Glycated haemoglobin and associated variables in diabetics: Ilorin experience

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Summary

One hundred and fifty type 2 diabetes mellitus patients were investigated to determine extent of haemoglobin glycation and factors that might influence it. Factors so considered were age, sex, disease duration, and body mass index.

The mean HbA_{1c} was 8.0%. Ninety-six (about 64%) of the subjects had HbA_{1c} >7.2%. Seventy-one of these were males. Sex and age did not have significant effect on HbA_{1c} and so was disease duration in our center.

Almost 70% of the female diabetics were overweight. Correlation was very poor between BMI and haemoglobin glycation. However, assessment of the individual group results tended to suggest that glycation decrease with increasing BMI.

Keywords: ***Glycated haemoglobin, Diabetics biodata.***

Résumé

Cent cinquante malades atteints de diabètes mellitus du type 2 ont été examinés afin de décider les conséquence de l'hémoglobine glycosylée et des facteurs qui pourront l'influencer. Des facteurs ainsi notés étaient: âge, sexe, la durée de la maladie et l'indice de la masse. Le HbA_{1c} moyen était 8,0%. Quatre vingt seize soit 64 des malades avaient HbA_{1c}>7,2%. Soixante dix de ceux ci étaient des hommes. Sexes et âge n'avaient pas des conséquences sensibles sur l'HbA_{1c}, et ainsi que la durée de maladie dans notre centre.

Environ 70% des femmes diabètiques étaient trop grosse corrélation était mauvaise entre BMI et hémoglobine glycosylée. Toutefois, l'évaluation des résultats de groupe individual a tendance à suggerer que la glycation diminue avec l'augmentation de BMI.

Introduction

Routine clinical laboratories commenced glycated haemoglobin estimation in the 1970s[1]. Ever since, the use of the test in developed countries, the role and importance of glycated haemoglobin estimation in the long-term assessment of diabetes patients has been recognised[2]. Both the British and American Diabetics Associations recommend regular glycated haemoglobin measurement in patients with type 1 and type 2 diabetes mellitus[3]. In furtherance to this, results of the Diabetes control and Complication Trial (DCCT) have confirmed the important role of glycated haemoglobin estimation in the long-term monitoring of diabetic patients[4]. The extent of haemoglobin glycation has been positively correlated with fasting blood sugar in various studies[5,6,7,8] especially in diabetics.

A disturbing finding in diabetics is the problem of overweight or obesity now being reported among them in different parts of the globe. Hassan and Al-Mousa reported that about 80% of diabetics in Kuwait were overweight[10]. In our environment, Bojuwoye[10] alluded the problem of obesity amongst diabetics in 1995.

Elevated glycated haemoglobin (HbA_{1c}) is an established finding amongst diabetics, more so when their glycaemic control is poor. The essence of this study was to find out if there is a relationship between body mass index (BMI) and level of glycated haemoglobin. We also wanted to know if there was a relationship between level of glycated haemoglobin and disease duration amongst our patients.

Patients and method

Type 2 mellitus patients attending the diabetics care clinic of University of Ilorin Teaching Hospital were recruited for this study. We excluded patients with history suggestive of shortened red blood cell survival, such as sickle cell anaemia.

Patient who did not have our exclusion criteria and were finally recruited into the study, had their ages, sex, duration of illness, weight, height (metres) and body mass index (BMI) recorded. One hundred and fifty diabetics subjects and one hundred and fifty healthy controls were involved in this study. The age range of the patients was 21 – 78 years. Forty percent of the subjects were males, while females constituted 60%, with a male to female ratio of 2:3.

The subjects were fasted overnight and 6mls of blood was collected from each of them between the 8th and 9th hour the following morning. Four mls of blood was put in heparinized sample bottles and stored in the refrigerator at a temperature of 4°C till assayed for glycated HbA_{1c} the following day. The remaining 2mls of blood was put in fluoride oxalate bottle and used for the determination of fasting blood sugar in each patient.

In estimating the percentage HbA_{1c}, we used the ion-exchange temperature independent chromatographic method that uses microcolumn as developed by Biosystem Company of Spain[11]. The glucose oxidase enzymatic method was used to estimate the level of fasting blood glucose[12].

One hundred and fifty age and sex matched controls were selected, and their blood collected and analysed similarly for HbA_{1c} as the patients' group. Patients with HbA_{1c} level above 7.2% were determined using this as a cut-off point for developing diabetic complication[4]. The patients were partitioned according to their sexes and their duration of illness and stratified according to their BMI values.

Epi-Info-Version 6.03

Statistical analysis was conducted using the Epi-Info software package version 6.03, descriptive statistics such as means

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and standard deviation (SD) were calculated to compare characteristics between different categories. The Student t-test was used to determine level of relationship between two mean values.

Results

One hundred and fifty diabetics subjects and one hundred and fifty healthy controls were involved in this study. Forty percent of the subjects were males, while females constituted 60%.

About 90% of the subjects were aged 40 years and above, while the remaining 10% were aged 21 to 39 years. Seventy-two percent of our subjects had diabetics for less than ten years.

Table 1 Age, sex and glycated haemoglobin

	Glycated haemoglobin		
Age (years)	<7.2%	>7.2%	Mean (SD)
20 – 29	3	6	8.43 (1.50)
30 – 39	0	6	9.20 (0.0)
40 – 49	21	30	7.69 (2.04)
50 –59	21	36	8.10 (2.33)
60 – 69	6	12	7.57 (2.14)
≥70	3	6	7.37 (0.58)
Total	54	96	
Female	33	60	7.83 (1.96)
Male	15	42	8.05 (2.16)

Table 2 Duration of treatment and glycated haemoglobin

Duration (Years)	Glycated haemoglobin			
	<7.2%	>7.2%	Mean	(SD)
<5	42	54	7.57	2.10
5 – 9	0	12	8.65	1.44
10 – 14	0	12	7.75	0.40
15 – 19	0	12	7.55	0.17
20 – 24	3	12	10.18	2.37
≥25	3	0	6.70	0.0
Total	48	102		

Table 3 Body mass index and glycated haemoglobin

BMI (Kg/m²)	Glycated haemoglobin			
	<7.2%	>7.2%	Mean	(SD)
15 – 19	0	12	8.55	1.33
20 – 24	15	24	8.77	3.10
25 – 29	15	48	7.76	1.66
30 – 34	12	0	6.40	0.35
35 – 39	0	12	7.40	0.0
≥40	0	12	7.35	0.64
Total	42	108		

Actually most of them had diabetics for less than 5 years. Twenty-eight percent of them had been diabetic for over ten years. Of these 28%, sixteen percent were diabetic for a duration of less than 20 years, while 12% had the disease for over 20 years

The mean glycated haemoglobin among our subjects was 8.0%, while it was 5.2% in the controls. About 64% of the patients investigated had HbA_{1c} value greater than 7.2% about 74% of the subjects with $HbA_{1c} \geq 7.2\%$, were males. (Table 1)

There was no particular relationship between the age of our patients and level of haemoglobin glycation. At the same time there was no distinct relationship between disease duration and HbA_{1c}. See tables 1 & 2

We also investigated the BMI. It was found that more females (66.7%) were overweight as against 35.4% in males. Only female subjects had a BMI > 30kg/m². Most of the subjects BMI fell in the 25 – 20kg/m² group. Body mass index when related to disease duration showed that of 30 patients with a BMI ≥ 30kg/m², 60% of them have diabetics duration of less than 10 years, while 40% of these patients had the disease for over ten years.

When BMI was correlated for glycated haemoglobin, the correlation coefficient *r* was 0.03. However, closer inspection, as shown in table 3, suggested that glycated haemoglobin decreases with increasing BMI.

Discussion

As has been noted by other workers[13,14] we found too that more females (62%) were diabetic in our center. Hassan[9] in Kuwait was of the opinion that the higher number of females in diabetic clinic was due to increased frequency of clinic attendance by females. Probably the males are busy working for money to fend for their families, as is typically the case in most communities in Nigeria, and therefore forget to keep clinic appointments.

Most of our patients (72%) had diabetics for less than ten years. In fact, most of them (64%) were actually diabetic for less than five years. Twenty-eight percent of our subjects had diabetics for more than ten years: of this number only 12% were diabetic for more than 20 years. Similar results regarding disease duration pattern were observed by Hassan[9] and Davidson[14]. Davidson suggested that above pattern either reflected an association between diabetes and recent changes in dietary habits and life style, or a high mortality among diabetic patients especially in developing countries. The two suggestions by Davidson are plausible in developing countries like Nigeria. There is the quick adoption of westernised dietary pattern and life style in Nigeria, at the same time level of poverty makes proper diabetic care unaffordable for most patients.

This is further exemplified by the finding of about 64% of subjects having HBA_{1c} level greater than 7.2%. Most of these patients (74.7%) were males. The implication is that glycaemic control in our center is not so encouraging, more so in males. It also means that the risk of developing diabetic complication was high in our patients, as this risk is more when HbA 1c level is greater than 7.2%[4].

Statistically, there was no relationship between duration of diabetes and level of glycated haemoglobin. This was somewhat incongruent with some other works. In a study[15] on type 2 diabetes as ours, level of glycated haemoglobin was associated negatively with the year since diagnosis of the disease. Similarly, Dorchy et al[16] showed that the levels of glycated haemoglobin were lower during the first two years of a patient devel-

oping diabetes.

In our study, we could'nt demonstrate this inverse relationship of glycated haemoglobin and disease duration. This seems to portend that ab initio glycaemic control in our patients is poor, more so, as all duration groups had HbA1c level greater than 7.2%. Also there was no demonstrated relationship between patient's age and glycated haemoglobin level.

Duration of disease and BMI showed a statistical relationship. The pattern suggested an increase in BMI as disease duration progressed. We found that most patients (60%) with BMI $\geq 30 kg/m^2$ had diabetes for less than ten years as against 40% who had the disease for more than ten years. This could be ascribed to increase morbidity and mortality associated with obesity more in diabetics[18].

The malady of overweight in diabetics was common in females (66.7%) than males. This has become a common finding among diabetic patients, as it has been demonstrated in other similar studies[9,15]. In fact, while most female subjects in our study had BMI greater than or equal to $30kg/m^2$; on relating BMI to level of glycation of haemoglobin, the correlation coefficient r was 0.03. However, a cursory look at respective BMI groups vis-a-vis glycated haemoglobin level, suggests a pattern of decreasing haemoglobin glycation with increasing BMI. Probably, the not so clear situation of this item of our results is likely related to our small sample size, which was affected by the cost of reagents.

However, some workers have noticed the seeming trend observed in our work, about the inverse relationship between BMI and HbA_{1c}. Garay-Sevilla[15] et al and Coutourier[17] et al works suggested that the level of haemoglobin glycation decreases with increasing BMI. It is our suggestion that the relationship between body mass index and glycation should be further investigated, even in our environment.

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