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EFFECT OF DIETARY INCLUSION OF *KIGELIA AFRICANA* ON SEMEN CHARACTERISTICS AND TESTICULAR MORPHOMETRY OF RABBIT BUCKS

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Abstract
The study investigated the effect of dietary supplementation with *Kigelia africana* (sausage tree) fruit powder on semen characteristics and testicular morphometry of rabbit bucks. Twenty grower rabbits (10–12 weeks old) were randomly assigned to four treatment groups with five animals each in a completely randomized design. Diets were formulated with 0 g/kg (control), 3 g/kg, 6 g/kg, and 9 g/kg of *K. africana* fruit powder. After 12 weeks of feeding, semen was collected using an artificial vagina and analyzed for semen volume, motility, viability, and concentration. Testicular morphometry was also assessed. Results revealed significant ($p<0.05$) improvements in semen volume, live sperm percentage, and sperm concentration in the supplemented groups, particularly at 6 g/kg (T2) and 9 g/kg (T3), compared with the control. Testicular parameters, including left testis weight, width, and length, were also significantly higher in supplemented groups. However, the highest inclusion level (9 g/kg) showed signs of reduced benefit in some traits. The findings indicate that moderate supplementation with *K. Africana* (6 g/kg feed) optimally enhances semen quality and testicular morphometry in rabbit bucks, suggesting its potential as a phytogenic feed additive in rabbit production.

Key words: *Kigelia africana*, rabbit bucks, semen quality, testicular morphometry, reproductive performance

DESCRIPTION OF PROBLEM

Rabbit production has gained increasing attention worldwide due to its potential to contribute significantly to food security by providing high-quality animal protein with minimal environmental impact (1). Rabbits are characterized by rapid growth, high feed conversion efficiency, and prolific reproduction (2). In rabbit farming, the reproductive performance of bucks plays a critical role in determining herd fertility and productivity, as semen quality and testicular morphology directly influence reproductive efficiency (3).

Enhancing reproductive efficiency using natural feed additives is gaining ground as an alternative to synthetic enhancers, given the increasing emphasis on sustainable livestock production. Phytogenic feed additives, derived from plants, have shown promising effects on animal performance and health by improving antioxidant status and modulating reproductive physiology (4). One such plant of interest is *Kigelia africana* (Bignoniaceae), commonly referred to as the sausage tree.

Traditionally, different parts of *K. africana* have been used in African medicine for the treatment of reproductive disorders, infectious diseases, and inflammatory conditions (5, 6). Its fruits and bark contain bioactive compounds such as flavonoids, phenolics, alkaloids, and naphthoquinones, which possess antioxidant, anti-inflammatory, and fertility-enhancing properties (7, 8). Previous studies have reported improvements in testicular morphology and sperm parameters in laboratory animals supplemented with *K. africana* extracts (9, 10).

However, limited research has been conducted on its effects in rabbits, particularly on semen quality and testicular development. This study therefore aimed to evaluate the effect of dietary inclusion of *K. africana* fruit powder on semen characteristics and testicular morphometry of rabbit bucks.

Materials and methods

The study was carried out at the Rabbit Unit of the Department of Animal Science Teaching and Research Farm, University of Nigeria, Nsukka. Nsukka, Enugu State, Southeastern Nigeria. A total of 20 mature (seven months old) rabbit bucks were used for the study. The rabbits were randomly allotted to four experimental diets (5/each) for 12 weeks. The diets were formulated with the inclusion of *K. africana* in different ratios as follows; 0g/kg, 3g/kg, 6g/kg and 9g/kg of feed for T1, T2, T3, and T4 respectively. The Experiment was arranged in a Completely Randomized Design (CRD). Fresh experimental diets and clean water were made available *ad libitium* for the bucks throughout the experimental period. All the management practices and ethics associated with animal use for experimentation in the University of Nigeria were strictly adhered to.

Semen collection and evaluation

The quality of the semen ejaculates of the sexually mature and healthy male rabbits were assessed as described by El-Desoky *et al*. (11) and Abdel-Wareth *et al*. (12). Semen was collected from twenty rabbits (one ejaculate per rabbit) per treatment at the end of 56 days. The ejaculates were collected using an artificial vagina. The volume of each ejaculate was recorded using a graduated collection tube after removal of the gel mass. The assessment of the live, dead, and abnormal sperm was performed by counting 200 sperm cells using an eosin-nigrosine blue staining mixture. The complete or partial purple-stained sperm cells were considered non-viable, whereas the non-stained cells were viable. The percentage of the motile sperm (progressive forward motility %) was performed in several microscopic fields in the semen samples under × 100 magnification using a light microscope with a hot stage and subjectively assessed from 0% to 100%.

Testicular morphometry

After rabbits were euthanized, the testes were collected and immediately covered in ice and was taken to the laboratory and processed the same day. The testes were trimmed off all adhering tissues and fat. The epididymis was carefully removed. Weight and measurements (length, width, and volume) were determined with the formula of Fathi *et al*. (13). The volumes of the testes were measured volumetrically using the Archimedes principle of water displacement in a measuring cylinder. Using a measuring cylinder, 1000ml of water was measured and the testis was inserted into the water, and the volume of water displaced represented the volume of the testis.

Result and discussion

The effects of dietary inclusion of *Kigelia africana* on the semen characteristics of rabbit bucks is presented in Table 1. Dietary inclusion of *K. Africana* significantly ($p<0.05$) affected semen volume, live sperm percentage, dead sperm percentage, and sperm concentration, while forward motility showed no significant ($p>0.05$) difference. Rabbits fed 6 g/kg (T2) and 9 g/kg (T3) had higher semen volume (1.55 ml), live sperm percentage (73.5%), and sperm concentration (87×10^6/ml) compared with the control group ($p<0.05$). Dead sperm percentage decreased significantly in supplemented groups.

The improvement in semen quality observed in *K. africana* supplemented groups agrees with reports that phytogenic feed additives can enhance male fertility by improving antioxidant status and reducing oxidative damage to sperm cells (14, 15). The increased semen volume and concentration in T2 and T3 groups may be attributed to androgenic properties of the fruit and on the other hand to the antioxidant properties. Indeed, it is well known that the phytochemicals such as flavonoids and phenolics present in the *Kigelia africana* fruit increase the level of testosterone and this hormone enhances spermatogenesis by stimulating Sertoli cell activity while the antioxidant properties of the fruit protect spermatozoa against lipid peroxidation (16, 17).

The effect of dietary inclusion of *Kigelia africana* on the testicular morphometry of rabbits is presented in Table 2. The results indicate that dietary inclusion of *K. Africana* significantly ($p<0.05$) influenced right testis weight, left testis weight, left testis length, left testis volume, and testis widths. T2 and T3 groups recorded significantly higher testicular weights and dimensions compared with the

control. However, T3 (9 g/kg) showed reduced values in some parameters compared to T2, suggesting possible negative effects of higher inclusion levels. The significant increase in testicular weights and dimensions may be attributed to the antioxidant properties of *Kigelia africana*, which mitigate oxidative stress, ensuring proper testicular growth and function (7). This result corroborates findings in other animal models (rats) where *K. africana* supplementation enhanced testicular growth (8, 18). The reduction observed at 9 g/kg inclusion suggests that excessive supplementation may impair testicular development, possibly due to phytochemical toxicity or hormonal disruption (19). These findings highlight the potential of *K. africana* as a natural fertility enhancer in rabbits, with optimal effects at moderate inclusion levels (6 g/kg). Its role in reducing dead sperm percentage also indicates its protective effect against oxidative stress-induced sperm mortality, consistent with reports by Adebayo *et al*. (20).

Table 1: Effect of Dietary Inclusion of Kigelia Africana on Semen Characteristics of Rabbit Bucks

Treatment Parameters	T1 (0g/kg)	T2 (3g/kg)	T3 (6g/kg)	T4 (9g/kg)	P value
Semen volume (ml)	0.77 ± 0.02^{b}	0.95 ± 0.15^{a}	1.55 ± 0.45^{a}	0.85 ± 0.05^{b}	0.02*
Forward motility	74.00±2.00	75.50±5.50	78.50±1.50	79.50±6.60	0.80^{NS}
Live sperm (%)	62.50 ± 1.50^{b}	66.00 ± 3.00^{b}	73.50 ± 1.50^{a}	70.50 ± 1.50^{a}	0.04*
Dead sperm (%)	37.50 ± 1.50^{a}	34.00 ± 3.00^{a}	26.50 ± 1.50^{b}	29.50 ± 1.50^{ab}	0.04*
Sperm Conc. ($x10^{6}$)	80.00 ± 3.00^{b}	81.00 ± 4.00^{b}	87.00 ± 1.0^{a}	82.00 ± 2.00^{ab}	0.03*

*Significant (P<0.05), ** significant (P<0.01), NS – not significant.

^{abc} : means on the same column with different superscripts are significantly different ($p\leq0.05$).

Table 2: Effect of dietary inclusion of Kigelia on the testicular morphometry of rabbits.

Treatment **Parameters**	**T1** **(0g/kg)**	**T2** **(3g/kg)**	**T3** **(6g/kg)**	**T4** **(9g/kg)**	**P value**
Paired testis Weight (g)	3.65±0.15	3.30±0.90	4.25±0.15	3.10±0.20	0.12^{NS}
Right testis weight (g)	1.85 ± 0.15^{a}	2.00 ± 0.00^{a}	2.15 ± 0.05^{a}	1.15 ± 0.15^{b}	0.01*
Left testis weight (g)	1.80 ± 0.00^{b}	2.30 ± 0.10^{a}	2.10 ± 0.10^{ab}	1.95 ± 0.05^{b}	0.001**
Right testis Length (cm)	29.00±1.78	31.81±0.19	31.33±0.52	25.70±1.68	0.07^{NS}
Left testis length (cm)	30.39 ± 0.61^{a}	31.59 ± 0.16^{a}	31.03 ± 0.22^{a}	24.32 ± 0.69^{b}	0.001**
Paired testis volume (ml)	4.75±0.25	5.00±0.00	4.50±0.50	2.75±0.75	0.08^{NS}
Right testis volume (ml)	2.00±0.00	3.00±0.00	2.25±0.25	1.50±0.50	0.07^{NS}
Left testis volume (ml)	2.75 ± 0.25^{a}	2.00 ± 0.00^{a}	2.25 ± 0.25^{a}	$1.25\pm0.\ 25^{b}$	0.03*
Right testis width (mm)	9.62 ± 0.44^{b}	11.49 ± 0.18^{a}	11.46 ± 0.18^{a}	8.97 ± 0.82^{c}	0.04*
Left testis width (mm)	10.21 ± 0.20^{b}	12.49 ± 0.03^{a}	10.95 ± 0.68^{ab}	9.40 ± 0.29^{b}	0.01*
Right vas deferens length (cm)	11.80±0.60	10.30±0.10	10.00±0.40	10.60±0.60	0.17^{NS}
Left vas deferens length (cm)	11.25±0.25	9.70±0.00	9.05±0.65	11.10±0.50	0.05^{NS}
Right epididymis weight (g)	0.25±0.05	0.35±0.05	0.25±0.05	0.35±0.05	0.38^{NS}
Left epididymis weight (g)	0.20±0.10	0.45±0.05	0.20±0.10	0.30±0.10	0.30^{NS}

*Significant (P<0.05), ** significant (P<0.01), NS – not significant.

^{a,b,c} – Means in the same row with different superscripts are significant at 5% (* P < 0.05.)

Conclusion and Application

Dietary inclusion of *K. africana* fruit powder significantly improved semen characteristics and testicular morphometry of rabbit bucks, with optimal benefits at 6 g/kg inclusion. Its bioactive phytochemicals likely enhance reproductive function through antioxidant activity. The plant shows promise as a natural feed additive to

improve buck fertility and overall rabbit production. Further studies should investigate the specific mechanisms of action and long-term safety of *K. africana* supplementation.

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