The Importance of Checking the Cumulative Blood Sugar A1c for Diabetics: with Reference to Saudi Arabia

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Abstracts

The diabetes is a curse to wide world as it takes many privileges from a given human being, i.e., change of eating habits, minimization of food intakes, social conditions, family issues, risk of life in acute cases and many other related conditions. For a developing country like Saudi Arabia, the cases of Diabetes are increasing with every passing year and coming near to the global averages. Checking and testing are the only methods to keep away from diabetes in real sense. This present study is based on the checking and testing parameters, on the basis of standards laid down by WHO, ADA and MoH of KSA. The study is based on secondary data and evaluates the conditions for the period of 2010 to 2020.

Keywords: Diabetes, A1c blood sugar, Saudi Arabia, Mecca.

1. Introduction

Analysis of glycated hemoglobin (HbA1c) in the blood stream of a patient proves that the blood glucose level is average for the last few months and it is also proved that it is pre-detected half-life of red blood cells (RBCs). The analysis of HbA1c is considered as a set standard of care for the monitoring of type 2 diabetes. As evidence from the previous studies, HbA1c was initially introduced by Huisman et al (1958) and the further characteristics were presented by Gallop et al (1968) and the name given was glycoprotein. Then further the advance level of HbA1c were represented by Rahbar et al (1969), and the formation of the same was given by Bunn et al (1975) and the biomarker for levels of glucose in Diabetic patients was given by Koenig et al (1976).

Proteins are regularly glycated for the duration of various enzymatic reactions whilst the conditions are physiologically favorable. however, within the case of hemoglobin, the glycation occurs via the nonenzymatic reaction between the glucose and the N-terminal quit of the β-chain,

which forms a Schiff base at some point of the rearrangement, the Schiff base is transformed into Amadori merchandise, of which the fine known is HbA1c. inside the number one step of glycated hemoglobin formation, hemoglobin and the blood glucose engage to shape aldimine in a reversible response. within the secondary step, that's irreversible, aldimine is steadily converted into the stable ketoamine shape. The primary web sites of hemoglobin glycosylation, in the order of prevalence, are β-Val-1, β-Lys-66, and α-Lys-61. In a given human being hemoglobin includes HbA (α2β2), HbA2 (α2δ2), and HbF (α2γ2) in the composition of 97%, 2.5%, and 0.5%, respectively. About 6% of total HbA is termed HbA1, which in turn is made up of HbA1a1, HbA1a2, HbA1b, and HbA1c fractions as explained by electrophoretic and chromatographic properties. HbA1c is the most abundant of these fractions and in health comprises approximately 5% of the total HbA fraction. Glucose inside the open chain layout binds to the N-terminal to form an aldimine earlier than undergoing an Amadori rearrangement to shape a stronger ketoamine. this is a nonenzymatic manner that occurs constantly in vivo. The formation of the glycated hemoglobin is a regular part of the physiologic function cycle. however, because the average plasma glucose increases, so does the amount of glycated hemoglobin in the plasma. This particular function of the hemoglobin biomarker is utilized for estimating the common blood glucose stages over the preceding two to three months. On an overview, we have described the cutting-edge trends in diabetes incidence, diagnostic and prognostic ability of HbA1c, analytical elements in HbA1c assays, and physiological adjustments due to hemoglobin glycation.

Challenges of Diabetes :

As per Ministry of Health, KSA 2018, and some other reports of 2012, 14 and 2016 17.8 million of adults were bearing diabetes. Type 1 diabetes prevalence approximates to 1.25 million KSA citizens. Apart from this there were around 25% of citizens those who have diabetes but are not being diagnosed yet, their previous records indicate their health issues and the detection can be assured out of it. The reports of WHO published in 2020 and 2021 it was stated that most of the detected patients are from the age group of 50-65 years and in KSA this percentage constitutes to around 23.07% of the total population, this includes both the diagnosed and undiagnosed units. Even though the incidence of new diabetes cases is astounding, the trajectory appeared to have slowed momentarily, with 1.3 million new diagnoses per year as reported in 2019 as compared to 1.04 million in 2015, stating that less cases were diagnosed in the preceding year. Now this can be stated that this downfall is due to non-reporting of cases or actually the people are getting aware of consequences.

Also the prediabetes cases have been on an upward swing with 32 million citizens, and the age of such people is above 22 years. Diabetes is the seventh leading cause of death in the KSA. According to the WHO, 52,142 death certificates listed diabetes as the underlying cause of death in 2018. A total of 123,601 death certificates listed diabetes as an underlying or contributing cause of death. According to the latest statistics available, the total costs of diagnosed diabetes was around USD 173 billion, of which, $92 billion was spent toward direct medical costs and USD 41 billion costs were associated with reduced productivity.

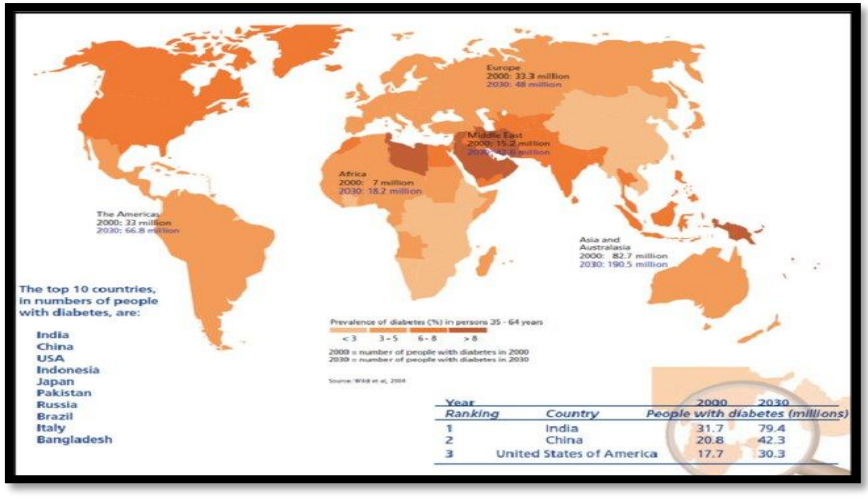
Research Process:

As this present study is based on secondary data, hence the researcher has taken the reference from other countries, in terms of diabetes standards, levels of Blood Pressure, age of patients (minimum and Maximum) and some of the other parameters. Some of the other points included are as:

- Reference points of the study were taken mainly from the reports of WHO and ADA
- The period of the study was from 2010 to 2020
- The location of the study was Mecca in Saudia Arabia
- Most of the patients were considered under the category of diagnosed and undiagnosed
- The study floats from the situation in other countries, comparison with Saudi Arabia and testing phases
- Some points of recent developments and previous stakes were also included in the study
- The Ministry of Health, KSA record (published) were used for portraying the stakes of patients in terms of Diabetes.

Reference from Other countries:

In the other nations like Australia, New Zealand, Malaysia, Mongolia, Philippines, and many others, an envisioned 138 million adult individuals have diabetes, that is the very best among any region within the international. In China, diabetes has obtained epidemic proportions and keeps to expand at an exceptional fee.

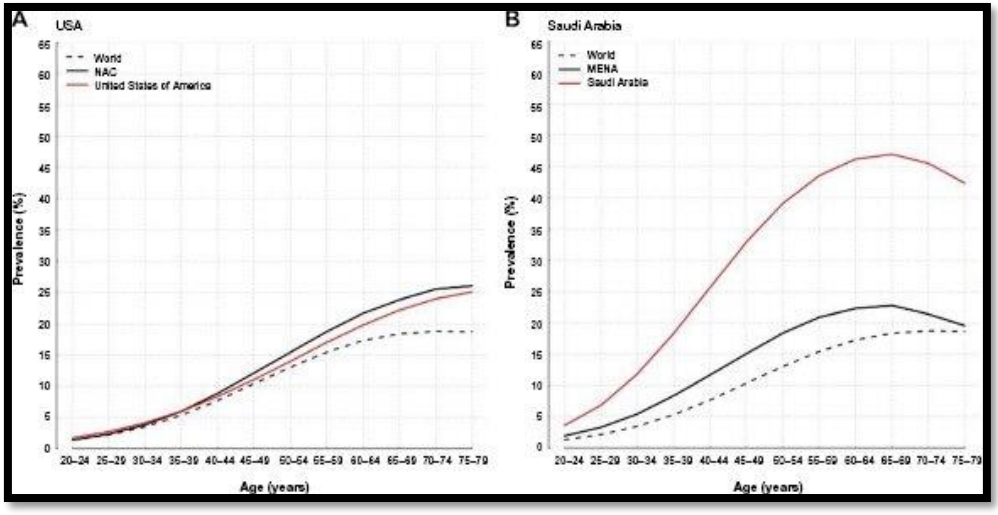


Source: Heinz Dreher (2014)

Figure 1: Spread of Hb1Ac Around the World

China has overtaken the us in the prevalence of diagnosed cases of diabetes, with 11.6% of chinese adults affected by confirmed cases of diabetes. The chinese language diabetes population (about 114 million) alone is one-third of the whole diabetes populace inside the global, and the developing wide variety of instances will maintain to position big strain on China's fitness-care device and the overall economic system.

Representing the South Asia region of the world, India is domestic to approximately sixty seven million (66,847.nine million) instances of diabetes, which is about eight.6% of the overall grownup populace (20–79 years) and keeps to grow at an alarming fee (2015 estimates: 50.8 million).13 weight problems, related to diabetes, has reached epidemic proportions amongst center-magnificence children and teens because of their exposure to speedy meals diets and shortage of exercising and physical pastime. In Russia, 6.2% of the complete grownup population (20–79 years antique) is tormented by diabetes with greater than 6.7 million cases of diabetes. it's miles predicted that there can be as many as 2.three million instances of undiagnosed diabetes some of the adults. domestically, Africa vicinity remains at the leading edge with majority of the deaths happening because of diabetes and its difficulty are constrained in people more youthful than 60 years antique. currently, there are approximately 2 million cases of diabetes in South Africa. The whole wide variety of people with diabetes can be even higher because of many undiagnosed and unreported cases, that is pretty common in lots of developing nations.



Shariq et al (2016)

Figure 1: Diabetes Cases in KSA as Compared to World

As of 2014, more than 11.6 million (8.7% adults) Brazilians had diabetes, which continues to grow with approximately 33 million reporting excessive blood pressure. more than eighty,000 deaths per 12 months are attributed to diabetes in Brazil. the prevalence of type 1 diabetes is the

best within the Europe (EUR) area. The EUR place has a total of 52 million diabetes patients, and this quantity is predicted to boom to 69 million by using 2035. Representing the EUR vicinity, Germany had over 7.2 million instances of diabetes as of 2014.

Diagnostics of HbA1c:

WHO and ADA have recently encouraged HbA1c with a reduce-factor 6.03% for diagnosing diabetes as an opportunity to fasting plasma glucose (FPG 7.0 mmol/L)-based totally criteria. The tiers of HbA1c are strongly correlated with FPG. FPG, 2-hour put up-glucose load plasma glucose, and oral glucose tolerance exams are endorsed for the prognosis of diabetes simplest if HbA1c checking out is not feasible due to unavailability of the assay, affected person factors that avoid its interpretation, and all through pregnancy.

Hba1c (%)	eAG (mg/dL)	Hba1c (%)	eAG (mg/dL)
4	68	9	212
4.5	82	9.5	226
5	97	10	240
5.5	111	10.5	255
6	126	11	269
6.5	140	11.5	283
7	154	12	298
7.5	169	12.5	312
8	183	13	326
8.5	197	13.5	341

Source: https://www.reddit.com/

Figure 3: HbA1c percentage for estimating Average Glucose (mg/dL)

HbA1c affords a dependable measure of chronic glycemia and correlates nicely with the risk of lengthy-time period diabetes headaches, in order that it's far presently considered the check of desire for monitoring and continual control of diabetes, but the reduce-point of HbA1c from the diagnostic factor of view remains controversial. amongst diabetics, the blood glucose levels boom in the blood and the glucose attaches to the hemoglobin molecule in a concentration-structured way.

The glucose-sure (glycated) hemoglobin or HbA1c presents the common glucose ranges in a man or woman's blood as it turns into glycated with the hemoglobin. it's far critical to observe

that the HbA1c ranges are directly proportional to the blood glucose levels. An easy blood glucose check consisting of a fasting glucose take a look at (FGT) is a measure of glucose attention found in an man or woman's blood at a given factor of time. The blood used for the FGT can be acquired thru a needlestick of a finger or without delay from the arm. a brand-new technology, non-stop.

Changes due to Hemoglobin Glycosylation:

An increase in HbA1c as found in situations of negative diabetic control has been related to multiplied blood viscosity. Glycosylation of hemoglobin and increased glucose tiers has a tendency to affect RBC houses, lowering the RBC flexibility and increasing their aggregation tendency, main to increased blood viscosity. Glycosylation of hemoglobin can also affect membrane lipid protein interactions in RBCs, changing their inner viscosity, enhancing viscoelastic homes of erythrocyte membranes, and impairing RBC deformability. there's additionally evidence that glycosylation of hemoglobin impairs nitric oxide (NO)-related rest of human mesenteric vessels.86 Hemoglobin glycosylation is likewise reported to modify NO binding with thiols resulting in lowered NO bioavailability and impaired vasodilatation in rabbit aortic earrings. any other mechanism by using which glycosylation of hemoglobin is proposed to be vasoactive is through the formation of reactive oxygen species. Glycosylation of hemoglobin additionally lowers oxygen-wearing capacity, thereby selling hypoxia and its associated systemic vascular vasodilatory adaptations and responses.

Presence of Glycosylation of hemoglobin leads to reduction in blood pressure in type 2 diabetic patients untreated for hypertension. Since 8%–10% HbA1c is considered to be a threshold beyond which the effects of hemoglobin glycosylation become significant, these investigators determined mean arterial blood pressure for patients not treated for hypertension below and above 9% HbA1c and found significant reduction in mean arterial blood pressure below the threshold (86.2 ± 3.9 mmHg) as compared to above the threshold (93.1 ± 12.5 mmHg).

2. Conclusion:

The HbA1c is an correct and clean-to-administer test with on-the-spot consequences availability and may be an powerful tool in organizing the diagnosis of diabetes, specifically in low- and middle-income nations and hard-to-attain populations. even though HbA1c has been encouraged for diagnosis of diabetes, in most of the nation's worldwide, some checking out techniques and cutoff stages are still being debated. but, combination of FGT and HbA1c significantly enhances the diagnostic accuracy of these man or woman checks. The prognostic capacity of HbA1c lies in its precise potential of assessing retrospective glycemic manipulate in addition to predicting the lipid profile in diabetic sufferers. as the epidemic of diabetes keeps to develop global, HbA1c take a look at may additionally continue to be applied as part of the diagnostic and prognostic device, leading to higher patient care and successful clinical effects.

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