blood sample, it seems unlikely that steak sauce, no matter which variety would be found in the blood stream.

I decided to consult an expert, my personal physician. I made an appointment. “Hi, doc, I have some questions about A1c.” “Sure, what would you like to know” she responded. “If my A1c goes below seven, does it become A1b?” She chuckled-“No, it is always A1c no matter what the number.” “So, below seven is good. I guess two or three would be even healthier.” “Actually”, she went on, “four and below is risky to your health and with two or three you would probably be in a coma or near death. Five to six would probably be ideal for most.” I wondered what was my level. “So, I should have five to six A1cs to stay healthy.” She knitted her brow. “You have only one A1c, the numbers tell us the amount.” The way she had stressed “one A1c” made me think that some irritation was beginning to develop.

I changed the topic. “A1c seems to be very important. Is it a hormone?” She answered “no.” “Is it an enzyme?” “no.” “Is it a special biomolecule?” “no.” I started to get frustrated. “Then what is it?” She settled back into her chair as she proceeded to give a description of A1c. “It is a variant of a normal blood protein. ‘A1c’ is a shortened form of hemoglobin A1c and to be more accurate, glycosylated hemoglobin A1c. The glycosylation refers to glucose, or blood sugar, something you know is needed to supply energy to the body. The blood sugar is able to stick to this variant of hemoglobin and the more sugar, the more the sticking.” I began to see: when A1c is low, there isn’t enough sugar to give energy to the brain, so people can faint or even die. Likewise, when A1c is high, more gets stuck so we have diabetes and complications like blindness, kidney failure and amputation of limbs. She pointed out that glycosylated hemoglobin A1c is naturally found in all of us and not only in diabetics.

The question was answered. I burst out “A1c is simply the amount of blood sugar.” She uttered an exasperated “NO”, followed by an apoplectic “WHAT?” from me. My angst level was reaching maximum. I could feel cortisol gushing from my adrenals. She offered a gentle hand on my head and helped me to get seated again. “I have something that will explain why A1c is not blood sugar, but only a proxy for it.” She went back to a file cabinet that housed old items from her days in med school. She returned with a weathered sheet of paper that was from her biochem first year class I have included a copy so you can see what we went over. There was a figure and a table.

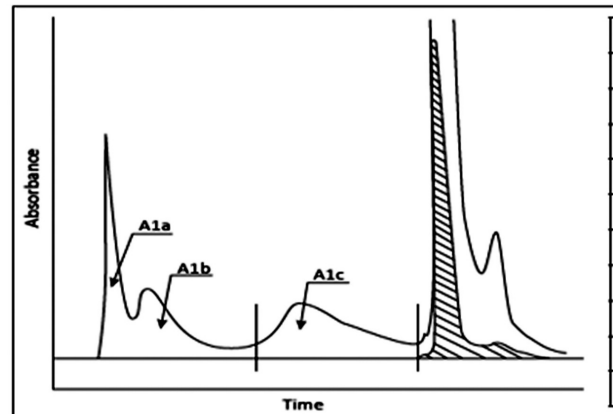


Figure 1. A1c in a blood sample.

Table 1. Relationship between A1c and blood sugar.

A1c	Glucose mg/dl
3	39
4	68
5	97
6	128
7	154
8	193
9	212
10	240
15	384

With the patience of Job, she articulated the history of A1c. “In the 1960’s an Iranian scientist named Samuel Rahbar isolated a minor abnormal fast-moving hemoglobin band in diabetic patients during routine screening for hemoglobin variants. This finding later turned out to be an important marker with clinical applications. The concentration of glucose is proportional to the percent variant which was A1c.” I looked at the table which was easy to use. I found that A1c below seven was equivalent to a blood sugar level of less than 154 mg per 100 ml. The identity of A1c could be seen on the figure which was taken from the journal *Diabetes* 1978;27:102-107. I counted the peaks, a, b, c. I finally learned what A1c really is –a peak on a chromatographic column and that it is a proxy for blood sugar. So, I was prompted to ask “Why don’t they just tell me what is my blood sugar reading? I understand what blood sugar means.” She replied “the general public has accepted the way it’s done. The mantra ‘my A1c is below seven’ may be about all you need to know about control of diabetes. Why complicate things?” This seemed reasonable. I stated my conclusion to her “so, when it comes to A1c, as long as people feel happy about it, they don’t need to have the slightest idea of what they are talking about” “Exactly” was her reply.

“Thanks doc”

“Glad to help”

The meeting ended with a handshake.

References

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