HbA$_{1c}$ Levels in Newly Diagnosed Diabetic Patients in Omdurman Hospital: A Pilot Study

Elmokashfi T Albala[1], Eltayeb Osman Elfaki[2], Ibrahim A Ali[3*], Omer A Musa[4]

[1, 3, 4]Department of Physiology, Faculty of Medicine, The National Ribat University, Khartoum, Sudan
[2]Department of Medicine, Faculty of Medicine, Alneelin University, Khartoum, Sudan

*Corresponding author
Ibrahim A Ali

Abstract: Sudanese values of HbA$_{1c}$ was found to be 3.8% ± 1.17 in males and 3.4% ± 1.17 in females and the diagnostic level of HbA1c was 6.5% according to WHO. The objective of this study was to measure the level of HbA$_{1c}$ in newly diagnosed diabetic Sudanese patients and to compare the results with the normal Sudanese values. This was a hospital based cross sectional pilot study conducted during 2017 in Omdurman teaching hospital, Khartoum state on Sudanese patients attending emergency department with age above 18 years and newly diagnosed with diabetes mellitus. Twenty patients were assessed by questionnaires covering age, family history of DM, physical activity and diet. The BMI was calculated from the weight and height and the blood pressure was measured and 5 ml of venous blood was taken to measure a test of HbA$_{1c}$using Nycocard© machine after overnight fasting. The mean of HbA$_{1c}$ in newly discovered males was 11.88%±0.43and in females was 13.26%±0.66%.Female gander was found to be positive relationship to HbA$_{1C}$ but statistically not significant with a p value (0.086). HbA$_{1c}$ level in newly diagnosed diabetic Sudanese patients was found to be very high compared to the normal Sudanese values of HbA$_{1c}$ (3.8% ± 1.17 in males and 3.4% ± 1.17 in females) and to the diagnostic value of HbA$_{Ic}$ (6.5%) which might indicate that DM diagnosis was late.

Keywords: HbA$_{1c}$, diabetes, Sudanese.

INTRODUCTION

HbA$_{1c}$ is Glycated (Glycosylated) Hemoglobin which is formed by the binding of glucose to the C chain or D chain of hemoglobin A (HbA) and as a result of non-enzymatic catalysis of mature hemoglobin (Hb) and glucose.

It is a form of haemoglobin used primarily to identify the average plasma glucose concentration over a prolonged period of time. Increased levels of glycated haemoglobin have been associated with cardiovascular disease' nephropathy and retinopathy in diabetes mellitus [1]. The increase in the level of HbA$_{1c}$in diabetes was first described in 1969 by Samuel Rahbar [2].

After that discovery, numerous small studies were conducted correlating it to glucose measurements resulting in the idea that HbA$_{1c}$ could be used as an objective measure of glycaemic control.HbA$_{1c}$ was introduced into clinical use in the 1980s and subsequently has become a cornerstone of clinical practice [3].

The synthesis of HbA$_{1c}$ is very slow, relatively irreversible and is positively related to the glucose concentration of red blood cells .HbA$_{1c}$can continue in the whole lifespan (120 days) of red blood cells. HbA$_{1c}$ reflects average plasma glucose over the previous 8 to 12 weeks. It can be performed at any time of the day and does not require any special preparation such as fasting; these properties have made it the preferred test for assessing glycaemic control in people with diabetes [4]. A rise of 1% in HbA$_{1c}$corresponds to an approximate average increase of 2 mmol/L (36 mg/dL) in blood glucose.

Diagnostic criteria of diabetes made by WHO report in 2011 determined that HbA1c of 6.5% was considered as cut off point for diagnosing diabetes. A value of <6.5% does not exclude diabetes diagnosed using glucose tests [5]. The normal range of HbA$_{1c}$ was taken as 4-5.7% but in a pilot study in Sudan it was found 1.2_5.4 in male with a mean of 3.8%±1.17 and 1.4- 5.3% in female with a mean of 3.43 % ±1.17 [6, 7].

In a study conducted on 2013 in Sudan on newly discovered diabetics , the results showed that the mean of HbA$_{1c}$ in young diabetics was 10%,while that of old diabetics was 8.8% [8]. without correlating it to the sex or symptoms before diagnosis.

This study was designed to reassess HbA$_{1c}$ level in newly diagnosed diabetics in relation to

Sudanese normal values in males and females and to period of symptoms before diagnosis.

METHODS

This study was hospital based cross sectional study with total coverage sampling during 2017 from August to November conducted in Omdurman teaching hospital among Sudanese patients attending accident and emergency department with newly diagnosed diabetes mellitus who were not having chronic liver or renal disease or pregnant and was not on medication affecting Hb A_{1c} levels and with age above 18 years of both sexes. Twenty patients were included after taking their informed written consent explaining the objectives to them and a Questionnaire interviews with all participants was done covering information about age, family history of DM, physical activity and duration of symptoms of DM.

The blood pressure was measured by sphygmomanometer, height and weight were measured by standard procedures and BMI was calculated.

Five millilitres of venous blood was withdrawn under aseptic condition and HbA_{1c} level was measured using modified ELISA reader known as NycoCard$^{©}$ Reader.

All the data collected in this study were analysed using the Statistical Package for Social Sciences (SPSS) computer program version 22, p value of< 0.05 was considered statistically significant compared to the normal values.

RESULTS

The study covered twenty newly diagnosed diabetics, attending Omdurman teaching hospital above 18 years old, including thirteen males and seven females.

All patients in the study recorded abnormal high HbA_{1c} levels in addition to their high random and fasting blood glucose levels with statistically significant difference (p value =0.00) compared to the normal values.

There was significant relationship between the duration of the symptoms and HbA_{1c} with p.Value (0.05), HbA_{1c} was high in patients with short duration of symptoms.

The results showed that there was significant relationship between physical activity and HbA_{1C} in male patients with p value=0.037, HbA_{1C} was found to be 13.47% ± 0.62 in physically active male and was 11.40% ± 0.43 in not physically active.
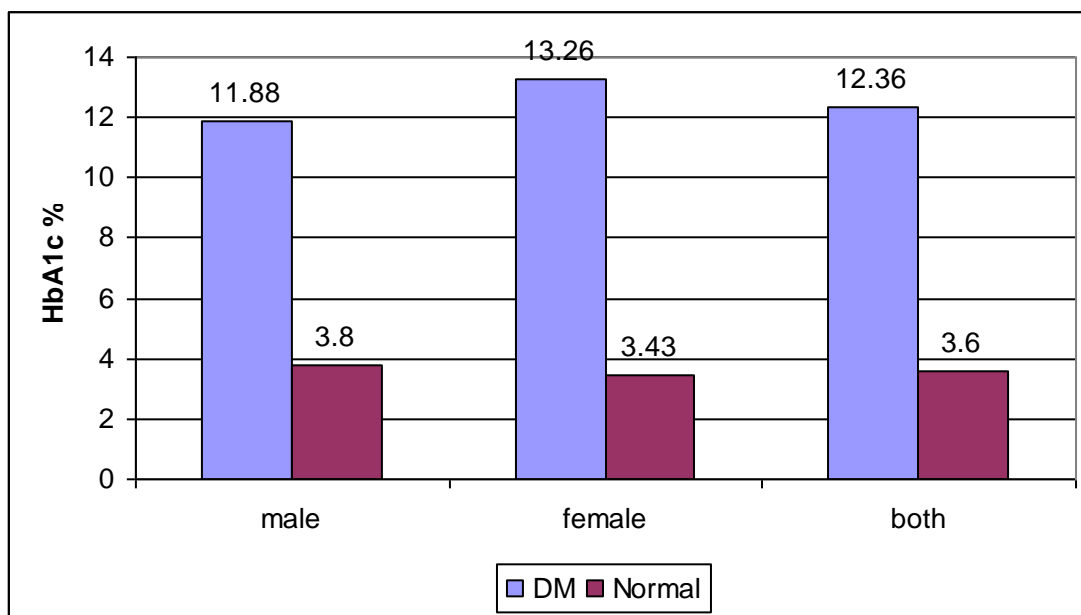

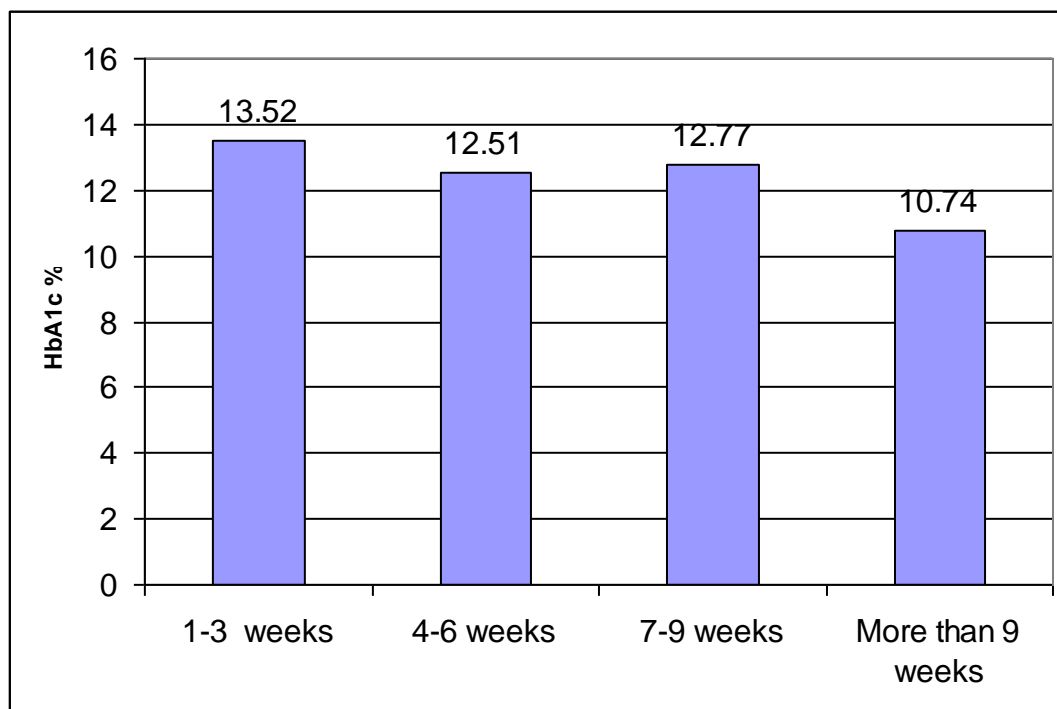**Fig-1: HbA1c in newly discovered diabetic patients in Sudan.**

Fig-2: Relationship between HbA$_{1c}$ and duration of symptoms.

Table-1:

Duration	N	Mean ± S.E	p. value	Result
1-3 weeks	5	13.52 ± 0.54	0.05	Significant
4-6 weeks	7	12.51 ± 0.68		
7-9 weeks	3	12.77 ± 0.79		
More than 9 weeks	5	10.74 ± 0.57		

DISCUSSION

The levels of HbA$_{1c}$ were found elevated in newly discovered diabetic patients above the mean level for normal Sudanese people with a mean of 12.36±0.38% and a range of 9.9%_15%.

The results in this study are higher than those of the previous study in newly diagnosed diabetic Sudanese patients [8].

In this study, the physical activity level was affectedHbA$_{1c}$ significantly (P = 0.04). The mean of HbA1c in physically active participants was higher than in non-active participants and this in agreement with Ali, et al in which they reported that there was a positive association between the physical activity and HbA1c [6], this finding need more elaboration.

This study elucidate that the gender is affecting the levels of HbA$_{1c}$ in newly discovered patients being higher in females with a (p value 0.086).BMI was found to have a positive relationship to HbA1c levels in newly diagnosed patients but statistically not significant (p = 0.829) , obesity is known risk factor for diabetes, because it increase the insulin resistance and thereby the level of glycaemia, these finding were in good agreement with Boeing *et*

al., [9], they recorded that obesity was found to be related with higher HbA$_{1c}$ levels .

CONCLUSION

In conclusion this study showed that the range of HbA$_{1c}$ in newly discovered Sudanese diabetic patients is in a range of 9.9% _ 15% with a mean of 12.36±0.38%.

The levels of HbA$_{1c}$ showed positive correlation with patient's physical activity and female gender. A large-scale study is needed for more clarification of these differences.

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