COMPARATIVE EFFECTS OF *MORINGA OLEIFERA* AND ASCORBIC ACID ON BODY WEIGHT CHANGES INDUCED BY SUBCHRONIC LEAD EXPOSURE IN 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 bodyweight of the animals was taken at the end of every week. Result of the study showed a decrease in body weight of animals in the 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. It is therefore recommended that ascorbic acid and *Moringa oleifera* should be used in ameliorating the toxic effects of lead.

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

INTRODUCTION
Lead is the most common environmental toxic metal used by man for thousands of years due to its important physicochemical properties (Wani *et al*., 2015). Toxicity to lead has been reported in both man and animals (Flora *et al*., 2012). Lead replaces trace metals such as calcium, manganese, magnesium, copper and chromium from the body (Mujahid *et al*., 2015), thus their presence in the environment is a health hazard. Heavy metals such as lead exert their effect by producing excess reactive oxygen species through catalyzing oxidative reactions (Patrick, 2006). Several nutraceuticals are recently employed as an aid to treatment or adjunct in the treatment of toxicities. Ascorbic acid is known to modulate lead-induced toxicity, thus exerting a beneficial effect while *Moringa oleifera*, a tree belonging to Moringaceae family and its leaves and seeds are reported to have ameliorative effects against metal toxicity (Velaga et al., 2014). Both agents have been reported to reduce the effect of oxidative stress in body systems. Exposure to lead is reported to cause a gradual loss of body weight through the induction of oxidative stress (Chasko *et al*., 1984). The gradual loss in body weight during lead poisoning could be a result of nausea, vomiting and anorexia that follows any metal toxicity (Rafique *et al*., 2008). Hence, agents with potential antioxidants effect come into play to reduce the menace associated with their exposure, as chelation, the mainstay in the treatment of heavy metal toxicity is found to also produce toxicity. Therefore, the study was conducted to evaluate the comparative effect of ascorbic acid and *Moringa oleifera* on body weight changes induced by exposure to lead.

MATERIALS AND METHODS

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 3 animals 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 bodyweight of the animals was taken weekly throughout the experiment using top loading digital weighing balance. Analytical grade lead acetate, Ascorbic were purchased from Sigma Aldrich and a recognized pharmaceutical outlet, respectively. *Moringa oleifera* was locally sourced from Pioneer Sustainable Agriculture Limited, Jaji, Kaduna State, Nigeria with Ascorbic acid reconstituted in 1 ml of distilled water to make 100 mg/ml suspension daily before administration. The work was approved by the Ahmadu Bello Committee on Animal Use and Care 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 posthoc test using Graph pad prism version 5.0. Values of $P < 0.05$ were considered significant.

RESULTS

Effects of treatments on body weight dynamics

Effects of treatments on body weight dynamics are shown in figure 1. There was a progressive increase in body weight dynamics in the DW group throughout the work. In the Pb group, there was an initial increase in the mean body weight from week 1 to week 3 followed by a decrease from week 4 to week 6. In the PbAA, PbMO and PbAAMO groups, there was an apparent increase in the mean body weight of the rats up to week 4, followed by a decrease from week 5 to the end of the experiment. There were percentage increases in body weight gain by 35%, 12%, 15%, 12% and 13% (figure 2) in the DW, PbAA, PbMO, PbAAMO and PbLAM groups, respectively, from the onset to final week of the experiment. 3 followed by a decrease in week 4 for PbMO, PbAAMO and PLAM groups. At week 6, a sharp decrease in the mean body weight dynamism was observed for Pb and PLAM group.

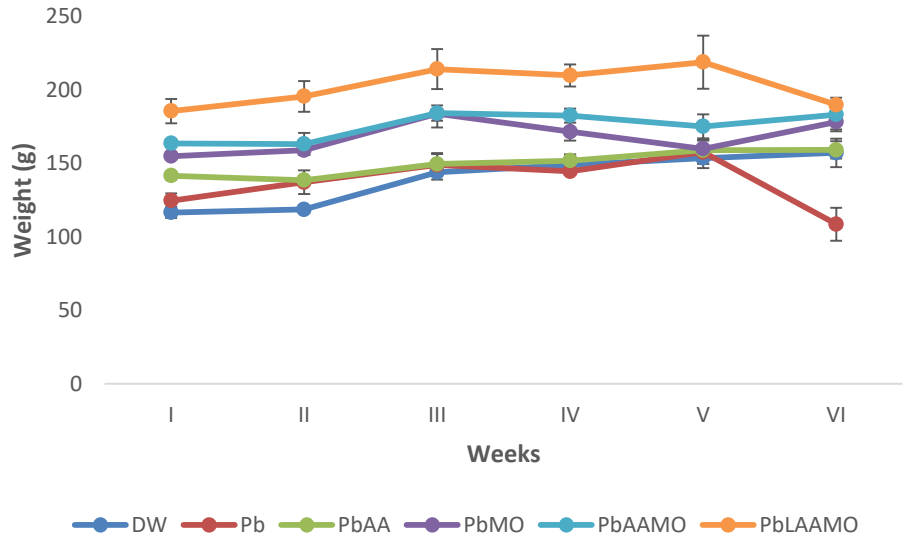

Fig.1: Effects of treatments on body weight dynamics from week 1 -6. n= 3.

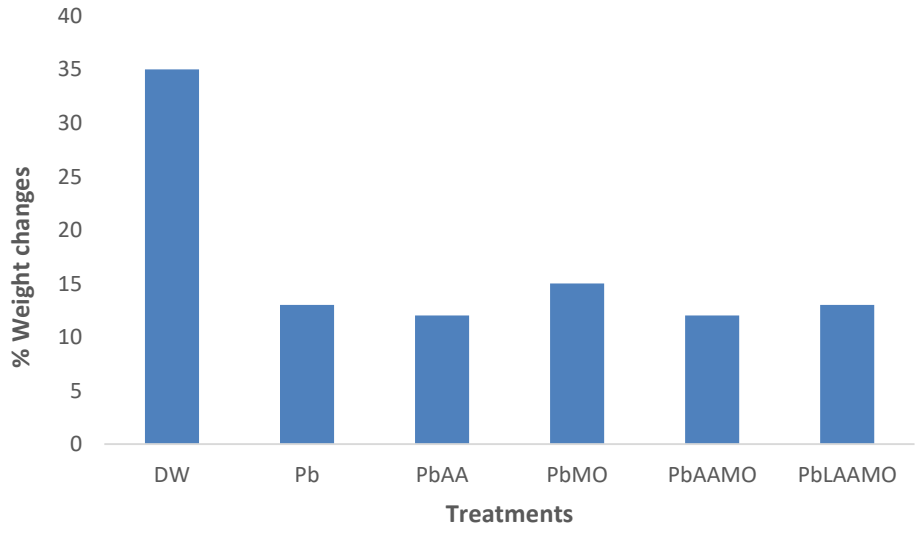

Fig. 2: Percentage of weight changes in adult male Wistar rats exposed to different

DISCUSSION

Bodyweight changes have been ascribed as an adverse indicator of environmental toxicants. In the present study, there was decreased body weight in the Pb group week 3. This finding agrees with the work of Seddik *et* al. (2010) where a decrease in growth rate was observed in rats following ingestion of lead. This could probably be due to loss of appetite and gastrointestinal abnormalities caused by the toxic effects of lead (Ahmad *et al*., 2003). Induction of oxidative stress has also been reported to enhance catabolism in the skeletal muscles, thus may lead to muscle wasting (Reid and Li, 2001). The rats in the DW group showed a steady increase in body weight from week 1 to week 6. Probably, the physiology of the animals was not hampered, since no toxic agent was administered to them. The apparent body weight gain in the PbAA, PbMO and PbAAMO groups could be a result of the antioxidant effects of both *Moringa oleifera* and ascorbic acid (Shousha *et al*., 2019; Macan *et al*., 2019). Ascorbic acid has been reported to increase renal clearance, thus reduces the plasma concentration of Pb (Nam *et al*., 2018).

Moringa oleifera show improvement in the restoration of lead-induced oxidative stress (Velaga *et al*., 2014)

CONCLUSION

From the present study, it can be concluded that subchronic exposure to lead has a negative effect on body weight gain of rats and the combination of ascorbic acid and *Moringa oleifera* were able to ameliorate the deficits.

Recommendation

Livestock should be kept away from the lead source, most especially when reared under semi-intensive and extensive management. Ascorbic acid and *Moringa oleifera* should be used in ameliorating the toxic effects of Pb.

References

Ahmad, I., Sabir, M. and Yasin, K.F. (2003). Study of the effects of lead poisoning on the testes of albino rats. *J Med Res*, 42:1-9.

Chasko, G.G., Hoehn, T.R. and Howell-Heller, P. (1984). Toxicity of lead shot to wild ducks mallard fed natural foods. *Bull Environ Contam Toxicol*, 32: 417-428.

Flora, G., Gupta, D. and Tiwari, A. (2012). Toxicity of lead: A review with recent updates. *Interdisciplinary Toxicology*, 5(2): 47–58.

Macan, A.M., Kraljevic, T.G and Raic-Malic, S. (2019). The therapeutic perspective of Vitamin C and its derivatives. *Antioxidants*, 8(8): 247.

Mujahid, A.M., Hafiz, S.M., Tariq, A.R. and Sadjid, M.Q. (2015). Protective effect of Vitamin C on body weight of albino rats with lead toxicity. *Pakistan Journal of Medical and Health Sciences*, 9(1): 430.

Nam, S.M., Chang, B.J., Kim, J.H., Nahm, S.S. and Lee, J.H. (2018). Ascorbic acid ameliorates lead-induced apoptosis in the cerebellar cortex of developing rats. Brain Res, 1686:10-18.

Patrick, L. (2006). The role of free radical damage and the use of antioxidants in the pathology and treatment of lead toxicity. *Alternative Medicine Review*, 11(2): 114-127.

Rafique, M., Perveen, K., Khan, N. and Nigar, S. (2008). Lead intoxication causing loss in body weight and loss of absolute weight of testes in albino rats. *Hamdard Medicus*, 51: 123-128.

Reid, M.B. and Li. Y.P. (2001). Tumour necrosis factor-α and muscle wasting: a cellular perspective. *Respiratory Research*, 2: 269-272.

Seddik, I., Bah, T.M., Aoues, A., Brnderdour, M. and Silmani, M. (2010). Dried leaf extract protects against lead-induced neurotoxicity in Wistar rats. *European Journal of Scientific Research*, 42(1): 139-151.

Shousha, W.G., Aboulthana, W.M. and Salama, A.H. (2019). Evaluation of the biological activity of *Moringa oleifera* leaves extract after incorporating silver nanoparticles, in vitro study. *Bulletin of the National Research Centre*, 43:212.

Velaga, M.K., Daughtry, L.K., Jones, A.C., Yallapragada, P.R., Rajanna, S. and Rajanna, B. (2014). Attenuation of lead-induced oxidative stress in rat brain, liver, kidney and blood of male Wistar rats by Moringa oleifera seed powder. *Journal of Environmental Pathology, Toxicology and Oncology*, 33(4):323-37.

Wani, A.L., Ara, A. and Usmani, J.A. (2015). Lead toxicity: a review. *Interdisciplinary Toxicology*, 8(2): 55-64.