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Monitoring Diabetes Mellitus with HBA_1C: The Abakaliki, Nigeria Experience

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Abstract

Glycated hemoglobin (HBA_1C) is a known and reliable method of having a window retrospectively of how glycemic control has been in the recent past (6-8weeks). This test is not routinely done in many parts of Nigeria. There are many diabetics patients being managed and there is every need to look into the effectiveness of the management hence the need for this study. The study involved patients attending the diabetic clinic at the Stae teaching hospital, Abakaliki, Nigeria in 2009. The mean level of HBA_1C for males and females were within the set limits by the American Diabetic Association(ADA) for diabetics under control. The mean value for the control population is also within the normal limits with those of females being closer to the upper limit for normal. There is need for routine check of HBA_1C to assure the quality of diabetic control and prevent the dreaded complications of diabetes mellitus.

Keywords: HBA_1C, Diabetes mellitus, Glycemic control, Nigeria.

1. Introduction

Diabetes mellitus is a chronic disease condition associated with disturbances in carbohydrate, lipid, and protein metabolism characterized by hyperglycemia. It is one of the most common diseases, affecting approximately 24 million individuals in the United States alone. Long-term treatment of the disease emphasizes control of blood glucose levels to prevent the acute complications which include ketosis and hyperglycemia. In addition, long-term complications such as retinopathy, neuropathy, nephropathy, and cardiovascular diseases can be minimized if blood glucose levels are effectively controlled (Hoelzel 2004).

Hemoglobin A1c (HbA1c) is one of the markers used to monitor the control of glucose in the system. It is a result of the nonenzymatic attachment of a hexose molecule to the N-terminal amino acid of the hemoglobin molecule. The attachment of the hexose molecule occurs continually over the entire life span of the erythrocyte and is dependent on blood glucose concentration and the duration of exposure of the erythrocyte to blood glucose. Therefore, the HbA1c level reflects the mean glucose concentration over the previous period (approximately 8-12 weeks, depending on the individual) and provides a much better indication of long-term glycemic control than blood and urinary glucose determinations. Diabetic patients with very high blood concentrations of glucose have from 2 to 3 times more HbA1c than normal individuals.

Diagnosis of diabetes includes 1 of the following:

-Fasting plasma glucose > or =126 mg/dL

-Symptoms of hyperglycemia and casual plasma glucose (Random plasma glucose) >or =200 mg/dL

-Two-hour glucose (2 hours post prandial) > or =200 mg/dL during oral glucose tolerance test unless there is unequivocal hyperglycemia, confirmatory testing should be repeated on a different day (Nathan 2008).

In addition, recommendations from the American Diabetes Association (ADA) include the use of HbA1c to diagnose diabetes, using a cutoff point of 6.5 %.(1) The cutoff point was based upon sensitivity and specificity data from several studies.

Advantages of using HbA1c for diagnosis:

-HbA1c provides an assessment of chronic hyperglycemia

-Assay standardization efforts from the Ameerian National Glycohemoglobin Standardization program have been largely successful and the accuracy of HbA1c is closely monitored by manufacturers and laboratories

-No fasting is necessary

-Intraindividual variability is very low (critical value of <2%)

-A single test could be used for both diagnosing and monitoring diabetes

When using HbA1c to diagnose diabetes, an elevated HbA1c should be confirmed with a repeat measurement, except in those individuals who are symptomatic and also have an increased plasma glucose >200 mg/dL. Patients who have an HbA1c between 5.7 and 6.4 are considered at an increased risk for developing diabetes in the future.

The ADA recommends measurement of HbA1c (typically 3-4 times per year for type 1 and poorly controlled type 2 diabetic patients, and 2 times per year for well-controlled type 2 diabetic patients) to determine whether a patient's metabolic control has remained continuously within the target range.

Diagnosing diabetes [American Diabetes Association (ADA)]

-Hemoglobin A1c (HbA1c) >6.5%

Therapeutic goals for glycemic control (ADA)

Adults:

Goal of therapy: <7.0% HbA1c

Action suggested: >8.0% HbA1c

Pediatric patients:

Toddlers and preschoolers: <8.5 % (but >7.5%)

School age (6-12 years): <8%

Adolescents and young adults (13-19 years): <7.5%

The 2009 ADA recommendations for clinical practice suggest maintaining a HbA1c value closer to normal yields improved microvascular outcomes for diabetics.(2) Target goals of <7% may be beneficial in patients such as those with short duration of diabetes, long life expectancy, and no significant cardiovascular disease. However, in patients with significant complications of diabetes, limited life expectancy, or extensive comorbid conditions, targeting a <7% goal may not be appropriate (Little 1992).

Since the HbA1c assay reflects long-term fluctuations in blood glucose concentration, a diabetic patient who has in recent weeks come under good control may still have a high concentration of HbA1c. The converse is true for a diabetic previously under good control who is now poorly controlled.

HbA1c results <4.0% are reported with the comment: Falsely low HbA1c results may be observed in patients with clinical conditions that shorten erythrocyte life span or decrease mean erythrocyte age. HbA1c

may not accurately reflect glycemic control when clinical conditions that affect erythrocyte survival are present. Fructosamine may be used as an alternate measurement of glycemic control (Goldstein 2003).

This study was therefore done to have an insight to the glycemic control of type ii diabetics in Abakaliki, Ebonyi State of Nigeria in 2009.

2. Method

Subjects were patients attending the diabetic clinic of the Ebonyi State Teaching Hospital Abakaliki in 2009. Fifty (50) volunteers were randomly selected from that attended the clinic in two month period were sampled after obtaining an ethical clearance from the appropriate authority. They had a written consent administered and signed. Controls (50) were drawn from among the students and staffers of same institution. These were apparently normal individuals that were non-diabetics.

A titrimetric method by Humana^{R} was used after haemolysate of the blood sample. The final process involved the use of the spectrophotometer to quantify the absorption of each sample relative to the standard and control.

Statistical analysis was by the Excel software.

3. Result

The mean HBA_1C in the diabetic population was 6.59 ±1.02 (CI 0.05 5.54-7.1) and the normal controls had HBA_1C of 4.5 ±2.6%. The breakdown is as shown in Table 1 and Figures 1 and 2 below.

4. Discussion

HBA_1C is a very good index for monitoring glycemic control in diabetics. From this study it can be seen that the glycemic control of the diabetics in Abakaliki, Nigeria is good and better still among males. The value obtained for both genders is within the normal range projected by the ADA for diabetics as outlined in my introduction. This is encouraging. This shows that these patients are getting good medical care. When it comes to the females specifically however, they are near the upper limit and much is needed in encouraging them to comply with their treatment regimen as their male counterparts are doing. If this is done the long term complications of diabetes mellitus can be avoided or prevented with attendant improvement in family lives and productivity (ADA 2011).

5. Conclusion

The glycemic control of diabetics in Abakaliki, Nigeria in the first attending the clinic at the teaching hospital in 2009 was good. This study may form a baseline for future studies and it is a call for routine check of HBA_1C in diabetics.

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Table 1: HBA_1C in different groups studied

	Male Diabetics	Female Diabetics	Male Controls	Female Controls
Mean Age	42	38	40	36
Mean HBA_1C	6.34	7.0	4.1	5
STDev	1.1	1.8	1.5	1.8

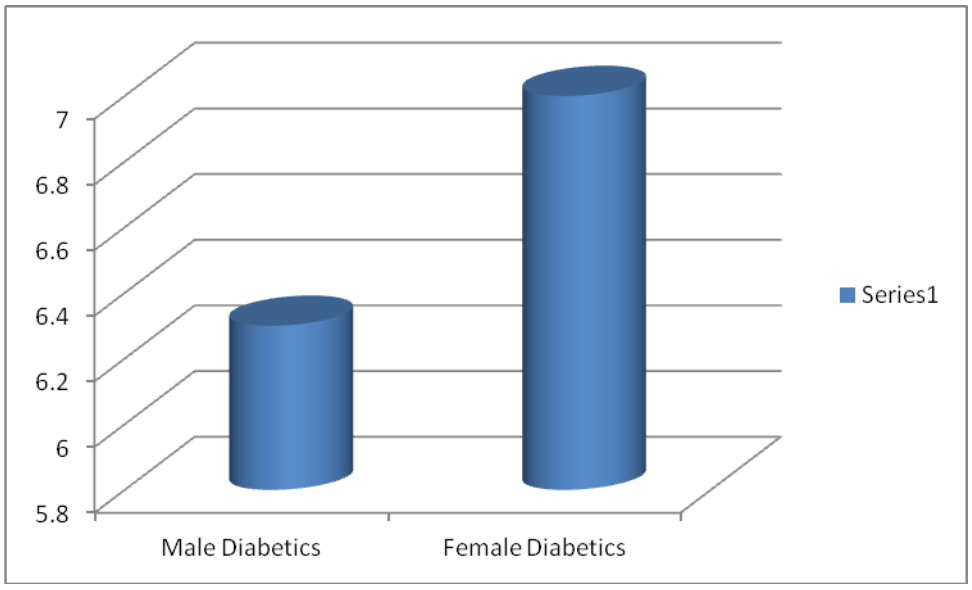

Figure1: HBA_1C in the diabetics

This shows the difference between the HBA_1C in male and female diabetics. There is a better control in the males more than the females within the last 6-8weeks.

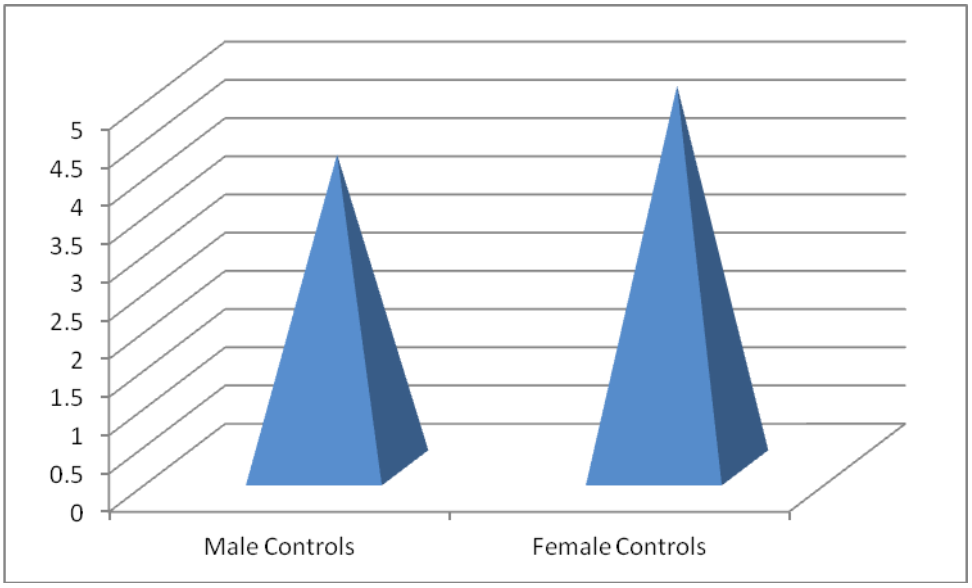

Figure 2: HBA_1C in the controls.

The normal glycemic control among these volunteers is good and encouraging but that among the females is towards the upper limit for normal.