Profile of Gamma Glutamyl Transferase (GGT) Levels Among Adolescents with Alcohol Consumption in Pagerbarang District

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ABSTRACT

Background & Objective: Alcoholic Liver Disease is a liver disorder caused by excessive and long-term alcohol consumption. Alcoholic liver disease is divided into fatty liver, alcoholic hepatitis, and cirrhosis. Liver damage can be influenced by many factors such as viruses, bacteria, drug toxicity, chemicals, and excessive consumption of alcoholic beverages. There is a direct relationship between the consumption of hard alcoholic beverages and mortality due to liver cirrhosis. Disruption of mechanisms in the liver can result in swelling with an increase in transaminase enzymes produced by the liver. This research aims to determine Gamma-GT levels in the serum/plasma samples of adolescent alcohol drinkers in Pagerbarang District. **Method:** This type of research is descriptive research. This method uses total sampling with 30 samples as respondents. **Result:** The results showed that the 30 research samples had an average respondent age of 15-20 years with a duration of alcohol consumption of 1-3 years. The research results found that all 30 samples had normal Gamma-GT levels. **Conclusion:** Consuming alcoholic beverages in excessive volume and duration will cause liver damage due to the toxicity of the end products of alcohol metabolism, such as acetaldehyde and hydrogen ions.

Introduction

Ethanol is the content found in alcoholic beverages. Ethanol is a substance that has long been used as a medicinal liquid and is commonly used as the core ingredient in a number of alcoholic beverages such as wine, whiskey, and beer. Ethanol (ethyl alcohol, C_2H_5OH), which is used as a gasoline additive, originates from the fermentation of various types of carbohydrates from grains, fruits, or flowers. In its

pure form, ethanol is colorless, transparent, volatile, has a boiling point of 78°C, and has a distinctive aroma (Manela and Hidayat, 2018). Ethanol is a non-electrolyte liquid substance that can circulate in the bloodstream and is soluble in fat. Ethanol in alcohol produces toxic chemicals, such as acetaldehyde, which can harm the body, one of which is Alcoholic Liver Disease (Maliangkay J, Youla and Murniati, 2020).

Alcoholic Liver Disease is a liver disorder caused by excessive and long-term alcohol consumption. Alcoholic liver disease is divided into fatty liver, alcoholic hepatitis, and cirrhosis (Istifara, Tualeka and Sillehu, 2023). Liver damage can be influenced by many factors such as viruses, bacteria, drug toxicity, chemicals, and excessive consumption of alcoholic beverages. There is a direct relationship between the consumption of hard alcoholic beverages and mortality due to liver cirrhosis. Disruption of mechanisms in the liver can result in swelling with an increase in transaminase enzymes produced by the liver (Dewi, 2016). Alcohol or liquor abuse is a growing problem among adolescents and shows an increasing trend from year to year.

According to the World Health Organization (WHO) in June 2024, the death toll reached 2.6 million per year caused by harmful use or excessive consumption of alcohol, which accounts for 4.7% of all deaths, particularly occurring in men with 2 million deaths due to alcohol consumption (WHO, 2024). In Indonesia, the percentage of adolescent alcohol consumers reaches 4.9%. The prevalence of alcohol drinkers in the past 12 months and 1 month starts high in the age group between 15-24 years, at 5.5% and 3.5% respectively, which then increases to 6.7% and 4.3% in the 25-34 age group, but later decreases with age. Alcohol consumption among youth is a serious health problem (K et al., 2021). If consumed over a long period, it can have negative health impacts, such as impaired liver function divided into fatty liver, alcoholic hepatitis, and cirrhosis (Nurzhorif and Sulistiyowati, 2022).

The test used to detect an increase in transaminase enzymes and impaired liver function is the Gamma Glutamyl Transferase (GGT) level test; furthermore, GGT is also very sensitive in heavy alcohol consumers (D. A. D Permata, 2019). The Gamma Glutamyl Transferase (GGT) enzyme is an enzyme that is widely distributed, with high concentrations in hepatocytes on the cell surface of tissues, especially on the outer membrane surface of cells except in erythrocytes and the cytoplasm; liver cells produce most of this enzyme. The GGT enzyme also functions to play a role in protein synthesis and the transport of amino acids across the cell membrane. The GGT enzyme is abundantly found in hepatocytes. An increase in the activity of this enzyme in the blood plasma indicates damage to the liver and bile ducts and can also be used as a marker in cases of liver damage due to excessive alcohol consumption, fatty liver disease, and other liver inflammations (Gumay and Mustofa, 2020). GGT is very sensitive to consumed alcohol, so it can be used to monitor the reduction of alcohol consumption in chronic or novice alcohol users. GGT activity increases in all forms of liver disease. This test is more sensitive than ALP, ALT, or AST in detecting obstructive jaundice, cholangitis, and cholecystitis. GGT is also used to find a differential diagnosis of liver disease in children and pregnant women with increased levels of LDH and ALP; besides that, GGT is also used as a marker for prostate cancer and metastasis of breast and colon cancer to the liver.

From the results of previous research conducted by Maliangkay J, Owen Youla, Assa Murniati, and Tiho in 2020 regarding Serum Glutamic Oxaloacetic Transaminase (SGOT) levels in consumers of alcoholic beverages in South Tosuraya Village, the

results from 50 samples showed that 43 samples (86%) had normal SGOT levels, and 7 samples (14%) had high SGOT levels. The majority of samples in this study were male, totaling 40 respondents (80%), while females totaled 10 respondents (20%) (Maliangkay J, Youla and Murniati, 2020).

Based on the researcher's observations, people living in Pagerbarang District, including males aged >15 years, are alcohol drinkers. Based on the description above, the researcher is interested in conducting research entitled "Description of Gamma-GT (Gamma Glutamyl Transferase) Levels in Adolescent Alcohol Drinkers in Pagerbarang District".

Objective

This study aims to determine the levels of Gamma Glutamyl Transferase in the serum/plasma samples of adolescent alcohol drinkers in Pagerbarang District.

Method

The type of research used in this study is descriptive research, a method that describes the characteristics of a population or the phenomenon being studied. The main focus of this research method is to describe the research subjects. This type of research is suitable for the study to be conducted, which is to determine the Gamma Glutamyl Transferase levels in the serum/plasma samples of adolescent alcohol drinkers in Pagerbarang District.

This research will be conducted from approximately February to May 2025. The population in this study consists of all adolescent respondents who are alcohol drinkers, aged 15-20 years, with a history of alcohol consumption for more than 1 year, and who consume alcohol 1-2 times per month in Pagerbarang District, totaling 30 respondents. The samples used in this study are the entire population, meaning a total sampling technique is used. Sample examination will be carried out at the Laboratory of the Pekalongan Academy of Analytical Health. For data analysis techniques, the data obtained from the research results will be presented in table form and analyzed descriptively.

Results

Based on the results of the study on Gamma-GT examination in adolescent alcohol drinkers in Pagerbarang Village, Pagerbarang District, Tegal Regency, which was conducted in 2025 at the Laboratory of the PEKALONGAN ACADEMY OF ANALYTICAL HEALTH, the following results were obtained:

TABLE 1. GGT Examination Results

No	Sample	Age (Years)	Consumption Duration (Years)	GGT Level (IU/L)	Description
1.	Sample 1	18 years old	2 Years old	20 IU/L	Normal
2.	Sample 2	20 years old	2 Years old	25 IU/L	Normal
3.	Sample 3	16 years old	1 Years old	18 IU/L	Normal
4.	Sample 4	15 Years old	1 Years old	12 IU/L	Normal
5.	Sample 5	15 Years old	1 Years old	17 IU/L	Normal
6.	Sample 6	18 Years old	2 Years old	18 IU/L	Normal
7.	Sample 7	15 Years old	1 Years old	16 IU/L	Normal
8.	Sample 8	17 Years old	1 Years old	16 IU/L	Normal
9.	Sample 9	20 Years old	2 Years old	28 IU/L	Normal

No	Sample	Age (Years)	Consumption Duration (Years)	GGT Level (IU/L)	Description
10.	Sample 10	20 Years old	3 Years old	30 IU/L	Normal
11.	Sample 11	15 Years old	1 Years old	13 IU/L	Normal
12.	Sample 12	15 Years old	1 Years old	14 IU/L	Normal
13.	Sample 13	15 Years old	1 Years old	15 IU/L	Normal
14.	Sample 14	17 Years old	1 Years old	12 IU/L	Normal
15.	Sample 15	19 Years old	2 Years old	25 IU/L	Normal
16.	Sample 16	17 Years old	1 Years old	16 IU/L	Normal
17.	Sample 17	17Years old	1 Years old	15 IU/L	Normal
18.	Sample 18	15 Years old	1 Years old	14 IU/L	Normal
19.	Sample 19	18 Years old	2 Years old	20 IU/L	Normal
20.	Sample 20	17 Years old	1 Years old	16 IU/L	Normal
21.	Sample 21	20 Years old	2 Years old	20 IU/L	Normal
22.	Sample 22	16 Years old	1 Years old	17 IU/L	Normal
23.	Sample 23	15 Years old	1 Years old	16 IU/L	Normal
24.	Sample 24	15 Years old	1 Years old	12 IU/L	Normal
25.	Sample 25	19 Years old	2 Years old	20 IU/L	Normal
26.	Sample 26	19 Years old	2 Years old	24 IU/L	Normal
27.	Sample 27	16 Years old	1 Years old	17 IU/L	Normal
28.	Sample 28	17 Years old	1 Years old	18 IU/L	Normal
29.	Sample 29	20 Years old	2 Years old	25 IU/L	Normal
30.	Sample 30	18 Years old	1 Years old	19 IU/L	Normal

The information above indicates that the 30 research samples had respondents with an average age of 15-20 years and a duration of alcohol consumption of 1-3 years. The research results found that all 30 samples had normal Gamma-GT levels.

These results show that the Gamma-Glutamyl Transferase (GGT) levels in adolescents who consume alcohol are within the normal reference range. This finding indicates that for the majority of the research subjects, alcohol consumption has not yet shown a significant biochemical impact on liver function. Physiologically, GGT is an enzyme involved in glutathione metabolism and amino acid transport and is known as one of the sensitive laboratory indicators for enzyme induction, particularly by alcohol. Elevated GGT levels are often associated with chronic alcohol consumption and hepatocellular damage. However, in the context of adolescents, alcohol consumption is generally periodic and of shorter duration compared to adult or chronic populations (Koenig and Seneff, 2015). This may explain why there was no statistically significant increase in GGT levels in the studied group.

Interviews with the subjects revealed that their duration of alcohol consumption was only 1-3 years, with a frequency of drinking twice a month. The subjects were moderate alcohol drinkers, meaning they only consumed alcohol in amounts ranging from 6-12 glasses (25ml). Adolescents are known to still have relatively good lifestyle patterns; their physical activity and sleep patterns influence alcohol metabolism and liver enzyme excretion. These results are consistent with research by Kenny (2021) and (Solar and Mewo, 2021), which state that in young people under 30 years of age, human metabolism is still good due to growth and significant factors influenced by an individual's physiological state.

Discussion

An increase in GGT levels in alcohol drinkers typically occurs at ages >30 years. At ages <30 years, the body's defense mechanisms, particularly the liver's capacity against the metabolic load induced by ethanol, are still better and more sensitive

compared to ages >30 years. Research conducted by Mardiana (2022) and (Putri, 2023) examined GGT levels in drinkers considering dose, duration, and previous drinking habits. The results from the examination of 30 samples found normal GGT levels.

Subjects aged 25-30 who consumed alcohol for 1 year were found to have normal GGT levels. This is because their body's metabolic processes are still productive, leading to a faster metabolic rate. Alcohol consumption at this age can lead to a tendency for increased muscle mass, generating more energy. In contrast, as individuals enter the age of 51-60, muscle mass tends to decrease while fat mass increases, which can slow down the metabolic process or calorie burning for energy production. Research conducted by Dewa Ayu (2019) and (D. A. D Permata, 2019) on adolescents aged 12-17 years with a consumption history of >5 years and a frequency of alcohol consumption 2-3 times per week found high GGT levels. Consuming alcoholic beverages in excessive volume and duration will cause liver damage due to the toxicity of the end products of alcohol metabolism, such as acetaldehyde and hydrogen ions.

Nevertheless, it is important to note that GGT levels within normal limits do not automatically rule out the possibility of subclinical liver damage. The GGT enzyme has low sensitivity in the early stages of hepatotoxicity, especially when alcohol consumption is still in its early stages or is not continuous. Furthermore, individual variations, such as differences in alcohol metabolism, nutritional status, as well as genetic and environmental factors, can influence the expression of the GGT enzyme (Koenig and Seneff, 2015). The fact that GGT levels remained normal in adolescent subjects who consume alcohol also indicates the possibility that the toxic effects of alcohol on liver function have not reached a level capable of triggering the release of this enzyme into the bloodstream. Therefore, in this study, GGT was not yet able to show a significant difference as an early indicator of liver dysfunction in the adolescent population (Solar and Mewo, 2021).

The finding of GGT levels within normal limits should not be a basis for ignoring the potential long-term risks of alcohol consumption at a young age. Health education and preventive strategies against alcohol consumption in this population must still be prioritized, given that alcohol-induced liver damage is progressive and often latent in its early stages.

Conclusion
Based on the research, all adolescent alcohol drinkers aged 15-20 years showed normal Gamma-Glutamyl Transferase (GGT) levels. This finding indicates that alcohol consumption with a duration of 1-3 years and low frequency has not yet caused significant biochemical impact on liver function. Nevertheless, it remains important to be cautious of potential long-term risks, considering that alcohol-induced liver damage is progressive.

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