LIPID PROFILE AND ITS RATIO AS SURROGATE MARKER OF INSULIN RESISTANCE IN OBESE PATIENTS

N. Senthil[1], R. B. Sudagar Singh[2], Sneha Thomas[3], C. Sujeetha[4], S. Sujatha[5], J. Damodharan[6]

[1]Associate Professor, Department of General Medicine, Sri Ramachandra Medical College.
[2]Associate Professor, Department of General Medicine, Sri Ramachandra Medical College.
[3]Senior Resident, Department of General Medicine, Sri Ramachandra Medical College.
[4]Resident, Department of General Medicine, Sri Ramachandra Medical College.
[5]Professor, Department of General Medicine, Sri Ramachandra Medical College.
[6]Professor, Department of General Medicine, Sri Ramachandra Medical College.

ABSTRACT: BACKGROUND: Insulin resistance plays a significant role in evolution of atherosclerosis and cardiovascular diseases.[1] Early assessment of this resistance will provide sufficient time in preventing this progression. The prevailing method of assessing this resistance is cumbersome and time consuming. This study is done to assess the relationship between lipid profile (lipoproteins) and insulin resistance which in turn will act as an easy marker of predicting insulin resistance in clinical setting.

OBJECTIVE: The aim of this study is to assess the correlation of lipid profile and its ratio's with insulin resistance and its predictability in identifying insulin resistance.

METHODS: This is a cross sectional study of 100 obese patients without diabetes. Obesity was defined by Body mass index (BMI) greater than 30. Fasting blood was obtained for Lipid profile, Insulin and blood glucose. Post prandial blood was taken for blood glucose. HOMA-IR model was chosen for calculating insulin resistance. Results obtained were analysed by student's t-test and Pearson's correlation done for the same.

RESULTS AND OBSERVATION: The data on analysis revealed triglycerides, triglyceride/hdl-c ratio, total cholesterol/hdl-c ratio and serum fasting insulin level were significantly higher in homa-ir>2.5 group with statistical significance, comparing with other group.

CONCLUSION: Triglycerides, triglyceride/hdl-c and total cholesterol/hdl-c ratios can be used as a simple surrogate marker of insulin resistance in clinical setting in obese non diabetic individuals.

KEYWORDS: Insulin Resistance (Ir), Obesity, Lipoprotein.

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INTRODUCTION: Insulin resistance (IR) plays a predominant role in evolution of atherosclerosis and cardiovascular diseases. IR is not a single simple entity of deficient glucose uptake in human body but a complex multifaceted syndrome associated with multiple factors which in turn increases the risk of cardiovascular diseases.[1] Modifiable risk factors can be altered leading to reduction in IR which reduces the risk of cardiovascular diseases.[2,3] IR is associated with the risk of cardiovascular diseases even before the onset of diabetes mellitus.[4,5] Recent studies also reveal persistent hyperglycaemia and hyperlipidemia alters normal metabolism resulting in insulin resistance and cardiovascular diseases.[6] So IR is considered as a predictor of cardiovascular events before diabetes sets in. Hence assessment of IR predicts future cardiovascular events.[7,8] The main aim of this study is to assess this IR by a simple routine blood lipid profile than using sophisticated cumbersome methods so that IR can be identified in clinics at a very early stage which in turn provides us sufficient time to intervene and change the risk factors causing IR by life style modification or therapeutic drugs.[2,3,9]

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Corresponding Author:
Dr. N. Senthil , No. 46,
7th Street Kesari Nagar,
Adambakkam, Chennai-88.
E-mail: sensuch74@yahoo.co.in
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MATERIAL AND METHODS: This study is done in 100 obese patients without previous history of diabetes, dyslipidemia and thyroid diseases in srmc. Informed consent was obtained from all patients. Obesity was defined by WHO criteria, BMI=weight (kg)/height (m^2). A value of greater than 30 was considered as obese and was included in this study. Fasting blood samples were collected and analysed for blood glucose, insulin, lipid profile, glycated haemoglobin (Hba1c). Postprandial blood was analysed for blood glucose alone. Blood glucose values were determined by glucose oxidase peroxidase method. Glycated haemoglobin (Hba1c) was determined by high pressure liquid chromatography. Serum insulin levels were assessed by chemilumiscent micro particle enzyme immune assay. Cholesterol was determined by cholesterol oxidase method. HDL and LDL by direct homogeneous assays and triglyceride by enzymatic methods.

Insulin resistance was defined by homeostasis model assessment of insulin resistance (HOMA-IR), according to which HOMA-IR= (Fasting Insulin Concentration (µu/ml) X

(FASTING GLUCOSE CONCENTRATION (mg/dl))/405.[10] The homa-ir values thus obtained were divided into two groups, Homa-ir values of greater than 2.5 were considered as having insulin resistance.[10,11,12] Homa-ir value of less than 2.5 was considered as insulin sensitive group. All parameters including fasting blood glucose, post prandial blood glucose, serum fasting insulin, fasting lipid profile, triglyceride/hdl-c ratio, total cholesterol/hdl-c ratio and glycated haemoglobin were compared between the two groups using student's t-test. Pearson's correlation was done to evaluate the correlation between homa-ir and the above parameters. P value of <0.05 was considered as significant p value after statistical analysis.

RESULTS: Total of 100 obese patients (bmi>30) were taken up for this study. They were divided into two groups homa-ir≤2.5 homa-ir>2.5 respectively. 17 patients belonged to homa-ir≤2.5 group, remaining 83 patients were in homa-ir>2.5 group (table 1).
The distribution according to sex were;

Out of 17 patients in homa-ir≤2.5 group 9 were males and 8 were females. There were 39 males and 44 females in homa-ir>2.5 group.

The relationship between the various components of lipid profile, its ratios with homa-ir was studied among both the groups which are as follows;

Comparison of Total Cholesterol: On comparing total cholesterol values between both the groups (table: 2) homa-ir>2.5 group had higher numerical values (207.83) than homa-ir≤2.5 group (182.76) but there were no statistical significance (p-value=0.61) on student's t test. Pearson's correlation was done as revealed by figure1.

Comparison of Triglycerides: On comparing triglyceride values homa-ir ≤2.5 group had average value of 111.53mgm/dl while homa-ir>2.5 group had a higher average value of 191.87mgm/dl (Bar diagram). There was a strong positive correlation between both the values which was statistically significant (p-value<0.001) table: 3. Pearson's correlation analysis was done which revealed positive correlation (Figure 2).

Comparison of High Density Lipoproteins (Hdl): Both groups had equally comparable values of HDL with no statistical significance on analysis (p-value=0.306) (table: 4) which is also depicted pictorially in Pearson's analysis (figure 3).

Comparison of Low Density Lipoproteins (LDL): Homa-ir>2.5 group had higher LDL values comparing with other group with statistical significance (p-value<0.009) (Table 5). Pearson's correlation revealed the same as depicted in Figure 4.

Comparison of Triglyceride/High Density Lipoprotein-C Ratio (Tg/Hdl-C): There was significant strong positive correlation between TG/HDL-C ratio, and HOMA-IR (p<0.001) (Table 6) on t test analysis. Significant positive correlation as per Pearson's analysis was observed which is shown in figure 5.

Comparison of Total Cholesterol/High Density Lipoprotein-C Ratio (Tc/Hdl-C): When TC/HDL-C ratio was compared with HOMA-IR there was positive correlation (p-value<0.031) (Table 7). Pearson, s correlation depicted the same picture (Figure 6).

This study also compared fasting blood glucose (FBG), post prandial blood glucose (PPBG), glycated haemoglobin (Hba1c), serum insulin values with homa-ir (table: 8, 9). The average fasting serum insulin level were 9.12 (µIU/ml) in insulin sensitive group, while in insulin resistant group the average values were 24.94(µIU/ml). On analysis there was significant positive correlation between fasting serum insulin level and homa-ir between both the groups (p-value<0.002). Other three components on comparison had no statistical significance.

DISCUSSION: This study was done to learn the association between lipid profile and insulin resistance in non diabetic obese persons. HOMA-IR was used as marker of insulin resistance. Insulin resistance was defined as HOMA-IR VALUE of greater than 2.5 as defined by previous studies[11,12] was used in our study as the cut off value between insulin sensitive and resistant groups. In our study there was significant positive correlation between serum fasting insulin level and HOMA-IR(p-value<0.002). On analysis of lipid profile and its ratios this study revealed a highly significant positive correlation between triglycerides and HOMA-IR with p-value <0.001. Comparison of triglyceride/hdl-c ratio and total cholesterol/hdl-c ratio with HOMA-IR also yeilded positive statisical significant p-value <0.001, p-value <0.03 respectively which was comparable to previous studies.[13,14,15,16] In a study done by McLaughin et al[13] it was found that there was a strong correlation between IR with triglycerides and TG/HDL-C ratio and both can be used as a metabolic marker of insulin resistance. A study done by Brehm et al[14] in non diabetic obese individuals showed TG/HDL-C ratio having strong correlation with IR which was similar to our study. Another study done by Ray S et al[15] revealed serum lipoprotein can be used as a marker of IR in which TG/HDL-c ratio and TC/HDL-c ratio significantly correlateing with IR which is similar to our results. A study done by Medha Rajappa et al[16] also revealed both lipid ratios correlating significantly with insulin resistance which was similar to this study. Thus our study reveal that triglycerides, TG/HDL-c ratio, TC/HDL-c ratio is comparable to fasting serum insulin, homa-ir in predicting insulin resistance and it can be used as surrogate marker of insulin resistance.

CONCLUSION: This study reveals that lipid profile and its ratios can be used as a marker of insulin resistance with triglyceride and triglyceride/hdl-c ratio and total cholesterol/hdl-c ratio predicting insulin resistance with strong statisically significance among its components.

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Homa-IR group	Male	Female	Total no of patients
≤2.5	9	8	17
>2.5	39	44	83

Table 1

Lipid component	Homa-IR ≤2.5 group	Homa-IR >2.5 group
Total cholesterol(mgms/dl)	182.76±33.60	207.83±45.72

Table 2: comparison of cholesterol

p value not significant.

Lipid component	Homa-ir ≤2.5 group	Homa-ir >2.5 group
Triglyceride(mgms/dl)	115.53±30.98	191.87±82.93
Table 3: Comparison of triglyceride		

p-value significant (<0.001).

Lipid component	Homa-ir ≤2.5 group	Homa-ir >2.5 group
HDL	43.94±4.58	42.90±7.25
Table 4: comparison of high density lipoproteins		

p value not significant.

Lipid Component	Homa-ir ≤2.5 Group	Homa-ir >2.5 Group
LDL	110.71±31.41	129.22±43.34
Table 5: comparison of low density lipoproteins		

p-value significant (<0.009).

Lipid Component	Homa-Ir ≤2.5 group	Homa-Ir >2.5 group
Tg/hdl-c ratio	2.54±0.68	4.6±2.17
Table 6: Comparison of Tg/Hdl-C Ratio		

p-value significant (<0.001).

Lipid Component	Homa-ir ≤2.5 Group	Homa-ir >2.5 Group
Tc/hdl-c	4.95±0.81	4.19±1.25
Table 7: comparison of tc/hdl-c ratio		

p-value significant (<0.03).

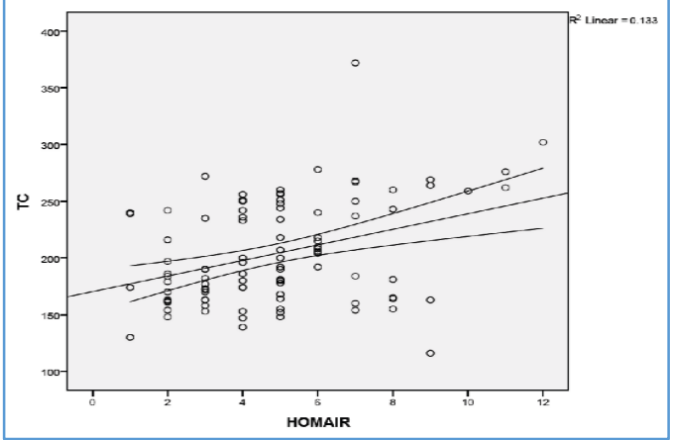
Serum Component	Homa-ir ≤2.5 Group	Homa-ir >2.5 Group
Fasting Insulin Values(μiu/ml)	9.12±3.44	24.94±09.22
Table 8: Comparison of serum insulin levels		

p-value significant (<0.002).

Values	Homa-ir≤2.5	Homa-ir>2.5	P-value
FBG	83.88±11.21	88.64±7.82	0.090
PPBG	106.06±11.43	115.27±12.95	0.239
HBAIC	5±.35	5.02±.26	0.741
Table 9: Comparison of sugar values and hba1c			

P-value not significant.

Figure 1: Total cholesterol with Homa-IR



BAR Diagram showing Mean Triglyceride and HOMA IR

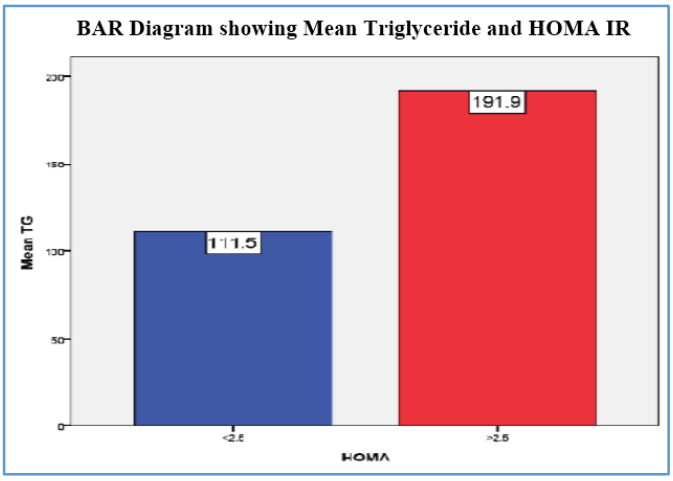


FIGURE 2: TRIGLYCERIDE with HOMA IR

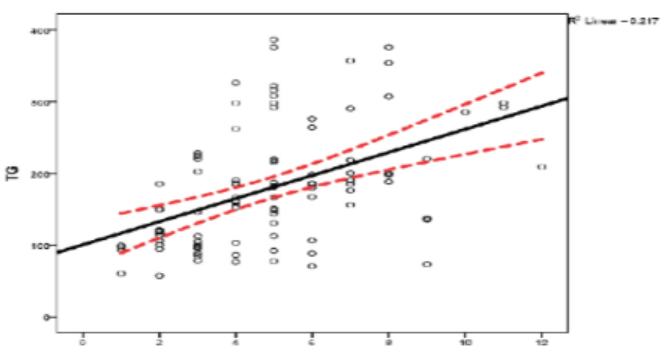


FIGURE 3: HDL-C WITH HOMA-IR

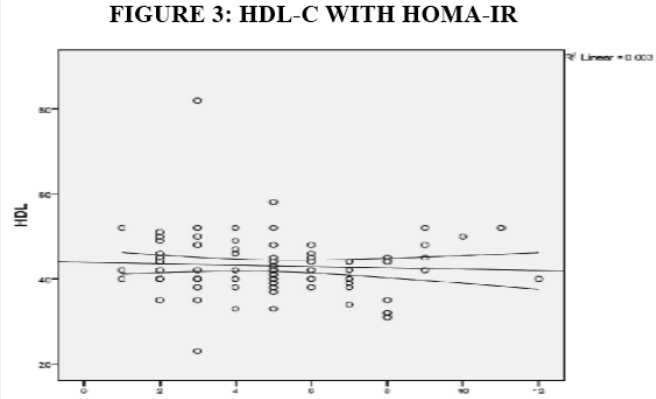


FIGURE 4: LDL WITH HOMA-IR

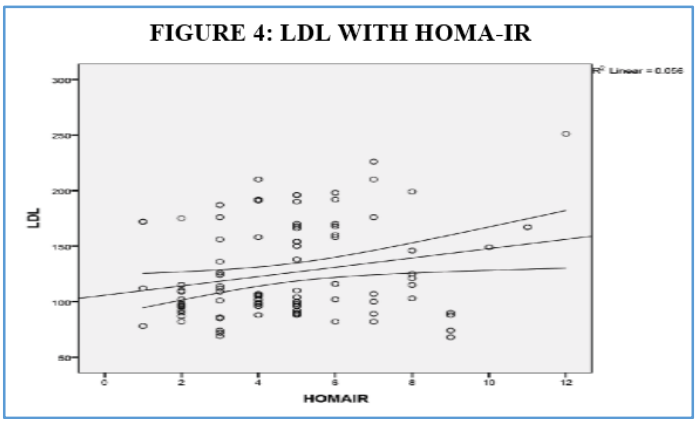


FIGURE 5: TG/HDL-C WITH HOMA-IR

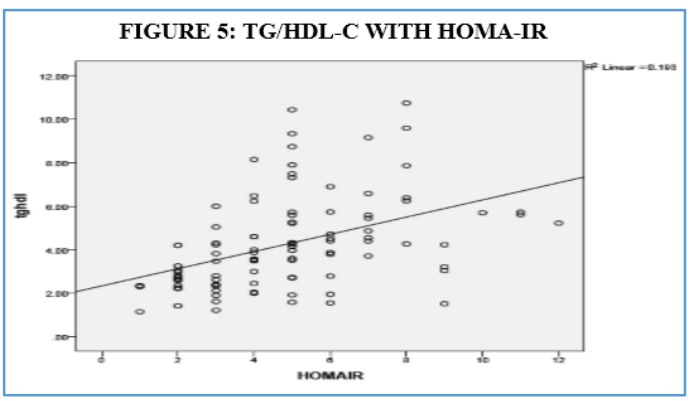


FIGURE 6: TC/HDL-C with HOMA IR