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Impact of Age on HbA1c Level of Diabetic Patients Attending Ahmadu Bello University Teaching Hospital Zaria, Nigeria

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ABSTRACT

The present study looked into the possibility of impact of age on HbA1c level of diabetic patients attending Ahmadu Bello University Teaching Hospital (ABUTH) Zaria, Nigeria, as there have been reports of correlation between age and HbA1c in some other parts of the world. Three hundred and fifty (350) diabetic patients were initially recruited over a period of 10 months, from March 2018 to December 2018. Subjects consisted of 200 female and 150 male diabetic patients. After 10-12 hours fast, 5mL of blood was drawn from volunteer patients. About 3mL was centrifuged in order to separate the serum after which the serum was then analysed for glucose. Two hundred and fifteen (215) subjects, comprising of 110 female and 105 male diabetic patients, with ages between 46 years and 84 years (mean age = 65±19 years) and mean blood glucose of 200±20 mg/dL were then selected for the study. The remaining 2mL whole blood was analysed immediately for HbA1c. Information about patient's age was obtained via a well-designed questionnaire and matched with hospital record. There was no significant difference in the mean HbA1c levels of male and female participants. For the given blood glucose range, the HbA1c level increased by 0.2%, proportionally, with every decade (10 years) increase in age. It was concluded that HbA1c increases consistently – independent of blood glucose and gender – with increase in age of diabetic patients.

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Received: June 15, 2023; **Accepted:** June 24, 2023; **Published:** June 30, 2023

Introduction

Glycated haemoglobin otherwise known as HbA1c is a form of haemoglobin (a blood pigment that carries oxygen) that is bound to glucose and primarily used to identify the average plasma glucose concentration over extended periods of time say about 2 to 3 months HbA1c, though increases proportionally with increase in fasting blood glucose, is said to be better in managing diabetes and diabetic patients than fasting blood glucose [1,2]. The World Health Organization reported that a total of 422 million adults globally were suffering from diabetes in 2014 [3]. Furthermore, diabetes mellitus is predicted to have about 110% increase in prevalence in Africa by the year 2035 (especially Type 2 diabetes), with Nigeria having the highest number of cases on the continent [4].

Many studies have reported increase in HbA1c levels with age for people without diabetes while others have reported decrease in the diagnostic efficiency of HbA1c with aging [5, 6]. Only few studies have investigated the effect of age on HbA1c in diabetic patients due to problem of not knowing whether it is age causing the observed differences or different glycaemic levels. Prompting the present study to look into the effect of age on HbA1c levels in diabetic patients for a given blood glucose range.

Methods
Ethical Approval

The study was approved by the Ethical Committee on Human

Research of Ahmadu Bello University Teaching Hospital, Zaria with the Approval No: ABUCUHSR/2017/002. Informed consent was also obtained from individual participant.

Study Participants

Three hundred and fifty (350) diabetic patients were initially recruited over a period of 10 months from March 2018 to December 2018. Subjects fasted for 10-12 hours overnight, after which 5mL of blood was drawn from each subject through venepuncture. About 3mL was centrifuged to obtain the serum and analysed for fasting blood glucose (FBG). Two hundred and fifteen (215) diabetic patients with mean blood glucose of 200±20 mg/dL were eventually selected to participate in the study, comprising of 110 and 105 female and male patients respectively. The remaining 2mL whole blood was analysed for HbA1c. The mean age of subjects was 65±19 years. They were divided into age-groups of about a decade (10 years) difference. There were four groups of both male and female in all (46-54, 55-64, 65-74 and 75-84). Information about patient's age was obtained with a well-designed questionnaire and matched with hospital record.

Statistical Analysis

All data were presented as mean ± standard deviation (SD). Pearson's correlation was used to test the relationship between two continuous variables. One way ANOVA was used to analyse the differences between and within groups followed by Tukey's

post-hoc test. The Student t-test tool was used to test the difference between the two gender groups. A p-value of ≤ 0.05 was taken as statistically significant. All analyses were performed using SPSS (IBM Inc.) version 24.

Table 1: Comparison between the HbA1c levels of different age groups

Age Group	HbA1c % (Mean±SD)	FBG mg/dL (Mean±SD)	F-value	p-value
45-54	8.7±0.01	200±20	3.97	0.0001
55-64	8.9±0.03	200±20	4.32	<0.00001
65-74	9.1±0.02	200±20	1.98	0.0001
75-84	9.3±0.05	200±20	2.85	0.0001

All data are presented as mean ± standard deviation; comparison of HbA1c levels between age groups was done with ANOVA. A p-value of 0.05 was accepted as statistically significant.

Table 2: Comparison between the HbA1c levels of different gender groups

Gender	HbA1c % (Mean±SD)	FBG mg/dL (Mean±SD)	t-value	p-value
Female	9.0±0.02	200±20	0.23	0.67
Male	9.0±0.01	200±20		

All data are presented as mean ± standard deviation; comparison of HbA1c levels between genders was done with student t-test. A p-value of 0.05 was accepted as statistically significant.

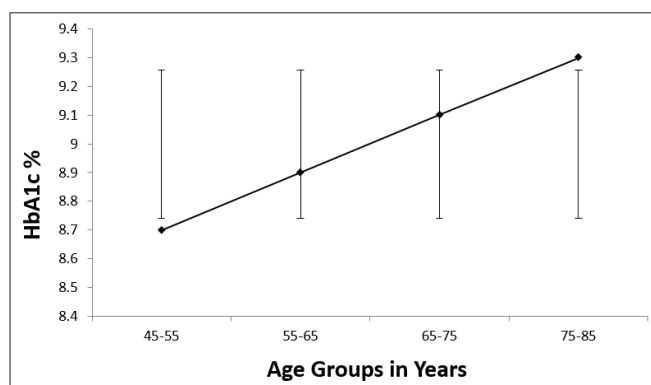


Figure 1: Relationship between HbA1c of different age groups shown with error bars. Regression coefficient, $r = 0.387$

Results

The mean HbA1c of each age group was compared with the other three, and there was significant difference between them (Table 1). The level of FBG remains relatively constant across all groups. The F-values for the comparisons between all the age groups as performed the Analysis of Variance (ANOVA) is also indicated.

There wasn't a statistically significant difference in the mean HbA1c levels across genders as seen in Table 2.

In Figure 1, the graph indicates the correlation relationship between age groups and HbA1c. As the age increases the HbA1c also increases continuously. A 10 year increase in age leads to a significant 0.2% rise in HbA1c ($r=0.38$) in given blood glucose range of about 200±20 mg/dL.

Discussion

This present study has simply shown that though slightly, HbA1c level increases with age among diabetic patients without necessarily meaning that their diabetic condition is getting worse. If diabetic condition is not worsening with increase in HbA1c, that is, the level of blood glucose is not increasing accordingly as shown by this study, then, there must be some other mechanisms responsible for the observed increase in HbA1c with age. It is possible that the decreased red blood cell (RBC) count caused by the decreased cell turnover would result in increase in RBC lifespan with aging, causing increased levels of HbA1c [6]. Or as reported by previous studies, the cellular damage caused by aging, including altered enzyme activity, decreased membrane lipids and increased cell fragility, promoting the acceleration of haemoglobin glycation. In another study, many physiological parameters such as tissue sensitivity to insulin, insulin receptor activity and pancreatic islets function were reported to decrease with age leading to an increase in HbA1c levels with aging [7,8].

In contrast to a study by Huang et al. that reported a significantly higher HbA1c levels for males than females of the 30-49 age group, this study found no significant difference in the HbA1c levels of male and female subjects used. This is likely due two reasons; firstly, the ages of subjects used for this study were higher than the age group of the subjects in the mentioned study where difference in HbA1c level between male and female was observed. Secondly, this study used diabetic subjects with a matched blood glucose level whereas the study mentioned above used non-diabetic subjects with varying blood glucose levels [9].

Many studies have shown a strong positive correlation between HbA1c levels and age amongst people without diabetes, making Huang et al., 2021 conclude that the HbA1c cut-off point for diabetes diagnosis should vary by age. However, only few studies have reported positive correlation between aging and HbA1c amongst diabetic patients. The present study was able to ensure a constant blood glucose range for all participating subjects, ruling out the possibility that the observed HbA1c increase was due to higher blood glucose level. This enabled this study to break through the limitation encountered by previous studies [5,9].

A positive correlation was observed between HbA1c and aging, so that a steady increase in HbA1c with age caused 0.2% rise in HbA1c level for every decade (10 year) increase in age confirming some previous reports, that indicate age is a significant independent impact factor of HbA1c [10].

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