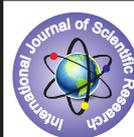


Serum Ferritin and HbA1c as indicator among Type II Diabetics



Medical Science

KEYWORDS: Diabetes type II, HbA1c, Serum ferritin and lipids.

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ABSTRACT

Type II diabetes is one of the most common chronic metabolic disease with multifactorial aspects hence considered metabolic X disease as well. Regarding monitoring the status of diabetes S. Ferritin and HbA1c are now considered easy, time saving and reliable method to identify average glucose tolerance over large range of period. The present study was conducted on 175 clinically proven diabetic subjects and 25 nondiabetics as control to assess relationship of P. glucose level with HbA1c and Serum Ferritin. The level of lipids viz. cholesterol, HDL and Triglycerides were also estimated. The subjects revealed a significant relationship of plasma insulin and serum ferritin levels. Among non-biochemical factors BMI was also a significant variable for diabetics.

Introduction

Type 2 diabetes mellitus is one of the most common chronic metabolic diseases expanding vastly all over the world. It is a complex, multi-factorial disease which affects the quality, quantity and style of life. Findings from the UKPDS (1994) suggested that the onset of diabetes may be up to seven years before the clinical diagnosis is made and Type 2 diabetes is associated with a significant burden of premature mortality, morbidity and economic burden. There is increasing evidence from the large clinical trials suggesting that earlier detection of diabetes and treatment of hyperglycaemia and the related metabolic abnormalities may be beneficial in reducing the development and progression of cardiovascular events and complications of diabetes. Serum ferritin (S. ferritin) is an intracellular plasma protein that stores iron and is used as a marker for iron overload disorders such as diabetes mellitus. Glycated haemoglobin *i.e.* HbA1c is a form of haemoglobin used primarily to identify the average plasma glucose concentration over prolonged period of time. Diabetes control and complications research group (DCCT 1993), predicted HbA1c as one of the well-established mean of monitoring glycaemic control in patients with diabetes mellitus. Regarding HbA1c, Thomas and Elliott (2009) described it as the best measure of long-term glycaemic control, since it represents the average blood glucose levels over several months.

HbA1c include single estimation, non-requirement fasting, least intra-individual variability, and minimal analytical variability. It provides information about the glucose levels of the previous 3 months. A diabetic person with good glucose control has HbA1c close to or within the references range. Thus HbA1c and S. ferritin levels play an important role in the detection and diagnosis of diabetes mellitus. Hence, the current study was conducted to verify the correlation and status of S. ferritin and HbA1c among diabetics and non-diabetics.

Material and Methods

The study was conducted on 175 clinically proven diabetics as per WHO criteria, irrespective of the duration of onset of disease along with these 25 healthy subjects free of diabetes belonging to same age group were also included as controls. A written consent from each subject was taken for their inclusion in study. To analyze various non biochemical parameters a detailed proforma including age, gender, smoking status, alcohol intake, hypertension, Body Mass Index (BMI), any previous family history of disease and daily duration and type of physical activity performed by individual was recorded. The biochemical parameters including fasting blood sugar, serum ferritin, plasma insulin (PI), Haemoglobin (Hb), serum cholesterol, HDL, triglycerides and HbA1c were estimated as per standardized techniques. Regarding S. ferritin WHO 2011 criteria and for grading HbA1c assessment criteria adopted by Al-Shoumer *et al.*, 2008 was used.

Results and Discussion

The study comprised study comprised of 175 clinically proven diabetics and 75 control subject corresponding to age group of 40-60

years. The findings as per biochemical and non-biochemical variables are presented as below

S. ferritin and HbA1c with relation to non biochemical parameters:

In the current study 47% of subjects were found to be hypertensive, 5% of subjects were smoker and 28% were found to be alcoholic. Regarding different aspects studied when compared for diabetics and controls significant difference in levels of FBS, S. ferritin and HbA1c were observed while slight significantly elevated BMI ($p=0.019$) in diabetics as compared to controls were recorded (Table 1). The results revealed consonance with Liu *et al.* (2015) who observed significant rise in S. ferritin levels among nonobese with deteriorated glucose disorder and found positive correlation between FPG and S. ferritin levels while revealed inverse relationship with HDL levels. In the present study, when HbA1c and serum ferritin levels were compared to diabetes mellitus with regard to physical activity, age, BMI, alcohol, smokers. With physical activity, levels of HbA1c were low, *i.e.* physically active subjects have good control on blood glucose.

Table 1: The levels of various variables for diabetic and controls.

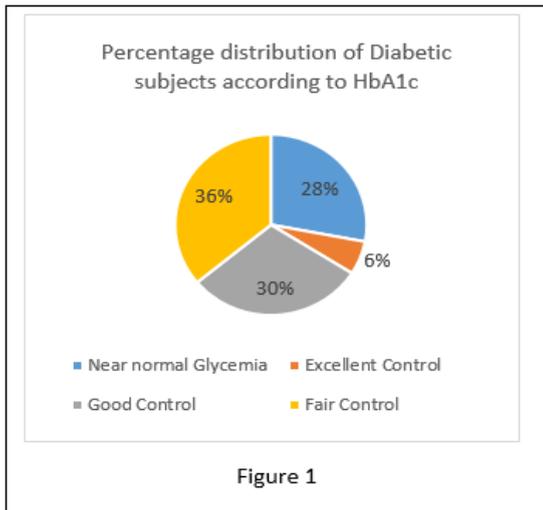
S. no	Factor	Diabetics	Control	T test	P value	Significance
1	Age (Years)	45.8 ± 14.4	45.16 ± 11.9	0.2004	0.84	NS
2	BMI	27.39 ± 2.13	25.15 ± 2.53	2.4688	0.0199	Slight S
3	Waist circumference	36.9 ± 4.9	34.95 ± 3.9	1.127	0.269	NS
4	FBS	153.4 ± 26.03	92.2 ± 15.7	5.685	0.0001	HS
5	TG	158.3 ± 28.22	148.7 ± 18.7	1.586	0.116	NS
6	HDL-C	39.5 ± 7.01	42.05 ± 5.189	1.96	0.0522	NS
7	S. ferritin	200.9 ± 106.3	124.84 ± 57.01	2.188	0.037	S
8	P. Insulin	24.87 ± 22.1	14.95 ± 13.46	1.3455	0.189	NS
9	HbA1c	18.75 ± 11.3	6.25 ± 3.98	0.0015	0.0015	HS

S= significant, NS= non-significant, HS = highly significant

HbA1c levels were significantly elevated in case of obese subjects as compared to normal subjects and are in confirmation to the findings of Wrede *et al.* (2006) showing less control on diabetes in obese diabetics than with normal BMI diabetics. Aged diabetes subjects have higher levels of HbA1c. Smoking represented significant influence on the level of diabetes mellitus HbA1c levels were low or near the reference range in smokers than non-smokers. S. ferritin levels are significantly raised with plasma insulin among diabetic population.

S. ferritin and HbA1c with relation to biochemical parameters

The following results among biochemical parameters have been observed



S. ferritin and HbA1c

The data revealed very meagre number of subjects with excellent control of HbA1c as compared to those with fair control (figure 1). Regarding relationship between biochemical parameters the analysis of samples from the subjects from present study revealed highly statistically significant difference between the S. ferritin level (p=0.0037) and HbA1c (p=0.0015) among diabetic with respect to controls (Table 1). While analysing the correlation of various variables the S. ferritin levels were found to be significantly correlated (Table 2) with HbA1c (p<0.005) and plasma insulin levels (p<0.001) and our findings are in consensus with Momeni *et al* (2015) who among 67 patients reported significant decline in S. ferritin levels, HbA1c and triglycerides with control in hyperglycemia while no decline in HDL and LDL levels. Similar to this Padmja *et al* (2015) detected statistically significant increase of FPG, HbA1C and S. ferritin levels in type 2 diabetes mellitus group than controls with a high (r= 0.62, r= 0.66) positive correlation between S. ferritin and HbA1c in diabetic group (p ≤ 0.01). Our findings are contrary to those of Sharifi and Sazandeh (2004) who did not found any significant difference between the diabetics and control groups regarding age, Hb and BMI however they described significant rise in mean S. ferritin in diabetics than in the control group (101±73 mg/ml vs. 43.5±42 mg/ml, p<0.001) but no correlation between S. ferritin and HbA1c in diabetic patients. Similar to them Parmiladevi *et al* (2013) found no correlation between S. ferritin and HbA1c, age, sex, metabolic syndrome, coexistent hypertension, total cholesterol, LDL and serum triglycerides.

Table 2: Correlation of various biochemical variables included in total population

	BMI	BP	FPG	TGs	HDL-C	S. ferritin	P. Insulin
BMI	1						
Waist circumference	-0.05773	1					
FPG	0.075429	0.4324	1				
TGs	-0.09939	0.89676*	-0.2242	1			
HDL-C	-0.12328	0.56262	-0.2362	0.1963	1		
S. Ferritin	0.104226	0.7659*	0.2594	0.0456	0.0364	1	
P. Insulin	0.192373	0.27999	0.2616	-0.1159	0.0585	0.882*	1

* significant

S. ferritin and HbA1c with lipids

S. ferritin levels in the current study did not revealed any significant correlation (Table 2) with levels of triglycerides and HDL, the results

were found to be differing with Fernandez *et al*, 1998 s they described positive correlation of S. ferritin concentration with plasma triglycerides while negatively with HDL cholesterol. The FBS levels in current study were significantly raised (p=0.001) while HDL levels (p=0.05), P. Insulin (p=0.03), triglycerides (p=0.116) did not represented any significant difference between diabetic and controls (Table 1) and results were in confirmation with Raj and Rajan 2013, describing positive correlation between S. ferritin and FBS, HbA1c while no correlation between S. ferritin and age, sex, hypertension and lipids. Similarly, Raghavani and Sirajwala (2014) detected statistically significant raised levels of S. ferritin in patients of DM with Cardio Vascular Disease (CVD) (368 ± 67 ng/ml) than DM without Cardio Vascular Disease (192 ± 32 ng/ml) and controls (65 ± 14 ng/ml) an described S. ferritin as an important and independent predictor of the development of diabetes mellitus and its cardiovascular complications.

S. ferritin and HbA1c as marker for diabetes type 2

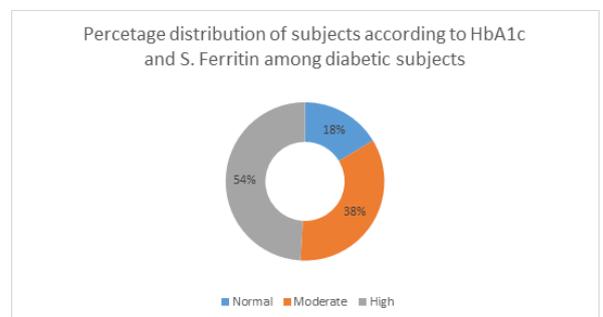
In the present study among total population, significant correlation was found between S. ferritin, HbA1c and FBS along with plasma insulin levels (Table 2). The results are confirmatory to the findings of Maheshwari *et al* (2015) as they in their case control studies concluded elevated S. ferritin levels to be having potential role in development of type 2 diabetes. They also suggested S. ferritin to be included in standard screening protocol to identify patients to be at risk of developing type 2 diabetes mellitus. In consonance to it Sudhakar *et al* (2015) also revealed a positive association between S. ferritin concentration as markers of glucose homeostasis in newly diagnosed type 2 diabetes mellitus patients, previously diagnosed type 2 diabetes mellitus patients, impaired fasting glucose subjects and healthy controls.

Conclusion

HbA1c and S. ferritin levels play an important role in the detection, thus diagnosis of diabetes mellitus. HbA1c and S. ferritin include single estimation, non-requirement fasting, least intra-individual variability, minimal analytical variability and provides information about of the glucose levels of the previous 3 months.

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Figure 2



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