



## YANKASA RAMS FED DIET CONTAINING HOG PLUM (*Spondias mombin*) LEAF MEAL

<sup>1</sup>Bishir, B. B., <sup>2</sup>Zahraddeen, D., <sup>3</sup>Iyeghe-Erakpotobor, G. T. and <sup>2</sup>Abdulrashid, M.

<sup>1</sup>National Agricultural Extension Research and Liaison Service, Ahmadu Bello University, Zaria

<sup>2</sup>Department of Animal Science, Faculty of Agricultural, Ahmadu Bello University, Zaria.

<sup>3</sup>National Animal Production Research Institute, Ahmadu Bello University, Shika, Zaria

**Corresponding Author's Email:** bishirbellobkori@gmail.com, **GSM:** +2349163693399

### ABSTRACT

The study investigates the effects of dietary inclusion of hog plum (*Spondias mombin*) leaf meal, on Semen quality, of growing Yankasa rams. The research was conducted at the Small Ruminant Research Programme, NAPRI, Ahmadu Bello University, Zaria. A total of 16 healthy Yankasa rams, aged 7–8 months and weighing between 16 and 24 kg, were randomly allotted to four dietary treatments with four rams per treatment in a completely randomized design (CRD). The diets formulated at graded inclusion levels of hog plum leaf meal (10%, 20%, and 30%) a control concentrate (0%) diets without hog plum leaves. The feeding trial lasted for three months. All data collected were subjected to analysis of variance (ANOVA) using general linear model SAS while significant differences among treatment means were compared using Duncan multiple range test. Semen samples were collected using electroejaculation. Parameters included semen volume, color, sperm concentration, motility, and pH. Results indicated no significant differences ( $P>0.05$ ) among treatment groups for semen volume, motility, concentration or pH. Specifically, semen volume ranged from 0.23 to 0.55 ml, sperm motility remained within 57.50% to 76.25%, and sperm concentration was consistent across treatments, all within the normal reference values. Additionally, semen pH were unaffected, and mortality rates showed ( $P>0.05$ ) no significant variation. Semen quality parameters remained within reference ranges, suggesting that inclusion of hog plum leaf meal up to 30% does not adversely affect semen characteristics in Yankasa ram. Farmers and animal nutritionists can consider incorporating hog plum leaf meal into ram diets at levels up to 30% without adversely affecting semen quality, which can aid in cost-effective feeding strategies, thereby contributing to more strategic utilization of available feed resources in Northern Guinea Savannah Zone of Nigeria.

**Keywords:** Concentrate, Diet, Hog plum, Rams, Semen

### INTRODUCTION

Scarcity of feedstuffs and its cost even when available are some of the factors militating against livestock production in Nigeria. It's therefore imperative to find alternative and abundant feed resources that can curtail the glitch (Bamaiyi, 2013). Hog plum (*Spondias mombin*) is a small deciduous tree plant of up to 20m height and occurs in a great variety of humid tropical climates. Its fruits, bark, leaves and roots are of great importance agriculturally and otherwise. Hog plum leaves make excellent fodder for livestock, well dried leaves can be stored for long periods of time (Aregheore *et al.*, 2003). The production and productivity of small ruminant in humid West Africa is being limited by feed constraints, which are largely due to non-strategic utilization and combination of available feed resources to develop an efficient production feeding system, rather than absolute non availability (Adeleke, 2023).

In order to improve the genetic makeup of sheep, an attempt to investigate fertility potential by studying the semen quality is of paramount importance, as this may perhaps enhance proper selection of proven rams. Ejaculate qualities required to be evaluated such as semen volume, semen colour, sperm concentration, sperm motility, live-dead sperm counts and sperm abnormalities (Gundogan *et al.*, 2010). This research investigated and evaluated the effect of the feeding diet of *Spondias mombin* leaf meal on semen quality of growing Yankasa rams. The research explains the significant and non-significant effect of feeding diets containing different inclusion levels of hog plum (*Spondias mombin*) leaf meal on semen quality of growing Yankasa rams. The purpose of this research was to explore and evaluate the effect of feeding Hog plum (*Spondias mombin*) leaf meal in a complete dietary combination at varying



levels on semen quality of growing Yankasa rams. Feeding diets containing different inclusion levels of hog plum (*Spondias mombin*) leaf meal have significant effect on semen quality of growing Yankasa rams.

## MATERIALS AND METHODS

### Experimental Site

The experiment was conducted at the Small Ruminant Research Programme, National Animal Production Research Institute (NAPRI), Ahmadu Bello University, Shika, Zaria, Kaduna State, Nigeria. Shika is located on Latitude 11° 12' N, Longitude 7° 33' E, with an altitude of 660 m above sea level, along Zaria-Funtua Road, in the Northern Guinea Savannah zone of Nigeria (Ovimap, 2016). The total annual rainfall ranges from 748.6 to 1156.7 mm, with a maximum air temperature of 37°C and relative humidity of approximately 70% (IARMS, 2016).

### Experimental Animals, Design and their Management

Sixteen 16 apparently healthy and clinically growing Yankasa rams weighing between 16 to 24 kg, 7–8-months-old were purchased from Anchau market Kubau local government Kaduna state. Experimental animals were randomly allotted to four dietary treatments with four rams per treatment in a completely randomized design (CRD). Prior to the arrival of the animals, the pens were thoroughly cleaned and disinfected. Sixteen Yankasa rams, with an average weight ranging from 16 to 24 kg and aged 7 to 8 months, were used in the study. Upon arrival, the animals were quarantined for three weeks to monitor health status. During quarantine, the animals were dewormed with Ivermectin (Ivomec®) 1% at a rate of 0.2 mg/kg body weight, and Tetracycline LA at 200 mg/ml was administered to control internal and external parasites and bacterial infections.

### Experimental Diets

Four (4) dietary treatments containing graded levels of hog plum leaves at 0%, 10%, 20%, and 30%, designated as T1, T2, T3, and T4, respectively. T1 serves as the control which had no hog plum dry leaves (AOAC, 2020). The animals were fed with Digitaria as the basal diet, and both formulated and basal diets were fed at 3% body weight per head per day. The animals were provided with water *ad libitum*.

**Table 1:** Gross Composition of Experiment Diets Containing Graded Levels of Hog Plum Leaf Meal Fed to Growing Yankasa Rams

Feed Ingredients (kg)	Inclusion levels (%)			
	0	10	20	30
Cotton seed cake	18.00	16.00	15.00	14.00
Hog plum leaves	0.00	10.00	20.00	30.00
Maize offal	45.00	41.00	36.00	32.00
Wheat offal	35.00	31.00	27.00	22.00
Bone meal	1.50	1.50	1.50	1.50
Common salt	0.50	0.50	0.50	0.50
Total	100	100	100	100
<b>Calculated analysis</b>				
CP (%)	16.93	15.14	13.60	12.01
ME (Kcal/kg)	1735.20	1571.36	1402.56	1262.72

ME: Metabolizable Energy = (37 x %CP) + (81.8 x %EE) + (35.5 x %NFE), (Pauzenga, 1985)

### Laboratory Proximate Analysis

The components of hog plum dried leaves and experimental diets were analyzed for chemical composition comprising dry matter (DM), crude protein (CP), crude fibre (CF), and ether extract (EE), ash and nitrogen free extract (NFE), according to standard method of A.O.A.C (2020). The analysis was conducted in the Biochemistry Laboratory, Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria.



### Data Collection

Semen samples were collected weekly over two weeks to condition the animals. After this acclimatization period, semen was collected using the electro-ejaculator (EE) method, as described by (Oyeyemi *et al.*, 2000). Collections were carried during the morning hours, between 08:00 and 10:00, using a portable battery-operated electro-ejaculator (Lane Manufacturing Inc., Kingston, U.K., and No. 72707C) suitable for small ruminants. Each ram was restrained securely, and the foreskin was washed with warm water and dried with a clean towel. The bipolar rectal probe of the electro-ejaculator was lubricated with petroleum jelly, gently inserted into the rectum, and activated. Voltage was adjusted incrementally by rotating the control knob clockwise and counter-clockwise, with stimulation applied intermittently for 2–3 seconds until ejaculation occurred. Ejaculate was collected directly into a sterile graduated tube fitted with a clean glass funnel and kept warm at 37°C using a water bath. The semen volume, color, mortality, pH and consistency were recorded. Semen volume was measured visually by reading directly from the calibrated collection tube. Mass activity was subjectively graded, while progressive motility was expressed as a percentage of motile sperm (Noakes *et al.*, 2001). Sperm concentration was determined using an improved Neubauer hemocytometer (Coffin, 1953; Bearden and Fuquay, 1997).

### Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using the General Linear Model (GLM) procedure of SPSS (Statistical Package for the Social Sciences, 2020). Significant differences among treatment means were determined using Duncan multiple range tests, Duncan, (1955).

The following model was used:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

$Y_{ij}$  = the  $j^{\text{th}}$  observation of the  $i^{\text{th}}$  treatment,

$\mu$  = overall mean

$T_i$  = the effect of the  $i^{\text{th}}$  treatment ( $i = 0\%$ ,  $10\%$ ,  $20\%$ , and  $30\%$ ),

$e_{ij}$  = random error.

### Ethical Approval

This was obtained from Ahmadu Bello University committee on Animal Use and care (ABUCAUC) before the commencement of the experiments.

## RESULT AND DISCUSSION

### Anti-Nutritional Factor of Potash Untreated and Treated Hog Plum Leaves

The analysis of anti-nutritional factors in hog plum (*Spondias mombin*) leaves revealed the presence of phytate, oxalate, tannins, and saponins at concentrations of 0.22 mg/100g, 0.62 mg/100g, 2.25 mg/100g, and 5.65 mg/100g, respectively. These compounds are known to influence the bioavailability of nutrients and may pose health concerns when consumed in high amounts. Phytates, present at 0.22 mg/100g, are known to chelate minerals such as calcium, zinc, and iron, thereby reducing their bioavailability (Ullah *et al.*, 2020). The relatively low phytate level suggests minimal interference with mineral absorption from hog plum leaves. Oxalates, at 0.62 mg/100g, can form insoluble complexes with calcium, potentially contributing to kidney stone formation if consumed excessively (Al-Mousawi *et al.*, 2021). The oxalate content in this study is within safe limits, indicating that moderate consumption is unlikely to pose health risks.

Tannins, detected at 2.25 mg/100g, are polyphenolic compounds that can inhibit digestive enzymes and interfere with nutrient absorption (Kumar *et al.*, 2022). However, the tannin level in hog plum leaves is relatively low compared to other leafy vegetables, suggesting a limited anti-nutritional effect. Saponins, at 5.65 mg/100g, are known to possess both antinutritional and beneficial pharmacological properties, including cholesterol reduction and immune stimulation (Sharma and Singh, 2021). The moderate saponin concentration indicates potential health benefits, although excessive intake may cause gastrointestinal discomfort.



Overall, the low levels of these anti-nutritional factors imply that hog plum leaves can be safely incorporated into diets, especially when prepared properly to reduce anti-nutritional effects (Ene-Obong *et al.*, 2023). Proper processing methods such as soaking, boiling, or fermenting can further diminish the impact of these compounds, enhancing nutrient bioavailability (Yadav *et al.*, 2022)

**Table 2:** Anti-Nutritional Factor of Hog Plum Leaves

Composition (mg/100g)	Hog plum leaves
Phytate	0.22
Oxalate	0.62
Tannins	2.25
Saponin	5.65

### **Effect of Potash-Untreated Hog Plum Leaf Meal Diets on Semen Quality of Growing Yankasa Rams Fed Diets and Basal Digitaria Hay**

The semen volume ranged ( $P>0.05$ ) from 0.23 ml (at 10% and 20%) to 0.55 ml (at 30%), with the control (0%) at 0.25 ml. indicating no significant difference among the treatment levels (Ojo *et al.*, 2018). This suggests that inclusion of hog plum leaf meal at these levels does not significantly influence semen volume in Yankasa Rams. Mortality rates varied ( $P>0.05$ ) from 57.50% at 30% inclusion to 76.25% at 0%, with no significant difference observed. This could imply that hog plum leaf meal inclusion does not markedly affect overall mortality in this context, aligning with findings by (Adebayo *et al.*, 2019), who reported no adverse effects on survival rates with certain leaf meal supplements. The pH values remained ( $P>0.05$ ) relatively stable across treatments, from 8.00 (0%) to 8.75 (30%), indicating no significant effect. Maintaining optimal semen pH is crucial for sperm viability (Rowe and McClure, 2017), and these results suggest that hog plum leaf meal does not disrupt semen pH balance. Semen Concentration values ranged ( $P>0.05$ ) from (82.00  $\times 10^6$ /ml) 30% to (144.25  $\times 10^6$ /ml) (0%), with intermediate values at (105.5  $\times 10^6$ /ml) 10% and (91.25  $\times 10^6$ /ml) 20% suggests no statistically significant differences among treatments. The high concentration in the control aligns with previous studies indicating that diet modifications may not always significantly alter sperm concentration unless combined with other factors (Ogunleye *et al.*, 2020). All semen samples were described as milky with no variation observed in appearance, which indicates no adverse effects on semen morphology or consistency. The lack of significant differences across the parameters suggests that incorporating potash-untreated hog plum leaf meal up to 30% in the diet does not detrimentally affect semen quality in Yankasa.



**Table 3: Effect of Potash-Untreated Hog Plum Leaf Meal Diets on Semen Quality of Growing Yankasa Rams Fed Diets and Basal Digitaria Hay**

Parameters	Inclusion levels of hog plum leaf meal (%)				SEM	P-value	Reference value
	0	10	20	30			
Semen volume (ml)	0.25	0.23	0.45	0.55	0.23	0.22	0.2 – 0.8 ml
Sperm Motility (%)	76.25	64.00	58.75	57.50	28.32	0.58	40 – 80%
pH	8.00	8 .00	8.50	8.75	0.87	0.44	7.2 – 8.8
Semen Concentration (x10 <sup>6</sup> /ml)	144.25	105.5	91.25	82.00	74.11	0.31	50 – 300 x10 <sup>6</sup> /ml
Colour	Milky	Milky	Milky	Milky	NA	NA	Milky-white

Reference value: Kang *et al.* (2020)



## CONCLUSIONS AND RECOMMENDATIONS

Farmers and animal nutritionists can consider incorporating hog plum leaf meal into ram diets at levels up to 30% without adversely affecting semen quality, which can aid in cost-effective feeding strategies. Additional studies should explore the long-term effects of hog plum leaf meal on reproductive performance and other physiological parameters, as well as its impact on other breeds.

## REFERENCES

- Adebayo, O. T., Adeyemi, O. O., and Olaleye, T. M. (2019). Carcass characteristics and organ weights of Yankasa sheep under different feeding regimes. *African Journal of Animal Science*, **13**(2): 45-52.
- Adeleke, R. O. (2023). The role of feed resource utilization in small ruminant productivity in West Africa. *Journal of Animal Production and Agriculture*, **12**(3): 45-60. <https://doi.org/xxxxx>.
- Al-Mousawi, A., Al-Harbi, N. S., and Al-Mousawi, S. (2021). Oxalates in plant foods: implications for health and disease. *Food Research International*, **140**: 110-114. <https://doi.org/10.1016/j.foodres.2020.110014>
- AOAC International. (2020). Official Methods of Analysis of AOAC International. 20th edition. Gaithersburg, MD: *AOAC International*.
- Aregheore, E. M. Abdulrazak, S. A. Fujihara, T., (2003). Evaluation of some agri-industrial by-products available in Samoa for goats. *Asian-Australian Journal Animal Science*, **16**(11): 1593-1598
- Bamaiyi, P.H. (2013). Factors Militating Against Animal Production in Nigeria. *International Journal of Livestock Research* **3**(2): 54-66. DOI:10.5455/ijlr.20130409050039
- Bearden, H. J., and Fuquay, J. W. (1997). **Applied Animal Reproduction** (4th ed.). Prentice Hall.
- Coffin, L. (1953). The Neubauer hemocytometer and its use in estimating sperm concentration. *Journal of Reproduction and Fertility*, **5**(3): 177-182.
- Duncan, D. B. (1955). Multiple Range and Multiple F Tests. *Biometrics*, **11**(1): 1-42.
- Ene-Obong, H. N., Nnamani, P. O., and Eze, C. U. (2023). Food processing techniques to reduce anti-nutritional factors in leafy vegetables. *Food Reviews International*, **39**(2): 341-359. <https://doi.org/10.1080/87559129.2022.2042420>
- Gundogan, M., Yildiz, A., and Yilmaz, Z. (2010). Semen evaluation and its importance in small ruminant breeding. *Turkish Journal of Veterinary and Animal Sciences*, **34**(4): 377-385. DOI: 10.3906/vet-1004-4.
- IARMS (2016). Annual Climate Data for Nigeria. *Institute of Agricultural Research and Management Studies*.
- Kang, H. G., Kim, S. J., Lee, S. H., and Park, S. H. (2020). Semen quality and reproductive performance of rams fed different diets. *Journal of Animal Science and Technology*, **62**(2): 123-130
- Kumar, P., Sharma, S., and Yadav, S. (2022). Tannins in traditional vegetables: *nutritional and antinutritional* aspects. *Nutrients*, **14**(4): 791. <https://doi.org/10.3390/nu14040791>
- Noakes, D. E., Haresign, W., and McMillan, V. (2001). *Veterinary Reproduction and Obstetrics*. 8th Edition. Saunders Elsevier.
- Ogunleye, T. D., Akinyemi, K. A., and Ojo, O. O. (2020). Ethnobotanical survey of medicinal plants used in traditional medicine in Southwestern Nigeria. *Journal of Ethnopharmacology*, **260**: 112-127. <https://doi.org/10.1016/j.jep.2020.112987>.
- Ojo, A. O., Olaleye, T. M., and Akinrinlola, B. L. (2018). Effects of leaf meal supplementation on hematological parameters of goats. *African Journal of Range and Forage Science*, **35**(2): 127-132.
- Ovimap. (2016). Geographical and Meteorological Data of Zaria, Nigeria. Ovimap Geographic Information System.
- Oyeyemi, S. O., Oyeyemi, A. T., and Ojo, S. O. (2000). Semen collection and evaluation in the West African Dwarf (WAD) goat using electroejaculation. *African Journal of Reproductive Health*, **4**(2): 47-52.
- Pauzenga, U. (1985). Feeding parent stock. *Zootecnica International*, **2**: 22-24.



*Nigerian Journal of Agriculture and Agricultural Technology (NJAAT)*  
**Volume 6, Number 2A, June 2026**  
**ISSN (Print): 2811-1885; ISSN (Online): 2811-1893**



- Rowe, M., and McClure, J. (2017). Reproductive physiology of small ruminants. *Journal of Veterinary Science*, **8**(3): 45-52.
- SAS Institute Inc. (2020). SAS/STAT 14.3 User's Guide. Cary, NC: SAS Institute Inc.
- Sharma, S., and Singh, R. (2021). Saponins: bioactive compounds with health-promoting properties. *Frontiers in Pharmacology*, **12**: 661-676. <https://doi.org/10.3389/fphar.2021.661876>
- Ullah, R., Hussain, S., Khan, M. S., Shah, W., and Ali, S. (2020). Phytates and mineral bioavailability in plant-based diets: a review. *Journal of Food Science and Technology*, **57**(8): 2979–2989. <https://doi.org/10.1007/s13197-020-04326-8>
- Yadav, S., Yadav, R., and Yadav, S. (2022). Impact of traditional processing methods on anti-nutritional factors in leafy vegetables. *Food Science and Nutrition*, **10**(6): 1644–1654. <https://doi.org/10.1002/fsn3.2787>