- Original Article
- Published: 02 February 2018

Effect of powdered seed of *Nigella sativa* administration on sub-chronic and chronic lead acetate induced hemato-biochemical and histopathological changes in Sprague Dawley rats

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Comparative Clinical Pathology **volume 27**, pages705–716(2018)Cite this article

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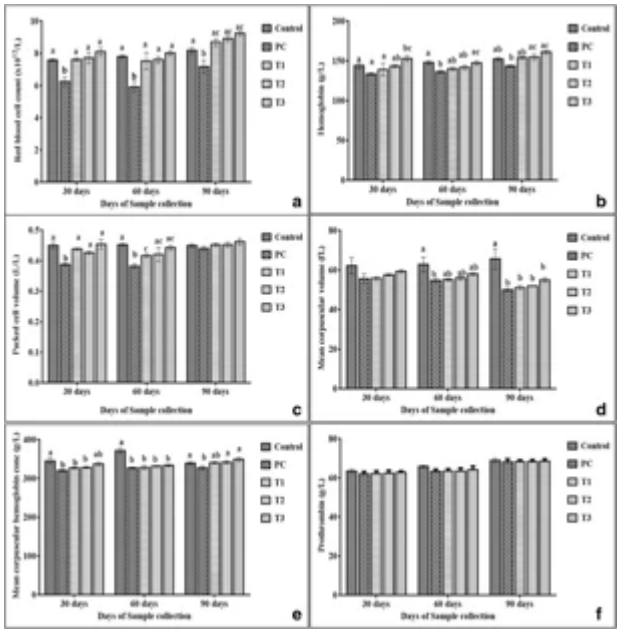
Abstract

Lead acetate (PbAC) toxicity can occur by either ingestion or inhalation from contaminated surfaces or from the environment. *Nigella sativa* is a natural product with immense pharmacological properties, which include antioxidant, antibacterial, and antianemia properties. It has been showed to counter the effect of PbAC-induced hematological and biochemical changes in short-term studies. This study hypothesized that the *N. sativa* (NS) administration will ameliorate the deleterious effects of chronic PbAC toxicity in rats. A total of 75 Sprague Dawley rats were divided into three groups of 25 rats, and each group was further sub-divided into five groups of five rats each. Group 1 rats (negative control) were given distilled water, group 2 (positive control; PC) were given 10 mg/kg of lead acetate (PbAC) daily, and groups 3 (T1), 4 (T2), and 5 (T3) were each given 10 mg/kg of PbAC followed by graded concentrations of powdered seeds of NS; 100, 150, and 200 mg/kg, respectively. Five rats in each group were euthanized at 30, 60, and 90 days for collection of whole blood and selected organs. Whole blood was collected after euthanized via cardio puncture and used to evaluate the complete blood profile, while plasma was used for biochemical analysis. Tissue samples of the liver and kidney were fixed with 10% buffered formalin, processed, and stained with H&E and periodic acid–Schiff (PAS) for the liver. Aggression and fear were increased in the PbAC-exposed group and absent in the T3 group. There was a lower ($p < 0.05$) red blood cell count (RBC), packed cell volume (PCV), mean corpuscular hemoglobin concentration (MCHC), and lymphocyte count in the PC and T1 groups only. Biochemical analysis revealed elevated ($p < 0.05$) liver enzyme and creatinine levels in the PC and T1 groups on day 90 for AST and day 30 for ALT and creatinine. The level of alkaline phosphatase (ALP) was higher ($p < 0.05$) in the PC at 30 and 60 days of sampling. Other parameters, such as WBCs, prothrombin, urea, and cholesterol, were not significant in all groups. Histopathological lesions in the liver and kidneys were more severe in the PC and T1 groups, while the T2 and T3 groups showed mild lesions resulting from *N. sativa* administration. There was a decrease ($p < 0.05$) in the total PAS-stained area signifying glycogen depletion in the PC, T1, and T2 groups at 60 days and a higher distribution of the PAS-stained areas ($p < 0.05$) in the T3 group. At 90 days, the PC group had a lower ($p < 0.05$) distribution of PAS-stained areas in comparison to the other groups. The results showed the therapeutic potential of *N. sativa* extract in modulating both hematological and biochemical alterations induced by chronic lead acetate administration in rats.

Fig. 1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PC
T1
T2
T3
20 days
60 days
90 days
Days of Sample collection
a
b
c
d
e
f

Fig. 2

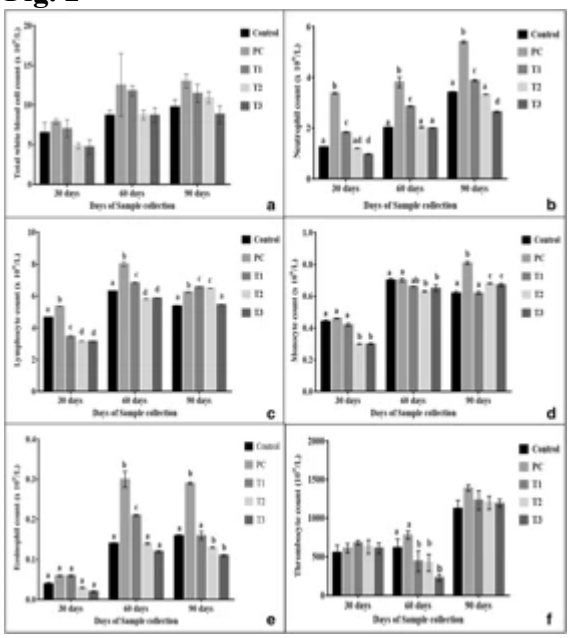

Control
PC
T1
T2
T3
20 days
60 days
90 days
Days of Sample collection
a
b
c
d
e
f

Fig. 3

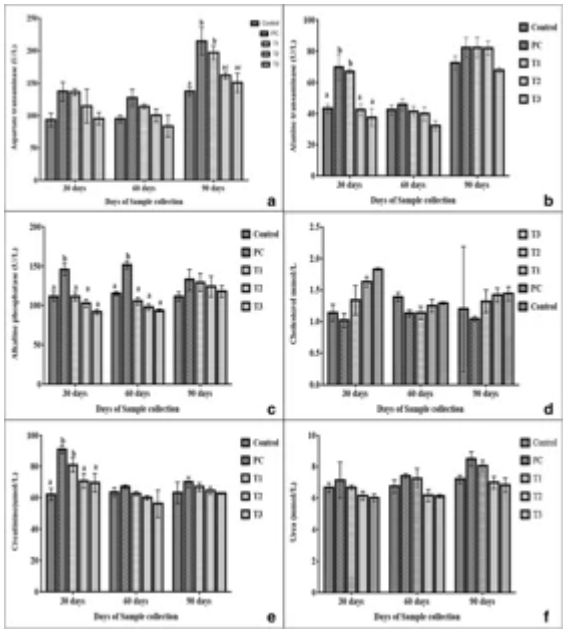


Fig. 4

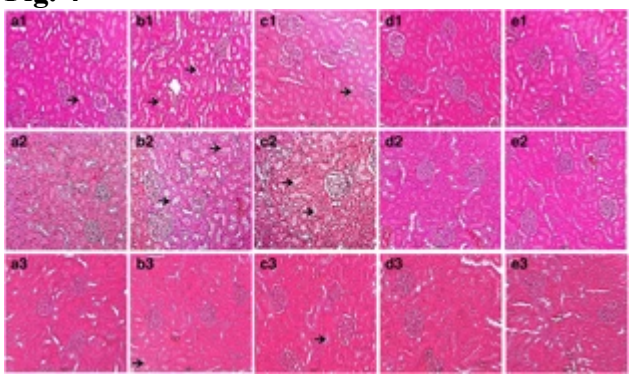


Fig. 5

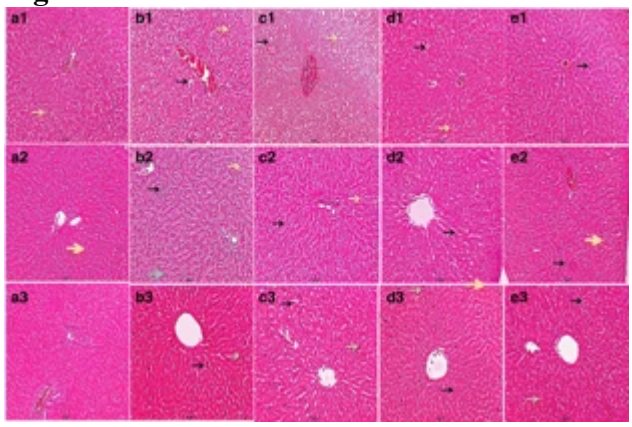
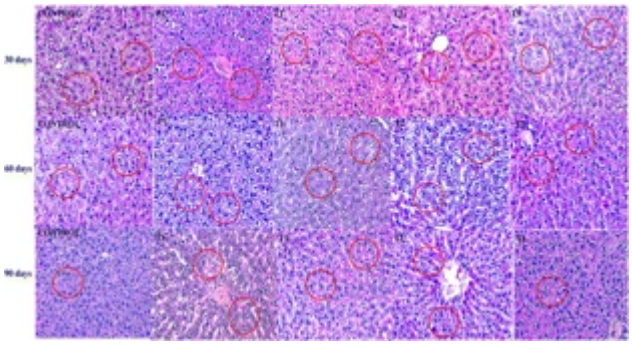


Fig. 6



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Contributions

All authors contributed equally to this work.

Corresponding author

Correspondence to M. N. M. Hezmee.

Ethics declarations

Ethical statement

The animal experimental protocol used in this study was approved by the Institutional Animal Care and Use Committee (IACUC) with reference number UPM/IACUC/AUP-R047/2015, in accordance with the standard guidelines on usage and care of laboratory animals. The animals were humanely handled and euthanized at stipulated dates (30, 60, and 90 days) during the experimental period, using CO_2 asphyxiation method after anesthesia procedure with ketamine + xylazine (50 mg/kg + 10 mg/kg body weight).

Conflict of interest

The authors declare that they have no conflict of interest.

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Assi, M.A., Abba, Y., Abdulkhaleq, L.A. *et al.* Effect of powdered seed of *Nigella sativa* administration on sub-chronic and chronic lead acetate induced hemato-biochemical and histopathological changes in Sprague Dawley rats. *Comp Clin Pathol* **27,** 705–716 (2018). https://doi.org/10.1007/s00580-018-2655-z

- Received: 21 August 2017
- Accepted: 25 January 2018
- Published: 02 February 2018
- Issue Date: May 2018
- DOI: https://doi.org/10.1007/s00580-018-2655-z

Keywords

- *Nigella sativa*
- Lead acetate
- Hematology
- Biochemistry
- Histopathology
- Sprague Dawley rats

- **Fig. 1**
- **Fig. 2**
- **Fig. 3**
- **Fig. 4**
- **Fig. 5**
- **Fig. 6**

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