OPEN ACCESS

Scholars International Journal of Traditional and Complementary Medicine

Abbreviated Key Title: Sch Int J Tradit Complement Med
ISSN 2616-8634 (Print) | ISSN 2617-3891 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Effect of Plantain Meal on Liver Enzymes Activity in Ethanol-Induced Wistar Rats

Wariebi Koikoibo[1], Joy Ebilade Nanakede[1], Samuel Chukwuma[2], Mao Ebimobotei Bunu[3], John Nwolim Paul[4*], Udo Orukwowu[5], Barisuka Kofii Nwibana[6], Chioma Akunnaya Ohanenye[7], Chukwuebuka Nnamdi Ohanenye[8], Osaat Roseline Sunday[9], Confidence Waribo Ihua[10]

[1]Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
[2]Department of Pharmacology, Faculty of Basic Clinical Sciences, College of Health Sciences, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria
[3]Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, Bayelsa Medical University, Yenagoa, Bayelsa State, Nigeria
[4]Department of Anatomy, Faculty of Basic Medical Sciences, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria
[5]Department of Nursing Science, Faculty of Basic Medical Sciences, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria
[6]Rivers State College of Health Science and Management Technology, Oroworukwo, Port Harcourt, Rivers State, Nigeria
[7]Department of Anatomy, College of Medicine, Rhema University, Aba, Abia State, Nigeria
[8]Department of Family Medicine, Abia State University Teaching Hospital, Aba, Abia State, Nigeria
[9]Department of Anatomy, Faculty of Basic Medical Sciences, Federal University Otuoke, Bayelsa State, Nigeria
[10]Department of Human Physiology, Faculty of Basic Medical Sciences, College of Medicine, David Umahi Federal University of Health Sciences, Uburu, Enonyi State, Nigeria

DOI: https://doi.org/10.36348/sijtcm.2026.v09i02.001 | **Received:** 27.11.2025 | **Accepted:** 20.01.2026 | **Published:** 10.02.2026

***Corresponding author:** John Nwolim Paul
Department of Anatomy, Faculty of Basic Medical Sciences, Rivers State University, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria

Abstract

This study investigated the hepatoprotective effects of plantain meal on liver enzyme levels in ethanol-induced Wistar rats. Eighteen male Wistar rats (160–270 g) were divided into three groups: Group I (control), received standard rodent chow; Group II, was fed a mixture of plantain meal and normal feed at a 1:1 ratio; and Group III, received a 2:1 plantain-to-feed ratio. After 14 days of dietary intervention, all groups were induced with 80% ethanol (5 ml/kg). Serum levels of alanine aminotransferase (ALT), aspartate aminotransferase (AST), and alkaline phosphatase (ALP) were measured. The results indicated that plantain meal significantly reduced ALT, AST, and ALP levels in the experimental groups compared to the control, with the 1:1 ratio being more effective. These findings suggest that plantain meal possesses hepatoprotective properties, making it a potential candidate for dietary interventions aimed at liver health.

Keywords: Plantain, Liver Enzymes, Ethanol-Induced, Hepatoprotective.

1.0 INTRODUCTION

1.1 Background

Plantains (*Musa paradisiaca*) are a major staple food in tropical and subtropical regions, prized for their high starch content and significant nutritional benefits (Arhoghro *et al.,* 2024). They are rich in carbohydrates, dietary fiber, vitamins (such as A, C, and B-complex), and essential minerals like potassium and magnesium (Kulkarni and Khedkar, 2019). Aside from their dietary value, plantains have garnered attention for their potential medicinal properties, particularly their ability to alleviate oxidative stress and inflammation—factors that play key roles in liver health (Santos *et al*., 2018). Recent studies suggest that the bioactive compounds in plantains, such as phenolic acids, flavonoids, and carotenoids, have antioxidant and anti-inflammatory properties that could aid in protecting the liver from toxins such as ethanol (Olabiyi *et al*., 2020).

The liver plays a central role in maintaining metabolic homeostasis by detoxifying harmful substances, producing essential proteins, and regulating fat and carbohydrate metabolism. Liver enzyme levels, such as ALT, AST, and ALP, are commonly used as

biomarkers for liver function. Elevated levels of these enzymes are typically indicative of liver damage or dysfunction (Pratt & Kaplan, 2000). Ethanol is known to induce liver injury, leading to the elevation of these enzymes, which is why it is widely used to model liver damage in experimental studies (Chalasani *et al*., 2018). Given the growing concern about liver diseases, including non-alcoholic fatty liver disease (NAFLD), exploring dietary interventions like plantain meal, which may modulate liver enzyme levels, could offer novel strategies for liver health management.

1.2 Statement of the Problem

While plantain has been implicated in promoting overall health, its specific effects on liver enzyme modulation in the context of ethanol-induced liver injury remain underexplored. Liver diseases, particularly those induced by ethanol and environmental toxins, are on the rise globally. Understanding how plantain meal influences liver enzymes in animal models can provide valuable insights into its potential hepatoprotective properties. This study addresses the gap in knowledge by investigating the impact of plantain meal on liver enzymes in Wistar rats.

1.3 Aims and Objectives

The primary aim of this study was to evaluate the effect of plantain meal on liver enzyme levels (ALT, AST, and ALP) in ethanol-induced Albino Wistar rats. The objectives of this study were:

A. To assess the serum levels of ALT, AST, and ALP in rats fed with plantain meal and induced with ethanol.
B. To compare the effects of two different ratios of plantain meal (1:1 and 2:1) mixed with normal feed on liver enzyme activity.

1.4 Significance of the Study

The significance of this study rested on its potential to highlight a natural dietary intervention for liver health. Liver enzyme assays are widely used to monitor liver function, and the findings of this study could suggest that plantain meal might reduce the risk of liver damage induced by toxins such as ethanol. If plantain meal was shown to modulate liver enzyme levels favorably, it could inform dietary recommendations for individuals at risk of liver disease, especially those who consume alcohol regularly. Furthermore, this study could lay the groundwork for future research into plantain's therapeutic role in liver health.

2.0 LITERATURE REVIEW

2.1 Plantain Overview

Plantains belong to the *Musa* genus and are closely related to bananas (Valmayo *et al,* 2020). Unlike desert bananas, plantains are starchier, and are typically consumed when cooked (Amah *et al,* 2021). They are rich in nutrients, providing a good source of complex carbohydrates, fiber, and essential vitamins (Babayemi *et al*., 2010). In addition to their dietary benefits, plantains contain bioactive compounds, including polyphenols and flavonoids, that have been shown to possess antioxidant and anti-inflammatory properties (Ugbogu *et al*., 2018). These properties suggest that plantains could play a role in mitigating oxidative stress, a contributing factor in liver damage (Santos *et al*., 2018).

2.2 Liver Enzymes

The liver performs several crucial functions, including detoxification of toxins, production of bile, and synthesis of essential proteins. Liver enzymes such as ALT, AST, and ALP are vital biomarkers for assessing liver function. ALT and AST are transaminases primarily found in the liver, with elevated levels in the blood indicating hepatocellular damage (Pratt & Kaplan, 2000). ALP, on the other hand, is involved in the breakdown of phosphate groups and is useful in detecting cholestatic liver conditions (Chalasani *et al*., 2018). Monitoring these enzymes provides a clear picture of liver health, particularly when exposed to toxic substances like ethanol.

2.3 Phytochemicals in Plantain

Plantains contain various phytochemicals, including alkaloids, tannins, flavonoids, and saponins, which have shown promise in reducing oxidative stress and inflammation (Sanni *et al*., 2019). These compounds are believed to have hepatoprotective effects, potentially reducing liver enzyme elevations associated with liver injury. Polyphenols in plantains, specifically, have been linked to antioxidant activity, which may help prevent or alleviate liver damage (Ugbogu *et al,* 2018).

3.0 MATERIALS AND METHODS

3.1 Experimental Animals

Eighteen male Wistar rats (160–270 g) were obtained from the animal house of the Department of Pharmacology, University of Port Harcourt, Rivers State, Nigeria. The rats were housed under standard laboratory conditions in the animal facility of the Faculty of Basic Medical Sciences, Niger Delta University, Bayelsa State, Nigeria. After acclimatization for 14 days, the rats were randomly divided into three groups of six each:

- **Group I (Control):** Fed with normal rodent chow.
- **Group II (1:1 Ratio):** Fed with a mixture of plantain meal and normal feed at a 1:1 ratio.
- **Group III (2:1 Ratio):** Fed with a mixture of plantain meal and normal feed at a 2:1 ratio.

3.2 Plantain Meal Preparation

Unripe plantains were purchased from Amassoma Market, Southern Ijaw Local Government, Bayelsa State, Nigeria, in the month of January, 2024. They were peeled off, and the pulp was sliced into pieces which were dried under the sun for 48 hours. The dried plantain pulp slices were then grinded into powder using

an electric blender. The powder was mixed with standard rodent chow using the designated ratios (1:1 and 2:1) for Groups II and III, respectively.

3.3 Experimental Protocol

After the 14-day feeding period, all rats were administered with 80% ethanol (5 ml/kg body weight) to induce liver injury. Blood samples were collected via cardiac puncture for liver enzyme assays after the rats were sacrificed under chloroform anesthesia.

3.4 Biochemical Analysis

Serum ALT, AST, and ALP levels were measured spectrophotometrically using standard biochemical kits from Randox Laboratories. The assays were performed according to the manufacturer's instructions.

3.5 Statistical Analysis

Data were analyzed using one-way analysis of variance (ANOVA), followed by a post-hoc Tukey test to determine statistical significance ($p < 0.05$). Results were presented as means ± standard error of the mean (SEM).

4.0 RESULTS

Figures 1, 2 and 3 show the effect of plantain on the liver enzymes, ALT, AST and ALP, respectively.

4.1 Effect of Plantain on ALT Levels

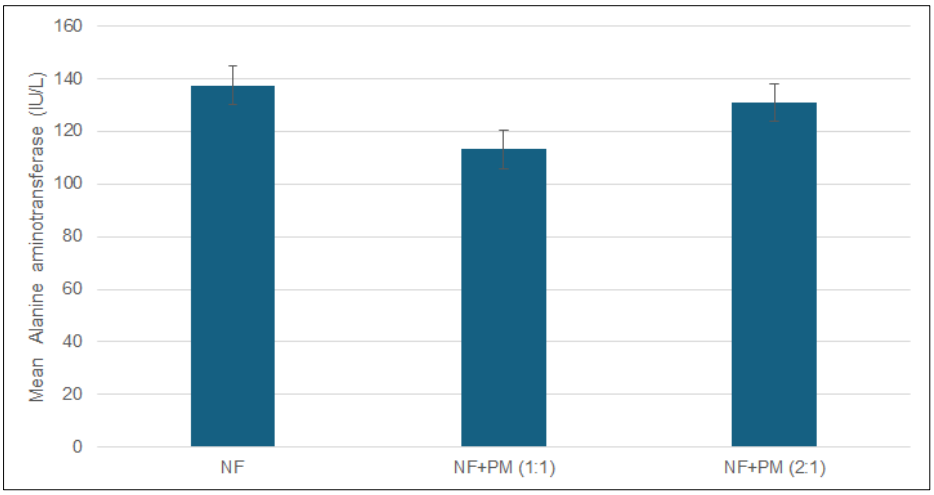

Figure 1: Effect of Plantain on serum levels of ALT, Alanine Aminotransferase. NF (normal rodent feeds), PM (plantain meal), values are in Mean ± SEM. n=6

The ethanol-induced rats fed with normal feed had significantly higher ALT levels (137.38 IU/L) compared to those in the experimental groups, where the 1:1 ratio (113.11 IU/L) was more effective in lowering ALT levels. The 2:1 group recorded a value of 128.10 IU/L.

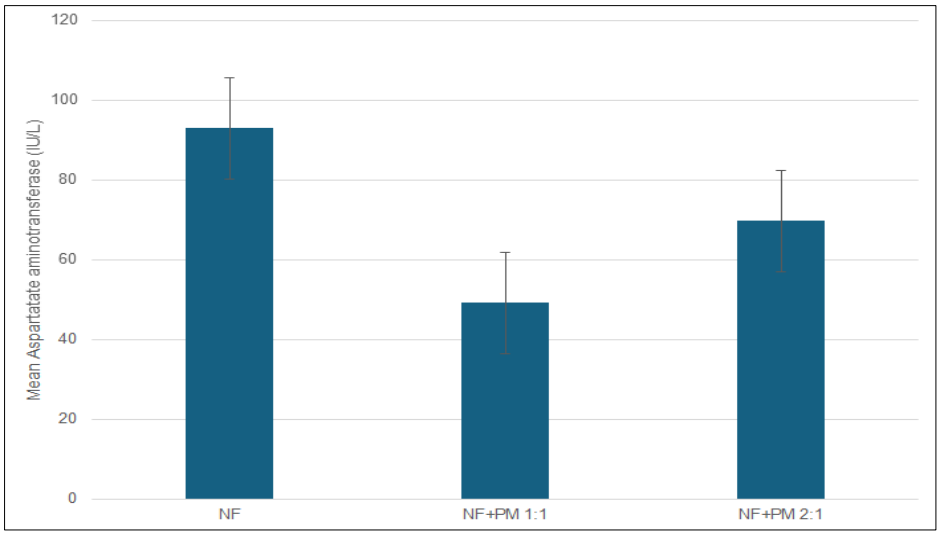

Figure 2: Effect of Plantain meal on the serum levels of Aspartate Aminotransferase enzyme. NF (Normal rodent feeds), PM (Plantain Meal), values are expressed as Mean ± SEM, n=6

4.2 Effect of Plantain on AST Levels

Figure 2 shows the effect of plantain on the serum level of Aspartate Aminotransferase. Ethanol induction increased AST levels to 93.00 IU/L in the control group, while plantain meal at ratios 1:1 and 2:1 reduced these levels to 49.22 IU/L and 69.70 IU/L, respectively.

4.3 Effect of Plantain on ALP Levels

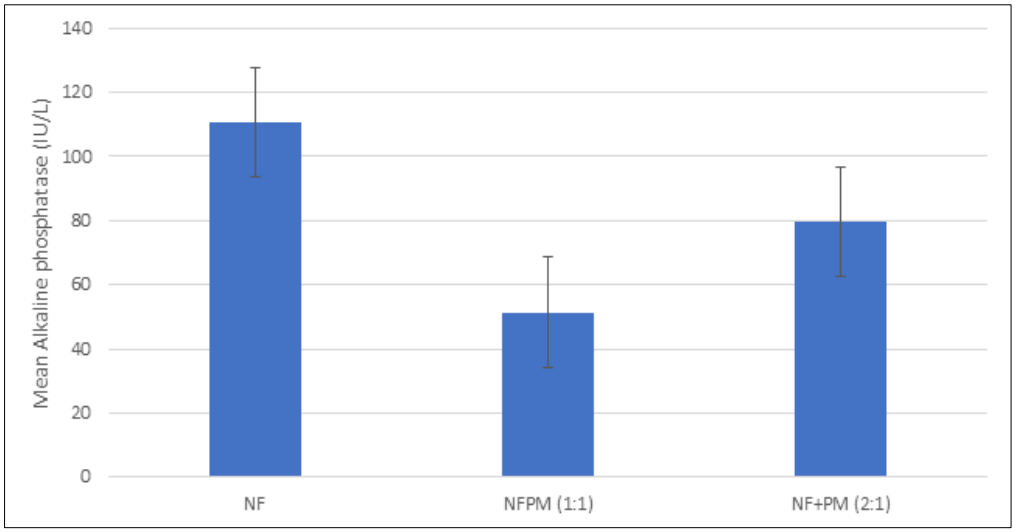

Figure 3: Demonstrates the effect of plantain on the serum levels of Alkaline Phosphatase enzyme, ALP. NF= Normal rodent Feeds, PM (Plantain Meal), values are expressed as Mean ± SEM, n=6

A significant increase in ALP levels (110.71 IU/L) was observed in the control group, whereas the experimental groups showed reduced ALP levels (51.36 IU/L for 1:1 and 79.56 IU/L for 2:1, respectively).

5.0 DISCUSSION AND CONCLUSION

5.1 Discussion

The results from this study demonstrate that plantain meal has a significant hepatoprotective effect in ethanol-induced liver injury in Albino Wistar rats. Ethanol-induced liver injury is commonly associated with elevated serum ALT, AST, and ALP levels, as these enzymes are released into the bloodstream when liver cells are damaged (Chalasani *et al*., 2018). The reduction in these enzyme levels in rats fed with plantain meal suggests that the bioactive compounds in plantain, such as flavonoids and polyphenols, might play a critical role in mitigating oxidative stress and inflammation in the liver (Adebayo *et al,* 2014, Santos *et al*., 2018, Arhoghro, 2022).

The more pronounced effect observed in the 1:1 plantain-to-feed ratio group may indicate an optimal concentration of plantain meal that maximizes its hepatoprotective potential. These findings align with previous studies suggesting that dietary plantains can reduce liver damage in animal models (Ugbogu *et al*, 2018, Olabiyi *et al,* 2020, El-Demerdesh *et al*, 2022, Arhoghro *et al*, 2024).

5.2 Conclusion

Plantain meal demonstrated significant hepatoprotective effects in ethanol-induced Wistar rats, as evidenced by reductions in serum ALT, AST, and ALP levels. These findings suggest that plantain meal may serve as a viable dietary intervention to support liver health, particularly in the prevention of liver diseases.

5.3 Recommendations

Further studies should explore the specific molecular pathways by which plantain meal affects liver enzymes. Investigations into plantain's antioxidant and anti-inflammatory properties will enhance the understanding of its hepatoprotective effects. Additionally, clinical trials are necessary to assess the applicability of these findings in human populations, particularly for individuals with liver disease or those at risk of ethanol-induced liver damage.

Authors Contributions

W K developed the concept/study design and drafted the manuscript; C S was the chief laboratory technologist and supervisor; J E N collated the results; others were actively involved in the literature review, technical assistance, procurements, data analysis, as well as the final manuscript write-up, editing and approval.

Acknowledgments

The authors are grateful to the technical and laboratory staff of the Department of Pharmacology, and Department of Human Physiology, both of the Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria. We are also grateful to the researchers whose works are herein cited.

Disclosure of Conflict of Interest: The authors declare that there is no conflict of interest.

REFERENCES

- Adebayo A H, Abolaji A O, Kela R, et al. (2014). Hepatoprotective potentials of aqueous leaf extract of *Basella alba* on ethanol-induced liver damage in Wistar rats. *Journal of Traditional and Complementary Medicine*, 4(3), 200–207.
- Amah D, Stuart E, Mignouna D, Swennen R, Teeken B (2021). End-user preferences for plantain food products in Nigeria and implications for genetic improvement. *International Journal of Food Science and Technology* 2021, 56, 1148–1159
- Arhoghro E M, Eric E U, Madock O J, Onitsha E. N., Berezi E. P. The impact of plantain stem juice on the levels of albumin, protein, and lipid profile in rats with induced hepatic toxicity and oxidative stress by aluminum chloride. *World Journal of Advance Healthcare Research*, 2024, ISSN:2437-0400, Vol. 8, Issue 4, pages 180-186
- Arhoghro E. M; and Kpomah E.D. Alanine Aminotransferase and Aspartate Aminotransaminase Activities in Wistar Rats Fed with Musa paradisiaca (Plantain) Stem Pulp in Aluminum Chloride Induced Hepatic Oxidative Stress *Journal of Applied Science and Environmental Management,* 2022; 26(6): 1057-1062.
- Babayemi, J. O., Dauda, K. T., Nwude, D. O. and Kayode, A. A. A. (2010). Evaluation of the Composition and Chemistry of Ash and Potash from various plant materials – A review. Journal of Applied Sciences, 10:1820 – 1824. http://scialert.net/abstract/?doi=jas.2010.1820.1824 Retrieved 22nd August, 2024.
- Chalasani N, Younossi Z, Lavine J E, Charlton M, Cusi K, Rinella M, Harrison S A, Brunt E M, and Sanyal A. J. (2018) The Diagnosis and Management of Nonalcoholic Fatty Liver Disease: Practice Guidance from the American Association for the Study of Liver Diseases. *Hepatology*, VOL. 67, NO. 1, 2018; pages 328-357
- El-Demerdash F M, Hussien D M, Ghanem N F, Farga A M. Bromelain Modulates Liver Injury, Hematological, Molecular, and Biochemical Perturbations Induced by Aluminum via Oxidative Stress Inhibition. *Biomed Research International Journal*, Nov. 21, 2022;5342559. doi: 10.1155/2022/5342559. PMID: 36452063; PMCID: PMC9705099
- Kulkarni, S., & Khedkar, C. D. (2019). Nutritional and therapeutic potential of plantains—a review. *Critical Reviews in Food Science and Nutrition*, 59(16), 2538–2549.
- Olabiyi, A. A., Oboh, G., Akinyemi, A. J., et al. (2020). Influence of ripening on the antioxidant and hepatoprotective properties of plantain (*Musa paradisiaca*) peel. *Journal of Food Biochemistry*, 42(1), e12469.
- Pratt, D. S., & Kaplan, M. M. (2000). Evaluation of abnormal liver-enzyme results in asymptomatic patients. *New England Journal of Medicine*, 342(17), 1266–1271.
- Santos, M. L. S., *et al*. (2018). The hepatoprotective effect of plantain *(Musa paradisiaca*) on liver enzymes. *Phytotherapy Research*, 32(10), 2000–2010.
- Ugbogu, E. A., Ude, V. C., Elekwa, I., Arunsi, U. O., Uche-Ikonne, C., Nwakanma, C. (2018) Toxicological profile of the aqueous-fermented extract of Musa paradisiaca in rats. *Avicenna Journal of Phytomedicine*, 2018; 8(6): 478.
- Valmayor, O. *et al*. (2000). Plantains and Bananas in Latin American Literature in Transition 1870–1930. Cambridge University Press. Retrieved from https://www.cambridge.org/core/books/abs/latin american-literature-in-transition 18701930/plantains-and bananas/540FEA9BA2449E9C70F496AC29C636 E 2