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EFFECT OF *FICUS ASPERIFOLIA* AQUEOUS EXTRACT ON SEMEN QUALITY, TESTICULAR HISTOLOGY AND REPRODUCTIVE PERFORMANCE OF NEW ZEALAND WHITE RABBITS RAISED UNDER TROPICAL CONDITION

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Abstract

Thirty-six rabbits consisting of two groups of 18 bucks and 18 does were allotted into three treatment groups (T1, T2 and T3 : 0 ml, 10 ml and 20 ml of aqueous *Ficus asperifolia* leaves extract, respectively) on a weight equalization bases in a completely randomized design. Data collected on the semen characteristics and reproductive performance were subjected to One Way analysis of variance; significant means were separated using Duncan-Multiple Range Test while data collected on reproductive hormones were subjected to descriptive statistical representation. Results revealed that *Ficus asperifolia* leaves extract significantly ($p < 0.05$) influenced the testosterone and double head sperms which significantly ($p > 0.05$) reduced with increase in level of administration of aqueous *Ficus asperifolia* leaves extract. Rabbit does administered 10 ml and 20 ml aqueous *Ficus asperifolia* leaves extracts recorded similar and higher (83.33%) breeding efficiency; fertility index was significantly ($p < 0.05$) highest in rabbit does administered 20 ml (5.17) and lowest in control group (3.17). This study therefore concluded that *Ficus asperifolia* leaves extract improved reproductive performance in the does as does administered *Ficus asperifolia* leaves extract significantly ($p < 0.05$) exhibited higher breeding efficiency and fertility index.

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Introduction

Rabbit is an important livestock that can contribute to meat and protein production in developing countries due to its rapid growth rate, high reproduction potential and ability to utilize forage (BIOBAKU and DOSUMU 2003). This is because human population growth in developed countries is stabilizing while that of developing countries including Nigeria is still increasing rapidly. Hence, there is need to intensify the search for alternative sources of protein to meet up with this population challenge (MAILAFIA et al. 2010). However, there are myriad of problems confronting rabbit farming in these countries, which have resulted to a gross shortage of meat to meet up with the population challenge (NWORGU 2007). One of these problems is breeding problem.

Breeding challenges always increase in the hottest months of the year and these could be as a result of summer heat. Bucks can become sterile in extremely hot weather. The length of time sterility lasts is directly proportional to the length of exposure; this condition affects adult males more than maturing ones (MATOLLI 1982). When the temperature exceeds 29^{o}C for several consecutive days, male rabbits remain sexually active but may not be fertile for about 60 days (i.e mounting without conception). Other conditions that can inhibit conception include physical condition, nutritional deficiencies, decreasing daylight, inherited factors, molting, stress, age, diseases and abnormalities like the malformation or absence of any of the reproductive organs e.g. un-descended testicles (LEBAS 1983).

NWOKO and IBE (2005) opined that the reproductive performance of the male is an essential economic trait in the management of breeder stock and the evaluation of the ejaculate is an important aspect of the determination of the reproductive status of the male animals. Some medicinal plants and plant products have been used in handling primary medical difficulties due to their accessibility, availability and affordability in developing countries. In these countries, a variety of plants are claimed to have fertility regulating properties and a few have been tested for such effect (BAKER et al. 1999, TELEFO et al. 2002, GANGULY et al. 2007, CHERDSHEWASART et al. 2007).

Ficus asperifolia is one of these plants. It is a small or average size tree, terrestrial or epiphyte which can reach 20 m in height. It is found in Senegal, Uganda, Tanzania, Natal (South Africa), Madagascar and Cameroon. According to ADJANOHUN et al. (1996), *Ficus asperifolia* is abundant in the savannah regions, especially along river banks and marshy areas at an altitude of up to 1100 m. The leaves are enormous and displayed spirally, the limb is largely oval or has a form of ellipse and the roots are most

often fibrous. Traditional medicine of this same region indicates that the decoction of dry fruits of *Ficus asperifolia* is used to reverse some cases of sterility or infertility whereas the leaves are used as anthelmintic and purgative. Although there is no scientific evidence to support the ethnopharmacological reputation of *Ficus asperifolia* on female reproduction, tribes continue to popularly use it in the management of cases of sterility or infertility in women. Previous work done by OMONIWA and LUKA (2012) on the aqueous stem extract of *Ficus asperifolia* revealed that it possesses hypoglycemic and hypolipidemic properties on diabetic rats while NKAMIFIYA et al. (2010) also published that the leaves of *Ficus asperifolia* has a higher protein, crude fibre and mineral contents than some vegetables. This study therefore seeks to evaluate the effect of aqueous extracts of *Ficus asperifolia* leaves on the semen characteristics, testicular histology and reproductive performance of New Zealand white rabbits.

Materials and Methods

The research work was carried out at the Rabbitry Unit of the Directorate of University Farms (DUFARMS) of Federal University of Agriculture, Abeokuta (FUNAAB) Ogun State, Nigeria. The region lies between latitude 7º10'N and longitude 3º2'E and altitude 830 m above the sea level. The experimental site is located in the derived savannah vegetation zone of South-Western Nigeria with annual average rainfall of 1100 mm and peak rainfall temperature ranges from 28ºC in December to 36ºC in February with a yield average relative humidity of about 82% (GOOGLE EARTH 2019).

The study protocol was approved and conducted in line with the Animal Ethics Committee guidelines of Federal University of Agriculture, Abeokuta, Nigeria (FUNAAB 2013). Thirty six New Zealand White rabbits with average weight of 2.1 kg and 6 months old were purchased from reputable farms in Abeokuta. Before the arrival of the animals, the stable was thoroughly washed and disinfected in readiness for stocking. On the first day of arrival of the animals, they were given anti stress (Maxiyield) and duration of acclimatization was two weeks to enable the animals adapt to the environment.

Thirty six (36) New Zealand White (NZW) rabbit bucks and does were divided into two groups of 18 bucks and 18 does. Each group was randomly assigned to three experimental treatment groups on a weight equalization bases in a completely randomized design. Each treatment group was subdivided into six replicates with a rabbit per replicate. Treatment 1 was

orally administered 0 ml aqueous *Ficus asperifolia* leaves extract and served as control, Treatment 2 and Treatment 3 were administered the prepared aqueous *Ficus asperifolia* leaves extract orally with 10 ml and 20 ml daily respectively for 3 weeks consecutively. After three weeks of *Ficus asperifolia* leaf extracts administration, does were hand mated twice to ensure conception and palpated at the 14th day of the gestation for pregnancy test. Kindling boxes were introduced on the 28th day of gestation into the hutches to stimulate nest building, safe delivery and kits protection. The animals were housed under the same condition fed concentrate containing 16% crude protein, 7% crude fibre, 5% ether extract, 1.6% calcium, 0.5% phosphorus, 0.75% lysine, 0.36% methionine, 0.3% salt (NaCl), 10,250.8 MJ/kg Metabolizable Energy and supplied water ad-libitum. This was supplemented with Tridax procumbens twice a week to prevent bloating. The experiment lasted for 12 weeks.

The fresh leaves of *Ficus asperifolia* were harvested within the environment of Federal University of Agriculture, Abeokuta. The leaves were sorted to remove contaminants, dead matter, sand particles and were air dried for 10 days in the absence of sunlight to retain its nutrients. The air-dried leaves were finely powdered using electric blender. The powdered leaf meal obtained was stored until further use. 200 g of the leaf meal was measured into conical flasks and extracted with 1000 ml distilled water for 24 hours. The mixture was filtered into 500 ml conical flasks with Whatman paper no. 1. The solution was filtered, decanted and filtered three times using sieve to achieve aqueous leaves extract of *Ficus asperifolia*.

At the end of the 3rd week Ficus administration, 5 ml of blood sample was collected from 3 bucks and 3 does per treatment into heparinized sterile test tubes and immediately centrifuged (4000 g) for 15 minutes. Then, plasma was separated and stored at -20^{o}C until hormonal assay was carried out. Concentration of melatonin in blood plasma was determined using commercial kit according to PINTOR et al. (2001). Plasma concentration of FSH and plasma concentration of LH were determined in duplicate by RIA, using commercial kit according to UBILLA et al. (1992). Also, Testosterone was determined using commercial kit according to ASHBY et al. (1980).

Testes were harvested from three bucks that were randomly selected per treatment for morphometric analysis and histology. Testes were carefully separated and freed of tunica albuginea and all adhering connective tissues. The length of each testis was measured using a vernier caliper. The testes weight (Left and Right) were measured on electronic scale. In estimating the testicular histology, the harvested testes were fixed in 10% formalin, dehydrated in a graded series of ethanol saturated in benzene,

benzene-paraffin and embedded in paraffin wax (MASSANYI et al. 2000). Testes were sectioned on a microtome and serial 10 m thick sections were stained with haematoxylin and eosin. Lumen and germinal epithelium of the treatments were treatments were compared.

For the semen evaluation, the caudal epididymis was placed in beakers containing physiological saline (maintained at 37ºC) and several lacerations were made on it to enable the spermatozoa swim out. Sperm motility was immediately determined by placing a drop of the suspension on a clean glass slide under the cover slip and viewed on a binocular microscope. Sperm motility was assessed immediately by counting both motile and immotile spermatozoa per unit area at the magnification of ×40. Sperm viability was assessed using eosin-nigrosin test. The percentages of unstained (live) and stained (dead) spermatozoa were calculated by counting 100 spermatozoa per sample (ZEMJANIS 1977).

Data collected on the reproductive parameters include:

– gestation length: this was determined by the time interval between conception and kindlin;
– breeding efficiency: this was expressed in terms of percentage of does that kindled following mating;
– litter weight at birth: this was obtained by weighing all the kits kindled by a doe in a litter together;
– average birth weight: it was determined by dividing litter weight at birth by the total number of the kits;
– litter size at birth: it was determined by counting the total number of kits born per doe both still and live kits;
– litter size at weaning: this was determined by counting the remaining number of kits at the time of weaning;
– pre-weaning loss: this was determined by counting and recording number of kits that died before weaning;
– litter weight at weaning: this was obtained by weighing all the kits remaining in a litter together at the time of weaning;
– fertility index was determined by multiplying the total number of litter at birth by the breeding efficiency divided by 100;

$$\text{Fertility Index (FI)} = \frac{\text{breeding efficiency (BE)}}{\text{litter size at birth (LSAB)}} \cdot 100$$

– still birth: it was determined by counting the number of kits dead at birth in a litter;
– litter weight gain: this was obtained by subtracting litter weight at birth from litter weight at weaning;
– kit weight gain: it was determined by dividing litter weight gain by litter size at weaning;

– weaning rate: this was obtained by dividing litter size at weaning by litter size at birth multiplied by 100;
– doe weight at kindling: it was taken on the kindling day by digital weighing scale;

$$\text{Weaning rate (WR)} = \frac{\text{litter size weaning (LSAW)}}{\text{litter size at birth (LSAB)}} \cdot 100$$

– doe weight at weaning: it was taken through the weighing of the kit on weaning.

Data obtained were subjected to One Way analysis of variance in a complete randomized design (CRD). Significant differences ($p < 0.05$) among means were separated using Duncan-Multiple Range Test as contained in SAS (2010).

Results

The effects of oral administration of aqueous *Ficus asperifolia* leaves extract on the reproductive hormones of rabbits is presented in Table 1 and Figures 1–3. *Ficus asperifolia* leaves extract significantly ($p < 0.05$) influenced the testosterone where the lowest value (0.09 mg/ml) was observed in the rabbits orally administered 20ml of the extract and the highest value (0.69 mg/ml) for testosterone was observed in the control treatment orally administered 0ml of the extract. There were no significant ($p > 0.05$) difference in luteinizing hormones and follicles stimulating hormones of the rabbits orally administered the extract. The luteinizing hormones increased numerically with increasing levels of *Ficus asperifolia* leaves extract; the values range from 2.86 mg/ml to 5.85 mg/ml and follicles stimulating hormones values range from 5.31 mg/ml to 12.77 mg/ml.

Table 1

Reproductive hormones analysis of rabbits administered aqueous *Ficus asperifolia* leaves extract

Parameters	0 ml	10 ml	20 ml	SEM
Testosterone [mg/ml]	0.69^a	0.17^b	0.09^b	0.10
LH [mg/ml]	2.86	4.26	5.85	1.37
FSH [mg/ml]	10.21	5.31	12.77	2.23

Means having different alphabet across the column are significantly different ($p > 0.05$)
LH – luteinizing hormone, FSH – follicles stimulating hormones

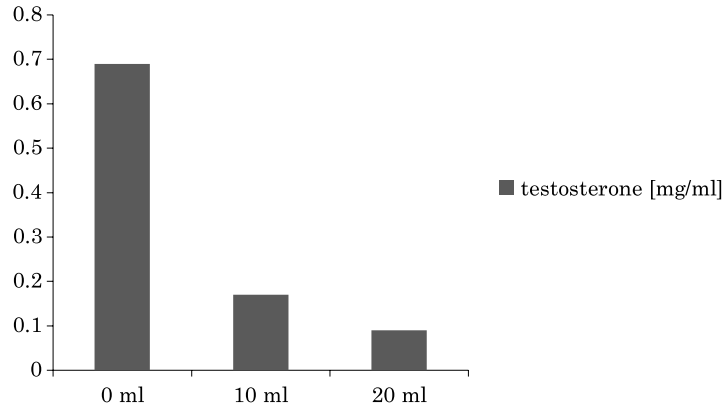

Fig. 1. Effect of *Ficus asperifolia* leaves extract on the testosterone of rabbits

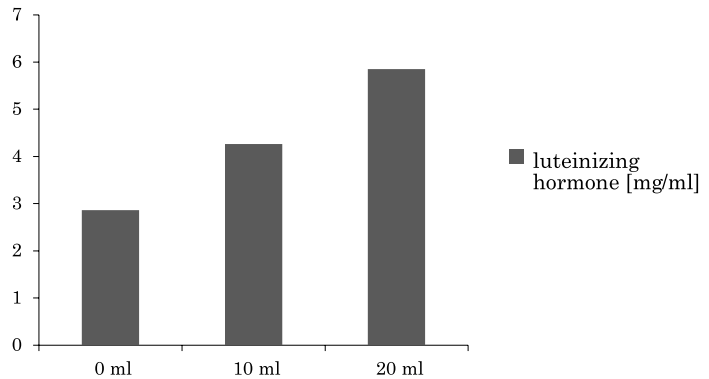

Fig. 2. Effect of *Ficus asperifolia* leaves extract on the luteinizing hormone of rabbits

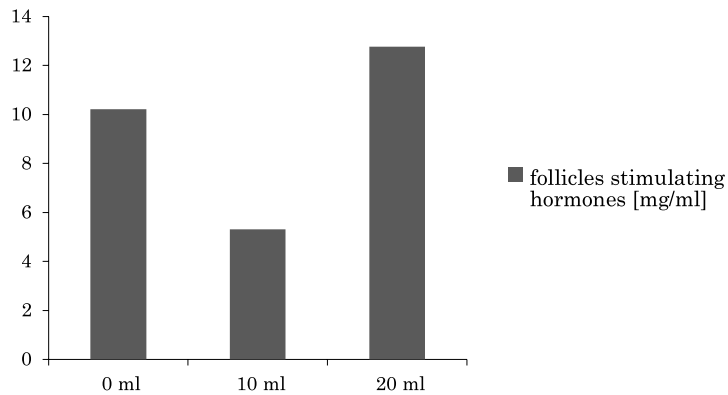

Fig. 3. Effect of *Ficus asperifolia* leaves extract on the follicles stimulating hormone of rabbits

The result obtained on the effect of oral administration of *Ficus asperifolia* on semen characteristics of New Zealand White rabbit is shown on Table 2. Oral administration of aqueous leaf extract of *Ficus asperifolia* at different levels (0 ml, 10 ml and 20 ml) had no significant effect ($P > 0.05$) on all the semen quality parameters measured in this study except on Double head sperms. Double head significantly ($p > 0.05$) reduced with increase in level of administration of aqueous *Ficus asperifolia* leaf extract. The highest value (6.00) of Double head was recorded in rabbit bucks administered 0ml of the extract while the least value (2.33) was observed in bucks given 20ml of the extract. Rabbit bucks administered 0 ml aqueous *Ficus asperifolia* leaf extract recorded the highest numerical values for liveability, live/death ratio and PH (96%, 0.38% and 7.7) respectively while individual motility was numerically highest in bucks administered 10 ml of the extract. Normal to abnormal sperm ratio and sperm concentration was observed in bucks administered 20 ml of the extract.

Table 2

Effect of oral administration of leaf extract of *Ficus asperifolia* on semen characteristics of New Zealand White rabbits

Parameters	Dosage			
	treatment 1 (0 ml)	treatment 2 (10 ml)	treatment 3 (20 ml)	SEM
Sperm motility [%]	94.67	94.67	96.33	10.70
Individual Motility	90.00	92.00	90.67	1.42
Liveability	93.33	87.67	94.67	2.05
Normal cell [%]	77.00	73.33	83.67	2.48
Abnormal cell	23.00	26.67	16.33	2.12
pH	7.70	7.11	7.35	0.13
Conc. [$\cdot 10^6$/ml]	344.50	348.33	363.00	13.71
Double head	6.00^a	4.33^{ab}	2.33^b	0.68
Free tail	0.88	0.58	0.33	0.44
Bent tail	2.67	3.67	4.00	0.63
Abnormal head	1.33	2.00	1.33	0.34

Table 3 shows the effect of *Ficus asperifolia* leaf extract on major testicular morphometry parameters administered at different levels. There was no significant ($P > 0.05$) difference between the animals for the parameters observed. There was no difference in testicular weight of the rabbit bucks administered 0 ml, 10 ml and 20 ml of aqueous *Ficus asperifolia* leaf

extract while the animals on 0ml of the extract has highest numeric testis length of 11.63 cm compare to 9.96 cm and 7.80 cm observed in animals with 10 ml and 20 ml of the extract respectively.

Table 3

Effect of oral administration of leaf extract of *Ficus asperifolia* on testicular morphometry of New Zealand White rabbits

Parameters	Dosage			
	treatment 1 (0 ml)	treatment 2 (10 ml)	treatment 3 (20 ml)	SEM
Testis weight [g]	3.33	3.33	3.33	0.28
Testis length [cm]	11.63	9.96	7.8	0.86

Effect of oral administration of leaf extract of *Ficus asperifolia* on testis histology of New Zealand White rabbits.

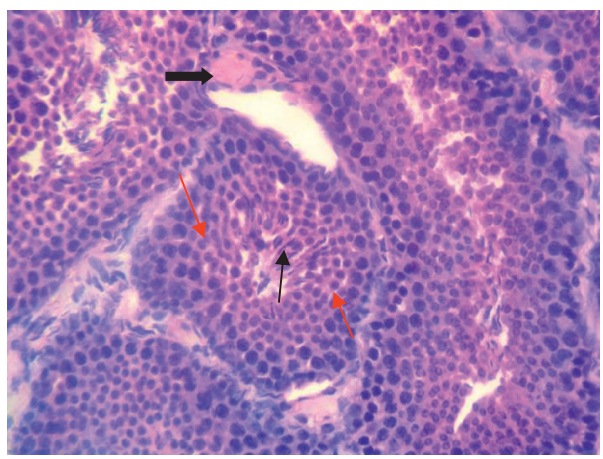

Fig. 4. Photomicrograph of testes tissue section of rabbit bucks administered 0 ml of *Ficus asperifolia*

There are numerous, closely packed, variably sized seminiferous tubule. The STs are packed full with abundant amounts of spermatogenic cells evidenced by the increased height of the germinal epithelium and reduced luminal space. Elongate spermatids (black arrow) and spermatocytes (red arrows) predominate. There is moderate congestion of the testicular blood vessels (thick arrow).

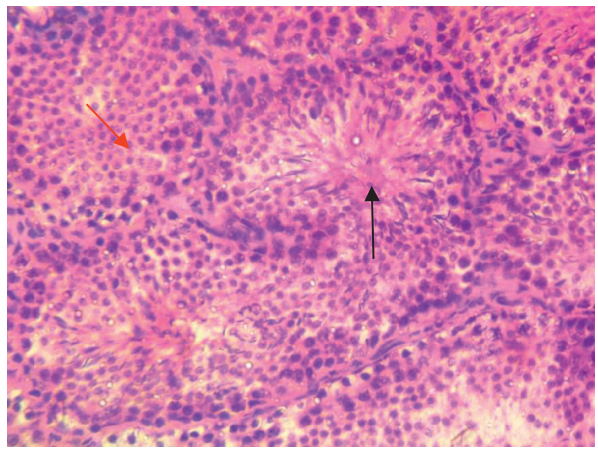

Fig. 5. Photomicrograph of testes tissue section of rabbit bucks administered 10 ml of *Ficus asperifolia*

There are numerous closely-packed large STs with regular outlines. These STs contain abundant amounts of spermatogenic cells. There is normal polarization and differentiation of the spermatogenic cells from the basal compartment to the luminal compartment. Elongate spermatids (black arrow) and spermatocytes (red arrows) predominate.

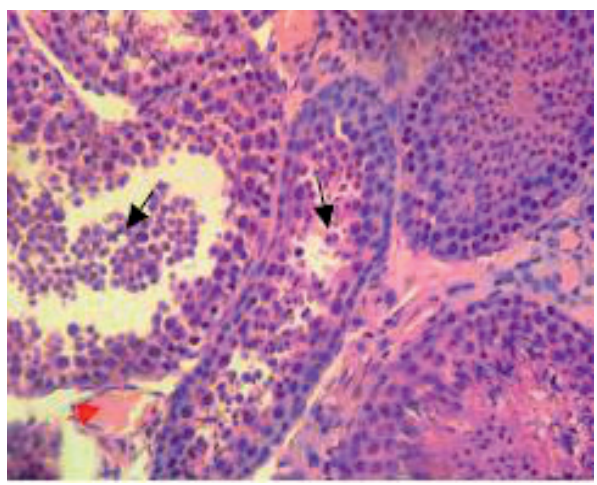

Fig. 6. Photomicrograph of testes tissue section of rabbit bucks administered 20 ml of *Ficus asperifolia*

There are numerous closely-packed, variably-sized STs with regular outlines. The STs show depletion and loss of spermatogenic cells from the basal aspects to the luminal aspects (black arrows). There is moderate congestion of the testicular blood vessels (red arrow).

Reproductive performance of rabbit does administered *Ficus asperifolia* leaves extract results presented in Table 4 show significant ($p < 0.05$) effect only for breeding efficiency, fertility index, doe weight at kindling and weaning. Doe administered *Ficus asperifolia* leaves extract significantly ($p < 0.05$) exhibited higher breeding efficiency and fertility index and reduced weight at kindling and weaning than the control. Rabbit does administered 10 ml and 20 ml aqueous *Ficus asperifolia* leaves extracts recorded similar and higher (83.33%) breeding efficiency compare to the 50% of rabbit does administered 0ml. Fertility index was significantly ($p < 0.05$) highest in rabbit does administered 20 ml (5.17) and lowest control group (3.17). Doe weight at kindling (2567.33g) and weaning (2600.00 g) was significantly ($p < 0.05$) higher in the control group than rabbit does administered *Ficus asperifolia* leaves extract.

Table 4

Reproductive performance of rabbit does administered *Ficus asperifolia* leaves extract

Parameters	Levels of *Ficus asperifolia* leaves extract			
	(0 ml)	(10 ml)	(20 ml)	SEM
Gestation length [d]	31.33	31.40	31.20	0.24
Breeding efficiency [%]	50.00^{b}	83.33^{a}	83.33^{a}	4.05
Litter weight at birth [g]	296.67	270.00	244.60	15.66
Average birth weight [g]	48.99	48.85	40.43	2.43
Litter size at birth	6.33	5.60	6.20	0.41
Litter size at weaning	4.00	5.20	4.00	0.54
Pre-weaning loss	2.33	0.40	2.00	0.60
Litter weight at weaning [g]	1588.33	2330.00	1650.00	248.29
Fertility index	3.17^{b}	4.67^{ab}	5.17^{a}	0.37
Still birth	0.00	0.00	0.20	0.08
Litter weight gain [g]	1286.67	2060.00	1405.40	254.50
Kit weight gain [g]	298.89	434.29	359.94	42.52
Weaning rate [%]	70.24	91.00	69.29	8.74
Doe weight at kindling [g]	2567.33^{a}	2222.00^{b}	2384.40^{ab}	58.82
Doe weight at weaning [g]	2600.00^{a}	2104.80^{b}	2350.00^{ab}	68.36

^{ab} Means on the same row having different superscripts are significantly different ($P < 0.05$).

Discussion

Testosterone hormone is produced by the interstitial cells of the testis and necessary for the completion of spermatogenesis. The testosterone values recorded was significant ($P < 0.05$) across the treatment and decreased with increasing level of *Ficus asperifolia* leaves extract. This result is an indication that *Ficus asperifolia* leaves extract can be used to reduce sexual drive in male animals; hence, it can be a biological method of castration for male animals, thereby reducing stress given to the animals in using other methods of castration and also to improve animal welfare. EL-HANOUN et al. (2014) reported that a good relationship exist between increased testosterone concentration and increased libido of male rabbits. The numerical increase observed in the value (12.77 mg/ml) of FSH of rabbits administered (20 ml) of the extract is in line with the report of OLUYEMI et al. (2007) that flavonoids increased follicle stimulating hormones (FSH) in rat models administered extract of *Garcinia kola.* Herbs balance the levels of hormones such as testosterone, luteinizing hormone and follicle stimulating hormones (KOUMANOV et al. 1982) and *Ficus asperifolia* is one of these herbs which its phytochemical screening have detected flavonoids, saponins, alkanoids, tannins, steroids and many others (OMONIWA et al. 2013).

The results of semen evaluation of New Zealand White rabbit administered aqueous leaf extract of *Ficus asperifolia* showed that the extract did not significantly influence semen characteristics parameters observed in the study except a significant increase in the number of coil tails. The significant increase observed in the number of coil tails in the animals administered aqueous *Ficus asperifolia* leaves extract and other indicators of abnormal sperm cells (bent tail and free tail) suggested that the extract can be used to reduce abnormal sperm cells thereby increasing chance of successful copulation. The values of sperm concentration observed in this research ranged from 344.50 to 363.00 $\cdot 10^6$/ml; it is conceivable that the increase in sperm concentration might lead to higher fertility which is supported by the findings of OYEYEMI et al. (2008). These values were higher than the recorded values of 136.00 to 184.00 $\cdot 10^6$/ml stated by AJAYI et al. (2009) on sperm motility of rabbits fed graded levels of blood-sunflower meal. OYEYEMI and OKEDIRAN (2007) reported that an increased concentration of spermatozoa is a signal to a possible high fertility rate by the reason of the number of spermatozoa available during service or insemination. Higher motility value obtained from animals administered the extract is an indication that the extract had supplied adequate nutrient to support sperm motility. OYEYEMI et al. (2002) reported that

adequate nutrition with high percentage of crude protein enhance motility and concentration of spermatozoa. Also, the results of this study are much higher than those reported by ABU and UCHENDU (2010), who studied the antispermatogenic effects of aqueous ethanolic extracts of *Hymenocardia acida* stem bark on sperm motility of laboratory rodents and obtained values of 23–28%. Sperm concentration in this study is higher than 126.00 to 154.00 · 10^6/ml and 123.30±1.76 to 138.30±1.20 reported by AHEMEN et al. (2013) on sperm quality and testicular morphometry of rabbits fed dietary levels of water spinach (*Ipomoea aquatic*) leaf meal and falls within the range of 50 to 350·10^6/mm^3 reported by BRACKETT (2004) and also similar to what was obtained by HAFEZ (1970) for rabbit bucks. The variation may be attributed to effect of the treatment and the breed or genetic line of the animal as indicated by ALVARINO (2000). High concentration of sperm recorded in this study is a sign of high possible fertility at the time of copulation.

The percentage normal sperm cells in this research ranged from 73.33 to 83.67% and were not significantly affected by *Ficus asperifolia* leaves extract. The percentage normal sperm cells value was higher in rabbit bucks administered 20 ml (83.67%) compared with 0 ml (77%) and 10 ml (73.33%). ARTHUR et al. (1989) discovered that high quality semen samples show an average of 25% dead sperms. The average value of percentage normal sperm (an indicator of sperm viability and fertilizing capacity) cells reported in this research was within the range of high quality samples. The percentage live sperm cells, which also indicate sperm viability and possibly higher fertilizing capacity, are those present for use during fertilization (AJALA et al. 2001). The percentage of abnormal sperm cells values in this research ranged from 16.33 to 26.67%. The percentage of abnormal sperm cells in bucks administered 20 ml extract were lower than the upper limit of 20% suggested as the least quantity recommendable for good reproductive potential and fertility in either normal mating or in artificial insemination (OYEYEMI and OKEDIRAN 2007). AJAYI et al. (2009) established the influence of quality feeding on sperm characteristics of rabbits. OYEYEMI et al. (1998) declared that quality nutrition with high percentage of protein will improve motility and concentration of spermatozoa.

The results of evaluation of testicular morphometry of New Zealand White rabbit fed aqueous leaf extract of *Ficus asperifolia* showed that the extract did not significantly influence testicular morphometry observed in this study. This result is in consonance with the submissions of BITTO and GEMADE (2001) who recorded a non-significant influence of pawpaw peel meal up to 30% on testicular morphometry of rabbit bucks and also agrees with the findings of OGUNLADE et al. (2006) who observed non-significant

differences in testis weight among rabbits fed fumonisin contaminated diets and AHEMEN et al. (2013) who fed water spinach leaf meal to male rabbits. The mean testicular weight values obtained in this study (3.33 g) is comparable to the range of 2.58±0.42 to 3.23±0.19 reported by AHEMEN et al (2013) in rabbits fed dietary levels of water spinach (*Ipomoea aquatica*) leaf meal and higher than the range (1.39–2.13 g) observed by ABU et al. *(*2016). The mean testicular weight (3.3g) observed in this study is lower than 3.1g reported by FRANCA et al. (2002) and higher than 6.7 g reported as the average testicular weight by HERBERT et al. (2005). Though not significant, the mean testicular length of rabbit bucks decrease with increase in the levels of administration of *Ficus asperifolia* leaves extract. Investigation on the morphometric parameters of reproductive tract have been observed to give invaluable information on adjudging the breeding and fertililizing ability of animals (OGBUEWU et al. 2009). GAGE and FRECKLETON (2003) reported that testes size, length and width of mammals are described as favourable pointer to the present and future spermatozoa production. Knowledge of the important morphometric qualities of the reproductive organ is important to enhance the opinion and forecast not only of sperm production ability, but likewise the storage potential and fertilizing capability of the breeder male. MOREIRA et al. (2001) verified in a study of Santa Ines sheep, that changes in testicular length and scrotal circumference is considered viable indicators of the effect of thermal stress on gonads. In accordance with EZEKWE (1998) and PERRY and PETTERSON (2001), testes size, length and width are high quality indicators of present and future sperm production. This enhances increased fertilizing potential in rabbits.

The effect of aqueous leaf extract of *Ficus asperifolia* on testis histology showed that, there was no observable difference in the seminiferous tubule of the observed animals from each of the treatments as the seminiferous tubule of the observed animals are numerous and closely packed. The seminiferous tubules are packed fully with abundant amount of spermatogenic cells evidence by increased height of germinal epithelium and reduced luminal space though the seminiferous tubules of animals on 20 ml of the extract show depletion and loss of spermatogenic cells from the basal aspect to the luminal aspect (Black arrows). This may be due to reduction in pH of the sperm as the extract is given at higher level. Animals on 0 ml and 10 ml of the extract had seminiferous tubule that is closely packed evident from the small size of the lumen. This non-differential observation reported in this study is in line with what was reported by CHRENEK et al. (2006) when comparing testicular histology of transgenic and non-transgenic line of rabbit and disagrees with report of EWUOLA and

EGBUNIKE (2002) on effects of dietary fumonisin B1 on the onset of puberty, semen quality, fertility rates and testicular morphology in male rabbits; they reported a degenerated seminiferous tubule on rabbits fed dietary fimonisin B1. It also contradict the report of IFEANYI et al. (2009) on Semen quality characteristics, reaction time, testis weight and seminiferous tubule diameter of buck rabbits fed neem (*Azadirachta indica A. Juss*) leaf meal based diets who also reported a decrease in size of seminiferous tubule of the animals fed test diet. The result from this study thus indicates that administering aqueous leave extract of *Ficus asperifolia* up to 10 ml did not have impairing effect on testicular histology though there is depletion and loss of spermatogenic cells at higher level (20 ml).

Significantly higher breeding efficiency exhibited by doe administered *Ficus asperifolia* leaves extract suggests that *Ficus asperifolia* leaves extract provided enough nutrients for maintenance and reproduction of the rabbits. This result is better and higher than the 16.67% breeding efficiency obtained from rabbits fed diet containing 7.5% Neem leaf meal reported by AYO-AJASA et al. (2018) and also disagrees with the 67 to 100% conception rate reported by ABDELLI-LARBI (2014) in New Zealand White breed of rabbits and the study of ODEYINKA et al. (2008) who fed Moringa leaf in place of *Centrosema pubescens*. Also the high fertility index reported in this study shows that *Ficus asperifolia* leaves extract prevented aspermic ejaculation from the bucks involved in the fertilization process and hence did not impair fertility (SZENDRO et al. 1984). This result could also be attributed to the high concentration of sperm recorded in this study which is a sign of high possible fertility at the time of copulation. Breeding efficiency and fertility index can be employed as traits to determine the future breeding programmes and lifetime productivity in rabbit production.

Conclusion

This study concluded that *Ficus asperifolia* leaves extract significantly ($p < 0.05$) reduced testosterone and double head sperm and improved reproductive performance in the does as does administered *Ficus asperifolia* leaves extract significantly ($p < 0.05$) exhibited higher breeding efficiency and fertility index and reduced weight at kindling and weaning than the control.

Recommendation

Aqueous *Ficus asperifolia* leaves extract can be used as biological method of castration for male animals and be used to boost breeding efficiency and fertility index which can be employed as traits to determine the future breeding programmes and lifetime productivity in rabbit production.

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