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Effects of "*Monodora Myristica*" (African Nutmeg) Seeds on Male Reproductive Parameters in Adult Male Wistar Rats

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ABSTRACT

Male sex hormone production, sperm and semen production, and semen transfer into the female reproductive canal are some of the bofunctions of the male reproductive system. The primary indicators of male fertility are semen characteristics like count, motility, and morphology. They are crucial for testicular spermatogenesis and epididymal maturation. In the study, adult male Wistar rats were used to investigate the effects of Monodora myristia (African nutmeg) seeds. For this investigation, twenty (20) male rats were employed. For 21 days, the African nutmeg seeds extract were administered orally using he orogastric tube. The animals were divided into three groups: Control (received distilled water), Low dose (received 500 mg/kg of plant extract), and High dose (received 1500 mg/kg of plant extract). Animals were sacrificed twenty-four (24) hours following administration. Semen was collected for semen analysis, and testicles and epididymis were removed for histological examinations. Data were expressed as mean ± S.E.M. The difference between the tested groups and the control was tested using a one-way ANOVA. Values were considered statistically significant when p is ≤ 0.05. The findings of the present study revealed that consumption of Nutmeg may enhance sperm viability, morphology, and count. In conclusion, infertility in test animals may be resolved by this plant.

KEYWORDS: Semen Analysis, Testis, Histological Studies

ARTICLE DETAILS

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INTRODUCTION

The male reproductive characteristics are a network of internal and external organs that functions to produce, support, transport, and deliver viable sperm for reproduction. Prenatally, the reproductive characteristics are formed under the influence of testosterone secreted from the fetal testes; by puberty, the secondary sex organs develop and become functional. Sperm is produced in the testes and transported through the epididymis, ductus deferens, ejaculatory duct, and urethra (Zachary, 2010). The organs that comprise to form the male reproductive characteristics all have individual roles that in combination aid in reproduction. To facilitate reproduction, the male reproductive characteristics has several functions within the body which includes, production and secretion of male sex hormones, production of sperm and semen, and the transportation of semen into the female reproductive tract (Zachary, 2010). The main causes of male infertility include endocrine diseases, malignancies and genetic anomality, but the cause remains unknown in 50% of cases. Mild and severe male infertility are frequently used in the literature to describe an abnormal semen assessment but are purely descriptive and without clear definition and relationship to the aetiology, which is only found in approximately 50% of cases.

Infertility has brought several misunderstandings between married couples in the society at large which has led to cases of divorce, depression, withdrawal from social activities as well as inferiority complex among peers. Despite the enormity of these impacts, this subject has not been

sufficiently studied. However, this study was conducted in order to evaluate the effects of *Monodora myristica* (African nutmeg) seeds on male reproductive characteristics in adult male Wistar rats as it relates to humans..

Sperm quality is the most important criterion for measuring male reproductive ability. Sperm morphology is a proven indicator of male infertility (Enginsu *et al*.,1991), and morphology assessment classifies the sperm in multiple categories (Auger 2010; Menkveld, 2013). Previous studies have shown that teratozoospermia (i.e., the increased concentration of abnormal sperm) is affected by various factors such as aging and genetics **(**Kidd *et al*.,2001; Braekeleer 2015). Therefore, the morphological classification of sperm is helpful to promote the pathological research in human reproduction. Human sperm consists of three main parts; head, midpiece and tail (Shaker *et al*.,2016). According to World Health Organization, human sperm can be divided into normal and abnormal sperm, and the abnormal sperm can be further classified into four sub-categories: head defects, neck and midpiece defects, tail defects and excess residual cytoplasm (World Health Organization, 2010). Among these defects, head defects, including tapered, pyriform, no acrosome, small, amorphous, vacuolated and small acrosomal areas, have the most significant impact on semen quality. Although the Computer-Assisted Semen Analysis (CASA) system has been applied in various scenarios for semen analysis, it has not yet been able to classify human sperm morphologically (Amann & Waberski, 2014)**.** In clinical applications, human sperm morphology analysis is conducted manually by experienced physicians (Brazil,2010; Freund 1966).

Sperm is the only human cell which perform its function outside the male body. The microenvironment of sperm, seminal plasma, is of great significance. Seminal plasma contains HCO_3^-/CO_2 inorganic ions, organic acids, sugars, lipids, steroids, polyamines, amino acids, proteins and nitrogenous bases (Wolters *et al*., 1986). The pH of a sperm may play an important role not only in maintain viability and quality, but also in ensuring fertilization. The studies of the pH of sperm in humans often focuses on clinical cases. It has been reported that semen pH is lower than 7.2 in patients with oligospermia or/ and asthenospermia (LG H *et al*.,2013). Another study which divided its cohorts into normal sperm motility and hypomotility male observed no significant value in seminal pH between the two groups (Banjoko & Adeseolu, 2013). Based on these reports, the sperm of healthy donors were used and explored the effect of different PH on the viability and motility -of the human sperm. The ∝4 isoform maintains the motility of male gametes primarily by controlling the transmembrane Na^+ gradient in sperm, and that ouabain inhibition of ∝4 caused motility decline in the sperm. Moreover, the ∝4 isoform can functionally couple with the Na^+/H^+ exchanger (NHE) to regulate the intracellular pH in spermatozoa, which affects the function of both vertebrate and invertebrate sperm, such as motility or the initiation of acrosome reaction (Babcock *et al*.,1983; Sase *et al*.,1995; Zeng *et al*.,1996). Some clinical cases reports indicate that the sperm pH of asthenospermia may have changed. However, whether and how the sperm pH affects movement and capacitation remains unclear. Understanding the effects of sperm pH may be helpful for the clinical treatment of infertility.

The use of plant extracts as a fertility enhancer in man is now on the increase because of the shifting of attention from synthetic drugs to natural plants (Dada *et al*.,2009). Studies have shown that, despite the high prevalence and psychological consequences of the disorder, relatively few men had sought for orthodox treatment prior to the introduction of sildenafil (McKinley *et al*.,1999). Reduced sexual performance among the males though associated with aging process has always been a matter of great concern to man. A study conducted to identify potential risks factors for male infertility indicated that there were associations between male infertility and previous exposure to sexually transmitted diseases, unorthodox medication and moderate consumption of alcohol (Okonofua *et al*., 2005). *Monodora myristica* (African Nutmeg) seed is a climber tree of the family of the Anannacea family which grows well in many tropical forest regions of Africa. *Monodora myristica*(African nutmeg) seeds, embedded in a white sweet-smelling pulp of the sub-spherical fruit, are economically and medially important as their kernels are a popular condiment, used as a spicing agent in both African and continental cuisines, and an important source of active natural anti-oxidants (Okwu 2004; Burubai *et al*.,2007). In many African countries, the bark of African nutmeg is used for treating number of ailments such as stomachaches, headaches, eye diseases, hypertension and hemorrhoids (Koudou *et al*.2007). In addition, *Monodora myristica* (African nutmeg) seeds is used to prepare pepper soup for constipation relief and uterine hemorrhage control in women immediately after childbirth.

MATERIALS AND METHOD

Plant Collection

The seeds of African nutmeg, Monodora myristica, were obtained from Rivers State University Farm, location in Port Harcourt, Rivers State, Nigeria. A voucher sample was deposited in the herbarium located in the Department of Plant Science and Biotechnology of the Rivers State University for proper identification. The remaining samples were washed and air dried for twenty two days. The dried seeds ere pulverized into fine powder using electric blender.

Preparation of Plant Extract

The fine powders of the Nutmeg seeds were soaked in 80 % ethanol solvent (ratio 40g of fine powders of the Nutmeg seeds: 250 ml of solvent). In orer to achieve maximum

extraction, the mixture was shaken periodically. The solution was filtered using Whatman No. I filter paper after 72 hours. The filtrate was concentrated using hot water bath at a temperature of 42 ^{0} C.

Study Models

Twenty male albino rats, weighing 180 ± 20g, were in good health and were acquired from Animal house unit of the Department of Human Anatomy in the Faculty of Basic Medical Sciences, Rivers State University, Nigeria. Standard cages were used and models were maintained under 12 hour's light and dark cycle. Animals had free access to feeds and water throughout the study.

Acclimatization of Animals

Prior to the experiment, the rats were acclimated for a total of 21 days (12 cycles of light and dark). Prior to the trial and throughout it, the rats had unfettered access to water. Standard rat meal was used to feed the rats.

Experimental Protocol

Ld_{50} Studies

The Lorke's method of determination of $LD_{50}$was used for the present study. This method involves two phases:

PHASE 1: 9 mouse was used in this phase. Animals were grouped into 3 groups, with each group containing 3 animals. Group 1 received 500mg/kg, group 2 received 1000mg/kg, group 3 received 2000g/kg. after waiting for 24 hours, no death was recorded.

PHASE 2: 9 mouse was used. Animals were grouped into 3 groups each containing 3 animals. Group 4 received 2000mg/kg, group 5 received 4000mg/kg and group 6 received 5000mg/kg.

Since no animal died at 5000mg/kg, the dosage calculation for low dose and high dose were 1⁄10 × 5000 and 3⁄10 ×5000 respectively.

Study Design and Administration of Extracts

The rats were randomly divided into six (6) groups as follows:

Group 1. Served as control. Animals received distilled water (0.5 mls) orally for 21 days.

Group 2. Received 500 mg/kg/d Ethanolic Extract of *Monodora myristica* for 21 days.

Group 3. Received 500 mg/kg/d Ethanolic Extract of *Monodora myristica* for 21 days.

Duration of Studies

This study was conducted for a period of 21 days in the animal house of the Rivers State University, College of Medical Sciences.

Procedure for Semen Collection

At the end of the experiment, the study models were exposed to inhalation anaethetic (diethyl ether) in a desiccator for sedation. The animals were sacrificed by cervical dislocation. Thereafter, the open castration method was used for orchidectomy via a midline scrotal incision (Kadir et al., 2018). After that, the distal epididymis was sliced open to reveal the semen for collection. The semen was then squeezed onto a microscope slide by lightly pressing on the caudal epididymis. After adding two drops of 2.9% sodium citrate, the slide was covered with a coverslip so that it could be examined under a microscope. The sperm cells were divided into three categories: actively motile, sluggish, and non-motile. Using the approach outlined by Osuchuku (2016), the percentage of motile sperm was determined by dividing the number of motile cells by the total number of sperm cells counted. The Neubauer Haemocytometer was used to analyze the sperm.

Procedure for Histological Analysis

Upon sacrificing the animals, histological sections were done on the seminiferous tubules of the testes. The testes were carefully dissected and briefly fixed in 10% formaldehyde solution (Krukru, et al., 2025). Histological sections were prepared and properly interpreted using the procedure reported by Isaac et al., (2023).

Sperm Motility

The caudal epididymis' semen was squeezed onto a microscope slide that had been preheated to 27 degrees Celsius. Two drops of warm 2.9% sodium citrate were then added, and the slide was covered with a warm cover slip before being viewed at x400 magnification. Sperm motility was randomly measured in ten randomly chosen microscope fields. They classified sperm as immotile, slow, or motile. The number of motile sperms divided by the total number of counted sperm (i.e., 100) was used to calculate the percentage of motile sperm cells.

Sperm morphology

The semen was placed on a preheated slide, and two drops of warm Walls and Ewas stain (Eosin/Nigrosin can also be used) were added. A homogeneous smear was then created and allowed to air dry. The stained slide was then viewed right away under a microscope at a magnification of x400. Five microscope fields were chosen at random, and the kinds and quantity of abnormal spermatozoa were assessed relative to the total number of spermatozoa in each field. The percentage of aberrant spermatozoa in each field was then expressed.

Sperm count

The right testes' caudal epididymis was removed, and filter paper was used to blot. The volume of fluid displaced was determined to be the volume of the caudal epididymis after it was submerged in 5 milliliters of formol-saline in a graduated test tube. After putting the caudal epididymis and five milliliters of formol-saline into a mortar and homogenising the mixture, the sperm count was determined using the upgraded Neubauer hemocytometer under a microscope.

Sperm Viability (Life/Dead Ratio)

To do this, two drops of warm Eosin/Nigrosin stain were added to the semen on a slide that had been preheated. A uniform stain was then created and allowed to dry with air. The stained slide was then promptly viewed under a microscope at a magnification of x400. While the dead sperm cells absorbed the stain, the viable sperm cells remained unstained. The percentage was determined by counting the stained and unstained sperm.

Statistical Analysis

Data was expressed as mean ± S.E.M. Mean differences between the control and the other groups were tested using One Way Analysis of Variance (ANOVA). Values were considered statistically significant when p is less than or equal to 0.05 ($P \leq 0.05$). The difference between the sample mean was calculated using Kramer's post-hoc test.

RESULTS

Table 1: Effect of *Monodora Myristica* (African nutmeg) extract on Semen Analysis

Groups	Volume	Ph	Viability	Normal	Abnormal	Active	Sluggish	Dead	Sperm Cells Count
LD Mean ± S.E.M	0.2 ± 0.1	8 ± 0	85 ± 10*	87.25 ± 12.5*	27.5 ± 12.26*	67.5 ± 12.5	10 ± 0	22.5 ± 12.5	580 ± 150*
HD Mean ± S.E.M	0.35 ± 0.05	8 ± 0	87.5 ± 2.5*	89.25 ± 2.5*	17.5 ± 2.50*	82.5 ± 2.5	7.5 ± 2.5	10 ± 0	650 ± 180.28*
Control Mean ± S.E.M	0.25 ± 0.05	8 ± 0	82.5 ± 2.5*	85 ± 0*	15 ± 0*	80 ± 0	10 ± 0	10 ± 0	600 ± 0*
F	0.233	0.0	16.103	17.013	12.973	0.043	10.563	15.909	14.12
P-Value	0.7025	0.0	0.0002	0.0004	0.0001	0.260	0.700	0.0075	0.0005s

key
HD= High Dose
LD= Low Dose
S.E.M= Standard Error of Mean

Table 2: Effect of *Monodora Myristica* (African nutmeg) extract on LH & Testosterone

	Control Mean ± SD	Low Dose (500 mg/kg) Mean ± SD	High Dose (1500 mg/kg) Mean ± SD	F	P
FSH	0.6300±0.05292	1.3250±0.07778	0.7850±0.04950	85.28	0.001
LH	0.70000±0.05000	1.530±0.24042	0.9700±0.01414	24.49	0.006
Testosterone	1.1567±0.6028	1.1850±0.04950	0.9300±0.2828	15.57	0.01

Key: Low Dose(500mg/kg)
High Dose(1500mg/kg)

Table 3: The Effect of *Monodora Myristica* (African nutmeg) extract on Liver Function

	Control Mean ± SD	Mean ± SD	Mean ± SD	F	P
AST	35.0000±8.00000	25.5000±2.12132	24.0000±1.41421	2.71	0.18
ALT	31.6667±3.05505	22.0000±4.24264	22.5000±0.70711	8.19	0.04
ALP	38.3333±5.50757	32.0000±9.89949	33.5000±2.12132	0.68	0.556
TP	73.0000±2.00000	66.000±9.19239	72.5000±3.53553	1.09	0.42
TB	7.0667±1.4364	5.8000±1.14142	5.25000±0.07071	2.11	0.24

Table 4: The Effect of *Monodora Myristica* (African nutmeg) extract on Kidney Function

	Control Mean ± SD	Mean ± SD	Mean ± SD	F	P
CB	4.5667±0.64291	3.6500±0.21213	3.1000±0.14142	6.14	0.06
K	4.6000± 0.26458	4.3000±0.84853	4.6000±0.14142	0.29	0.76
Na	1045.6667±4.1633	138.5000±12.020	143.5000±2.1213	0.68	0.56
Ur	4.7667±0.25166	4.1500±0.35355	4.9000±1.1313	0.87	0.49
CR	96.3333±5.1316	86.0000±4.2426	102.5000±24.748	0.82	0.50
CL	82.6667±8.7368	78.5000±16.263	96.5000±2.1213	1.73	0.29
HC03	22.6667±2.0816	26.0000±1.4142	26.0000±2.8284	2.04	0.25

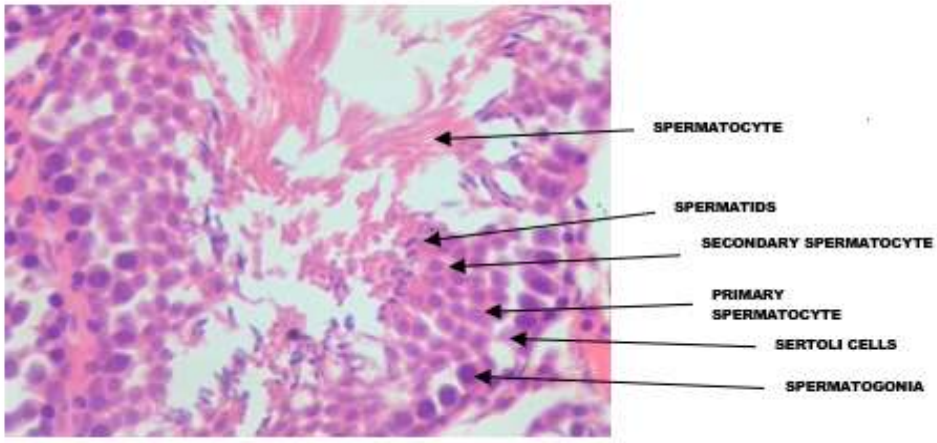
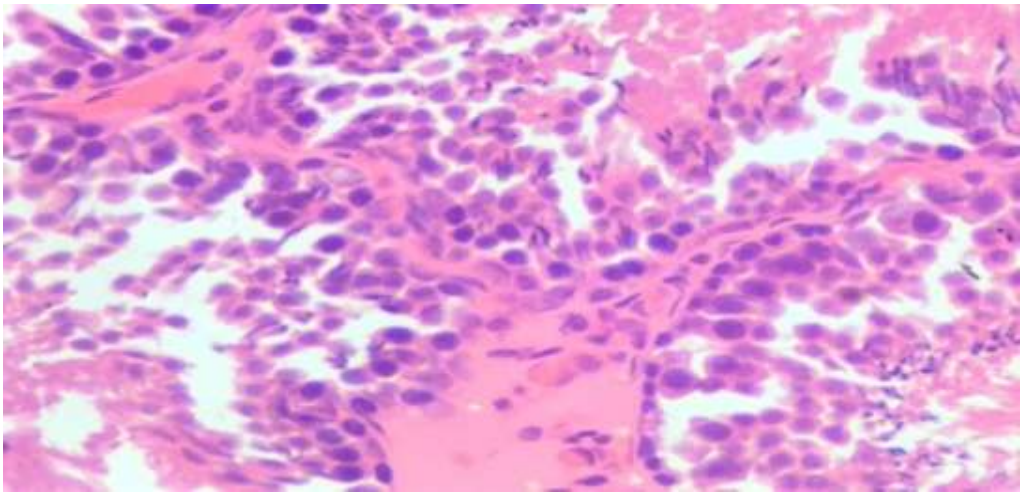


PLATE I: Photomicrograph showing section of testicular tissue. Group 1 (Control Group). Section displayed spermatocyte, spermatids, secondary and primary spermatocyte, Sertoli cells and spermatogonia. H & E x400



X400

PLATE II: Photomicrograph showing Group 2 (Low Dose -500mg/kg African Nutmeg). showed a normal well-preserved seminiferous space, tunica albuginea and congested blood vessels. The interstitial spaces were normal. H & E x400

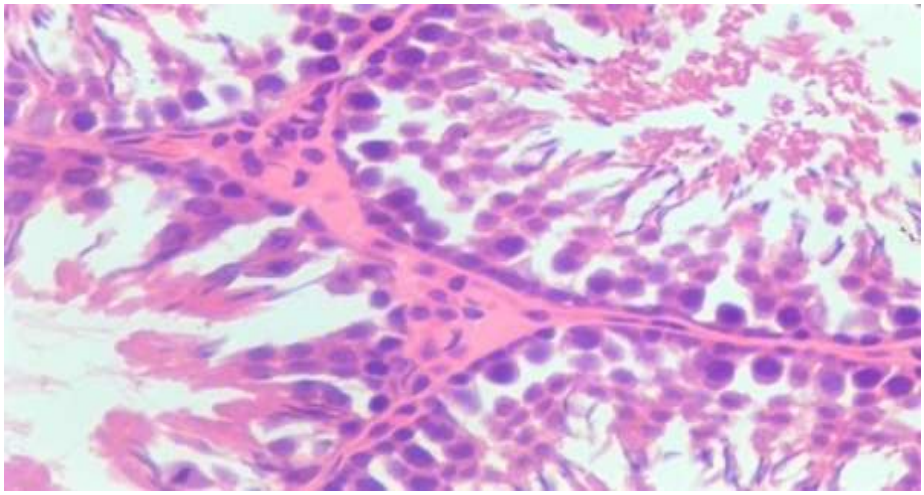
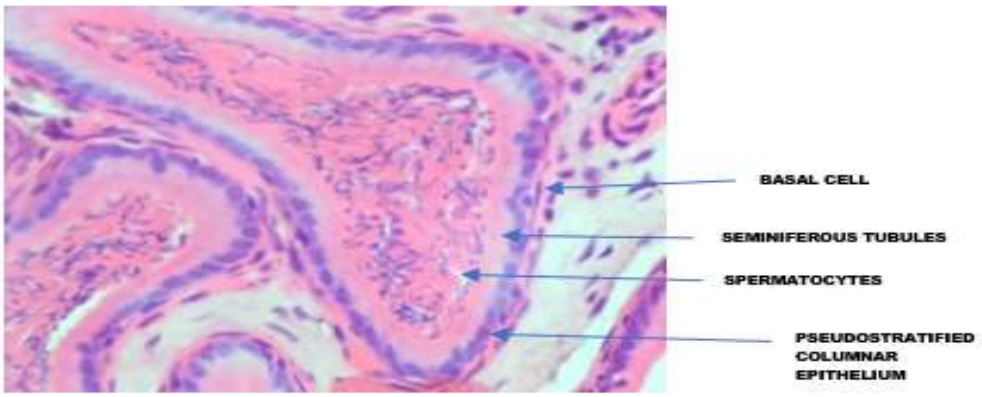
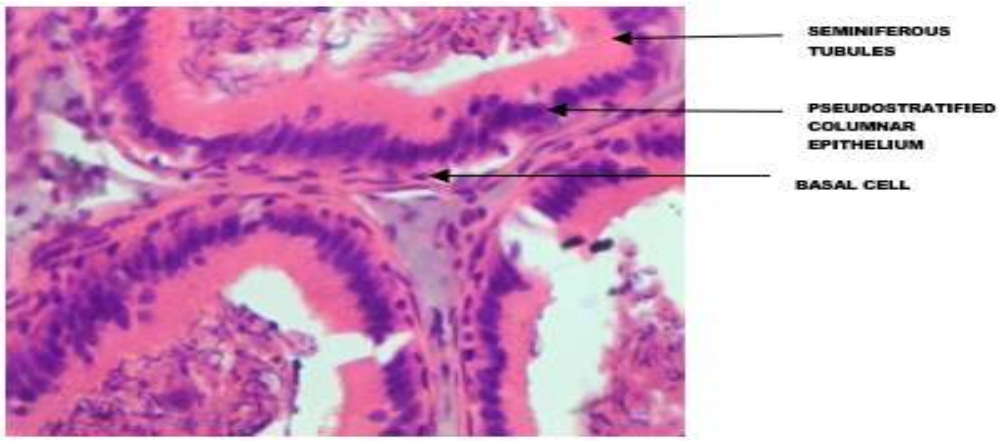


PLATE III: Photomicrograph showing section of testicular tissue. Group 3(High Dose -1500mg/kg Nutmeg) with numerous well-preserved seminiferous tubules and interstitial spaces. The spaces contain normal Leydig cells. The seminiferous tubule contains spermatogonia, normal 1 and 2 spermatocytes and spermatids. Features are those of hyperactive testis. H&Ex400



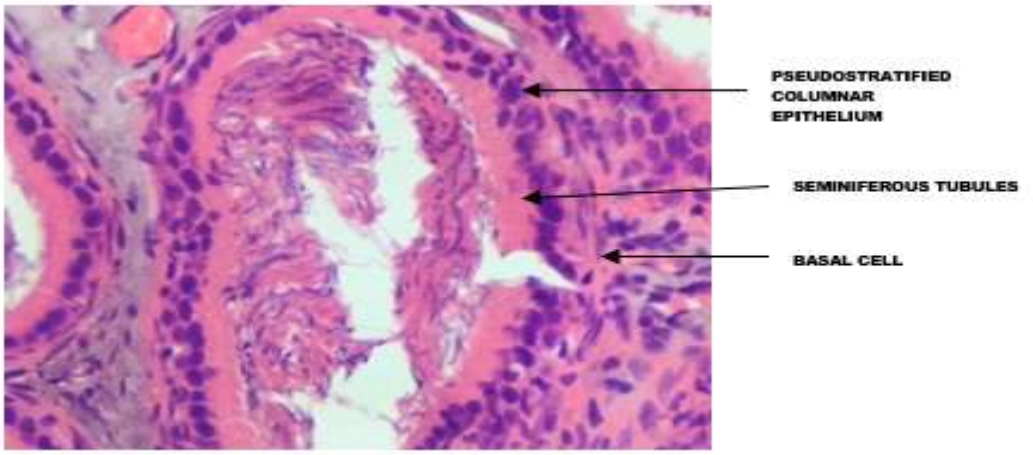
X400

PLATE IV: Photomicrograph showing section of epididymal tissue(CONTROL GROUP 1) with tubules lined by pseudostratified columnar cells, most of which have a cytoplasmic blue which are few cells with pyknotic nuclei and clear vacuole. The lumen contains abundant/ heavy spermatids. The interstitium is slightly widened. H & Ex400



X400

PLATE V: Photomicrograph showing section of epididymal tissue (Low Dose-500kg/mg African Nutmeg) with tubules lined by pseudostratified columnar epithelium; some of these cells have cytoplasmic blue hue. The interstitium is slightly widened. The lumen contains normal spermatids. H&EX400



X400

PLATE VI: Photomicrograph showing section of epididymal tissue (High Dose-1500mg/kg African Nutmeg) with epididymal tubule lined by pseudostratified columnar and the lumen containing matured spermatids. The interstitium is histologically normal and contain congested blood vessels. H&Ex400

DISCUSSION

There is growing concern that occupational, environmental and lifestyle factors adversely affect male reproductive health (Dorostghoal et al., 2013). Men and women seeking to improve their sexual life continue to rely on plant-derived and herbal remedies despite the availability of effective conventional medical treatments (Rowland, and Tai, 2003) In developing countries, large population confide on medicinal plants as their source of primary health care (WHO, 2005; Adienbo et al., 2024). *Monodora myristica* is being heavily documented in African traditional medicine (particularly Nigeria) to cure various ailments and has been supposed to have fertility-enhancing properties. The present study conducted an investigation on the Effects of "" (African Nutmeg) seeds on Male Reproductive Parameters in Adult Male Wistar Rats.

In the rats treated with African nutmeg, the number of abnormal sperm cells increased while the sperm count reduced. This suggests an alteration in sperm production in the testis and maturation in the epididymis. This agrees with Ahmed *et al* (2002). They reported that depletion of sperm counts and sperm motility in extract treated rat suggests alteration in sperm production in the testis and maturation in the epididymis. The decreased sperm motility observed in the study may be an effect of altered function of the accessory organs (Kushwaha & Singh, 2017). Kushwaha and Singh, (2017) also reported that an abnormal sperm function ultimately gives rise to male sterility. Although African nutmeg increased the normal of abnormal sperm count cells, it increased sperm count at a dose of 1500mg/kg. this implies that at a high dose, African nutmeg is not spermatotoxic. This is not in agreement with Sakpa and Uzoma (2019). They reported that Bryophyllum pinnatum is spermatotoxic because it causes a decline in sperm count.

Section of the testis from African Nutmegshowed a normal well-preserved seminiferous space, tunica albuginea and congested blood vessels. The interstitial spaces were normal, with well-preserved seminiferous tubules and interstitial spaces. This implies that Nutmeg is likely to have a protective effect on the testis. This agrees with Al-Doaiss and Al-Shehri (2020), they reported that Arabic gum has a protective effect because it has the tendency to improve seminiferous tubules. Histologic sections of the epididymis of animals from African Nutmeg showed lumen contains normal spermatids. This implies that African Nutmeg supports fertility in adult male Wistar rats. This study was not in agreement with Orheruata (2019), they reported that low and high doses of *M. pruiens* will likely cause anti fertility because it caused a spermatogenic arrest.

CONCLUSION

African nutmeg seeds has shown to improve sperm count which is beneficial in oligospermia which may likely help solve the problem of infertility.

REFERENCES

I. Kadir, E.O., Ojulari, L.S. , Ibrahim, A., Ekundayo, O.J., Jaji-Sulaimon, R., Jimoh-Abdulghaffaar, H. (2018).Testicular morphology and seminal fluid parameters of adult Wistar rats following honey administration. Tropical Journal of Pharmaceutical Research July; 17 (7): 1331-1335 ISSN: 1596-5996 (print); 1596-9827 (electronic)

II. Isaac, U.B., Oyo-Ita, E., Igwe, N.P., Lazarus Ije, E.L. PREPARATION OF HISTOLOGY SLIDES AND PHOTOMICROGRAPHS: INDISPENSABLE TECHNIQUES IN ANATOMIC EDUCATION. Anatomy Journal of Africa. 2023. Vol 12 (1): 2252-2262

III. Dorostghoal,M., Seyyednejad, M.S., Khajehpour, L., Jabari, A. (2013). Effects of Fumaria parviflora leaves extract on reproductive parameters in adult male rats. Iran J Reprod Med Vol. 11. No. 11. pp: 891-898, November 2013 Original article

IV. Rowland, D. L., and Tai; W. (2003). A review of plant-derived and herbal approaches to the treatment of sexual dysfunctions. *Journal Sex and Marital Therapy*. 2003 29: 185–205.

V. World Health Organization (2005). Traditional Medicine Strategy. Geneva; 2002-2005. World Health Organization, Geneva.

VI. Adienbo, O.M., and Azosibe, P. **(**2024**).** Sexual Function-Enhancing Potentials Of *Monodora Myristica* (African Nutmeg) Seed Extract In Experimental Animal Model. Greener Journal of Medical Sciences. Vol. 14(1), pp. 31-36,. ISSN: 2276-7797

VII. Ahmad, M., Ahmad, R.N., Aldakatti, R.H. &Ghosesawar, N.G. (2002). Reversible antifertility effect of benzene extract of *Ocimum sanctum* leaves on sperm parameters and fructose content in rats. *J Basic Clin Physiol Pharmcol* 13(1):51-59

VIII. Burubai, W., Akpor, A.J., Igoni, A.H. & Puyate, Y.T. (2007). Effects of temperature and moisture content on the strength properties of *Monodora myristica* (African Nutmeg) *International Agrophysics*, 21(1): 217-223.

IX. Koudou, J., Ossibi, A.W.E., Awlikokou, K., Abena, A.A., Gbeassor, M. & Bessiere, J.M. (2017). Chemical composition and hypotensive effects of essential oil of *Monodora Myristica* (African Nutmeg). *Journal of Biological Science*, 7(6):937-942.

X. Kushwana, V.B. & Singh, P. (2017). Effect of ethanolic extract of different parts of plant (*Annona squamosa*) on fertility of male rats. DOI: 10. 26717/BJSTR.2017.01.000429

XI. Okwu, D.E. (2004). Phytochemicals and vitamin content of indigenous species of South Eastern Nigeria. *Journal of Sustainable Agriculture and the Environment* 6(2):30-43.

XII. Sakpa, C.L. & Uzoma, S.C. (2019). Spermatotoxic effects of aqueous leaf extract of Bryophyllum pinnatum on adult male Wistar rats. *Ann. Biomed. Sci*., 18:72-84