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Curcuma longa (Turmeric) and *Cucumis sativus* (Cucumber) Juice Ameliorative Hematological Effects in Lead Induced Toxicity in Male Wistar Rats

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ABSTRACT: Hematological parameters are essential clinical indicators of health status, which are of great research interest. Our study attempts an assessment of the possible ameliorative hematological effects of Turmeric and Cucumber juice in lead induced toxicity using male Wistar rats as models. Experimental animals were acclimatized for 2 weeks and were subsequently randomly distributed into five groups made up of five rats per group. Lead toxicity was induced through a single daily oral administration of 2.25mg/kg body weight of lead in all rat groups except groups1 and 7 for 28 days and were treated as follows: **Group 1**: Control; animals in this group had free access to tap water and normal rat chow at will. **Group 2:** Pb only; animals in this group received 2.25mg/kg bw of lead acetate only. **Group 3:** Pb + TUM; rats in this group got 1ml of Turmeric juice only following induction of lead toxicity. **Group 4:** Pb + CUC; animals in this group were given 1ml of Cucumber juice only following induction of lead toxicity. **Group 5:** Pb + TUM + CUC; animals in this group received 1ml of Turmeric and 1ml of Cucumber juice following induction of lead toxicity. **Group 6:** Pb + bioferon; animals in this group received 0.23ml/kg body weight dose of bioferon following lead induced toxicity. **Group 7:** Bioferon Only; animals in this group received 0.23ml/kg body weight dose of bioferon only. All administrations were orally carried out once a day in the morning hours (between 8am-9am) using oral cannula. On day 29, experimental animals were anesthetized using diethyl ether and blood samples taken via cardiac puncture for serum erythrocyte parameters (PCV, Hb and RBC) and total WBC and PLT counts determination. Assayed parameters were assessed using a reflotron produced by Boehringer Mannhein. Predictably, administration of 2.25mg/kg bw of lead acetate to group 2 (Pb Only) rats produced a significant reduction ($p<0.05$) in PCV, Hb, RBC, WBC and PLT counts when compared to group 1 (Control) rats. This is suggestive of a possible deleterious effect of lead acetate at the administered dose. However, administration of 1ml each of turmeric and cucumber juice respectively significantly increased ($p<0.05$) the above parameters amongst groups 3 (Pb + TUM) and 4 (Pb + CUC) rats when compared to group 2 (Pb Only) rats with turmeric showing a better effect. Significantly higher ($p<0.05$) values of PCV, Hb, RBC, WBC, and platelet counts were observed amongst group 5 (Pb + TURM + CUC) rats co-administered 1ml each of both turmeric and cucumber juice, compared togroups1 (Control), 2 (PbOnly), 3 (Pb + TUM) and 4 (Pb + CUC) rats. Indicating a possible greater hematopoietic effect of the combined administration of both juices compared to single administration of either juice. Our findings suggest possible synergistic effects of the juices on haematological indices when combined following lead administration in experimental rats.

Keywords: Hematological, turmeric, Cucumber, toxicity, synergistic effects.

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INTRODUCTION

Hematological parameters are essential clinical indicators of one's health status. These parameters are controlled within a narrow range in healthy persons (Stern, 1989). Any variation from known ranges suggests a possible manifestation of a disease condition(Stern, 1989).

Over the years, nations of the world have witnessed an increasing dependence on medicinal plants for purposes of good health (Iwu, 1993). The usefulness of theseplants is attributed to their minimal side effects and accessibility when compared to over-the-counter medications (Chilpa *et al.,* 2006). Identified inherent active compounds in these medicinal plants are responsible largely for their usefulness (Saronee *et al.*, 2023b). These inherent bio-active compounds are commonly characterised, refined and applied as raw materials for thesynthesis of most medications (Iwu, 1993).

Turmeric is a perennial herbaceous plant belonging to the Zingiberaceae family, and is widely planted in many countries including Nigeria, India, China, etc. (Akter *et al.*, 2019). It is a well sought after Phyto-medicinal plant in West Africa and has great medicinal applicationsin folklore medicine (Okwu, 2001). It's been reported locally to be beneficialin the management of many ailments including inflammation, stomach aches, reproductive abnormalities, blood disorder, diarrhea, diabetes(Okwu, 2001;Fortune *et al.*, 2019 and Saronee *et al.*, 2019). Cucumber belongs to the Cucurbitaceae family and is well distributed in our environment, it is a commonly consumed salad vegetable ((McLean *et al.*, 2013). Literature reports its copious therapeutic applications in inflammation, fungal infection, bacterial infection,and as an anti-diabetic agent (McLean *et al.*, 2013: Dan-Jumbo *etal.*,2024). Scientific reports on the use of turmeric and cucumber juice are scanty in our environment. This study therefore attempts an investigationof the possible ameliorative hematological effects of Turmeric and Cucumber juice in lead induced toxicity using male Wistar rats as models.

MATERIALS AND METHODS

Procurement of Experimental Rats, Lead and Induction of Lead Toxicity

Thirty-five (35) male Wistar rats (170 to 250g) were purchased from PAMO University of Medical Sciences animal house. They were housed in transparent polycarbonate cages with wired top covers, with 12 hours light/dark cycle and were fed with normal rat chow with unhindered access to clean water. Procured experimental animals were acclimatized for 14 days and were later grouped for the experiment. Lead acetate was obtained from Eddy Chemicals and Safety Supply Co. Port Harcourt, Rivers State, Nigeria. Lead toxicity was induced with a single oral daily administration of 2.25mg/kg bw of lead in the morning hours (between 8- 9AM daily)in line with Saronee *et al.*,(2024).

Purchase and Preparation of Turmeric and Cucumber Juice

Turmeric and cucumber used for this study were bought from a local fruit market in Port Harcourt, Nigeria and were duly identified and authenticated. Turmeric juice was prepared according to the method of Gul and Bakht (2015). After collection, a known

quantity of turmeric rhizomes was washed thoroughly and grinded using an electronic blender with 400ml of distilled water. The solution was later filtered using a sieve and a mesh cloth, and the juice obtained was put in a universal bottle and stored in the refrigerator for preservation prior administration. The process was done in the Department of Physiology Laboratory, PAMO University of Medical Sciences. Cucumber juice was prepared according to the method of Aderinolaand Abaire, (2019). Fresh cucumbers werewashed thoroughly and grinded using a blender. The solution was later filtered using a sieve and a mesh cloth, and the juice obtained was also put into a universal bottle and stored in the refrigerator for preservation. This study was conducted in line with the guidelines set by the United States Institute for Laboratory and Animal Research (1996).

Ethical Approval

The study was approved by the Research Ethics Committee of PAMO University of Medical Sciences and the ethical approval code of PUMS/REC/2024022 was issued.

Acute Toxicity Study

Acute toxicity (LD50) of Turmeric was estimated as reported by Shafira *etal*.,2022 and Yuandani, 2017, ≥3000mg/kg bw. Similarly, the LD50 of Cucumber was as previously reported by Vivek *et al.,* (2016) ≥1000mg/kg bw.

Experimental Design

Laboratory animals were acclimatized for 2 weeks and were later randomly distributed into 5 groups of 5 rats per group. Toxicity was induced through a single daily oral administration of 2.25mg/kg body weight of lead in all rat groups except groups1 and 7 for 28 days and were treated as follows:

Group 1:Control; animals in this group had free access to tap water and normal rat chow at will.
Group 2: Pb only; animals in this group received 2.25mg/kg bw of lead only
Group 3: Pb + TUM; rats in this group got 1ml of Turmeric juice only following induction of lead toxicity.
Group 4: Pb + CUC; animals in this group were given 1ml of Cucumber juice only following induction of lead toxicity.
Group 5: Pb + TUM + CUC; animals in this group received 1ml of Turmeric and 1ml of Cucumber juice following induction of lead toxicity.
Group 6: Pb + Bioferon; rats in this group received 0.23ml/kg body weight dose of bioferon following lead induced toxicity.
Group 7: Bioferon Only; animals in this group received 0.23ml/kg body weight dose of bioferon only.
All administrations were orally carried out once a day in the morning hours (between 8am-9am)using oral cannula for 28 days.

Blood Samples Collection and Estimation of Haematological Indices

On day 29, rats were anesthetized using diethyl ether and blood samples were collected by cardiac puncture for serum erythrocyte parameters (PCV, Hb and RBC) and total WBC plus PLT counts determination.Above parameters were assayed with the aid of a reflotron made by Boehringer Mannhein.

Statistical Analysis

Obtained data were analyzed with the aid of one-way ANOVA followed by a post hoc (LSD) test with SPSS 23.0Version. Results were presented in figures (figures 1-2). A P value < 0.05was considered statistically significant.

RESULTS AND DISCUSSION

Mean ErythrocyteIndices inTurmeric and Cucumber Juice Treated Wistar rats.

Predictably, administration of 2.25mg/kg bw of lead acetate to group 2 (Pb Only) rats brought about a significant reduction ($p<0.05$) in packed cell volume (PCV), haemoglobin concentration (Hb) and red blood cell (RBC) count when compared to group 1 (Control) rats as seen in figure 1. This is suggestive of a possible deleterious effect of lead acetate at the administered dose. These findings are consistent with recent studies from our centre, in which administration of 2.25mg/kg body weight of lead acetate induced specificorgan- system toxicity in Wistar rats (Saronee *et al.,* (2019): Dan-Jumbo *et al.*, (2024): Saronee *et al.*,(2024a):Saronee *et al*(2024b).However, administration of 1ml each of Turmeric and Cucumber juice respectively elicited a significant increase ($p<0.05$) in PCV, Hb and red blood cell count amongst groups 3 (Pb + TUM) and 4 (Pb + CUC) rats when compared to group 2 (Pb Only) rats, with Turmeric showing a better effect, validating earlier beneficial reports of individual administration of Turmeric and Cucumber (Saronee *et al.,* (2020): Saronee *et al.,* (2024b).Significantly higher ($p<0.05$) values of PCV, Hb andRBC count were observed amongst group 5 (Pb + TURM + CUC) rats co-administered 1ml each of both Turmeric and Cucumber juice, compared togroups1 (Control),2 (Pb Only), 3 (Pb + TUM) and 4 (Pb + CUC) rats. Suggesting a possible greater hematopoietic effect of the combined administration of both juices compared to single administration of either juice. Similar tonic effects have been reported with*Citrullus lanatus,* C*nidoscolus aconitifolius* and C*raterispermum schweinfurthi*amongst other decoctions (Kolawole *et al.,* (2017): Ezebuiro *et al.,* (2020) and Saronee *et al.,* (2023).

The estimation of haematological parameters remains a veritable tool in determining the functionality of the haematopoietic system of rodents (Straus, (1998). Available literature suggeststhat significant reduction in red blood cell indices is indicative ofa possible increase in red blood cell destruction or slow/decreased production (Straus, (1998): Adedapo *et al.,* (2007). The significant increase in red blood cell indices observed following administration of both juices suggest that turmeric and cucumber juice have beneficial efficacies on erythropoiesis (Iranloye, (2002): Mansi and Lahham, (2008). Similarfindings were observed following bioferon administration amongst groups 6 and 7 rats.

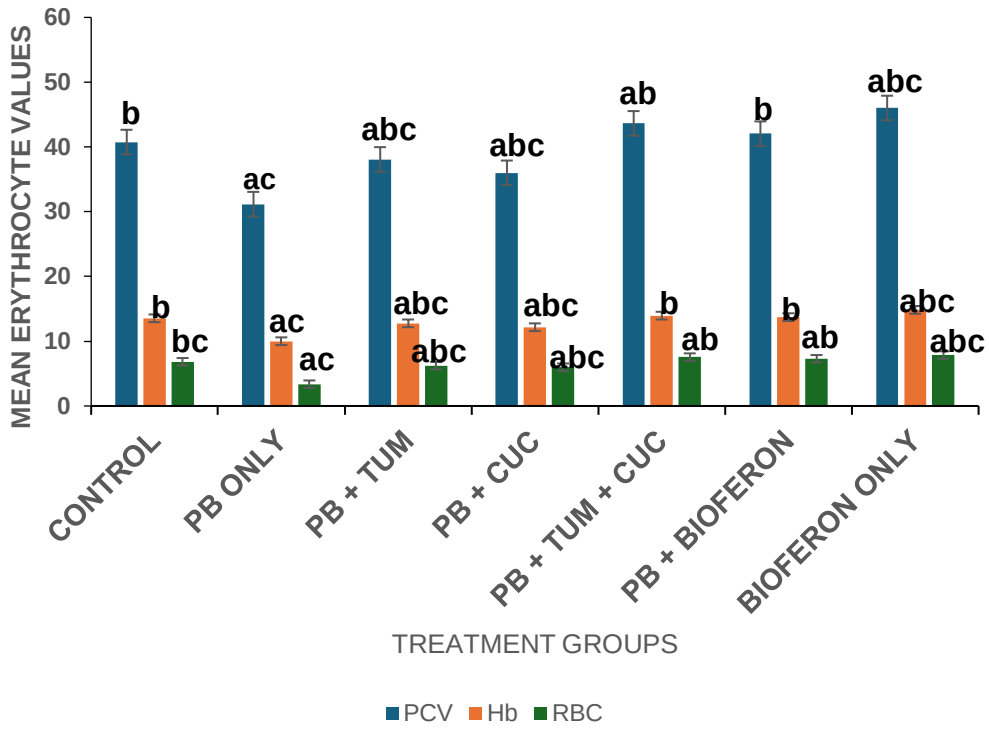

Fig. 1: Shows mean erythrocyte values of turmeric and cucumber juice treated rats.

[a]< 0.05 compared to control. [b]< 0.05 compared to PB Only. [c]< 0.05 compared to PB + Bioferon. All values are expressed as mean ± SEM

Mean WBC and PLT counts in Turmeric and Cucumber juice Treated Wistar Rats

In figure 2, significantly lower ($p<0.05$) values of white blood cell and platelet were observed amongst group 2 (Pb Only) rats administered daily single oral dose of 2.25mg/kg bw of lead aetate when compared to group 1 (Control) rats. Indicating a likely harmful effect of lead acetate. Upon daily single oral administration of 1ml each of Turmeric and Cucumber juice to groups 3 (Pb + Tum) and 4 (Pb + CUC) rats, significantly higher($p<0.05$) values of white blood cell and platelet were observed compared to group 2 rats. Indicating a possible ameliorative effect of Turmeric and Cucumber juice. Turmeric however, demonstrated a better ameliorative effect than cucumber juice judging by the observed mean values. Combined administration of both juices to group 5 (Pb + TUM + CUC) rats elicited a significant increase ($p<0.05$) in the above parameters when compared to groups 1,2, 3 and 4 rats. Suggesting a possible synergism of effect of Turmeric and Cucumber. Ourfindings are consistent with Anslem *et al.* (2017), Mohammad *et al.* (2019) and Saronee *et al.*, (2023a) in which plants products ameliorated the hematological effects of major toxicants in rodents. The results of bioferon administration amongst groups 6 and 7 rats are comparable to the effects of turmeric and cucumber juice. Administration of lead acetate to rodents depresses the bone marrow and reduces platelet and leucocyte counts as observed in the present study (Morris *et al.*, (2005).

Phytochemical examination of turmeric and cucumber have revealed the presence of many bioactive compounds including flavonoids, tannins, glycosides, curcumin amongst

others. These identified compounds have been implicated in ameliorating potential insults on the haematological system of the body Farid *et al*., (2015) and Saronee *et al.*, (2023b).

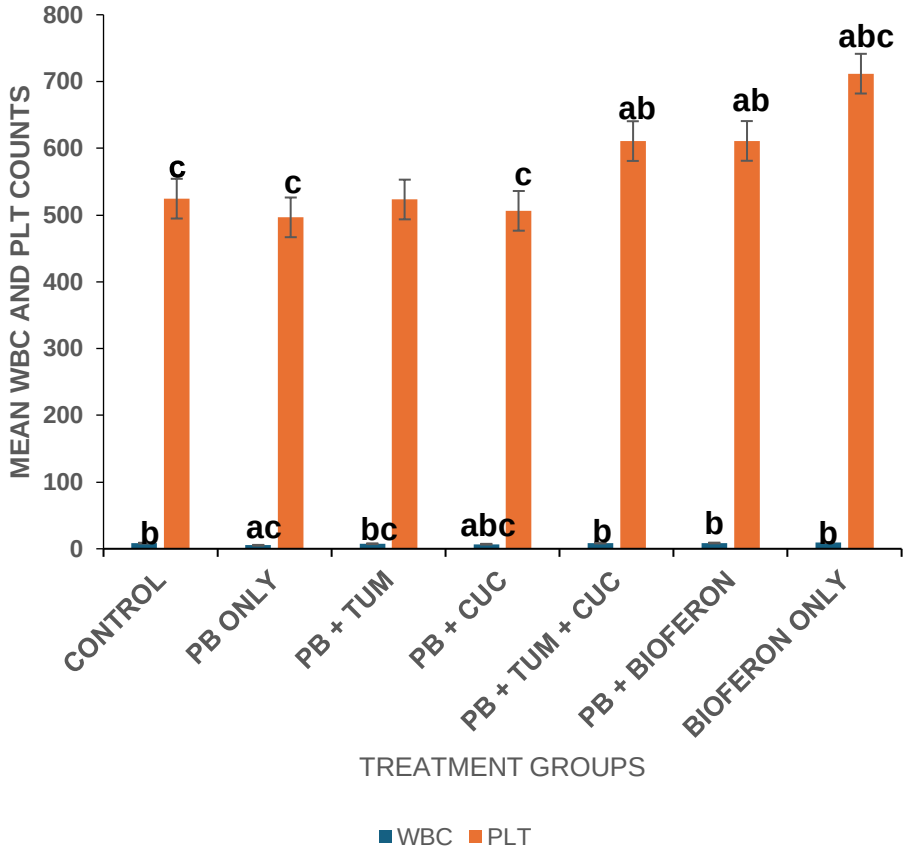

Fig. 2: Shows mean WBC and PLT counts in Turmeric and Cucumber juice Treated Wistar Rats.

^{a}< 0.05 compared to control. ^{b}< 0.05 compared to PB Only. ^{c}< 0.05 compared to PB + Bioferon. All values are expressed as mean ± SEM

CONCLUSION

The present study reports that administration of Turmeric and Cucumber juice *elicited* a significant increase in erythrocyte parameters, white blood cell and platelet counts following lead induced toxicity in male Wistar rats. Our findings suggest a possible synergistic ameliorative hematological effects of the juice when combined following lead toxicity in experimental rats.

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