



**EFFECTS OF METHANOL EXTRACT OF *PERSEA AMERICANA* (AVOCADO) AND VITAMIN E ON THE REPRODUCTIVE PARAMETERS OF MALE WISTAR RATS**

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**ABSTRACT**

**Background:** *Persea Americana* (avocado) is traditionally used for the treatment of various health problems such as male infertility. The current research investigates the specific effects of methanolic extract of *Avocado* on the male reproductive parameters of wistar rats. **Method:** Twenty-four (24) male wistar rats weighing between 160g and 180g used for the study were divided into four groups (n=6); Group 1 was the control group, groups 2 and 3 were experimental groups given low (150mg/kg) and high (300mg/kg) doses of the extract respectively. Group 4 was given vitamin E (200mg/kg). The administration was for 56 days. On the 57<sup>th</sup> day, all the animals were sacrificed and the epididymis, testes, seminal vesicles and prostate glands were harvested and weighed. The histology of the testes was also conducted. **Results:** Group 2 showed significant increase in sperm count compared to group 1 (control)  $p \leq 0.05$ . Group 3 showed a slight decrease in sperm viability. The testosterone level and epididymal organ weight for groups 2 and 3 significantly increased ( $p < 0.05$ ) when compared to the control group and the group given Vitamin E. Though not significant, a slight increase was observed in follicle stimulating hormone (FSH) and luteinizing hormone (LH) levels in group 2 and 3. **Conclusion:** *Persea americana* enhances fertility by improving sperm count but caused a slight decrease in sperm motility and viability which could be due to the phenol content of the extract. The *Persea americana* extract also enhanced the FSH and LH levels thereby promoting fertility.

**KEYWORDS:** *Persea americana*, Reproductive Parameters, Sperm count, Luteinizing Hormone, Follicular Stimulating Hormone, Testosterone.

**INTRODUCTION**

Reproduction is the process by which organisms create descendants. This is a characteristic that all living things have in common and sets them apart from non-living things. But even though the reproductive system is essential to keeping a species alive, it is not essential to keeping an individual alive. In human reproduction, two kinds of sex cells or gametes are involved. Sperm, the male gamete, and an egg or ovum, the female gamete must fertilize in the female reproductive system to create a new individual. For reproduction to occur, both the female and male reproductive systems are essential and must be functional.<sup>[1]</sup>

The male reproductive system consists of the testes and a series of ducts and glands. Sperm cells are produced in the testes and are transported through the reproductive ducts. These ducts include the epididymis, ductus deferens, ejaculatory duct and urethra. The reproductive glands produce secretions that become part of semen, the fluid that is ejaculated from the urethra. These glands

include the seminal vesicles, prostate gland and bulbourethral glands.<sup>[2]</sup>

*Persea americana* (avocado) plants products have been known for the treatment of various health problems. This plant is also one of the most important sources of drugs used in traditional medicine as in vaso-relaxants, analgesics, anti-inflammatory agents, hypotensive agents, anticonvulsant agents, antiviral agents etc.<sup>[3]</sup>

The current study investigates the specific effects of the extract on some reproductive parameters such as, sperm count, sperm motility/viability and hormones of reproduction.

**MATERIALS AND METHODOLOGY**

**Materials**

10% normal saline, 100% ethanol, 5% sucrose solution, Alcohol, Automated tissue processor, Basket, Beaker, Cannula, Centrifuge, Chem-well chemistry auto analyser, Clean bottles, Cotton wool, Disinfectant, Dissecting blade/fine scalpel, Dissecting board,

Dissecting kit, Dissecting set, Enzyme assay kit, Feed, Fixative (normal saline), Four rats cages, Freezer, Glass slides, Glass slip, Gloves, Hormonal assay kits, Laboratory coat, Light microscope, Lithium heparin bottle, Measuring cylinder, Methanol, Microtomes, Neuber haemocytometer chamber, Olive oil, Organ bottle, *Persea americana* (avocado), Plastic bottles, Rotary evaporator, Stains [hematoxylin and eosin (H&E), GFAP-stained], Syringe, Trinity biotech reagent, Twenty male wistar rats, Vitamin E, Waste basket, Water, Water bath, Weighing balance, Weighing scale.

### Methodology

#### PREPARATION OF PLANT EXTRACT

Unripe fruit of *Persea americana* were collected from Enugu market in Enugu, Nigeria. The fruits were sliced into pieces and left to dry under shade for three weeks.<sup>[4]</sup><sup>[5]</sup> It was then pounded into powdered form.<sup>[6]</sup><sup>[7]</sup>

3.5kg of the powder was soaked in 5 liters of 70% of methanol for 24 hours using maceration process.<sup>[8]</sup>

The extraction was put in a rotary evaporator at 50 degree Celsius for a day to evaporate the methanol content<sup>[6]</sup>, after which a concentrated extract is obtained.<sup>[9]</sup>

#### STANDARD DRUG

The standard drug used was vitamin E; each soft gel capsule is made up of 400IU and contains d-alpha Tocopheryl acetate. The excipients of vitamin E are soya bean oil, gelatine, and glycerine. The vitamin E is manufactured by Mega Life Science LTD, at 384 pattana 3 road, Bangpoo industrial estate, Samutprakarn, Thailand. It was bought at Olex Pharmacy in Maraba town of Nasarawa state, in Nigeria.

#### EXPERIMENTAL ANIMAL PROCURED SOURCE AND CARE

Male wistar rats weighing 160-180g were used in the present study. The rats were procured from Ahmadu Bello University, Zaria, Nigeria. The rats were left to acclimatize for two weeks and maintained over husk bedding in metallic well ventilated (air-spaced) cages in the Animal House of the Department of Physiology, Bingham University, Nigeria. They were kept in a standard laboratory condition; temperature at 35.5-37°C and allowed 12-hour light-dark cycle throughout the experimental period. The rats were fed with a balanced commercial pellet diet. Water and adequate animal ethical care were taken.

#### EXPERIMENTAL GROUPING

In order to evaluate the effects of *persea americana* and vitamin E consumption on the male reproductive system, the following grouping were used for the study for 56 days.<sup>[10]</sup> The rats were selectively grouped into four (groups one, two, three and four), each containing six animals<sup>[11]</sup>. Group one served as control, group two and group three was administered orally with 150mg/kg and

300mg/kg of *persea americana* extract as low dose and high dose respectively.<sup>[12]</sup> Group four was administered orally with 200mg/kg of vitamin E.<sup>[13]</sup>

#### ADMINISTRATION

##### PERSEA AMERICANA

0.9g of the extract was dissolved in 10mls of distilled water to make a concentration. Using a 2ml syringe with a cannula attached, the extract was then given to the groups of animals in the appropriate dosage of 150mg/kg<sup>[14]</sup><sup>[15]</sup> and 300mg/kg<sup>[12]</sup><sup>[16]</sup><sup>[17]</sup> as low and high dose respectively. The extract was administered for 56 days.

##### VITAMIN E

10 tablet of vitamin E was dissolved in 4mls of olive oil and was given to rats in group 4 (200mg/kg). The extract was administered for 56 days.<sup>[18]</sup>

#### METHOD OF ANIMAL SACRIFICE

The final body weight of the wistar rats were obtained at the end of *persea americana* extract and vitamin E administration, they were then sacrificed through cervical dislocation by applying a pressure on the neck separating the spinal cord from the skull causing loss of sensitivity to pain and dissection was easily carried out.<sup>[19]</sup>

#### BIOCHEMICAL ANALYSIS

##### HORMONAL ASSAY ANALYSIS

The blood sample of about 2ml was collected from the rat anterior canthes of the eyes using non heparinised capillary tubes for serum studies. The blood samples were run at 2500 rpm for 15 minutes using a centrifuge, the resulting serum samples were stored in bottles and kept in refrigerator and assayed for luteinizing hormone (LH), follicular stimulating hormone (FSH) using Hormonal Assay Analysis technique.<sup>[20]</sup>

##### SEMEN ANALYSIS

##### SPERM COUNT DETERMINATION

The caudal epididymis was dissected and minced in 1ml of normal saline (0.9%). The suspension was then fixed in formal saline and spermatozoa counted using the Neuber haemocytometer chamber and light microscope at a magnification of 400x was used.<sup>[21]</sup><sup>[22]</sup>

##### SPERM MOTILITY

The content of the vas deference was collected with aid of syringe and needle and a drop was placed on a clean slide (37°C) and covered with cover slip. The motility was determined by eye estimation of the proportion of spermatozoa moving forward (motile) and those that didn't move were considered non-motile.<sup>[23]</sup>

##### SPERM VIABILITY

A drop of stained sperm suspension (which was prepared for sperm count) was smeared on a glass slide, air dried for a maximum of 3 minutes and visualized microscopically at a magnification of 400x. for each rats,

the sperms were screened and the percentage of total abnormality of heads (such as microcephalus, detached head, flattened head, double head) and/or tails (such as coiled tail, bent tail and double tail) was determined.<sup>[24][22]</sup>

#### TISSUE COLLECTION AND PRESERVATION

The tissues were collected by harvesting the organ through the dissection of the rats and then it was been preserved using formal saline solution for the testes used for histological analysis while 5% sucrose solution was used to preserve the testes used for enzyme analysis.

#### HISTOLOGICAL PROCESSING OF TESTICULAR TISSUE

After samples of the testis were harvested from the Wistar rats, they were kept in a container with 10% normal saline to prevent autolysis which will disrupt the histological structure of the testis. The testis tissues were then taken to the automatic tissue processor for proper processing of the tissues. The following steps were taken: fixation, dehydration, clearing and filtration.<sup>[25]</sup>

- **Fixation:** 1cm of fresh testicular tissue samples were preserved in normal saline.<sup>[26]</sup>
- **Dehydration:** the blocks of tissue are transferred sequentially to 30%, 50%, 70%, 80%, 90%, 100% alcohols for about 12-24 hours each. The blocks are then placed in the second 100% ethanol solution to ensure that all water is removed.
- **Embedding:** tissues are embedded in paraffin.
- **Clearing:** This was used to remove constituents of alcohol from the tissue and was achieved with the use of the agent xylene.
- **Infiltration:** This is the immersion of the tissue in molten paraffin wax. Molten paraffin wax melted at 70°C was used to provide support for tissue by filling the holes created by the clearing agents. It helps in proper embedding.
- **Embedding:** After tissue processing, the tissue was then taken to the embedding machine with the use of the embedding mould. The embedding mould was filled with molten paraffin wax, the tissue was picked with forceps and oriented at the centre of the embedding mould and then the cassette was placed on it to allow solidification. The block of tissue was packed into the freezer for cooling and for easy removal of mould. The block is trimmed to remove excess wax.
- **Sectioning:** The block of tissue was placed in the microtome and trimmed to expose the organ surface after which the block was cooled on ice to allow easy sectioning. The microtome was set at 3-5

microns and the testes were cut from block of testis tissues. Sections were picked with forceps and placed on a slide. 20% of alcohol was used to float section in water bath to allow the section to spread well. The slide obtained was labelled with the aid of a pencil according to the number on the block. After labelling, the slide was placed on a hot plate for the section to stick properly to the slide.

- **Staining:** The dried slide was arranged in a staining rack and then dewaxing was done in two changes of xylene for ten minutes of which it was then hydrated in descending grades of alcohol i.e. from absolute to 70%. Then it was Rinsed in water for a few minutes and it was Stained in haematoxylin afterward (this stains the nucleus blue), and then differentiating procedure was carried out in 1% alcohol. For ten minutes a blowing process was done slowly in a running tap. A counterstaining was then done in eosin for few minutes of which rinsing in water were then carried out after it; it was then dehydrated in ascending grades of alcohol i.e. in 70%, 80% and absolute alcohol (100%). After which it was dried in a hot plate. A clearing in xylene and the mounting was done using dibutylphosphate xylene (DPX) mounting and coverslips. Finally the slides were then allowed to dry before arrangement.<sup>[27]</sup>
- **Photomicrography:** Histological slides were then viewed using a light microscope with objective lens x10. Photomicrography was taken using an attached colour digital camera. Slides microscopes were viewed and Photomicrography taken at objective lens x40 and x100 using immersion oil - (cedar wood oil).

#### PHYTOCHEMICAL SCREENING PROCEDURES

##### Test for Tannins

About 0.5g of the plants extract was stirred with 1ml of distilled water, filtered, and ferric chloride reagent added to the filtrate. A blue-black, green, or blue green precipitate was taken as evidence for the presence of tannins.

##### Test for Saponins

About 0.5g of the plant extract was shaken with water in a test tube. Frothing which persist on warming was taken as preliminary evidence of saponins.

##### Test for Flavonoids

2g of the powdered fruit was completely detained with acetone. The residue was extracted in warm water after evaporating the acetone on a water bath. The mixture was filtered while hot. The filtered was cooled and used for the following tests.

Lead acetate test for flavonoids: To 5ml of the detained water extracted was added lead acetate solution. A yellow colour precipitate indicates the presence of flavonoids.

**Test for Alkaloids**

About 0.5g of the powdered extract was stirred with 10ml of 1% aqueous hydrochloride acid on a steam bath; 1ml each of the filtrate was treated with a few drops of Mayer's reagent, dragendorff's reagent, and picric acid solution. Precipitation with either of these reagents was taken as preliminary evidence for the presence of alkaloid in the extract.

**Test for Terpenes**

5g of powdered pulp was extracted by maceration with 50ml of chloroform (95%) filtered and the filtrate was evaporated to dryness. The residue was dissolved in 10ml of anhydrous chloroform and the filtered filtrate was divided into two equal portions and the following test was carried out.

Using the Liebermann-burchard test, the first portion of the chloroform solution from above was mixed with 1ml of acetic anhydride, followed by addition of 1ml of concentrated sulphuric acid down the wall of the test-tube to form a lower layer. The formation of a reddish-violet colour in the chloroform layer indicates the presence of terpenes.

**Test for Steroids**

5g of powdered pulp was extracted by maceration with 50ml of chloroform (95%) filtered and the filtrate was evaporated to dryness. The residue was dissolved in 10ml of anhydrous chloroform and the filtered filtrate was divided into two equal portions and the following test was carried out.

Using salkowski's test, the second portion of the solution was mixed with 2ml of concentrated sulphuric acid carefully so that the acid forms a layer. A reddish brown colour at the interface indicates the presence of a steroidal ring.

**Test for Glycosides**

About 100mg of each extract was taken in a test tube and 2.5ml of dilute sulphuric acid was added and boiled in a water bath for 15 minutes. This was cooled and neutralized with 20% potassium hydroxide solution. 5ml of a mixture of Fehlings solution A and B was added and boiled for 3 minutes. A brick red precipitate indicates the hydrolysis of a reducing sugar, an indication of glycoside.

**Test for Resins**

5ml of petroleum ether extract was made using 0.1g of powdered pulp and filtered into a test-tube. An equal

volume of copper acetate solution was added and shaken vigorously then allowed to separate. A green colour indicates the presence of resins.

0.5g of the powdered pulp was dissolved in acetic anhydride and 1 drop of concentrated sulphuric acid was added. A purple or colour indicates the presence of resins.

**Test for Carbohydrates**

3g of the powdered pulp were boiled in 50ml of distilled water on a water bath for 3 minutes. The mixture was filtered while hot and the resulting filtrate cooled and used for the following carbohydrate test Using Melisch's general test; a few drops of melisch's reagent was added to 2ml of water extract obtained above then a small quantity of concentrated sulphuric acid was added and allowed to form a lower layer. A purple ring at the interface of the liquids indicates the presence of carbohydrates. The mixture was the shaken allowed to stand for 2 minutes and then diluted with 5ml of water. A purple precipitate also indicates the presence of carbohydrates.<sup>[28] [29] [30]</sup>

**STATISTICAL ANALYSES**

All data are presented as mean  $\pm$  standard deviation (SD). The significance of differences among different groups was assessed by paired student T test and one-way analysis of variance (ANOVA). The acceptance level of significance was  $P \leq 0.05$ . Data was evaluated by SPSS for windows (SPSS Inc., Chicago, Illinois, USA) version 12.0.1 with 95% confidence interval level.

**RESULTS****Phytochemical Analyses**

**Table 1: Results of the phytochemical analysis of the plant *persea americana* (avocado) on the following parameter.**

Compounds	Results
Tannins	+
Saponins	+
Flavonoids	+
Alkaloid	-
Phenols	+
Terpens	-
Steroids	-
Glycosides	-
Resins	+
Carbohydrates	+
Oil	+

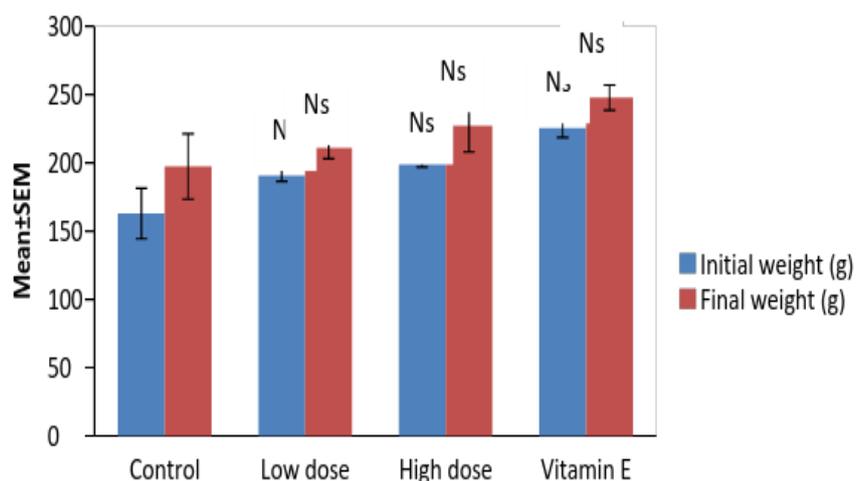
Keys; positive (+) = present, negative (-) = absent

**Initial and Final Body Weight**

**Table 2: Initial and final body weight of control and experimental rats.**

Groups (mg/kg)	Initial weight (g)	Final weight (g)
Control	162.83 $\pm$ 18.47	197.33 $\pm$ 23.85
Low Dose (150)	190.67 $\pm$ 4.18	211 $\pm$ 8
High Dose (300)	201.33 $\pm$ 4.32	227.17 $\pm$ 19.25
Vitamin E (200)	225.67 $\pm$ 7	247.83 $\pm$ 9.37

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$



**Figure 1: Initial and final body weight of control and experimental rats.**

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ . <sup>NS</sup> Statistically not significant.

**Reproductive Organ Weight**

**Table 3: Left side reproductive organ weight of the control and experimental rats**

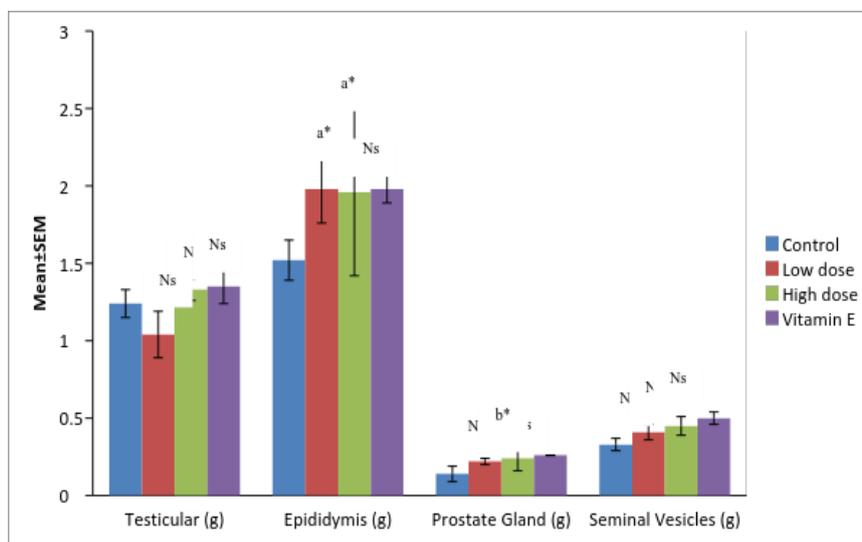
Groups (mg/kg)	Testicular (g)	Epididymis (g)	Prostate Gland (g)	Seminal Vesicles (g)
Control	1.28±0.08	1.55±0.15	0.12±0.03	0.26±0.04
Low Dose (150)	1.21±0.10	2.12±0.15*	0.26±0.03	0.37±0.04
High Dose (300)	1.31±0.05	2.11±0.19*	0.26±0.07*	0.30±0.01
Vitamin E (200)	1.35±0.12	2.06±0.12	0.24±0.02	0.43±0.05

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ .

**Table 4: Right side reproductive organ weight of the control and experimental rats**

Groups (mg/kg)	Testicular (g)	Epididymis (g)	Prostate Gland (g)	Seminal Vesicles (g)
Control	1.24±0.09	1.52±0.13	0.14±0.05	0.33±0.04
Low Dose (150)	1.04±0.15	1.98±0.22*	0.22±0.02	0.41±0.05
High Dose (300)	1.33±0.07	1.96±0.54*	0.24±0.08*	0.45±0.06
Vitamin E (200)	1.35±0.11	1.98±0.09	0.26±0.00	0.50±0.04

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ .



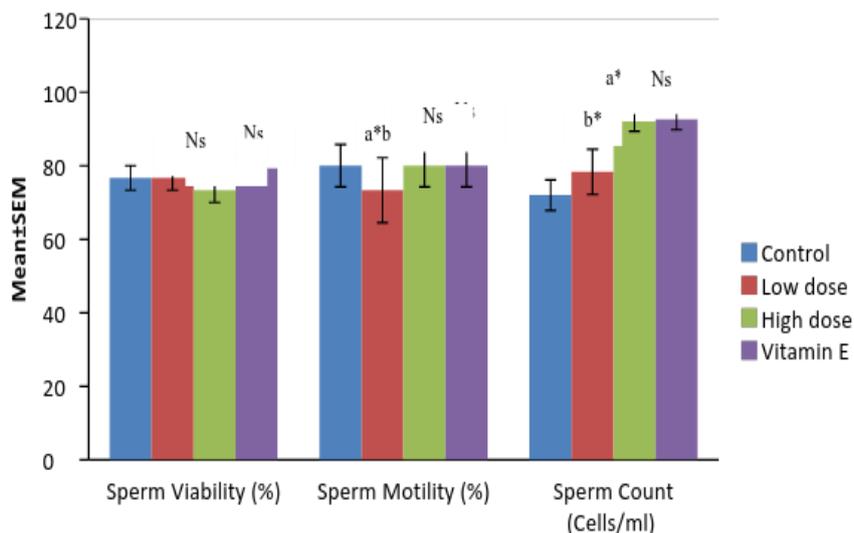
**Figure 2: Right side reproductive organ weight of the control and experimental rat's.**

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ . <sup>NS</sup> Statistically not significant.

**Table 5: Semen analysis in the control and experimental rats groups**

Groups (mg/kg)	Sperm Viability (%)	Sperm Motility (%)	Sperm Count (Cells/ml)
Control	76.67±3.33	80.00±5.77	72.00±4.16
Low Dose (150)	76.67±3.33	73.33±8.81*	78.33±6.17*
High Dose (300)	73.33±3.33	80.00±5.77	92.00±2.65*
Vitamin E (200)	80.00±0.00	80.00±5.77	92.67±2.91*

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ . <sup>NS</sup> Statistically not significant.



**Figure 3: Semen analysis in the control and experimental rats groups.**

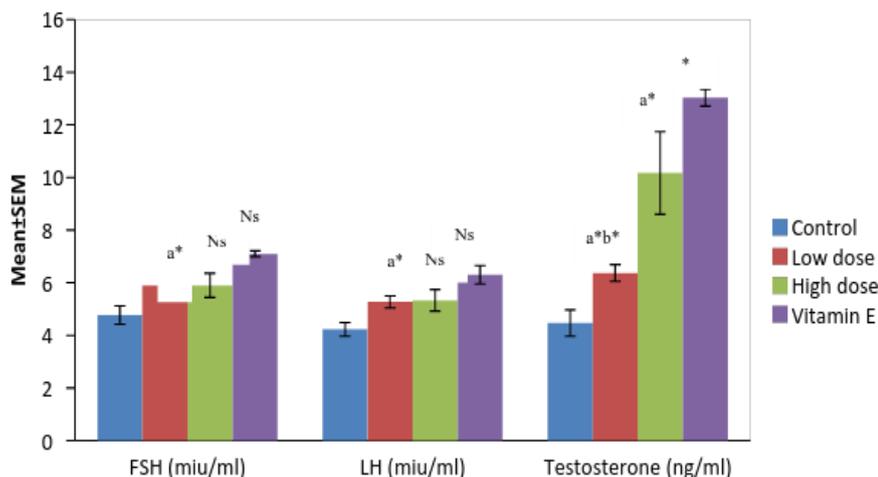
Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ . <sup>NS</sup> Statistically not significant.

**Activities of serum FSH, LH, and Testosterone in the control and experimental groups**

**Table 6: Activities of serum FSH, LH and testosterone in control and experimental groups**

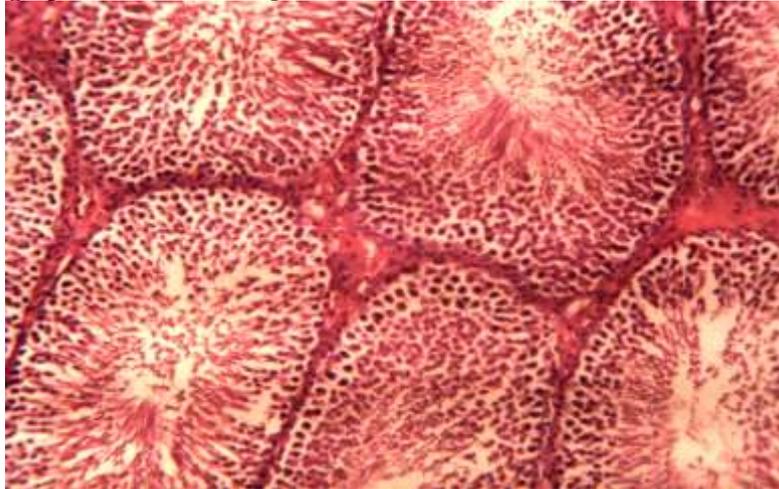
Groups (mg/kg)	FSH (miu/ml)	LH (miu/ml)	Testosterone (ng/ml)
Control	4.77±0.35	4.23±0.26	4.47±0.50
Low Dose (150)	5.90±0.31*	5.27±0.23*	6.37±0.32*
High Dose (300)	5.90±0.46	5.33±0.41	10.17±1.57*
Vitamin E (200)	7.10±0.11	6.30±0.35	13.03±0.32*

Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ .

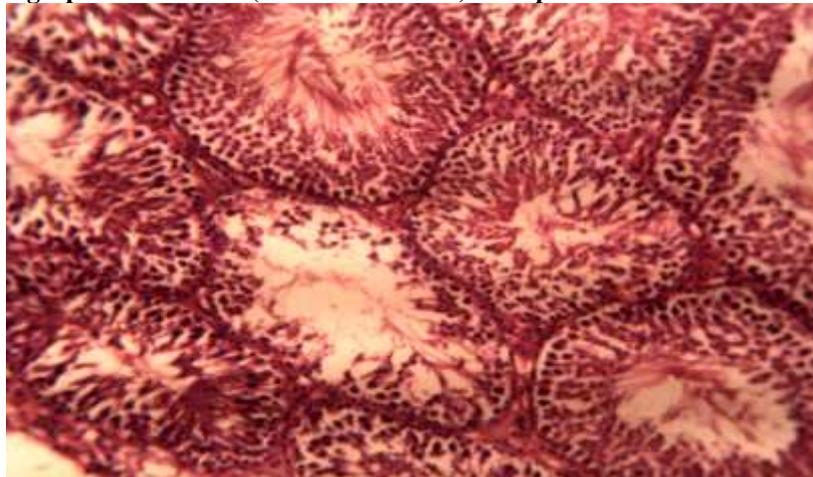


**Figure 4: Activities of serum FSH, LH and testosterone in control and experimental groups.**

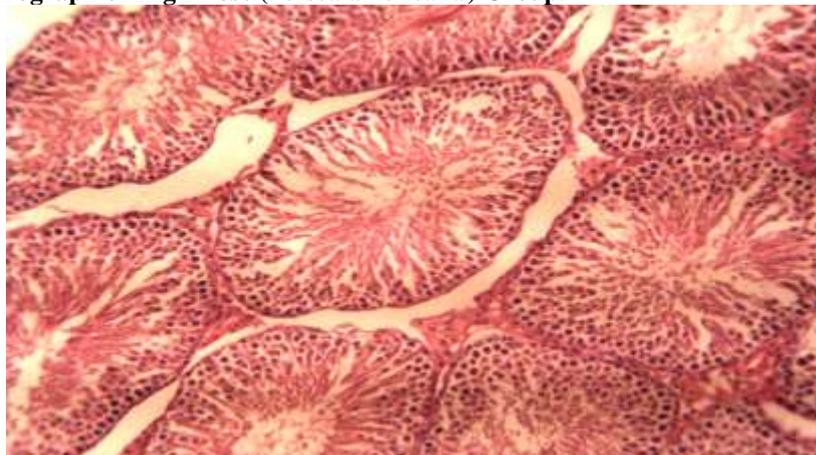
Values are given as mean ± SEM. \* Significant at  $p \leq 0.05$ . <sup>NS</sup> Statistically not significant.

**Testicular Photomicrograph of Control Group**

**Figure 5: Light microscopic photomicrograph of left testis from adult rats in control groups showing normal spermatogenic epithelium composed of different spermatogenic cells, sertoli cells, leydig cells. Magnification: × 100.**

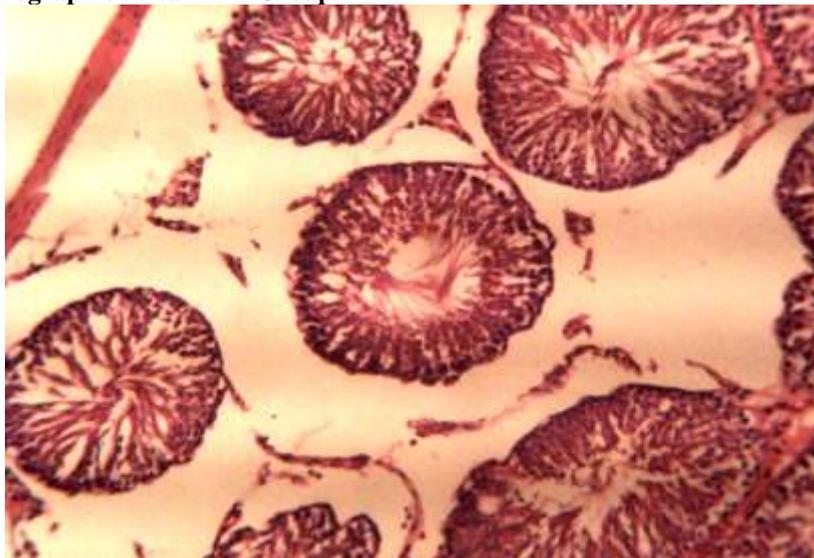
**Testicular Photomicrograph of Low Dose (*Persea americana*) Group.**

**Figure 6: Light microscopic photomicrograph of left testis from adult rats in low dose (persea americana) showing abnormal testicular architecture with focal areas of germ cells layer reduction and mild tubular thickness. Magnification: × 100.**

**Testicular Photomicrograph of High Dose (*Persea americana*) Group.**

**Figure 7: Light microscopic photomicrograph of left testis from adult rats in high dose (persea americana) showing abnormal testicular architecture with focal areas of germ cells layer reduction and mild tubular thickness. Magnification: × 100.**

### Testicular Photomicrograph of Vitamin E Group.



**Figure 8:** Light microscopic photomicrograph of left testis from adult rats in standard drug showing normal spermatogenic epithelium composed of different spermatogenic cells, sertoli cells, leydig cells. Magnification:  $\times 100$ .

### DISCUSSION

The result of the study showed a slight increase in the final body weight of the rats in the treated groups which was not significant when compared to the initial body weight of the rats and the final body weight of the control group at the end of the 56 days ( $p \geq 0.05$ ). The slight increase in the body weight of the rats could be due to the presence of oleic acid in the *Persea americana* (avocado).<sup>[31]</sup>

The epididymis organ weight of the treated groups showed significant increase when compared with the control group ( $p \leq 0.05$ ). The prostate gland also showed a significant increase when the high dose group was compared to the vitamin E group ( $p \leq 0.05$ ). The increase in the weight of the epididymis and prostate gland could be due to the ability of the *Persea americana* to stimulate the proliferation of epithelial cells.<sup>[32] [33]</sup>

A slight decrease was observed in the weight of the testes of low dose group when compared to the control group and the vitamin E group, which was statistically not significant ( $p \geq 0.05$ ). However a slight increase was observed in the vitamin E group, which was also statistically not significant at ( $p \geq 0.05$ ). The slight increase observed in the vitamin E group could be due to the increase in testosterone which enhances spermatogenesis.<sup>[32] [34]</sup>

The high dose extract group and the vitamin E group showed a significant increase in sperm count when compared to the control group and the low dose group at  $p \leq 0.05$ . The significant increase in the sperm count could be due to the increased secretion of the testosterone when the extract and vitamin E were administered, which aided spermatogenesis.<sup>[34]</sup>

The sperm viability and sperm motility showed a slight decrease when the high dose group was compared to the control group and the low dose group, which was though not statistically significant ( $p \geq 0.05$ ). A slight increase was observed when the vitamin E group was compared to the control group and the high dose group, which was also statistically not significant at ( $p \geq 0.05$ ).

The low dose of extract group showed a significant increase when compared with the control group at ( $p \leq 0.05$ ) of the Follicle Stimulating Hormone (FSH) and the Luteinizing Hormone (LH). A slight decrease was observed in the follicle stimulating hormone (FSH) and the luteinizing hormone (LH) when the vitamin E group was compared with the control group, which was statistically not significant at  $p \geq 0.05$ . The slight increase seen in the vitamin E group when compared to the control group could be due to the stimulation of the hypothalamus by the vitamin E drug, which stimulates the secretion of the gonadotropin-releasing hormone (GnRH).<sup>[35] [34]</sup>

The high dose extract group when compared to the control group and the low dose group showed a significant increase in the testosterone level at  $p \leq 0.05$ . The low dose extract group when compared to the high dose group and vitamin E group showed a significant decrease of the testosterone at  $p \leq 0.05$ . The increase seen in the testosterone level at high dose could be as a result of the FSH and LH increased secretion.<sup>[36]</sup>

In the photomicrograph of the testicle, it was observed that the control group had normal spermatogenesis with intact germ cell layers of the seminiferous tubules being evidence of normal spermatogenesis. But the low dose group had an abnormal testicular architecture with focal areas of germ cells layer reduction and mild tubular

thickness. It was also observed that the high dose group had an abnormal testicular architecture with focal areas of germ cells layer reduction and mild tubular thickness. The abnormality observed in the testicular architecture could be as a result of the phenol content present in the extract. In the vitamin E group, it was observed under the photomicrograph to be structurally the same with the control showing normal spermatogenesis with intact germ cell layers of the seminiferous tubules, hence there is every evidence of normal spermatogenesis.<sup>[37]</sup>

## CONCLUSION

*Persea americana* extracts and vitamin E drug enhance the sperm count, although the extract caused a decrease in the sperm motility and viability which could have been as a result of the phenol content present in the extract. The phenol content may also have affected the testicular architecture of the experimental groups. The *Persea americana* extract also enhances the Follicular Stimulating Hormone (FSH) and Luteinizing Hormone (LH) levels in the blood which increased the level of testosterone. The enzyme assay level was normal which was due to the absence of increased cellular division.

As much as *Persea americana* extract enhances sperm count and hormones of reproduction, and consequently enhancing fertility in male, caution should be taken to avoid its indiscriminate use because of its side effects on the testicular architecture and the motility/viability of the sperm cells. Vitamin E still serves as a better alternative because of the advantage it has over *Persea americana* in these regards: the testicular architecture and sperm motility/viability remain intact.

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