IAA Journal of Biological Sciences 10(1):156-163, 2023. ISSN: 2636-7254

Hepatic and Renal Biochemical Profile of Wistar Rats fed with Powdered Turmeric (*Curcuma longa* Linn.) Supplement

Victoria C. Obinna and Leelee F. Zitte*

Animal Health and Physiology Unit, Department of Animal and Environmental Biology, Faculty of Science, University of Port Harcourt, Port Harcourt, Rivers State, Nigeria
Corresponding Author: Leelee F. Zitte, E-mail address: leelee.zitte@uniport.edu.ng

ABSTRACT

In recent times, the use of many medicinal plants for healing purposes has been abused. Turmeric is one of the medicinal plants used indiscriminately for different purposes in ethnomedicine, without adequate attention to any apparent adverse effect such use may pose to the health status of the individual. This study was carried out to assess the hepatic and renal biochemical profile of powdered turmeric supplement (PTS)-fed-wistar rats. A total of twenty male animals were randomly assigned to 4 groups, 5 per group. Group A (Control) = 1ml of distilled water, Group B = 250mg/kg PTS, Group C = 500 mg/kg PTS and Group D = 1000 mg/kg PTS. All administrations were by oral gavage daily for 28 days. At the end of the administrations, blood samples were collected for the estimation of serum concentrations of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Alkaline Phosphatase (ALP), Total Protein (TP), Albumin (ALB), Creatinine and Urea. PTS caused a significant ($p<0.05$) decrease in serum AST in comparison with the control. There was no significant ($p> 0.05$) effect in the serum ALP, ALT, TP, ALB, Creatinine and Urea concentrations relative to the control. It was therefore concluded that under the conditions of this study, powdered turmeric supplement had no toxic effect on serum hepatic and renal biochemical parameters.

Keywords: Hepatic, Renal, Biochemical Profile, Turmeric and Supplement

INTRODUCTION

In Nigeria, the use of plants as medicine has a long history. Several medicinal plants are frequently employed as alternative therapeutic agents in developing countries, for the treatment and prevention of various ailments [1]. Due to the severe economic situation of the populace and high cost of new conventional medications in West Africa, herbal remedies and medicinal plants are used more frequently [2]. Nigeria, a nation in West Africa with over 250 ethnic groups and languages, is well-known for its varied uses of plants for ethnomedical purposes. Over the years, the use of complementary and alternative medicine has grown in both urban and rural regions of Nigeria, but there is significant public and government concern about its efficacy, safety, and control [3]. In recent times, the use of many medicinal plants for healing purposes has been abused. These plants which are readily available and affordable are used arbitrarily for the acclaimed belief that they are 'wonder plants', and can be used to treat a lot of ailments. One of such plants is turmeric. Turmeric (*Curcuma longa*), a widely used spice which is consumed as a dietary protein, has both biological effects and potential medical uses[4]. It has several beneficial effects on a variety of biological processes, including anti-inflammatory, antioxidant, anticarcinogenic, antimutagenic, anticoagulant, antifertility, antidiabetic, antibacterial, antifungal, antiprotozoal, antiviral, antifibrotic, antivenom, hypotensive, and hypocholesteremic activities [4]; [5]; [6]; [7]). Turmeric is the ground root of *Curcuma longa* and its active compound is curcumin [8]. It is one of the key components in curry powder, and is also utilized as a natural remedy for various diseases [9] [6]. Curcumin is an orange-yellow dye practically insoluble in water and authorized by the European Union (EU) as a food additive [7]. It has been administered in several formulations, such as capsules, tablets, powder nanoparticles, liposomal encapsulation, and emulsions for therapeutic purposes [7]. Curcumin has been utilized in food preparation and cosmetics for many years. This is partly as a result of consumers' worries about synthetic dyes and the widespread bans on the use of various synthetic colouring agents by regulatory agencies [7]. In addition, a rise in

consumer awareness has given a boost to the demand for curcumin over the course of the forecast period, despite the fact that it is also used in the pharmaceutical and cosmetics industries [10].

Due to the increasing interest in natural products, which are usually regarded to be relatively safe, as remedies to health challenges, there seems to be a constant resort to natural roots and herbs for medicinal purposes. Turmeric is one of the medicinal plants used indiscriminately for different purposes in ethnomedicine, without adequate attention to any apparent adverse effect such use may pose to the health status of the individual. This study was, therefore, designed to investigate the safety of turmeric by evaluating the hepatic and renal biochemical profile of treated wistar rats.

Material and Methods

Plant Collection and Processing

The dried rhizomes of turmeric (*Curcuma longa* Linn.) were purchased from Modern market, Makurdi Metropolis, Benue State, Nigeria. The Authentication was carried out at the Ecoland Herbarium, Port Harcourt, Nigeria. The specimen voucher number of the plant is EH / P/ 069. A 3.3kg portion of the rhizomes was milled at Ozuoba Market, Obio-Akpor Local Government Area of Port Harcourt, Rivers State, to obtain a fine powder. The powder was further dried after milling to remove any residual moisture, before passing it through a fine sieve. The obtained turmeric powder which weighed 3.2kg was used for the study.

Experimental Animals

Twenty adult male wistar rats with an average weight of 185g were purchased from the Pharmacology Department of the University of Port Harcourt. They were kept in Animal House for a week before the start of the experiment and all through the duration of the study, with free access to food ((Top Feeds Nigeria Limited®) and tap water. All experimental animals were humanely handled in accordance with the Ethics and Regulation guiding the use of research animals as approved by the institution.

The animals were assigned into four (4) groups of five (5) each and fed daily for 28 days with powdered turmeric supplement (PTS) as follows:

Group A (Control) received 1ml of distilled water (vehicle)
Group B received 250mg/kg dose of PTS
Group C received 500mg/kg dose of PTS
Group D received 1000mg/kg dose of PTS

The powdered turmeric supplement was reconstituted in distilled water and administered by oral gavage. At the end of the experiment, the rats were anaesthetized and blood samples were collected from their retro-orbital plexuses using plain sample bottles. The Collected blood samples were allowed to stand for 30-45 mins in order to coagulate, and later centrifuged for 15 min at 3000 rev/min to obtain the serum for hormone analysis. The serum was then tipped into a separate vial, placed in microcentrifuge tubes, capped and stored at -20°C until analysis. The serum was later subjected to estimation of the hepatic biochemistry parameters (aspartate aminotransferase (AST), alkaline phosphatase (ALP), alanine aminotransferase (ALT), total protein and albumin levels) and the renal biochemical parameters (creatinine and urea levels) using commercial kits. The serum activities of AST and ALT were measured according to [11] while ALP activity was determined by the thymolphthalein monophosphate method according to [12]. The total protein was assayed by the direct Biuret method [13] while the albumin was evaluated by the bromocresol green method[14]. Urea and creatinine levels were estimated using the Urease-Berthelot method [15] and the modified Jaffe method [16] respectively.

RESULTS

The charts in figures 1-5 show the effect of PTS on the hepatic biochemical profile of male wistar rats fed daily for 28 days. From the result, PTS caused a significant ($p < 0.05$) decrease in the serum AST level, only at the highest dose of 1000mg/kg, relative to the control – group A (fig. 1). However, the serum concentrations of ALP and ALT in all the treated rats showed no significant ($p > 0.05$) variation when compared with Group A (figures 2 and 3). Similarly, PTS had no significant ($p > 0.05$) effect on the serum levels of Total protein and

Albumin in comparison with group A (Figs 4 and 5). The renal biochemical profile of PTS fed male rats for a duration of 28 days are illustrated in Figures 6 and 7. The charts in figure 6 shows that the serum creatinine level of PTS treated rats was not significantly ($p>0.05$) altered relative to that of the control (Group A). There was no significant ($p > 0.05$) change in the serum urea concentration of PTS treated rats in comparison with that of the control group A (figure 7)

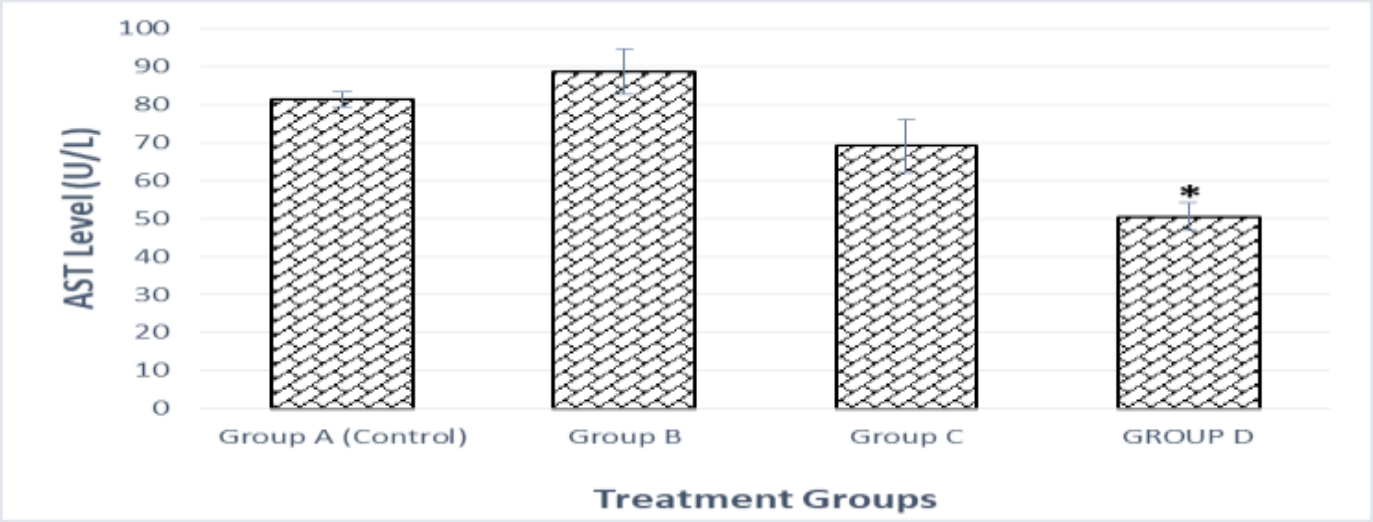

Fig. 1: Effect of Powdered Turmeric Supplement on Aspartate Aminotransferase (AST) level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A(Control). * indicates a significant difference at $p < 0.05$. Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

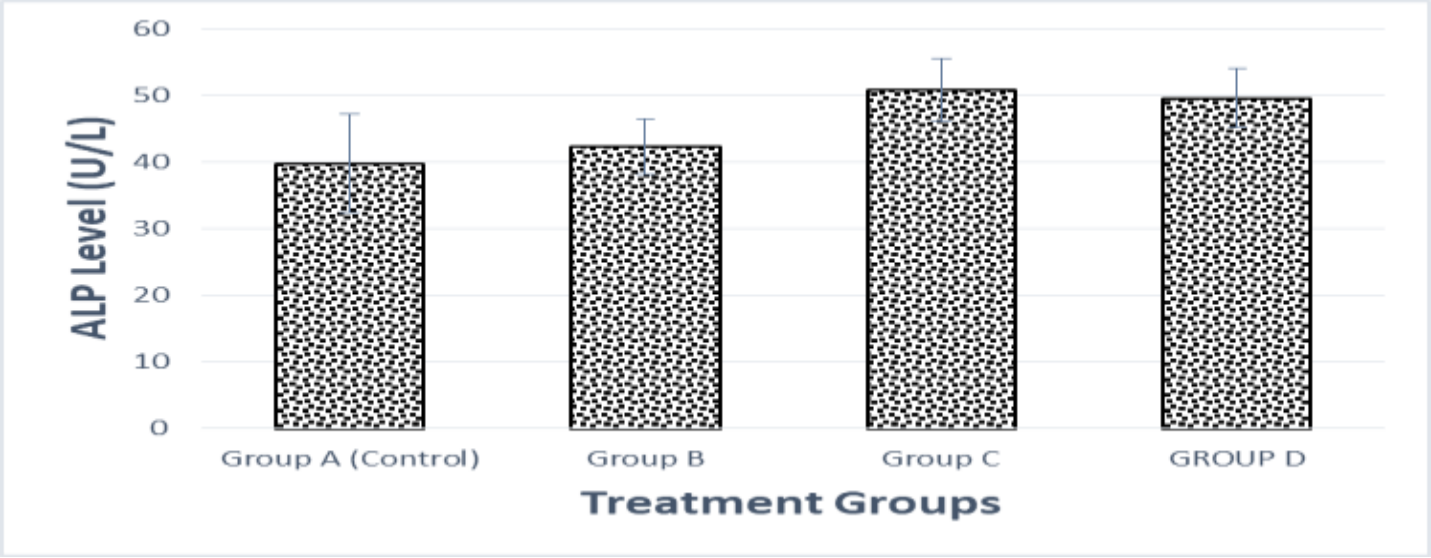

Fig. 2: Effect of Powdered Turmeric Supplement on Alkaline Phosphatase (ALP) level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A(Control). No significant difference at 95% confidence interval ($P > 0.05$). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

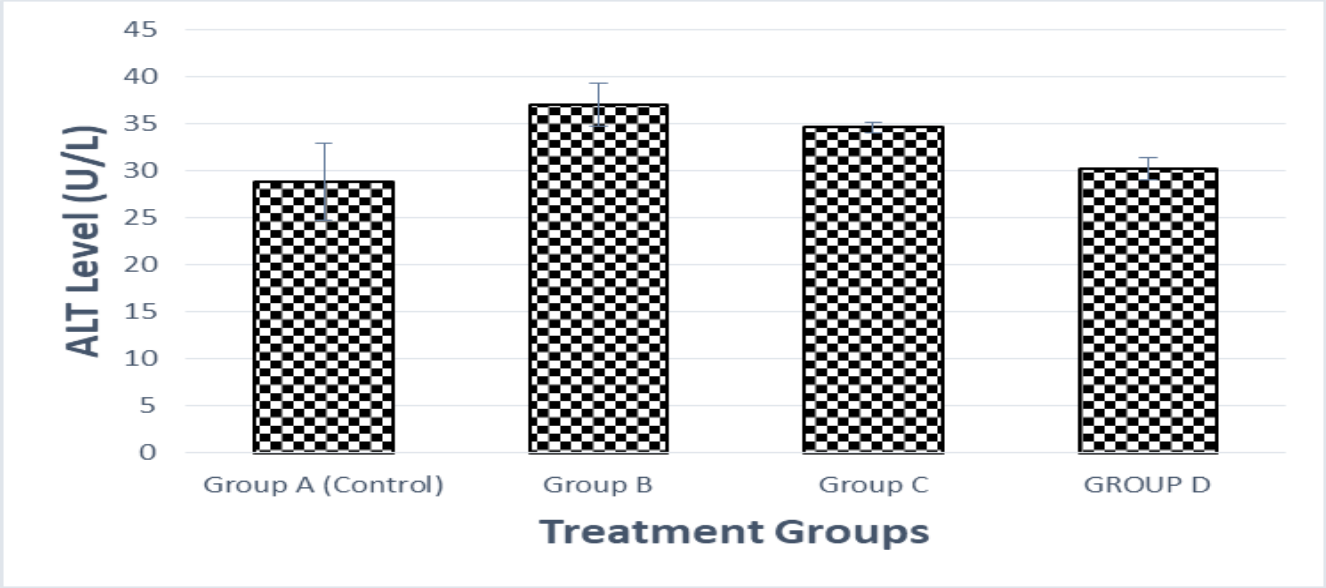

Fig. 3: Effect of Powdered Turmeric Supplement on Alanine Aminotransferase (ALT) level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A(Control). No significant difference at 95% confidence interval (P > 0.05). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

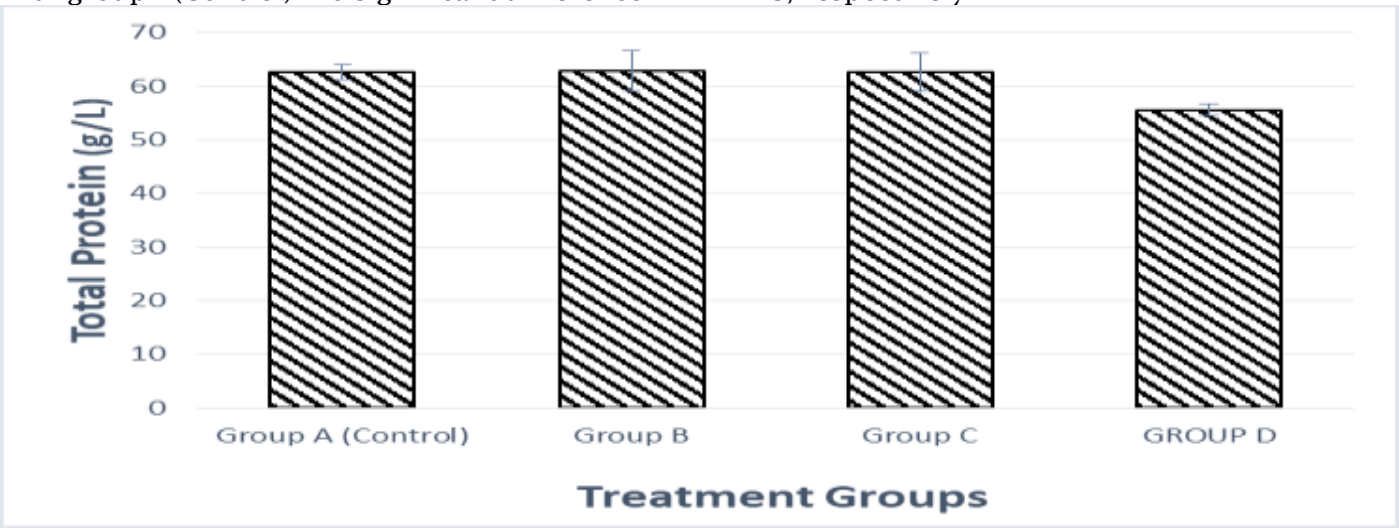

Fig. 4: Effect of Powdered Turmeric Supplement on Total Protein level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A(Control). No significant difference at 95% confidence interval (P > 0.05). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

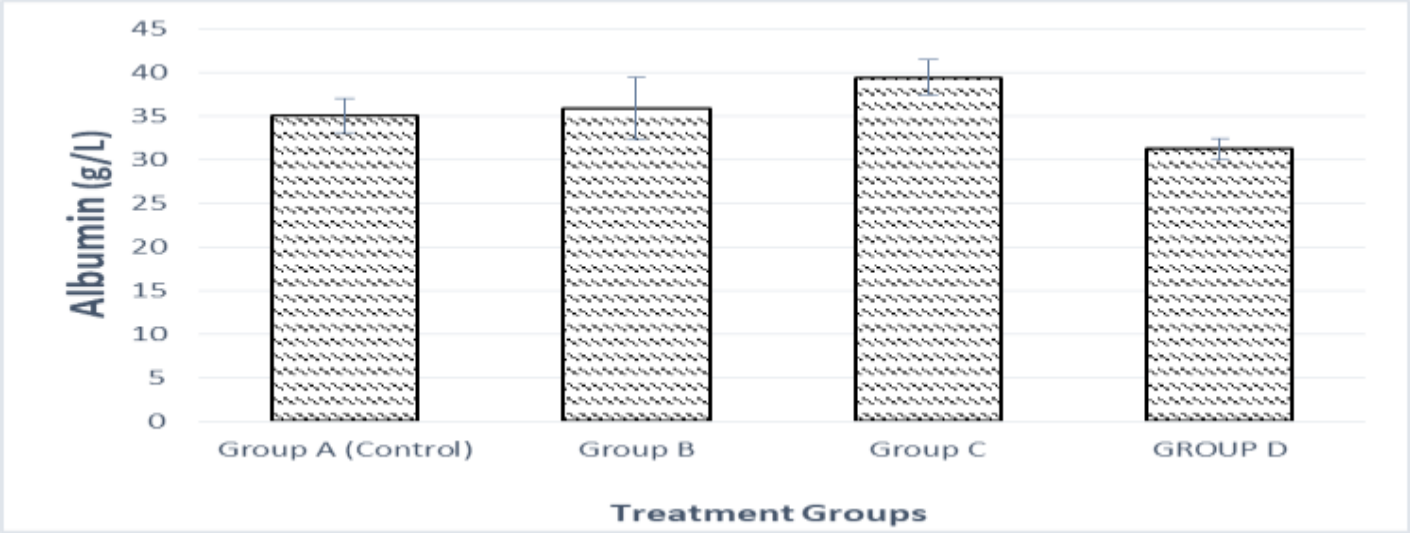

Fig. 5: Effect of Powdered Turmeric Supplement on Albumin level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A(Control). No significant difference at 95% confidence interval (P > 0.05). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

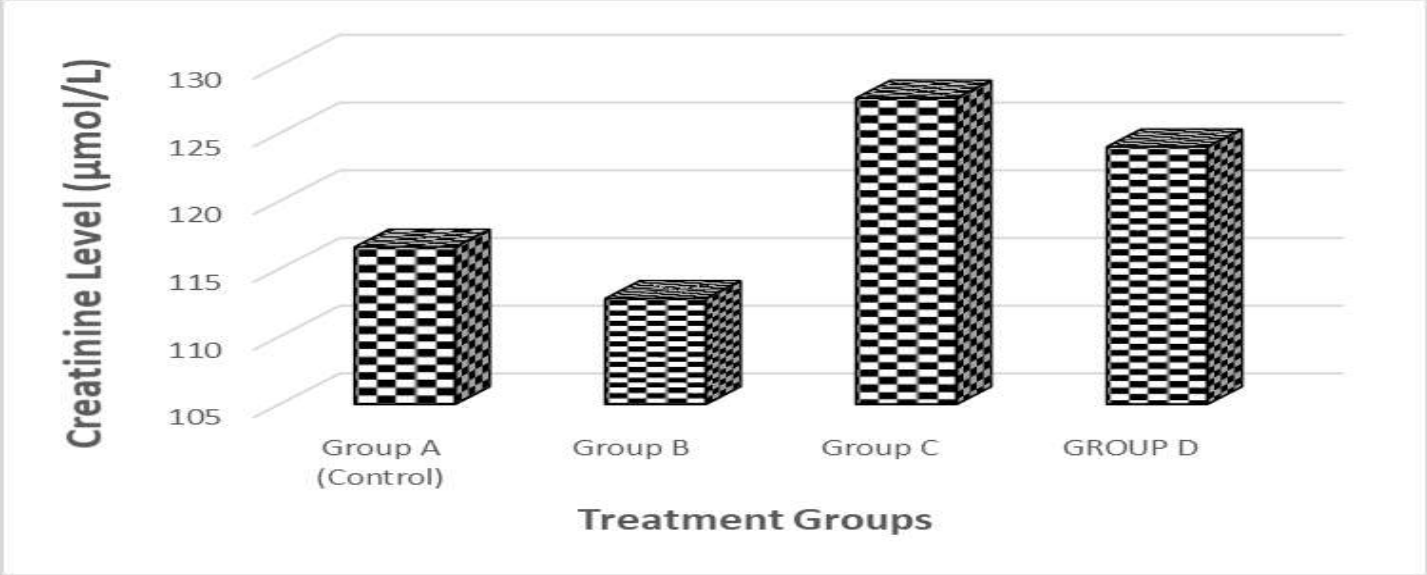

Fig. 6: Effect of Powdered Turmeric Supplement on Creatinine level of male wistar rats fed for 28 days

Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A (Control). No significant difference at 95% confidence interval (P > 0.05). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

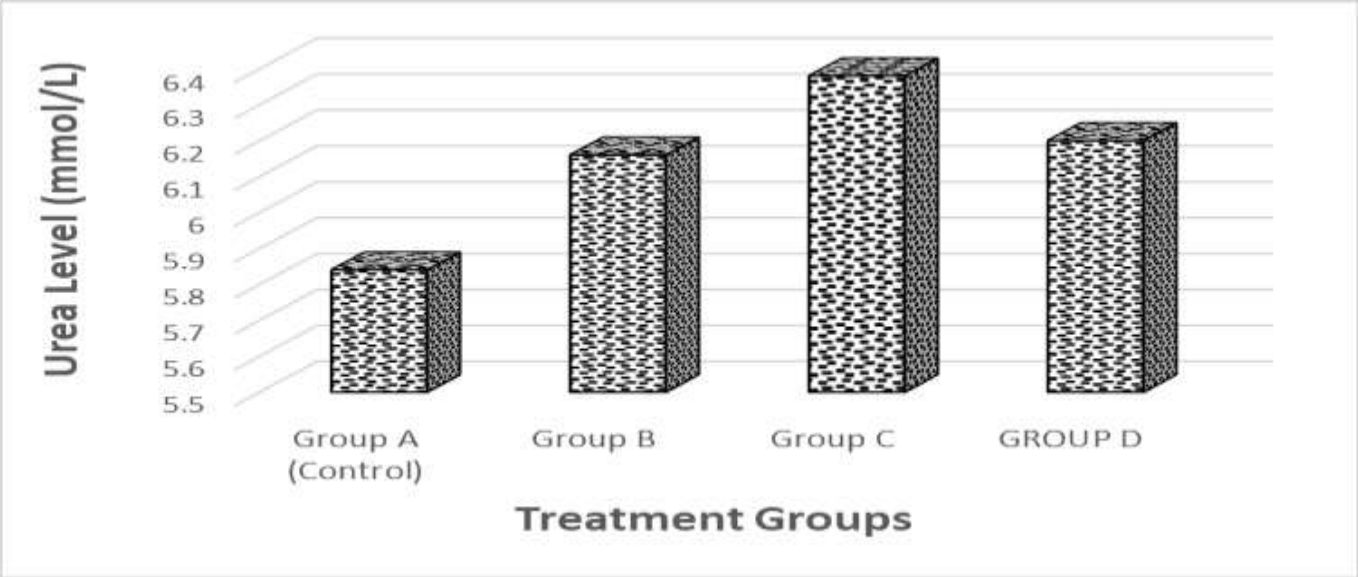

Fig. 7: Effect of Powdered Turmeric Supplement on Urea level of male wistar rats fed for 28 days
Results are given as mean ± SEM for 5 rats in each group. Experimental groups are compared with group A (Control). No significant difference at 95% confidence interval (P > 0.05). Groups A, B, C and D were given 1ml distilled water, 250mg/kg PTS, 500mg/kg PTS and 1000 mg/kg PTS, respectively.

DISCUSSION

Haematological and blood biochemical indicators serve as diagnostic aids in assessing the physiological and pathological status of animals. The functional state of the body's internal organs, including the liver, kidney, heart, and muscle, can be determined by serum or plasma biochemical testing [17]. According to [18], blood biochemistry parameters and antioxidant activity are significant biomarkers of state of health and nutrient metabolism in an organism's body. Thus, the determination of the hepatic and renal biochemical profile of turmeric-fed rats investigates turmeric's effect on the health status of the animals as well as the functionality of their vital body organs. The result of this study shows that powdered turmeric supplement reduced the serum level of AST at the dose of 1000mg/kg, without stimulating any significant effect in the other hepatic and renal biochemical parameters. This indicates that even at high dose of 1000mg/kg and 28-day duration of administration, PTS is not harmful to the animal's health, rather it is beneficial. This is demonstrated by the decline in AST serum concentration, one of the enzymes whose elevated blood levels have been linked to serious organ damage, particularly to the liver, kidney, heart, and muscle. According to [19], the increase in plasma level of aminotransferases in their study, may be as a result of liver damage which causes the release of these intercellular enzymes thus culminating into an increase in plasma aminotransferase level.

In line with the result of this study, [20] has reported that inclusion of turmeric powder rhizome supplementation in the diet of broiler rabbits at 150 and 300 mg/100g feed did not show significant difference in the serum levels of AST, ALT, ALP, Total protein and albumin. However, contrary to our findings, in a similar study using heat stressed broiler chicken, dietary turmeric powder supplementation at 0.4 and 0.8% reduced the serum concentration of ALT, ALP and AST after 42 days of their exposure to heat stress [6]. The heat stress included in the latter study may have boosted the efficacy of the turmeric against the stressors, which could be one explanation for the discrepancy in the results. Curcumin, the active ingredient in turmeric, reduced the levels of ALT, AST, creatinine and urea at the doses of 100 and 200 mg/kg [6]. Curcumin administration at the dose of 200 mg/kg in Sprague-Dawley rats decreased the activities of both ALT and AST [22]. [23] reported that curcumin may be a potential agent to prevent oxidative stress-related liver disorder, by decreasing ALT, AST, and ALP at the same time increasing GST, GR, GPx, SOD and CAT, and

reducing NO as well as inhibiting ROS production. In dyslipidemic rats, the serum concentrations of AST, ALT, ALP, blood urea nitrogen (BUN), creatinine and uric acid were significantly decreased by turmeric supplementation diet [24].

CONCLUSION

Powdered turmeric supplement, as used in this study, has no toxic effect on serum hepatic and renal biochemical parameters of male wistar rats.

REFERENCES

1. Abd El-Ghani, M. M. (2016). Traditional medicinal plants of Nigeria: an overview. Agriculture and Biology. *Journal of North America*, *7*(5), 220–247. https://doi.org/10.5251/abjna.2016.7.5.220.247
2. Akharaiyi, F. C., & Boboye, B. (2010). Antibacterial and phytochemical evaluation of three medicinal plants. *Journal of Natural Products*, *3*, 27–34.
3. Banaee, M., Mirvagefei, A. R., Rafei, A. R., & Amiri, M. (2008). Effect of sub-lethal Diazinon Concentrations on Blood Plasma Archive of SID. *International Journal of Environmental Research*, *2*(2), 189–198.
4. Basavaraj, M., Nagabhushana, V., Prakash, N., Appannavar, M. M., Wagmare, P., & Mallikarjunappa, S. (2011). Effect of Dietary Supplementation of Curcuma Longa on the Biochemical Profile and Meat Characteristics of Broiler Rabbits under Summer Stress. *Veterinary World*, *4*(1), 15–18.
5. Blass, K. G., Thiebert, R. J., & Lam, L. K. (1974). A study of the mechanism of the Jaffe Reaction. *Journal of Clinical Biochemistry.*, *12*, 336–343.
6. Bulus, T., David, Bilbis, L. S., & Babando. (2017). In Vitro Antioxidant Activity of N-Butanol Extract Of Curcuma Longa and Its Potential to Protect Erythrocytes Membrane Against Osmotic-Induced Haemolysis. *Science World Journal*, *12*(1), 2017. www.scienceworldjournal.org
7. Carol, A., & Bell, M. (1995). *Clinical guide to laboratory tests.* (3rd editio). WB Saunders Company.
8. Chan, E. W. C., Lim, Y., & Wong, S. (2009). Effects of different drying methods on theantioxidant properties of leaves and tea of ginger species. *Food Chemistry*, *113*, 166–172.
9. Chattopadhyay, I., Biswas, K., Bandyopadhyay, U., & Banerjee, R. K. (2004). Turmeric and curcumin: Biological actions and medicinal applications. *Current Science*, *87*(1), 44–53.
10. Chukwuma, E. C., Soladoye, M. O., & Feyisola, R. T. (2015). Traditional medicine and the future of medicinal Plants in Nigeria. *Journal of Medicinal Plants Studies*, *3*(4), 23–29. http://www.plantsjournal.com/vol3Issue4/Issue_july_2015/3-2-49.1.pdf
11. Da-Young, O., Dong-Soo, K., Young-Geun, L., & Han-Soo, K. (2019). Effects of Turmeric (Curcuma longa L.) Supplementation on Blood Urea Nitrogen and Enzyme Activities in Dyslipidemic Rats. *Journal of Environmental Science International*, *28*(5), 475–4839.
12. Doumas, B. T., Watson, W. A., & Biggs, H. G. (1971). Albumin standards and the measurement of serum albumin with bromcresol green. *Clinica Chimica Acta*, *31*, 87–96.
13. Farzaei, M. H., Zobeiri, M., Parvizi, F., El-Senduny, F. F., Marmouzi, I., Coy-Barrera, E., Naseri, R., Nabavi, S. M., Rahimi, R., & Abdollahi, M. (2018). Curcumin in liver diseases: A systematic review of the cellular mechanisms of oxidative stress and clinical perspective. *Nutrients*, *10*(7). https://doi.org/10.3390/nu10070855
14. Fawcett, J. K., & Scott, J. E. (1960). A rapid and precise method for the determination of urea. *Journal of Clinical Pathology*, *13*, 156–159.
15. Gupta, S. C., Patchva, S., & Aggarwal, B. B. (2013). Therapeutic roles of curcumin: lessons learned from clinical trials. *The AAPS Journal*, *15*, 195–218. https://doi.org/10.1208/s12248-012-9432-8
16. Hosseini-Vashan, S. J., Golian, A., Yaghobfar, A., Zarban, A., Afzali, N., & Esmaeilinasab, P. (2012). Antioxidant status, immune system, blood metabolites and carcass characteristic of broiler chickens fed turmeric rhizome powder under heat stress. *African*

Journal of Biotechnology, *11*(94), 16118–16125. https://doi.org/10.5897/ajb12.1986

17. Hosseini, A., & Hosseinzadeh, H. (2018). Antidotal or protective effects of Curcuma longa (turmeric) and its active ingredient, curcumin, against natural and chemical toxicities: A review. *Biomedicine & Pharmacotherapy*, *99*, 411–421.
18. Kasprowicz, S., & Lio, P. A. (2018). Complementary and Alternative Medicine. In J. L. Bologina, J. V. Schaffer, & L. Cerroni (Eds.), *Dermatology* (4th ed., pp. 2318–2324). Elsevier Ltd.
19. Lee, H. Y., Kim, S. W., Lee, G. H., Choi, M. K., Jung, H. W., Kim, Y. J., Kwon, H. J., & Chae, H. J. (2016). Turmeric extract and its active compound, curcumin, protect against chronic CCl4-induced liver damage by enhancing antioxidation. *BMC Complementary and Alternative Medicine*, *16*(316), 1–9. https://doi.org/10.1186/s12906-016-1307-6
20. Obinna, V. C., & Agu, G. O. (2021). Haematological and Biochemical Profile of Wistar Rats Exposed to Chloroform Stem Extract of Portulaca oleracea Linn. (Purslane). *Annual Research & Review in Biology*, *36*(7), 1–11. https://doi.org/10.9734/arrb/2021/v36i730394
21. Qasem, M. A. A., Alhajj, M. S., Jer El Nabi, A. R., & Al-Mufarrej, S. I. (2016). Effects of dietary supplement of turmeric powder (Curcuma longa) on blood biochemistry parameters and antioxidant activity in chickens. *South African Journal of Animal Sciences*, *46*(2), 204–213. https://doi.org/10.4314/sajas.v46i2.12
22. Reitman, S., & Frankel, S. A. (1957). A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. *American Journal of Clinical Pathology*, *28*, 56–63. https://doi.org/10.1093/ajcp/28.1.56
23. Roy, A. V. (1970). Rapid method for determining alkaline phosphatase activity in serum with thymolphthalein monophosphate. *Clinical Chemistry*, *16*, 431–436.
24. Sharifi-Rad, J., Rayess, Y. El, Rizk, A. A., Sadaka, C., Zgheib, R., Zam, W., Sestito, S., Rapposelli, S., Neffe-Skocinska, K., Zielinska, D., Salehi, B., Setzer, W. N., Dosoky, N. S., Taheri, Y., Beyrouthy, M. El, Martorell, M., Ostrander, E. A., Suleria, H. A. R., Cho, W. C., … Martins, N. (2020). Turmeric and Its Major Compound Curcumin on Health : Bioactive Effects and Safety Pro fi les for Food , Pharmaceutical , Biotechnological and Medicinal Applications. *Frontiers in Pharmacology*, *11*, 1–23. https://doi.org/10.3389/fphar.2020.01021