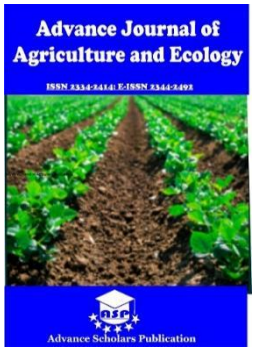
Advance Journal of Agriculture and Ecology
Adv. J. Agric. & Eco.
Volume: 9; Issue: 6
June-2024
ISSN 2334-2414
E-ISSN 2344-2492
Impact Factor: 5.39
Advance Scholars Publication
Published by International Institute of Advance Scholars Development
https://aspjournals.org/Journals/index.php/ajae/index



THE INFLUENCE OF SEASONS ON SPERM QUALITY PARAMETER SUCH AS SEMEN MOTILITY, VIABILITY AND MORPHOLOGY IN SELECTED NIGERIAN BREEDS OF SHEEP

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Keyword: *seasons, semen quality, Yankassa, Uda WAD and Balami rams*

***Abstract**: The study was carried out to determine the influence of seasons on semen quality of selected Nigerian breeds of sheep at the Livestock Investigation Division of National Veterinary Research Institute, Vom.*
Objective of the study to determine the influence of seasons on semen and necessitate the harvest of quality ejaculates. A total of forty-eight (48) rams of four different breeds; Balami, Uda West African Dwarf and Yankasa were used for the experiment in a complete randomized design. Six (6) Semen ejaculates were collected from each ram for six (6) weeks using improvised artificial vagina and assessed for semen quality. From the result, the volume varied from 0.80±0.13-1.04±0.16mL, colour from 3.20±0.13-4.50±0.67 (milky to creamy), mass activity from 4.10±0.28-4.50±0.16, sperm individual motility from 91.10±3.24-95.10±0.43%, live spermatozoa (viability) 95.54±0.37-96.61±0.31%, and concentration from, 1981.60±357.31-3545.60±453.92 x 10^6/mL. The concentration in Uda was significantly (P<0.05) lower (1981.60±357.31 x 106/mL) compared with Yankasa (3039.40±333.34 x 106/mL) and Balami (3545.60±453.92 x 10^6/mL), normal sperm cell varied from 94.58±0.58-97.51±0.78%, acrosome integrity from 97.88±0.38-98.43±0.05%, membrane integrity (Hypo Osmotic Swelling Test) from 91.96±1.02-95.93±0.20% and sperm index 338572±41559-560215±105829 x10^9. Therefore, it was concluded that all the selected Nigerian sheep can be used for breeding throughout the year without any effect on reproductive capability.

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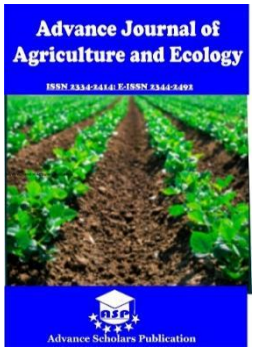

Introduction

In Nigeria, four breeds of sheep stand out (Yankasa, West African Dwarf, Balami and Uda) because of their renowned carcass quality. Adaptability, hardness, good mothering ability and high demand in various geographical locations in the country (Agossou*et al.,* 2017*)*. Small ruminants are important protein sources and cash income for many farmers' in the tropics and sub-tropics. Among the small ruminants, sheep contribute a substantial amount to the farm household income, mutton and non-food products, such as manure, skin and coarse wool (Hirut *et al.,* 2011). Unlike most domestic livestock species, sheep are widely known as animals with marked seasonality of breeding activity (Moghaddam *et al.,* 2012). Sperm morphology, sperm concentration and sperm motility are some of the most important parameters to be considered when performing a soundness evaluation of a breeding male. They closely correlate with the normality of the genital organs, as well as with fertilization rate, than other semen variables (Kaya *et al., 2002)*. There are factors that affect ejaculate volume and semen quality in breeding rams. These include breed, season of the year, age of the ram, nutritional status of the animal, reproductive management, Skill of the semen collector, responsiveness of the ram, method and the frequency of semen collection (Talebi *et al.*, 2009). This study aimed to determine the influence of seasons on semen quality parameters on selected Nigerian breeds of sheep.

Materials and Methods

This study was carried out at Livestock Investigation Division, National Veterinary Research Institute (NVRI), Vom. Semen was collected from each ram once a week for 6weeks. Forty-eight (48) mature apparently healthy rams (12 each of Yankasa, Balami, Uda and West African Dwarf) with a mean body weight of 39.7±9.3kg (range of 25 - 53kg) and a mean aged of 18± 4.7 months (range of 14 - 24 months) were housed according to breeds, (6 per pen) allowed to graze in paddock for a period of six hours daily on Rhode grass/or Acha grass and provided with additional supplementary feed (maize offal, rice bran, bean husk, millet husk, salt) and water *ad libitum* as described by Patil (2017). The animals were observed for a period of 24 months (excluding an adaptation and training period) from January, 2021 to December, 2022. Rams were allocated according to age and weight for semen collection. Seasons were stipulated as Rani (January, February, March), Bazara (April, May, June), Damina (July, August, September), Kaka (October, November, December) (Abubakar and Burrah 2013). Within 1 to 2 min after collection, the semen was placed in a water bath at 37^{o}C and it was taking to the AI laboratory. Seminal traits of the fresh semen were evaluated according to the methods of David *et al.,* (2007). The volumes of each

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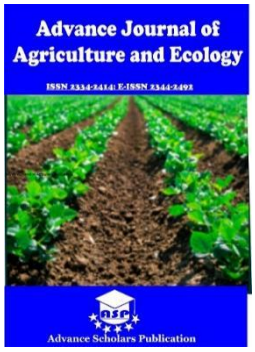

ejaculate were measured in a graduating collection vial, and pH was recorded with a pH-meter. Sperm concentrations were measured in a hemocytometer after diluting an aliquot of semen with a 0.05% formaldehyde saline solution (1:200) and observe at 100x magnification using a microscope. The number of spermatozoa per ejaculate were calculated (volume x concentration).

The ejaculate obtained was evaluated as described by David *et* al., (2007). This also included the visual or gross evaluation of the ejaculate soon after collection for volume, pH and color as well as microscopic examination for motility, concentration, percentage live spermatozoa and morphological abnormalities.

Results

The baseline means values for semen colour, volume, pH, mass activity of spermatozoa individual motility, concentration, live sperm percentage and normal sperm percentage are presented in Table 1. The progressive motility varied significantly (P<0.001) among the rams during different seasons of the year with a range of 95.10±0.43 - 91.10±3.24 (very rapidly moving waves and eddies formation). WAD had a significantly higher (P<0.001) progressive motility (vigorous movement with moderately rapid waves and eddies to dense) followed by Yankasa, Uda and Balami rams respectively. The pH varied significantly (P<0.001) among the rams during different seasons with a range of 5.96±0.14 - 5.58±0.15. Balami breeds had the higher pH value followed by WAD, Yankasa and Uda respectively. Live sperm cells among the rams varied significantly (P<0.001) with a range of 96.59±0.12% to 95.54±0.37%. Yankasa breeds had the higher value followed by WAD, Balami and Uda respectively. The normal sperm morphology varied significantly (P<0.001) with a range of 96.81±0.59 to 94.15±0.78%. Uda breeds had a significantly higher value followed by WAD, Balami and Yankasa. The late dry season did not differ significantly (P>0.001) among the breeds. The acrosome integrity varied significantly (P<0.001) with a range of 98.43±0.05 to 97.88±0.38. WAD breed had significantly higher acrosome integrity with 98.43±0.05 across the season, whereas Yankasa breed showed significantly lower (P<0.001) acrosome integrity 97.93±0.49 to 97.88±0.38%. Though late rainy and late dry seasons did not differ significantly (P>0.001) among the breeds. The sperm plasma membrane integrity varied with a range of 95.93±0.20 to 91.96±1.02%. WAD breeds had significantly higher (P<0.001) sperm plasma membrane integrity with a range of 95.93±0.20 to 95.90±0.22%, whereas Balami breeds had significantly lower (P<0.001) sperm plasma membrane integrity 91.96±1.02 to 92.11±1.05%. Sperm index ($x10^9$) varied significantly (P<0.001) among the breeds with a range of 338572±41559 to 560215±105829. Balami breeds had a significantly higher

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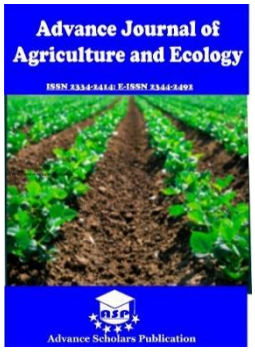

(P<0.001) value 560215±105829, whereas WAD had significant lower (P<0.001) values 338572±41559 sperm index (x10⁹). The sperm morphological characteristic show a highly significant difference (P<0.001) its range varies from 0.00±0.00 to 1.93±0.45 across the abnormalities (Detached head, Coil tail, Bent tail, Kinked tail and Midpiece).

Conclusion and recommendation

From the result of this study, it was concluded that Balami breed recorded the highest values intern of mass activity, live spermatozoa and sperm concentration. Uda breed had the best semen volume among the selected Nigerian breeds of sheep. While West African Dwarf rams had the highest progressive or individual motility and early dry season (October to December) has the higher values for semen evaluation among the four Nigerian breeds of sheep. Therefore, all breeds can be use for breeding purposes.

Acknowledgments

The authors are thankful to staff of Artificial Insemination Laboratory, Livestock Investigation Division and Central Diagnostic Laboratory, NVRI, Vom, for providing necessary technical support to carry out the present work.

Conflict of Interests

The authors declare no conflict of interest

Table 1: Mean±SD of the sperm motility measured on quality of semen collected during the four seasons on four Nigerian breeds of sheep

Parameters	Seasons	Breeds Balami (Mean±SD)	Uda (Mean±SD)	WAD (Mean±SD)	Yankasa (Mean±SD)	Mean±SEM	P-value
Progressive motility (%)	LRS	91.72±1.14^{b}	94.31±0.90^{a}	95.04±0.53^{a}	94.88±0.52^{a}	93.99±0.23	0.000***
	EDS	91.10±3.24^{b}	94.36±0.90^{a}		94.88±0.58^{a}	93.85±0.34	
	LDS	91.53±1.35^{b}	94.35±0.89^{a}	95.07±0.0.53^{a}	95.00±0.76^{a}	94.00±0.25	0.000***
	ERS	91.68±1.62^{b}	94.36±0.90^{a}		94.88±0.58^{a}	94.00±0.24	
				95.10±0.43^{a}			0.000***
				95.10±0.43^{a}			0.000***
pH	LRS	5.96±0.14^{a}	5.61±0.14^{c}	5.87±0.05^{ab}	5.73±0.18^{bc}	5.79±0.03	0.000***
	EDS	5.92±0.13^{a}	5.58±0.15^{b}	5.87±0.05^{a}	5.76±0.26^{ab}	5.78±0.03	
	LDS	5.79±0.63	5.58±0.15	5.86±0.05	5.73±0.25	5.74±0.05	0.000***
	ERS	5.92±0.12^{a}	5.58±0.15^{b}	5.86±0.05^{a}	5.76±0.26^{ab}	5.78±0.03	
							0.265^{NS}
							0.000***
	LRS	95.62±0.98^{b}	95.54±0.37^{b}		96.59±0.13^{a}	95.94±0.10	

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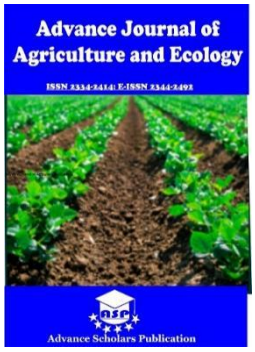

Live sperm (%)	EDS	95.82±0.77^{b}	95.61±0.30^{b}	96.01±0.29	96.59±0.12^{a}	96.01±0.08	0.000***
	LDS	95.59±0.93^{b}	95.61±0.31^{b}	ab	96.56±0.19^{a}	95.94±0.09	
	ERS	95.89±1.12^{b}	95.61±0.30^{b}	96.01±0.29	96.59±0.12^{a}	96.03±0.10	0.000***
				b			
				96.02±0.29			0.000***
				ab			
				96.03±0.30			0.002***
				ab			
Normal sperm cells (%)	LRS	94.75±0.78^{b}	96.70±0.72^{a}	96.31±0.15^{a}	94.60±0.60^{b}	95.59±0.16	0.000***
	EDS	94.61±0.67^{b}	96.81±0.57^{a}	96.32±0.15^{a}	94.58±0.58^{b}	95.58±0.16	
	LDS	97.51±0.78	96.81±0.59	96.33±0.16	96.33±0.62	96.74±0.27	0.000***
	ERS	94.67±0.90^{b}	96.81±0.57^{a}	96.32±0.15^{a}	94.66±0.58^{b}	95.59±0.17	
							0.415^{NS}
							0.000***
Acrosomal integrity (%)	LRS	98.15±0.94	98.22±0.28	98.43±0.05	97.88±0.41	98.17±0.08	0.103^{NS}
	EDS	98.34±0.47^{a}	98.24±0.25^{a}	98.43±0.05	97.88±0.38^{b}	98.22±0.05	0.001***
	LDS	98.06±1.15	98.27±0.23	a	97.93±0.49	98.17±0.09	
	ERS	98.33±0.38^{a}	98.24±0.25^{ab}	98.43±0.05	97.88±0.38^{b}	98.22±0.05	0.251^{NS}
				98.43±0.05			0.001***
				a			
Membrane integrity (%)	LRS	92.03±1.02^{c}	95.37±0.39^{a}	95.90±0.22	94.46±0.26^{b}	94.44±0.23	0.000***
	EDS	91.96±1.02^{c}	95.38±0.45^{a}	a	94.45±0.33^{b}	94.42±0.24	
	LDS	92.11±1.05^{c}	95.40±0.46^{a}	95.90±0.22	94.51±0.31^{b}	94.49±0.23	0.000***
	ERS	92.03±0.86c	95.38±0.45^{a}	a	94.45±0.33^{b}	94.45±0.23	
				95.93±0.20			0.000***
				a			
				95.93±0.20			0.000***
				a			
Sperm index (x10^{9})	LRS	551793±72525	464474±684	338373±41	446650±102	550917±107	0.000***
	EDS	a	35^{b}	577^{c}	29^{b}	70	
	LDS	560215±10582	446434±163	338572±41	447030±410	443214±10	0.000***
	ERS	9^{a}	01^{b}	559^{c}	085^{b}	831	
		541501±52559	449577±1856	342584±46	447457±103	340558±61	0.000***
		a	2^{b}	106^{c}	89^{b}447259±	40	
		550160±66155	412369±1310	342704±46	9176^{b}	447099±13	0.000***
		a	77^{b}	160^{c}		95	

*a, b, c, Means within row with different superscripts differ significantly (*** P<0.001). SEM: standard error of the mean NS: Not significant. LRS = late rainy season, EDS = early dry season, LDS = late dry season, ERS = early rainyseason*

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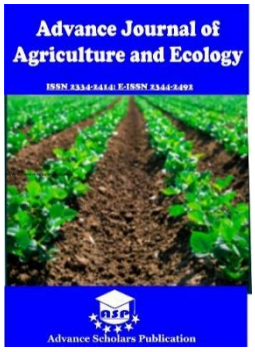

Table 2: Mean±SD of sperm morphological characteristics measured on semen ejaculate collected during the four seasons on Four Nigerian breeds of Sheep

Parameters	Seasons	Breeds Balami (Mean±SD)	Uda (Mean±SD)	WAD (Mean±SD)	Yankasa (Mean±SD)	Mean±SEM	P-value
Primary abnormality	LRS	0.33±0.14^{a}	0.23±0.05^{b}	0.00±0.00^{c}	0.39±0.08^{a}	0.24±0.02	0.000***
	EDS	0.36±0.09^{a}	0.23±0.05^{b}	0.00±0.00^{c}	0.40±0.09^{a}	0.25±0..02	0.000***
Detached head	LDS	0.38±0.10^{a}	0.23±0.05^{b}	0.00±0.00^{c}	0.39±0.08^{a}	0.25±0.02	0.000***
	ERS	0.39±0.08^{a}	0.23±0.05^{b}	0.00±0.00^{c}	0.40±0.09^{a}	0.25±0.03	0.000***
Secondary abnormality	LRS	0.23±0.07^{b}	0.15±0.09^{c}	0.23±0.07^{b}	0.52±0.04^{a}	0.28±0.02	0.000***
	EDS	0.23±0.07^{b}	0.13±0.05^{c}	0.23±0.07^{b}	0.52±0.04^{a}	0.28±0.02	0.000***
Midpiece	LDS	0.213±0.07^{b}	0.13±0.05^{c}	0.24±0.07^{b}	0.52±0.06^{a}	0.28±0.02	0.000***
	ERS	0.24±0.07^{b}	0.13±0.05^{c}	0.23±0.07^{b}	0.53±0.05^{a}	0.28±0.02	0.000***
Tertiary abnormalities	LRS	1.68±0.14^{a}	1.03±0.41^{c}	1.24±0.07^{bc}	1.48±0.15^{ab}	1.36±0.05	0.000***
	EDS	1.68±0.14^{a}	0.99±0.33^{c}	1.24±0.07^{b}	1.49±0.13^{a}	1.35±0.05	0.000***
Bent tail	LDS	1.69±0.17^{a}	0.97±0.35^{c}	1.23±0.05^{b}	1.48±0.18^{a}	1.34±0.05	0.000***
	ERS	1.71±0.17^{a}	0.99±0.33^{c}	1.23±0.05^{b}	1.49±0.13^{a}	1.36±0.05	0.000***
	LRS	1.23±0.29^{a}	0.72±0.09^{c}	0.96±0.07^{b}	1.28±0.23^{a}	1.05±0.04	0.000***
Kinked tail	EDS	1.23±0.27^{a}	0.72±0.09^{c}	0.95±0.08^{b}	1.32±0.21^{a}	1.05±0.04	0.000***
	LDS	1.24±0.26^{a}	0.72±0.09^{c}	0.95±0.08^{b}	1.31±0.21^{a}	1.05±0.04	0.000***
	ERS	1.26±0.27^{a}	0.72±0.09^{c}	0.95±0.08^{b}	1.32±0.21^{a}	1.06±0.04	0.000***
Coiled tail	LRS	1.85±0.37^{a}	1.24±0.27^{b}	1.22±0.07^{b}	1.73±0.17^{a}	1.51±0.05	0.000***
	EDS	1.85±0.38^{a}	1.19±0.25^{b}	1.21±0.07^{b}	1.72±0.17^{a}	1.49±0.05	0.000***
	LDS	1.88±0.39^{a}	1.19±0.25^{b}	1.21±0.07^{b}	1.70±0.18^{a}	1.50±0.06	0.000***
	ERS	1.93±0.45^{a}	1.19±0.25^{b}	1.21±0.07^{b}	1.72±0.17^{a}	1.51±0.06	0.000***

$^{a, b, c,}$ Means within rowwith different superscripts differ significantly (*** P<0.001). SEM: standard error of the mean, SD: standard deviation. LRS = late raining season, EDS = early dry season, LDS = late dry season, ERS = early raining season

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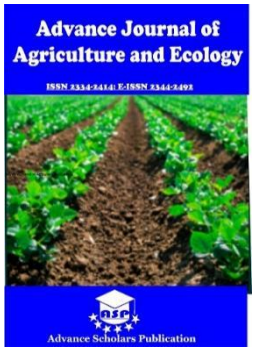

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