



## EVALUATION OF TESTICULAR FUNCTIONS AND ONSET OF PUBERTY OF KANO BROWN BUCK KIDS FED GROUNDNUT HAULMS

Aliyu, A.M<sup>1</sup>., M. Nasir<sup>2</sup>, E.A. Rotimi<sup>1</sup>

<sup>1</sup>Department of Animal Science, Federal University Dutsin-Ma, Katsina State. P.M.B. 5001

<sup>2</sup>Department of Animal Science, Kano University of Science and Technology Wudil, Kano State. P.M.B.

**Corresponding Author:** Aliyu, A.M. Email; [amaliyu@fudutsinma.edu.ng](mailto:amaliyu@fudutsinma.edu.ng), +2348064209979

### Abstract

This study was carried out to investigate the effects of feeding groundnut haulms on onset of puberty and testicular functions of Kano Brown buck (KBB) kids. A total of 30 KBB, aged 3 months old with average initial body weight of  $6.05 \pm 1.57$ kg were used for the study. Animals were kept in an individual pen under one shed to eliminate any variations attributed to environmental and management changes. A concentrate diet (control) was formulated to contain 13% crude protein and groundnut haulms were supplemented at 0, 100, 200, 300 and 400 g/head/day designated as T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub> and T<sub>5</sub>, respectively. Animals on treatment 1 were fed on the control diet (*ad libitum*) for the whole period of the experiment. Animals on treatments 2, 3, 4 and 5 were also offered the control diet and supplemented with 100, 200, 300 and 400 g/head/day of sun-dried groundnut haulms, respectively. Result showed that age at puberty decreased significantly ( $P < 0.05$ ) with increased groundnut haulms supplementation, with animals on T<sub>5</sub> (400 g) attained puberty earlier followed by those on 300g supplementation (T<sub>4</sub>). Animals on the control (0 g) attained puberty at a later age. Semen volume, semen colour, normal sperm cells, concentration, motility and scrotal circumference were significantly ( $P < 0.05$ ) higher in animals on T<sub>5</sub> (400 g) supplementation at the onset of puberty. Sperm morphological abnormalities (detached head, narrow head, coil tail and bent tail) decreased significantly ( $P < 0.05$ ) with increased groundnut haulms supplementation. It is concluded that feeding groundnut haulms hastened attainment of age at onset of puberty with significant increase in testicular functions of KBB.

**Key words:** Sperm Mortility, Semen Colour Scrotal Circumference and Nutrition,

### INTRODUCTION

Goats are kept primarily for meat and contribute substantially to the household income and food security in most rural areas (Raji *et al.*, 2018). The reproductive efficiency in goat production is aimed at bringing both young male and female animals into optimum sperm cell production and conception at an early age. The interaction between nutrition and reproduction has been known to have important implications for the reproductive performance of farm animals (Bindari *et al.*, 2018). Nutrition is central to reproductive performance with sub-optimal nutrition associated with delayed onset of puberty, reduced expression of reproductive behaviours, reduced reproductive rates and poor growth of young. However, reproductive behaviour is inhibited as nutrition becomes progressively more limiting and also, optimal levels of nutrition are required if animals are to express their full genetic potential for reproduction. Puberty in bovine has been defined as the age at which ejaculated semen contained at least  $50 \times 10^6$  spermatozoa with a minimum of 10% motility (Oyedipe *et al.*, 2017; Rekwot *et al.*, 2017). It is also defined as the age at which sexual development is attained and the animals become

capable of reproduction (first ovulation in the female and first spermatozoa in the ejaculate of the male) (Bielli *et al.*, 2017). Early puberty is an important index to achieve optimum reproductive performance

in goats. Puberty can also be achieved at an earlier age with improved feeding and, thus, reduction in the generation interval and then increase the rate of genetic gain of our local livestock. Animals that are gaining more rapid weight due to increased feed intake have greater weight of internal organs as a proportion of body weight, higher rate of metabolism, higher circulating concentration of insulin-like growth factor-I (IGF-I), and they attain puberty earlier (Wester, 2019). The age at which puberty is attained is more dependent upon body weight than influenced by animal's plane of nutrition. Effective male reproduction requires both the production of sufficient and viable spermatozoa and adequate libido to ensure deposition of the sperm cells in the female genital tract. Full development of the sex organs is required to physically accomplish a successful mating and development, if libido is needed to initiate copulation. Failure to achieve maturity in any aspect will result in reproductive incapability (Wester, 2019). The current study was designed to

investigate the nutritional effects of groundnut haulms on onset of puberty and testicular functions of KBB.

## MATERIALS AND METHODS

### Study Area

The study was conducted at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil. Wudil lies between longitude 8°58' East and latitude 11° 35' North at an altitude of 403m above sea level. The average annual rainfall ranges from 850 to 870mm, minimum and maximum temperature is 26°C and 33°C, respectively (Olofin *et al.*, 2008).

### Experimental Animals

Thirty (30), three months (3) old male Kano Brown bucks with average body weight of 6.05 ±1.572kg were used for the study. Animals were treated against ecto-and-endo parasites using Ivotek super® (Ivermectin + Clorsulon) at dose of 200 µg/kg body weight. They were also vaccinated against pneumo-enteritis complex [peste-des-petits ruminants (PPR)] at a dose of 1 ml/animal subcutaneously. Animals were quarantine for two (2) weeks and water and mineral lick were provided *ad libitum*. All animals were kept in individual pens under one shed so as to eliminate any variations attributed to environmental and management changes (Mukherjee, 2020).

### Experimental procedure

The thirty (30) Bucks were randomly allotted into five (5) treatments of six (6) animals per treatment. Each animal within a group was housed individually. Animals in treatment 1 were fed on the basal diet (*ad libitum*) for the whole period of the experiment. Animals in treatments 2, 3, 4 and 5 were offered 100, 200, 300 and 400 g/head/day of sun-dried groundnut haulms supplement. A completely randomized design was used and data was taken for 24 weeks.

### Pubertal study

Age at onset of puberty was determined as the age at which sexual development is attained and the animals become capable of reproduction (first spermatozoa in the ejaculate of the male) (Bielli *et al.*, 2001).

### Semen Collection and Evaluation

Semen samples were collected early in morning throughout the experimental period from each buck using electro-ejaculator (design for sheep and goat, lane manufacturing Inc., USA) the samples were Label and keep for further examination in terms of: semen colour, volume, motility, concentration and

pH as describe by Zemjanis (2015). Semen samples were collected at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture and Agricultural Technology, Kano University of Science and Technology, Wudil and evaluated at the Departmental Laboratory of this Institution on weekly. The following parameters were determined: volume (ml), motility (%), semen pH (pH paper), semen colour (Visual observations), sperm concentration (X106), live and dead ratio (%) and sperm morphological abnormalities.

### Statistical analysis

Data generated were coded and then subjected to analysis of variance (ANOVA) using General Linear Model Statistical Analysis System (SAS, 2002), where significant difference exist, means were separated using Duncans Multiple Range Test (DMRT). They were randomly allotted to five experimental treatments in a completely randomized design (CRD).

## RESULTS AND DISCUSSION

The results of the effect of groundnut haulms supplementation on pubertal characteristics of KBB is presented in Table 1. Although there was no significant ( $P > 0.05$ ) difference in body weight for at onset of puberty, animals on 400 g supplementation had numerically higher body weight. This confirmed earlier report that bulls on high protein diet have higher growth rate, compared to low-protein diet. Age at onset of puberty was significantly ( $P < 0.05$ ) influenced by groundnut haulms supplementation. Animals on treatment 5 (400g supplementation) attained puberty at earlier age than the other groups. This result may be attributed to higher protein consumed by these animals. Similarly, Rekwot *et al.* (2018) reported that low concentration of protein in the diet of Bunaji bulls and their Friesian crosses delays onset of puberty and that Bunaji bulls attain puberty later than their Friesian crosses, when placed on low protein diets, but earlier when placed on high protein diet. This report was in agreement with the finding of Alabi (2018) who showed that Bunaji bulls on low protein attained puberty later than those on high energy diets, apparently attributed to low nutrient intake. Additionally, Reid and Looli (2019) reported that feeding 100% total digestible nutrient levels to heifers enable them to attain puberty at 49 weeks, compared to 88 weeks when the level is reduced to 68% total digestible nutrients. Scrotal circumference, semen volume, semen colour, normal sperm cells, concentration and motility (Table 1) increased significantly ( $P < 0.05$ ) with increase

groundnut haulms supplementation at onset of puberty. This result confirmed the report of Hassan (2020) that yearling Kano Brown bucks fed graded levels of groundnut haulms have significantly ( $P < 0.05$ ) higher scrotal circumference, semen volume, colour, motility, concentration and normal

protein diets. A significantly ( $P < 0.05$ ) high percentage of sperm morphological abnormalities (Table 2) for animals on lower groundnut haulms (100g) and the controls (0 g) in the present study showed that bucks on higher levels of

spermatozoa. Rekwot *et al.* (2018) also reported similar observation in Bunaji bulls and their Friesian crosses on low and high protein diets, where bulls on high protein diets attained puberty at a younger age with better pubertal traits than those placed on low

supplementation (300 g and 400 g) had better semen quality traits and attained puberty at an earlier age. This agreed with the report of Rekwot *et al.* (2018) that bulls fed low protein diets have poorer semen quality than those fed high protein diets.

Table 1: Pubertal characteristic of Kano Brown bucks fed groundnut haulms supplements at onset of puberty

Parameter	Treatments (g)					SEM
	0	100	200	300	400	
Body weight (kg)	6.78	7.17	7.57	7.77	7.92	0.58
Scrotal circumference (cm)	8.92 <sup>b</sup>	15.00 <sup>a</sup>	15.58 <sup>a</sup>	13.43 <sup>a</sup>	15.30 <sup>a</sup>	1.06
Semen volume (ml)	0.13 <sup>b</sup>	0.15 <sup>b</sup>	0.14 <sup>b</sup>	0.23 <sup>ab</sup>	0.42 <sup>a</sup>	0.07
Semen colour	2.17 <sup>b</sup>	2.17 <sup>b</sup>	2.67 <sup>ab</sup>	3.00 <sup>a</sup>	3.17 <sup>a</sup>	0.20
Semen Ph	8.00 <sup>a</sup>	7.83 <sup>a</sup>	7.83 <sup>a</sup>	7.5 <sup>a</sup>	6.67 <sup>b</sup>	0.21
Live spermatozoa (%)	26.17 <sup>c</sup>	51.67 <sup>ab</sup>	31.67 <sup>c</sup>	66.00 <sup>a</sup>	40.00 <sup>bc</sup>	6.05
Normal sperm cells (%)	23.45 <sup>b</sup>	50.58 <sup>a</sup>	50.29 <sup>a</sup>	50.46 <sup>a</sup>	53.12 <sup>a</sup>	4.37
Sperm concentration ( $\times 10^6$ /ml)	240.00 <sup>c</sup>	436.50 <sup>bc</sup>	525.00 <sup>abc</sup>	798.00 <sup>a</sup>	716.80 <sup>ab</sup>	101.09
Motility (%)	37.50 <sup>b</sup>	37.33 <sup>b</sup>	48.14 <sup>ab</sup>	63.09 <sup>a</sup>	45.33 <sup>ab</sup>	5.79
Age at puberty (months)	5.70 <sup>e</sup>	5.50 <sup>d</sup>	5.23 <sup>c</sup>	5.05 <sup>b</sup>	5.00 <sup>a</sup>	0.00

<sup>abcde</sup>Means within the same row with different superscript are significantly different ( $p < 0.05$ ) SEM = Standard Error of the Mean,  $n = 6$  animals per group.

Table 2: Nutritional effects of groundnut haulms on sperm morphological abnormalities of KBB

Parameter	Treatments (g)					SEM
	0	100	200	300	400	
Detached head (%)	4.14 <sup>b</sup>	24.88 <sup>a</sup>	13.25 <sup>ab</sup>	7.67 <sup>b</sup>	10.74 <sup>ab</sup>	5.07
Narrow head (%)	42.58 <sup>a</sup>	15.06 <sup>b</sup>	10.91 <sup>b</sup>	20.48 <sup>b</sup>	16.20 <sup>b</sup>	3.32
Coil tail (%)	10.17 <sup>a</sup>	8.77 <sup>ab</sup>	7.69 <sup>ab</sup>	4.54 <sup>b</sup>	3.58 <sup>b</sup>	1.74
Bent tail (%)	19.67	14.27	16.09	16.54	15.83	1.86

<sup>ab</sup>Means within the same row with different superscript are significantly different ( $p < 0.05$ ) SEM = Standard Error of the Mean,  $n = 6$  animals per group.

## CONCLUSIONS

The following conclusions were drawn from the present study:-

- Groundnut haulms enhanced early attainment of onset of puberty in KBB kids, indicating that supplementation up to 400 g reduce age at puberty and improved reproduction in buck kids.
- Testicular functions were significantly improved with increased groundnut haulms supplementation
- Sperm morphological abnormalities were reduced with increased groundnut haulms supplementation.

## REFERENCES

- Alabi, J. A. (2018). Effects of energy supplementation on growth and reproductive function of bunaji and Friesian x bunaji bulls. *Journal of Advances in Applied Science Research*, 4(1): 221-229.
- Bindari, Y. R., Sulochana, S., Nabaraj, S. and Gaire, T. N. (2018). Effect of nutrition on reproduction-A review. *Advances in Applied Science Research*, 4(1) : 221-229.

- Bielli, A., Katz, H., Gastel, M. T., Morana, A., Castrillejo, A. Lundehein, N., Forsberg, M. and Rodriguez, H. (2017). Nutritional management during fetal and postnatal life and the influence on testicular stereology and sertoli cell numbers in Corriedale ram lambs, *Journal of Small Ruminant Research*, 70: 63-71.
- Hassan, A. M. (2020). Effect of groundnut haulms supplementation on growth and reproductive performance of Kano Brown bucks, *ARPJN Journal of Agriculture and Biological Science*, 12(4): 116-120.
- Mukherjee, T.K. (2020). Improvements of goats in the tropics through genetic and biotechnological methods. Conference Proceedings, Plenary papers and invented lectures, 44<sup>th</sup> International Conference on goats. New Delhi, India. Pp. 25-36.
- Olofin, E. A., Nabegu, A. B. and Dambazau, A. M. (2008). Wudil within Kano region: A geographical synthesis, 1<sup>st</sup> edition, Adamu joji publishers. Kano State, Nigeria, Pp 134-138.
- Oyedipe, E. O., Kumi-Diaka, J. and Osari, D. I. K. (2017). Determination of onset of puberty in Zebu bulls under Tropical conditions of Northern Nigeria. *Theriogenology*, 16(4): 419-431.
- Raji, A. O., Igwebuike, J. U. and Aliyu, J. (2018). Testicular biometry and its relationship with body weight of indigenous goats in a semi-arid region of Nigeria. *ARPJN Journal of Agriculture and Biological Science*, 10(2): 16-19.
- Reid, J. T. and Looli, J. K. (2019). Causes and prevention of reproductive failures in dairy cattle IV. Effect of plane of nutrition during early life on growth, reproduction, health and longevity of Holstein cows. Birth to fifth calving. *Cornell University Agricultural Experimental Station Bulletin No. 987*, Ithaca, New York, U. S. A.
- Rekwot, P. I., Oyedipe, E. O., Akerejola, O. O. and Kumi-Diaka, J. (2017). The effect of protein intake on bodyweight, scrotal circumference and semen production of Bunaji bulls and their Friesian crosses in Nigeria. *International Journal of Animal Production Science*, 56 (3) pp 16-19.
- SAS (2012) (Statistical Analysis Systems). SAS user's Guide. Statistics, SAS Institute, Cary, NC.
- Wester, T. J. (2019). Endocrine and metabolic responses to plane of protein and energy nutrition in sheep. *Theriogenology*, 28(4): 427-434.
- Zemjanis, R. (2015) "Collection and evaluation of semen in diagnostic and therapeutic techniques in animal Reproduction" *Journal for Tropical Animal Health and Production* (55):773-774