



INFLUENCE OF SCROTAL BIPARTITION ON HORMONES AND SEMEN CHARACTERISTICS OF UDA RAMS

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ABSTRACT

The study evaluated the influence of scrotal bipartition on semen characteristics and reproductive hormone profiles in Uda rams. The experiment was carried out at the Animal Health and Production Department Research and Demonstration farm in the small ruminant unit of the Federal Polytechnic Bauchi following standard management protocol. Twelve (12) Uda rams aged 1 to 1.5 years consisting of Six (6 each) rams with scrotal bipartition (SB group) and non-scrotal bipartition (NB group) were studied. Semen was collected from the rams using electro ejaculator and analyzed for gross and microscopic characteristics while blood collected and evaluated for serum levels of reproductive hormones (testosterone and FSH). The result of semen parameter showed that there was no significant difference ($p>0.05$) in sperm volume, motility and livability between both groups, however, SB yielded higher values in volume (0.88mL), motility (66.50%) and livability (74.50%) compared to the NB (vol. (0.87mL), motility (62.5%) and livability (72.50%). The evaluated reproductive hormones were not statistically different ($p>0.05$) between both groups. Although a higher testosterone level was recorded in NB (12.35 ng/mL) compared to SB (8.55 ng/mL). Similarly, serum concentrations of FSH were not differed ($p>0.05$) between both groups, the result showed SB (0.24 ng/mL) appeared to be higher compared to NB (0.15 ng/mL). It was concluded that scrotal bipartition in rams was shown to be an evolutionary indicator as the animals with this characteristic presented more efficient heat dissipation to maintaining optimal testosterone and FSH for spermatogenesis for production of quality semen for normal reproductive function and overall fertility. Therefore, monitoring reproductive hormone levels and semen quality can be useful for assessing reproductive health and fertility in Uda rams.

Keywords: Bipartition, Characteristics, Hormones, Influence and Scrotal

INTRODUCTION

Reproductive efficiency is a key determinant of livestock productivity, particularly in sheep production systems in sub-Saharan Africa (Assefa *et al.*, 2024). The Uda breed, a hardy and well-adapted indigenous sheep of Nigeria and West Africa, plays a crucial role in food security, income generation, and cultural practices (Assefa *et al.*, 2024).

Despite its importance, reproductive performance among Uda rams is often suboptimal due to environmental stressors, inadequate management practices and lack of genetic selection for reproductive traits (Pehan *et al.*, 2025). One anatomical feature observed in tropical sheep breeds, including Uda rams, is scrotal bipartition a vertical division of the scrotum that separates the testes into distinct compartments (Rocha *et al.*, 2018; Amole *et al.*, 2022). This feature was hypothesized to facilitate better thermoregulation of the testes, potentially enhancing spermatogenesis and improving semen quality (Nanayakkara *et al.*, 2021). Scrotal bipartition has been studied in some tropical breeds, but comprehensive data on its influence on semen in Uda rams were limited (Nanayakkara *et al.*, 2021).



The scrotum, a pouch-like structure containing the testes, plays a crucial role in maintaining an optimal temperature for spermatogenesis. Scrotal bipartition has been studied in various livestock species, including bulls and boars, with mixed results regarding its impact on semen characteristics and fertility (Abd-Allah *et al.*, 2012). Additionally, reproductive hormones like testosterone, luteinizing hormone (LH) and follicle-stimulating hormone (FSH) are pivotal in regulating spermatogenesis and libido (Yavuzer *et al.*, 2009). Hence examining the effects of scrotal bipartition on these parameters could reveal its potential as a management tool for enhancing reproductive efficiency in rams. However, the bipartition impact on semen characteristics of Uda rams remains unclear, with some studies reporting no significant changes and others are indicating alterations in semen parameters (Oyeyemi and Olusoji, 2018). Given the genetic, physiological and environmental differences between breeds and species, it is imperative to assess the specific effects of scrotal bipartition on Uda rams (Abd-Allah *et al.*, 2012).

Evaluating the relationship between scrotal bipartition; hormones and semen quality characteristics will provide insights into breeding selection criteria for improved fertility and productivity in this indigenous breed.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out at Research and Demonstration Farm in the Small Ruminant Unit of Animal Health and Production Department, Federal Polytechnic Bauchi.

Experimental Animal and their Management

Twelve (12) Uda rams aged 1 to 1.5 years consisting of Six (6) rams with scrotal bipartition (SB group) and Six (6) rams non-bipartition scrotum (NB group) obtained from livestock market of Gamawa Local Government Area of Bauchi State and used for the study. Animals were housed in well-ventilated pens while water and feed were provided *adlibitum*. They were acclimatized for a two weeks period and routinely screened for gastrointestinal and blood parasites. General physical, musculoskeletal and reproductive tract examinations were carried out on all animals to confirm normal health status before the commencement of sample collection.

Semen collection

Animals were initially trained for semen collection by using the electro-ejaculator and subsequently semen was collected twice a week for four consecutive weeks at morning hours from 8:00 am to 9:00 am. Following this, semen samples were collected for analysis according to procedure by (Oguejiofor *et al.*, 2018). The animals were restrained in lateral recumbence and the hairs around the preputial opening were trimmed and cleaned properly. The rectal probe of the electro-ejaculator was lubricated with inert petrolatum and gently inserted into the rectum. The voltage regulator was applied to stimulate the floor of the rectum and the underlying accessory sex glands to cause penile erection followed by semen ejaculation into a clean wide mouthed plastic container that was non-toxic to spermatozoa. Total ejaculates were collected by avoiding the loss of any semen portion. Semen samples were maintained between 28°C - 37°C before laboratory evaluation.

Gross and Microscopic Semen Evaluation

Semen volume was determined using a graduated pipette. The spermatozoa motility was estimated by mixing a drop of prepared phosphate B saline with semen and a fixed volume placed onto a warm glass slide and covered using cover slip. The mixture then examined at x400 magnification using a phase-contrast microscope (ZEISS NIKON) equipped with a stage slide

warmer set at 37°C. Live sperm (unstained head) and dead sperm (red-stained head) were identified using light microscopy at X100 magnification under oil immersion. Sperm cells were counted per slide using hand counter. All percentage values were determined by examining 200 sperm cells in replicates.

Blood Collection and Hormonal Assay

Four rams (Two each from the group) were randomly selected and blood samples were collected from the jugular vein of each ram at the end of the experiment to assess reproductive hormone levels. The collected blood samples allowed to clot at room temperature and then centrifuged at 3,000 rpm for 10 minutes to separate the serum. The serum was stored at -20°C until analysis. Serum concentrations of the reproductive hormones testosterone, FSH and LH were measured by using Enzyme-linked immunosorbent assay (ELISA) kit, following the manufacturer's instructions.

Data Analysis

Data were analyzed statistically using SPSS version 25. Student *t-test* was used to compare the means between the two groups. Values were considered significant when $p < 0.05$.

RESULTS AND DISCUSSION

Results of Semen characteristics of scrotal bipartition and non-bipartition Uda rams.

The result in Table 1 showed the seminal characteristics of volume, motility and livability were not significantly different ($P > 0.05$) between both groups although the corresponding values of obtained yielded higher semen volume (0.88 mL) in SB group compared to NB ram groups (0.87 mL). The percentage of sperm motility in SB group yielded a higher value (66.50 %) compared to NB group (62.00 %). The mean (%) yield of sperm livability was higher in SB group (74.50 %) compared to NB group (72.50 %).

Table 1: Results of Semen characteristics of scrotal bipartition and non-bipartition Uda rams

Sperm parameter	SB group	NB group	P value
Volume (mL)	0.88	0.87	0.831 ^{NS}
Sperm motility (%)	66.50	62.00	0.214 ^{NS}
Sperm Livability (%)	74.50	72.50	0.106 ^{NS}

NS= $P > 0.05$ is considered not significant, SB= scrotal bipartition and NB= non-bipartition

Comparison of serum levels of reproductive hormones of scrotal bipartition and non-bipartition Uda rams

The result in Table 2 showed that the serum testosterone concentration appeared to be higher in NB rams (12.35 ng/mL) compared to the SB rams (8.55 ng/mL), although this difference was not significant ($P > 0.05$). Similarly, serum concentrations of the gonadotrophin FSH concentration appeared to be higher in SB rams (0.24 mIU/mL) compared to the NB rams (0.15 mIU/mL) but there was no significantly ($P > 0.05$) difference between both groups.

Table 2: Comparison of serum levels of reproductive hormones of scrotal bipartition and non-bipartition Uda rams

Parameter	SB group	NB group	P value
Testosterone (ng/ml)	8.55	12.35	0.624 ^{NS}
Follicle-stimulating hormone (mIU/ml)	0.24	0.15	0.342 ^{NS}

NS= $P < 0.05$ is considered not significant



RESULTS AND DISCUSSION

In scrotal bipartition, the division of the scrotum may disrupt the normal thermoregulatory mechanism. If the two compartments are not equally effective in cooling the testes, one or both testes may experience elevated temperatures which can lead to reduced spermatogenesis and potentially impairing sperm production and quality which can negatively affect fertility (Nanayakkaraa *et al.*, 2021). In this study, the semen volume in both SB and NB groups were within the range of normality for the specie, for which volumes are described in the literature that ranges from 0.5 Rocha *et al.* (2018) to 1.1 mL (Nanayakkaraa *et al.*, 2021; Yavuzer *et al.*, 2009). The results are in line with Luna-Orozco *et al.* (2012) who studied goats with different scrotal conformations and did not observe differences in semen volume between the groups studied. A study on rams and goats has reported a significant increase in semen volume following scrotal bipartition, likely due to enhanced testicular thermoregulation (Rodrigues *et al.*, 2016).

In contrast to this study Rocha *et al.* (2018), presented higher semen volumes in NB and SB in sheep Brazil. Other seminal parameters studied motility and livability was within the desirable values in both groups Yavuzer *et al.* (2009), although contrary to this study other literature indicates higher values (Oguejiofor *et al.*, 2018). On the other hand, studies have shown that the hairless breeds are well adapted to regions with semiarid climate and the semen quality is not influenced by climatic factors (Amole *et al.*, 2022; Nanayakkaraa *et al.*, 2021). Almeida *et al.* (2010) observed difference in the spermatogenic parameters of crossbred sheep with bipartition compared to non-bipartitioned sheep, with higher efficiency in spermatogenesis and Sertoli cell yield in the sheep with scrotum bipartition. Since there was no statistical difference between the two groups of rams studied regarding the semen parameters, although higher in SB group than NB group, there is indication that the animals demonstrated adaptability to the climatic conditions of the region to suit their reproductive capacity which is line with earlier report of (Rocha *et al.*, 2018). Several studies have demonstrated that scrotal bipartition can enhance sperm motility and sperm viability by improving testicular thermoregulation and reducing the negative effects of heat stress on sperm cells (Luna-Orozco *et al.*, 2012).

The measurement of reproductive hormones are often used to assess their effects on fertility of an animals, in this study, the level of follicle-stimulating hormone (FSH) in sheep (rams) with a bipartition scrotum can be influenced by the condition's impact on testicular function and feedback mechanisms within the hypothalamic-pituitary-gonadal (HPG) axis (Oduwole *et al.*, 2021). The serum concentration of testosterone is within normal range (2–10 ng/mL) or higher in ram with SB but appeared to be lower (8.55 ng/mL) compared to NB (12.35 ng/mL) although this difference was not significant ($p > 0.05$) which are in agreement with findings of Okpe and Anya, (2017) and Oguejiofor *et al.* (2018) in bucks. Many studies do not account for these fluctuations, leading to inconsistent results. For instance, a study by Oluwatosin *et al.* (2017) found that rams with scrotal bipartition had higher testosterone levels, but the timing of hormone measurements was not consistent, which could have contributed to the variability in the results. In another vein, the evaluation of serum concentration of FSH are below normal range (1–10 ng/mL) in ram with SB (0.24 ng/mL) but appeared to be higher compared to NB (0.15 ng/mL) although this difference was not significant ($p > 0.05$) which are in agreement with findings of Oguejiofor *et al.* (2018). One study Okpe and Anya, (2017) reported higher serum levels of testosterone and LH but not FSH in bucks. Similarly, serum concentrations of the gonadotrophins FSH were not significantly different between both groups which is in line with the previous finding of (Oguejiofor *et al.*, 2018). In contrast, other studies did not find any effect on serum testosterone (Onugwu *et al.*, 2018)



and both testosterone and the gonadotrophins (Uchendu and Ezeasor, 2015). These conflicting observations may be due to differences in the number of sampled animals or differences in the methods and times of sample collection relative to any sexual activation or breeding.

CONCLUSION AND RECOMMENDATIONS

Based research findings, scrotal bipartition has no impact on hormones and semen characteristics of Uda rams. The application of this study indicating that, both scrotal bipartition and non-scrotal bipartition rams can equally be considered for breeding programs.

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REFERENCES

- Abd-Allah, S. M., Abdel-Ghaffar, S. K. and Abdelsalam, A. (2012). The impact of scrotal bipartition on testicular function in bulls. *Theriogenology*, **77**(8):1506-1511.
- African Dwarf Goats. *Asian Pacific Journal of Reproduction*, **7**(4): 172-177.
- African Dwarf Rams. *Veterinary medicine international*, **8**(4):213-340.
- Almeida, M. M, Machado-Júnior, A. A. N., Ambrosio, C. E., Menezes, D. J. A., Righi, D. A, Nascimento, M. R. I. and Carvalho, M. A. M. (2010). Influencia do grau de bipartição escrotal sobre parâmetros reprodutivos de caprinos. *Pesqui Vet Bras*, **30**: 345-350.
- Amole, T., Augustine, A., Balehegn, M., and Adesogoan, A.T. (2022). Livestock feed resources in the West African Sahel. *Agronomy journal*, **114**(1):26-45.
- Assefa, S., Duguma, B. and Worku, Z. (2024). Assessment of livestock husbandry practices and production constraints among smallholder mixed crop-livestock production systems in the Majang zone, southwest Ethiopia. *Heliyon*, **10**(19):37-40.
- Atawalna, J., Junior Essel, D. C., Netey, N. and Amponsah, P. M. (2022). Correlation between testicular morphometric parameters and sperm reserves in Ghanaian West
- Hany, A. Z., Saeed, A. A. and Ayman, A. S. (2020). Effects of season and breed on the reproductive performance of sheep. *Journal of Animal Reproduction and Biotechnology*, **35**(2): 149-154.
- Hasani, A. M., Hasani, A. et al (2022). Evaluation of testicular biometry and spermatozoa recovered after slaughter from cauda epididymal of Awassi Ram. *Archives of Razil Institute*, **77**(6):2329-2334.
- Kastelic, J. P., Cook, R. B., Coulter, G. H. and Saacke, R. G. (1996). Insulating the scrotal neck affects semen quality and scrotal/testicular temperatures in the bull. *Theriogenology*, **45**:935-942.
- Luna-Orozco, J. R., González-Santoyo, G. and Delgado-Buenrostro, N. L. (2012). Effect of scrotal bipartition on reproductive characteristics and body temperature of rams. *Tropical Animal Health and Production*, **44**(5):1111-1115.
- Nanayakkara, S. D. I., Gihanb, M. C. and Nanayakkarac, P. S. K. (2021). A review of scrotal temperature regulation and its importance for male fertility. *Sri Lanka Journal of Obstetrics and Gynaecology*, **43**: 308-313.
- Oguejiofor, C. F., Izuchukwu, S., Ochiogu, O. L., Okoro, V. and Ogbu, U. (2018). Consequences of unilateral cryptorchidism on semen and sperm characteristics in West
- Oyeyemi, M. O. and Olusoji, M. J. (2018). Semen characteristics, morphology and testicular parameters of Uda (ovis aries) in Ibadan, Nigeria. *Journal of Veterinary Medicine and Animal Health*, **10**(3):72-77.
- Pehan, E. A., Miah, M., Rahman, M. H., Shejuty, S. F., Haque, M. N., Huda, M. N., Habib, M. R. and Ali, M. Y. (2025). A holistic review of buffalo productivity, reproductive efficiency, genetic improvement, and disease management in Bangladesh. *Veterinary and animal science*, **29**: 100-496.
- Rocha, E. F., Romulo, F. F. D., Joyce, G. S., Jose, R. S. S., Gustavo, A. S., Joao, V. B. R., Olaf, A. B., Norma, L. S. A., Bonifacio, B. S. and Danilo, J. A. M. (2018). Scrotum bipartite in sheep as a parameter indicative of adaptation to semi-arid climates: A thermographic and reproductive study. *Theriogenology*, **12**(1): 91-96.



- Rodrigues, R. T. G. A., Santos, J. R. S., Azerêdo, L. M. S., Rocha, E. F., Carvalho, M. A. M., Portal, M. J. I. D, Sousa, O. B., Menezes, D. J. A. (2016). Influence of scrotal bipartition on spermatogenesis yield and sertoli cell efficiency in Snnmheep. *Pesq Vet Bras*, **3**(6):258-262.
- Tanga, B. M., Qamar, A. Y., Raza, S., Bang, S., Fang, X., Yoon, K. and Cho, J. (2021). Semen evaluation: methodological advancements in sperm quality-specific fertility assessment - A review. *Animal bioscience*, **34**(8):1253-1270.
- Yavuzer, U., Türker, H. and Simsek, G. (2009). Effect of scrotal bipartition on testicular size, semen characteristics, and testosterone concentrations in Goats. *Animal Reproduction Science*, **111**(3-4):285-293.