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Research Article

EFFECT OF AGE AND PHASE OF ESTROUS CYCLE ON BIOMETRIC PARAMETERS OF MARWARI GOAT GENITALIA

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ABSTRACT

With an objective to elucidate the effect of age on the biometry of genital organs in Marwari goats, a total of 115 genital organs were collected from municipal and local abattoirs of Bikaner city. Out of total 115 genitalia, 80 were non- pregnant healthy which were further subdivided into two groups (based on history and dentition before slaughter) Gp A (<1 year) and Gp B (>1 year). Furthermore, Gp B organs were categorized into two stages based on characteristics of corpus luteum and follicular structures on ovarian surface. Biometries of healthy genital organs were recorded in respective groups and phases. A significant ($P<0.05$) difference was observed in the biometry of genital organs in Gp A and Gp B. A significant ($P<0.05$) difference was recorded in weight, width and number of surface ovarian follicles between the follicular and luteal phase of estrous cycle whereas, no significant ($P>0.05$) difference was observed in ovarian biometry within the phases of estrous cycle. It was concluded that biometrical measurements of the different parts of female reproductive tract increase with age.

Keywords: Abattoir, biometry, estrous cycle, genital organs, Marwari goat

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Goats were one of the first animals to be tamed by humans. Goats provide a dependable source of income to the majority of the rural population living below the poverty line in India. According to the 20th Livestock Census 2019, the total goat population in India is 148.88 million (M) showing an increase of 10.14% over the previous census. Reproductive performance is economically important in small ruminants because of its effect on the number of offspring produced per year (Greyling, 2000). The Capra hircus species is a domestic animal in which the reproductive physiology is least understood compared to cattle, sheep and pigs. Findings of biometry during different phases of the estrous cycle may be utilized by the physiologist, embryo transfer technologist, breeders and other related workers for the development of the goat husbandry. Information on the biometrics of the reproductive system of livestock animals is necessary to improve fertility, reproduction and performance as well as enable the adoption of other assisted reproductive technologies (Okoye *et al.*, 2017) and its reflects the overall well-being of the animal (Kumar *et al.*, 2004). An accurate idea about the reproductive organs is necessary to maintain the good reproductive performance of goats.

The present study was therefore designed to determine the reproductive tracts morphometry to provide baseline data for teaching, further research and for enhancing the reproductive capacity of the Marwari breed of goats.

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MATERIALS AND METHODS

Experimental location and duration: The whole experiment was conducted from June 2022 to October 2022 at the Department of Veterinary Gynaecology and Obstetrics, College of Veterinary and Animal Science, Rajasthan University of Veterinary and Animal Sciences, Bikaner (Rajasthan), India.

Collection of samples: The samples were collected from the municipality and local slaughterhouse of Bikaner city. During routine slaughtering operations, the reproductive tracts of female Marwari goat genitalia were collected in Thermocol box with ice packs. Biometric parameters were recorded from 80 healthy non-gravid genital organs of Marwari goat.

Sample preparation and segregation of organs: As soon as genital organs were brought to the laboratory and it was washed with normal saline 2-3 times. Healthy non-gravid genital organs were divided into two groups on the basis of history taking and dentition before slaughter group A (age below 1 year and group B (more than 1 year). Organs in group B were further subdivided into two groups i.e. follicular phase and luteal phase based on differences in the morphological criteria like colour, consistency and vasculature of CL as described by Katare *et al.* (2015). The follicular stage would be characterized by the CL with creamy reddish white coloured tissues, regressing vessels (few to nil) and firm consistency (Jaglan *et al.*, 2010) with

at least 4-5mm or above diameter follicle present on ovaries (Ghosh *et al.*, 2005; Tungal *et al.*, 2014). In luteal phase, CL at early-luteal stage would be showed haemorrhagic or red coloured luteal tissues with loose soft consistency in which blood vessels were not visible. The CL at mid-luteal stage would be showed reddish brown to orange in colour, growing vessels appearing at the periphery and apex with soft to compact consistency. Late-luteal stage would be having tan to orange brown or flesh coloured CL; apex would be pinkish with developed vessels at periphery and compact in consistency (Jaglan *et al.*, 2010).

Biometrical measurements: Examination of the specimens was carried out under bright light. All measurements were recorded in centimetres (cm) and all weights in grams (g). After washing genital organs all the peripheral surrounding tissues were chopped off with the help of scissor. The lumen of genital organs was exposed and spread on a clean shroud for further biometrical procedures. Different segments of the genital tract i.e. ovary, oviduct, uterine horns, uterine body and cervix was measured. The length, width and thickness of the genial organs were measured using a digital vernier calliper and those above 10 cm were recorded with the help of a thread that was calibrated against the measuring scale.The weight of ovaries was measured by placing individual ovary on a weighing pan. Length of ovary was measured from the cranial to the caudal surface, width from the lateral and medial border and thickness from the dorsal to the ventral surface (Shah *et al.*, 2015) (Fig. 1). The numbers of surface follicles were counted by visual observation. The length of fallopian tube was taken from the infundibulum to the uterus junction (Gupta *et al.*, 2011). The tube was first made straight by cutting the surrounding facia and then thread held against the whole length of the oviduct from fimbriae to the junction of the uterus marked. After that, the marked points were measured against the measuring scale (Fig. 2). The uterine horns were dissected free of their ligamentous attachments and extended their full length for measurement. Each uterine horn was incised along its dorsal surface to expose its lumen from the oviduct tubal junction to the bifurcation of the body of the uterus. The length was taken from the uterine body to the apex of the horn, the width was measured at the center and the thickness was measured in the middle (Gupta *et al.*, 2011) (Fig. 3). The number of caruncles was counted by visual observation. The body of the uterus was incised and the dorsal incision continued in a straight line to the dorsal commissure of the vulva to fully expose the cervical canal. The length was recorded from the cervix to the uterine horn, width and thickness in the middle (Gupta *et al.*, 2011). The length of the cervix was measured from internal os to external os (Fig. 4). Width and thickness were measured in the middle (Fig. 5). The cervical folds were counted and their accentric folds were recorded (Gupta *et al.*, 2011).

Statistical Analysis: The data were subjected to analysis of variance and Duncan's multiple range tests (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

The mean dimensions of biometric parameters of genital organs of group A and group B are presented in Table 1 and Fig. 6. A Significant ($P<0.05$) difference was observed in the biometry of genital organs between group A and group B whereas no significant difference ($P>0.05$) was observed in these parameters within the groups. A similar trend of having a significant difference in the biometry of genital organs with age was observed by Suri *et al.* (2013) in Bakerwali goat (Kaghani goat) and Prasad *et al.* (2020) in Nellore sheep. Uddin *et al.* (2021) reported that overall the size of most parts of the reproductive tract of goats increased with age in Black Bengal goats. The average number of caruncles in uterus were recorded 69.2. The mean number of rings in cervix were recorded 4.46 ± 0.96.

The mean dimensions of the right and left ovary (weight, length, width, thickness and the number of follicles) in the follicular and luteal phase are presented in Table 2 and Fig. 7.

A Significant ($P<0.05$) difference was observed in the biometry of genital organs between group A and group B whereas no significant difference ($P>0.05$) was observed in these parameters within the groups. Similar trend of having significant difference in biometry of genital organs with age was observed by Suri *et al.* (2013) in Bakerwali goat (Kaghani goat) and Prasad *et al.* (2020) in Nellore sheep. Uddin *et al.* (2021) studied the biometric and histomorphometric parameters in female reproductive system of Black Bengal goats and stated that the overall size of most parts of the reproductive tract of goats increased with age.

No significant difference ($P>0.05$) was observed in the biometry of right and left ovaries within phases of estrous cycle. But a significant difference ($P<0.05$) was observed in weight and width of right and left ovaries between follicular and luteal phase. Similar to the present study Islam *et al.* (2007) and Osman *et al.* (2021) recorded a significant difference in weight of ovaries between the different phases of estrous cycle and found that a significant higher weight in luteal phase than in follicular phase of estrous cycle. This might be due the hypertrophy of luteinized granulosa cells, hypertrophy of fibroblasts of

Fig. 1. (a) Length of ovary (b) Width of ovary recorded using digital vernier caliper

Fig. 2. Measuring the length of oviduct

Fig. 3. Measuring the length of uterine horn

Fig. 4. Measuring the length of cervix

Fig. 5. Measuring the width of cervix

the connective tissues and vascularity that contribute to an increase in size of the CL (Islam *et al.*, 2007). The significant increase of width of ovary during luteal phase might be because of presence of corpora lutea along their surface (Saleem *et al.*, 2017).

The mean weight of right ovary was more compare to left ovary in this study. The results of recent study were in agreement with Haque *et al.* (2016) and Islam *et al.* (2018). Normal physiological explanation of ovarian activity is that right ovaries are more active than left ones, according to previous reports (Karamishabankareh *et al.*, 2015).The variation in the biometrics of ovaries might be attributed to breed, season and nutrition (Ramsingh *et al.*, 2013). In goats the size of the ovary also varied depending on the stage of the estrous cycle, certainly influenced by changes in the CL (Miranda-Moura *et al.*,

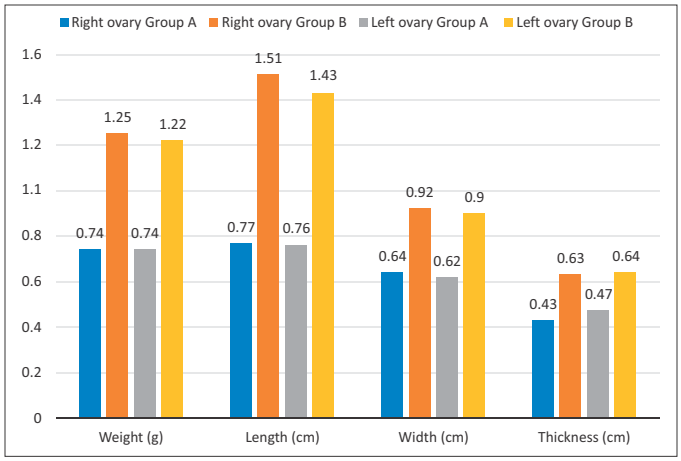

Fig. 6. Mean dimension of ovary between group A and group B

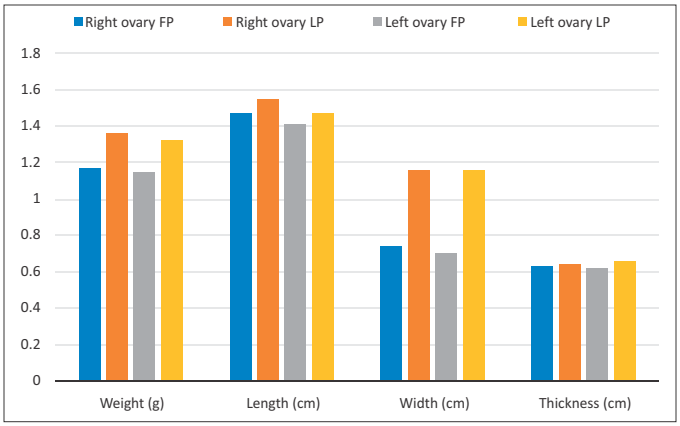

Fig. 7. Mean dimensions of ovary in different phases of estrous cycle

Table 1. Biometrical comparison of genitalia between Group A (below 1yr age) and Group B (above 1yr age)

Parameters			Group A (n=20)	Group B (n=60)	Overall Mean
Ovary	Right	Weight (g)	0.74^{b}±0.03	1.25^{a}±0.04	1.12±0.04
		Length (cm)	0.77^{b}±0.03	1.51^{a}±0.03	1.32±0.04
		Width (cm)	0.64^{b}±0.02	0.92^{a}±0.04	0.85±0.03
		Thickness (cm)	0.43^{b}±0.02	0.63^{a}±0.01	0.58±0.01
	Left	Weight (g)	0.74^{b}±0.02	1.22^{a}±0.04	1.10±0.04
		Length (cm)	0.76^{b}±0.02	1.43^{a}±0.03	1.26±0.04
		Width (cm)	0.62^{b}±0.02	0.90^{a}±0.04	0.82±0.03
		Thickness (cm)	0.47^{b}±0.02	0.64^{a}±0.02	0.59±0.02
Oviduct	Right	Length (cm)	14.90^{b}±0.52	18.84^{a}±0.21	17.85±0.28
	Left	Length (cm)	14.93^{b}±0.57	19.02^{a}±0.23	17.99±0.30
Uterine Horn	Right	Length (cm)	7.24^{b}±0.27	13.43^{a}±0.18	11.89±0.34
		Width (cm)	0.84^{b}±0.39	1.54^{a}±0.04	1.36±0.05
		Thickness (cm)	0.26^{b}±0.01	0.50^{a}±0.02	0.44±0.18
	Left	Length (cm)	7.40^{b}±0.18	13.00^{a}±0.17	11.60±0.30
		Width (cm)	0.84^{b}±0.04	1.51^{a}±0.03	1.34±0.04
		Thickness (cm)	0.24^{b}±0.01	0.49^{a}±0.01	0.43±0.02
Uterine Body	Length (cm)		1.37^{b}±0.03	3.60^{a}±0.07	3.04±0.12
	Width (cm)		0.94^{b}±0.05	1.79^{a}±0.03	1.57±0.05
	Thickness (cm)		0.26^{b}±0.01	0.51^{a}±0.01	0.45±0.01
Cervix	Length (cm)		2.11^{b}±0.06	4.25^{a}±0.08	3.72±0.12
	Width (cm)		0.89^{b}±0.05	1.47^{a}±0.04	1.32±0.04
	Thickness (cm)		0.24^{b}±0.01	0.53^{a}±0.01	0.46±0.01

Note: Means with different superscripts in a row differ significantly from each other (P<0.05).

2010).No significant difference (P>0.05) was observed in right and left ovaries within phases, but a significant difference (P<0.05) was observed in number of follicles between follicular and luteal phase. Similar results were obtained by Talukdar *et al.* (2015) and Gabr *et al.* (2019). Absence of a significant difference in the number of surface ovarian follicles between the luteal and follicular phases was reported by Acar *et al.* (2013).The causes of higher number of follicles found in follicular phase ovaries than those of luteal phase were as per the endocrinological explanation as higher level of FSH hormone in follicular phase (Islam *et al.*, 2007). CL also had local effect on the diameter of ovary and number of follicles (Bartlewski *et al.*, 2001). Multiple factors may affect the ovaries and their developing follicles, including animal age, environmental differences between herds, management practices, nutrition and body condition score (Ramsingh *et al.*, 2013).

CONCLUSION

It was concluded from the present study that measurements of the different parts of female reproductive organ increase with age. The overall weight, length, width and thickness was higher in right ovary which confirm the fact of right ovary being more active than the left one. These results have established the baseline dimensions of the different segments of the female reproductive tract of the Marwari goat and the information will help the diagnosis of various genital abnormalities and ART in the future prospects.

Table 2. Biometricalcomparison of right and left ovary (Mean ±SE) between follicular and luteal phase

Ovarian Parameters		Follicular Phase (n=35)	Luteal Phase (n=25)	Overall mean
Weight (g)	Right	1.17^{b}±0.06	1.36^{a}±0.05	1.25±0.04
	Left	1.15^{b}±0.06	1.32^{a}±0.03	1.22±0.04
Length (cm)	Right	1.47±0.04	1.55±0.03	1.51±0.03
	Left	1.41±0.04	1.47±0.04	1.43±0.03
Width (cm)	Right	0.74^{b}±0.05	1.16^{a}±0.03	0.92±0.04
	Left	0.70^{b}±0.03	1.16^{a}±0.05	0.89±0.04
Thickness (cm)	Right	0.63±0.01	0.64±0.03	0.63±0.01
	Left	0.62±0.02	0.66±0.03	0.64±0.02
No. of follicles	Right	4.97^{a}±0.24	3.32^{b}±0.26	4.28±0.20
	Left	5.20^{a}±0.19	2.68^{b}±0.20	4.15±0.21

Note: Means with different superscripts in a row differ significantly from each other (P<0.05).

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