INTERNATIONAL JOURNAL OF BASIC AND CLINICAL SCIENCES
Volume 1, Issue 1, October, 2026
Print ISSN: 0000-0000 Online ISSN: 0000-000X

Original

Effects of *Talinum fructicosum* and *Gnetum africanum* Extracts on the Ovaries of Wistar Rats

Ekokodje W. Joy[1], Oladipo S. Gabriel[2]

[1]Department of Anatomy, Faculty of basic medical sciences, College of Medical Sciences, Rivers State University Nkpolu Oroworukwo

[2]Department of Anatomy, Faculty of basic medical sciences, College of Medicine, University of Port Harcourt, Rivers State.

Corresponding author: ***Ekokodje W. Joy*****,** Department of Anatomy, Faculty of basic medical sciences, College of Medical Sciences, Rivers State University Nkpolu Oroworukwo. joy.wilberforce@ust.edu.ng: ORCID ID:

Article History:
Received: 30 April 2026 | Revised: 11 May 2026 | Accepted: 20 June 2026 |
Published: ?? October 2026 |DOI:

Abstract

Background: African indigenous leafy vegetable are the most readily available source of micronutrients. Recent studies have provided evidence of the potential effects of these plants on reproductive health. Given the widespread consumption of these plants and their potential impact on hormonal balance and reproductive function, there is a growing interest in investigating their effects on reproductive health. Some studies have suggested that certain phytochemicals present in these plants may modulate reproductive processes, influencing fertility and reproductive processes, and reproductive outcome. (Okwu and Okwu, 2004). The study examined the histological and stereological effects of chronic administration of *Talinum fructicosum* (waterleaf) and *Gnetum africanum* (okazi) aqueous extracts on the ovaries of adult female wistar rats.

Materials and Methods: A total of Twenty-four wistar with six in each group were used for the experiment. Animals were grouped based on similar weights following a 2weeks period of acclimatization. Group One were the Control and were given only feeds and water. Group two were given waterleaf extract (*talinum fructicosum*) feeds and water. Group three where given okazi extract (*Gnetum africanum*) including feeds and water. Group four were given waterleaf extract (*talinum fructicosum*) and okazi extract (*Gnetum africanum*). Approximate concentrations of the extract were constituted to the required doses for the treatment of the animals using normal saline. Extracts were given daily to experimental rats. Phases of estrous cycle of rats were checked by vaginal smear method and recorded weekly. Ovarian tissues were processed and serial sections of stained tissues of hematoxylin and eosin were then examined microscopically to determine the morphology and number of primordial and growing follicles, number of corpora lutea and cellular integrity. Histomorphometry of cells from the tissues were counted using stereologic techniques.

Results: Histological analysis revealed that T. fructicosum produced mild alterations in ovarian structure, with largely preserved follicular morphology during early exposure. However, G. africanum caused progressive degenerative changes characterized by thinning of the theca interna, granulosa cell necrosis, follicular atresia, and loss of primary oocytes, becoming more pronounced with prolonged exposure. The combined extract had fluctuating effects, demonstrating episodes of degeneration and partial restoration of the follicular structure, indicating possible antagonistic or synergistic interactions between the phytochemical constituents. Furthermore, Stereological assessment demonstrated no statistically significant differences ($p > 0.05$) in morphometric indices across groups, although subtle trends mirrored the histological findings. Hormonal assays revealed alteration of levels of FSH, LH, and estrogen, with the highest concentration of estrogen occurring in the combined extract group. This suggests potential dysregulation of the hypothalamic–pituitary–ovarian axis.

Conclusion: Findings from this study shows that T. fructicosum exerts mild ovarian effects, whereas G. africanum poses greater reproductive risk through cumulative structural degeneration. Given their wide dietary use, further investigations are needed to isolate phytochemicals responsible and provide long-term fertility implications.

Keywords*:* Ovary, *Talinum fructicosum, and Gnetum africanum,* Granulosa Cell

How to cite this article

Ekokodje WJ, Oladipo SG. Effects of *Talinum fructicosum* and *Gnetum africanum* Extracts on the Ovaries of Wistar Rats. Int J Basic Clin Sci. 2026:1(1):xxx-xxx. https://doi.org/10.00000/blab

© 2026 The Author(s). Published by the International Journal of Basic and Clinical Sciences (IJBACS). This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC BY 4.0), which permits unrestricted use, distribution and reproduction, provided the original author(s) and source

INTRODUCTION

The ovary represents a specialized organ in female reproductive physiology, being responsible for the cyclical maturation of oocytes and the synthesis of essential hormones regulating the estrous cycle, ovulation, pregnancy, and secondary sexual characteristics (Hoffmann, 2018; Orsi et al., 2024). The ovarian architecture is organized into primordial, primary, secondary, and Graafian follicles-relies on intricate interactions among granulosa cells, theca cells, stromal components, and interstitial tissues (Hummitzsch et al., 2019; Ma et al., 2023). Because of this structural and functional sensitivity, the ovary is particularly vulnerable to dietary exposures, phytochemicals, endocrine-disrupting agents, and metabolic stress. Even subtle damage to follicular cells or supporting tissue can have long-lasting consequences on reproductive competence, hormonal balance, and fertility outcomes. In many African societies, vegetables form a critical part of daily diets and are closely associated with traditional healing (Kimiywe et al., 2007; Maseko et al., 2017). *Talinum fructicosum,* commonly known as waterleaf, and *Gnetum africanum*, popularly known as okazi, are two popular leafy vegetables consumed for their nutritional value (Khaing and Moe, 2019). Despite its consumption as a healthy food, scientific evidences are yet to establish its long-term effect on the reproductive tissues. These plants contain various phytochemicals, which include alkaloids, flavonoids, tannins, phenols, and saponins, exert antioxidant actions, and might also show cytotoxic, estrogenic, or anti-fertility influences, depending on concentration and duration of exposure (Oluba et al., 2019; Akin-Osanaiye et al., 2019; Madubogwu et al., 2025). Therefore, chronic consumption of these plants may affect ovarian physiology in ways yet not fully understood. Additionally, previous studies have shown that bioactive compounds derived from plants exhibit toxic effect (Lavecchia et al., 2013; Ohiagu et al., 2021). While some phytochemicals support ovarian antioxidant defense and cellular function (Chen et al., 2012; Pundir et al., 2022). Others may disrupt folliculogenesis, impair steroidogenesis, or trigger apoptotic pathways. Given the different phytochemical profiles of *Talinum fructicosum* and *Gnetum africanum*, their single and combined effects on the ovary could be very different. This is particularly important because in traditional culinary practices, both plants are usually cooked and taken together, raising the possibility of synergistic, antagonistic, or cumulative biological interactions. The study therefore examined the histological and stereological effects of the chronic administration of the aqueous extracts of *Talinum fructicosum, Gnetum africanum,* and their combination on the ovaries of adult female wistar rats. Morphology and number of primordial and growing follicles, number of corpora lutea and cellular integrity were assessed. Histomorphometry of cells from the tissues were counted using stereologic techniques. Providing evidence-based information on the reproductive implications of chronic dietary exposure to these commonly consumed vegetables.

MATERIALS AND METHODS

Experimental Design: The study employed an experimental laboratory design to investigate the effects of *Talinum fructicosum*, *Gnetum africanum* and their combined aqueous extracts on the ovaries of female wistar rats. A total of twenty-four (24) healthy adult female rats were assigned into four groups based on similar weights. (n = 6 per group). Weights ranged from 140grammes to 160 grammes.

Group 1 (Control): Received distilled water and standard laboratory feed.

Group 2 (T. fructicosum): Received aqueous extract of *Talinum fructicosum* at 700mg/kg body weight and two weeks later increased to 1000mg/kg.

Group 3 (G. africanum): Received aqueous extract of *Gnetum africanum* at 700mg/kg body weight and two weeks later increased to 1000mg/kg.

Group 4 (Combined extract): Received a mixture of equal proportions of both extracts at 700mg/kg body weight and two weeks later increased to 1000mg/kg.

Plant Sample Collection, Processing and Extraction

Fresh leaves of *Talinum fructicosum* and *Gnetum africanum* were obtained from a local market and air dried. A large amount of the harvested plants were made free of soil, and roots and separated from the aerial plants. The dried plants were

© 2026 The Author(s)

ground with a sample grinding machine, which is specifically reserved for this purpose alone. Grinded samples were weighed and soaked in a maceration jar, with solvent been distilled water. This was allowed to stand for three days with continuous stirring. Next the sample in the different jars were filtered with a basket containing a mesh to remove the shafts. The sample obtained was filtered with filter paper to remove any debris. The different filtrates of plant samples obtained were mounted on a water bath with the aid of a crucible for evaporation set at a temperature of 60 degrees centigrade. Evaporation was allowed to continue until the plant sample became semi- solid (paste-form). The water bath is used in order to prevent denaturation of the active constituents of the plant sample. The resultant extracts were kept in a refrigerator till the period of administration. 120grammes of ground leaf of *Gnetum africanum* and *talinum fructicosum* were macerated separately in 1litre of distilled water for 24hrs. This was thereafter filtered with sterile filter paper (Whatman No.1) and evaporated to dryness at 40°C in a vacuum using a rotary evaporator RE52. Approximate concentrations of the extract were constituted to the required doses for the treatment of the animals using normal saline. Qualitative phytochemical screening of the aqueous extract of *Gnetum Africanum and Talinum fructicosum* were done to detect the presence or absence of secondary metabolites (phytochemicals) using standard procedures as described Ezekwe et al (2010). Extracts were given daily to experimental rats. For each rat, body weights were recorded every day using a weighing balanced scale

Experimental Animals

Female Wistar rats were housed under standard laboratory conditions, including a 12-hour light/dark cycle, controlled temperature and free access to feed and water. Animals were acclimatized for one week before treatment commenced. For each rat body weights were recorded every day using a weighing balanced scale. The resultant extracts in paste form were obtained for both leaves *Gnetum africanum* and *Talinum fructicosum* and the dose to be given was determined after using the Lux Method in ml/day/rat. Extracts were given daily to laboratory rats

Collection Of Vaginal and Blood Sample, Cytology and Histology

Vaginal Smears: During the treatment period, phases of estrous cycle of rats were checked by vaginal smear method and recorded weekly. Vaginal cytology was done by inserting a sterilized vaginal loop into the vagina and allowed to touch the vaginal wall by rolling it smoothly. Smear was then be spread on a clean slide and fixed on a flame before staining with methylene blue for 3 – 5 minutes, stained smears were then washed with tap water, air dried and examined under a light microscope to determine estrous cycle phases.

Collection of Blood Sample: Blood samples were collected weekly from each rat by the retro-orbital method (this is to allow continuation of experimental procedure) using capillary tubes at intervals of 3 weeks on day 21, 42, 64, 84. Samples were then centrifuged in a centrifuge at 3000rmp for 30minutes. Serum collected and sent for hormonal assay for the different parameters; that is estrogen, progesterone, FSH, LH, and prolactin

Histological Preparation: Incision of the abdominal wall of anesthetized rat was done, and the whole reproductive system was removed after sacrifice, fine surgical scissor was used to dissect both ovaries and immersed in a tube containing bouins fluid. Serial sections of stained tissues of hematoxylin and eosin were then examined microscopically at ×400 magnification. Photomicrographs were captured using digital light microscope. Note that one rat from each group on days 21, 42, 63, and 84 were sacrificed to determine the morphology and number of primordial and growing follicles, number of corpora lutea and cellular integrity.

Stereological Assessment, Quantitative analysis of ovarian tissue included measurements of total cell count, area, perimeter and cell size. Stereological evaluation was performed using image analysis software calibrated to microscopical magnification. Three photomicrographs per tissue section were analyzed to ensure accuracy and reproducibility. The parameters quantified were derived from standard stereological principles for biological tissues.

Statistical Analysis

Data were analyzed using one-way analysis of variance (ANOVA) followed by Tukey's post hoc test to determine significant differences between groups. Results were expressed as mean ± standard error of the mean (SEM). Statistical

© 2026 The Author(s)

significance was set at $p \leq 0.05$. Graphical presentations were presented to illustrate variations in ovarian cell counts across groups and time points.

Ethical Approval

For the purpose of this research, ethical clearance was obtained from the University of Port Harcourt Research Ethics Committee. The ethical clearance number is **UPH/CEREMAD/REC/MM99/002.** Ethical principles regarding the proper use of animals in this research were adhered to.

RESULTS

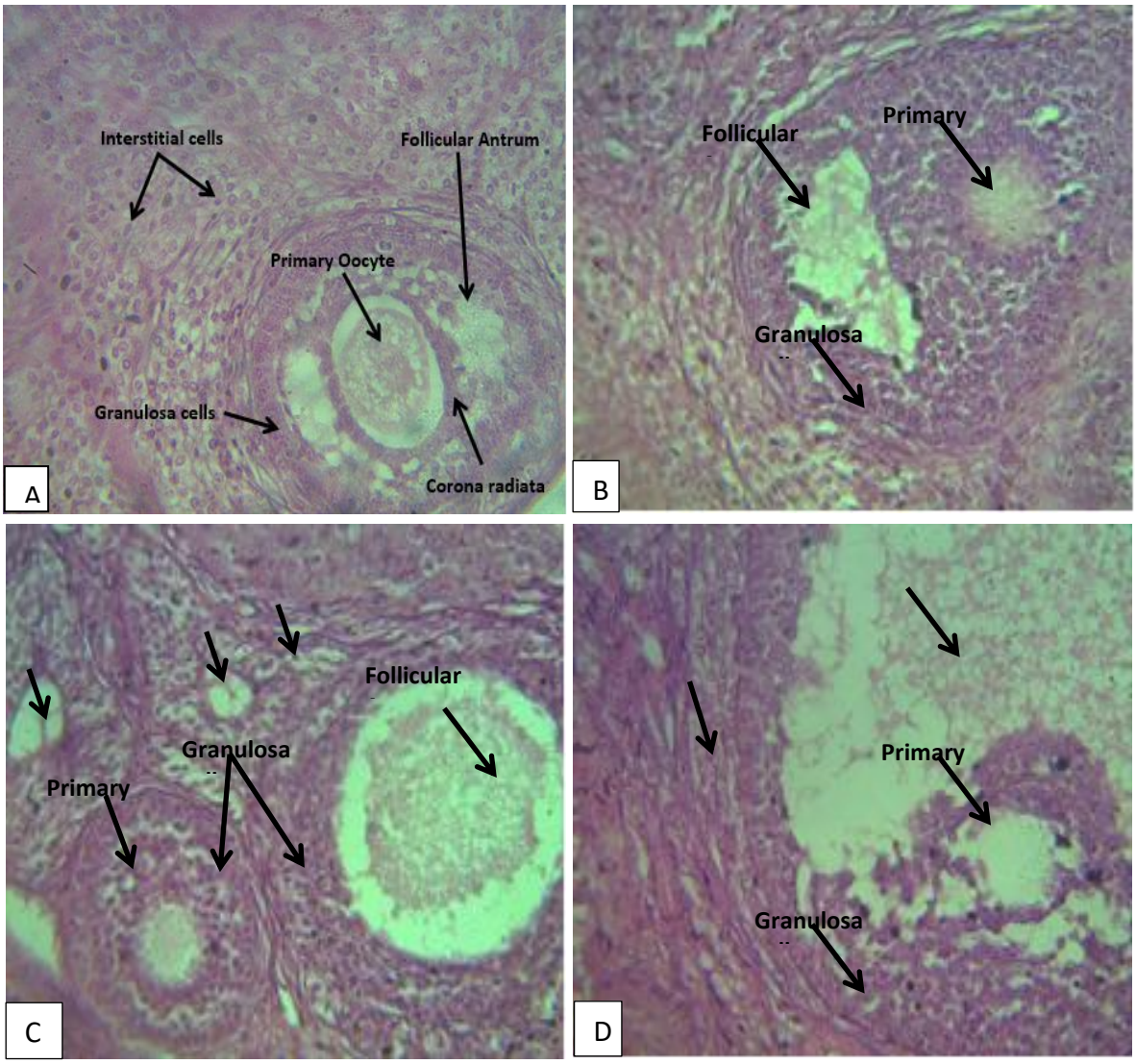


Plate 1. (Day 21) Photomicrography of the ovary; A) Control: showing the normal ovarian follicles with the interstitial cells, secondary follicles and granulosa cells, the corona radiata surrounding the primary oocyte within the antrum**. B) Group 2. *T. Fructicosum***: Normal Graafian follicle with granulosa cells (GC) and the corona radiata of primary oocyte**. C) Group 3. *G. Africanum*:** Mild distortion with reduced thickness of the theca internal, vacuolations within the interstitial with no demarcation**. D) Group 4. *T. Fructicosum* and *G. Africanum:*** Mild atretic lesion with almost disorganized granulosa cells associated with loss of the primary oocyte of the graafian follicles

© 2026 The Author(s)

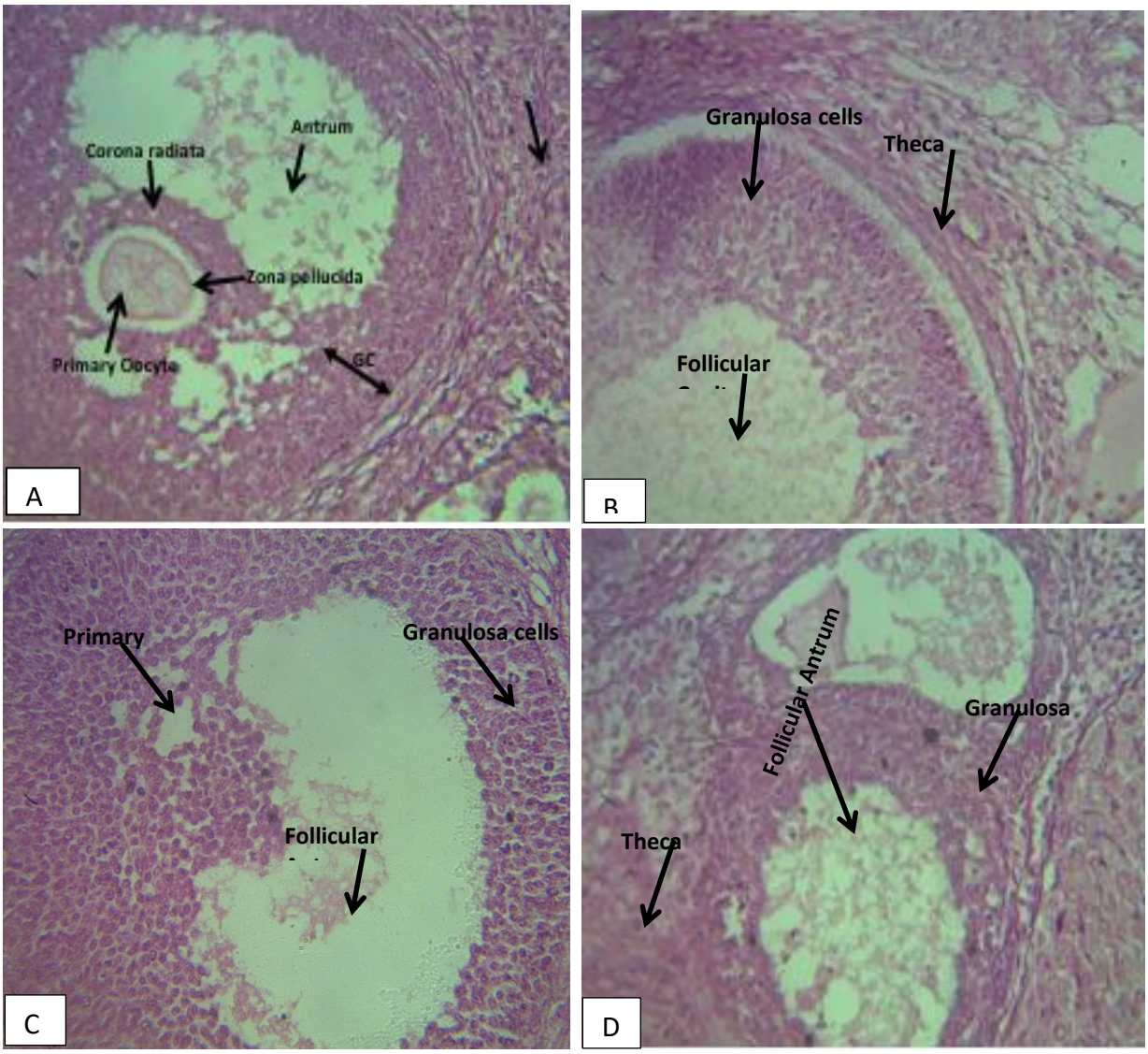


Plate2: (Day 42) Photomicrography of the Ovary; showing **A) Control:** Normal appearance of ovary with the secondary follicles, granulosa cells (GC) and the corona radiata surrounding the primary oocyte with a differentiated zona pellucida. **B) Group 2. *T. Fructicosum*:** Mild distortion showing decreased thickness of the theca internal with sparse arrangement of the granulosa cells associated with demarcation of the basement membrane of the follicle (arrows) **C) Group 3. *G. Africanum*:** Moderate distortion showing decreased thickness of the theca internal with sparse arrangement of the granulosa**. D) Group 4. Combined, *T. Fructicosum* and *G. Africanum:*** No observable lesions with organized granulosa cells lining the graafian follicles

© 2026 The Author(s)

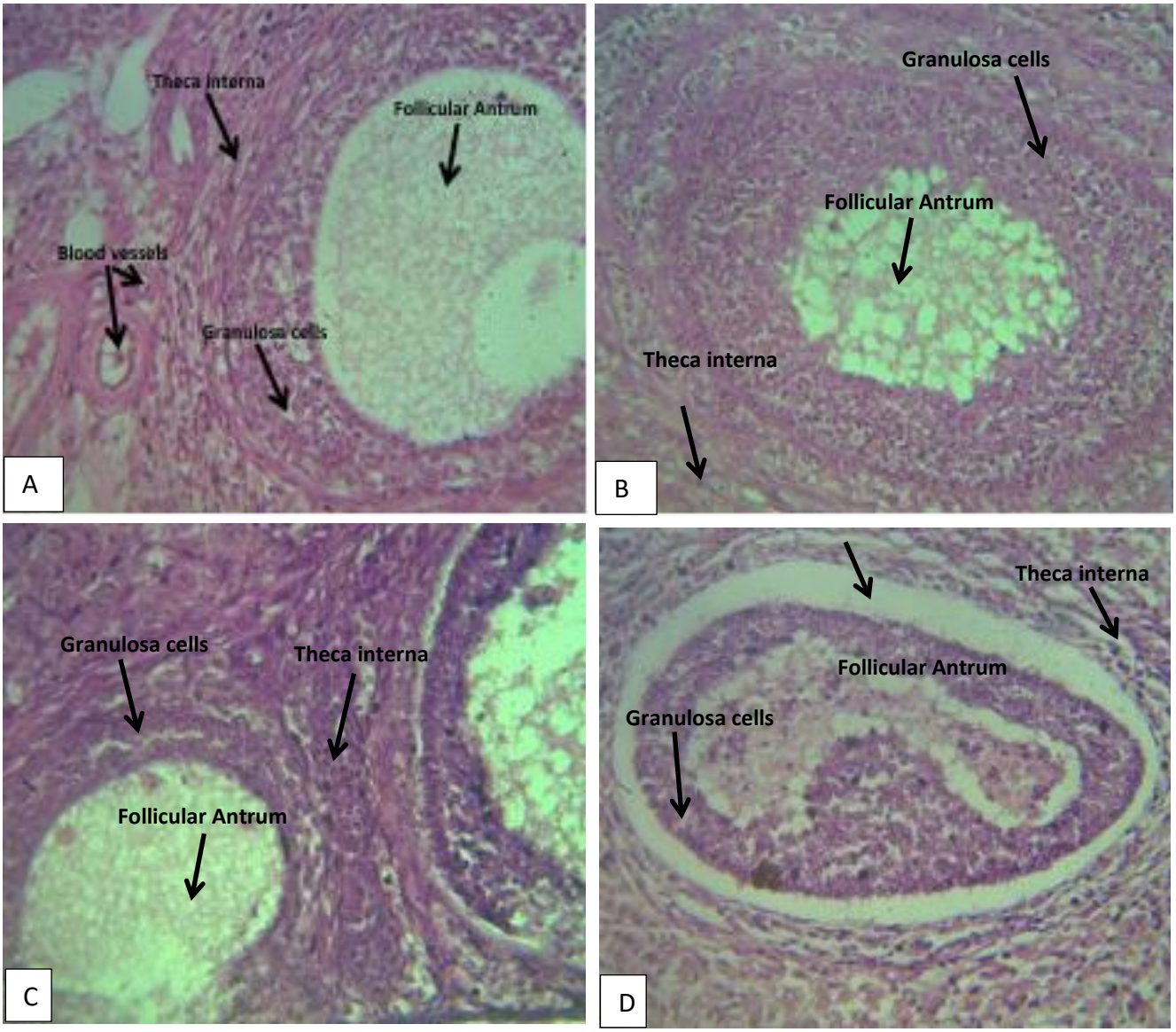


Plate 3:(Day 63) Photomicrography of the Ovary; showing **A) Control:** Normal ovarian with the blood vessels and the granulosa cells surrounding the secondary follicles**. B) Group2.** ***T. Fructicosum*****:** Second degree atretic distortion with apoptotic appearance of the granulosa cells within the Graafian follicle with no presence of primary oocyte**. C) Group 3.** ***G. Africanum*****:** Degeneration of the ovarian tissue with necrotic interstitial and granulosa cells surrounding the graafian follicles (arrows)**. D) Group 4. Combined,** ***T. Fructicosum*** **and** ***G. Africanum:*** Mild atretic distortion with reduced thickness of the theca internal with vacuolations within the interstitial with no follicular.

© 2026 The Author(s)

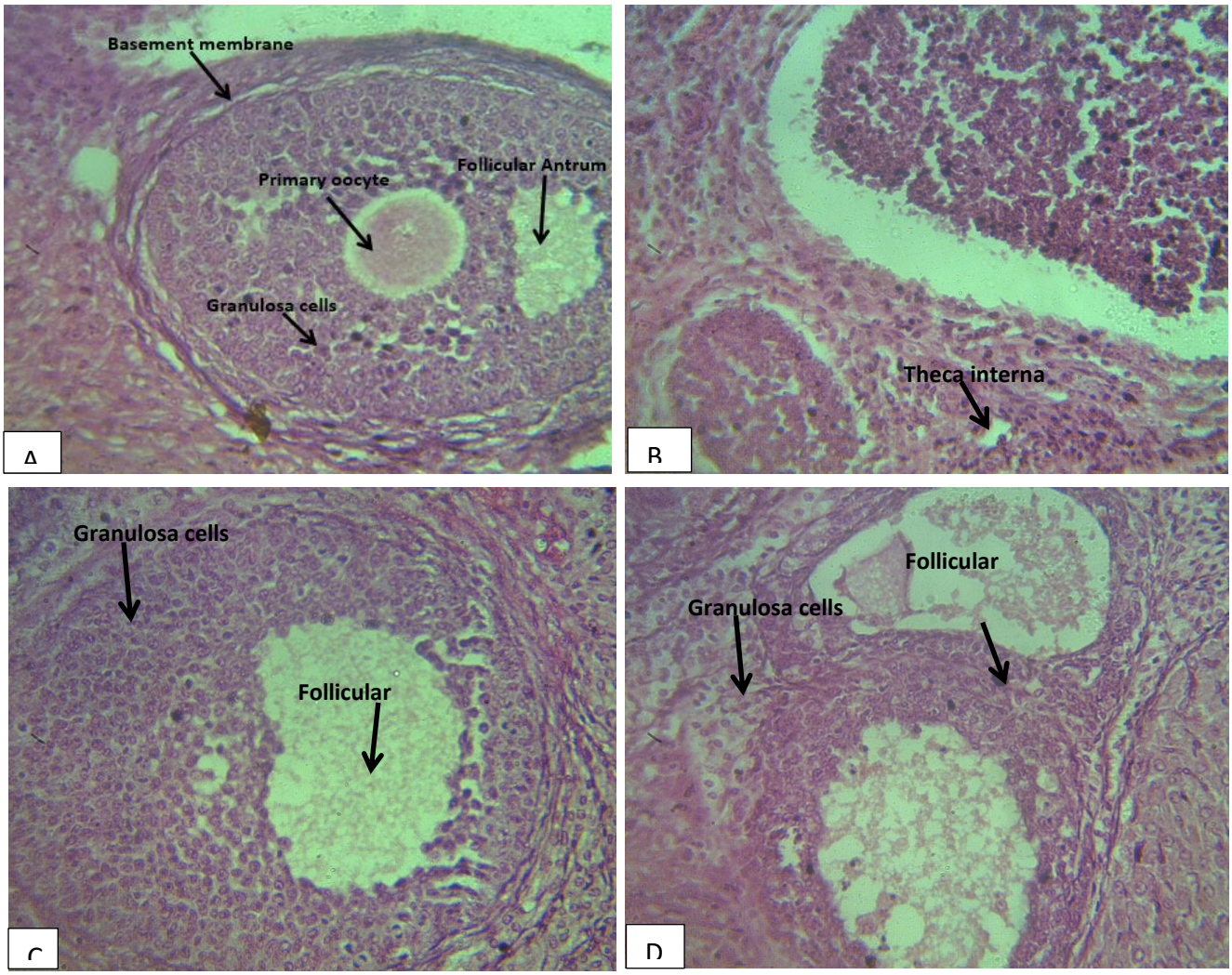


Plate 4: (Day 84) Photomicrography of the Ovary; showing **A) Control:** Ovary with the secondary follicles having integrated granulosa cells (GC) within the antrum and primary oocyte with a non-differentiated corona radiata and zona pellucida**. B)** ***T. Fructicosum*****: Group2** Mild Distortion with follicular demarcation with gross thickening of the thecal internal and blood deposits within the antrum with clear interstitial cells of the ovary (arrows) **C)** ***G. Africanum*****: Group3.** Moderate atretic distortion and necrotic appearance of granulosa cells. **D) Combined, Group4.** ***T. Fructicosum*** **and** ***G. Africanum:*** No observable lesions with organized granulosa cells lining the graafian follicles

Table 1: Stereological assessment

Groups	Source of variation between groups(ss)	Source of variation within groups (ss)	Df	Df	Ms	Ms	F	P-value	F-critical
RATS 1	12.84	486.05	3	2687	4.28	1.81	2.364	0.069	2.61
RATS 2	8.92	4113.12	3	2205	2.97	1.87	1.594	0.189	2.61
RATS 3	3.46	2677.17	3	1281	1.15	2.09	0.552	0.646	2.61
RATS 4	8.58	1217.86	3	768	2.86	1.57	1.803	0.145	2.61

© 2026 The Author(s)

Table 1 shows the results of the ANOVA analysis of differences in ovarian cell-based stereological parameters in the four experimental groups. In this table, between- and within-groups sum of squares, degrees of freedom, mean squares, and resulting F-values are compared. For the four groups of rats, p-values were greater than 0.05, showing no evidence of statistically significant differences in cellular morphometric indices like cell area, perimeter, and global tissue structure. However, small differences among groups reflect subtle extract-induced changes in cellular structure consistent with observed histological changes, especially those observed in the *Gnetum africanum* exposed tissues.

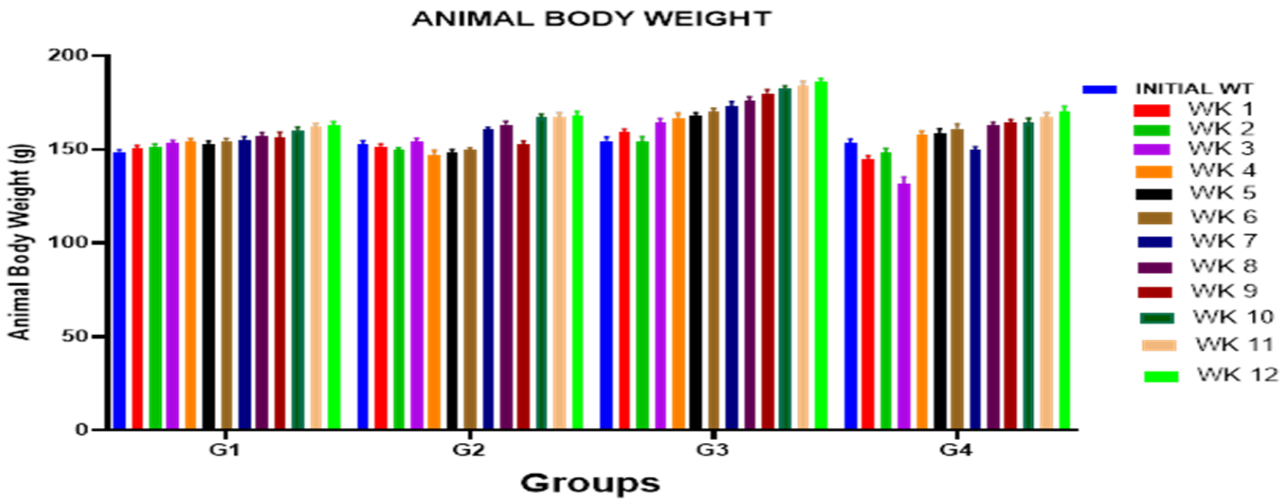


Fig 1. Bar chart showing animal body weight across all groups for the 12weeks period.

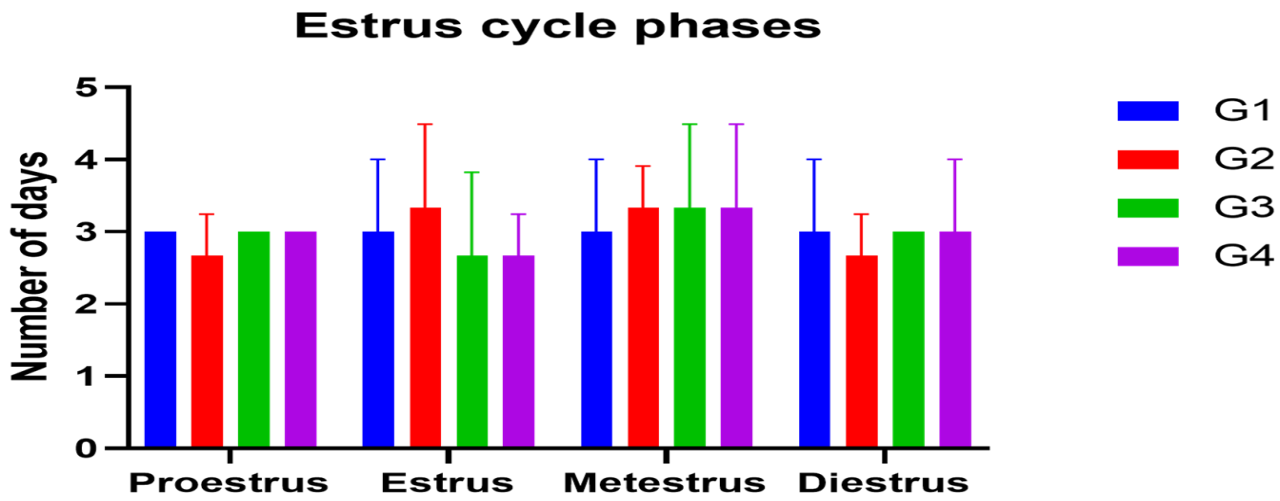


Figure 2. Assessment of Animal estrus cycle phases

Across all groups, the proestrus and estrus phases showed slight variations in the mean cycle length for each group but no statistically significant difference. For the metestrus and diestrus phases all groups maintained a comparable cycle length, indicating extracts did not disrupt the cycle when compared to the control.

© 2026 The Author(s)

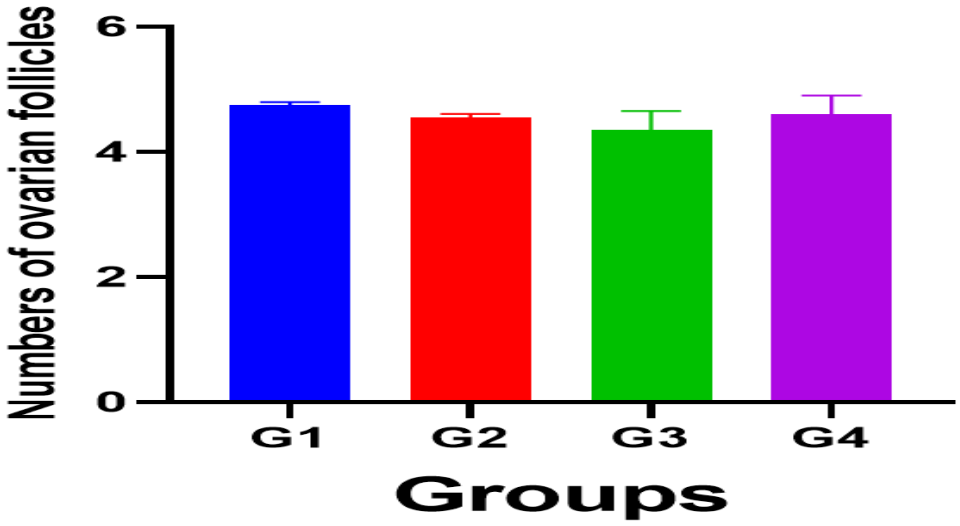


Figure 3. Histomorphometry Quantification summary of cell count in the ovarian tissues.

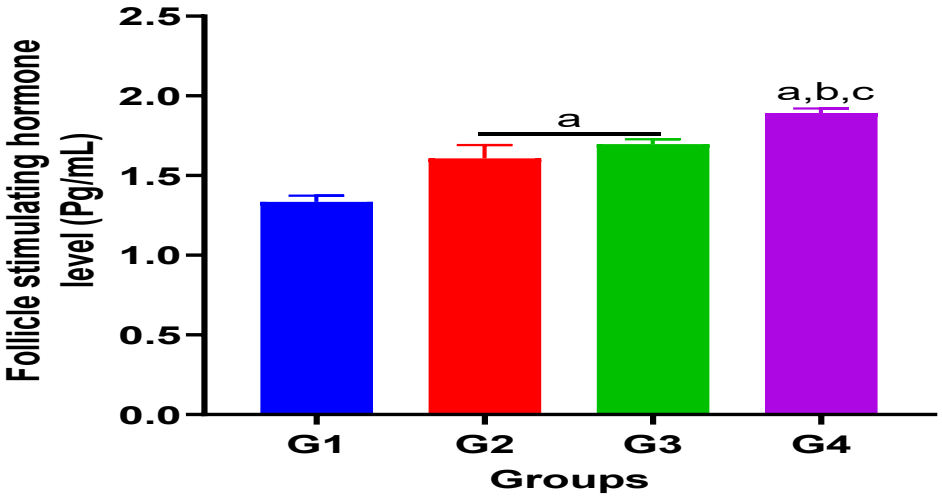


Figure 4. A Bar chart showing the mean concentration of (FSH) follicle stimulating hormone in Pg/mL across groups.

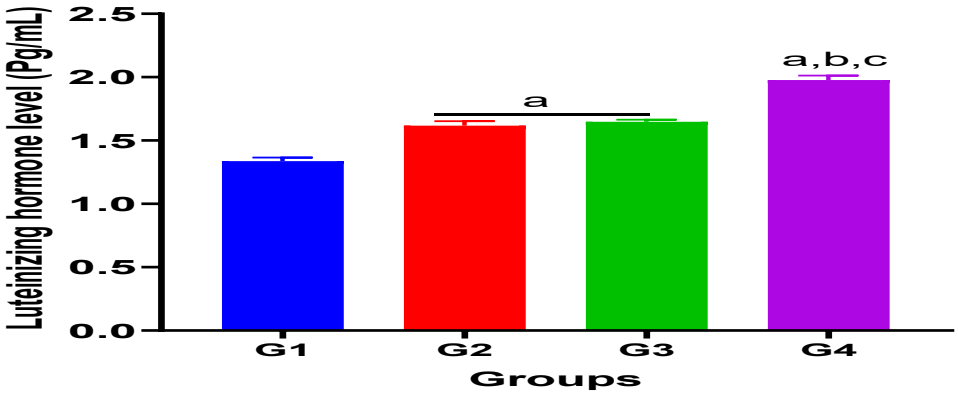


Figure 5. A Bar chart showing the mean concentration of (LH) luteinizing hormone in Pg/mL across groups.

© 2026 The Author(s)

Table 2: Showing the effects of Leaf extract on the levels of estrogen across groups of Wistar Rat

	Group	Mean concentration of estrogen ± SD (Pg/mL)	Mean Concentration of estrogen ± SEM (Pg/mL)	Minimum concentration of estrogen in the blood (Pg/mL)	maximum concentration of estrogen in the blood (Pg/mL)
1	(Control)	1.34 ± 0.50	1.34 ± 0.24	0.67	1.75
2	(Waterleaf extract)	1.61 ± 0.33	1.61 ± 0.16	1.17	1.95
3	(Okazi extract)	1.65 ± 0.85	1.65 ± 0.42	0.52	2.35
4	Okazi + waterleaf extract)	1.98 ± 0.66	1.98 ± 0.33	1.38	2.92

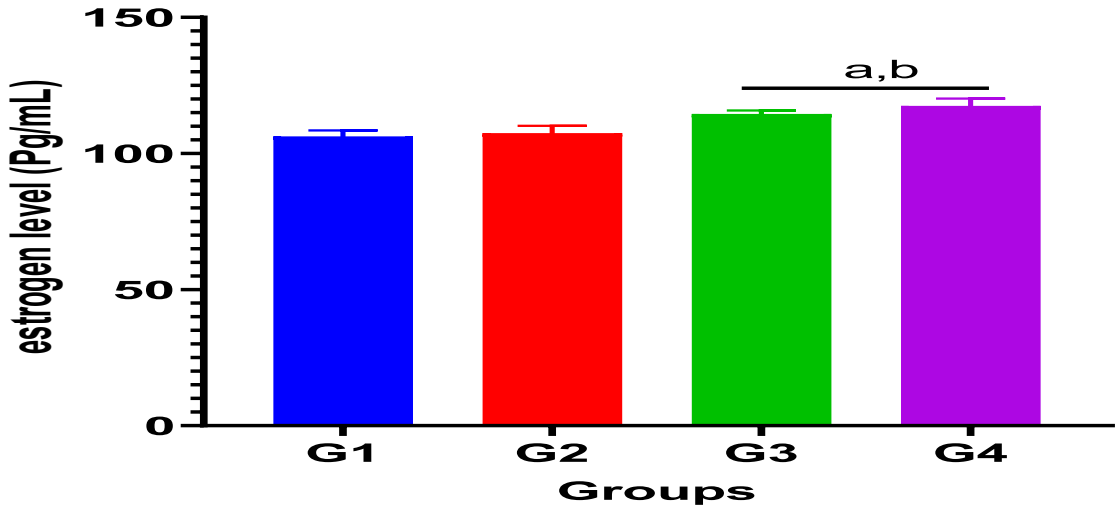


Figure 6. A Bar chart showing the mean concentration of (LH) luteinizing hormone in Pg/mL across groups.

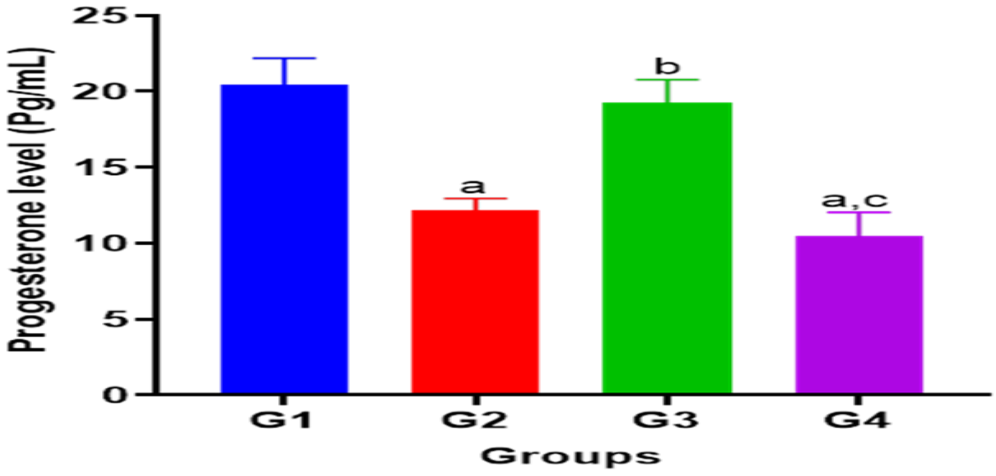


Figure 6. A Bar chart showing the mean concentration of progesterone in Pg/mL across groups.

© 2026 The Author(s)

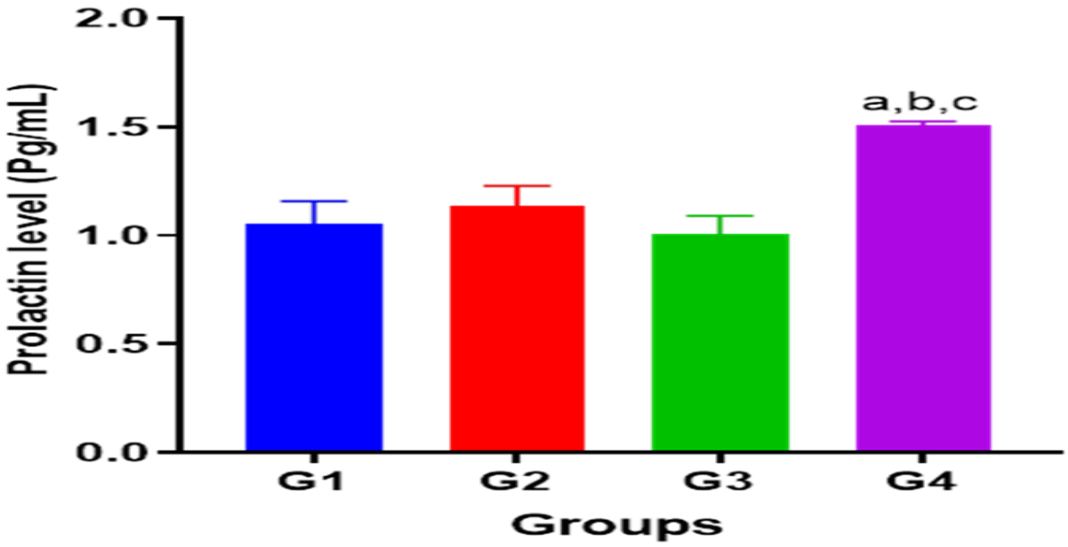


Figure 7. A Bar chart showing the mean concentration of Prolactin in Pg/mL across groups.

DISCUSSION

The study investigated the effects of *Talinum fructicosum* and *Gnetum africanum* on the ovarian tissue of female Wistar rats over a 12-week exposure period. The results show that the two commonly consumed leafy vegetables have differential and time-dependent effects on ovarian morphology, follicular integrity and cellular organization. It further provides implication in female. During the first week of exposure, T. fructicosum appeared to maintain normal follicular structure, including the layering of granulosa cells, the organization of theca interna, and the presence of a clearly marked primary oocyte. This shows that early exposure to T. fructicosum may enhance folliculogenesis stability. However, G. africanum triggered early morphological changes resulting in thinner theca interna, indistinct follicular boundaries, and vacuolation in the interstitial space. Such changes indicate compromised structural integrity and point toward potential cytotoxic effects of its bioactive components as an essential element in the production of androgen, which granulosa cells convert to estrogen. Therefore, structural damage can impair steroidogenesis and limit the ovary to support optimal follicular maturation.

In the second week, degenerative features became visible in the *G. africanum* group, with advanced granulosa cell necrosis, loss of the primary oocyte, and widespread interstitial degeneration by third week. These findings align with literature indicating that certain phytochemicals present in leafy vegetables such as saponins, alkaloids, tannins, flavonoids, and phenolic compounds may interfere with membrane stability, oxidative balance, and hormone-dependent cellular signaling (Ezekwe et al., 2020; Hossain et al., 2025). Prolonged exposure to such compounds can trigger apoptosis, impair follicular recruitment, and accelerate atresia. The advanced lesions observed in Day 63 and 84 strongly suggest cumulative toxicity associated with persistent consumption of *G. africanum*. The group consisting of combined extracts showed fluctuation across the study duration. Notably, in Week 1 and 3 revealed significant granulosa disorganization, reduced theca interna thickness and atretic lesions consistent with irregular hormonal profile in both FSH and LH. However, Weeks two and four exhibited an unexpectedly preserved ovarian structure, almost similar to normal follicular morphology. Also, the combined extract had the highest estrogen level among all groups. This increases may occur due to synergistic or antagonistic phytochemical interactions, promoting granulosa aromatase activity and modification of steroidogenic conversion pathways transiently. Moreover, high levels of estrogen can suppress FSH and LH release through negative

© 2026 The Author(s)

feedback, demonstrating the inconsistency in the gonadotropin trend across these time points (Herbison, 2020; Moenter and Starrett, 2024). Furthermore, the evidence from the study demonstrates that *G. africanum* has the strongest degenerative impact on ovarian tissue and endocrine function, while *Talinum fructicosum* exhibits milder effects. The

CONCLUSION

The study showed that chronic administration of aqueous extracts of Talinum fructicosum and Gnetum africanum to female Wistar rats induced distinct and time-dependent changes in ovarian morphology, follicular integrity, and reproductive hormonal regulation. Control showed a steady but moderate increase in body weight reflecting normal physiologic growth, no stimulatory/ inhibitory effects from plant extract. Slightly higher weights recorded in Group 2 compared to the control, phytochemicals like phenols, alkaloids, proteins and saponins may have enhanced nutrient uptake. Group 3 recorded the highest and most consistent increase in weight, flavonoids and alkaloids content may support better metabolic function. Group 4 showed moderate weight gain, suggesting a complementary effect, *Gnetum* may promote weight gain but Talinums detoxifying effect limited excess fat build up. Increase in weight following administration of leaf extracts also reported by (Udeh et al., 2018, Anaga et al., 2018, Callistus et al 2022).

Across all groups, the proestrus and estrus phases showed slight variations in the mean cycle length for each group but no statistically significant difference. For the metestrus and diestrus phases all groups maintained a comparable cycle length, indicating extracts did not disrupt the cycle when compared to the control. Saponins and alkaloids may alter luteal function or delay ovulation by interfering with pituitary gonadotropin secretion as seen in Group 2 rats treated with Talinum fructicosum with a prolonged estrus. Both *Talinum f.* and *Gnetum africanum* elevated FSH and LH concentration through the action of their bioactive phytochemicals like flavonoids, alkaloids, phenols and saponins. Group 2 had a moderate increase meaning mild stimulation of gonadotrophins. Group 3 had a higher increase meaning stronger stimulation supporting follicular development and ovulation. Group 4 has the highest increase meaning synergistic stimulation of FSH and LH. Flavonoids, phenols, can act as phytoestrogens binding to estrogen receptors and triggering mild feedback effect on the Hypothalamo-pituitary gonadal axis thereby increasing FSH and LH concentration. Increased estrogen levels in group 3 and 4 maybe due to the phytoestrogenic effects of flavonoids and phenolic compounds that mimic or enhance endogenous estrogen activity. Reduction in progesterone levels observed in group 2 and 4 may result from the presence of saponins and alkaloids which interfere with corpus luteum function and progesterone synthesis. *Gnetum africanum* appears to enhance both estrogen and progesterone production suggesting a hormone balancing or reproductive effect. Talinum fructicosum tends to suppress progesterone. Both extracts are rich in flavonoids, phenols, alkaloids, saponins and glycosides, which are known to influence reproductive hormones. Group 4, significant increase in prolactin indicating synergistically enhanced pituitary activity. Elevated prolactin maybe associated with estrogenic stimulation of the anterior pituitary, since estrogen is known to promote prolactin synthesis and release (Oladimeji et al., 2017). Histology and histomorphometry of ovarian follicles remained insignificantly unaffected across groups indicating no adverse effect on follicular structure and count or ovulation potential. The findings from the hormonal assay, weight of rats, histological and histomorphometry analysis revealed that the extracts had distinct but complementary effects on the female reproductive system and pituitary regulation. It also provided insights into their potential reproductive implications, which could be dependent on the mechanisms of action, optimal dosages and duration of exposure to the extract. *Talinum fructicosum* demonstrated a fertility- enhancing potential, while *Gnetum africanum* exhibited mild antifertility effects. The combination of both produced synergistic outcomes. In conclusion depending on the concentration and duration of exposure, these findings scientifically support the ethnobotanical uses of the plants and highlight their potential in fertility regulation as the and natural contraceptive development in the near future. It recommended that extended research which should include mating and implantation studies following extended duration and dosages

© 2026 The Author(s)

to determine fertility outcomes and reversibility be done to clarify their fertility effects in future research

Declarations

Ethics approval and consent to participate:

Consent for publication:

Availability of data and materials:

Authors' contributions:

Acknowledgements:

Funding:

Competing interests: The author declares no conflict of interest.

Use of artificial intelligence or AI-assisted technologies:

Reporting guideline:

REFERENCES

Akin-Osanaiye, B. C., Ekpeyong, E. J., & Olobayotan, I. W. (2019). Phytochemical and antimicrobial screening of Gnetum africanum stem and root. *International Journal of Pathogen Research*, *3*(2), 1-11.

Chen, S. S., Michael, A., & Butler-Manuel, S. A. (2012). Advances in the treatment of ovarian cancer—A potential role of anti-inflammatory phytochemicals. *Discovery medicine*, *13*(68), 7-17.

Dada, T., Otitoloju, K., Adjonu, R., Crockett, J., & Nwose, U. (2021). Nutritional and medicinal values of common green leafy vegetables consumed in Delta state, Nigeria: A review. *International Journal of Community Medicine and Public Health*, *8*(5), 2564-2571.

Ezekwe, A. S., Ugwuezumba, P. C., Nwankpa, P., Egwurugwu, J. N., Ekweogu, C. N., Emengaha, F., & Akukwu, D. (2020). Qualitative phytochemical screening, gcms studies and in-vitro anti-oxidative properties of aqeuous leaf extract of Gnetum africanum. *Journal of Drug Delivery and Therapeutics*, *10*(1), 11-17.

Herbison, A. E. (2020). A simple model of estrous cycle negative and positive feedback regulation of GnRH secretion. *Frontiers in neuroendocrinology*, *57*, 100837.

Hoffmann, K. H. (2018). Oogenesis and the female reproductive system. In *Insect reproduction* (pp. 1-32). CRC Press.

Hossain, M. S., Wazed, M. A., Asha, S., Amin, M. R., & Shimul, I. M. (2025). Dietary phytochemicals in health and disease: Mechanisms, clinical evidence, and applications—a comprehensive review. *Food Science & Nutrition*, *13*(3), e70101.

Hummitzsch, K., Irving-Rodgers, H. F., Schwartz, J., & Rodgers, R. J. (2019). Development of the mammalian ovary and follicles. In *The ovary* (pp. 71-82). Academic Press.

Khaing, Y. Y., & Moe, M. M. (2019). Morphological, Microscopical Characters and Antioxidant activity of leaves of Talinum fruticosum (L.) Juss. In *2nd Myanmar Korea Conference Research Journal* (Vol. 1, pp. 540-550).

Kimiywe, J., Waudo, J., Mbithe, D., & Maundu, P. (2007). Utilization and medicinal value of indigenous leafy vegetables consumed in urban and peri-urban Nairobi. *African Journal of food, agriculture, nutrition and development*, *7*(4), 1-15.

Lavecchia, T., Rea, G., Antonacci, A., & Giardi, M. T. (2013). Healthy and adverse effects of plant-derived functional metabolites: the need of revealing their content and bioactivity in a complex food matrix. *Critical Reviews in Food Science and Nutrition*, *53*(2), 198-213.

Ma, L., Shen, W., Zhang, J., Ma, L., Shen, W., Shen, W., ... & Zhang, J. (2023). The life cycle of the ovary. In *Ovarian aging* (pp. 7-33). Singapore: Springer Nature Singapore.

Madubogwu, N., Ajaghaku, D. L., Okoye, N. N., Unekwe, P. C., Proksch, P., & Okoye, F. B. C. (2025). A flavone C-glycoside, the major component of Gnetum africanum leaf extract, displayed strong immunomodulatory activity. *South African Journal of Botany*, *178*, 28-32.

Maseko, I., Mabhaudhi, T., Tesfay, S., Araya, H. T., Fezzehazion, M., & Plooy, C. P. D. (2017). African leafy vegetables: A review of status, production and utilization in South Africa. *Sustainability*, *10*(1), 16.

Moenter, S. M., & Starrett, J. R. (2024). Estradiol action in the female hypothalamo–pituitary–gonadal axis. *Journal of Neuroendocrinology*, *36*(10), e13390.

Ohiagu, F. O., Chikezie, P. C., & Chikezie, C. M. (2021). Toxicological significance of bioactive compounds of plant origin. *Pharmacognosy Communications*, *11*(2), 67-77.

Oluba, O. M., Adebiyi, F. D., Dada, A. A., Ajayi, A. A., Adebisi, K. E., Josiah, S. J., & Odutuga, A. A. (2019). Effects of Talinum triangulare leaf flavonoid extract on streptozotocin-induced hyperglycemia and associated complications in rats. *Food science & nutrition*, *7*(2), 385-394.

© 2026 The Author(s)

Orsi, N. M., Baskind, N. E., & Cummings, M. (2024). Anatomy, development, histology and normal function of the ovary. In *Pathology of the ovary, fallopian tube and peritoneum* (pp. 1-33). Cham: Springer International Publishing.

Pundir, M., Sharma, A., & Kumar, J. (2022). Phytochemicals used as inhibitors in the treatment of ovarian cancer: A Mini-review. *Materials Today: Proceedings*, *48*, 1620-1625.

© 2026 The Author(s)