Evaluation of serum lipoprotein ratios in impaired glucose tolerance patients and a comparison study with euglycemic control

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Abstract

Background: It is well known that both diabetes and dyslipedemia are potent risk factors for cardiovascular disease and both conditions are correlated strongly. In the current study we have analysed TG/HDL ratio and TC/HDL ratio to evaluate the dyslipidemic status in impaired glucose tolerance patients and a comparative study with the control for the same. **Methods:** We have studied two groups for comparison which include normoglycemic control group and impaired glucose tolerance group of sample size 67 and 44 respectively. Student t-test is used for comparison study and P value <0.05 considered as significant. **Results:** It is found that the serum lipoprotein ratios TG/HDL is increased significantly in impaired glucose tolerance group compared to control with P value <0.05 and TC/HDL ratio is not significantly altered between the groups. **Conclusion:** Our study found that the serum lipoprotein ratio (TG/HDL) is elevated in conditions of impaired glucose tolerance suggesting a link between hyperglycemia and dyslipidemia.
Key Words: Diabetes Mellitus, dyslipidemia, TG/HDL, TC/HDL.

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INTRODUCTION

Diabetes (DM) and dyslipidemia are major non – communicable diseases which may lead to micro and macrovascular complications[1] which may lead to cardiovascular diseases. Type 2 Diabetes mellitus (t2DM) which are characterised by hyperglycemia, insulin resistance and insulin deficiency and was found to be a major causative factor for dyslipidemia associated with type 2 DM[2]. Dyslipidemia is defined as derangements of one or more of the lipoproteins in blood such as elevated Total Cholesterol (TC), low density lipoprotein cholesterol (LDL-C) or low levels of high density lipoprotein cholesterol (HDL-C) alone[3]. Many reports have shown that disturbance of lipid metabolism appear to be an early event in the development of type 2 diabetes, potentially preceeding the disease by several years[4]. The dyslipidemia which is characterised by moderately increased TG levels carried in Very low density lipoprotein particles (VLDL) and reduced high density lipoprotein particles (HDL-C) carried in small HDL particles and LDL-C do not differ substantially from those of individuals with type 2 diabetes[5] and increased circulating insulin concentration,[6]. Plasma TG, HDL-C and TC are independent factors associated with insulin resistance and are independent predictors of cardiovascular complications associated with

dyslipidemia[7,8]. In this study we investigated whether patients with impaired glucose tolerance (≥ 107 mg/dl) have altered TG/HDL or TC/HDL ratio compared to normal control.

MATERIALS AND METHODS

Subjects

The study group was categorised into two groups. The first group is normoglycemic group which served as control and the comparison group was hyperglycaemic impaired glucose tolerance group (IGTG) which is the case group. The total sample size used for control normoglycemic group was n=67 and the sample size used for impaired glucose tolerance hyperglycaemic group was n=44. The study group includes both men and women in the age between 25 and 65. The cut off value for impaired glucose tolerance is set as blood glucose ≥ 107 mg/dl. Blood was collected by venipuncture after a 12 hour fast. Fasting plasma glucose, serum total cholesterol and triglycerides were measured immediately after collecting blood. Glucose, triglyceride and total cholesterol in blood was estimated by enzymatic method (Beacon diagnostics) and HDL-cholesterol was measured by precipitation method (Beacon diagnostics). Total cholesterol/HDL ratio was calculated by dividing Total cholesterol by HDL-C (TC/HDL) and triglyceride/HDL ratio was calculated by dividing Triglyceride level by HDL-C (TG/HDL). All the analysis was done in a biochemistry semi-autoanalyser (Robonics).

Statistical Analysis

The values are expressed as Mean ± SD. The statistical significance between the groups was studied by student t-test. All P values < 0.05 (two tailed) were considered as significant. All statistical analysis was performed using Microsoft excel software.

RESULTS

In the first part of the result depicted in table 1 we compared the TG/HDL ratio of control and Impaired glucose tolerance group (IGTG). From the statistical analysis we have found that the TG/HDL ratio increased significantly in IGTG compared to normoglycemic control (P value < 0.05, 0.0313). The bar graph to show the comparison with average value represented as Mean±SD (Figure1).

Table 1:

Group	Average (TG/HDL)	SD	P value
Control	3.97002	1.527377831	0.0313
IGTG	4.686098	1.905837	P <0.05 (significant)

In the second part of the result depicted in table 2 we compared the TC/HDL ratio of control and Impaired glucose tolerance group (IGTG). From the statistical analysis we have found that the TC/HDL ratio increased in IGTG compared to normoglycemic control but not significantly (P value>0.05, 0.164). The bar graph to show the comparison with average value represented as Mean±SD (Figure2).

Table 2:

Group	Average (TC/HDL)	SD	P value
Control	4.645022	1.272015	0.164
IGTG	4.973579	1.095663	P>0.05 (non significant)
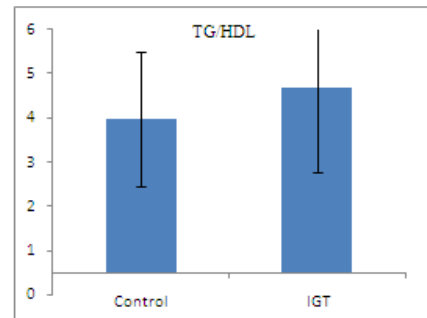
Figure 1: Represents comparison of TG/HDL ratio between control and IGTG. It is found that TG/HDL ratio is increased significantly in IGTG compared to control (P<0.05)
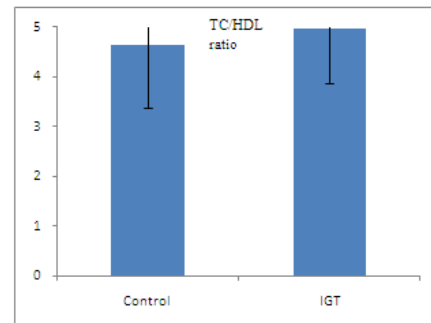
Figure 2: Represents comparison of TC/HDL ratio between control and IGTG. It is found that TC/HDL ratio is increased in IGTG compared to control but non- significantly (P>0.05)

DISCUSSION

Many studies have shown that Diabetes mellitus and dyslipidemia are intrinsically related. Insulin resistance observed in Type 2 Diabetes mellitus is central to the pathogenesis associated with diabetes and contributes to dyslipidemia[9]. Impaired glucose tolerance associated with insulin resistance results in impaired regulation of circulating lipoprotein and glucose levels. It is found that impairment in the ability of insulin to suppress hepatic production of large TG-rich VLDL in patients with type 2 diabetes is responsible for increased TG level in plasma[10,11,12]. Impaired insulin action at the level of

adipocyte is supposed to cause defective suppression of TG hydrolysis due to impaired lipoprotein lipase activity. The unregulated influx of non esterified fatty acid (NEFA) into liver promotes TG synthesis which may contribute to hypertriglyceridemia[13]. Hypertriglyceridemia may cause reduction in cardioprotective HDL-C as TGs are transferred when these particles collide[1,13]. Serum TG levels are a surrogate for TG rich lipoproteins (VLDL-C and non HDL-C). Currently there is no evidence to suggest that lowering TG levels is associated with a reduction in CVD events; consequently reducing TG levels in patients with diabetes mellitus is of secondary importance[13]. While HDL-C is a strong cardiovascular disease predictor, a ratio of TG/HDL may be a more reliable index to correlate diabetes and dyslipidemia. It appears that the low HDL-C level is independently associated with resistance to insulin mediated glucose disposal and compensatory hyperinsulinemia[14]. In our study we have found that patients with impaired glucose tolerance had significantly higher TG/HDL ratio than normoglycemic control group. This also supports the previous findings that hyperglycemia due to insulin resistance is correlated with hypertriglyceridemia and lowered HDL-C level[15]. In our study we have also found that impaired glucose tolerance group had slightly elevated TC/HDL ratio compared to control which says that in relation to insulin resistance there could be an alteration in cholesterol metabolism. The reason for hypercholesterolemia in hyperglycaemic condition may be attribute to decreased HDL-C level, as the later helps in transport of cholesterol back to liver, a process called reverse cholesterol transport.

CONCLUSION

Our study has found that both TG/HDL and TC/HDL ratio are elevated in impaired glucose tolerance group compared to normoglycemic control group. Hence we can conclude that altered hyperglycaemic status could be a strong causative factor for dyslipedemia. The TG/HDL and TC/HDL ratio is a simple, reliable and cost effective method to assess the dyslipidemic status.

REFERENCE

1. Strattom IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, Hadden D, Turner RC, Holman RR: association of glycemia with micro and macrovascular complications of type 2 diabetes (UKPDS 35): prospective and observational study: BMJ 2000, 321: 405-412.
2. Adiels M, Olofsson SO, Taskinen MR, Boren J: Diabetic dyslipidemia. Curr Opin Lipidol 2006, 17: 238-246.
3. Bayram F, Kocer D, Gundogan K, Kaya A, Demir O, Coskun R, et.al Prevalence of dyslipidemia and associated risk factors in Turkish adults. J Clin Lipidol. 2014;8(2): 206-216.
4. Wen Quing Ni, Xiao-Li Liu, Zhi-Peng Zhuo, Xue-Li Yuan, Jin-Ping Song, Hong-Shan Chi and Jian Xu. Serum lipids and associated factors of dyslipidemia in the adult population in Shenzhen. Lipids in health and disease 2015: 14: 1-11.
5. Adiels M, Olofsson SO, Taskinen MR, Boen J. Overproduction of very low density lipoproteins is the hallmark of the dyslipidemia in the metabolic syndrome. Arterioscler Thromb Vasc Biol 2008, 28: 1225-1236.
6. Miller GJ, Miller NE. Plasma high density lipoprotein concentration and development of ischemic heart disease. Lancet 1975, 1: 16-19.
7. Sheu WH, Shieh SM, Fuh MM, Shen DD, Jeng CY, Chen YD, et.al. Insulin resistance, glucose intolerance and hyperinsulinemia. Hypertriglyceridemia Vs hypercholesterolemia. Arterioscler Thromb Vasc Biol 1993, 13: 367-370.
8. Stamler J, Vaccaro O, Neaton JD, Wentworth D. Diabetes, other risk factors, and 12 year cardiovascular mortality for men screened in the Multiple Risk Factor Intervention trial. Diabetes Care 1993, 16: 434-444.
9. Grundy SM, Cleeman JI, Merz CN, Brewer HB Jr, Clark LT, Hunninghake DB, Pasternak RC, Smith SC Jr, Stone NJ. Implications of recent clinical trials for the national cholesterol education program adult treatment panel III guidelines. Circulation 2004, 110: 227-239.
10. Krentz AJ. Lipoprotein abnormalities and their consequences of patients with type 2 diabetes. Diabetes Obes Metab 2003, 5(Suppl 1): S19-S27.
11. Taskinen MR. Tpe 2 diabetes as a lipid disorder. Curr Mol Med 2005, 5: 297-308.
12. Brunzell JD, Davidson M, Furberg CD, Goldberg RB, Howard BV, Stein JH, Witztum. Lipoprotein management in patients with cardiometabolic risk: consensus statement from the American Diabetes Association and the American College of Cardiology Foundation. Diabetes care 2008, 21: 811-822.
13. Laws A, Reawen GM. Evidence for an independent relationship between insulin resistance and fasting plasma HDL-cholesterol, triglyceride and insulin concentrations. J Intern Med 1992, 231: 25-30.
14. Jeppesen J, Facchini FS, Reaven GM. Individuals with high total cholesterol/HDL cholesterol ratios are insulin resistant. J Intern Med 1998, 243: 293-298.
15. Tangavarasittichai S, Poonsub P, Tangavarasittichai O. Association of serum lipoprotein ratios with insulin resistance in type 2 diabetes mellitus. Indian J Med Res 131: 641-648.