2026 Volume: 02 Issue: 04 www.ijrpa.com ISSN 2456-9995 Case Study

International Journal Research Publication Analysis

Page: 01-22

IMPACT OF PHOENIX DACTYLIFERA ON REPRODUCTIVE ORGANS AND HORMONAL LEVELS IN MALE WISTAR RATS: A PHYSIOLOGICAL STUDY

[1]Ogbonnaya Mba Arunsi *[2]Erienu Kennedy Obruche, [3]Ikechukwu Sampson Chikwe, [4]Onuh Obinna Francis, [5]Odimgbe Ezekiel Izudike, [6]Etus Patrick Chimuanya,[7]Oguike Victor Chinwem and [8]Madu Kenneth Chibuike

[1]Department of Medical Laboratory Science, Abia State University, Uturu

[2]Department of chemistry, Delta State College of Education, Mosogar.

[3,7,8] Department of Science Laboratory Technology, Imo State Polytechnic, Omuma

[4]Department of Public Health, Federal University of Technology, Owerri

[5]Department of Industrial Chemistry, Ebonyi State University, Abakaliki

[6]Department of Microbiology, Ebonyi State University, Abakaliki

Article Received: 15 March 2026
Article Revised: 05 April 2026
Published on: 25 April 2026

***Corresponding Author: Erienu Kennedy Obruche**
Department of chemistry, Delta State College of Education, Mosogar.

DOI: https://doi-doi.org/101555/ijrpa.3552

ABSTRACT

This study aimed to assess the effects of aqueous extracts from dry date palm (Phoenix dactylifera) fruit on the reproductive organs and hormonal profiles of male Wistar rats. Twenty rats were divided into four groups, with one control group receiving distilled water and three experimental groups treated with 250 mg/kg, 500 mg/kg, and 1000 mg/kg of the extract for 35 days. At the end of the experiment, rats were sacrificed, and blood samples were collected for hormonal assays (testosterone, follicle-stimulating hormone (FSH), and luteinizing hormone (LH)). Semen was collected for sperm count, motility, and morphology analysis, and tissue samples from the testes, epididymis, seminal vesicles, and prostate were examined. Morphometric analysis was performed on seminiferous tubular diameter, interstitial size, and epididymal epithelial thickness. The results showed a significant decrease in serum testosterone levels, sperm count, motility, and morphology in the experimental groups compared to the control. Additionally, there were structural changes, including a reduction in interstitial size and epididymal epithelial thickness, as well as degeneration of Leydig cells and distortion of spermatogenic cells. However, FSH and LH levels were unaffected. The study concluded that the aqueous extract of date palm fruit may cause

infertility in male rats by affecting Leydig cells and disrupting testosterone production, sperm quality, and reproductive organ structure.

KEYWORDS: Phoenix Dactylifera, Reproductive Organs, Hormonal, Rats, Physiological.

INTRODUCTION

The study of plant-based interventions in medicine has gained increasing attention in recent years due to their potential therapeutic effects across a wide range of biological systems. Among these, *Phoenix dactylifera*, commonly known as the date palm, is one of the most widely cultivated and nutritionally valued plants (Obruche et al., 2025). Known for its rich content of vitamins, minerals, and bioactive compounds, date palm has traditionally been utilized in various cultures for its purported health benefits, including enhancing fertility and improving reproductive health (Etus and Erienu, 2026). The reproductive system, particularly in males, is highly sensitive to changes in diet, environmental factors, and hormonal fluctuations. Male reproductive health is primarily regulated by a complex interplay between the hypothalamic-pituitary-gonadal (HPG) axis, which influences the secretion of key hormones such as testosterone, luteinizing hormone (LH), and follicle-stimulating hormone (FSH). Any disturbances in this hormonal balance can lead to significant alterations in reproductive function and fertility (Agboola & Adejumo, 2013). In this context, *Phoenix dactylifera* has been explored for its potential effects on male reproductive health. Previous studies suggest that date palm may possess antioxidant, anti-inflammatory, and hormonal-modulating properties, all of which could influence reproductive organs and hormonal profiles (Akunna et al., 2012; Sarah et al., 2026). However, the specific effects of *Phoenix dactylifera* on male reproductive organs and hormones remain largely understudied, particularly in controlled experimental models such as laboratory rats (Chao & Krueger, 2007). This study aims to investigate the effects of *Phoenix dactylifera* on some reproductive organs and hormonal profiles of male Wistar rats. Wistar rats, a widely used animal model in pharmacological and physiological research, offer an ideal platform to examine these potential effects (Erienu et al., 2022). The objective is to elucidate how the consumption of *Phoenix dactylifera* might influence key reproductive organs such as the testes and epididymis, as well as hormonal parameters including serum testosterone levels, LH, and FSH. By doing so, this research seeks to contribute valuable insights into the potential role of *Phoenix dactylifera* as a natural agent for modulating male reproductive health.

MATERIALS AND METHOD

Materials

The equipment used include: Rotary Microtome (Leica RM 2125RT Austria), Centrifuge Machine (MSE 846307 England), Chemical balance (ACCULAB Sartorius group United States of America USA). Sensitivity = 0.001g), Microscope (Leitz Wetzlar HM-Lux Wetzlar, Germany), Am Scope (3.0.0.5 USA), Ocular/Stage micrometer (Graticules Ltd. Tombridge Kent England), Haemocytometer (Hawksley Christalite), Heamatoxylin, eosin, Bouin's fluid, neutral buffered formalin, Dissecting set, needles and syringes (1ml, 5ml and 10 ml), mortar, cages, feeders, surgical blades ETC.

Animals and plant materials

Twenty (20) male Wistar rats (122-134 g) were purchased from the Animal House, Department of Human Anatomy, Faculty of Medicine, Ahmadu Bello University (ABU), Zaria, Kaduna State, Nigeria. The date palm fruit was purchased from Samaru market in Zaria Kaduna State. Identification and authentication of the fruit was donein the herbarium section of the Department of Biological Sciences, Ahmadu Bello UniversityZaria, Kaduna Stateand was given Voucher number of 4032 (Etus and Erienu, 2026).

METHODS

Experimental Design

The Wistar Rats were kept in metal cages located in the Animal House of the Department of Human Anatomy at Ahmadu Bello University Zaria. They were maintained on a 12-hour light and 12-hour dark cycle and were provided with standard feed pellets (Growers mash, Vital Feed, Grand Cereal, Nigeria) along with water available ad libitum. The rats underwent a two-week acclimatization period in the animal house before the commencement of the experiment. Subsequently, the rats were randomly assigned into four groups, each consisting of five rats. The control group (Group I) received distilled water, while Groups II-IV were administered the extract at dosages of 250 mg/kg, 500 mg/kg, and 1000 mg/kg, corresponding to 5%, 10%, and 20% of the LD50, respectively, via oral intubation once daily for a duration of 35 days (Mehrabane et al., 2014; Okpanachi et al., 2025).

Preparation of Extract

The aqueous extraction of the fruit of Phoenix dactylifera was performed in the Department of Pharmacognosy at Ahmadu Bello University Zaria, Kaduna State, following the methodology outlined by Obruche et al. (2019) and Nathan et al., (2025). The fruit was

opened, and the fleshy portion was dried in an oven at 50°C and subsequently ground into a powder. This powder was then soaked in a maceration apparatus with distilled water for 24 hours, filtered, and allowed to settle. The resulting solution was decanted and dried in an oven at 50°C.

Acute Toxicity (LD50) Study

The acute toxicity (LD50) study of the aqueous extract of Phoenix dactylifera fruit was carried out as previously described by Chao and Krueger, (2007) and Jacintha et al.,(2025), utilizing the Organization for Economic Cooperation and Development (OECD) guidance document on humane endpoints aimed at reducing the overall suffering of animals involved in toxicity testing. Four Wistar rats were divided into two groups of two rats each and were administered the aqueous extract of Phoenix dactylifera at dosages of 2500 mg/kg and 5000 mg/kg, respectively, and monitored for 72 hours to determine any mortality.

Table 1: Animal grouping, concentration, and frequency of administration of Phoenix dactylifera to Male Wistar Rats.

Groups	Number of Rats	Dosage	Duration
Group I	5 Rats	Distilled Water	35 days
Group II	5 Rats	250 mg/kg	35 days
Group III	5 Rats	500 mg/kg	35 days
Group IV	5 Rats	1000 mg/kg	35 days

All animals were sacrificed on the 36th day through cervical dislocation, after which the testes, epididymis, seminal vesicle, and prostate gland were dissected and weighed utilizing a chemical balance (ACCULAB Sartorius group USA, Sensitivity = 0.001g). The testes were preserved in Bouin's fluid, while the epididymides, seminal vesicles, and prostate glands were fixed in neutral buffered formalin (NBF). All tissues were embedded in paraffin wax, sectioned at 5 µm using a rotary microtome (Leica RM 2125 RT Austria), and stained with hematoxylin and eosin (H and E).

Tissue processing

This tissues processing was conducted in accordance with Francis et al. (2007). The tissues underwent processing in the Department of Histopathology at Ahmadu Bello University, Zaria, Kaduna State, Nigeria. They were subjected to graded alcohol solutions of 30%, 50%, 70%, and 90% for 2 minutes each. Subsequently, the tissues were embedded in molten paraffin wax using tissue blocks and allowed to cool and solidify. The sections were cut using

a rotary microtome at 5µm and cleared in two changes of xylene for 3 minutes each. The sections were then placed in graded alcohol solutions of 90%, 70%, and 50% for 2 minutes each.

Hematoxylin and Eosin staining

The procedure for hematoxylin and eosin staining adhered to the methodology established by Gatti et al., (2004) and Obruche et al. (2019). The sections were immersed in water and stained with Mayer's hematoxylin for 10 minutes. They were then washed in water and bleached in tap water for 2 minutes, followed by another wash in tap water. The sections were counterstained with eosin for 60 seconds and differentiated through changes of ethanol. They were placed in absolute alcohol for 2 minutes, cleared in two changes of xylene for 2 minutes each, and finally mounted with DPX.

Morphometric Study

The diameter of the seminiferous tubules, the size of interstices, and the thickness of the epididymal epithelium were measured using a standardized ocular micrometer (Graticules Ltd. Tonbridge Kent England) in the Department of Microbiology at Ahmadu Bello University, Zaria, Kaduna State, Nigeria. Five slides were examined for each rat, with five distinct measurements taken from each slide. The average of these measurements across the five slides was considered the representative value for each rat. The diameter of the seminiferous tubules was measured at a magnification of X100, while the dimensions of the interstices and the thickness of the epididymal epithelium were assessed at X400. A stage micrometer was positioned on the microscope alongside the ocular micrometer in the eyepiece. The number of grids or lines on the ocular micrometer that corresponded to Xµm on the stage micrometer was recorded. After removing the stage micrometer, a slide was placed on the microscope. The seminiferous tubules, interstices, and epididymal epithelium were aligned with the grids or lines of the ocular micrometer when viewed under the microscope for each slide. The counts of grids or lines were documented for the seminiferous tubule, interstices, and epididymal epithelium (for the interstices, the average of length and breadth was utilized as the measurement). The values obtained were subsequently employed to calculate the diameter of the seminiferous tubules, the size of the interstices, and the thickness of the epididymal epithelium in micrometers.

Semen Analysis

The semen analysis was performed following the methodology outlined by Ismail and Radzi, (2013). The right epididymis was teased apart and placed in a vessel containing 5ml (9.5%) normal saline to create a suspension. A pipette was utilized to transfer the suspension onto an improved Neubauer haemocytometer (Hawksley Christalite), which was equipped with a cover slip and positioned under the microscope for counting. A smear was prepared on a glass slide, from which cresyl fast violet staining and Feulgen nuclear reaction were conducted to examine sperm morphology by counting in various fields.

Hormonal Profile

This tissues processing was conducted in accordance with Jaswir et al. (2011). A blood sample was obtained from the heart using the cardiac puncture technique and collected in a plain bottle. It was then centrifuged at 2500 rpm xg for 5 minutes with a centrifuge machine (MSE 846307 England), and the resulting serum was utilized to measure the levels of testosterone, FSH, and LH through an enzyme-linked immunosorbent assay (ELISA) kit (Testosterone) from Crystal Chem Inc. USA and Elabscience Biotechnology Ltd. China (FSH and LH), following the manufacturer's guidelines.

Statistical Analysis

The data are presented as Mean ± SEM (standard error of the mean) and were analyzed using the Instat Statistic Package version 3 (Graph Pad). A one-way analysis of variance (ANOVA) was employed to assess the mean differences between and within the groups, with a P-value ($P<0.05$) deemed statistically significant.

RESULTS DISCUSSION

Acute Toxicity (LD50) Study

No fatalities were observed in rats administered with the aqueous extract of Phoenix dactylifera at doses of 2500 mg/kg and 5000 mg/kg after 72 hours of treatment. The extract demonstrates a considerable safety margin.

Effect of Aqueous Extract of Phoenix dactylifera on the Hormonal Profiles of Male Wistar Rats.

Table 2: indicates a significant reduction in testosterone levels between the control group (2.02±0.07 ng/ml) and the rats treated with aqueous Phoenix dactylifera extract at doses of 250 mg/kg, 500 mg/kg, and 1000 mg/kg (1.14±0.09 ng/ml, 1.00±0.11 ng/ml, and 1.14±0.09

ng/ml, respectively) at P≤0.05, with no significant differences in FSH and LH levels between the control and treated groups.

Table 2: Levels of Testosterone, FSH and LH of Rats treated with Aqueous Extract of *Phoenix dactylifera.*

Groups	Testosterone (ng/ml)	FSH (mlµ/ml)	LH (mlµ/ml)
Control	2.02±0.07[a]	0.41±0.015	0.59±0.012
250 mg/kg	1.14±0.09[b]	0.39±0.014	0.58±0.012
500 mg/kg	1.00±0.11[b]	0.39±0.017	0.58±0.012
1000 mg/kg	1.14±0.09[b]	0..40±0.013	0.58±0.008

All values expressed as Mean±SEM. Values in the same column with different superscript are significantly different at P≤0.05 using one-way ANOVA.

The impact of the aqueous extract of Phoenix dactylifera on body weight, organ weight, and epididymal sperm count, motility, and morphology in male Wistar rats is presented in Table 3. The results indicated no significant differences in body and organ weights (including testes, epididymis, seminal vesicles, and prostate glands) between the control and treated groups of rats administered the aqueous extract of Phoenix dactylifera. However, a significant reduction in sperm count was observed when comparing the control group (130.14±8.18x10^6/ml) with the groups treated with the extract at dosages of 250 mg/kg, 500mg/kg, and 1000mg/kg body weight, which yielded counts of 93.90±3.08x10^6/ml, 91.15±3.33x10^6/ml, and 93.55±10.59x10^6/ml, respectively, at a significance level of P≤0.05. Furthermore, a notable decrease in sperm motility was recorded in the rats treated with the extract at the aforementioned dosages (79.50±8.51x10^6/ml, 70.75±4.03x10^6/ml, and 68.60±8.91x10^6/ml, respectively) when compared to the control group (116.60±7.43x10^6/ml), also at P≤0.05. Additionally, there was a significant decline in sperm morphology (normal sperm cells) in the treated rats at 250 mg/kg, 500 mg/kg, and 1000 mg/kg (74.49±1.38%, 79.59±0.75%, and 70.58±1.50%, respectively) in contrast to the control group (87.16±1.94%) at P≤0.05.

Table 3: Body Weight, Organs Weight and Epididymal Sperm Count, Sperm Motility and Sperm Morphology of Rats treated with Aqueous Extract of *Phoenix dactylifera.*

Parameters	Control	250mg/kg	Groups 500mg/kg	1000mg/kg
Body weight (g)	77.20±2.69	60.00±4.52	82.00±2.98	71.80±7.23
Left Testis (g)	0.740±0.033	0.748±0.012	0.692±0.016	0.638±0.024
Right Testis (g)	0.748±0.028	0.740±0.027	0.686±0.018	0.618±0.023

Left Epididymis (g)	0.506±0.292	0.196±0.014	0.160±0.014	0.180±0.014
Right Epididymis (g)	0.226±0.023	0.212±0.013	0.156±0.016	0.190±0.018
Left Seminal gland (g)	0.094±0.016	0.136±0.025	0.118±0.017	0.140±0.014
Right Seminal gland(g)	0.088±0.017	0.112±0.019	0.096±0.016	0.144±0.028
Prostate gland (g)	0.278±0.013	0.288±0.055	0.228±0.028	0.316±0.058
Sperm count $\times 10^6$/ml	130.14±8.18[a]	93.90±3.08[b]	91.15±3.33[b]	93.55±10.59[b]
Sperm Motilityx10^6/ml	116.60±7.43[a]	79.50±8.51[b]	70.75±4.03[b]	68.60±8.91[b]
Sperm Morphology Normal sperm (%)	87.16±1.94[a]	74.49±1.38[b]	79.59±0.75[b]	70.58±1.50[b]

All values expressed as Mean±SEM. Values with different super script in the same row are significantly different at P≤0.05 using one-way ANOVA.

Sperm Morphology

The result showed significant decrease in percentage of sperm cells with normal morphology in rats treated with aqueous extract of Phoenix dactylifera at 250 mg/kg, 500 mg/kg and 1000 mg/kg compared to that of control rats. The abnormal sperm cells observed include no tail, no head and coiled tails (figures 1, 2 and 3).

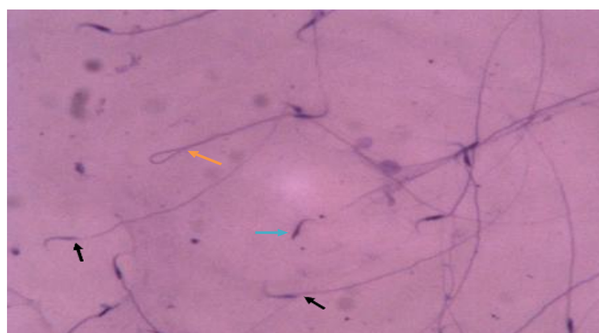

Figure 1: Photomicrograph of sperm cells of rats treated with *Phoenix dactylifera extract* at 1000 mg/kg in a field;showing normal sperm cells (black arrows), no tail (light blue arrow) and coiled tail (orange arrow) cresyl fast violent stain x400.

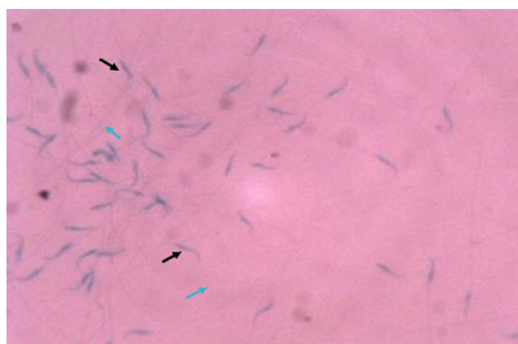

Figure 2: Photomicrograph of sperm cells of control rats in a field; showing normal cells with the head/mid piece (black arrows) stained green and a pale tail (light blue arrows) fuelgen stain x400.

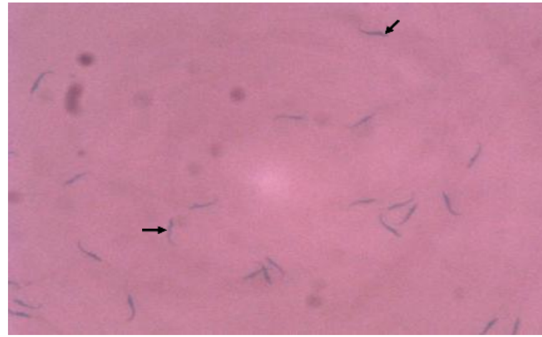

Figure 3: Photomicrograph of sperm cells of rats treated with *Phoenix dactylifera* at 1000 mg/kg in a field; showing scanty sperm cells without tail (black arrows) fuelgen stain x400.

Histopathology

The photomicrograph depicting the testes of control rats revealed the characteristic structure of the seminiferous tubules, showcasing the various stages of spermatogenesis, from spermatogonia to fully developed sperm cells (figure 4). In contrast, the testes of rats administered Phoenix dactylifera at dosages of 250 mg/kg and 500 mg/kg exhibited distortion in spermatogenic cells (figures 5 and 6) when compared to the control group. Furthermore, rats treated with the extract at a dosage of 1000 mg/kg displayed degeneration of Leydig cells and the seminiferous tubular capsule (figure 7) relative to the control (figure 4). The epididymis of control rats maintained a normal architecture, characterized by ducts and an epithelial lining composed of simple columnar epithelium, along with normal sperm cells present within the duct lumen (figure 8). Conversely, the epididymis of rats treated with Phoenix dactylifera extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg demonstrated degeneration of sperm cells and vacuolated epithelial cells (figures 9, 10, and 11). The seminal vesicles of control rats exhibited no significant differences when compared to those of rats treated with Phoenix dactylifera extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg, with all groups displaying normal glandular structures and smooth muscle layers (figures 12, 13, 14, and 15). The prostate glands of control rats showed normal glandular structures, connective tissues, and smooth muscle layers (figure 16). However, the prostate of rats treated with Phoenix dactylifera at 250 mg/kg revealed degeneration of connective tissues and distorted glands (figure 17), while those treated with the extract at 500 mg/kg and 1000 mg/kg exhibited distorted glands lacking the typical convolutions (figures 18 and 19).

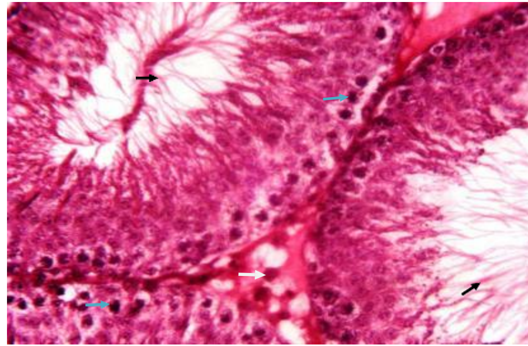

Figure 4: Photomicrograph of transverse section of the testis of control rats; illustrating the typical structure of the seminiferous tubule showing the stages of spermatogenesis, spermatogonia (light blue arrows), sperm cells (black arrows), and the interstitial cells of Leydig (white arrow) H and E x250.

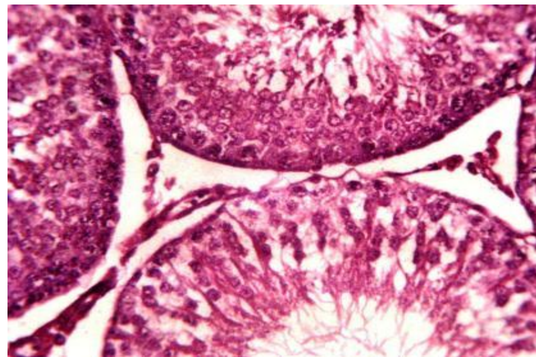

Figure 5: Photomicrograph of transverse section of testis of rats treated with aqueous *Phoenixdactylifera* extract at 250mg/kg; showing scanty sperm cells in the lumen of seminiferous tubule (black arrow), distortion of spermatogenic cells (light blue arrows) and compacted interstices (green arrows) H and E x250.

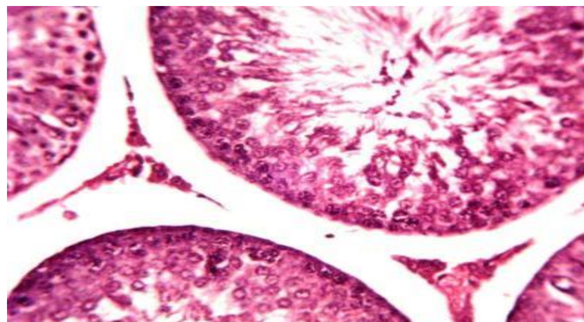

Figure 6: Photomicrograph of transverse section of the testis of rats treated with aqueous extract of *Phoenixdactylifera* at 500mg/kg; showing distorted sperm cells (black arows) within the lumen of seminiferous tubule and compacted interstices (Light blue arrows) H and E x250.

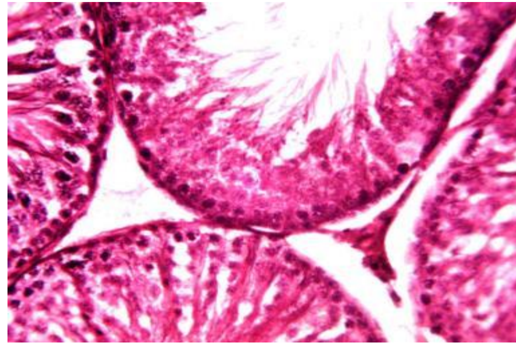

Figure 7: Photomicrograph of transverse section of testis of rats treated with aqueous *Phoenix dactylifera* extract at 1000mg/kg; showing seminiferous tubule with scanty sperm cells (black arrow), degeneration of capsule (green arrows), compacted interstices (light blue arrow),vacuolated cells (yellow arrows) and degeneration of leydig cells (orange arrow)H and E x250.

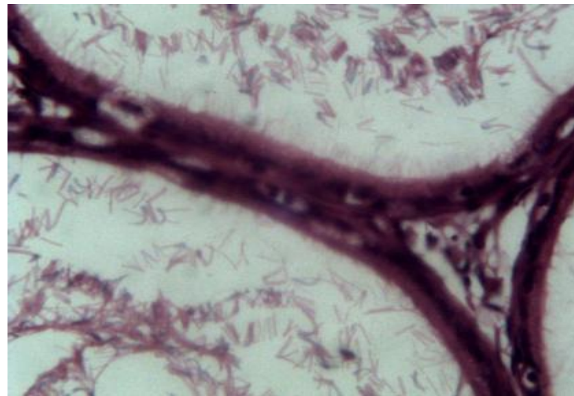

Figure 9: Photomicrograph of transverse section of epididymis of rats treated with aqueous extract of *Phoenix dactilifera at* 250mg/kg showing scanty and distorted sperm cells (black arrows) and vacuolated epithelial cell (Light blue arrow) H and E x40

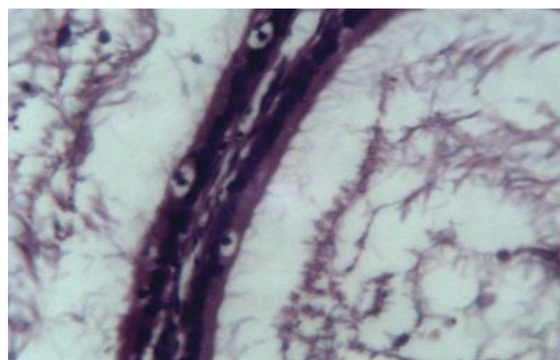

Figure 10: Photomicrograph of transverse section of epididymis of rats treated with *Phoenix dactylifera* at 500mg/kg; showing the lumen with scanty and distorted sperm cells (black arrows) and vacuolated epithelial cells (light blue arrows) H and E x400.

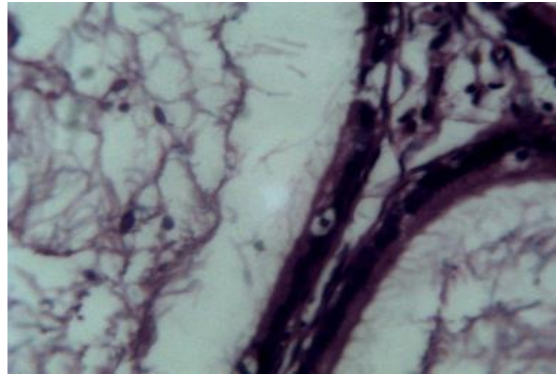

Figure 11: Photomicrograph of transverse section of epididymis of rats treated with aqueous extract of *Phoenix dactylifera* at 1000mg/kg; showing distorted and scanty sperm cells(black arrows),and epithelium with vacuolated cells (Light blue arrow)H and E x400.

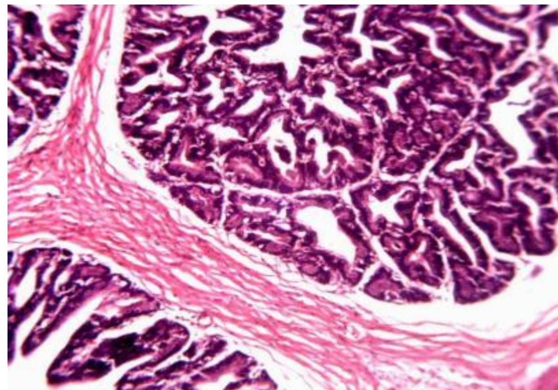

Figure 12: Photomicrograph of transverse section of seminal vesicle of control rats; illustrating the typical structure of the seminal vesicle showing the glands (light blue arrows) and smooth muscle (black arrows) H and E x100

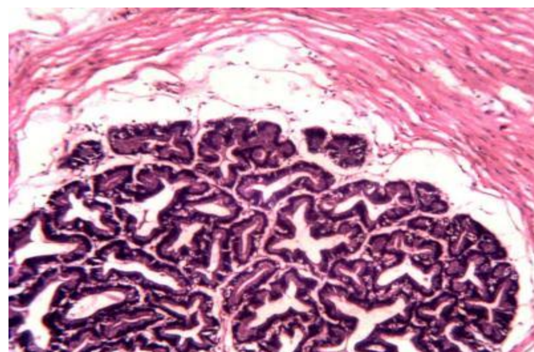

Figure 13: Photomicrograph of transverse section of seminal vesicle of rats treated with aqueous extract of *Phoenix dactylifera* at 250mg/kg; showing the normal architecture with normal glands (light blue arrows) and smooth muscle layer (black arrows) H and E x100.

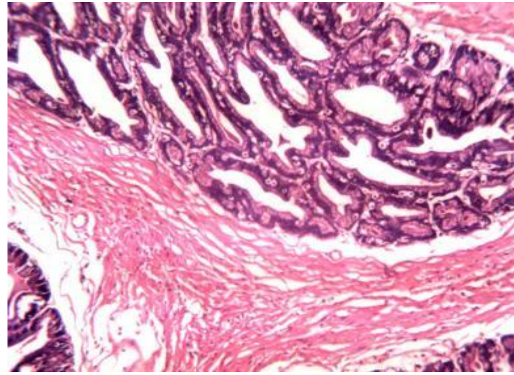

Figure 14: Photomicrograph of transverse section of seminal vesicle of rats treated with aqueous extract of *Phoenix dactylifera* at 500mg/kg showing normal glands (light blue arrows) and smooth muscles (black arrows) H and E x100.

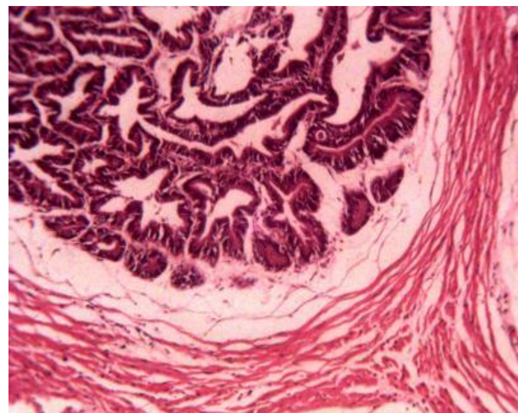

Figure 15: Photomicrograph of transverse section of seminal vesicle of rats treated with aqueous extract of *Phoenix dactylifera* at 1000mg/kg; showing normal glands (light blue arrows) and smooth muscles (black arrows) H and E x100.

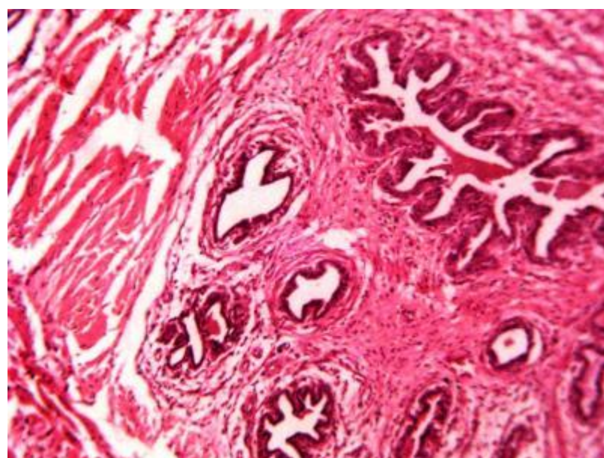

Figure 16: Photomicrograph of prostate gland of control rats; illustrating the typical structure with normal glands (light blue arrows), connective tissues (black arrows) and smooth muscles (green arrows) H and E x100.

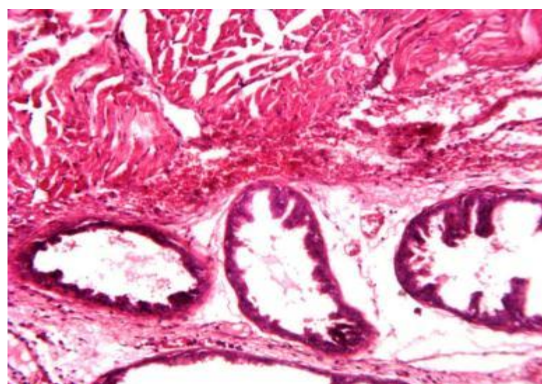

Figure 17: Photomicrograph of prostate gland of rats treated with aqueous extract of Phoenix dactylifera at 250mg/kg showing normal smooth muscles (green arrows), degenerated connective tissues (black arrows) and distorted glands (light blue arrows) H and E x100.

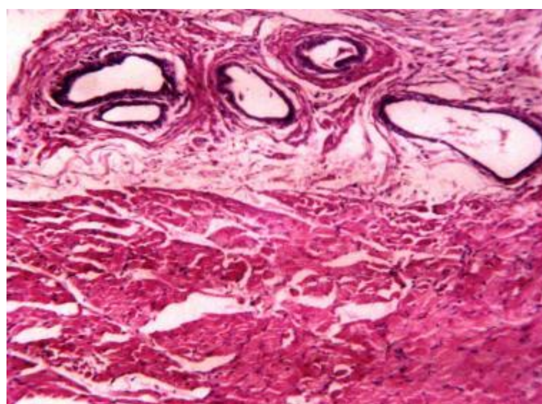

Figure 18: Photomicrograph of prostate gland of rats treated with aqueous extract of *Phoenix dactylifera* at 500mg/kg showing normal smooth muscles (green arrows), normal connective tissues (black arrows) and distorted glands (light blue arrows) H and E x100.

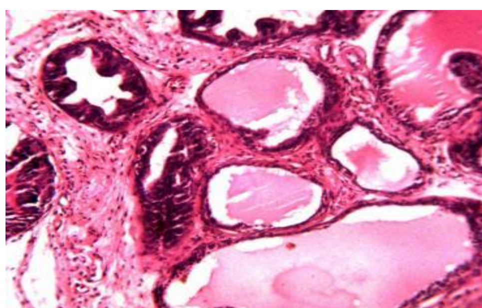

Figure 19: Photomicrograph of Prostate gland of rats treated with aqueous extract of *Phoenix dactylifera* at 1000mg/kg showing normal connective tissues (black arrow) and distorted glands (light blue arrows) H and E x100.

Impact of Aqueous Extract of Phoenix dactylifera on Morphometric Parameters of Certain Reproductive Organs in Male Wistar Rats.

Table 4.3 illustrates a notable increase in the diameter of seminiferous tubules when comparing the control group (23.35±0.07µm) to those administered the extract at doses of 250mg/kg (25.72±0.46µm) and 1000mg/kg (25.14±0.55µm) (P≤0.05). Regarding the size of interstices, a significant reduction was observed between the control group (36.50±2.18µm) and the groups receiving the extract at 250mg/kg (27.30±1.38µm), 500mg/kg (26.60±1.98µm), and 1000mg/kg (27.30±1.38µm) at P≤0.05. Additionally, for the epididymis, there was a significant decrease in epithelial thickness when comparing the control group (10.06±0.09µm) to those treated with the extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg body weight (7.20±0.22µm, 6.64±0.25 µm, and 6.12±0.12µm, respectively) at P≤0.05.

Table 4: Morphometric Parameters of Testis and Epididymis of Rats treated with Aqueous Extract of Phoenix dactylifera.

Groups	Seminiferous Tubular Diameter (µm) x100	Sizeof Interstices µm x400	Epididymal Epithelial Thickness µm x400
Control	23.35±0.07[a]	36.50±2.18[a]	10.06±0.09[a]
250 mg/kg	25.72±0.46[b]	27.30±1.38[b]	7.20±0.22[b]
500 mg/kg	24.83±0.56	26.60±1.98[b]	6.64±0.25[b]
1000 mg/kg	25.14±0.55[b]	27.30±1.38[b]	6.12±0.12[b]

All values expressed as Mean±SEM. Values in the same column with different superscript are significantly different at P≤0.05 using one-way Analysis of Variance (ANOVA) (SEM =standard error of the mean)

DISCUSSION

The aqueous extract of Phoenix dactylifera did not lead to the death of any Wistar rat at dosages of 250 mg/kg and 500 mg/kg after 72 hours of treatment, indicating that the extract is relatively safe and that the lethal dose (LD50) exceeds 500 mg/kg. This observed relative safety may account for the extensive use of the fruit as both food and a remedy for various ailments, making it a significant component of the diet in Arab countries, where it is consumed in fresh, dried, or various processed forms (Mehraban et al.,, 2014; Joensen et al., 2008; Akacha et al., 2025). There was no notable change in the serum levels of FSH and LH in rats treated with the extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg when compared to the control group, suggesting that the extract may not influence the hypothalamus and

pituitary gland, which are responsible for the production of FSH and LH. This finding aligns with the research conducted by Sullivan, (2004) and Odimgbe et al.(2026), which demonstrated that the extract of Phoenix dactylifera enhances brain function and possesses neuroprotective properties. The significant reduction in serum testosterone levels in rats treated with the extract, in comparison to the control group, indicates that the extract may impact spermatogenesis, as testosterone is essential for the normal development of spermatogenic lineage cells (Truenting & Dintzis, 2012; Moses et al., 2025). The steroid and flavonoid content of the extract could be responsible for the decrease in serum testosterone levels, as steroids are known to lower testosterone levels. Additionally, flavonoids have been reported to reduce plasma testosterone levels in rodents Vayali, (2002) and to cause malformations in the male reproductive system of rat pups exposed to flavonoids during gestation (Weber et al., 2001). The reduction in testosterone levels may be responsible for the decline in sperm count, motility, and morphology, as testosterone is the key hormone that facilitates the transformation of spermatogonial stem cells into mature sperm cells (Joensen et al., 2008). In experiments, animals administered with Phoenix dactylifera extract at dosages of 250 mg/kg, 500 mg/kg, and 1000 mg/kg exhibited no significant alterations in body or organ weight when compared to the control group, indicating that the extract likely does not influence metabolic processes. This finding aligns with previous research conducted by Obruche et al., 2025, which reported no significant changes in the weights of the prostate, seminal vesicles, testes, and epididymis following the administration of date palm gemules or pollen to rats. The notable reduction in epididymal sperm count, motility, and morphology in rats treated with Phoenix dactylifera extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg, in comparison to the control group, suggests that the extract may influence spermatogenesis or possess the potential to damage sperm cells. The extract is rich in steroids, flavonoids, and saponin with steroids known to negatively impact male fertility by diminishing sperm quality and serum testosterone levels. Saponins have been documented to exhibit antifertility, abortifacient, and anti-implantation effects in rodent models (Kehinde et al., 2025). Flavonoids and saponins are recognized for their tumor-suppressive properties and are utilized as anticancer agents, and any compound with tumor-suppressive activity is known to inhibit the proliferation of stem cells. Consequently, the presence of steroids, flavonoids, and saponins in Phoenix dactylifera extract may be responsible for the observed decrease in sperm count and morphology. No alterations were observed in the structure of the seminal vesicles of rats administered with Phoenix dactylifera extract at dosages of 250 mg/kg, 500 mg/kg, and 1000 mg/kg when compared to the control group, indicating that the extract did

not adversely affect the structure and functionality of the seminal vesicles. In contrast, the prostate glands of the rats receiving the extract exhibited damage to connective tissues and distorted glandular structures; this suggests that the extract may influence prostate function by diminishing sperm quality and viability, as the secretions from both the prostate and seminal vesicles constitute the majority of semen and are essential for the nourishment of sperm cells (Ogwuche & Obruche, 2020). The notable increase in the diameter of seminiferous tubules in rats treated with the extract at 250 mg/kg and 1000 mg/kg, in comparison to the control group, may be attributed to inflammation of the spermatogenic cells. The damage to the cell and basement membrane could be responsible for the enlargement of cell size, as basement membranes are believed to play significant roles in the filtration and transport of substances and fluids in and out of cells (Abeokuta et al.,, 2025; Umudi et al., 2026). Furthermore, the reduction in the thickness of the epididymal epithelium in rats treated with Phoenix dactylifera extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg relative to the control group indicates that the extract may possess the potential to damage the epididymal epithelium. Additionally, the observed decrease in the size of interstitial spaces in rats treated with the extract at 250 mg/kg, 500 mg/kg, and 1000 mg/kg compared to the control group may lead to a reduction in serum testosterone levels, as the primary role of Leydig cells in the interstitium is the production of testosterone (Ugochukwu et al., 2025; Micheal et al., 2026). The administration of aqueous extract from Phoenix dactylifera at dosages of 250mg/kg, 500 mg/kg, and 1000 mg/kg to male Wistar rats may influence fertility by causing degeneration of Leydig cells and distortion of spermatogenic cells, alongside a reduction in serum testosterone levels, which leads to decreased sperm count, motility, and morphology. This phenomenon could be a contributing factor to the observed decline in fertility rates in the Middle East and North Africa, as noted by Obruche et al., (2019),, where the date palm is a dietary staple (Ekpo et al.,2023; Micheal et al., 2026).

CONCLUSION

Based on the findings of this study, it can be inferred that the administration of aqueous extract from Phoenix dactylifera at 250mg/kg, 500mg/kg, and 1000mg/kg over a period of 35 days may adversely affect fertility in male Wistar rats through several mechanisms. These include degeneration of Leydig and spermatogenic cells, distortion of epididymal sperm cells, vacuolation of the epididymal epithelium, and alterations in prostate gland morphology. Additionally, there is a noted decrease in the size of interstitial spaces and the thickness of the epididymal epithelium, along with reduced serum testosterone levels and diminished sperm

count, motility, and morphology. Consequently, it is advisable to exercise caution regarding the consumption of Phoenix dactylifera fruit, despite its various therapeutic benefits.

REFERENCES

1. Abeokuta, O.J, Uriri, S.A, Obruche, E.K, Okurame, O (2025). Hydrochemical Assessment of Borehole Water Quality in Eku, Delta State, Nigeria. Journal of Science, Technology and Environmental Studies,1(2):17-25
2. Agboola, O. S. and Adejumo, A. L. (2013). Nutritional composition of the fruit of the Nigerian wild Date palm (Phoenix dactylifera). Journal of Dairy and Food Science, 8(2): 196-200.
3. Akacha Joshua Richard, Oladosu Micheal Abimbola, Moses Adondua Abah, Oderanti Mustapha Olayemi, Agbanigo Bolade Sunday, Imade Blessing, Shinggu Paula Paul, Akinbolawa Olujimi Adeolu, Okabeonye Sunday Agbo, Inyam Benjamin Izang, Odimgbe Ezekiel Izudike , Philemon Onyejeme Chimere, Igwe Ejikeme Peter. (2025).The Effect of Cefuroxime on Aquatic Macrophyte (Lemna Minor) and Algae (Scenedesmus Sp.). Journal of Medical Discoveries, RPC Publisher, 2(1): 1 – 15
4. Akunna, G. G., Sa'alu, C. L., Ogunmodede, O. S., Ogunlade, B. and Bello, A. J. (2012). Aqueous extract of Date fruit (Phoenix dactylifera) protects testis against Atrazine induced toxicity in Rat. World Journal of Life Science and Medical Research, 2(2): 100 108.
5. Chao, C. T. and Krueger, R. R. (2007). The date palm (Phoenix dactylifera L.): Overview of biology, uses and cultivation. Hortscience, 42(5): 1077-1082.
6. Cline, M. J., Franke, A. A., Register, T. C., Golden, D. L. and Adams, M. R. (2004). Effects of dietary Isoflavone Aglycones on the reproductive tract of male and Female Mice.Toxicology and Pathology,32: 91-99.
7. Erienu Obruche Kennedy, Itodo Adams, Wuana Raymond and Sesugh Ande (2022). Polycyclic Aromatic Hydrocarbons in Harvested Rainwater in Warri and Agbarho, Nigeria. *Bulletin of chemical society of Ethiopia*, 36(4): 27-35.
8. Etus Patrick Chimuanya and Erienu Kennedy Obruche (2026). Assessment of Toxic Metals in Cassava Varieties Cultivated in Damagum L.G.A, Yobe State, for Environmental and Health Impacts. International Journal of Science, Engineering and Technology, 1: 11

9. Etus Patrick Chimuanya and Erienu Kennedy Obruche (2026). The Role of plants in treating diseases caused by microorganisms through natural product based therapies. International Journal of Science, Engineering and Technology:1–6
10. Francis, G., Kerem, Z., Makkar, H. P. S. and Becker, H. (2002). The Biological action of saponin in Animal systems: A review. British Journal of Nutrition,88: 587-605.
11. Gatti, J. L., Castella, S., Dachuex, F., Ecroyd, H., Metayar, S., Thimon, V. and Dachuex, J. L. (2004). Post-Testicular Sperm environment and fertility.Animal Reproduction Science,82/83: 739-744.
12. Ismail, W. I. W. and Radzi, M. N. F. M. (2013). Evaluation on the benefits of Date palm (Phoenix dactylifera) on the brain.Alternative and Integrative Medicine, 2(4): 1-3.
13. Jacintha Ijeoma Ossai, Okpanachi Nuhu Oyibo, Anne Okonta, Christian Isioma Okonta, Ejike Success Nkwachi, Michael Unekwuojo Attah, Evurani Somtochukwu Amuche, Oladosu Micheal Abimbola, Moses Adondua Abah, Aham Christopher, Daniel Temiloluwa Oyedemi, Elvis Obi Besong, Christian Chuwang Musa, Biola Rasheedat Adebayo, Anthony Olalekan Akande, Etus Patrick Chimuanya, Sunday Kaura ,Chinonso Hillary Ezeja (2025). Assessment of Nephrotoxicity and Hepatotoxicity in HIV-Positive Subjects on Antiretroviral Therapy (ART) in Nsukka Senatorial Zone, Nigeria. Journal of Human Virology & Retrovirology, 12(1):5–10
14. Jaswir, I., Noviendri, D. Hasrini, R. F. and Octavianti, F. (2011). Carotenoids: Sources, Medicinal properties and their application in food and Nutraceutical industry. Journal of Medicinal Plants Research,5(33): 7119-7131.
15. Joensen, U. N., Jorgensen, N., Meyts, E. R. and Skakkebaek, N. E. (2008). Testicular Dysgenesis syndrome and leydig cell function.Basic and Clinical Pharmacology and Toxicology, 102: 155-161.
16. Kehinde Sowunmi; Oladosu Micheal Abimbola; Moses Adondua Abah; Luqman Olaitan Sulaiman; Odimgbe Ezekiel Izudike; Ugwah Jiata Ekele; Dele-Osibanjo Taiwo A; Olowookere Adepeju Kafayat; Adewale Femi Emmanuel; Julius Sarah Oluwaseun; Nnametu Peter Onyedikachukwu; Agbanigo Bolade Sunday; Tobi David Farinde; Olutayo Nathaniel Farinde; Kelechi Asogwa; Taiwo Awojulu; Sunday Ameh (2025). Green Synthesis, Photo-Physical Characterization, and Evaluation of in-vitro Antioxidant, Anti- Inflammatory, and Antidiabetic Properties of Selenium Nanoparticles Derived from Nigella Sativa seeds. Journal of Nanomedicine, 8(1): 1 – 6
17. Mehraban, F., Jafari, M., Toori, M. A., Sadeghi, H., Joodi, B., Mostafazade, M. and Sadeghi, H. (2014). Effect of Date palm Pollen (Phoenix dactylifera L.) and Astralagus

ovinus on Sperm parameters and sex hormones in Adult Male Rats. Iran Journal of Reproductive Medicine,12(10): 705-712.

18. Micheal Abimbola Oladosu, Moses Adondua Abah, Ezekiel Izudike Odimgbe3, Femi Emmanuel Adewale, Clinton Arthur, Abiola Samuel Ajayi, Joseph Ezeani, Franklin Ogonna Ede, Olaide Ayokunmi Oladosu, Emmanuella Chidimma Ohanele (2026). Smart Electrochemical Sensors and Iot For Monitoring Heavy Metals in Nigerian Water: Review Of Advances And Deployment Challenges. Trends in Ecological and Indoor Environmental Engineering, 4(1), 79–89.
19. Micheal Abimbola Oladosu1, Moses Adondua Abah, Shola David Omoseeye, Zakka Musa, Patra Chisom Ezeamii, Patrick Chimuanya Etus, Joseph Oteng, Oluwadamilola Zainab Yakub, Emmanuel Obia Ginika, Olaide Ayokunmi Oladosu (2026). Determinants and Interventions for Vaccine Hesitancy in Rural Communities: A Global Narrative Review of Socio-Cultural, Institutional, and Infrastructural Barriers. Int. J. Adv. Biol. Biomed. Res., 14(2):171-190
20. Moses Adondua Abah, Micheal Abimbola Oladosu, Sulaiman Luqman Olaitan, Leah Eneotse Adayi, Silas Verwiyeh Tatah, Ochuele Dominic Agida, Okocha Jennifer Uchenna, Ibrahim Ayinla Mahmud, Odimgbe Ezekiel Izudike, Ridwan Musa, Najamu Yau, and Okpanachi Nuhu Oyibo (2025). Advanced Oxidation Processes for the Degradation of Organic Pollutants in Wastewater. Environmental Sciences and Ecology: Current Research (ESECR), 6(1): 1 – 7
21. Nathan Rimamsanati Yohanna, Joseph Oteng, Olabisi O. Ogunlewe, Micheal Abimbola Oladosu , Patrick Chimuanya Etus, Moses Adondua Abah, Okabeonye Sunday Agbo, Oluwadamilola Zainab Yakub, Sarah Oluwaseun Julius, Olaide Ayokunmi Oladosu.(2025). Molecular identification of pathogenic bacteria in hospital environments: Implications for infection control and patient safety. European Journal of Microbiology and Infectious Diseases, 2(4): 173-192
22. Obruche E. K, Emakunu S.O, Ugochukwau G. C (2025). Rainwater Harvesting: Microbial and Chemical Water Quality Assessment in Warri District. Mosogar Journal of Science Education,10(1):36-45
23. Obruche E. K, Ogwuche C.E, Erhabor O.D and Mkurzurum.C (2019).Investigating Corrosion Inhibition Effects of *Tagetes Erecta L*. Leaf Extrac on Aluminium in Acidic Medium. *Global Scientific Journals*, 7 (1): 1-17
24. Odimgbe Ezekiel Izudike, Clark Poro David, Olubunmi Abiola Adewusi, Akpanuko Mary Emmanuel, Apuyor Stanley Ejohwomu, Onwugbuta Godpower Chukwuemeka,

Ikechukwu Sampson Chikwe and Erienu Obruche Kennedy (2026). Modification of Coconut Shell Activated Carbon With an Azo Ligand (Ddptp) For Enhanced Removal Of Pb^{2+} From Contaminated Water. FUDMA Journal of Sciences (FJS), 10 (2): 284 – 293

25. Ogwuche C.E and Obruche E.K. (2020). Physio-chemical analysis of palm oils (*elaeis guineensis*) obtained from major markets in agbarho, unenurhie, opete, ughelli and evwreni town, Delta state, Nigeria. *International journal of trend in scientific research and development*,4(2):56-60
26. Okpanachi Nuhu Oyibo; Chidinma Favour Uhuegbu; Emmanuella Mamah; Michael Unekwuojo Attah; Micheal Abimbola Oladosu; Moses Adondua Abah; Victor Okpanachi; Kyrian Ikenna Onah; Chinecherem Precious Agu; Godman Eneojo Sule; Bolade Sunday Agbanigo; Patrick Chimuanya Etus; Joshua Ibrahim West; Ozioma Osonyekele; Tobi David Farinde; Olutayo Nathanael Farinde; Victor Chiedozie Ezeami (2025). Assessment of the Drinking Quality of Roof Harvested Rainwater in Nsukka Metropolis, Nigeria. Annals of Epidemiology and Public Health, 8(1): 1125
27. R.E. Ekpo, A.C. Marcus and E.K. Obruche (2023). Spartial and Temporal Variations in the Concentration of Particulate Matter in Ambient Air from three Different Locations in River State, Nigeria. International Journal of Scientific Research in Chemical Science,10(4):32-38
28. Sarah Oluwaseun Julius, Oluwadamilola Zainab Yakub, Micheal Abimbola Oladosu, Olabisi O. Ogunlewe, Oluwasegun Anthony Bosede, Moses Adondua Abah, Patrick Chimuanya Etus, Olaide Ayokunmi Oladosu.(2026). Antibiotic Resistance Patterns of Escherichia coli Isolated from Drinking Water Sources: Implications for Public Health and Surveillance Strategies. Int. J. Adv. Biol. Biomed. Res.,14(1):127-145
29. Sullivan, R. (2004). Male fertility markers, myth or reality. Animal Reproduction Science,82/83: 341-347.
30. Truenting, P. M. and Dintzis, S. M. (2012). Comparative Anatomy and Histology. A Mouse and Human atlas 1st edition, Academic Press Elsevier Inc.14-38 and 292-298.
31. Ugochukwu Gladys Chioma, Ataine Theresa Ifeyinwa and Erienu Kennedy Obruche (2025). Determination of the Physicochemical Properties of Soil Amended with Cassava Mill Effluent in Mosogar Area of Delta State. Mosogar Journal of Science Education,10(1):81-89
32. Umudi Ese Queen, Odimgbe Ezekiel Izudike, Anyanwu Chidinma Gogo, Andrew Ogheneovo Onofuevure, Ikechukwu Sampson Chikwe, Ndego Chukwudi. Charles,

Onwugbuta Godpower Chukwuemeka, Abubakar Abdulkarim, Wilson joseph joseph, Erienu Kennedy Obruche (2026). Physicochemical and Toxicological Characterization of Five Mushroom Species and Their Potential Application in the Bioremediation of Trace Metal Contaminated Soils. International journal of computational research in science and technology, 2(1): 77 – 92

33. Vayali, P. K. (2002). Antioxidant and Antimutagenic properties of aqueous extract from dates (Phoenix dactylifera L. Arecaceae). Journal of Agriculture and Food Chemistry,50: 610 617.
34. Weber, K. S., Setchell, K. D., Stocco, D. M. and Lephart, E. D. (2001). Dietary Soy phytoestrogen decrease testosterone levels & prostate weight without altering LH, Prostate 5-alpha reductase or testicular steroidogenic acute regulatory peptide in adult male Sprague-dawley rats. Journal of Endocrinology,170: 591-599.