



Postnatal biometrical and micrometrical changes of the cauda epididymis in Assam goat from birth to 10 months of age*

KAMAL SARMA¹, S N KALITA² and J DEV³

Assam Agricultural University, Khanapara, Guwahati, Asom 780 022 India

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ABSTRACT

The present work is aimed to elucidate the age-wise post natal development of the corpus epididymis of Assam goats from 0 day to 10 months of age. Assam goats (18) divided into 6 age groups, viz. group 1 (0-day), group 2 (2 months), group 3 (4 months), group 4 (6 months), group 5 (8 months) and group 6 (10 months) consisting of 3 animals in each group were used in this study. After dissection of these organs from the animal's body, their gross features and biometrical parameters were recorded. The tissues fixed from various organs were utilized for micrometrical studies. The values of majority of the biometrical parameters of corpus, viz. length, width, thickness and weight showed a highly significant variation between different age groups. Bilateral variations of recorded parameters were also noticed between right and left counterparts of this organ. The diameter of the epididymal tubules, height of tubular epithelium and height of the stereo cilia of the cauda epididymides showed a significant increase with advancing age of the male Assam goats.

Key words: Biometry, Cauda epididymis, Goat, Micrometry, Postnatal development

Post natal anatomical studies on the male genital system at various ages, particularly its tubular system are important to know the anatomical growth and development. The reports on the postnatal development of the epididymis are scant. Although some work was conducted on goats (Harshan *et al.* 1978, Islam *et al.* 2002), buffalo (Goyal and Dhingra 1975) and indigenous and crossbred pigs (Veerabrahmaiah *et al.* 1998). The present study was undertaken to elucidate the age related post natal biometrical and micrometrical sequential development of the cauda epididymis in Assam goat and which is the first ever study of its kind in this indigenous breed of goat.

MATERIALS AND METHODS

Male Assam goats (18) varying in age from 0-day to 10

months were used in the present study. The animals were divided into 6 age groups, viz. group 1 (0-day), group 2 (2 months), group 3 (4 months), group 4 (6 months), group 5 (8 months) and group 6 (10 months) consisting of 3 animals in each group. The age of the goats were estimated from birth records. Each animal was weighed using spring balance to record the body weight. The animals were sedated by giving intramuscular injection of squal @ 1mg/kg body weight and subsequently anaesthetized by administering intravenous injection of intravel sodium @ 15 mg/kg body weight (Hall *et al.* 2000). After induction of proper level of anesthesia, the animals were sacrificed.

Each epididymis was separated from the testis and divided into caput, corpus and cauda based on the external morphology. The length, width and thickness of cauda epididymides were measured in cm using Vernier Callipers. The weight of each segment of epididymis was recorded using an electronic balance with sensitivity from 0.02 mg to 310 g. Tissue pieces from the 3 parts of the epididymis (caput, corpus and cauda) were fixed in 10% neutral buffered formalin solution prepared as per Luna (1968). All the tissues were processed for paraffin sections (Luna 1968) by alcohol-xylene method using cedar wood oil. Sections were cut at 5 µ thickness using a rotary microtome. Paraffin sections stained with Haematoxylin and Eosin were used for following micrometric studies. The various measurements were

* Part of PhD Thesis of the first author submitted to Assam Agricultural University, Khanapara, Asom.

Present address: ¹ Associate Professor and Head, Division of Veterinary Anatomy ((kamalsarma73@yahoo.com), ³ Associate Professor and Head (devi.jonali@yahoo.com), Division of Veterinary Physiology and Biochemistry, Faculty of Veterinary Sciences and Animal Husbandry, S.K. University of Agricultural Sciences and Technology, Jammu, R.S. Pura, Jammu 181 102 (J&K). ² Formerly Professor (satyendranathkalita@yahoo.com), Department of Veterinary Anatomy and Histology, College of Veterinary Sciences.

recorded by image analyzer using. All the data were put to statistical analysis (Snedecor and Cochran 1994) and the means along with their standard errors were calculated. Variations of different parameters among different age groups were estimated by ANOVA and the probable variations between individual age groups were calculated by critical difference test. The correlation between certain parameters was determined by calculating the correlation coefficients. All the above calculations were carried out by using SPSS software version 11.5.

RESULTS AND DISCUSSION

Gross morphology and biometry: The mean values for different biometrical parameters of the cauda epididymis are presented in Table 1.

The mean length, width and thickness of the cauda epididymis (Fig. 1) showed a highly significant ($P < 0.01$) increase between their right and left sides as well as between various age groups (Table 2). Further, the mean values for these parameters exhibited marked bilateral variations between the epididymides of right and left counterparts in this study. Similar observations were also reported in lambs (Colyer 1971) and pigs (Veerabramhaiah *et al.* 1998).

The mean weight of the cauda epididymis increased with the advancing age of the animals. Analysis of variance showed no significant variation of weights of cauda epididymis between their right and left sides of the body. However, the mean weight of the cauda revealed a highly



Fig. 1. Cauda epididymis of goats

significant variation between different age groups. Critical difference test (Table 1) revealed that the mean values pertaining to this parameter differed significantly between day-old, 2 and 4 months old kids (groups 1, 2 and 3). A significant difference in weights between right and left epididymides was also reported in lambs (Colyer 1971). Again, Harshan *et al.* (1978) reported that the left cauda

Table 1. Biometrical values (mean $\pm$ se) of cauda epididymis of male Assam goats at different ages

Age group	Length (cm)			Width (cm)		
	Body side			Body side		
	Right	Left	Overall	Right	Left	overall
0-Day	1.04 $\pm$ 0.02	0.99 $\pm$ 0.02	1.02 ^a $\pm$ 0.02	0.92 $\pm$ 0.01	0.91 $\pm$ 0.01	0.91 ^a $\pm$ 0.01
2- months	1.52 $\pm$ 0.03	1.40 $\pm$ 0.03	1.46 ^b $\pm$ 0.03	1.35 $\pm$ 0.02	1.20 $\pm$ 0.01	1.28 ^b $\pm$ 0.04
4- months	1.56 $\pm$ 0.02	1.57 $\pm$ 0.01	1.57 ^{bc} $\pm$ 0.01	1.59 $\pm$ 0.01	1.54 $\pm$ 0.03	1.57 ^{bc} $\pm$ 0.02
6- months	1.65 $\pm$ 0.01	1.62 $\pm$ 0.01	1.63 ^{bcd} $\pm$ 0.01	1.70 $\pm$ 0.01	1.66 $\pm$ 0.01	1.68 ^{cd} $\pm$ 0.01
8- months	1.71 $\pm$ 0.01	1.68 $\pm$ 0.01	1.70 ^{bcd} $\pm$ 0.01	1.78 $\pm$ 0.02	1.72 $\pm$ 0.02	1.75 ^{cde} $\pm$ 0.02
10- months	2.09 $\pm$ 0.01	1.92 $\pm$ 0.02	2.00 ^{def} $\pm$ 0.04	2.00 $\pm$ 0.01	1.85 $\pm$ 0.03	1.93 ^{cdef} $\pm$ 0.03
Average	1.59 $\pm$ 0.08	1.53 $\pm$ 0.07	1.56 $\pm$ 0.05	1.56 $\pm$ 0.08	1.48 $\pm$ 0.08	1.52 $\pm$ 0.06
Age group	Thickness (cm)			Weight (g)		
	Body side			Body side		
	Right	Left	Overall	Right	Left	overall
0-Day	0.61 $\pm$ 0.01	0.55 $\pm$ 0.00	0.58 ^a $\pm$ 0.01	0.02 $\pm$ 0.00	0.03 $\pm$ 0.00	0.02 ^a $\pm$ 0.00
2- months	0.76 $\pm$ 0.02	0.78 $\pm$ 0.01	0.77 ^{ab} $\pm$ 0.01	0.69 $\pm$ 0.02	0.64 $\pm$ 0.02	0.67 ^b $\pm$ 0.02
4- months	1.00 $\pm$ 0.03	1.04 $\pm$ 0.02	1.02 ^{bc} $\pm$ 0.02	1.55 $\pm$ 0.01	1.63 $\pm$ 0.02	1.59 ^c $\pm$ 0.02
6- months	1.18 $\pm$ 0.01	1.18 $\pm$ 0.01	1.18 ^{cd} $\pm$ 0.01	1.72 $\pm$ 0.01	1.73 $\pm$ 0.01	1.73 ^{cd} $\pm$ 0.01
8- months	1.32 $\pm$ 0.02	1.24 $\pm$ 0.02	1.28 ^{cde} $\pm$ 0.02	1.86 $\pm$ 0.02	1.80 $\pm$ 0.01	1.83 ^{cde} $\pm$ 0.01
10- months	1.57 $\pm$ 0.03	1.57 $\pm$ 0.01	1.57 ^f $\pm$ 0.01	2.27 $\pm$ 0.02	2.19 $\pm$ 0.05	2.23 ^{def} $\pm$ 0.03
Average	1.07 $\pm$ 0.08	1.06 $\pm$ 0.08	1.07 $\pm$ 0.05	1.35 $\pm$ 0.18	1.34 $\pm$ 0.18	1.34 $\pm$ 0.13

Means bearing similar superscript in a column do not differ significantly.

Table 2. Micrometrical parameters (mean $\pm$ se in μ) of cauda epididymis of male Assam goats at different ages

Parameters	External diameter of epididymal tubules	Height of tubular epithelium	Height of stereo cilia
0-Day	77.53 ^a $\pm$ 3.23	18.02 ^a $\pm$ 1.49	0.00
2- months	263.50 ^b $\pm$ 9.50	20.55 ^{ab} $\pm$ 2.69	7.77 ^c $\pm$ 0.75
4- months	279.97 ^{bc} $\pm$ 9.73	21.40 ^{abc} $\pm$ 1.78	2.39 ^a $\pm$ 0.22
6- months	358.68 ^d $\pm$ 23.30	22.39 ^{bc} $\pm$ 1.50	3.88 ^{ab} $\pm$ 0.55
8- months	492.02 ^{ef} $\pm$ 21.44	26.69 ^{cd} $\pm$ 1.35	9.06 ^{de} $\pm$ 0.85
10- months	490.70 ^e $\pm$ 35.13	30.98 ^e $\pm$ 2.03	8.88 ^{cd} $\pm$ 1.07
Total	327.07 $\pm$ 18.62	30.34 $\pm$ 2.09	5.33 $\pm$ 0.52

Means bearing similar superscript in a column do not differ significantly.

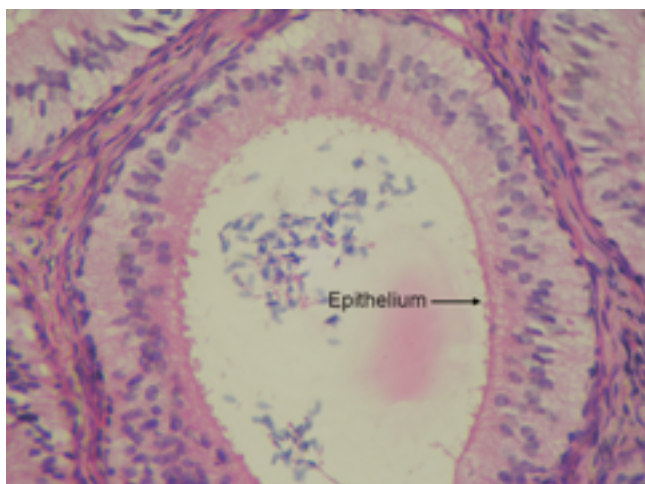


Fig. 2. Diameter of epididymal tubules.

epididymis was found to be significantly heavier than the right one in all the age groups in Malabari goats from 1 to 180 days of age.

Micrometry: The various dimensions of the epididymal tubules of the cauda epididymis in Assam goat kids at their different postnatal ages are given in Table 2.

The mean diameter of the epididymal tubules (Fig. 2) showed a highly significant ($P < 0.01$) increase between different age groups. The extent of growth was more between 6 and 8 months of age. This might be to accommodate the increased sperm produced by the seminiferous tubules at this age because the age of puberty in this goat species was ascertained in this present study to be at 6 months of age as evidenced by the presence of free spermatozoa in the epididymal tubular lumen. Similar trend of growth was also documented in the earlier reports of Bhattacharya *et al.* (1978) in Assam goats, Harshan *et al.* (1978) in Malabari goats, Bilaspuri and Kaur (1998) in Beetal goats, Goyal and Dhingra (1975) in buffaloes and Wrobbel and Fallenbacher (1974) in boars.

The mean height of tubular epithelium (Fig. 2) of the cauda epididymides (Table 2) increased in the male goats with their

— Diameter of epididymal tubules — Height of tubular epithelium — Height of stereo cilia

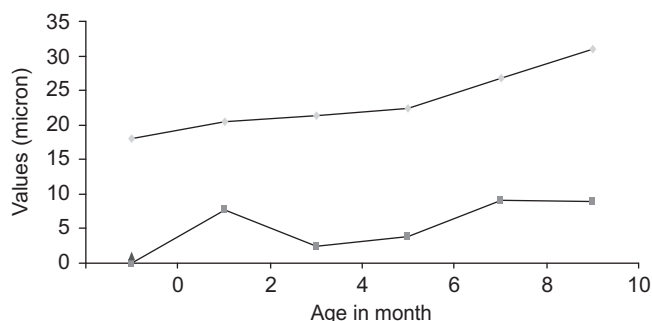


Fig. 3. Height of stereo cilia showed fluctuation at different age groups.

advancing ages. The height of the epididymal tubular epithelium was recorded to be the highest in 10-month-old goats (group 6). Again, the variation in tubular epithelial height was highly significant ($P < 0.01$) between different age groups. Furthermore, the height of tubular epithelium raised tremendously between 8 and 10 months of age. This pattern of growth of tubular epithelium recorded in growing Assam goat kids could not be compared to the findings of other workers due to paucity of available relevant literature. However, the height of the tubular epithelium of cauda epididymides exhibited much lower values than the same of caput and corpus as also observed in Malabari goats (Harshan *et al.* 1978), Black Bengal bucks (Pyne 1987) and camel (Tingari and Moniem 1989).

Stereo cilia was absent in the tubular epithelium of the cauda epididymis in day-old kids (group 1) and observed in the kids from 2 months of age (group 2) onwards. The height of the stereo cilia showed a fluctuating pattern of growth in respect of their length between the age groups (Fig. 3), the maximum height being recorded in the goats of 8 month of age (group 5) and the minimum in 4 month old kids (group 3). The variation of growth of the stereo cilia was highly significant ($P < 0.01$) between different age groups under study. However, critical difference test (Table 3) revealed that the height was reduced significantly ($P < 0.05$) between 2 and 4 months of age (groups 2 and 3) and the increase in height between 6 and 8 months old bucks (groups 4 and 5) was also found to be significant ($P < 0.05$). The stereo cilia in reality were the microvilli which increased the surface area of the epididymal epithelial surface to many fold needed for reabsorption of the fluid from the epididymal lumen. This absorption took place mainly in the tubules of the caput, followed by corpus and cauda epididymides (Banks 1981). The stereo cilia found in the cauda of Assam goats were shorter than those of corpus and caput. This might be due to the less absorptive function of the tubular epithelium of the cauda epididymis. This observation of the present study concurred with the findings of Tingari and Moniem (1989) in camel.

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