



PRINT ISSN 1119-8362
Electronic ISSN 2659-1499

Full-text Available Online at
<https://www.ajol.info/index.php/jasem>
<https://www.bioline.org.br/ja>

J. Appl. Sci. Environ. Manage.
Vol. 30 (4) 1236-1242 April 2026

Hepatoprotective Activity of Poly-Herbal Formulated Tea Comprising of *Moringa olifera*, *Curcuma Longa*, *Zingiber officinale*, *Allium sativum* and *Citrus limon* in Carbon tetrachloride-Induced Hepatotoxicity in Albino Rats

¹*UWAYA, DO; ²EHIGIAMUSOR, VA; ¹UWAMUSI, MO; ¹OMOREGIE, AE

¹*Department of Biomedical Science Laboratory Technology, Faculty of Sciences Laboratory Technology, University of Benin, Benin City, Nigeria

²No. 4 Hopwood Street, PR1 1UY Preston Lancashire, United Kingdom

*Corresponding author email: dickson.uwaya@uniben.edu

*ORCID: <https://orcid.org/0000-0001-6217>

*Tel: +2347059650758

Co-Authors email: amenvictory15@gmail.com; marvellousuwamusi8@gmail.com; Andrew.omoregie@uiben.edu

ABSTRACT: Chinese medicine practitioners have used polyherbal tea, also known as herb-herb combinations, but there is a lack of scientific evidence supporting their therapeutic benefits. This study aims to investigate the Hepatoprotective Activity of Poly-Herbal Formulated Tea Comprising of *Moringa olifera*, *Curcuma Longa*, *Zingiber officinale*, *Allium sativum* and *Citrus limon* in Carbon tetrachloride-Induced Hepatotoxicity in Albino rats using appropriate standard methods. Results obtained show that the polyherbal tea extract reduced the body weight and the liver-to-body weight ratio of animals and CCL4 alone when compared to control ($p < 0.05$). The tea extract reduced the level of ALP, ALT, and AST compared with CCL4 alone ($p < 0.05$). The tea extract increased the levels of SOD and catalase and reduced the level of MDA when compared with CCL4 alone ($p < 0.05$). The polyherbal tea formulation provides significant protection against liver injury caused by CCL4, which has potential for clinical application in the management of liver diseases. The antioxidant present in the formulated tea may be responsible for the hepatoprotective effect of the tea.

DOI : <https://dx.doi.org/10.4314/jasem.v30i4.20>

License: **CC-BY-4.0**

Open Access Policy: All articles published by **JASEM** are open-access and free for anyone to download, copy, redistribute, repost, translate and read.

Copyright Policy: © 2026. Authors retain the copyright and grant **JASEM** the right of first publication. Any part of the article may be reused without permission, provided that the original article is cited.

Cite this Article as: UWAYA, D. O; EHIGIAMUSOR, V. A; UWAMUSI, M. O; OMOREGIE, A. E (2026). Hepatoprotective Activity of Poly-Herbal Formulated Tea Comprising of *Moringa olifera*, *Curcuma Longa*, *Zingiber officinale*, *Allium sativum* and *Citrus limon* in Carbon tetrachloride-Induced Hepatotoxicity in Albino rats. *J. Appl. Sci. Environ. Manage.* 30 (4) 1236-1242

Dates: Received: 25 February 2026; Revised: 30 March 2026; Accepted: 17 April 2026; Published: 30 April 2026

Keywords: Polyherbal tea; Antioxidant; Hepatotoxicity; Carbon tetrachloride; Hepatoprotective

Plants have been used to make natural products for thousands of years. More recently, their possible medical benefits in treating many diseases have been studied because they can neutralize the harmful effects of oxidants on foods (Salehi *et al.*, 2020; Sen *et al.*, 2010). Compared to canonical drugs, medicinal plants possess exceptional and diverse characteristics such as accessibility, affordability, durability, and a broader range of therapeutic applications, as noted by Calixto (2000) and Idu (2010). Chinese medicine practitioners have used polyherbal remedies, also

known as herb-herb combinations, for thousands of years, but scientific evidence of their therapeutic benefit is lacking (Moussavi *et al.*, 2024). Certain formulas incorporating naturally occurring herbs and herbal ingredients have demonstrated potential interaction effects such as mutual enhancement, mutual assistance, mutual restraint, and mutual antagonism (Zhou *et al.*, 2016). Research has it that natural plant products such as *Moringaoleifera*, *turmeric*, *ginger*, *garlic*, and *lemon*, *Allium sativum*, are effective in the treatment of diseases such as

*Corresponding author email: dickson.uwaya@uniben.edu

*ORCID: <https://orcid.org/0000-0001-6217>

*Tel: +2347059650758

cough, fever, diarrhea, etc. (Odebunmi *et al.*, 2022), and these plants are reported to ameliorate ailments such as kidney, liver failure, and heart disease (Xiao *et al.*, 2020). The objective of this paper investigated Hepatoprotective Activity of Poly-Herbal Formulated Tea Comprising of *Moringa olifera*, *Curcuma longa*, *Zingiber officinale*, *Allium sativum* and *Citrus limon* in Carbon tetrachloride-Induced hepatotoxicity in albino rats.

MATERIALS AND METHODS

Plant Collection: The lemon plant was brought in from Oredo Local Government Area's New Benin Market. We bought ginger, garlic, and turmeric at Oregbuni Market in the local government area of IkpobaOkha. The leaves of *Moringaoleifera* were collected from farms in Edo State's Ordeo Local Government Area.

Preparation of plant materials: Ginger, garlic, turmeric, and lemon were cleaned and cut into small pieces. After being cut off from the stem, the *Moringaolifera* leaf was cleaned. Using a dehydrator, the diced lemon, garlic, ginger, turmeric, and washed moringa leaves were dried. After dehydration, we ground the dehydrated leaves of moringa, garlic, turmeric, ginger, and lemon to a powder using an impact grinder. To make the herbal tea, equal parts of powdered lemon, garlic, turmeric, ginger, and moringa leaf were weighed and combined. The method of making the herbal tea resulted in each powdered plant material weighing 200 mg per 1 g tea bag.

Experimental Animals: Albino rats weighing 100-200 g were purchased from the animal house of the Department of Pharmacology & Toxicology, Faculty of Pharmacy, University of Benin. The Department of Science Laboratory Technology housed the rats in its animal facility, acclimating them to normal laboratory conditions with a 12-hour light/dark cycle over two weeks. They were fed with normal animal pellets and water spontaneously. The animals were handled in accordance with normal protocols for laboratory animals.

Hepatoprotective Experimental Design: Hepatoprotective activity was studied according to the method of Mohammed *et al.* (2011) with slight modification. Albino rats 24 were allotted into 6 groups of 4 rats in each group as follows:

Group 1: Received distilled water

Group 2 received an extract of a polyherbal formulation at a dose of 5 mg/kg.

Group 3 received 10 mg/kg of an extract from a polyherbal formulation.

Group 4 received an extract of a polyherbal formulation at a dose of 5 mg/kg plus CCl₄.

Group 5: Received 10 mg/kg of extract of polyherbal formulation + CCl₄

Group 6: Received CCl₄ alone

The animals in group 2 - 5 were administered polyherbal extract orally for 14 days orally while CCl₄ 1:1 in olive oil at dose of 2ml/kg was administered twice a week to the animals in group 4 – 6 intraperitoneally. Following a 14-day oral administration of the extract, we used chloroform as an anesthesia to sacrifice the animals. Blood was collected for biochemical and antioxidant analysis, and each liver was weighed.

Biochemical analysis: Biochemical analysis was carried out using a random test kit. Albumin was analyzed by the measurement of serum albumin (Doumas *et al.*, 1971). Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) were assayed by the method of the International Federation of Clinical Chemistry and Laboratory Medicine (Schumann *et al.*, 2002). Alkaline phosphate was assayed using the Principle of Analysis of Alkaline Phosphatase method (Raymond-Habecker and Lott, 1995). Total protein was quantified by the Biuret method (Doumas *et al.*, 1981), while bilirubin was analyzed by the Jendrassik Grof method (Doumas and Wu, 1991)

Antioxidant Analysis: Determination of Catalase Activity: Catalase activity was assessed using the methodology outlined in Idu *et al.* (2016) and Uwaya *et al.* (2024). After putting the sample (50 µl) into a test tube, 500 µl of H₂O₂ was added, and the mixture was thoroughly mixed by inversion to start the reaction. Three minutes later, mixing by inversion halted the reaction after 1000 µl of 6M H₂SO₄ was added. It was then mixed again using inversion after 700 µl of 0.01 M KMnO₄ was added. A spectrophotometer with a visible wavelength of 480 nm was then used to measure absorbance against a blank in 30 to 60 seconds. Using distilled water, the spectrophotometer was set to zero.

Estimation of malondialdehyde (MDA): Malondialdehyde (MDA) was evaluated as described in Uwaya *et al.* (2024) and Idu *et al.* (2016) with slight modification. Using a micropipette, equal amounts of malondialdehyde (MDA) reagent (15% TCA-0.375% TBA-0.25NHCl) were pipetted into different test tubes. Then, 600 µl of a homogenised sample of brain tissue was added and mixed well.

The solution was then heated for 15 minutes in a boiling water bath at 100°C. Thereafter, the reacted mixture was allowed to cool and then centrifuged for 10 minutes at 3000 rpm (revolutions per minute) in order to remove the flocculant precipitates. A spectrophotometer was used to compare the clear supernatant's absorbance to that of a reference tube containing 3 ml of MDA reagent and 600 µl of distilled water at a wavelength of 535 nm.

Determination of Superoxide Dismutase (SOD): Test tubes with labels, each had 2.5 ml of carbonate buffer in it, and 0.2 ml of tissue homogenate was added. There was also a reference test tube with 2.5 ml of carbonate buffer. The reference tube and each test tube were each added 0.3 ml of epinephrine solution. After they were mixed properly, they were measured at 420 nm absorbance using a UV spectrophotometer (Model T80+UV spectrophotometer, PG Instruments Ltd.). Distilled water was used to zero the machine (Uwaya *et al.*, 2024).

Statistical Analysis: Mean $\pm$ standard error of the mean (SEM) was used to show the data, and "n" stood for the number of mice in each experimental group. Two tests were used: the Newman-Keuls post hoc test and a one-way analysis of variance (ANOVA). For all data analysis, the UK's GraphPad Prism program, version 6, was used. There were significant differences between the compared data with a significance level of $P < 0.05$.

RESULTS AND DISCUSSION

Body weight: Figure 1 shows that polyherbal tea had a significant effect on body weight. The animals that were given 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4, 10 mg/kg of the extract + CCL4, and CCL4 without treatment all lost more weight than the control group ($*p < 0.05$). Additionally, the effects of polyherbal tea on the liver-to-body weight ratio during CCL4-induced hepatotoxicity show a significant reduction in liver weight in animals given distilled water, 5 mg/kg of the formulated extract, 10 mg/kg of the tea extract, 5 mg/kg of the tea extract + CCL4, and 10 mg/kg of the tea extract + CCL4 compared to CCL4 without treatment (Figure 2).

Biochemical analysis: Figure 3, 4, and 5 indicate that the polyherbal tea extract at 5 and 10 mg/kg of the tea extract alone, 5 mg/kg of the tea extract + CCL4, and 10 mg/kg of the tea + CCL4 reduced the level of ALP, AST, and ALT when compared to CCL4 without treatment ($p < 0.05$). Marked elevations in serum levels of ALP, AST, and especially ALT are specific indicators of liver injury (Anand *et al.*, 2011).

Researchers found that CCL₄ hurt hepatocytes, which increased the amounts of AST, ALT, ALP, and bilirubin in the blood (Alkreathy *et al.*, 2014). It is well established that hepatotoxicity by CCL₄ is due to the enzymatic activation of the released CCL₃ radical in a free state, which in turn disrupts the structure and function of lipid and protein macromolecules in the cell membrane.

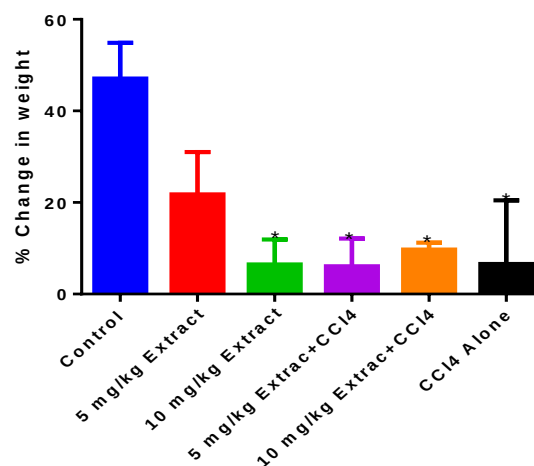


Fig 1: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on body weight on CCL₄ induced hepatotoxicity in rat. There was weight reduction in the animals that were given 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL₄, 10 mg/kg of extract + CCL₄ and CCL₄ without treatment when compared to control ($p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

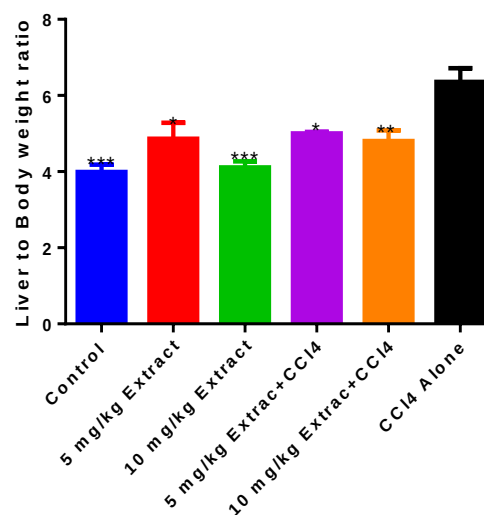


Fig 2: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on liver to body weight ratio on CCL₄ induced hepatotoxicity in rat. There was liver weight reduction in the animals that were given distilled water, 5 mg/kg of the tea extract, 10 mg/kg of the tea extract, 5 mg/kg of the tea extract + CCL₄, 10 mg/kg of the tea extract + CCL₄ when

compared with CCL4 without treatment (** $p < 0.001$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

Any cause of hepatocyte damage results in an increased release of enzymes such as AST, ALT, ALP, and bilirubin into the blood (Achliya *et al.*, 2014; Ali *et al.*, 2008). The tea's ability to lower the levels of ALP, ALT, and AST demonstrated its hepatoprotective properties and its ability to alleviate liver damage due to CCL4. Figure 6 showed that there was no effect of the total protein level.

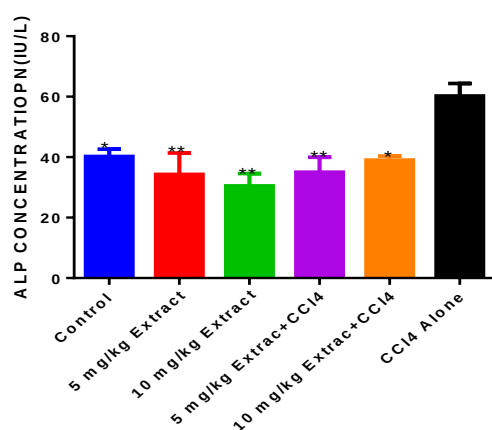


Fig 3: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on ALP on CCL4 induced hepatotoxicity in rat. ALP value reduce in the animals that were given distilled water, 5 mg/kg of the formulated extract, 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4, 10 mg/kg of extract + CCL4 when compared with CCL4 without treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

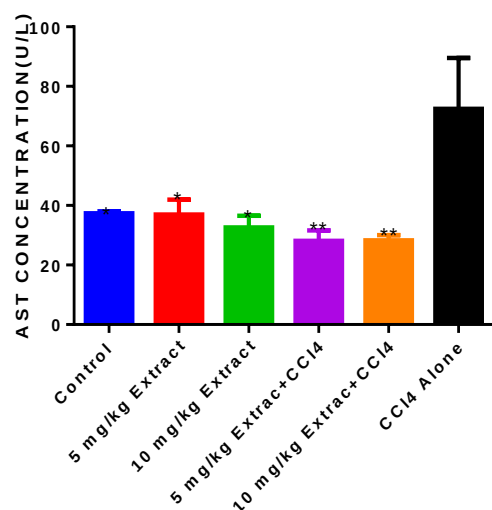


Fig 4: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on AST level in CCL4 induced hepatotoxicity in rat. AST value reduce in the animals that were given distilled water, 5 mg/kg of the formulated extract, 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4 and 10 mg/kg of extract + CCL4 when compared with CCL4 without

treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

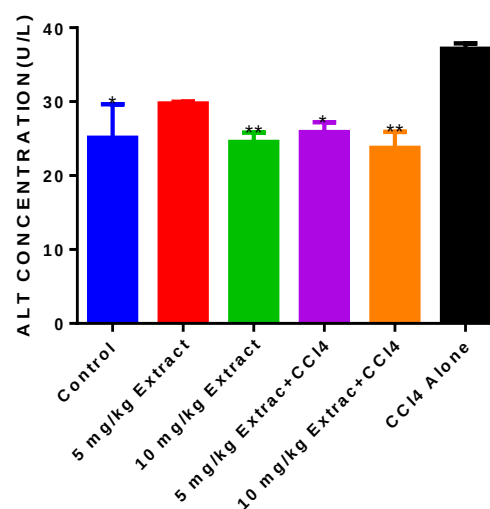


Fig 5: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on ALT level in CCL4 induced hepatotoxicity in rat. ALT value reduce in the animals that were given distilled water, 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4 and 10 mg/kg of extract + CCL4 when compared with CCL4 without treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

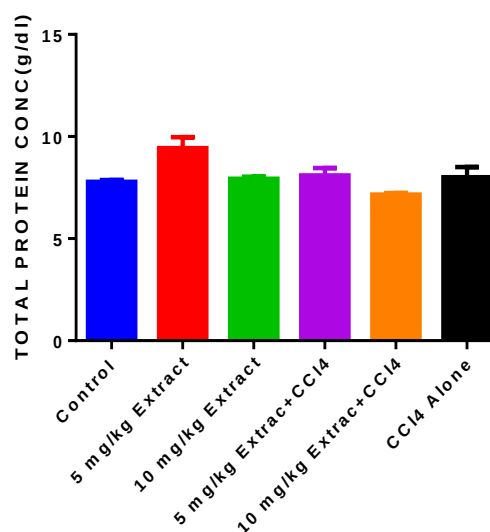


Fig 6: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on total protein in CCL4 induced hepatotoxicity in rat. There were no effect on total protein when compared with CCL4 without treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

Antioxidant activity: The study's results show that the polyherbal tea formulation greatly raised the levels of catalase (Figure 7) and superoxide dismutase (Figure 8), while lowering the level of MDA (Figure 9). Aziz *et al.* (2019) say that studies have shown that superoxide dismutase (SOD) and catalase are very important in protecting against oxidative stress-

related diseases like ischemia reperfusion injury, high blood pressure, lung injury, and liver injury. MDA, on the other hand, provides an index for the extent of peroxidative damage that has occurred in the liver (Ozolua *et al.*, 2019). Thus, this study shows that a polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric, and lemon) can reduce liver injury through its antioxidant effect. This study demonstrates the polyherbal tea's capacity to decrease the liver-to-body weight ratio, lower the levels of ALT, ALP, and AST, boost the levels of superoxide dismutase and catalase, and lower the levels of MDA. This study suggests that a polyherbal tea formulation, which includes *Moringaolifera*, garlic, ginger, turmeric, and lemon, can serve as an effective hepatoprotective treatment for liver injury. The hepatoprotective activity of the polyherbal tea could be a result of the antioxidants present in it.

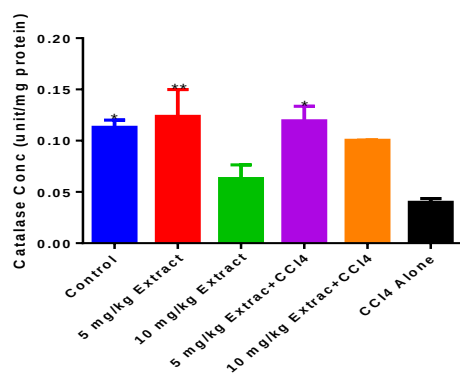


Fig 7: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on Catalase level in CCL4 induced hepatotoxicity in rat. Catalase value increased in the animals that were given distilled water, 5 mg/kg of the formulated extract and 5 mg/kg of the extract + CCL4 when compared with CCL4 without treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

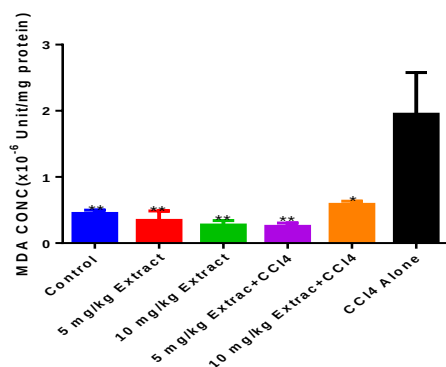


Fig 8: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on MDA level in CCL4 induced hepatotoxicity in rat. MDA value reduced in the animals that were given distilled water, 5 mg/kg of the formulated extract, 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4 and 10 mg/kg of extract + CCL4 when compared with CCL4

without treatment (** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

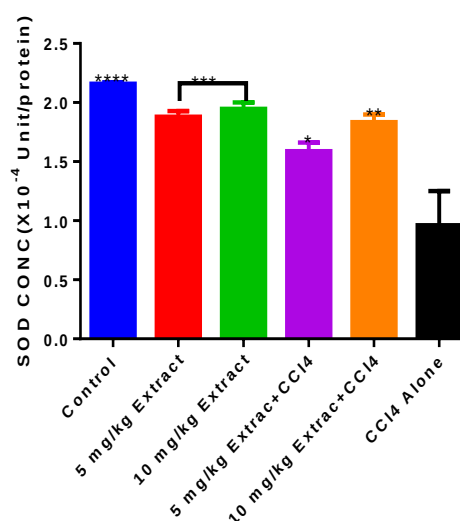


Fig 9: The effect of polyherbal tea formulation (*Moringaolifera*, garlic, ginger, turmeric and lemon) on SOD level in CCL4 induced hepatotoxicity in rat. SOD value increased in the animals that were given distilled water, 5 mg/kg of the formulated extract, 10 mg/kg of the formulated extract, 5 mg/kg of the extract + CCL4, and 10 mg/kg of extract + CCL4 when compared with CCL4 without treatment (**** $p < 0.0001$; *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$). Values were presented as mean $\pm$ S.E.M, $n = 4$.

Conclusion: The study found that the polyherbal tea (*Moringaolifera*, garlic, ginger, turmeric, and lemon) protects the liver from CCL4 damage in a big way. This implies its potential application in clinical settings for the treatment of liver diseases. The antioxidant present in the formulated tea may be responsible for the hepatoprotective effect of the tea.

DECLARATIONS

Ethical Approval: This study involved animal experimentation and therefore ethical approval was obtained from the animal ethical committee of Faculty of Faculty of Science Laboratory Technology, University Of Benin, Benin City with a number of UNIBEN/FSLT/00069. All procedures involving data handling and analysis were conducted responsibly and in accordance with standard academic and institutional guidelines.

Declaration of Conflict of Interest: The authors declare that no known conflict of interest or personal relationships that could have influence the work reported in this paper.

Disclaimer on Artificial Intelligence usage: The author(s) declare that no generative artificial intelligence (AI) technologies, including large language models (e.g., ChatGPT, COPILOT, XLNet,

Ernie 3.0 Titan) or text-to-image generators, were utilized in the writing or editing of this manuscript.

REFERENCES

- Achliya, GS; Wadodkar, SG; Dorle, AK. (2004). Evaluation of hepatoprotective effect of Amalkadi Ghrita against carbon tetrachloride-induced hepatic damage in rats. *J Ethanopharmacol* 90:1-4. <http://dx.doi.org/10.1016/j.jep.2003.09.037>
- Ali, BH; Blunden, G; Tanira, MO; Nemmar, A. (2008). Some phytochemical, pharmacological and toxicological properties of ginger (*Zingiber officinale Roscoe*): A review of recent research. *Food Chem. Toxicol.* 46 (2): 409–420. <https://doi.org/10.1016/j.fct.2007.09.085>
- Alkreathy, H; Khan, M; Khan, R; Sahreen, S. (2014). CCl₄ induced genotoxicity and DNA oxidative damages in rats; hepatoprotective effect of *Sonchus arvensis*. *BMC Complement. Alternat. Med* 14(3): 452-456. <https://doi.org/10.1186/1472-6882-14-452>
- Aziz, MA; Diab, AS; Mohammed, AA. (2019). in Antioxidants (Emad Shalaby Ed), in Chapter 1, bAntioxidant categories and mode of action, InTech Open. Pp 1- 20. <https://doi.org/10.5772/intechopen.83544>
- Calixto, JB. (2000). Efficacy, Safety, quality control, marketing and regulatory guidelines for herbal medicines (Phytotherapeutic agents). *Braz. J. Med. Biol. Res.* 33(2): 179–189. <https://doi.org/10.1590/S0100-879X2000000200004>
- Doumas, B; Wu, TW. (1991). The measurement of bilirubin fractions in serum. *Crit. Rev. Clin. Lab. Sci*, 28: 415-445. <https://doi.org/10.3109/10408369109106872>
- Idu, M; Uwaya, DO; Uvo, OO. (2016). In vivo Antioxidant Evaluation of *Combretum platypterum* (Welw.) Hutch. and *Combretum racemosum* P. Beauv. (Combretaceae) in Rodents. *Appl. Med. Res.* 2(3): 50-55. <https://doi.org/10.5455/amr.20160818035633>
- Mohammed, A; Abubakar, SA; Sule, MS. (2011). Hepatoprotective effect of aqueous leaf extract of *Carica papaya* Linn. against CCL₄-Induced hepatic damage in rats. *Int. J. Pharm. Sci. Rev. Res.* 11(2): 13-16
- Moussavi, N; Mounkoro, PP; Dembele, SM; Ballo, NN; Togola, A; Diallo, D; Sanogo, R; Wangenstein, H; Paulsen, BS. (2024). Polyherbal Combinations Used by Traditional Health Practitioners against Mental Illnesses in Bamako, Mali, West Africa. *Plants*, 13(3): 454. <https://doi.org/10.3390/plants13030454>
- Odebunmi, CA; Adetunji, TL; Adetunji, AE; Olatunde, A; Oluwole, OE; Adewale, IA; Ejiwumi, AO; Ihome, CE; Aremu, TO. (2022). Ethnobotanical Survey of Medicinal Plants Used in the Treatment of COVID-19 and Related Respiratory Infections in Ogbomosho South and North Local Government Areas, Oyo State, Nigeria. *Plants* (Basel), 11(19):2667. <https://doi.org/10.3390/plants11192667>
- Ozolua, RI; Bafor, EE. (2019). *A handbook of Techniques in Experimental Pharmacology*, 1st edn, Mindex Publishing Co., Benin City. Pp 133–145
- Salehi, B; Azzini, E; Zucca, P; Varoni, EM; Nanjangud, V; Kumar, A; Dini, L; Panzarini, E; Rajkovic, J; Fokou, PVT; Peluso, I; Mishra, AP; Nigam, M; Rayess, YEI; Beyrouthy, Mel; Setzer, W. N., Polito, L., Iriti, M., Sureda, A., Quetglas-Llabrés, MM; Martorell, M; Martins, N; Sharifi-Rad, M; Estevinho, LM; Sharifi-Rad, J. (2020). Plant-Derived Bioactives and Oxidative Stress-Related Disorders: A Key Trend towards Healthy Aging and Longevity Promotion. *Appl. Sci.* 10(3):947. <https://doi.org/10.3390/app10030947>
- Schumann, G; Bonora, R; Ceriotti, F; Ferard, G; Ferrero, CA. (2002). IFCC primary reference procedures for the measurement of catalytic activity concentrations of enzymes at 37 degrees C. international federation of clinical chemistry and laboratory medicine. Part 5. Reference procedure for the measurement of catalytic concentration of aspartate aminotransferase. *Clin. Chem. Lab. Med.* 40: 725-733. <https://doi.org/10.1515/CCLM.2010.137>
- Sen, S; Chakaraborty, R; Sridhar, C. (2010). Free radicals, antioxidants, diseases and phytochemical current status and future prospect. *Int. J. Pharm. Sci. Rev. Res.* 3. (1): 91-100
- Uwaya OD; Ohonbamu, AK; Obasuyi EI. (2024). Anti-arthritis activity of methanol extract of *Peperomia pellucida* in complete Freund's Adjuvant induced arthritis in Wistar Rats. *Niger.*

- J. Physiol. Sci.39: 285 – 293. <https://doi.org/10.54548/njps.v39i2.15>.
- Uwaya, OD; Emoghware, HO; Osagie, OS; Obinna, UK (2024). Acute anti-stress properties of polyherbal formulated tea (*Citrus limon*, *Curcuma longa*, *Zingiber officinale*, *Allium sativum*, and *Moringa oleifera*). *Sci. Afr.* 23 (5): 133-146. <https://dx.doi.org/10.4314/sa.v23i5.11>
- Xiao, X; Wang, J; Meng, C; Liang, W; Zhou, TWB; Wang, Y; Luo, X; Gao, L; Zhang, L. (2020). *Moringa oleifera* Lam and its Therapeutic Effects in Immune Disorders. *Front Pharmacol.* 11:566783. <https://doi.org/10.3389/fphar.2020.566783>.
- Zhang, M; Zha, R; Wang, D. (2020). Ginger (*Zingiber officinale* Rosc.) and its bioactive components are potential resources for health beneficial agents. *Phytother. Res.* 35(2):711-742. <https://doi.org/10.1002/ptr.6858>
- Zhou, X; Seto, SW; Chang, D; Kiat, H; Razmovski-Naumovski, V; Chan, K; Bensoussan, A. (2016). Synergistic Effects of Chinese Herbal Medicine: A Comprehensive Review of Methodology and Current. *Front Pharmacol.* 7:201. <https://doi.org/10.3389/fphar.2016.00201>.