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EFFECT OF SUB CHRONIC LEAD EXPOSURE ON BLOOD LEAD LEVEL AND RELATIVE ORGAN WEIGHTS OF MALE WISTAR RATS

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ABSTRACT

This work was aimed at assessing the effect of Moringa oleifera and Ascorbic acid on subchronic lead exposure in male Wistar rats. Eighteen adult male Wistar rats were grouped into 6 groups comprising of 3 rats each. Group 1 was administered distilled water (DW) (2 ml/kg), group 2 was given lead only (Pb) (190 mg/kg), group 3 was administered lead and ascorbic acid (PbAA) (190 mg/kg +100 mg/kg, respectively), group 4 was dosed lead and Moringa oleifera (PbMO) (190 mg/kg+500 mg/kg, respectively), in addition, group 5 was dosed with a combination of lead with ascorbic acid and Moringa oleifera (PbAAMO) (190 mg/kg+100 mg/kg+500 mg/kg, respectively) while group 6 received lead with ascorbic acid and low dose Moringa oleifera (PbLAMO) (190 mg/kg+50 mg/kg+250 mg/kg, respectively). Treatment was given through oral route once daily. The experiment lasted for 6 weeks and the blood lead level and weight of some organs of the animals were taken at the end of the experiment. Result of the study showed a decrease in liver and kidney weights, as well as increased blood lead level in Pb group compared with other groups. Comparably, improvement in the body deficits was recorded in the group treated with a combination of ascorbic acid and Moringa oleifera. The improvement in body weight may likely be due to their antioxidant effects.

Key words: Lead, Organ weight, Ascorbic acid, Moringa oleifera, Wistar rats.

INTRODUCTION

Lead is one of the major environmental pollutants that has been associated with human activities (Ghorbe *et ai*., 2001). After ingestion, lead is majorly stored in the bone and soft tissues, with major concentrations found in the brain, liver, kidney, spleen, lung, bone and teeth (Mudipalli, 2007). After absorption, lead is conjugated in the liver and passed to the kidneys, where only a small amount is excreted in the urine and the rest accumulated in different organs of the body (Jarrar *et al*., 2006). Around the world, lead ranks among the most dangerous environmental toxicants and it is implicated in diseases of animals and humans (Mitra and Sharma, 2019). *Moringa oleifera* is one of the most useful trees in the world, as almost all of its parts are either useful as food or for other beneficial purposes (El Shater *et al*., 2019). It has been shown to prevent the formation of free radicals through its antioxidant functions (Jaiswal *et al*., 2021). Ascorbic acid is also known for its antioxidant and ant-inflammatory properties (Shittu *et al*., 2012). Chelation therapy is the classical method of treatment of lead poisoning. The use of chelators such as dimercaptosuccinic acid (DMSA), calcium-disodium-ethylene-diamine-tetra acetic acid ($CaNa_2EDTA$) and D-penicillamine (DPA) have been employed in the treatment of lead poisoning (Kim *et al*., 2013). However, the use of these chelators has been reported to have side effects such as renal toxicity, cardiac problems, abdominal pain, skin lesions, alopecia, vomiting, diarrhoea and skin rashes (Thuppil and Tannir, 2013). The study was carried out to determine the effect of *Moringa oleifera* and ascorbic acid on organ weights and blood lead level in lead-exposed male Wistar rats.

MATERIALS AND METHOD

This work was carried out in the Toxicology Research Laboratory of the Department of Veterinary Pharmacology and Toxicology, Ahmadu Bello University, Zaria. Eighteen adult male Wistar rats were obtained from the animal holding facility of the Department. They were fed rats chow made from growers' marsh (Vital Feeds Ltd, Jos, Nigeria) while water was provided *ad-libitum*. They

were acclimatized for two weeks before use. The rats were randomly grouped into 6 groups of 6 rats each and dosing was done as follows;

Group 1-DW- Distilled water (2 ml/kg)
Group 2- Pb- Lead (190 mg/kg)
Group 3- PbAA- Lead (190 mg/kg) and ascorbic acid (100 mg/kg)
Group 4- PbMO - Lead (190 mg/kg) and methanol leaf extract of *Moringa oleifera* (500 mg/kg)
Group 5- PbAAMO - Lead (190 mg/kg), ascorbic acid (100 mg/kg) and methanol leaf extract of *Moringa oleifera* (500 mg/kg)
Group 6- PbLAM- Lead (190 mg/kg), ascorbic acid (50 mg/kg) and methanol leaf extract of *Moringa oleifera* (250 mg/kg).
Dosing of the animals was done once daily by oral gavage for 6 weeks. The weight of organs (brain, liver, kidney, spleen) of the animals were taken at the end of the 6 weeks using top loading digital weighing balance. The blood lead level was measured using microwave plasma atomic emission spectrometer (4210 MP-AES, USA). Ascorbic acid reconstituted in 1 ml of distilled water to make 100 mg/ml suspension daily before administration. The Ahmadu Bello Committee on Animal Use and Care granted approval for the work with approval number: ABUCAUC/2020/006.

Data Analysis

Values obtained were expressed as mean □ SEM and subjected to repeated one-way analysis of variance (ANOVA), followed by Tukey's post-hoc test using Graph pad prism version 5.0. Values of $P < 0.05$ were considered significant.

RESULTS

Effects of *Moringa oleifera* and ascorbic acid on blood lead level in Wistar rats exposed to lead

The blood lead level (BLL) was significantly higher in group 2 (16.20 ± 1.00) compared with group 1 (0.36 ± 0.07) ($P<0.001$), group 3 (9.16±1.53), group 4(3.83 ± 1.73) ($P<0.01$), group 5 (3.40 ± 1.42) ($P<0.001$) and group 6 (5.46 ± 2.43) ($P<0.01$), respectively. In addition, BLL was significantly lower ($P<0.05$) in group 1 (0.36 ± 0.07) relative to that of group 3 (9.16 ± 1.53) (Figure 1).

Effects *Moringa oleifera* and ascorbic acid on relative organ weights in Wistar rats exposed to lead

The relative weight of the brain was not significant ($P > 0.05$) in between the groups. However, the percentage relative organ weight in group 1 (19.7%) was highest compared to group 2 (17.5%), group 3 (16.4%), group 4 (15.9%), group 5 (15.0%) and group 6 (15.2%) (Table 1).

There was a significantly ($P < 0.05$) higher relative liver weight in group 2 compared to other groups (Table 1).

The relative (kidneys) weight in group 2 was significantly ($P < 0.05$) higher compared to groups 3, 5 and 6 (Table 1).

Although not significant ($P > 0.05$), the relative weight of the spleen increased in group 2 (22%) compared to groups 1 (14%), 3 (16%), 4 (19%), 5 (14%) and 6 (15%) (Table 1).

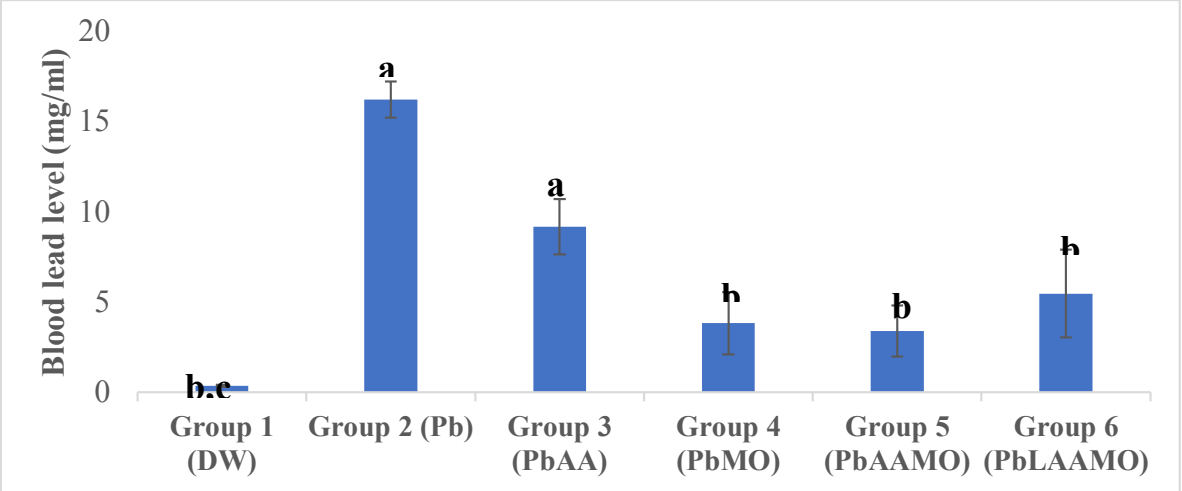

Figure 1: Effects of administration of subchronic lead intoxication on blood lead level in Wistar rats exposed to lead. [a,b,c] Means with different letters are significantly different at $p \leq 0.05$.

DISCUSSION

This study has shown an increased blood lead level in group 2 relative to other groups. This agrees with the findings of Okediran *et* al. (2017), who showed that absorbed lead is carried via blood to other tissues and that 95% of absorbed lead is transported by the erythrocytes. The higher concentration of lead seen in group 2 can be associated with increased bioconcentration of lead due to lack of treatment. The lower blood concentration of Pb seen in the other groups is an indication of ameliorative effects of *Moringa oleifera* and ascorbic acid likely through their antioxidant effects on lead-induced toxicity (El Shater *et al*., 2019). In this study, no significant difference in relative organ weight was observed in all the specific organs across the groups except the kidneys and liver in group 2. There was a significant increase in the weight of the kidneys and liver in group 2 compared to other groups. Lead results in renal functional impairment and liver injury (Al-Attar, 2020; Cameron and Greger, 1998).

CONCLUSION

It can be concluded from this study that subchronic exposure of animals to lead without veterinary intervention can lead to increased blood level which might result in toxicity. Organ functions, especially the liver and kidneys can be compromised with lead exposure. *Moringa oleifera* and ascorbic acid combination ameliorated the level of lead concentration in the rats.

RECOMMENDATION

Moringa oleifera and ascorbic acid should be used in ameliorating the toxic effects of lead. Animals should not be allowed to graze on or near lead polluted areas.

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