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Original Research Article

Multiple serum enzyme level changes in chronic alcoholic with special reference to gamma-glutamyl transpeptidase and lipid peroxidase

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ABSTRACT

Introduction: Chronic alcohol intake can lead to functional disturbances and irreversible lesions in organs such as the liver, brain, pancreas, gastrointestinal tract, heart, and endocrine gland. Determining the serum activities of various enzymes such as aminotransferases, glutamate dehydrogenase (GDH), and gamma-glutamyltransferase (GGT) has widely been used as a method of screening for hepatic involvement in chronic alcoholism.
Aim: This study was conducted to analyze multiple serum enzyme level changes in a chronic alcoholic with special reference to GGT and lipid peroxidase
Materials and Methods: 34 subjects were selected for the study. They are all male individuals with a positive history of chronic alcohol abuse. 10 healthy male volunteers who matched in age and socioeconomic status served as the controls.
Result: The activity of serum enzyme levels in test and control groups has been statistically analyzed. There was a highly significant difference ($p<0.001$) in the mean values of the Serum glutamic oxaloacetic transaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), GGT of these two groups, whereas Serum lipid peroxidase (SLP) was less significant ($p<0.01$). The concentration of GGT was significantly low ($p<0.001$) in controls compared to that in the alcoholics.
Conclusion: GGT can be taken as a marker of chronic alcoholism, provided serum bilirubin, SAP is within the reasonably average level

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1. Introduction

Liver injury resulting from alcohol use, ranging from hepatic steatosis to more advanced forms, including alcohol-associated cirrhosis (AC), alcoholic hepatitis (AH), and acute AH presenting as acute or chronic liver failure represents alcohol-associated liver disease (ALD). A significant cause of the liver disease is ALD, both on its own and as a co-factor in the progression of nonalcoholic fatty liver disease (NAFLD), chronic viral hepatitis, iron overload, and other liver diseases. ALD develops through several stages, beginning with hepatic steatosis and, in some individuals, gradually progressing through AH, culminating in cirrhosis.[1,2] The most important risk factor for the development of ALD is the quantity and the type of alcohol ingested.[3]

Mathew Baillic recognized the association of ethyl alcohol with cirrhosis of the liver in 1793. Since then, the correlation between alcohol and hepatic cirrhosis has been established. In up to 25% of patients with cirrhosis, alcohol was identified as the cause in the latest study. It is significant that not all those who abuse alcohol develop cirrhosis. The incidence is 10-15% at autopsy. The explanation for the apparent predisposition of certain people is mainly unknown.[4–8]

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Gamma Glutamyl transpeptidase (GGT) is an enzyme derived from the hepatocytes plasma membrane and as a biomarker of ALD, its activity has been widely accepted. Its usefulness as a marker is based on the pharmacological effects of ethanol on the liver. Hence, it shows different characteristics in the patients without liver disease compared to those in the patients with liver disease.[9]

The main molecular mechanism involved in the toxicity process that leads to cell death and oxidative damage to cell structure is considered to be lipid peroxidation. Oxidative metabolism in the liver results from the production of acetaldehyde, extensive displacement of the liver's normal metabolic substrates, and reactive oxygen species (ROS). A decrease in the antioxidant enzyme glutathione peroxidase-1 and increased ROS production strongly suggest that chronic ethanol consumption created an oxidative and potentially injurious environment within the hepatocyte. This could ultimately lead to the inactivation of cellular macromolecules and oxidation. After acute and chronic ethanol exposure, oxidative alterations of mitochondrial DNA and lipid peroxidation have been observed.[10,11]

The present study is undertaken to analyze the changes in the serum enzyme levels of alcohol abusers with particular reference to GGT and SLP and to predict the type of injury responsible for the development of cirrhosis.

2. Materials and Methods

This study was conducted in Dhanalakshmi Srinivasan medical college and Hospital College hospital for alcoholic intoxication, alcoholic gastritis, or alcoholic hepatitis from March 2021 to July 2021. 34 subjects were selected for the study with a history of chronic alcoholic abuse. 10 healthy male volunteers who matched in age and socioeconomic status served as the controls. None of them gave a history of alcohol intake previously and was not suffering from any illness clinically. The Institutional Ethics Committee approved the study. Only those patients who suffered from jaundice, cirrhosis or chronic liver disease caused by alcohol intake were included in the study.

Those patients showing frank cirrhosis of the liver with portal hypertension, upper gastrointestinal bleeding, hepatic encephalopathy were excluded. Also excluded from the study are those subjects taking drugs that are likely to cause Hepatic damage (INH, Rifampicin, etc.) and Hepatic microsomal enzyme induction (like antiepileptics). Patients with a previous history of jaundice, biliary colic, diabetes, hypertension, and pancreatitis were also excluded.

Detailed history regarding alcohol intake was obtained in all the test groups (34 individuals). The quantity of alcohol consumed per day, frequency of alcohol consumption, nature of the alcoholic drink was considered.

The following investigations were done for the 34 individuals in the test group and 10 in the control group (Table 1). All of them were detained for alcohol during their hospital stay. All the blood investigations are done on the 3^{rd} to 5^{th} hospital day and overnight fasting samples.

3. Results

There were 34 alcoholic individuals in the test group and 10 healthy controls. All of them are male individuals. Their age ranged from 22 years to 60 years, and all of them were from low or middle socioeconomic status. Out of 34 patients, 12 patients were normal in weight, 20 were underweight and only 2 were obese and overweight.

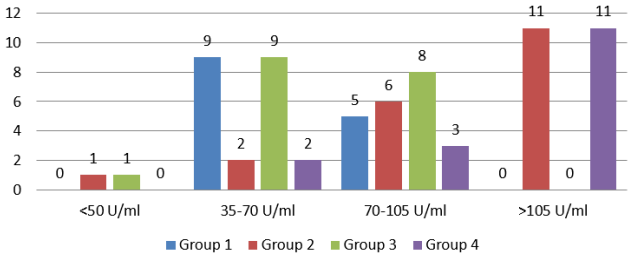

Figure 1: SGOT levels in different groups

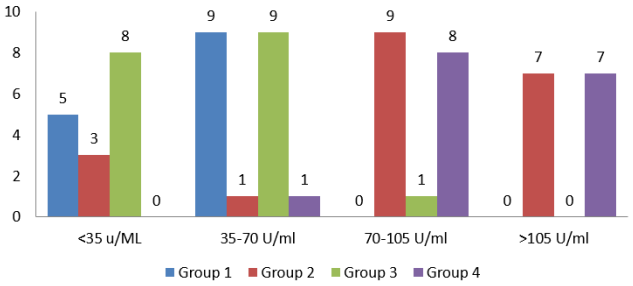

Figure 2: SGPT levels in different groups

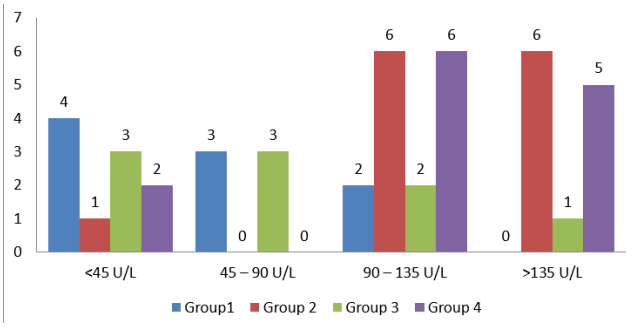

Figure 3: GGT levels in different groups

26 of them showed many withdrawal symptoms on the 3^{rd} to 5^{th} day in the form of facial flushing, increased sweating, tremor of hands, loss of sleep. 8 patients had only mild tremors and loss of sleep. None of them had delirium tremors. Their symptoms were controlled with diazepam.

Table 1: Reference values for enzyme and its method of study

S.No.	Enzyme	Method of Study	Normal Range
1	Serum Bilirubin (mg%)	Method of Powell	Less than 1 mg%
2	Serum glutamate oxaloacetate transaminase (SGOT) (U/ml)	Reitman & Frankel	10-30 U/ml
3	Serum glutamate pyruvate transaminase SGPT (U/ml)	Reitman & Frankel	5-10 U/ml
4	Serum alkaline phosphatase (SAP) (U/ml)	King & Armstrong	3-13 U/ml
5	Serum protein (g%)	Biuret method	5.0-7.0 gm%
6	Gamma Glutamyl transpeptidase (GGT) (IU/L)	S.B.Salkie	Upto 45 IU/L
7	Serum lipid peroxidase (SLP)	Optical density	Less than 0.025

Table 2: Serum enzyme levels in control and test groups.

Parameter	Control Group (n=10)	Test Group (n=34)
Serum Bilirubin (mg%)	1.1±0.2	1.4±0.72
SGOT (U/ml)	14.3±3.3	85.23±36.54
SGPT (U/ml)	11.3±2.36	71.71±42.03
SAP (U/ml)	6.4±0.72	7.78±2.25
Serum protein (g%)	6.32±0.39	6.07±0.47
GGT (IU/L)	28.8±6.55	107.32±63.78
SLP	0.025±0.003	0.042±0.017

Table 3: Serum enzyme levels in different groups

Parameter	Group 1	Group 2	Group 3	Group 4
Serum Bilirubin (mg%)	1.20±0.22	1.69±0.87	1.22±0.31	1.78±0.92
SGOT (U/ml)	55.14±11.09	106.88±37.74	52.44±1.51	107.63±36.59
SGPT (U/ml)	38.42±8.59	106.18±32.14	40.66±15.39	106.31±35.18
SAP (U/ml)	8.12±2.27	7.55±2.26	7.44±2.16	7.79±2.18
Serum protein (g%)	6.05±0.48	6.1±0.47	6.09±0.51	6.06±0.45
GGT (IU/L)	56.43±32.86	144.89±57.59	75.53±58.66	129.95±61.24
SLP	0.03±0.01	0.048±0.017	0.032±0.012	0.050±0.016

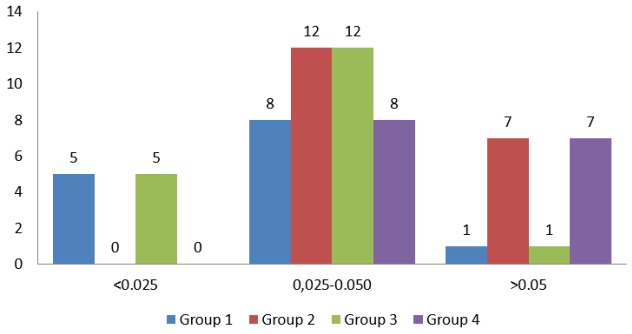

Figure 4: SLP levels in different groups

The activity of serum enzyme levels in the two groups has been presented in [Table 2]. There was a highly significant difference ($p<0.001$) in the mean values of the serum SGOT, SGPT, GGT of these two groups, whereas SLP was less significant ($p<0.01$). Serum bilirubin, SAP, and SP showed no significant changes in these groups. The concentration of GGT was significantly low ($p<0.001$) in controls compared to that in the alcoholics.

The test group was further divided into four subgroups based on duration and daily consumption of alcohol. Group 1 includes individuals with daily consumption of alcohol less than 300ml. Group 2 has individuals with daily consumption of more than 300ml. Group 3 and 4 consisted of individuals with a duration of fewer than 20 yrs and more than 20yrs respectively. Serum enzyme levels of these groups are represented in table 3. SGOT, SGPT, GGT, and SLP levels were significant between the test and control groups. These levels were determined within various ranges and are shown in Figures 1, 2, 3 and 4.

4. Discussion

In the transfer of the γ-glutamyl residue from the γ-glutamyl peptides to the amino acids GGT enzyme is involved.[12] In most of the biological systems, the donor of γ-glutamyl is glutathione.[13] In the synthesis of glutathione, GGT is also involved[14]. The plasma GGT activity has been widely used as an index of alcohol intake and liver dysfunction.

In our study, serum bilirubin ranged from 0.8 to 4.2mg %. Only seven individuals showed serum bilirubin of more than 2mg %. All the 7 classified in group 2 with daily consumption of more than 300ml. 1 individual in duration less than 20 years (group 3) and 6 of them were in (group 4) more than 20years. These increases were not statistically significant (p= 0.5) when compared with controls value 1.4± 0.72mg%.

Serum alkaline phosphatase ranged from 5.0 to 12.1 U/ml. None of them showed elevation of SAP more than the upper limit of normal 13 U/ml. When compared to controls, it is not significant. Control value 7.78± 2.25 U/ml (Tables 1 and 2). Serum proteins ranged from 5.0 to7.0 mg%. All of them were normal. Albumin/Globulin ratio was above 1.5 in 32 subjects and 1.1 & 1.0 in two of them. None of them showed a reversal of the A/G ratio. When compared to control, it is not significant.

Of the 34 individuals in the test group, 33 showed raised SGOT levels. Eleven of them showed increased SGOT level above 90U /ml (3 times the normal value). Another eleven patents registered increased SGOT by more than 60 U/ml (more than twice the normal value). The only one showed normal value. They were compared to the control mean value14.3 ± 3.3. It is highly significant (p<0.001).

Of the 34 subjects in test groups, 26 subjects showed an increase in SGPT level. Seven of them had more than 105U/ml (three times normal), and nine showed increased levels of 70U/ml (two times the normal). Only eight patients registered normal values. Compared to the control mean value of 11.3±2.36U/ml, it is highly significant (p<0.001).

Five patients registered a normal value of less than 45U/ml, and the rest, twenty-nine patients, registered an elevated value of GGT. Six of them showed values more than 135U/ml (three times normal), and eight showed 90U /ml (Two times normal value). Compared to the control value 28.8 ± 6.55, it is highly significant (p<0.001). These results were in accordance with those of many prospective studies, which demonstrated a strong relationship between GGT activity and ALD incidence [15–17].

Serum lipid peroxidase is measured as optical density and compared with the test group of the control for evaluation. Twenty-eight patients out of thirty-four showed increased SLP levels. Out of these, eight patients registered increased more than 0.050.

5. Conclusion

Alcoholic liver damage is, for the most part, not clinically evident. A biochemical and pathological study by liver biopsy is necessary to assess the extent of liver damage. GGT can be taken as a marker of chronic alcoholism, provided serum bilirubin. SAP is reasonably normal and has no history of enzyme induction by drugs. Finding normal enzyme studies does not rule out alcohol abuse. However, further extensive controlled study is essential to establish that serum lipid peroxidase level is more helpful in monitoring alcohol abuse and predicting permanent liver cell damage.

6. Source of Funding

None.

7. Conflict of Interest

None.

References

1. Mathurin P, Lucey MR. Management of alcoholic hepatitis. *J Hepatol*. 2012;56(Suppl 1):39–45.
2. Edmondson HA, Peters RL, Frankel HH, Borowsky S. The early stage of liver injury in the alcoholic. *Medicine*. 1967;46(2):119–29.
3. Singh M, Gupta S, Singhal U, Pandey R, Aggarwal SK. Evaluation of the oxidative sress in chronic alcoholics. *J Clin Diagn Res*. 2013;7(8):1568–71.
4. Dolganiuc A. Alcohol and Viral Hepatitis: Role of Lipid Rafts. *Alcohol Res Curr Rev*. 2015;37(2):299–309.
5. Sahlman P, Nissinen M, Pukkala E, Färkkilä M. Cancer incidence among alcoholic liver disease patients in Finland: A retrospective registry study during years 1996-2013. *Int J Cancer*. 2016;138(11):2616–21.
6. Loconte NK, Brewster AM, Kaur JS, Merrill JK, Alberg AJ. Alcohol and Cancer: A Statement of the American Society of Clinical Oncology. *J Clin Oncol*. 2018;36(1):83–93.
7. Ganesan M, Eikenberry A, Poluektova LY, Kharbanda KK, Osna NA. Role of alcohol in pathogenesis of hepatitis B virus infection. *World J Gastroenterol*. 2020;26(9):883–903.
8. Singal AK, Bataller R, Ahn J, Kamath PS, Shah VH. ACG Clinical Guideline: Alcoholic Liver Disease. *Am J Gastroenterol*. 2018;113(2):175–94.
9. Nalpas B, Hispard E, Thepot V, Pot S, Dally S. A comparative study between carbohydrate-deficient transferrin and gamma-glutamyltransferase for the diagnosis of excessive drinking in a liver unit. *J Hepatol*. 1997;27(6):1003–8.
10. Galicia-Moreno M, and GGR. The role of oxidative stress in the development of alcoholic liver disease. *Rev Gastroenterol Mex*. 2014;79(2):135–44.
11. Nassir F, Ibdah JA. Role of mitochondria in alcoholic liver disease. *World J Gastroenterol*. 2014;20(9):2136–42.
12. Johnson-Davis K, McMillin G. Enzymes. In: Bishop M, Fody E, Schoeff LE, editors. Clinical Chemistry Techniques, Principles, Correlations. 6th edn. Philadelphia: Lippincott Williams and Wilkins; 2010. p. 300.
13. Singh RB, Ghosh S, Niaz MA, Rastogi V, Wander GS. Validation of tobacco and alcohol intake for the five city study and a proposed classification for Indians. *J Assoc Physicians India*. 1998;46(7):587–91.
14. Zhang H, Forman HJ, Choi J, Choi J. Gamma-glutamyl Transpeptidase in glutathione biosynthesis. *Methods Enzymol*. 2005;401:468–83.
15. Gupta S, Pandey R, Katyal R, Aggarwal HK, Aggarwal RP. Lipid peroxide levels and antioxidant status in alcoholic liver disease. *Indian J Clin Biochem*. 2005;20(1):67–71.
16. Das SK, Nayak P, Vasudevan DM. Biochemical markers of alcohol consumption. *Ind J Clin Biochem*. 2003;18(2):111–8.
17. Pujar S, Kashinakuti SV, Guruadappa K, Manjula R. Serum MDA, antioxidant vitamins and erythrocytic antioxidant enzymes in chronic alcoholic liver disease - A case control study. *Al Ameen J Med Sci*. 2011;4(4):315–22.

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