Biochemical Parameter of Gamma Glutamyl Transferase (GGT) as a Link Marker to Metabolic Syndrome

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The role of the Enzyme Gamma Glutamyl Transferase (GGT) as a link marker to Metabolic Syndrome (MetS) in Indians is significant. The MetS is a clustering of components that reflect over nutrition, sedentary lifestyles and resultant excess adiposity. Metabolic Syndrome is posing a major public health challenge to the health systems in developed and developing countries. This study is an attempt to see the role of biochemical markers such as GGT & Blood glucose in Metabolic Syndrome in study cases of Indian population. The 405 study subjects aged between 25-65 yrs from general population in Ghaziabad, India, were taken, who attended the hospital for general checkup. GGT and Blood Glucose of subjects were evaluated. On application of ATP 3rd criteria on the screened subject patients, they are classified. Our study found that the number of subjects having MetS was 173 (42.71% of total). In the subgroup of metabolic syndrome with diabetes, the total number of subjects was 105 (25.92%) in which age wise distribution was 26 (6.41%) in 25-45 yrs and 79 (19.50%) in 45-65 yrs. In the second subgroup of metabolic syndrome without diabetes total number of subjects was 68 (16.79%) in which age wise distribution was 16 (3.95%) in 25-45 yrs and 52 (12.83%) in 45-65 yrs. The study proposes the inclusion of biochemical parameter GGT in the criteria for defining cases of metabolic syndrome, so that more metabolic syndrome cases can be picked up at earliest. This issue is especially pertinent for the Indian patient population in whom cardiovascular disease is becoming increasingly common in both sexes and in age group of 25-65 yrs. There should be emphasis on detection of metabolic syndrome and intensification of targeted preventive strategies. In this study; there is strong evidence that GGT should be included in the case definition criteria or diagnostic criteria of Metabolic Syndrome. The study proposes the inclusion of biochemical parameter GGT in the criteria for defining cases of metabolic syndrome in Indians. So that more cases of Metabolic Syndrome can be picked up at earliest.

Keywords: Metabolic Syndrome (MetS), Gamma Glutamyl Transferase (GGT).

1. INTRODUCTION

Metabolic syndrome (MetS) has generated a great deal of interest of Indian researchers in recent years. Metabolic syndrome and diabetes mellitus have reached global pandemic proportions with India being designated 'diabetes capital' of the world. Metabolic syndrome is a name for a group of risk factors that occur together and increase the risk for coronary artery disease, stroke, and type-II diabetes [1]. Metabolic syndrome (MetS) represents a combination of cardiovascular risk determinants such as

obesity, insulin resistance and lipid abnormalities such as hypertriglyceridemia, increased free fatty acids, low high-density-cholesterol and hypertension. As a multiple component condition it imparts a doubling of relative risk for atherosclerotic CVD [2]. MetS is a plausible precondition for type II diabetes and cardiovascular diseases is also on rise. Metabolic syndrome is the name for a group of risk factors that raise your risk for heart disease and other health problems, such as hypertension, hyperglycemia, dyslipidaemia and obesity. This has been attributed to greater availability of food, urbanization and industrialization, and reduced physical activity, resulting in increase adiposity. It is predicted that by 2030, 75% of the world's adults diabetic patients will be in developing countries, and that 80 million of them will be in India [3]. Risk factor for type-II Diabetes Mellitus & Cardiovascular disease (CVD) is usually present together; known as Metabolic Syndrome [4]. Different organizations; WHO (1999), EGIR (1999), NCEP ATP III (2001), IDF (2006) [5] have included different parameter in their definition & names of metabolic syndrome but majority include Waist circumference, High Triglyceride level, and Low high density lipoprotein, High blood pressure & Impaired glucose metabolism which are all independently associated with higher cardiovascular risk with or without history [6]. The GGT is also gaining much attention in the field of cardiovascular disease and metabolic syndrome. It is found in many tissues most notable the liver and has significance in medicine as a diagnostic marker for alcoholism, liver disease, jaundice CVD and in metabolic syndrome. Elevated levels of GGT may also be due to congestive heart failure. These enzyme concentrations have been associated with many CVD risk factors or components of the insulin resistance syndrome or metabolic syndrome. Some studies [7] have been shown high level of GGT associated in population with increase risk of atherosclerotic cardio vascular disease in metabolic syndrome. It has been suggests that an increase in GGT concentration within its physiological range is a sensitive and early biomarker for the development of metabolic syndrome [7].

2. MATERIALS AND METHODS

2.1. ATP 3rd Criteria for Metabolic Syndrome

The presence of three or more of the following risk factor, (1) Abdominal obesity (2) Elevated Triglycerides (3) High density lipoprotein (HDL) cholesterol (4) Hypertension or anti hypertensive medication use and (5) Impaired fasting glucose is termed as Metabolic Syndrome.

- Three or more than three positive of the above five factors = Metabolic Syndrome
- Less than three positive of the above five factors = No Metabolic Syndrome

2.2. Study Subject

The 405 patients aged between 25-65 yrs from general population in Ghaziabad, India, were taken, who attended the hospital for general checkup, as study subjects for this study. In these 405 subjects age-wise distribution is 108 (26.66% of total) in 25-45 yrs age group and 297 (73.33% of total) in 46-65 yrs age group. All subjects after various tests divided into three groups as:

(i) Control group: Only those subjects were selected for inclusion in the control group that does not fulfill adult treatment panel 3rd criteria for Metabolic Syndrome.

(ii) Metabolic syndrome with Diabetes group: Only those subjects were selected for inclusion in this group that fulfills adult treatment panel 3rd criteria for Metabolic Syndrome and they should have Diabetes. This group is further mentioned as 'Diabetic group'.

(iii) Metabolic Syndrome with No Diabetes group: Only those subjects were selected for inclusion in this group that fulfills adult treatment panel 3rd criteria for Metabolic Syndrome but they should not have Diabetes. This group is further mentioned as 'Non-Diabetic group'.

Fasting blood samples has also be taken from all the subjects for the estimation of Gamma-Glutamyl Transferase and fasting blood glucose. All parameters have estimated by the reagent Randox international laboratory Ltd. and run the samples on fully auto chemistry analyzer Olympus AU480 in the laboratory. We applied internal and external quality control measures in the laboratory.

2.3. Statistical Analysis

The statistical analysis was carried out using ANOVA (One-way) by SPSS (Ver.19) Inc., Chicago, Illinois, USA.

3. RESULT AND DISCUSSION

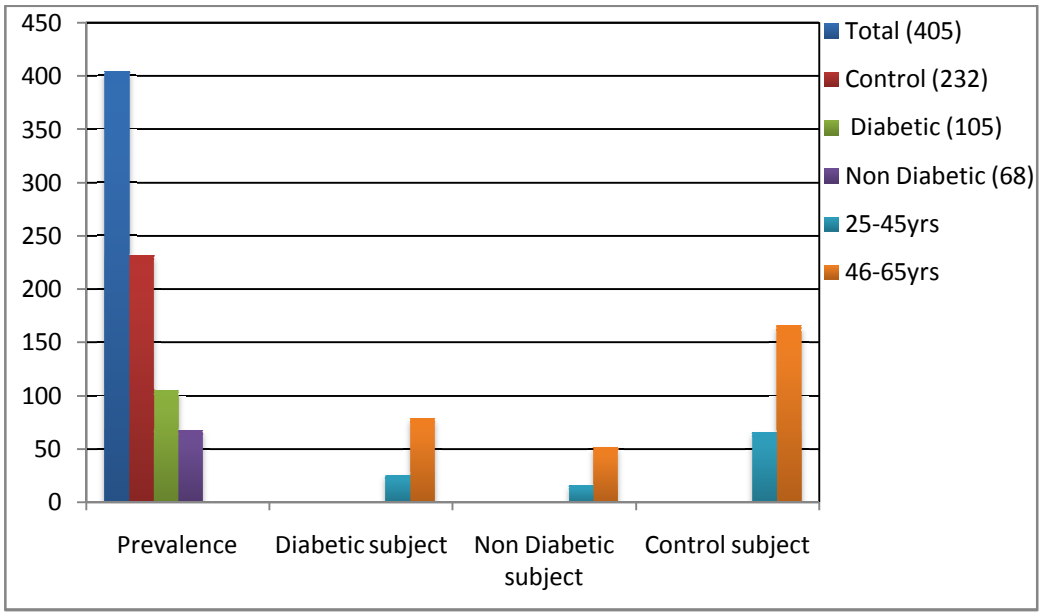

Fig. 1: Total prevalence and age wise distribution (Control, Diabetic, and Non Diabetic group of Study subjects.

The prevalence of metabolic syndrome in our study of general population of city Ghaziabad, India is based upon 405 subjects. In these subjects 232 were found in control group, 105 were found in Diabetic group and rest 68 were found in Non- Diabetic group as shown in Figure 1.

In the diabetic group, the number of subjects was 105 (25.92% of total) with age-wise distribution as 26 (6.41% of total) in 25-45 yrs age group and 79 (19.50% of total) in 45-65 yrs age group. In the non-diabetic group, the number of subjects was 68 (16.79% of total) with age-wise distribution as 16 (3.95% of total) in 25-45 yrs age group and 52 (12.83% of total) in 45-65 yrs age group. In control group the number of subjects was 232 (57.29% of total) with age-wise distribution as 66 (16.30% of total) in 25-45 yrs age group and 166 (40.99% of total) in 45-65 yrs age group as shown in Figure 1. It is comparable to 18-48% in previous studies conducted in the resident Indian population [8,9].

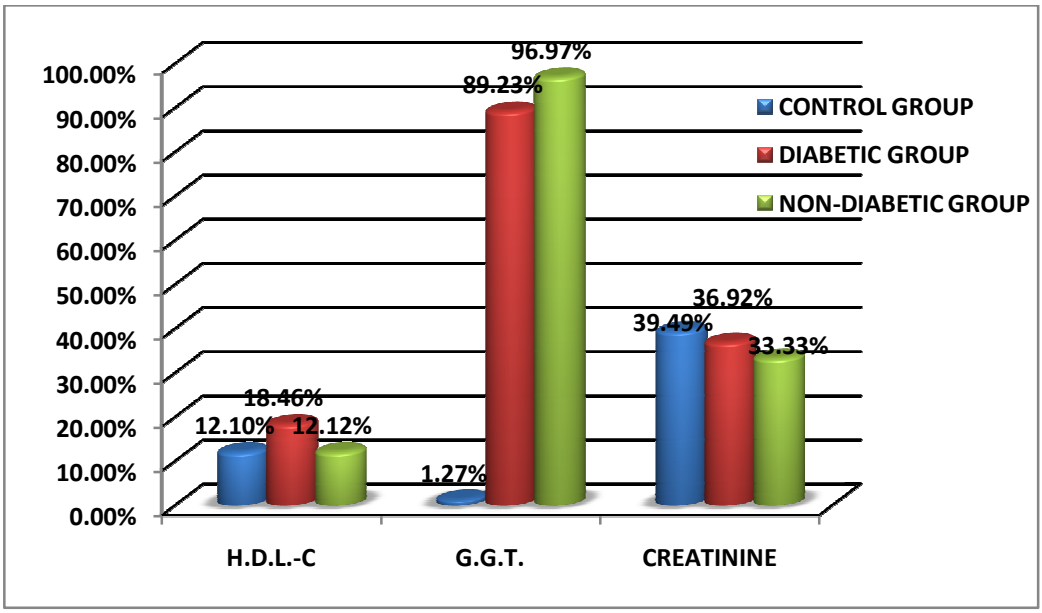

Fig. 2: The percentage distribution of increased males in different parameters from actual values in three groups.

GGT was raised in approx 90% of the male patients of metabolic syndrome in the diabetic group. GGT is not raised in 98% of male subjects of control group as shown in Figure 2.

GGT is increased in 100% of the female of metabolic syndrome both diabetic and non diabetic group females as shown in Figure 3.

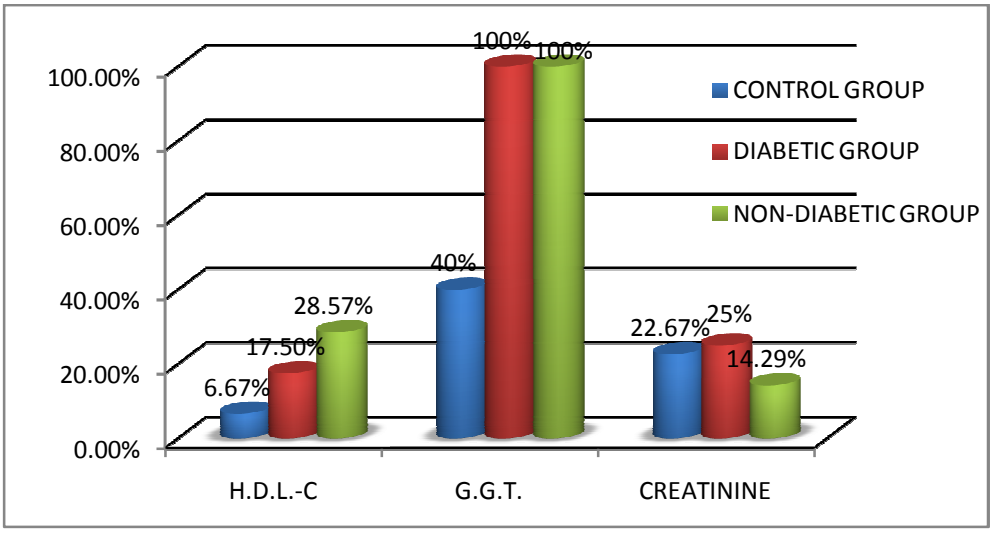

Fig. 3: The Bar percentage distribution of increased females for different parameters from actual values in three groups.

All these data are summarized in Table 1, which indicate that an elevated GGT level could be suggested as a subsidiary marker for MetS and partially reflects dyslipidaemia as a component of MetS [10].

Table 1: Percentage wise comparison of biochemical value in control, diabetic and non diabetic group.

S. No.	Biochemical Parameter	Control Group (%)	Diabetic Group (%)	Non Diabetic Group (%)
1.	Blood Sugar (Fasting)	5.60%	99.04%	0.0%
2.	Hs-CRP	0.0%	52.38%	83.82%
3.	Lp(a)	2.50%	100%	100%
4.	GGT	**Male**-1.27%	**Male**-89.23%	**Male**-96.97%
		Female-40%	**Female**-100%	**Female**-100%
5.	T.CHO.	55.17%	59.04%	55.88%
6.	TG	17.60%	66.66%	83.82%
7.	LDL	9.40%	13.33%	13.23%
8.	HDL-C	**Male**-12.10%	**Male**-18.46%	**Male**-12.12%
		Female-6.67%	**Female**-17.50%	**Female**-28.57%
9.	VLDL	62.50%	48.57%	38.23%
10.	Blood Urea	24.13%	16.19%	11.76%
11.	Creatinine	**Male**-39.49%	**Male**-36.92%	**Male**-33.33%

GGT had the potential to be considered in the diagnostic algorithms of metabolic syndrome. The predictive ability of increased GGT levels to diagnostic MetS was higher than hypertriglyceridemia, increased waist circumference and impaired glucose tolerance for both genders. Among the various components of MetS, increased systolic blood pressure showed highest predictive ability to diagnose MetS in men and increased waist circumference in women [11]. An increase in GGT level over time, even when GGT is in the normal range is correlated with increasing insulin resistance and is associated with a risk of incident type-II diabetes in both sexes, independently of baseline GGT, which is itself a diabetes risk factor [12]. Our data support the hypothesis that increase GGT activity is related to liver function, clinical stability, and inflammatory activity rather than the severity of CVD, measurement of GGT activity may be useful in predicting metabolic syndrome [13,14]. It is also demonstrated that an increase in serum GGT predict onset of metabolic syndrome, incident CVD and death, suggesting that GGT is a marker of metabolic syndrome and CVD [13,14].

Mean level of GGT in Control, Diabetic and Non Diabetic group is presented in Figure 4 and Figure 5 for age group 25-45 and 46-65 years respectively.

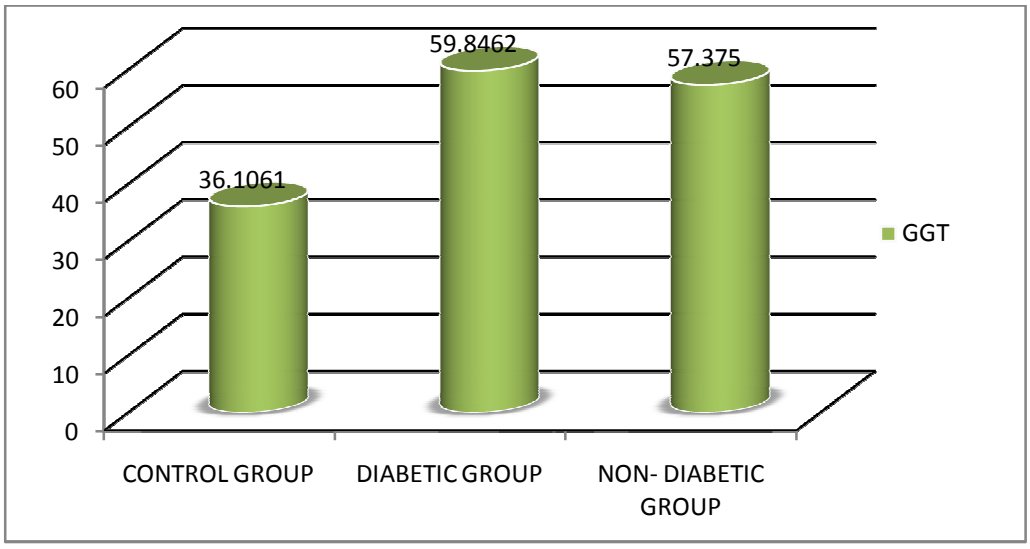

Fig. 4: Mean level of GGT with age group 25-45years.

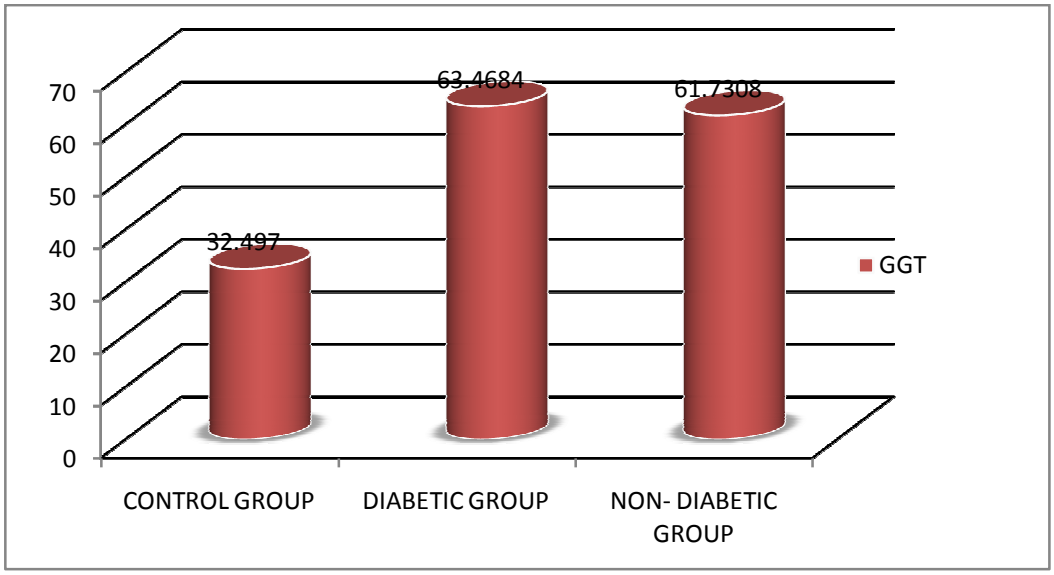

Fig. 5: Mean level of GGT with age group 46-65 years.

CONCLUSION

The study proposes the inclusion of biochemical parameter GGT in the criteria for defining cases of metabolic syndrome in Indians. So that more metabolic syndrome can be picked up at earliest. This issue is especially pertinent for the Indian patient population in whom cardiovascular disease is becoming increasingly common in both sexes and in age group of 25-65 yrs. There should be continued health care emphasis on detection of metabolic syndrome and intensification of targeted preventive strategies. We strongly recommend that large prospective studies are needed to establish link between the biochemical parameter of GGT with metabolic syndrome.

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