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Original Research Article

Assessment of Gamma Glutamyl Transferase as a Diagnostic Marker of Metabolic Syndrome

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Abstract

The purpose of this study was to identify the value of gamma glutamyl transferase (GGT) in instances of metabolic syndrome (MetS), the value of GGT in an age- and sex-matched control group, and the association of GGT as a marker in the diagnosis of metabolic syndrome.

Method: Total number of 176 cases of metabolic syndrome, 78 cases (44% of all cases) was male and 98 cases (56% of cases) were female included from outpatients or inpatients in our tertiary care hospital. From January 2021 until June 2022, the study period lasted 18 months. It was possible to estimate GGT and other biochemical parameters. In line with this, descriptive and analytical statistical tests were run.

Result: In this study, 25% of patients with metabolic syndrome fell within the upper limit of normal GGT levels, compared to 75% of instances with higher GGT levels. GGT was found to have a sensitivity and specificity of 67% and 100% in men and 94% and 98% in women, respectively, for the diagnosis of patients with metabolic syndrome.

Conclusion: Therefore, the study found that individuals with metabolic syndrome had higher GGT levels. The test's sensitivity for detecting metabolic syndrome was higher in females, but there was no gender difference in its specificity. So, it is possible to suggest GGT as a marker in the algorithm used to assess metabolic syndrome.

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

Introduction

Non-communicable diseases (NCDs) now outnumber old infectious diseases as the main cause of morbidity and mortality in both industrialised and developing countries because many of the old infectious diseases have been successfully wiped from the world. Among all of these NCDs, metabolic syndrome was the one that caused the most harm globally.

Other names for the Metabolic Syndrome (MetS) include "insulin resistance syndrome," "syndrome X," "deadly quartet," "dysmetabolic syndrome," and "hypertriglyceridemic waist." It consists of a group of metabolic abnormalities that are of primary concern in raising the risk factors for the progression of "atherosclerotic cardiovascular disease."[1].

Intolerant glucose levels, type 2 diabetes, impaired fasting glycaemia, insulin resistance, central obesity, dyslipidaemia, and hypertension are included in the group of metabolic abnormalities. [2] The number of persons worldwide who have the MetS has significantly increased during the past 20 years. According to Sanjay N. Bhasme and Rajesh S. Sangrame, the two main disease kinds that affect the majority of people worldwide are obesity and diabetes [3].

With an estimated 20–25% of the world's population suffering from MetS, India has a percentage of 25.8%. They are more likely to experience a heart attack or stroke owing to undiagnosed cardio-vascular disorders than people with the condition [4].

The MetS is based on biochemical markers and clinical investigation, according to several organisations. A detailed "platinum standard" is called for in the recently released International Diabetes Federation (IDF) definition of MetS in order to create a list of additional details in epidemiological research. It draws attention to the global application of the given diagnostic tools, which are needed for both clinical and research purposes [5].

IDF Criteria

With a waist circumference of around 90 cm for men and 80 cm for women, significant abdominal obesity is present in the Indian population. Some of the linked criteria should be present when diagnosing MetS together with central adiposity, or significant abdominal obesity. [5]

1. Fasting triglycerides ≥ 150 mg/dl.

2. HDL cholesterol < 40 and < 50 mg/dl for men and women.

3. Blood pressure ≥ 130 mm systolic or ≥ 85 mm diastolic or previous diagnosis or prescribed medication.

4. Fasting plasma glucose ≥ 100 mg/dl or previously diagnosed as type 2 diabetes [6].

The plasma membrane-bound enzyme gamma glutamyl transferase (GGT), which is present in many organs including all of the liver [6], is thought to be a sign of oxidative stress, fatty liver disease, and chronic hepatitis. It is known to aid in the hydrolysis of glutathione. [7] Extra hepatic organs such as the kidney, epididymis, fibroblasts, lymphocytes, and lung secrete GGT [8]. The main thiol antioxidant in humans, glutathione, is catabolized extracellularly by GGT. In order to facilitate intracellular glutathione (GSH) resynthesis and mitigate oxidative stress, GGT increases the availability of cysteine [9]. It is seen colocalizing with foam cells and oxidized low density lipoprotein (LDL) in the atheromatous core of coronary plaques [10].

Due to the rise in noncommunicable diseases including DM, HTN, and CVD in the Indian population and the lack of proper healthcare resources, it is crucial to have some standard laboratory parameters for the diagnosis of metabolic syndrome. Ferritin and GGT can be used as less expensive tests for MetS risk assessment because they are readily available at the primary care level. This study investigated the association between these traditional biomarkers and the metabolic syndrome.

Materials and Methods

This was a case control hospital based study carried out in the OPD and IPD of the department of general medicine at the

National Institute of Medical Sciences & Research Hospital in Jaipur, Rajasthan. Total number of subjects 176 Out of them 78 subjects in case group (patients diagnosed with having metabolic syndrome) and 78 subjects in control group (normal individual). Patients having Metabolic Syndrome were included in the study have central obesity (male waist circumference >90 cm and female waist circumference >80 cm in the Asian Indian population) was assessed on the basis of the International Diabetes Federation (IDF) 2005 criteria. All patients were subjected to standardized interviews from January 2020 to December 2021 after providing written, informed consent about research enrolment and upholding appropriate privacy and confidentiality. A thorough medical history was obtained, and a pre-designed and pre-tested proforma was used for the clinical examination, which included measuring the patient's blood pressure and their waist, hip, and ratio. According to the history proforma, the patient was given extensive laboratory tests. These data were classified and analysed as per aims and objectives of the study. Inferences were drawn with use of appropriate test of significance.

Result

The table and pie chart show that out of 176 cases of metabolic syndrome, 78 cases (44% of all cases) were male and 98 cases (56% of cases) were female. As a result, the incidence of metabolic syndrome is higher in women than in men.

Table 1 Dissemination by sex in the study group

Sr. No.	Gender	No. Of Subject	Percentage
1.	Male	78	44%
2.	Female	98	56%
Total		176	100%

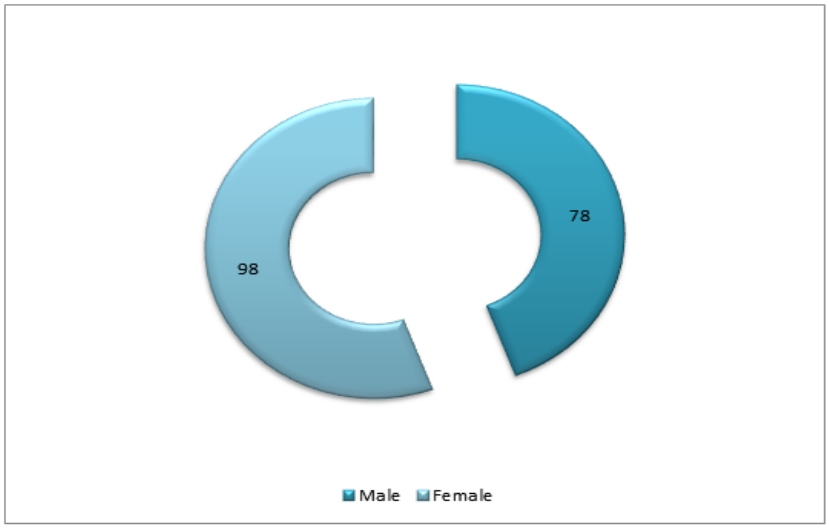

Figure 1: The pie graph of dissemination by sex in the study group

One hundred seventy six out of 78 cases of metabolic were studied in male, and 18 of them were in the 31-40 age group and two cases were over 81-90 years of age. One hundred seventy six out of 98 cases of metabolic syndrome were studied in female, and 18 of them were in the 31-40 age group and three cases were over 71-80 years of age.

Table 2: The age distribution of the study group in both male & female

Sr. No.	Group of Age	No. of Cases In Male	No. of Cases In Female
1.	21-30	9	1
2.	31-40	18	18
3.	41-50	13	15
4.	51-60	14	31
5.	61-70	13	30
6.	71-80	9	3
7.	81-90	2	0
	Total	78	98

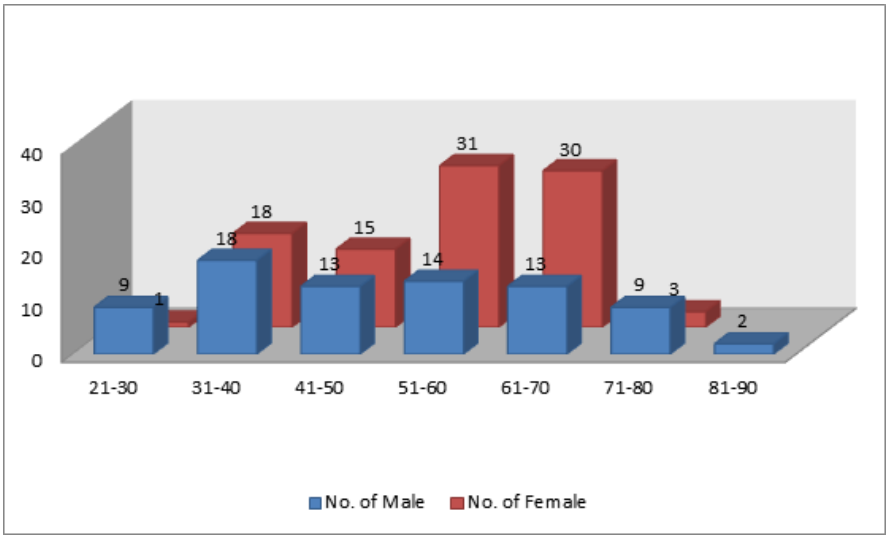

Figure 2: The age distribution of the study group in both male & female

Table 3: The values of GGT in MetS patients

Result	Values	Percentage
Normal	14	8%
Increased	162	92%

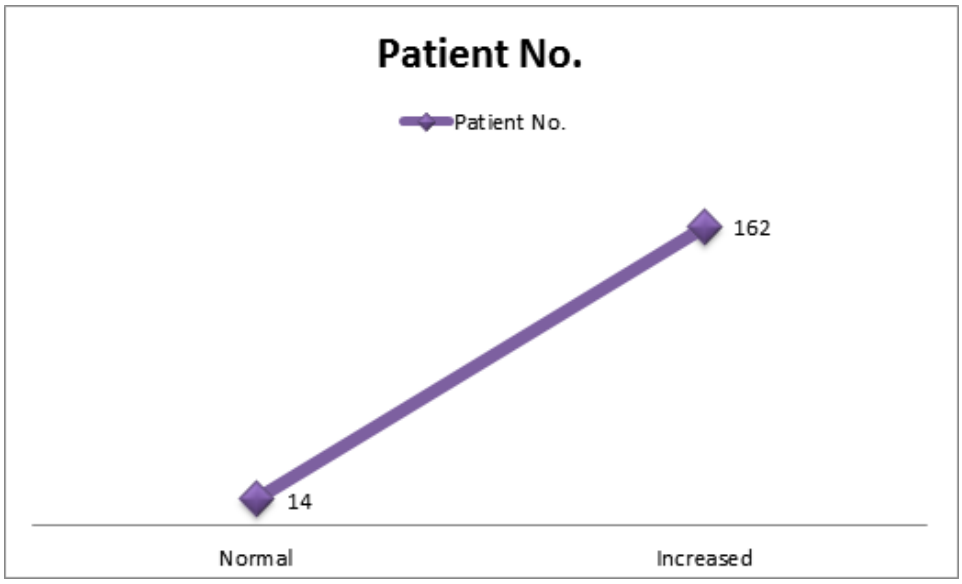

Figure 3: The age distribution of the study group in both male & female

Table 4: The biochemical parameters of MetS

S.No.	Measurements	Mean±SD
1.	Age	53.19±13.47
2.	Waist conference	87.42±4.927073
3.	Total cholesterol	192.22±7.45459
4.	Triglyceride	157.35±5.73
5.	HDL	41.33±5.46
6.	LDL	112.47±15.76
7.	GGT	24.47±4.59
8.	ALT	47.97±6.86
9.	AST	55.68±11.95
10	Systolic	142.20±12.84
11.	Diastolic	87.21±4.14

Discussion

These results suggest that the prevalence of metabolic syndrome increases with increasing GGT levels. These results were significant even after adjusting for alcohol intake. Patients with metabolic syndrome have increased risks for diabetes, cardiovascular disease, and mortality. Therefore, various markers for metabolic syndrome have been proposed to predict and prevent cardiovascular disease [11] Adiponectin and other adipocytokines can also be used as indicators of metabolic syndrome. However, they are complex and relatively expensive measurement. [12]. But, GGT is one of the easiest markers to measure and generally included in basic blood tests. So, physicians can easily prescribe and interpret the GGT level. Since the early 2000s, many studies have assessed the association between GGT and diabetes, metabolic syndrome, and cardiovascular disease[13] In most cases, these were the results of cohort studies. In addition to basal GGT, modifications in GGT are also linked with the occurrence of metabolic syndrome [14]

Some meta-analyses have also reported the a strong relationship of GGT with metabolic syndrome [15,16] The results of the present study were not significantly different from those of previous studies. However, in our study, 176 subjects were recruited comprising 98 cases of metabolic syndrome in female and 78 cases in male. The mean age in the study group was 53.19±13.47 years. In a similar study done by B Kasapgolu et al and Harini G L et al, the mean age was 51.3±3.2 years and 50.76±10.36 in cases, 78(44%) were males and 98(56%) females.[17,18] In a similar study done by B Kasapgolu et al, the gender distribution showed 62% females and 38% males in the study group.[17] Another study done by Vijayalakshmi Masalmani et al included 42% males and 58% females in cases and 47% males and 53% females in the control group.[19] The mean waist conference ratio was 87.42±4.92 in the study group. The said finding suggests that the aetiology of metabolic syndrome is heavily dependent on obesity and higher central adiposity.

The SBP and DBP of the patients were, respectively, 142.20±12.84 mm of Hg and 87.2±14.14 mm of Hg. Higher results were seen in a study by A O Rantala et al. [20] that was significantly different from our study, with SBP being 160.220.3 and DBP being 98.210.2. [20] These findings imply that type 2 diabetes is highly prevalent in persons with metabolic syndrome. Triglyceride levels were 157.36±5.73, HDL was 41.34±5.46, and LDL was 112.48±15.76 in the mean. Total

cholesterol was 192.22±7.45. The reference study made a similar observation as well. [21-22]

In the assessment of liver function tests, GGT one of enzyme test being assessed in this study. In the study group, the mean GGT was 24.47±4.59. B. Kasapgolu et al. a related study showed mean GGT among cases was 40.9±10.2. [17]

Thus, a study revealed that individuals with metabolic syndrome had higher GGT levels. The test's sensitivity for detecting metabolic syndrome was higher in females, but there was no gender difference in its specificity. In individuals with metabolic syndrome and high GGT readings, primary prevention may be prioritised while taking the CVD risk into account. So, it is possible to suggest GGT as a marker in the approach used to assess metabolic syndrome. [23-24]

Limitation

Several limitations of our approach merit comment. Establishing that GGT is a "risk factor" for CVD would require additional mechanistic studies that further assess systemic oxidative stress and evaluate hepatic steatosis and insulin resistance. We used baseline results rather than repeat GGT assessments, which has the potential to be a weakness of this study because changes may have occurred over time.

Also, we did not extend this study to other emerging biomarkers of vascular risk. However, GGT assays are widely accessible and frequently analyse in clinical laboratories.

Conclusion

Early detection of fat overflow to the liver is greatly aided by elevated liver enzyme levels. Raised liver enzymes are associated with increased prevalence of CVDs. Due on their wide availability, simplicity, and universal standardization, these tests, especially GGT, have the potential to be considered in appproch for MetS. Additionally, GGT has a strong prognosis for both MetS and CVD risk, suggesting a potential role in the early identification of MetS, due to its association with insulin resistance. It is unaffected by additional confusing variables. Gamma glutamyl transferase is a sensitive but moderately specific marker for the early diagnosis of MetS.

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