

POSTNATAL CHRONOLOGICAL MORPHOMETRIC STUDY ON THE SPLEEN OF NON-DESCRIPT GOATS IN CAUVERY DELTA DISTRICTS

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Abstract: An age-wise study on the length, width, weight, volume and thickness of spleen in non-descript goats reared in Cauvery delta districts of Tamilnadu was conducted as part of the Ph.D. Research. The spleen were collected from seven different post natal age groups of goats viz. 3 to 5 months (Group 1), 8 to 12 months (Group 2), 1 to 2 years (Group 3), 2 to 3 years (Group 4), 3 to 4 years (Group 5), 4 to 5 years (Group 6), 5 years and above (Group 7) irrespective of sex, from slaughter houses. A parallel increase in length and width of spleen was noticed with advancement of age. There was a gradual increase in weight of the spleen up to 4 years (Group 5) of age. The rate of increase in weight of the spleen beyond four years age was much appreciable. There was a remarkable increase in the volume of spleen with increase in age of goats. The rate of increase in volume was high when compared with the rate of increase in weight with age, which implied that the density of the organ decreased beyond 4 years of age. Thickness of spleen at 8 determined points were measured using digital Vernier caliper. The pattern of increase in the thickness with age, at concerned points in the spleen was recorded for all the age groups. All the data were analysed and presented in tables and compared in graphs.

Keywords: Spleen, Gross Anatomy, Morphometry, Goat.

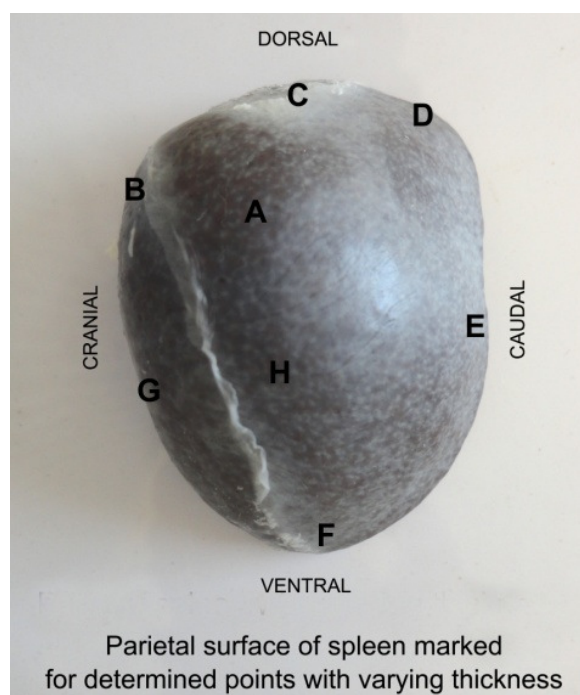
Introduction

The spleen of goat is intermediate (storage and defensive) in type (Sinha *et al.*, 2013). It is the largest lymphoid organ in the body. Different climatic zones certainly have their influence in the immune status of animals to a variety of infections and infestation. This in turn decides the magnitude of normal physiological activity that any lymphatic organ should undergo. Therefore, habitats of different geographical locations show little variation in morphometry of lymphoid organs during postnatal growth. Hence, the present study was designed to observe the chronological change in the morphometry of spleen in the postnatal age groups of the goats in Cauvery delta districts. Measurement of thicknesses at eight determined points on the spleen of apparently healthy goats in the present study is unique of this kind of morphometric studies. A comparative weight and volume measurement indirectly reveals the

density of the organ. The present study would be much useful as normal reference parameter for further research progress in some clinical and pathological investigations.

Materials and Methods

The spleen were collected irrespective of sex, from seven different postnatal age groups of goats viz., 3 to 5 months (Group 1), 8 to 12 months (Group 2), 1 to 2 years (Group 3), 2 to 3 years (Group 4), 3 to 4 years (Group 5), 4 to 5 years (Group 6), 5 years and above (Group 7). Each age group composed of six goats, thereby a total of 42 number of spleen was utilized for the present research work. Spleen were procured immediately after slaughter and washed in normal saline and the peritoneal folds attached to the organ were trimmed using fine scissor. The weight of these organs was determined using digital monopan balance and the volume was measured by, the volume of water replaced when the organ was suspended. The length of the spleen was measured using indistensible cotton thread starting from the dorsal border to the ventral border of the organ and the width was measured starting from the cranial border to the caudal border of the spleen on its parietal surface. Thickness of spleen was measured using digital Vernier caliper at eight determined points viz., A, B, C, D, E, F, G and H as marked in the following photograph. The data were analysed by 't' test (Snedecor and Cochran, 1994)



Results and Discussion

The spleen of goat was rectangular in shape. It showed two surfaces viz., parietal and visceral, four distinct borders viz. cranial, dorsal, caudal and ventral with cranial border being thickest, caudal and ventral borders being thinnest. Similar observations were made by Sinha *et al.* (2013) in goats. In contrast spleen of sheep was approximately triangular and weighed around 100 grams (Sisson and Grossman, 1958). The spleen of goat was bluish red coloured in fresh specimen as observed by Frandson and Spurgeon (1992) in sheep.

In the present study the parietal surface was convex as noted by Sisson and Grossman (1958) in sheep and was in contact with the diaphragm and showed a narrow retroperitoneal area in the cranial one fourth where a phrenico-splenic ligament connects it to the diaphragm. The concave visceral surface was related to the parietal surface of the rumen and showed retroperitoneal area in the cranial half, behind which it was attached by gastro-splenic ligament to the rumen as also noticed by Getty (1975) in the spleen of sheep. The cranial and dorsal borders are nearly straight, but the ventral border in younger subjects was convex upto 2 years of age and the caudal border was undulated in all age groups.

A small circular depression represented the hilus in the visceral surface closer to cranial border near antero-dorsal angle which was in accordance with the observations of Raju *et al.*, (2004) in the spleen of 2 year old adult Indian goat. The ultrasonographic examination of the spleen of adult goats (about 2 years of age) revealed that the greatest length was found at 8th intercostals space which was about 20 cm and the smallest length was found to be behind the last rib which was about 7 cm and this finding was in agreement with the observations made by Braun and Steininger (2010). The results of this research were presented in tables 1 and 2 and were graphically presented in Graphs 1 and 2.

In current research findings, the mean length of the spleen of goat at 3 to 5 months of age was 4.9 ± 0.17 cm, at about 1 year the length increased to 6.5 ± 0.45 cm and at 2 years of age the length was recorded as 08.28 ± 0.71 cm. The mean length gradually raised upto the maximum of 14.45 ± 0.48 in goats aged above 5 years. In contrast, Sinha *et al.* (2013) recorded the mean length of the spleen in adult black Bengal goat as 10.3 ± 0.21 cm at 2 years of age, Usende *et al.* (2014) measured the mean length as 9.2 ± 0.77 cm in Nigerian goats and 36.87 ± 2.71 cm in Nigerian pig, Maina *et al.* (2014) observed 35.5 cm in one humped camel and Emam N.K. (2010) recorded the length as 9.93 ± 0.34 cm in Iraqi awasi sheep.

The present study showed that the mean width of goat spleen was 3.55 ± 0.15 cm at the age of 3 to 5 months, 7.0 ± 0.87 cm at about 2 years of age. There was a gradual increase in width

upto 13.43 ± 0.37 cm in goats aged above 5 years. The observations of Sinha *et al.* (2013) was 7.9 ± 0.15 cm in Black Bengal goat, Emam (2010) in Awasi sheep in Iraq was 6.48 ± 0.23 cm, Usende *et al.* (2014) in Nigerian goats was 5.8 ± 0.73 cm, Nigerian pig was 6.9 ± 0.28 cm and Maina *et al.* (2014) in one humped camel was 8.15 ± 0.49 cm.

The observation in present study revealed that the mean weight of spleen in 3 to 5 month kids was about 12.68 gm, in 2 year age goat it was 37.10 ± 6.38 gm which increased to about 135.83 ± 7.60 gm in goats aged above 5 years. According to Sinha *et al.* (2013), the mean weight of spleen of black Bengal goat at 2 years of age was 47 ± 20 gm, 68 ± 5.43 gm in Nigerian goat and 180 ± 17.32 gm in Nigerian pig (Usende *et al.* 2014), 425 ± 0.05 gm in one humped camel (Maina *et al.*, 2014). In Iraqi sheep Emam (2010) reported that the spleen weight at 1 to 2 year age as 69 ± 6.6 gm. The observations on the weight of adult goat spleen by Bhatia and Sharma (1953) was 35.0 gm, by Ghanekar and Soman (1973) was 53.0 gm and by Ostertag and Wilcox (1907) was 60.0 gm.

The mean volume of spleen at 3 to 5 month old kids was found to be 16.98 ± 0.36 ml, at 8 to 12 month age it was 29.16 ± 4.07 ml, the volume gradually increased to a maximum of 75.83 ± 1.60 ml in the goats aged above 5 years. In the present research, thickness of spleen of goat that completed 2 years of age was observed to be 14.8 ± 0.32 mm at the hilus, 3.7 ± 0.15 mm at the cranial border, ventral and caudal borders were of similar thickness i.e., 1 ± 0.09 mm. Raju *et al.* (2004) recorded the thickness of spleen of 2 year old goat at the hilus as 14.28 ± 0.2 mm, at cranial border as 10.17 ± 0.14 mm, at ventral border as 5.0 ± 0.23 mm and at caudal border as 5.63 ± 0.18 mm.

The rate of increase in length and width with advancement of age was nearly parallel but the rate of increase in weight and volume with age showed higher trend. The graphical presentation of the morphometrical data inferred that there was a gradual decrease in the density of spleen with age because the rate of increase in volume with age was greater than the rate of increase in weight with age. The current observations on morphometrical parameters analysed in this research work may be useful as reference data for further studies on abnormalities in the spleen of goat due to any clinical or pathological conditions.

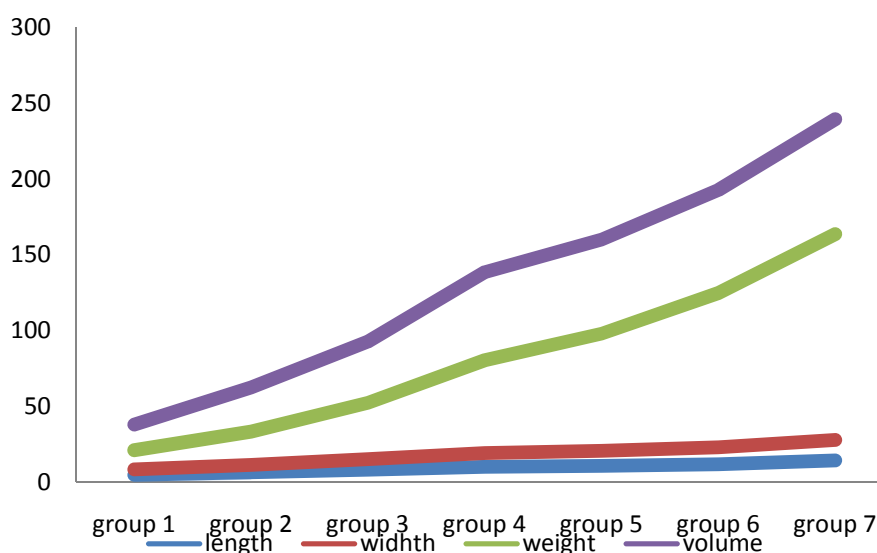
TABLE 1. MORPHOMETRICAL PARAMETERS OF SPLEEN

Mean	3-5 months	8-12 months	1-2 year	2-3year	3-4year	4-5year	5 & above
Length (cm)	04.90 ± 0.17	06.50 ± 0.45	08.28 ± 0.71	10.15 ± 0.30	10.81 ± 0.24	11.95 ± 0.58	14.45 ± 0.48
Width (cm)	03.55 ± 0.15	04.90 ± 0.56	07.00 ± 0.87	09.13 ± 0.48	09.93 ± 0.23	11.16 ± 0.49	13.43 ± 0.37
Weight (gm)	12.68 ± 4.10	22.01 ± 4.08	37.10 ± 6.38	61.16 ± 7.62	77.33 ± 4.67	101.66 ± 11.30	135.83 ± 7.60
Volume (ml)	16.98 ± 0.36	29.16 ± 4.07	40.50 ± 5.68	58.16 ± 1.94	62.16 ± 2.85	68.66 ± 1.50	75.83 ± 1.60

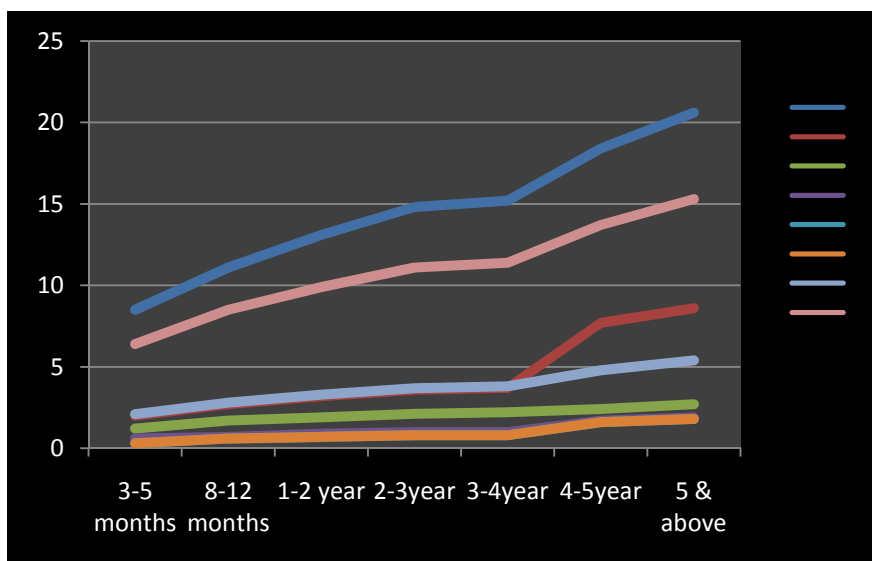
TABLE 2. THICKNESS OF SPLEEN AT 8 DETERMINED POINTS (in mm)

	3-5 months	8-12 months	1-2 year	2-3year	3-4year	4-5year	5 & above
A	8.5 ± 0.31	11.1 ± 0.23	13.1 ± 0.34	14.8 ± 0.32	15.2 ± 0.30	18.4 ± 0.28	20.6 ± 0.25
B	2.0 ± 0.15	2.7 ± 0.13	3.2 ± 0.11	3.6 ± 0.14	3.7 ± 0.10	7.7 ± 0.12	8.6 ± 0.16
C	1.2 ± 0.13	1.7 ± 0.15	1.9 ± 0.16	2.1 ± 0.14	2.2 ± 0.15	2.4 ± 0.12	2.7 ± 0.13
D	0.6 ± 0.03	0.7 ± 0.02	0.9 ± 0.06	1 ± 0.09	1 ± 0.05	1.7 ± 0.06	1.9 ± 0.04
E	0.3 ± 0.02	0.6 ± 0.01	0.7 ± 0.04	0.8 ± 0.06	0.8 ± 0.02	1.6 ± 0.05	1.8 ± 0.03
F	0.3 ± 0.02	0.6 ± 0.01	0.7 ± 0.04	0.8 ± 0.06	0.8 ± 0.02	1.6 ± 0.05	1.8 ± 0.03
G	2.1 ± 0.18	2.8 ± 0.15	3.3 ± 0.16	3.7 ± 0.15	3.8 ± 0.18	4.8 ± 0.14	5.4 ± 0.16
H	6.4 ± 0.25	8.5 ± 0.31	9.9 ± 0.34	11.1 ± 0.36	11.4 ± 0.38	13.7 ± 0.21	15.3 ± 0.28

GRAPH 1



GRAPH 2



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