The effect of Glycated Haemogloin A1c and Fasting Blood Glucose in Type1 Diabetes

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Abstract :

The glycated haemoglobin A1c(HbA1c) and Fasting blood glucose(FBG) effect on type1 diabetic pateints as a screening tests and as a gold standard for assessing glycemic control in subjects with diabetes were studied .

Ninety one blood samples were collected in a peroid between June and the end of November 2012 at AL- Kindy Diabetic Center and Central Child Hospital,48 Females and 43 Males , aging between (11 month- 18 year), are divided into three groups, newly diagnosed , ongoing and healthy control group, with duration of disease between(1 day-3months) and (from birth-8 years) for newly diagnosed and ongoing groups respectevily .

The results showed that FBG and HbA1c for newly diagnosed were high (291 mmol/l and 10.6%) respectevily with short duration mean (3.32 week) while ongoing group (207mmol/L and 7.4%) with duration mean(154.5 week) compared with control group values (92.6mmol/L and 4.9%).There was a significant differences between FBG in patients and control at P value < 0.005, and $p < 0.05$ between HbA1c for patients and control .The correlation of FBG in patients and duration of disease were (r= - ve 0.19) and for the control group (r= -ve 0.49).When we compared FBG and HbA1c in patient the correlation was (+ve 0.64) .This study concluds that the combined use of FBG and HbA1c are very important for assessing glycemic control and enhanced the detection of diabetes individuals at high risk for diabetes.

Key words: Type1 diabetes , HbA1c , FBG.

Introduction:

Type 1 diabetes (T1D) is one of the greatest challenges in public health and one of the most frequent chronic diseases which can occur at any age but usually appears between infancy and the late 30s, most typically in childhood and adolescence (1). It accounts for approximately 15% of diabetes population (2). In Iraq, the record for T1D in 1994 was 230 in every 100,000 population (3). In 2007, the overall prevalence of diabetes in Iraq was 21.8 per 1000. Rates are greater in urban than rural areas (25.3 and 15.8 per 1000 , respectively), and in the South/Centre than in Kurdistan (23.0 and 14.3/ per 1000 , respectively). Over the past 20 years, evidences have been accumulated that T1D is an immune-mediated disease which lead to destruction of insulin-producing beta-cells in pancreatic islets of Langerhans (4). At diagnosis patients usually show both cellular and humoral immune changes in their peripheral blood, including the production of autoantibodies to islet cells and insulin, and activation of T- cells (5,6).Some reports have suggested that HbA1c may not be suitable screening test (7,8). Most of studies have suggested the opposite (9,10). HbA1c , which does not require special preparation and measured at any time of the day

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regardless of the duration of fasting or the content of previous meal .The HbA1c test is currently one of the best ways to check diabetes which is under control . Therefore , the purpose of this study is to assess the validity of a measurement of FBG and HbA1c as a screening tests and control for diabetic population .

Material and Methods :

Selection of Study Groups.

During the period from June to the end of November 2012,91 individuals, who were divided in to three groups, were included in this cross sectional study .The first group including 33(17 males and 16 females) clinically newly diagnosed T1D patients with an age range of 1-14 and with duration of disease range (1 day – 3 months) . The second group including 33 (13 males and 20 females) chronic T1D patients with an age range of 3-17 years , and with duration of disease range of (from birth - 8 years) . All members of these two groups were insulin dependent . The third group including 25 (13 males and 12 females) with an age range of (5 – 16 years) , all members of this group were clinically non - diabetic (healthy) individuals .

Clinical Data :-

According to a specified prepared case sheet descriptive variables of the patients were recorded (obtained during collection of blood samples) including: name, age, sex, type of treatment (insulin , personal health decisions or others) , family history of diabetes (weather type1 , type2 or both), duration onset of disease .

Laboratory Analysis:-

Venous blood (3 ml) was drawn from each subject of three groups , at AL- Kindy Diabetic Center and Central Child Hospital , some of blood put in the Ethelen Diamine Tetra acetic acid (EDTA) tube used to quantitative coloreimetric determination of glycohemoglobin A1c in whole blood (HbA1c) analysis (supplied by STANBIO/ Boerne ,Texas) ,and measurement absorbance at 415 nm using by spectrophotometer (CECIL 2031 / France). Sera was separated from remaining blood and used immediately for glucose oxidase method of Fasting blood glucose (FBG) analysis (supplied by GLU-PAP/ United Kingdom), and measurement absorbance at 500nm using by spectrophotometer.

Normal range of FBG for undiabetic individuals ≤ 6.1 mmol/L (≤ 100 mg/dl), and ≥ 7.0 mmol/L (≥126mg/dl) for diabetic individuals. Normal range of HbA1c was (4.2-6.2%) for undiabetic individuals , and ≥48 mmol/mol (6.5%) for diabetic individuals.

Statical analysis was done by use of SPSS program, and p value <0.05 considered significant.

Results :

A total sample of 91 Iraqi diabetic patients and healthy control of both genders. Type1 diabetes was selected of those 48 (52.7%) were femals and 43 (47.2%) were males their percentage are showed in Table 1 for all groups , with age average (1-8 years) their percent showed in Table 2 , and disease duration from (<1->8 years) their percent show in Table 3. Table 4 showed the higher mean of FBG of acute cases (newly diagnosed) with control (195.600 ± 136.70) than mean of FBG in chronic cases with controls (108.880 ± 95.364), and both significantly were higher (p =0.000) , and mean of HbA1c values of acute cases with control were higher (5.628± 2.149) than chronic cases with control (2.492± 2.083),(p=0.000). As well as the level of HbA1c was increased with short duration in acute cases (6.953± 4.180)weeks compaired

with mean of chronic cases (147.081±120.790) weeks. However and the pearson correlation between the FBG and the duration of DM1(r = -ve0.19) and for control group (r = -ve0.49) , while the correlation between the DM1 suger and HbA1c in patients were (+ve0.64). Table 5 showed the level of poor glycemic patients higher 28(30.7%) in newly diagnosed than chronic patients 26(28.5%) , wheares the control group appeared high level of good glycemic 25 (27.4%) than two groups of patients . Good control appeared in HbA1c value(≤7%) versus poor control HbA1c (>7%) according to the American Diabetes Association (ADA). Table 5 showed good control of diabetes was found in chronic patients 8 (8.7%) , and poor control appeared with high level in newly diagnosed patients 31 (34.0%).

Figure1 showed the level of FBG was increased in both patient groups compaired with control group. Wheares Figure 2 showed the level of HbA1c in both patients groups was higher than control group and observed the HbA1c of newly diagnosed was higher than chronic group.

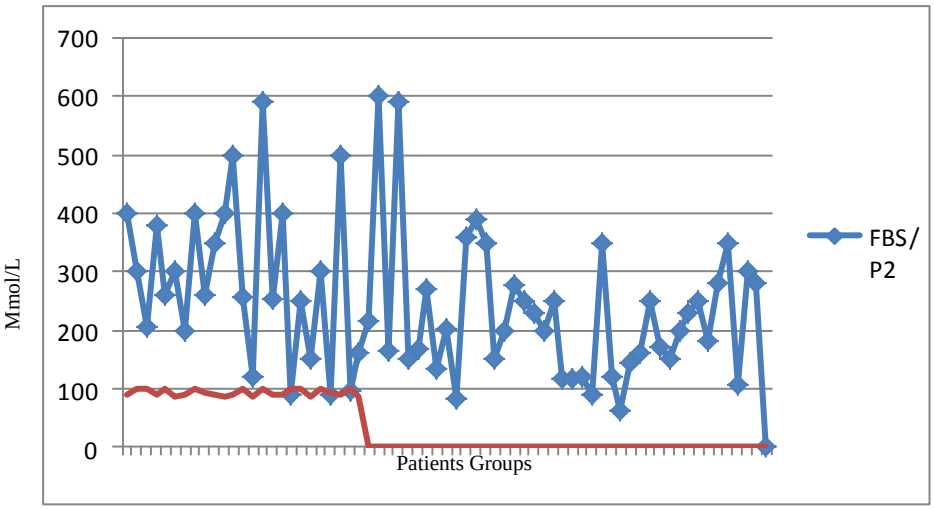

Fig.1:The level of the FBG in both patients and the control groups
P2= patients Group. C= control

Table 1:- Distribution of the categorized groups by gender

Gender	Group 1		Group 2		Group3		Total	
	NO	%	NO	%	NO	%	NO	%
Male	17	18.6%	13	14.2%	13	14.2%	43	47.2%
Female	16	17.5%	20	21.9%	12	13.1%	48	52.7%
Total	33		33		25		91	

Table 2:- Distribution of the categorized groups by Age

Age (years)	Group 1		Group 2		Group3		Total	
	NO	%	NO	%	NO	%	NO	%
1-6	12	13.1%	3	3.2%	1	1.09%	16	17.5%
7-12	17	18.6%	17	18.6%	10	10.9%	44	48.3%
13-18	4	4.3%	13	14.2%	14	15.3%	31	34%
Total	33		33		25		91	

Table3:Distribution of the categorized groups by disease duration

Duration of DM(yr)	Group 1		Group 2		Group3		Total	
	NO	%	NO	%	NO	%	NO	%
<1	33	36.9.%	2	2.1%	/	/	35	38%
1-4	/	/	25	27.4%	/	/	25	27.4%
5- 8	/	/	5	5.3%	/	/	5	5.4%
>8	/	/	1	1%			1	1.0%
Total	33		33				66	

Table 4:- The comparesion between mean for all study groups

	Mean	Std. Deviation	95% Confidence Interval of the Difference		T	Signefecans
			Lower	Upper		
FBG in acute DM1 /chronic DM1	83.84848	163.96725	25.70823	141.98874	2.938	.006
FBG in acute DM1 /control	195.60000	136.70894	139.16932	252.03068	7.154	HS/.000
FBG in chronic DM1/control	108.88000	95.36435	69.51553	148.24447	5.709	HS/.000
HbA1c of acute cases /HbA1c of the controls	5.62800	2.14971	-6.51536	-4.74064	-13.090	HS/.000
HbA1c of chronic cases /HbA1c of the control	2.49200	2.08365	-3.35209	-1.63191	-5.980	HS/.000
HbA1c of acute cases vs the duration of DM 1 in weeks	6.95313	4.18091	5.44575	8.46050	9.408	HS/.000
HbA1c of chronic cases vs the duration of DM in weeks	-147.08182	120.79004	-189.91210	-104.25153	-6.995	HS/.000
The age of the acute cases in years /the age of the chronic cases in years	4.00606	6.00942	-6.13691	-1.87521	-3.830	S/.001

Table 5: Distribution of FBG and HbA1c concentration in all study groups

Marker	Results	Group1 n = 33		Group2 n =33		Group3 n = 25	
		count	%	Count	%	count	%
FBG	Good * glycemic	5	5.4%	7	7.6%	25	27.4%
	Poor ** glycemic	28	30.7%	26	28.5%	/	/
	Total	33	36.1%	33	36.1%	25	27.4%
HbA1c	Good # control	2	2.1%	8	8.7%		
	Fair control ##	/	/	8	8.7%	/	/
	Poor control ###	31	34.0%	17	18.6%	/	/
	Total	33	36.1%	33	36%	25	27.4%

*< 100mmol/L(6.1mg/dl). **≥126mmol/L (6.5 mg/dl).
#(5.5-6.8%) ##(6.8-7.8%). ###(Above 7.8%).

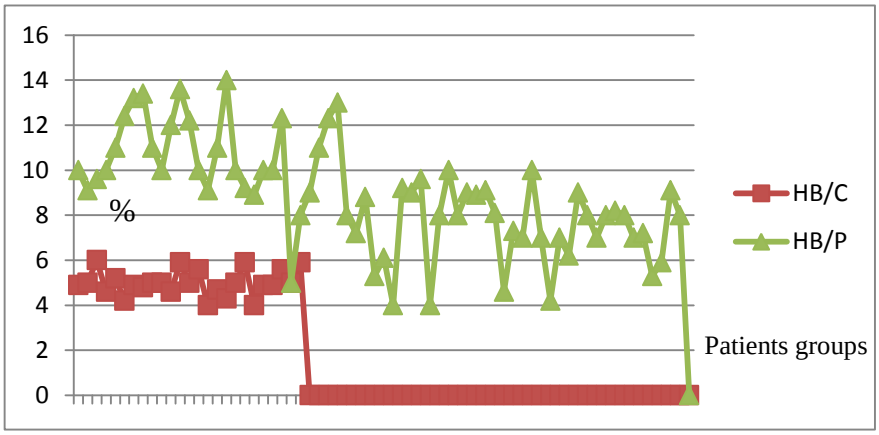

Fig 2:The level of the HbA1c in both patients and the control groups
HB/C= HbA1c for control. HB/P= HbA1c for patients.

Discussion:

Type1 diabetes (T1D) is an autoimmune destruction of pancreatic islet beta cell , an individuals ability to regulate blood glucose ultimately resulting in poor blood circulation, heart disease,strok, kidney failure, and death(11). This study was agreement another previous one (12) in which parameters associated with higher levels of HbA1c , uncontrolled glycemic levels were significantly associated with higher level of HbA1c (p=0.000), and in other study that showed FBG to be strongly correlated

with HbA1c (r=0.60 p=0.000) agreement with present study(r=+0.46) ,and There was significant relationship between poor control of HbA1c and short duration those showed in newly diagnosed patients (group1) p=0.000,while other study reported the HbA1c independently of DM duration(13).To determine the risk factors of poor control of glycated haemoglobin it must agreement between poor control of HbA1c ≥7% and poor control of glycemic≥126 mg/dl (14); because the good glycemic control are in diet and manengment therapy that possible insulin production,and poor control of HbA1c is presumed due to sub- optimal treatment with insulin. Table 4 showed there is a difference between newly diagnose cases of diabetes whose age (11 month - 17 years) and other diabetes patients. HbA1c of newly diagnosed were high because some of cases are smaller in age may be under one year and the symptoms might be lately diagnosis. In this study good glycemic and good control appeared in group 2(chronic cases) more than in newly diagnosed because correct diabetes care , as well as control of HbA1c and good treatment with insulin in these cases morethan in newly diagnosed patients.

Conclusion:

Urgent and efficient diabetes care and diabetes monitoring are needed in Iraq . Diabetes care in these patients is not adequate as shown by very high rates of poor control of HbA1c, poor glycaemic control. We have suggest using the paried values of FBG and HbA1c to identify potential diabetes subjects. Good glycaemic control is more important than earlier belived in preventingcomplications (retinopathy,neuropathy,nephropathy, and macrovascular). The A1c test gives a picture of your average blood glucose control for the past 3 months, and the results give you agood idea of how well your diabetes treatment plan is working.

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تأثير كلوكوز الدم التراكمي وكلوكوز دم الصائم في النوع الاول لمرضى السكري

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الخلاصة :

تم دراسة تأثير كلوكوز الدم التراكمي وكلوكوز دم الصائم لمرضى النوع الاول لداء السكري وذلك لتحديد مدى السيطرة على نسبة السكر في الدم.

تم جمع (91) عينة دم للفترة من حزيران حتى نهاية تشرين الثاني لعام 2012 من مركز الكندي للغدد الصم والسكري ومستشفى الطفل المركزي، (48) اناث و(43) ذكور تتراوح اعمارهم بين (11 شهر-18 سنة)، قسمت العينات الى ثلاثة مجاميع وهي ،المرضى المشخصين حديثا والمرضى المستمرين ومجموعة السيطرة الاصحاء، فترة بقاء المرض بين (1 يوم-3 اشهر) و(منذ الولادة- 8 سنوات) للمشخصين حديثا وللمرضى المستمرين على التوالي .

اوضحت النتائج ان نسبة قياس مستوى السكر في الدم ونسبة تراكمه على كريات الدم الحمراء كانت عالية للمرضى المشخصين حديثا وهي(291 ملي مول/لتر و10٫3%) على التوالي مع معدل قليل لبقاء المرض (24 يوم) مقارنة مع نتائج المرضى المستمرين والتي كانت (207 ملي مول/لتر و 7٫4%) مع معدل بقاء المرض(2٫6 سنة) . تم مقارنة النتائج مع القيم الطبيعية لنسبة السكر في الدم وهي < 1و6 ملي مول/لتر اي < 100 ملي غرام/ديسيلتر و(2٫4 -2٫6 %) نسبة الكلوكوز المتراكم هذا بالنسبة للاشخاص الاصحاء ، في حين تكون نسبة السكر< 0٫7 ملي مول/لتر اي (126 ملي غرام/ديسيلتر) ونسبة التراكمي > 48 ملي مول /مول اي (5٫6 %) في كلا الجنسين ولكل الاعمار للاشخاص المصابين بالسكري. اوضحت النتائج الاحصائية يوجد فرق معنوي للاختلاف بين نسبة السكر للمرضى وللاشخاص الاصحاء هو <5 00و 0 ، في حين كان فرق معنوي لقيم السكر التراكمي بين المرضى والاشخاص الاصحاء هو < 05و0 ،بينما كانت هناك علاقة عكسية بين قيم السكر ومدة بقاء المرض وهي (-19 و0) وعكسية ايضا مع مجموعة السيطرة وهي (-49 و0)، وعند مقارنة نسبة السكر والسكر التراكمي لمجاميع المرضى وجدت هنالك علاقة طردية وهي (+64و0) .نستنتج من هذه الدراسة ان الربط بين القياسين مهم جدا لتحديد السيطرة على الكلوكوز في الدم ويعزز هذا من اكتشاف المرض للاشخاص الذين هم في خطورة للاصابة بداء السكري.