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Random Serum Insulin level in prediction of diabetes mellitus type2

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Abstract

Background: Diabetes mellitus is a chronic physiological disease characterized by increase levels of blood glucose, and can leads to damage to the urinary system circulation system, eyes, nerves system. So that it causes serious problem to healthcare systems. Objective: This study was designed to assess the serum levels of fasting blood sugar (FBS), HbA1C, fasting insulin and random insulin in prediction of type 2 DM in apparently healthy subjects who have had family history of type 2 DM (FH+) of first degree and compare that with those who have no history (FH-). Subjects and Methods: This study was carried out at Biochemistry Department, College of Medicine, University of Baghdad and at Al-Kindy hospital, Baghdad, during the period from July 2022 to November 2022. It involved 50 participants all of them were nondiabetic persons (20 men and 30 women) aged between 23−44 years. These subjects were sub grouped according to their family history of type 2 DM into two groups: group 1 (FH+) was consisted of 29 subjects (13 male and 16 female) and group 2 (FH-) included 21 subjects (7 males and 14 females). Serum investigations included measurements of fasting glucose and insulin as well as random serum insulin by Cobase and blood HbA1C by ion exchange analyzer. Body mass index (BMI) was also calculated for all included subjects. Results: The results showed that there was highly significant increase in mean value in serum random insulin in subjects with FH+ (55.63± 27.08) in comparison with those with FH- (14.43 ± 4.65) (P<0.001). In addition, the mean values of fasting serum insulin, FBS and HbA1C have lower significant increase in subjects with FH+ group (=mean value 13.88, 107.75, 5.03 respectively) comparison with those with FH- group (mean value 7.84, 100.19, 4.85 respectively) (P<0.001). However, the gender, age and BMI did not differ significantly between FH- and FH+ groups. The results also found significant positive correlation between fasting serum insulin and BMI (r= 0364, p <0009) as well between random serum insulin and HbA1C (r= 0286, p < 0044). Conclusion: Random serum insulin was the superior measured parameter in prediction of type 2 DM in apparently healthy subjects who have positive familial history of this disease and differentiate them from those healthy subjects with no history. Fasting serum insulin also has this clinical utility.

Key words:

Diabetes, insulin, prediction

Diabetes mellitus is a group of metabolic disorders causes hyperglycaemia if the patient does not use treatment and it may include Insulin resistance and β-cell dysfunction, or same time both [1]. There is report for WHO estimates presence of 422 million case of diabetes worldwide in 2014. Diabetes mellitus (DM) type 2 is the most common diabetes in the world [1].

High number of type 2 DM a considerable problem for healthcare systems, because type 2 DM is a main cause of nephropathy and blindness and cardiac diseases and mortality [2]. Also, the fungus infection is main complication of type 2 diabetes mellitus [3]. The patients suffering from type 2 DM are at higher risk of tuberculosis [4], H. pylori infections [5]. There is a study for Wesen et al. reported that the cholesterol, triglycerides, high density lipoprotein, low density

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lipoprotein, very low density lipoprotein, uric acid were significantly different in patients suffering from type 2 DM when compared with non diabetes persons [6].

The cases of type 2 diabetes may be reduced by use preventive methods in high-risk persons, but this need previous knowledge of risk in the persons. Non-pharmacological (such as lifestyle) and pharmacological (such as metformin) interventions have ability to reduce the incidence of type 2 DM in high-risk persons [7].

Abbas et al. in a study try to use methods or program to reduce the risk of incident of DM, one program depend on the healthy lifestyle, another one use metformin they found that the risk rates for DM were lowest in the group the lifestyle participants, intermediate in the group of the metformin participants and highest in the group of the placebo participants [8].

Many studies try to prediction of type 2 DM because there is evidence that some interventions may be prevent or delay onset of T2DM in persons at high risk [9]. There are many risk factor were studied as prediction factors included age, sex, family history, body mass index, and smoking [10], value of fasting glucose and, waist circumference [11].

Predictor risk factor differed between men and women, in study for Beverley B. et al. their results was showed that the predictive risk factor were waist circumference and hypertension in men and women, smoking in men, and family history in women. Also, the results showed fasting glucose is a predictive factor of diabetes, without difference between men and women, whereas predictive factors which deferent between men and women are triglycerides and HDL cholesterol, they are a slightly higher relation in women [12]. Also, Eugene et al. showed that lipids with lower carbon number and double bond were associated with high risk of diabetes, whereas the lipids of higher carbon number and double bond were associated with low risk of diabetes [13]. Also, there is study showed that there is relation between IL-18 level and risk associated with type 2 DM [14].

In this study we try to compare multiple risk factors including age, gender, body mass index (BMI), family history, HbA1C, fasting blood sugar, fasting insulin and random insulin and try to determined which one is more relation to prediction for diabetes.

Subjects, Material and Methods

Study population

The study involved 50 participants all of them were nondiabetic persons (20 men and 30 women) aged between 23–44 years from Baghdad, Iraq.

Body weight, height and age were recorded and body mass index was calculated as weight in kilograms divided by the square of the height in meters. Participants were asked whether they have diabetes or not. They were also asked if they were having family history of diabetes (FH+) or they have not family history (FH-). The Family history of diabetes was considered positive if there is any first-degree relative have diabetes [15].

Collection of blood sample

Ten ml of blood were obtained from each participant by vein puncture using 10 ml syringes after an overnight 10-h fast. The blood sample was divided into two tubes. 5 ml was placed in (EDTA) tube and it was processed within three hours, used for HbA1c estimation. And 5 ml was placed in a plain tube and left clot at room temperature after that separated by centrifugation at 3000 rpm for 10 minutes to separate serum and used to test fasting blood sugar and fasting insulin. For random insulin test, another 5 ml of blood was collected after one hour from meal.

Biochemical test

All biochemical tests were done in health center laboratories located in Specialized Center for Endocrinology and diabetes in Baghdad, Iraq. fasting serum glucose, was tested by the glucose oxidase method, a using echnicon glucose, linear company Spain chemical. S. L. [16].

Insulin was quantified by microparticle enzyme immunoassay with an automated analyzer (c 2022 f. Hoffmann-La Roche Ltd). HBA1C was quantified by high-performance liquid chromatography, using a L9100 automated ion exchange analyzer (Roche Company, USA)

Statistical analysis

The data was analyzed by the statistical package available from SPSS-26. Data were showed in simple measures of frequency, percentage, mean, standard deviation and range (minimum and maximum values).

The significance of the difference for qualitative data was tested using the Pearson Chi-square test (χ2-test). Statistical significance was taken into account when the P-value was equal to or less than 0.05.

Numeric data were presented as mean and standard deviation after performance of Kolmogorov- Smirnov normality test and making decision about normally and non-normally distributed variables. Independent samples t-test was used to study difference in mean between any two groups provided that the variable is normally distributed.

Results and discussion

Table 1 shows the distribution of demographic characteristics of the studied samples, the results revealed that the highest percentage of 10 (34.5%) of participants FH+ in age group (36-40 year), while 10 (47.6%) of the studied sample FH- in age group (26-30 year). Also the results showed the most of participants were females. These results indicate normal weight was prominent in the highest percentage (57.1%, and 51.7%) of FH- and FH+ groups respectively.

Table (1) the distribution of demographic characteristics of the studied samples

			Family History		X2	P. value
			FH-	FH+		
age groups	≤ 25 years	No.	1	1	2.458	0.652 NS
		%	4.8%	3.4%		
	26-30 years	No.	10	8		
		%	47.6%	27.6%		
	31-35 years	No.	3	5		
		%	14.3%	17.2%		
	36-40 years	No.	5	10		
		%	23.8%	34.5%		
	>40 years	No.	2	5		
		%	9.5%	17.2%		
Gender	Male	No.	7	13	0.670	0.413 NS
		%	33.3%	44.8%		
	Female	No.	14	16		
		%	66.7%	55.2%		
BMI Categories	Underweight	No.	1	0	1.902	0.593 NS
		%	4.8%	0.0%		
	Normal Weight	No.	12	15		
		%	57.1%	51.7%		
	Overweight	No.	7	13		
		%	33.3%	44.8%		
	Obesity	No.	1	1		
		%	4.8%	3.4%		

Table 2 represents the difference of the mean values between FH- and FH+ groups according to age, weight, height and BMI of the participants, the results reveal that there is no significant difference between FH- and FH+ groups (P. value >0.05) figure 1. Whereas other study for Isomaa et al. in Western Finland showed that the family history of DM type 2 was associated with high BMI [17].

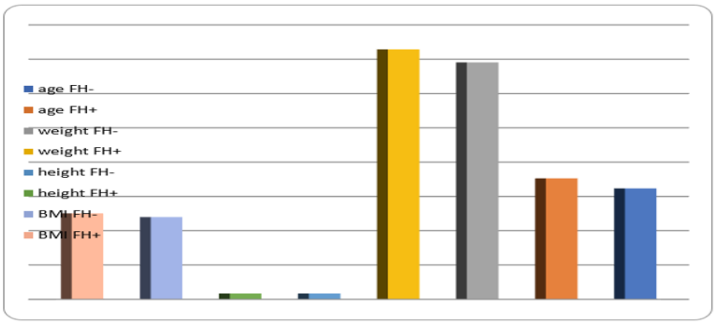

Figure 1 the mean values of FH- and FH+ groups according to age, weight, height and BMI

Table (2) the difference of the mean values between FH- and FH+ groups according to age, weight, height and BMI of the participants

Independent sample test						
	History	N	Mean	Std. Deviation	t. test	P. value
Age	FH-	21	32.33	5.579	-1.825-	0.074
	FH+	29	35.27	5.662		
Weight	FH-	21	69.09	9.549	-1.468-	0.149
	FH+	29	72.89	8.649		
Height	FH-	21	1.69	0.036	-0.542-	0.590
	FH+	29	1.70	0.052		
BMI	FH-	21	23.96	3.151	-1.370-	0.177
	FH+	29	25.04	2.405		

*significant <0.05

In table 3 the current study demonstrates that there is a significant difference between FH- and FH+ groups (P. value <0.05) and showed that the participants who have a history of diabetes have mean value higher significantly than those who have not history of diabetes regarding the studied parameters HbA1C, fasting blood sugar, fasting insulin and random insulin. That is may be because the heritability of type 2 diabetes is high [18].

Also the results showed that the correlation between random insulin and family history is highly significant more than other parameter and the mean value is 55.63 for FH+ whereas 14.43 for FH- (P. value <0.001) figure 2.

Table (3) the difference of the mean values of the parameters between FH- and FH+ groups

Independent sample test						
	History of DM	N	Mean	Std. Deviation	t. test	P. value
HbA1C	FH-	21	4.85	0.344	-2.352-	0.023*
	FH+	29	5.03	0.189		
FBS	FH-	21	100.19	12.122	-2.436-	0.019*
	FH+	29	107.75	9.825		
Fasting insulin	FH-	21	7.84	2.778	-4.792-	<0.001*
	FH+	29	13.88	5.266		
Random insulin	FH-	21	14.43	4.657	-6.879-	<0.001*
	FH+	29	55.630	27.082		

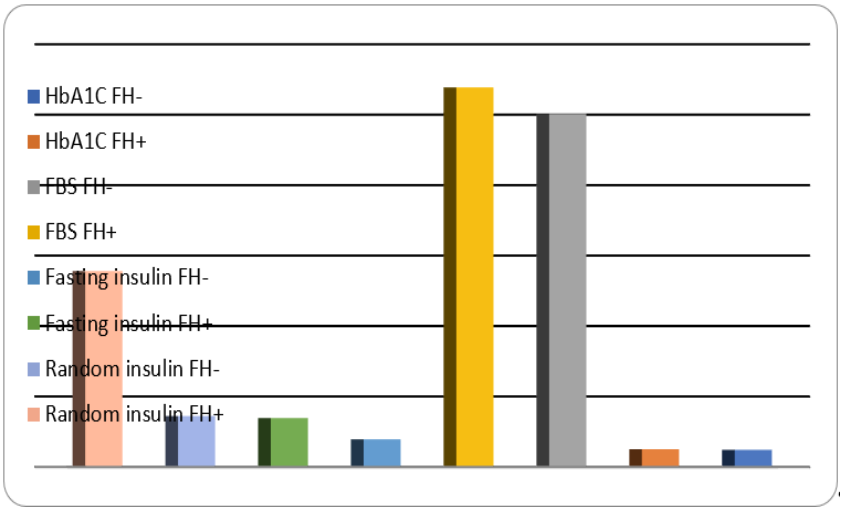

Figure 2 the mean values of the random insulin, fasting insulin, FBS and HbA1C in FH- and FH+ groups

In previous study the researcher reported that the HbA1C have predictive power similar to fasting glucose but the strongest predictive value was seen by use 2h glucose [19]. Other study showed that even random glucose provide predictive ability for diabetes type 2 [20].

Beverley et al. try to camper among many parameters as predictive factors for DM type 2 they found the fasting glucose was the most predictive factors camper with waist circumference, BMI, and GGT (Gamma Glutamyl transpeptidase), smoking status and triglycerides [12], but they did not studied the insulin levels. In spite of in many models of predictive of type 2diabetes the fasting serum insulin was used as significantly associated with type 2 diabetes [15].

Our results is agreed with previous study for Tomoshige et al they proved that the insulin level during OGTT (Oral Glucose tolerance test) have strong predictor of future type 2 diabetes. And they explained that as if insulin sensitivity reduces, insulin secretary must increase to keep normal glucose tolerance [15]. Tomoshige et al. measured insulin level after 1 hour from giving 100 g glucose whereas our study after one hour of meal.

Table 4 shows that the age have positive correlation with BMI, fasting insulin, and random insulin (r= 0.294/ P. value=0.038, r=0.367/P. value= 0.009, and r=0.371/p. value =0.008 respectively). While body mass index have positive correlation with FBS, and fasting insulin (r=0.282/ P. value=0.047, and r=0.364/ p. value=0.009 respectively). HbA1C have only positive correlation with Random insulin (r= 0.286/P. value =0.044). Finally, Random insulin have a significant positive correlation with Fasting insulin (r=0.577/ P. value =0.001). Positive correlations between parameters indicate that there is a direct proportion between the studied values.

Table (4): Correlation between markers level and Demographic characteristics of the studied sample

		age	BMI	HbA1C	FBS	Fasting insulin	Random insulin
Age	Pearson Correlation	1	0.294*	0.162	0.083	0.367**	0.371**
	P. value		0.038	0.260	0.565	0.009	0.008
BMI	Pearson Correlation	0.294*	1	0.134	0.282*	0.364**	0.213
	P. value	0.038		0.353	0.047	0.009	0.137
HbA1C	Pearson Correlation	0.162	0.134	1	0.256	0.227	0.286*
	P. value	0.260	0.353		0.073	0.113	0.044
FBS	Pearson Correlation	0.083	0.282*	0.256	1	0.197	0.200
	P. value	0.565	0.047	0.073		0.171	0.163
Fasting insulin	Pearson Correlation	0.367**	0.364**	0.227	0.197	1	0.577**
	P. value	0.009	0.009	0.113	0.171		0.001
Random insulin	Pearson Correlation	0.371**	0.213	0.286*	0.200	0.577**	1
	P. value	0.008	0.137	0.044	0.163	0.001	

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the 0.01 level (2-tailed).
r (Pearson Correlation)

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