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ORIGINAL ARTICLE

Biometry of the Ovary in Balami, Yankassa Sheep and Sahel Goat

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SUMMARY

This study was designed to determine the biometry of ovaries of Balami, Yankassa sheep and goats in Maiduguri, Nigeria. This cross sectional study involved 100 ovaries of sheep and goats slaughtered at the Maiduguri metropolitan abattoir, Maiduguri, Nigeria. Two breeds of sheep (Yankassa and Balami) were utilized for this study as well as the Sahel breed of goat. The mean weights of ovaries were 0.88 ± 0.37g, 0.76 ± 0.45g and 1.06 ± 0.46g in Balami, Yankassa breed of sheep and Sahel goats respectively. The diameters of the ovaries were 1.57 ± 0.28cm, 1.49 ± 0.35cm and 1.67 ± 0.26cm in Balami, Yankassa Sheep and Sahel Goats. Similarly, the numbers of follicles on the ovaries studied were 14.3 ± 4.89. 14.67 ± 6.82 and 18.72 ± 8.63 in Balami, Yankassa sheep and Sahel goats respectively. There was no significant difference ($P > 0.05$) in these parameters between the left and right ovaries of all the species and between Yankassa and Balami sheep breeds. There was also no difference ($P > 0.05$) in these values when the age of animals was considered. Gross observations on the ovary of sheep shows that 12% were having cystic ovaries, 20% were having inactive ovaries and 68% were in different stages of the oestrus cycle. Similarly, gross examination of the ovary of goats sampled showed 18% were having cystic ovaries, 34% inactive ovaries and 48% were cycling. Although the biometrics of the right ovaries appear to have higher values than the left ovary in this study, statistical analysis did not detect a significant difference between the left and right ovary in both sheep and goats in Maiduguri, Nigeria.

Key words: Biometry, Goat, Sheep, Reproduction, Ovary, Follicles.

INTRODUCTION

The global population of sheep and goats stands at 1078.2 million and 861.9 million respectively (Aziz, 2010). Out of this figure, Nigeria is home to 33.9 million (3.1%) sheep and 53.8million (6.2%) goats (Aziz, 2010). These species of animals are well adapted to the tropics (Burrow and Henshall, 2014) and their economic importance is quite significant (Kapa *et al*., 2001; Omoike, 2006; Oluwatayo and Oluwatayo, 2012). Based on these qualities, careful selection and breeding can improve production from

these animals.

The predominant sheep breeds in Nigeria are the Balami, Uda, West African Dwarf, and the Yankassa breeds. The Balami (characterized by large droopy ears) and the Yankassa (easily distinguished by black patches around the eyes, ears and at times at the fetlock) breeds are the most common in the country's North east (Adu and Ngere, 1979). Similarly, there are basically two breeds of goats in Nigeria, the Dwarf (West African Dwarf) and the long legged (Sahel) breeds. Among the other ecotypes of the Sahel type, the Borno White is the predominant breed in and around Maiduguri, Nigeria (Abba and Igbokwe, 2015).

The ovary synthesizes and secretes progesterone and estrogen which are necessary for reproduction (An *et al.,* 2012). The shape and size of the ovary vary across different species of animals. There also exist variations on the type of structure on the ovary during different stages of the estrous cycle which enables the gonad to perform both endocrine and cytogenic properties in different species (Fradson *et al.*, 2003). Although there is an insight on the nature and biometry of the ovary of both sheep and goat using ultrasonography (Bartlewski et al., 1998; Simones et al., 2005) there is a scarcity of information on to gross biometry of the ovary in sheep and goats. This study was thus designed to determining the gross biometry of ovaries from sheep and goats using abattoir specimens. Data obtained from this study would provide baseline data in these breeds and to which comparison could be made in other breeds of sheep and goats.

MATERIALS AND METHODS

The study was conducted in Maiduguri Nigeria located in the conventional Sudan savannah and Sahel savannah zone. The area is characterized by low annual rainfall and sparse vegetation. Animals are kept under semi intensive or the extensive system of management. Rainfall usually last for four months (June to September) and is followed by a long dry season. Sampling for this study was carried out during the dry season (December-February).

Study Animal and sample collection

Indigenous apparently healthy trade sheep and goats between the ages of 1-5 years and brought for slaughter at the Maiduguri metropolitan abattoir were used for this study. A total of 100 animals were used for this study and this include fifty each of sheep and goat. Immediately after slaughter the ovary and the reproductive organs were removed and examined. The presence or absence of pregnancy was noted but the stage of pregnancy was not determined as this was not within the scope of this study. The ovaries were then transported on ice to the Theriogenology Laboratory, University of Maiduguri for examination.

Sample Processing and Examination

The ovaries were trimmed of excess connective tissue and washed with distilled water. The total number of visible follicles on the surface of each ovary were counted and recorded. The width of each ovary was measured using a standard Type B Vernier caliper (Triclebrand, Shangai, China). The weight of the ovaries was measured using an electronic balance (Xy-C Electronic Balance, Shangdong, China) with a sensitivity of 0.1g. Ovarian follicular and luteal structures were identified and each structure was classified as a follicle, active *corpus luteum*, *corpus albicans*, or *corpus hemorrhagicum* (as described by McDonald, 1980). Ovaries showing presence of active *corpus luteum* were considered to belong to a cycling animal. *Corpus luteum* of pregnancy was identified during sampling by its characteristic pinkish red appearance. An animal was identified as having abnormal ovarian function when it showed evidence of follicular growth without active *corpus luteum/ corpus albicans*, or presence of cyst on the ovary. Animals that had no luteal

TABLE I: Biometry of ovary of Balami and Yankassa breed of Sheep slaughtered at the Maiduguri metropolitan abattoir

Balami Age (in years)	Weight of ovary (g)	Width of ovary (cm)	Number of follicles on ovary
1-1.5	0.71±0.38	1.50±0.35	14.12±5.43
1.5-2	1.04±0.39	1.72±0.23	15.30±5.87
2-2.5	1.08±0.28	1.58±0.24	16.25±1.26
>2	0.72±0.19	1.43±0.21	12.00±3.69
Yankassa Age (in years)	Weight of ovary (g)	Width of ovary (cm)	Number of follicles on ovary
1-1.5	0.51±0.23	1.24±0.21	12.50±2.59
1.5-2	0.90±0.55	1.54±0.28	17.60±8.00
2-2.5	0.85±0.21	1.75±0.07	18.00±1.41
>2	0.77±0.37	1.61±0.24	13.16±5.74

structure(s) on its ovary with complete absence of follicles were defined as anoestrus/inactive ovaries.

Statistical Analysis

Data generated from weights and width of the ovary and number of follicles on the ovary was expressed as mean and standard deviation. One way analysis of variance was used to determine variation between different age groups of both sheep and goats. P value was considered significant at $P < 0.05$. Data generated on cycling, pregnancy, inactive ovary were expressed in numbers and simple percentages.

RESULTS

From the 50 sheep sampled in this study 17 (34%), were of the Balami breed while the remaining 33 (66%) were of the Yankassa breed.

The results of this study shows that the mean weight, width of ovaries and number of follicles on the ovaries of Balami sheep aged between 1-1.5 years were 0.71 ± 0.38, 1.50 ± 0.35 and 14.12 ± 5.43 respectively. Sheep of the same breed at 2 years and above, had mean weight, width and number of follicles on their ovaries to be 0.72 ± 0.19, 1.43 ± 0.21 and 12.00 ± 3.69 respectively (TABLE I). There were no significant difference (P>0.05) when these values were compared across different age groups of sheep and also between right or left ovaries in this breed (TABLE II). In the Yankassa sheep, the mean weight, width of ovaries and number of follicles on the ovary of sheep aged between 1-1.5 years were 0.51 ± 0.23, 1.24 ± 0.21 and 12.50±2.59 respectively. Similarly, in sheep aged 2 years and above had values of 0.77 ± 0.37, 1.61 ± 0.24 and 13.16 ± 5.74 respectively (TABLE I). There were no significant difference (P>0.05) when these values were compared across age and between the left and right ovaries (TABLE II). From the 50 sheep sampled in the study, 27 (54%) were cycling, 6 (12%) were having cystic ovaries, 10 (20%) were found to have inactive ovaries and 7 (14%) of the Sheep were found to be pregnant (TABLE V).

All the goats sampled for this study were of the Sahel breed. The mean weight, width of ovaries and number of follicles on the ovary of Sahel goats aged between 1-1.5 years were 0.92 ± 0.39, 1.66 ± 0.29 and 18.20 ± 7.42. In goats aged 2 years and above, the values were 1.1 ± 0.00, 1.75 ± 0.07 and 22.00 ± 1.41 (TABLE III). There were no significant difference ($P > 0.05$) when these values were compared across age and between the right and left ovaries (TABLE IV). Furthermore, 17 (34%) where cycling, 9 (18%) were also having cystic ovaries, 7

TABLE II: Biometry of ovary of Balami and Yankassa breed of Sheep slaughtered at the Maiduguri metropolitan abattoir

Balami	Weight of ovary (g)		Width of ovary (cm)		Number of follicles on ovary	
Age (in years)	LO	RO	LO	RO	LO	RO
1-1.5	0.53±0.15^{a}	0.90±0.47^{a}	1.43±0.25^{b}	1.58±0.45^{b}	10.75±2.99^{c}	17.50±5.45^{c}
1.5-2	0.94±0.43^{a}	1.14±0.37^{a}	1.70±0.19^{b}	1.74±0.29^{b}	15.00±5.83^{c}	15.60±6.58^{c}
2-2.5	0.85±0.07^{a}	1.30±0.14^{a}	1.50±0.14^{b}	1.65±0.35^{b}	17.00±1.41^{c}	15.50±0.70^{c}
> 2.5	0.60±0.20^{a}	0.83±0.12^{a}	1.47±0.25^{b}	1.40±0.20^{b}	13.00±5.66^{c}	12.00±5.66^{c}
Yankassa	Weight of ovary (g)		Width of ovary (cm)		Number of follicles on ovary	
Age (in years)	LO	RO	LO	RO	LO	RO
1-1.5	0.48±0.13^{d}	0.54±0.32^{d}	1.28±0.19^{e}	1.20±0.23^{e}	12.20±3.35^{f}	12.80±1.92^{f}
1.5-2	0.65±0.23^{d}	1.15±0.67^{d}	1.44±0.28^{e}	1.63±0.26^{e}	18.00±6.72^{f}	17.20±9.46^{f}
2-2.5	1.00±0.00^{d}	0.70±0.00^{d}	1.80±0.00^{e}	1.70±0.00^{e}	19.00±0.00^{f}	17.00±0.00^{f}
> 2.5	0.70±0.35^{d}	0.84±0.39^{d}	1.63±0.29^{e}	1.60±0.19^{e}	13.00±6.53^{f}	13.33±5.10^{f}

LO= Left Ovary, RO= Right Ovary
Superscript with the same alphabet do not differ significantly ($p>0.05$)

TABLE III: Biometry of ovary of goats slaughtered at the Maiduguri metropolitan abattoir

Age	Weight of ovary (g)	Width of ovary (cm)	Number of follicles on ovary
1-1.5	0.92±0.39	1.66±0.29	18.20±7.42
1.5-2	1.06±0.48	1.64±0.25	18.90±8.22
2-2.5	1.17±0.50	1.77±0.31	19.25±9.78
>2	1.10±0.00	1.75±0.07	22.00±1.41

(14%) were pregnant and 17 (34%) were having inactive follicles (TABLE V).

DISCUSSION

This study was conducted to determine the weight, diameter and also the number and type of structures on the surface of the ovary. Ovaries of sheep and goats were collected immediately after slaughter at the abattoir and were studied. Results from the study did not detect a statistically significant difference in the biometry of the ovary in both sheep and goats. In this study the right ovary appears to be more active than the left in both species but this difference is not significant. This result agrees with results of a few similar studies (Khojasteh *et al.*, 2012; Asad *et al.,* 2016; Hague *et al.,* 2016) that observed that there is no significant difference in the biometery of the right and left ovary in goats. However, other studies have shown that the right ovary is more active and thus likely to be heavier than the left especially in goats (Sah and Rigor, 1985; Eiamvitayakorn and Rigor. 1988). This difference could be due to environmental and or genetic factors or could be due to a combination of both factors. Khojasteh *et al.* (2012) were able to show that the right ovary was more active than the left ovary in pregnant Iranian goats. Comparison between the two breed of sheep show no differences in ovarian biometry.

Ovarian cysts were a common abnormality on the ovaries of both sheep and goats in this study. This has been earlier identified as an important cause of infertility in farm animals (Medan *et al.,* 2004). Although the pathogenesis of this condition is not fully understood, it is however safe to state those

TABLE IV: Biometry of ovary of goat slaughtered at the Maiduguri metropolitan abattoir

Age	Weight of ovary (g)		Width of ovary (cm)		Number of follicle on ovary	
	LO	RO	LO	RO	LO	RO
0.5-1	0.78±0.16[a]	1.06±0.52[a]	1.72±0.13[b]	1.60±0.40[b]	15.60±6.39[c]	20.80±8.14[c]
1-1.5	1.01±0.52[a]	1.10±0.44[a]	1.63±0.30[b]	1.64±0.20[b]	17.10±7.71[c]	20.71±8.50[c]
1.5-2	1.14±0.54[a]	1.20±0.50[a]	1.74±0.28[b]	1.80±0.35[b]	18.00±9.49[c]	20.50±10.56[c]
2-2.5	1.10±0.00[a]	1.10±0.00[a]	1.80±0.00[b]	1.70±0.00[b]	21.0±0.00[c]	23.0±0.00[c]
> 2.5	0.87±0.34[a]	1.32±0.41[a]	3.20±4.12[b]	1.75±0.20[b]	15.50±12.29[c]	19.00±9.76[c]

LO= Left Ovary, RO= Right Ovary

Superscript with the same alphabet do not differ significantly (p>0.05)

TABLE V: Reproductive status of sheep (Balami (n=17), Yankassa (n=33) and goats (Sahel n=50) slaughtered at the Maiduguri abattoir in northeastern Nigeria

Reproductive status	Sheep		Goats
	Balami n (%)	Yankassa n (%)	Sahel n (%)
Cycling	9 (52.9)	18 (54.5)	17 (34.0)
Cystic ovarian condition	3 (17.6)	3 (9.1)	9 (18.0)
Inactive ovaries	3 (17.6)	7 (21.2)	17 (34.0)
Pregnant	2 (11.8)	5 (15.2)	7 (14.0)

ovarian cysts are likely occur due to hormonal deficiencies (Roukbi, 2013). Cystic ovarian disease is a serious economic problem as affected animals are barren until the next breeding season (Medan et al., 2004). Prevalence rates of up to 12% have been reported in goats (Moreira *et al.,* 1991). This study shows a higher prevalence and this variation could be due to variation in breed or geographical location. Studies have now shown that such cases can be treated effectively in goats using gonadotrophin releasing hormones (Dobson *et al.,* 1997; Medan et al., 2004).

This study also shows a high percentage of sheep and goats with inactive ovaries. One of the important causes of this may be due to a Negative Energy Balance (NEB) in these animals (Opsomer *et al.,* 1998). A NEB is likely to occur in polytocous animals such as sheep and goats and have been shown to cause ovarian inactivity through abolishment of the pulsatile secretions of gonadotrophin releasing hormone and luteinizing hormone which are required to start a new oestrus cycle (Zurek *et al.,* 1995). The extent and duration of NEB determines when affected animals will resume normal cyclicity especially after delivery and subsequent nursing (Villa- Godoy *et al.,* 1988). Resumption of ovarian activity in affected animals returns only when NEB is at its lowest (Canfield and Butler, 1991). Therefore, regular reproductive examination should be carried on goats with the view of culling animals that are infertile or with inactive ovaries in order to boost reproduction rate in this species.

CONCLUSION

This study did not detect any difference in the biometry of left and right ovary in either sheep or goats in Maiduguri, Nigeria. Further in-depth studies are required to elucidate the influence of climate and management on the functioning of the ovary in indigenous sheep and goats with the aim of improving their production in Maiduguri, Nigeria. It is also suggested that further investigations be made to determine the impact of occurrence of cystic ovaries and inactive ovaries on reproduction in sheep and goats.

ABBA, Y. and IGBOKWE I. O. (2015): Testicular and related size evaluations in Nigerian Sahel goats with optimal cauda epididymal sperm reserve. Vet. Med. Int. dx.doi.org/10.1155/2015/357519

ADU, I.F. and NGERE, L.O. (1979): The indigenous sheep of Nigeria. World Rev. Anim. Prod. 15(3): 51-62.

AN, X.P., HOU, J.X., LI, G., PENG, J.Y., LIU, X.Q., LIU, H.Y., XIAO, W.P., WANG, X.Y. and CAO, B.Y. (2012): Analysis of different expressed genes of ovaries of polytocous versus monotocous dairy goats using suppressive subtractive hybridization. Reprod Domestic Anim. 47:498-503.

ASAD, L., RAHMAN, A., HOSSAIN, M.M. and AKTER, M (2016): Ovarian category, follicles and oocytes analysis of Goat ovaries in view of in vitro production of embryos. Int. J. Anim. Res.1 (1):27-34

AZIZ, M.A. (2010): Present status of the world goat populations and their productivity. Lohmann Information. 45(2): 42-52.

BARTLEWSKI, P.M. BEARD, A.P. COOK, S.J. and RAWLINGS, N.C. (1998): Ovarian follicular dynamics during anoestrus in ewes. J Reprod Fert. 113:275-285.

BURROW, H.M. and HENSHALL, J.M. (2014): Relationships between adaptive and productive traits in cattle, goats and sheep in tropical environments. Proceedings, 10th World Congress of Genetics Applied to Livestock Production.

CANFIELD, R.W. and BUTLER, W.R. (1991): Energy balance, first ovulation and the effects of naloxone on LH secretion in early postpartum dairy cows. J Anim. Sci. 69, 740-746.

MOREIRA, E.L.T., NASCIMENTO E.F.D., CHQUILOFF M.A.G., DODASCIMENTO, E.F. (1991): Morphological alterations in the

DOBSON, H., RANKIN, J.E. and WARD, W.R. (1997): Bovine cystic ovarian disease: plasma hormone concentrations and treatment Vet Rec 101(23):459-461.

EIAMVITAYAKORN, J. AND RIGOR, E.M. (1988): Behavioral estrus and ovarian activity in goats (Capra hircus). Thai J Hlth Resch 2(2): 85-90.

FRANDSON, R.D., LEE WILKE, W. and FAILS, A.D. (2009): Anatomy and physiology of farm animals. 6th edition. Willey-Blackwell. Pp 395.

HAQUE, Z., HAQUE, A. AND ABUL QUASEM, M (2016): Morphologic and morphometric analysis of the ovary of black bengal goat (*capra hircus*) 34(1):13-16, 2016. J Agric. Soc. Res. 6(2): 23-31.

KAPA, M.M.J., ROLA-RUBZEN, M.F. and BENT, M. (2001): An Economic Model of Small Ruminant Production in Small Scale Dryland Farming Systems in West Timor, Indonesia. Paper presented to Australian Agricultural and Resource Economics Society 45th Annual Conference 22 – 26 January 2001, Adelaide, SA

KHOJASTEH, S. M.B., HATAMI NEMATI, H. and Khajehnasiri, N. (2012): Size of genitalia of Iranian goats in pregnancy. Bangladesh veterinarian 29(1): 38 – 40

McDONALD, L.E. (1980): Veterinary endocrinology and reproduction. Lea and Febiger, Philadalphia. Pp 274-398.

MEDAN, M.S., WATANABE, G., SASAKI, K. and TAYA, K. (2004): Transrectal ultrasonic diagnosis of ovarian follicular cysts in goats and treatment with GnRH. Domest. Anim. Endocrinol. 27: 115–124.

ovaries and uterus of *Capra hircus*. L1 regressive alterations. Arguivos da Escola de Medicina Veterinaria da Universidade Federal de Bhia. 14:25–39.

OLUWATAYO, I.B. and OLUWATAYO, T.B. (2012): Small Ruminants as a Source of Financial Security: A Case Study of Women in Rural Southwest Nigeria. Institute of Money, Technology and Financial Inclusion working paper 2012-2.

OMOIKE, A. (2006): Prevalence of diseases among sheep and goats in Edo State, Nigeria

OPSOMER, G., CORYN, M., DELUYKER, H. and de KRUIF, A. (1998): An analysis of ovarian dysfunction in high yielding dairy cows after calving based on progesterone profiles Reprod Dom Anim. 33:193-204.

ROUKBI, M. (2013): A survey of some ovarian abnormalities responsible for sterility in Damascus goats. Iraqi J. Vet. Sci., 27(2): 109-114.

SAH SK, AND RIGOR EM. (1985): Estrous cycle, estrous duration and ovulation time in goats. Phil Agr UP Los Ban 68(4): 461-470.

SIMÕES, J., POTES, J., AZEVEDO, J., ALMEIDA, J.C., FONTES, P., BARIL, G. and MASCARENHAS R. (2005): Morphometry of ovarian structures by transrectal ultrasonography in Serrana goats. Anim Reprod Sci. 85: 263–273

VILLA-GODOY, A., HUGHES, T.L., EMERY, R.S., CHAPIN, L.T. and FOGWELL, R.L.(1988): Association between energy balance and luteal function in lactating dairy cows. J Dairy Sci 71:1063-1072

ZUREK, E., FOXTROFT, G.R. and KENNELY. J. J. (1995): Metabolic *status* and interval to first ovulation in postpartum dairy cows. J Dairy Sci 78:1909-1920.