

ISRG JOURNAL OF CLINICAL MEDICINE AND MEDICAL RESEARCH [ISRGJCMR]



OPEN ACCESS



ISRG PUBLISHERS

Abbreviated Key Title: ISRG J Clinic.Medici.Medica.Res.

ISSN: 3048-8850 (Online)

Journal homepage: <https://isrgpublishers.com/cmmr/>

Volume – III, Issue - IV (July – August) 2026

Frequency: Bimonthly



A STUDY ON THE EFFECTS OF AQUEOUS SOLUTION OF MANGIFERA INDICA (MANGO PEEL) ON THE HISTOLOGY OF THE OVARIES OF ALBINO WISTAR RATS EXPOSED TO ALUMINIUM CHLORIDE TOXICITY.

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| Received: 21.06.2026 | Accepted: 25.06.2026 | Published: 29.07.2026

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Abstract

Background: Mango is a popular fruit known for its sweet flavor and various commercial uses, such as in fruit salads and juices. The ovary, a distinctive feature of a female is responsible for the production of ova and undergo cyclical changes on which fertility and other characteristics of a developing female heavily depend.

AIM: The study was aimed at giving a concise insight into the effect of aqueous solution of *Mangifera indica* on the hormonal profile and histology of the the ovaries of female albino wistar rats following aluminum toxicity.

Material and methods: Twenty-five rats were divided into five groups; Group A (control); Group B (aluminium exposure only); after aluminium exposure, Group C and D received extract twice and three times daily respectively; and Group E received extract continuously. Ovaries were harvested for histological analysis using haematoxylin, and eosin (H&E) standard procedure. Furthermore, Follicular stimulating and Luteinizing hormones were assessed.

Results: Results obtained showed a dose dependent increase in body weight across the groups. Histological analysis showed aluminum administration induced structural alteration in ovarian tissue, including follicular degeneration and disrupted morphology, while extract demonstrated protective effects that improved ovarian architecture and restored hormone levels in dose-dependent manner. The obtained hormonal analysis showed a dose dependent increase in Luteinizing hormone (LH) and Follicle Stimulating Hormonal (FSH) in groups administered with extract when compared to the control group.

Conclusion: This finding suggests that mango peel often discarded as waste, contains bioactive compounds capable of mitigating aluminum-induced reproductive toxicity. The study highlights the potential of mango peel extracts as a natural, effective therapeutic agent in reproductive medicine.

Keywords: *Mangifera Indica*, Ovaries, Aluminum, Follicle-stimulating Hormone, Luteinizing hormone.

INTRODUCTION

Mango is a commonly enjoyed fruit found today. It is known for its distinctive sweet flavour, making it a very top choice for commercial use, such as using this fruit in fruit salads, fruit juice and flavours in food (Mandal *et al.*, 2023). It is also known for its physical features, which are: Oval, kidney-shaped, round or elongated in shape, depending on the species and variety of the mango (George, 2016). Mango is a fleshy fruit with a flattened single seed. Its skin, which varies in colour, ranges from red, yellow, orange or green. In most cases, it appears orange when it is fully ripe (Nguyen *et al.*, 2004).” Mango is a dicotyledonous fruit, and it belongs to the family *Anacardiaceae*” (Lizada, 1993). The scientific name for Mango is *Mangifera indica*. “It is known to have about 30 species, some of which are: *Mangifera caesia*, *Mangifera decandra*, *Mangifera odorata*, *Mangifera sinilis*, *Mangifera kemanga*, *Mangifera longipes*, *Mangifera torquenda*, *Mangifera swintonioides*”. It also belongs to the genus *Mangifera* and species *Indica* (Shah *et al.*, 2010). The ovaries are paired organs that produce both the sex cells and the hormones, estrogen and progesterone, necessary for reproduction (Gibsy & Mahdy, 2025). This organ is one of the distinctive features of a female. It controls various events and cycles on which fertility and other characteristics of a developing female heavily depend. These events are controlled mainly by two hormones: The follicle-stimulating hormone (FSH) and the luteinizing hormone (LH). The

release of these hormones from the anterior pituitary gland is controlled by the gonadotropin-releasing hormone (GnRH) from the hypothalamus. The ovary is highly packed with a composite of germ cells (oocytes or eggs) and somatic cells (stroma, thecal and granulosa cells) (Richards & Pangas, 2010).

Aims and Objectives.

The primary aim of the research was to examine the effects of *Mangifera Indica* peels on the histology of the ovaries of female Wistar albino rats exposed to aluminium chloride toxicity, with a focus on their impact on ovarian histology, morphology, hormone levels, and overall reproductive health.

Materials and Methods

Twenty-five (25) apparently healthy female Wistar rats weighing between 90g and 160g were used for the research and maintained in the Bingham University animal house, Nasarawa State. Based on the administration dosage, they were grouped into five (A, B, C, D, and E) and housed in separate cages, maintained under proper temperature, ventilation, and hygienic conditions. The animals were allowed to acclimatize for two weeks before the administration of test substances for 21 days.

Experimental Design

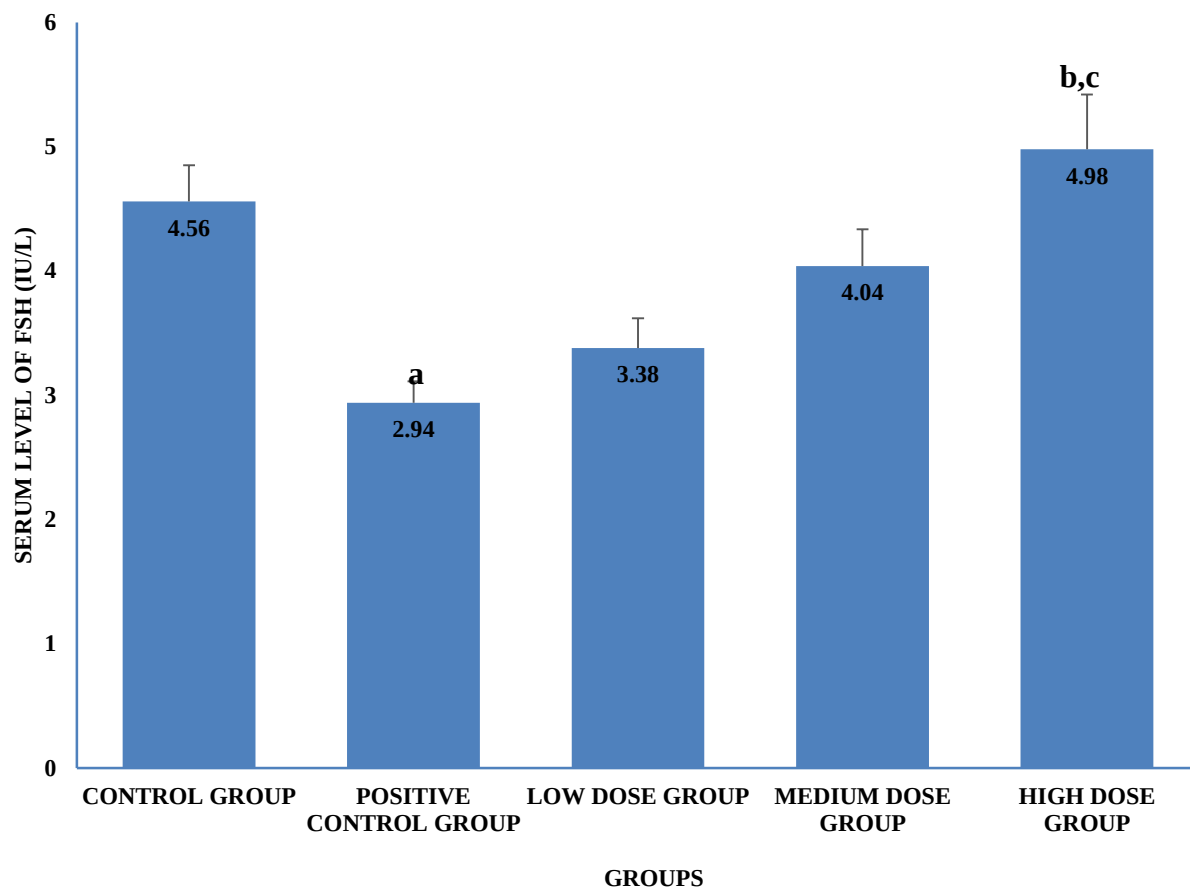
Days Groups	1	2	3	4	5	6	7	8	9	10	11	12	13	14-21
A	(Negative Control) Given Water + Feed Only													
B							(Positive Control) 0.5ml Aluminum chloride + Feed + Water							
C	(Low Dosage) 0.5ml Aluminium chloride + 100mg OF Extract Concurrently													
D							(Medium Dosage) 0.5ml Aluminium chloride And 200mg Extract Concurrently							
E	(High Dosage) 0.5ml Aluminium chloride and 300mg Extract Concurrently													

Organs and blood were harvested from each experimental group twenty-four 24hours after the last administration

RESULTS

Hormonal Analysis

Results from Blood samples collected from the animals for hormonal analysis of Follicle-stimulating hormone (FSH), Luteinizing hormone (LH), Estrogen, and Progesterone shows a significant increase in the hormonal level of all the experimental animals, which indicates that the aqueous extract of mango peels enhances fertility.

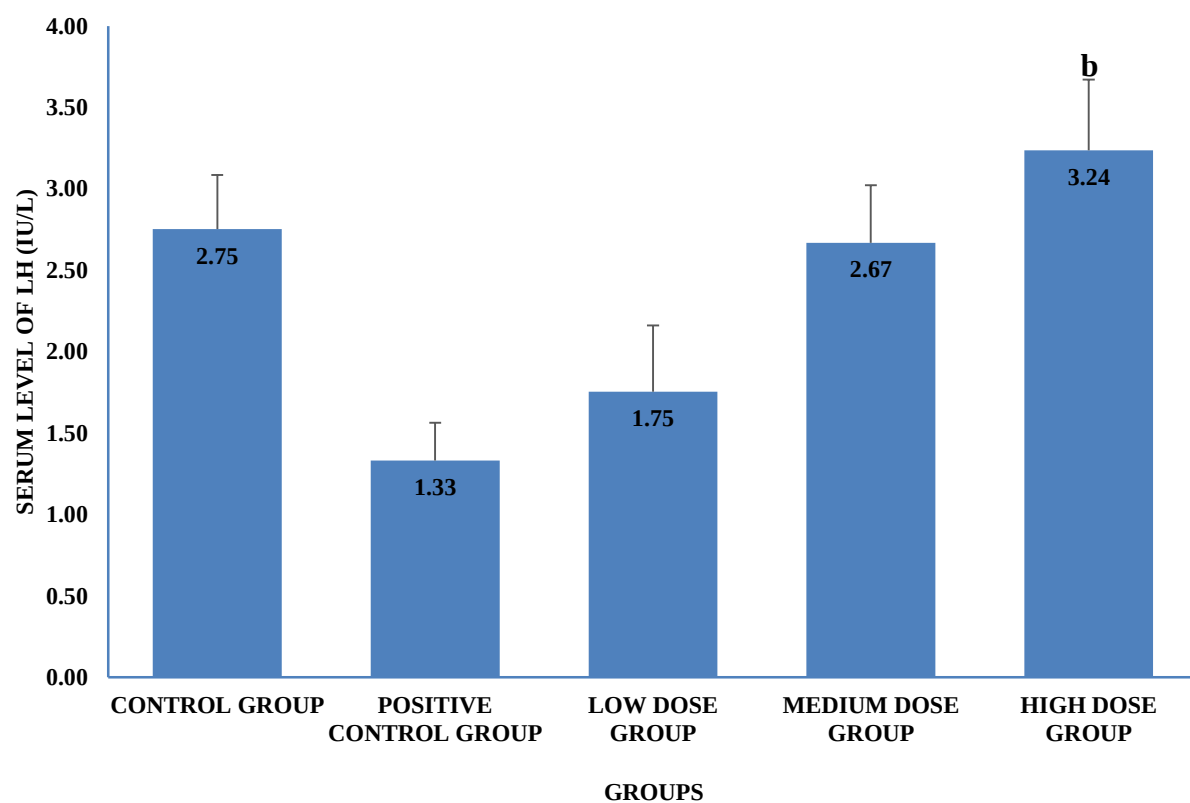


a = significantly different from control group

b = significantly different from Positive Control group at $p < 0.05$

c = significantly different from Low dose group at $p < 0.05$

d = significantly different from Medium dose group at $p < 0.05$

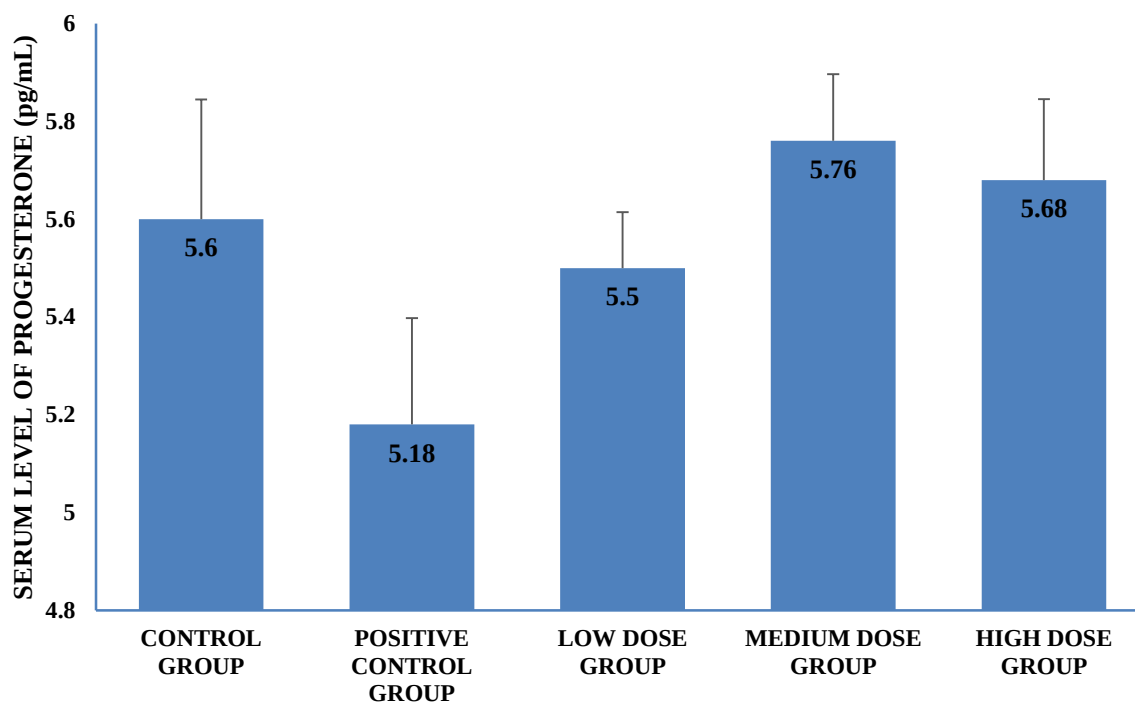


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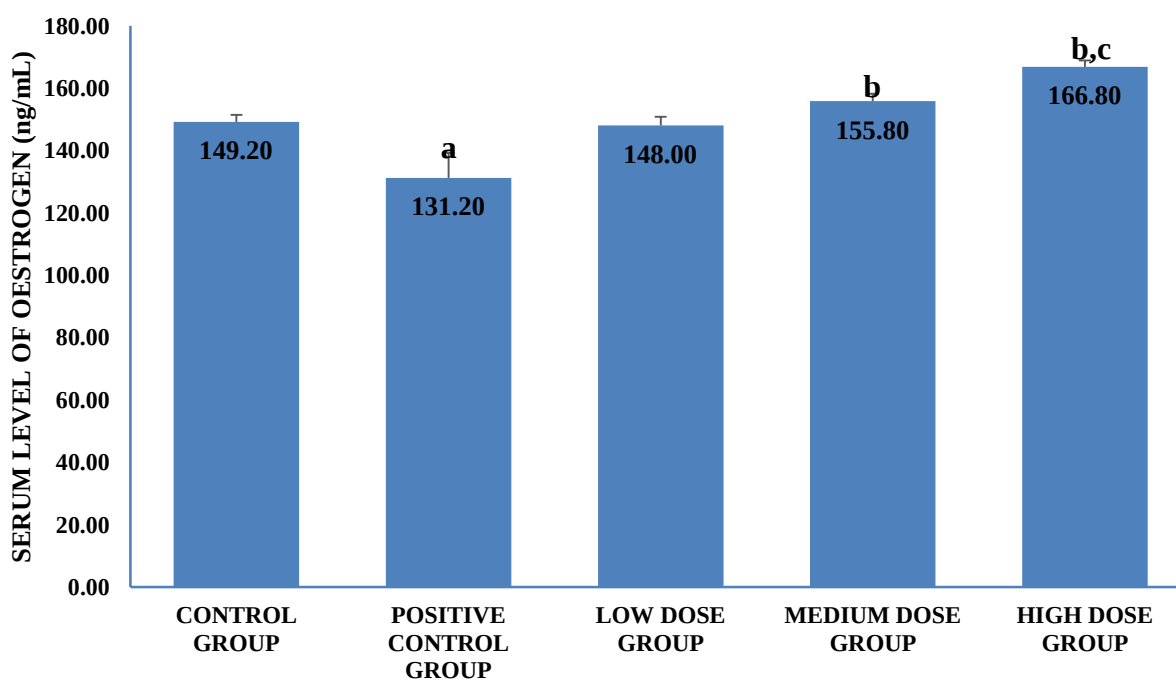
GROUPS

a = significantly different from control group

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GROUPS

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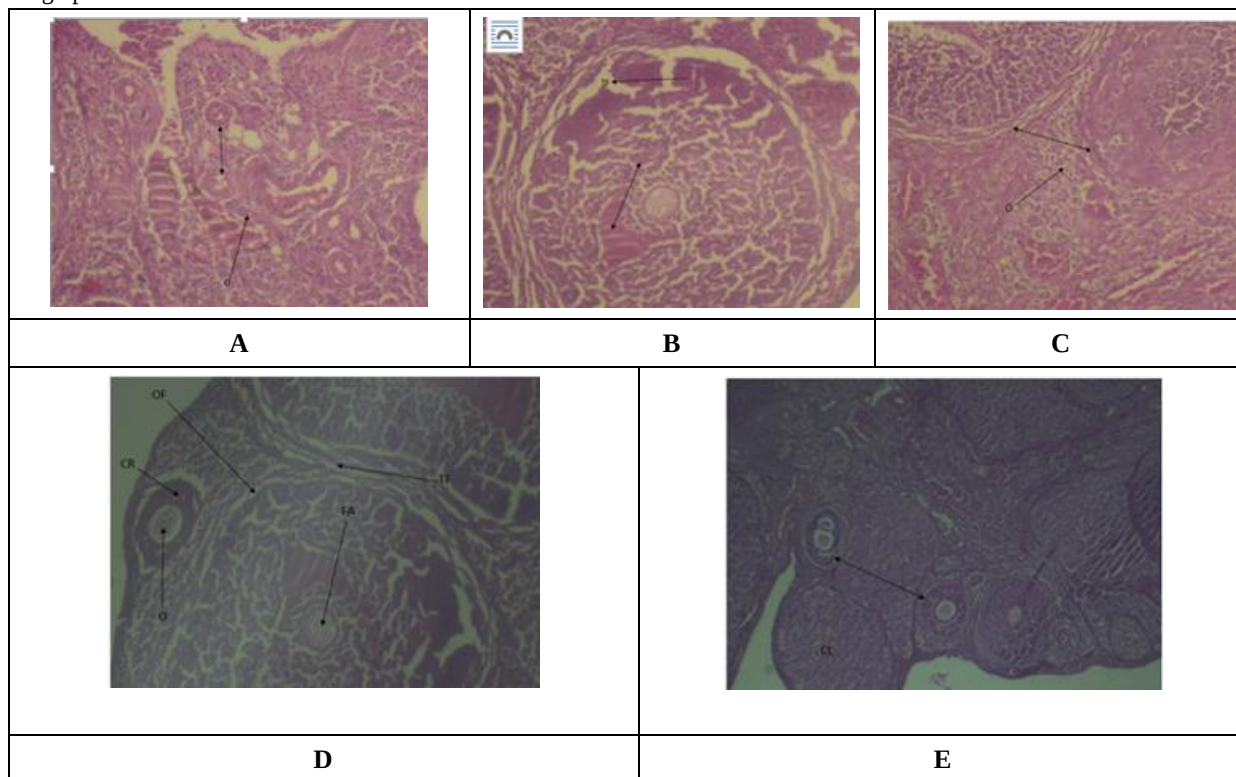
b = significantly different from Positive Control group at $p < 0.05$

c = significantly different from Low dose group at $p < 0.05$

d = significantly different from Medium dose group at $p < 0.05$

Histological results

Photomicrographs are transverse sections of the rats ovaries stained with H&E at $\times 250m$



Group A: (Negative Control): Primary and secondary ovarian follicles are present at various stages of maturation, with normal histological architecture. A maturing oocyte (O) and intact stroma are observed. **Group B** (Positive control; Aluminum chloride, 0.5ml/bwt): Blood in the corpus luteum is seen, with absence of primary oocytes and cellular degeneration around the theca follicle (TF). **Group C** (Mango peel extract, 0.5ml/100 mg/bwt): A Recovering ovarian follicle is noted, with a maturing oocyte (O). **Group D** (Mango peel extract, 0.5ml/200 mg/bwt): Normal histological features of the ovary are evident, including ovarian follicle (OF), follicular antrum (FA), oocytes (O), corona radiata (CR), and theca follicle (TF). **Group E** (Mango peel extract, 0.5ml/300 mg/bwt): Fully recovered ovary with normal histological features; ovarian follicles (black arrows), corpus luteum (CL), and intact stroma are present.

DISCUSSION

Hormonal result (FSH, LH, estradiol, progesterone): Aluminum chloride ($AlCl_3$) exposure in the positive-control group depressed gonadotropins (FSH/LH) and estradiol, while the mango-peel decoction (MPLD) groups showed dose-related recovery of these hormones and marked histological improvement versus the $AlCl_3$ -only group. These patterns are internally coherent with aluminum chloride's known ovarian toxicity and antioxidant rescue by polyphenol-rich botanicals. $AlCl_3$ group recorded the lowest LH and FSH, consistent with suppression of the hypothalamic–pituitary–ovarian (HPO) axis after chronic aluminum chloride ingestion. Oral $AlCl_3$ reduced serum FSH, LH, and E2 in a dose-

dependent manner, mirroring the same direction. It was demonstrated that sub-chronic $AlCl_3$ damaged ovarian tissue and down-regulated FSHR and LHR.

Ovarian histology: Consistent with prior reports that aluminium chloride accumulates in reproductive organs and disrupts ovarian structure and endocrine function, the $AlCl_3$ -only group in this research showed histological disruption (Loss of primary oocytes, inflammation, and cellular degeneration around the theca) relative to controls. These effects align with established mechanisms in which aluminum chloride promotes oxidative stress and damages ovarian follicles and stromal architecture, ultimately impairing steroidogenesis and ovulation. By contrast, concurrent or delayed treatment with mango peel extract produced a dose-related restoration of ovarian morphology: at 100mg/kg, follicles appeared to be recovering, while 200–300 mg/kg showed near-normal architecture with visible follicles, corpus luteum, intact stroma, and organised granulosa/theca layers. These findings are biologically credible because mango peel is rich in polyphenols (e.g., mangiferin, gallic acid, catechins) with antioxidant and anti-inflammatory properties that can reduce reactive oxygen species and protect ovarian cell.

Conclusion

Aluminum chloride exposure disrupted ovarian histo-architecture and altered reproductive hormones in female Wistar rats. The use of mango peel extract ameliorated these effects in a dose-dependent manner, with 200–300 mg/kg showing near-complete restoration of ovarian morphology and improvement in

LH/FSH/estradiol profiles. This protective action is consistent with the antioxidant polyphenols abundant in mango peel.

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