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Study of serum γ-Glutamyl transpeptidase and its association with obesity in subjects with metabolic syndrome

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Abstract

Serum γ- glutamyl transpeptidase is a well known marker for alcoholic hepatitis. Recent studies suggests possible association of γ- Glutamyl transpeptidase with metabolic syndrome. Obesity is an important risk factor for many cardio metabolic diseases like hypertension, diabetes mellitus, cardiovascular disease etc. Our study was conducted to assess association of serum γ-glutamyl transpeptidase with body mass index and waist hip ratio which measure obesity. Materials and methods: 50 subjects with metabolic syndrome and 50 age and sex matched healthy controls both male and female between 25-70 years of age were recruited from General Medicine department of Narayana Medical college and Hospital, Nellore, A.P. Serum γ-glutamyl transpeptidase was measured by calorimetric kinetic assay. Height, weight, waist circumference and waist-hip ratio are measured by standard anthropometric procedures. BMI is calculated using the formula weight (kg) / height $(m)^2$. Systolic and diastolic blood pressures were recorded manually using mercury sphygmomanometer. Plasma glucose is analyzed by glucose oxidase method by automated chemistry analyzer. Results: GGT is significantly elevated in subjects with metabolic syndrome (mean±SD 70.32 ± 23.97) IU/L compared to controls (mean±SD 25.30 ± 6.82) IU/L (*P value <0.001*). GGT is significantly correlated with BMI (r= 0.26 p<0.001) and waist hip ratio (r= 0.69 p<0.001). Conclusion : Our findings suggest that elevated GGT levels are elevated in subjects with metabolic syndrome may contribute to their susceptibility to cardiometabolic diseases and provide an additional evidence of novel role of GGT in metabolic syndrome risk evaluation.

Keywords: Gamma Glutamyl transpeptidase, obesity, waist hip ratio, metabolic syndrome

Introduction

Gamma-glutamyl transpeptidase (GGT) is considered as an excellent marker for alcohol addiction[(1)]. GGT is an enzyme on cell surface synthesized by many tissues in our body. GGT in circulation is mostly derived from epithelium of hepatocytes[(2)]. Serum levels of GGT dependents mainly on alcohol consumption, both duration and frequency[(3)]. GGT acts on glutathione, an anti-oxidant tripeptide and decreases the serum levels of active glutathione.Activity of GGT on glutathione modulates redox potential of protein thiols present on cell membrane resulting in formation of free radicals. Free radicals result in oxidative

stress and accelerate atherosclerosis[4]. GGT therefore can be considered as a proinflammatory marker in the pathogenesis of atherosclerosis. Many recent studies found an association of serum GGT with metabolic syndrome[5]. Metabolic syndrome includes several atherogenic risk factors like obesity, hypertension, diabetes and hyperlipidemia[6]. All comorbidities of metabolic syndrome are found to be linked to many cardio metabolic diseases[7,8]. Some studies showed strong association between liver enzymes and obesity[9]. To study the interaction between GGT and obesity our study aimed on the associations of GGT with anthropometric parameters like body mass index (BMI) and waist hip ratio(WHR) which measure the adiposity of an individual.

Materials and methods

50 subjects with metabolic syndrome and 50 age and sex matched healthy controls are recruited from General Medicine department of Narayana Medical college and Hospital, Nellore, A.P. According to International Diabetic Federation[10] metabolic syndrome is defined as waist circumference ≥ 94cm for males and ≥ 80cm for females and any two of the following four factors:

1. Serum triglycerides: ≥ 1.7mmol/L
2. HDL-cholesterol: <40 mg/dL in males and <50 mg/dL in females
3. Blood pressure: systolic BP ≥130 or diastolic BP ≥85mm Hg.
4. Fasting plasma glucose 100 mg/dL.

Based on the above criteria subjects are diagnosed to have metabolic syndrome. Both male and female between 25-60 years of age are included in the study. Subjects with a history of alcoholism are excluded from the study. Pregnant and lactating women, patients suffering with liver disease and patients on medications which can alter serum levels of GGT are excluded from the study.

Anthropometric measurements like height, weight, waist circumference and waist-hip ratio are measured by standard procedures. Height (cm), waist and hip circumference (cm) were noted using a measuring tape (to the nearest 0.1 cm). Waist Circumference was measured at the mid point between the lower border of rib cage and the iliac crest, and Hip circumference was measured at the level of Trochanter, the widest part of the hip region. Weight (kg) was measured to the nearest 0.1Kg using a weighing machine simultaneously. BMI is calculated using the formula weight (kg) / height $(m)^2$. Systolic and diastolic blood pressures are recorded manually using mercury sphygmomanometer. Serum GGT was measured by calorimetric kinetic assay method. HDL cholesterol by standard enzymatic procedure. Plasma glucose is analyzed by glucose oxidase method by automated chemistry analyzer. All tests assessed in our study are standard procedures. Informed consent is taken from all the participants in the study. The study was approved by the institutional ethical committee. Statistical analysis was done using SPSS-13 soft ware version.

Results

A total of 100 samples are collected and 50 are grouped as subjects with metabolic syndrome based on the IDF criteria of metabolic syndrome and 50 subjects as healthy controls. Table-1 shows the main characteristics of the subjects with metabolic syndrome and controls. mean± SD of GGT levels in subjects with metabolic syndrome (70.32 ± 23.97) is significantly higher than in controls (25.30 ± 6.82) ($p<0.001$). Increase in serum GGT is observed both in males and females. BMI, WHR, HDL cholesterol, triglycerides, fasting glucose and blood pressure showed a linear trend in relation to serum GGT. GGT levels are positively correlated with WHR and BMI. Association between GGT and WHR is more significant than GGT and BMI. Fig-1

shows the positive association between GGT and waist hip ratio (r=0.69).

Discussion

The principle findings in our study are increase in serum GGT levels in subjects with metabolic syndrome and its positive association with obesity markers like waist hip ratio and body mass index. This is in accordance to previous studies which also showed association between serum GGT and obesity[11,12,13]. Our findings appears to be consistent with the findings of Lee et al [14] which showed that elevations of GGT are associated with metabolic syndrome. In our study the association is stronger with waist hip ratio than with body mass index. This in contrast to previous studies which showed strong association of GGT with BMI than with WHR[15]. GGT levels are also correlated with serum levels of other components of metabolic syndrome like HDL cholesterol, triglycerides, fasting glucose, and blood pressure. The associations between GGT and the components of metabolic syndrome can be explained to some extent by the underlying pathology of free radical generation and enhanced oxidative stress[16,17]. Our results indicate that increased GGT is related to increased risk of cardiometabolic diseases. One explanation to our findings is that excees deposition of fat in liver leads to increased expression of liver enzymes particularly GGT enzyme16. Many studies observed that higher GGT levels occur in obese persons[18,19] and also extends to an association of higher GGT levels with hypertension[20,21]. This reveals that all of the key components of the metabolic syndrome are linked to increased GGT levels. Our observation relating serum GGT to the components of metabolic syndrome suggests that GGT can be considered as a marker of metabolic syndrome.

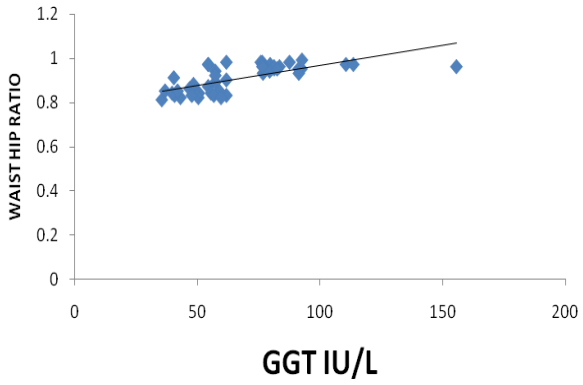

Figure 1: Correlation between Waist Hip ratio and GGT levels in subjects with metabolic syndrome.

Table 1: Main Characteristics of the cases with metabolic syndrome and controls.

Variable (n)	Cases (50)	Controls (50)	*p* value
GGT	70.32 ± 23.97	25.30 ± 6.82	<0.0001
Total cholesterol (mg/dl)	390.34 ± 79.53	156.02 ± 27.18	<0.0001
LDL cholesterol (mg/dl)	148 ± 15.52	93.72 ± 19.99	<0.0001
HDL cholesterol (mg/dl)	29.32 ± 4.94	69.34 ±14.46	<0.0001
Triacyglycerides (mg/dl)	25.76 ± 13.42	87.78 ± 31.23	<0.0001
WAIST HIP: Ratio	0.90 ± 0.06	0.82 ± 0.05	<0.0001
BMI	31.96 ± 1.39	20.96 ± 1.48	<0.0001

Data are expressed as mean ± S.D., P<0.05 were significant

Conclusion

In conclusion our study observed elevated serum GGT levels and its positive association with waist hip ratio and body mass index which are key components of metabolic syndrome. measuring GGT therefore can be sensitive marker for early prediction of metabolic syndrome. Our study on the association serum GGT with markers of obesity provides insights into the cardiometabolic risk. Measuring serum GGT is simple, accurate and cost effective. Therefore clinical utility of serum GGT levels as a useful marker for metabolic syndrome can be considered.

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Conflicts of Interest: none

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