Atherogenic Index of Plasma Levels in Iraqi Diabetic and Diabetic Nephropathy Patients

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Abstract

The study aimed todetermine the Levels of HbA1c %, urea, createnine, albumin,total cholesterol, triglyceride,high density lipoprotein (HDL-c), low density lipoprotein (LDL-C) and very low-density lipoprotein (VLDL) in diabetic and diabetic nephropathy patients and to compare the results with that of control group. Then, to compare Atherogenic Index of Plasma levels in these groups that may be predict prone of patients to cardiovascular illness. This study has selected one hundred fifty participates who were consideredto be enrolled in this research with aged ranged (40-65) years that divided into three groups as follows: group one (G1) consists of 50 healthy individuals as a control group, group two (G2) consists of 50 patients with diabetes and group three (G3) consists of 50 patients with diabetes and nephropathy as complication.

This study illustrated significant increased were found in Total Cholesterol and low-density Lipoprotein in G2 comparing to G1, while there was highly significant increase in total cholesterol and low-density lipoprotein in G3 comparing to G2 and in G1. Results, also, revealed highly significant increase in triglyceride and very low density in G2 and G3 comparing to G1. Data demonstrated highly significant decrease in high density lipoprotein in G2 and G3 comparing to G1. Also, demonstrated highly significant increase in Atherogenic Index levels in G2 and G3 comparing to G1, while no significant increased observed in G3 comparing to G2. Sothe study concluded that Atherogenic Index is elevated in diabetic and nephropathy diabetic patients who could be used as a marker for predict cardiovascular disease in patients groups.

Keywords: *Diabetic Nephropathy, Lipid profile and Atherogenic Index (AIP).*

Introduction

Diabetic nephropathy is the most common cause of chronic kidney disease and represents a large and ominous public health problem. Patients with diabetic kidney disease have exceptionally high rates of cardiovascular morbidity and mortality. In fact, the excess mortality among patients with diabetes appears to be largely limited to the subgroup with kidney disease and explained by their high burden of cardiovascular disease [(1)].

Obesity increases the risk of many diseases such as heart disease, type 2 diabetes, obstructive sleep apnea, cancers and osteoarthritis**[(2)].** There is a seven times greater risk of diabetes in obese people in contrast with healthy weight, with a threefold increase in risk for overweight people. Also, body fat distribution is an important determinant of increased risk of diabetes **[(3)].**

The atherogenic index of plasma (AIP), defined as logarithm [log] of the ratio of plasma concentration of triglycerides to high-density lipoprotein (HDL) cholesterol, has recently been proposed as a predictive marker for plasma atherogenicity and is positively correlated with cardiovascular disease risk. Also, AIP correlates with the size of high-density lipoprotein and

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low-density lipoprotein particles and with the fractional esterification rate of cholesterol by lecithin: Cholesterol acyl transferase in plasma. This ratio accurately reflects the presence of atherogenic small low-density lipoprotein and high-density lipoprotein particles, is a sensitive predictor of coronary atherosclerosis and cardiovascular risk and a useful surrogate for insulin resistance [4].

Materials and Method

One hundred fifty individuals with age ranged between (40-65) years were enrolled in this study. They divided into three groups as follows:-

1. Group (G1) that consists of 50 healthy individuals as control group.
2. Group (G2) that consists of 50 diabetic patients.
3. Group (G3) that consists of 50 diabetic nephropathy patients.

Blood samples were collected from all groups after a period of fasting 12-14 hours. The study was conducted between March 2020– June 2020 in the diabetic & endocrinology center in Al- Yarmouk Teaching Hospital/Iraq.

Whole blood was used in determination of HbA1c. The HbA1c was determined by HPLC method. A hemolyzed whole blood was mixed with a weakly binding cation-exchange resin. The nonglycosylated hemoglobin (HbA0) linked to the resin, leaving (HbA1) free to remove by a resin separator. The percent of HbA1 was measured by evaluation of the absorbance values at 415nm of HbA1 fraction and of the total Hb fraction,by calculating the ratio of absorbances (R). This ratio comparing was compared to the ratio of a glycohemoglobin standard that obtained from the same procedure[5]. The urea level was estimated after enzymatic hydrolysis by urease enzyme. Indophenol compound was generated from Salicylate and Hypochlorite as shown in below . The intensity of the green complex is proportional to the urea found in the sample[6]. Creatinine in the sample was reacted with picrate in alkaline medium forming a coloured complex (Jaffe method)[7]. The method for determination of albumin was based on the specific binding of bromocresol green (BCG), an anionic dye and the protein at acidic pH with the resulting shift in the absorption wavelength of the complex. The intensity of the color formed was proportional to the concentration of albumin in the sample[8]. Serum glucose was measured by using kits from (Randox Company, United Kingdom) which based on the PAP enzymatic determination of glucose[9]. Total cholesterol[10],triglyceride [11]and HDL-c [12]were measured by enzymatic method from (Human Gesellschaft fur biochemical and Diagnostica mbH, Germany.). The levels of LDL-C and VLDL-C were analyzed by using Friedewald equation as follows[13]:

$$\text{LDL} - \text{C}\left(\frac{mg}{dl}\right) = Total\ cholesterol - HDL - \frac{TG}{5}$$

Serum VLDL-C can be calculated by:

$$\text{VLDL} - \text{C}\left(\frac{mg}{dl}\right) = \frac{TG}{5}$$

The atherogenic index of plasma (AIP) was calculated according to Milada formula equation as display below[14]:

$$\text{AIP} = \frac{logTG}{HDL}$$

Statistical Analysis: The results expressed as mean± SEM. Students t-test was applied to compare the significance of the difference between DN, Diabetic patients and control groups. p-value ($P \geq 0.05$), ($P \leq 0.05$), ($P \leq 0.001$) considered statistically nonsignificant, significant and highly significant respectively. The correlation coefficient (r) test is used for describing the association between the different studied parameters.

Findings: Results in table (1) illustrated levels of (FBG, HbA1C%, urea, creatinine and albumin) in G1, G2 and G3. Results in table (1) reveled a significant elevation in FBG, HbA1c%, urea and creatinine levels in G2 comparing to G1. Results, also, showed a highly significant elevation in these parameters in G3 comparing to G1 and G2. While results display a significant decrease in albumin levels in G2 and G3 comparing to G1 and in G3 comparing to G2.

Table 1: Descriptive Parameters for G1, G2, G3

Parameters	(G1)	(G2)	(G3)	T-Test G1 vs G2	T-Test G1 vs G3	T-Test G2 vs G3
FBG (mg/dL)	90.62±7.223	177.62±25.742	230.67±50.974	S	S	S
HbA_{1C} (%)	5.32±0.475	8.42±1.068	11.77±1.47	S	S	S
Urea (mg/dL)	20.31±3.4	33.67±4.62	107.37±57.2	S	S	S
Creatinine (mg/dL)	0.47±0.11	0.92±0.164	3.94±2.42	S	S	S
Albumin (mg/dL)	4.029±0.3	3.97±0.215	2.4±0.836	NS	S	S

Table (2) shows the levels of total cholesterol, triglyceride, high density lipoprotein (HDL-c), low density lipoprotein (LDL-C), very low density lipoprotein (VLDL) and AIP levels for G1, G2 and G3. Results revealed a significant elevation in levels of total cholesterol, triglyceride, low density lipoprotein and very low density lipoprotein in G2 and G3 comparing to G1 while a significant decrease was found in HDL levels in G2 and G3 comparing to G1. Results, also showed a significant elevation in (TC, TG, LDL-c and VLDL-c) in G3 comparing to G2,while nosignificant was found in G3 comparing to G2 in HDL levels. Result in this table, also, demonstrated highly significant elevation in Atherogenic Index levels in G2 and G3 comparing to G1, while no significant increase observed in G3 comparing to G2.

Table (2): Lipid profile (TC, TG, HDL-c, LDL-c, VLDL-c) and AIP levels for all studied groups.

Parameters	(G1)	(G2)	(G3)	T-Test G1 vs G2	T-Test G2 vsG3	T-Test G1 vsG3
TC (mg/dL)	187.4±6.1	193.5±6.6	271.47±5.5	N.S	S	S
TG (mg/dL)	105.04±20.111	177.01±52.8	228.5±6.8	S	S	S
HDL-c (mg/dL)	48.166±4.444	35.167±4.32	35.2±4.211	S	NS	S
LDL-c (mg/dL)	82.2±14.37	110.1±32.47	195.95±5.8	S	S	S
VLDL-c (mg/dL)	22.475±6.34	34.42±9.21	53.62±12.41	S	S	S
AIP	0.54±0.017	0.82±0.024	0.89±0.017	S	N.S	S

Diabetic dyslipidemia comprises a triad of raised triglycerides, decrease HDL-c and excess of small, dense low density lipoproteinparticles, which is in agreement with the present study[15]. The dyslipidemia are found in diabetes patients due to insulin resistance or deficiency affect key enzymes and pathways in lipid metabolism[16].

In individuals with type 2 diabetes, metabolic syndrome and the combined dyslipidemia, cardiovascular risk is elevated by a clustering of risk factors such as abdominal obesity, impaired fasting glucose, increased blood pressure, low HDL-cholesterol (HDL-C), elevated triglycerides (TGs) and an elevated in small, dense LDL particles. The current increase in the incidence of type 2 diabetes in the population perhaps poses the most urgent cardiovascular risk. Although insulin resistance is crucial to the pathogenesis of the disease, the associated atherogenic lipoprotein phenotype considerably enhances the risk. Hence there is an ongoing intense search for a medication capable of modifying the atherogenic lipid profile as well as lowering glucose. Medications of the thiazolidinedione class traditionally used for glycemic control in patients with type 2 diabetes seem to hold promise in this respect[17].

Atherogenic Index may be an important tool for analyzing the results of clinical trials. The association of triglycerides and high density lipoprotein in this simple ratio theoretically reflects the balance between risk and protective lipoprotein forces and both triglycerides and high density lipoprotein are widely measured and available[18].

In summary, Atherogenic Index provides

information about the atherogenicity of plasma and quantifies the response to therapeutic intervention[19].

Conclusion

The study concluded that Atherogenic Index is increased nephropathy diabetic patients more than diabetic and control group that could be used as a marker for predict CVD in patients' groups.

Conflict of Interest: None

Funding-self or other Source: None

Ethical Clearance: All studies were conducted in accordance with the ethical committee of Al-Farahidi University/Iraq.

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