

Sokoto Journal of Medical Laboratory Science 2025; 10(2): 14 - 22**SJMLS - 10 (2) - 002****Assessment of Hepatic and Cardiac enzymes among adult male alcoholics in Ilorin Metropolis, Kwara state Nigeria**

Ganiyu O. Adeosun ^{*1}, Abdullahi O. Olawuyi ², Moses O. Adeboye ³, Fatai O Salaudeen ⁴, Adam Abdullahi ⁵, Hassanat A Adeosun ⁶

Department of Medical Laboratory Science Clinical Chemistry Unit, University of Medical Sciences, Ondo City, Ondo, Nigeria ¹, Federal University of Health Sciences. Ila -Orangun.Osun State, Nigeria ². Department of Medical Laboratory Science, Elizade University Ilara Mokin, Ondo State ³, Department of Medical Laboratory Science Clinical Chemistry Unit, A-Lhikmah University, Adeowo Estate Ilorin, Kwara State ⁴, Department of Medical Laboratory Science Clinical Chemistry Unit, A-Lhikmah University, Adeowo Estate Ilorin, Kwara State ⁵, Department of Biological Science, Faculty of Science, Biology Unit, University of Abuja ⁶.

Author for Correspondence*: ogadeosun@yahoo.com/+234-08037148125. <https://dx.doi.org/10.4314/sokjmls.v10i2.2>

Abstract

Alcoholic beverages, containing ethanol, have been consumed from time immemorial, playing a significant role in human social life, culture and history. Moderate alcohol consumption is associated with sociability and relaxation but its abuse can lead to a wide range of physiological and pathological health challenge. This case-control cross-sectional study involving 80 adult male alcoholics and 40 non-alcoholic who served as controls was conducted to assess the effect of alcohol consumption on hepatic and cardiac enzymes among the Alcoholics. Plasma hepatic and cardiac enzymes were assayed in one hundred and twenty adult males' alcoholics recruited from selected popular beer parlours or bars in Ilorin North Central, Nigeria, and were grouped into: mild and chronic alcohol and non-alcohol consumers as control. Reference analytical methods were employed to assay the hepatic and cardiac enzymes in both the study and control subjects. Plasma ALT, AST and ALP, LDH and Troponin enzyme activities in both mild and chronic alcoholics were significantly elevated ($p < 0.05$) when compared to the non-alcoholics. The plasma hepatic and cardiac enzymes activities assayed in the chronic alcoholics were also significantly higher ($p < 0.05$) than the values obtained among the mild alcohol drinkers. Alcohol consumption has dose-response effect on the alcoholics. Mild or chronic alcoholism have deleterious effects on the physiological and biochemical regulations of plasma enzymes both the hepatic and cardiac enzymes activities in the mild and chronic alcoholics were dysregulated and was precipitated by the effect of addicted alcohol consumption.

Keywords: Alcohol, mild, chronic, enzymes, hepatic and cardiac.

Introduction

An alcoholic beverage also known as alcoholic drink is a liquid that contains ethanol which is naturally produced from the fermentation of grains, fruits, or different sources (Turki *et al.*, 2022). At low concentration, alcoholic drink has been used as a drug or depressant that precipitates euphoria, reduces tension and can also increase sociability and at higher doses the consequences are detrimental and includes; drunkenness, stupor, unconsciousness and accidental death (Nehring *et al.*, 2024). The complications of alcohol abuse are not limited but also contributes to poor performance at school and work, associated family problems, unprotected sex leading to sexually transmitted diseases, violence, memory blackouts; unintentional injuries, accidents, and overdose's as well as organ damages (Kooband George, 2024) which can precipitate alcohol use disorder (AUD) known to be a serious chronic condition that affects 16 million people in the United States (Sacks *et al.*, 2010). Epidemiological survey of the side effects of alcohol abuse among alcoholics in Nigeria population shows that alcohol related complication abounds (Lasebikan *et al.*, 2018). In spite these negative impacts, alcohol remains part of our society as people use it to celebrate, socialise, relax, and enhance the enjoyment of meals. Globally, alcohol accounts for 3.3 million deaths; 5.9 percent of all deaths—each year (Sacks *et al.*, 2010), while nearly 90 percent of

adults in Nigeria have drunk alcohol at some point in their lifetime (Ajayi *et al.*, 2019 and Onodugo *et al.*,2019).There are limited information in literature about the toxic effects of continuous impact of administration of alcohol on some internal organs in the body such as the heart and liver with respect to their enzyme metabolism. The need to update these limited references cannot be overemphasized which is the focus of this study.

Materials and Methods

Study Design: This case-control cross-sectional study was conducted on 80 adult male alcoholics and 40 non -alcoholic who served as controls. They were grouped into Non, Mild and Chronic alcohol consumers relative to their degree of addiction to alcohol consumption. They were recruited from the various bear parlors and in the study jurisdiction for the period of three months.

Materials

Administration of Questionnaire:

Questionnaires which contain specific information such as, age, education background, brand of alcohol consumed, unit of alcohol consumed per day, duration of addiction and alcohol related complications were administered to study participants. Only the consenting individuals were allowed to respond to the questionnaire in compliance with protocol and the institutional Ethics committee guidelines and also in conformity with the internationally accepted practice for use of research subjects.

Collection of Blood Samples for Enzyme Assay

Ten millilitres (10ml) of random venous blood were aseptically by taken by venepuncture of the antecubital vein for the alcoholic subjects and non-alcoholic controls. It was dispensed into lithium heparin bottle and centrifuged to obtain plasma which was frozen until it was ready for the assay of the haptic and cardiovascular enzymes.

Assay of Plasma Hepatic and Cardiac Enzymes

Aspartate transaminase (AST) and Alanine transaminase (ALT) were assayed by the methods described by Huang *et al.* (2006) and Morials *et al.* (2024) respectively. The measurement of plasma Alkaline phosphatase (ALP) and Lactate dehydrogenase enzyme activities were accomplished by the methods described by Zhenwei *et al.* (2019) and Farhana & Lappin, (2025) respectively. Gamma-glutamyl transferase (GGT) and Troponin concentration were measured by Schiele *et al.* (1981) and Qingzhuo *et al.* (2023) respectively,

Results

Table 1 shows the description of the of the subjects with respect to the level of alcohol abuse and the duration of exposure to the toxicants in the drink. Eighty subjects (40 mild and chronic alcoholic) and 40 non- alcoholic controls were enlisted for the study. The scope of the duration of exposure to alcoholism will provide a comprehensive information about the relationship between the alcohol toxicants and plasma hepatocellular and cardiovascular enzymes in the study subjects.

Table 1: Grouping of Participants

Group	Age	Addiction Level	Addiction Period	Number of Participants
1	18-25 Years	Mild	1-5 Years	40
2	30 Years and above	Chronic	6-10 Years	40
3	25 Years and above	Controls	Not applicable	40

As shown on Table 2, plasma AST, ALT, CK, LDH only significantly increased with increase in the amount of alcohol consumed(<0.05). These enzymes were progressively elevated in the mild and chronic alcohol consumers (p<0.05).

Table 2. Analysis of Variance of the Plasma Liver and Cardiovascular enzymes in mild, chronic and non-alcohol consumers

Parameters	Controls	Mild Alcohol	Chronic Alcohol	p-value
AST (IU/L)	6.91±1.81	10.69±4.59	21.27±6.07	0.001**
ALT (IU/L)	7.38±1.75`	11.13±4.70	11.36±3.56	0.001**
ALP (IU/L)	32.72±7.65	50.08±13.1147	82±13.87	0.001**
CK (IU/L)	89.29±11.67	122.42±15.74	216.91±51.07	0.001**
LDH (IU/L) `	261.24±19.45	264.58±21.03	289.45±32.76	0.001**
Troponin (ng/L)	0.001±0.00	0.34±0.252.	29±0.82	0.001**

Table 3 shows that plasma AST, ALT, ALP CK and Troponin levels in the mild alcohol consumers were statistically significant elevated ($p < 0.05$), when compared with the non -alcoholics. However, there was no statistically significant difference between the plasma level of Lactate Dehydrogenase ($p > 0.05$) in the mild alcohol consumer relative to the controls.

Table 3: Liver and Cardiovascular enzymes in Mild and Non -Alcohol consumers

Parameters	Mild Alcohol Consumer	Controls	P-value
AST (IU/L)	10.6±4.59	6.9±1.81	0.001**
ALT (IU/L) `	11.13±4.70	7.389±1.75	0.001**
ALP (IU/L)	50.08±13.11	32.72±7.65	0.001**
CK (IU/L)	122.42±15.74	89.29±11.67	0.001**
LDH (IU/L)	264.58±21.03	261.24±19.45	0.368
Troponin (ng/L)	0.34±0.25	0.0±01	0.001**

Table 4 shows the comparison between the plasma liver and Cardiac enzyme levels in alcoholics and the controls are expressed in table 4. The plasma liver and cardiovascular enzymes assayed among the groups of the alcoholics were all statistically significant in the study subjects when compared with the controls. ($p < 0.05$).

Table 4: Liver and Cardiovascular enzymes in chronic and non-alcohol consumers

Parameters	Chronic Alcoholics	Controls	p-values
AST (IU/L)	21.27±6.07	6.91±1.81	0.001**
ALT (IU/L)	11.36±3.56	7.38±1.75	0.001**
ALP (IU/L)	47.82±13.87	32.72±7.65	0.001**
CK (IU/L)	216.91±51.07	89.29±11.67	0.001**
LDH (IU/L)	289.45±32.76	261.24±19.45	0.002
Troponin (ng/L)	2.29±0.82	0.0±0.2	0.001**

Table 5 shows the comparison of the plasma liver and cardiovascular enzymes in both test and control subjects. The values of plasma AST, ALT, CK, LDH and Troponin among the chronic alcohol consumers were recorded to be statistically and significantly higher ($p < 0.05$) when compared with the mild alcoholics. Plasma ALP only in the mild alcoholics was statistically and significantly higher compared to the values in chronic alcoholics.

Table 5: Liver and Cardiac enzymes in mild and chronic alcohol consumers

Parameters	Mild Alcoholics	Chronic Alcoholics	Level of significance
AST (IU/L)	10.69±4.59	21.27±6.07	$p < 0.05$
ALT (IU/L)	11.13±4.70	11.36±3.56	$p < 0.05$
ALP (IU/L)	50.08±13.11	47.82±13.87	$p < 0.05$
CK (IU/L)	122.42±15.74	216.91±51.07	$p < 0.05$
LDH (IU/L)	264.58±21.03	289.45±32.76	$p < 0.05$
Troponin (ng/L)	0.34±0.25	2.29±0.82	$p < 0.05$

The relationship between the enzymes among the various groups of alcohol consumers is shown on table 6. Among the mild alcohol consumers, ALT showed significant direct correlation with AST ($r = 0.366$; $p < 0.06$) while LDH showed significant indirect correlation with ALP ($r = -0.325$; $p < 0.05$). Other parameters showed no statistically significant correlation with each other. ($p > 0.05$).

Table 6: Correlation analysis of Liver and Cardiac enzymes in the mild alcohol consumers.

Dependent variable	Independent variable	“r” value	P-value
AST	ALT	0.366*	0.010
LDH	ALP	-0.325	0.024
ALP	Troponin	-0.130	0.377
CK	AST	0.103	0.485
AST	LDH	0.196	0.183

Table 7 revealed that among the chronic alcohol consumers, all the parameters showed no statistically significant correlation with each other ($p>0.05$).

Table 7: Correlation analysis of Liver and Cardiac enzymes in the chronic alcohol consumers

Dependent variable	Independent variable	“r” value	P-value
ALT	AST	-0.181	0.594
LDH	ALP	0.202	0.551
ALP	Troponin	0.097	0.540
CK	AST	0.077	0.822
LDH	AST	0.477	-0.518
Troponin	LDH	0.489	0.127

Discussion

Alcohol consumption has become part of most society in the world because it has been used for celebration, socialization, relaxation and sometimes to enhance the enjoyment of meals (CDC,2021). Despite these benefits, the abuse of alcoholic beverages has been grouped among the top five predisposing factors to diseases, alcohol use disorder, disability and death throughout the world (Lim *et al.*,2012). It is also documented in literature that alcohol misuse is frequent and across the globe and has been linked to various disorders among the global populace which include 3.3 million deaths, memory blackouts; unintentional injuries, accidents, and overdoses, organ damage, diseases and alcohol use disorder(AUD)(Varghese *et al.*,2022).

This present study recorded a significant increase in the plasma levels of AST, ALT, and ALP among the mild alcohol consumers compared to the controls ($p<0.05$). Päivikki *et al.*, (2009) and Torkadi *et al.*, (2014) earlier findings align with the report of this present study which suggests that even moderate dosage of alcohol consumption can precipitate negative impact on the liver function. Moderate consumers of alcohol are women who drank one bottle of beer per day and men who drank up to two drinks per day according to the Centre for Disease Control (Dufour, 1999; CDC, 2021).

The elevated plasma AST and ALT which are hepatocytes enzymes is indicative of hepatic stress, or progressive hepatic damage (Pratt, 2009; Lala *et al.*, 2023).

The elevation of plasma ALT confirmed the presence of liver pathology among the alcoholics because serum ALT is a liver specific enzyme (Moriles *et al.*, 2024).

Plasma Alkaline Phosphatase (ALP), known to be a liver specific enzyme present in the biliary system and bile ducts was recorded to be significantly elevated among the alcoholics compared to the controls ($p<0.05$) as previously reported by Pun *et al.* (2023). The elevated liver enzymes among the moderate alcohol consumers might be precipitated by the stress placed on the liver during the metabolism of alcohol which can induce stress on the liver that may lead to the release of these enzymes when the liver is exposed to working harder than usual during alcohol metabolism.

We also evaluated the effect of chronic alcohol consumption on the liver enzymes. Our finding is consistent with the data obtained among the moderate alcoholics in which a statistically significant increase in the plasma AST, ALT, and ALP levels was reported among the chronic

alcohol consumers compared to the controls ($p < 0.05$). This result compares well with the earlier report of Päivikki *et al.* (2009); Gazy *et al.*, (2019) and Tripathi *et al.* (2020).

The elevated liver enzymes reported among the chronic alcoholics can be attributed to the liver damage precipitated by the alcohol intake which generated acetaldehyde, a toxic substance that can harm liver cells, leading to increased enzyme levels. Long long-term effects of chronic alcohol consumption have been associated with alcoholic hepatitis and cirrhosis which precipitate life threatening consequences has earlier been attributed to significant higher levels of AST, ALT, and ALP ($p < 0.05$). Shah *et al.* (2023) and Patel *et al.* (2023). We also noticed that the concentration of the plasma liver enzymes among the alcoholics varies with the amount alcohol consumed which reflects the various stages of liver damage evaluated and is in consonance with the earlier report by Adak *et al.* (2012) and Torkadi *et al.* (2014).

Plasma Creatinine kinase and Troponin concentration assayed among the mild and chronic Alcoholics was significantly elevated compared to the non-alcoholics ($p < 0.05$). The two enzymes are indicators of muscle and cardiac disorders, thus the alcoholics in this study are prone to developing muscle and cardiac injury should they continue with the addiction of alcohol consumption. The collective evidence of increased CK and Troponin levels in mild and chronic alcohol consumers suggests that alcohol consumption can indeed have detrimental effects on the cardiovascular system. Previous findings of Georgescu *et al.* (2024) and Biddingere *et al.* (2022) on the relation of these enzymes with alcohol consumption supports the outcome of this current study.

Lactate Dehydrogenase (LDH) is documented to be involved in energy production in various body tissues, including the heart. However, the lack of a statistically significant variation in the LDH levels among the mild alcoholics but significant difference among the chronic alcoholics compared to the non-alcoholics may suggest that alcohol consumption does not directly precipitate the release of LDH enzyme into the bloodstream and therefore may not be regarded as an absolute

biomarker for cardiac damage in this study. However, Dezman *et al.* (2016) previously reported an association between alcohol consumption and plasma LDH levels, this is at variance with the findings of this present study.

The dose-response relationship between alcohol consumed and the cardiac biomarkers evaluated revealed a significant direct relationship between the quantity of alcohol consumed and the concentration of plasma enzyme levels. This is an indication that alcohol consumption portends potential harm to the hepatic and cardiovascular systems. Previous reports (Mehlig *et al.*, 2021; Arora *et al.*, 2022; Meza *et al.*, 2022; Georgescu *et al.*, 2024) aligns with the findings of this present study that established elevated liver enzymes in all the groups of alcoholics evaluated.

Conclusion

We conclude that alcohol consumption has dose-response effect on its consumers. Mild alcohol consumption significantly elevated the liver enzymes activities of the plasma ALT, AST and ALP enzymology, while plasma levels of Cardiac troponin and creatine kinase were altered in both mild and chronic alcoholics. Chronic alcohol consumption had direct significant relationship with both hepatic and cardiovascular enzymes.

Limitations of the Study

Despite observing all the research protocol before the commencement of study, we experienced some challenges. Meeting the sample size figure of the study was challenging, convincing the study subjects to be enlisted in study met little resistance which correlate with the option of visiting many beer parlours and joints. Similarly getting the cooperation of the study subjects for phlebotomy was also a herculean task due to fear expressed on sighting the needle and syringe. However, counselling and enlightenment remedied this challenge. Fasting sample could not be collected because the study subjects vehemently turned down the proposal.

Disclaimer (Artificial Intelligence)

Author(s) hereby declares that NO generative AI technologies such as large language Models

(ChatGPT, COPILOT et) and text -to-have been used during writing or editing the manuscript.

Consent

Consent forms were administered to obtain the voluntary participation of the subjects before sample collection. Sample was collected from the subjects that gave consent.

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Competing interest

Authors of this study declared that no competing interest exists

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