



Gross anatomical studies on the pancreas of gurez sheep (*Ovis aries*) in different postnatal stages of life

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ABSTRACT

Gurez sheep is the largest native sheep breed of Kashmir and is also the 4th registered breed of ovine germplasm in India. Livestock, especially the small ruminants are the main economic contributor from the primary sector in the Gurez valley. Keeping in view the fact that no anatomical study has been conducted on the pancreas of Gurez sheep, the present study was undertaken. A total of 30 samples, that included 10 samples from each age group were collected from slaughter houses of the Gurez valley. Pancreas of Gurez sheep was a compact, soft, encapsulated gland located mostly to the right of median plane. It consisted of three irregularly quadrilateral lobes; right (duodenal) lobe, body or connecting lobe and a left (splenic) lobe, of which the right lobe was the largest in all the age groups. The gland was covered largely by the peritoneum and was suspended by the mesentery. The average weight of the gland increased with the advance in age and was 52.40 g, 41.68 g, 22.35 g in adult, young and neonatal Gurez sheep, respectively. Several pancreaticoduodenal lymph nodes were present on ventral surface of the body. The pancreatic duct in Gurez sheep joined the bile duct in the right/ duodenal lobe of pancreas.

Key words: *Gurez sheep, pancreas, gross anatomy, lobes*

Gurez sheep is the largest native registered sheep breed of Kashmir. It is well adapted to the local agro-climatic and geo-physical conditions of the Gurez valley and is reared by the Dard-Shina tribe (Rather *et al.*, 2021). The breed is known for sturdiness, adaptability, disease resistance and mutton production (Ganai *et al.*, 2010). Pancreas is a major accessory organ which has an important role in digestion. It is a unique gland as it consists of both exocrine and endocrine portions. The exocrine portion of pancreas secretes digestive enzymes into the duodenum while the endocrine portion of pancreas or the islets of Langerhans are discrete micro endocrine organs that synthesize insulin, glucagon, somatostatin and pancreatic polypeptide (Kenneth and Andrew, 2016). In light of the important functions of pancreas as well as the clinical importance of pancreas-specific diseases such as diabetes, pancreatic cancer and pancreatitis, it has been a subject to intense research activity. No anatomical study has been conducted on the pancreas of Gurez sheep. Keeping in view the unique genetic potential of this animal, its economic contribution to the livelihood of small and marginal farmers in the Gurez valley and the fact that no literature is available on the pancreas of this animal, the present study was undertaken.

MATERIALS AND METHODS

The present study was conducted in the Division of Veterinary Anatomy and Histology, F.V.Sc and A.H, SKUAST-K, Shuhama. The pancreas of apparently healthy sheep were collected from slaughter houses in Gurez valley from three age groups as described in the Table 1. Gross examination and biometrical observations were made immediately after slaughtering the animals. The gland was separated from surrounding organs by careful blunt dissection and washed with normal saline. The length and breadth of each pancreatic lobe was recorded

with the help of non-stretchable thread, metric scale and vernier calipers. The weight of the pancreas was measured with the help of electronic weighing balance machine. Statistical analysis was done using one way analysis of variance followed by Duncan's Multiple Range test (Duncan, 1977). A probability of $P < 0.05$ was considered statistically significant.

RESULTS AND DISCUSSION

In all the age groups of Gurez sheep, pancreas was a compact lobulated gland located to the right of median plane. The colour of the gland was light pink. Nickel *et al.* (1973) have reported that the colour of the pancreas was pinkish yellow or yellowish brown in bovines and pinkish yellow, grey, light or dark yellow red or reddish cream in equines. Sisson (1975) reported that the pancreas of ox was irregularly quadrilateral in form and lies almost entirely to the right of the median plane. In the present study, the lobulation of pancreas was distinct and it consisted of three irregularly quadrilateral lobes: right (duodenal) lobe, body or connecting lobe and a left (splenic) lobe (Fig 1). The same has been observed by Habel (1975) in ruminants. Rung-rangkijkrai and Klomkleaw (2014) observed a unique F-shape in swamp buffaloes and also reported the presence of an uncinate process in addition to right lobe, left lobe and body of pancreas. Massad (2002) reported that the pancreas of camel lied entirely to the right of the median plane and consisted of a quadrilateral body, long tongue shaped left lobe and a wide quadrate lobe. The pancreas of Gurez sheep was covered to a large extent by peritoneum and suspended by mesentery (Fig 3). It was attached to liver at the portal fissure and to the crura of the diaphragm, between which it was free forming the ventral wall of epiploic foramen.

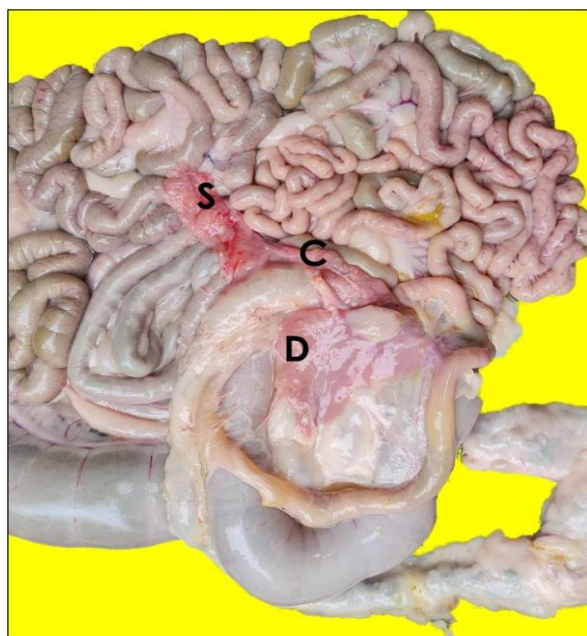


Fig 1: Pancreas of adult Gurez sheep showing duodenal (D), connecting (C) and splenic (S) lobes.

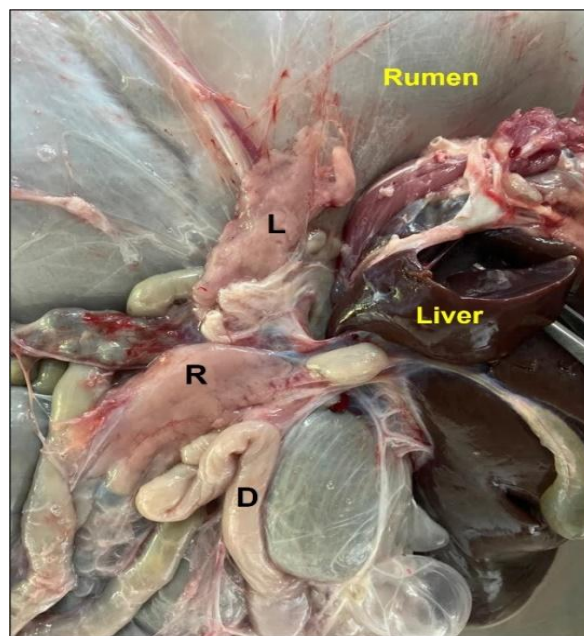


Fig 2: Pancreas of Gurez sheep (young) showing left (L) and right (R) lobes in relation to liver, duodenum (D) and rumen.

The right or the duodenal lobe was the largest among the three lobes located on the right side of the abdominal cavity. It was bound by the short S-shaped curve of duodenum, between the descending and ascending limbs of the duodenum, related dorsally to the right kidney. It was attached cranially to the liver and caudally to right flank at the lumbocostal angle. These findings are in line with the observations of Habel (1975) who noticed a longer right lobe and a shorter left lobe in the pancreas of ruminants which was almost totally positioned in the mesoduodenum.

Body of pancreas was long and connected the right and left lobes without any distinct demarcation. The body was enforced towards the stomach, bounded by the pylorus, duodenum and descending colon. Dorsally the body was adherent to the liver. A small part extended from the body to the last part of the ascending duodenum. The ventral surface of this lobe was in contact with the dorsal curvature of the rumen and intestine and presented a deep notch for the portal vein and hepatic artery. Several pancreatico-duodenal lymph nodes were present here. Sisson (1975) suggested that the body of the pancreas in ruminants was located at the confluence of the right and left lobes and was attached dorsally to the liver and duodenum.

The left lobe was the smallest of the three lobes located at the left side of the abdominal cavity bounded by the spleen and dorsal sac of rumen (Fig 2). It was related to the left kidney (Fig 4) and the descending colon and extended as a thin, flattened ribbon over the parietal surface of the stomach and then between the two extremities of the spleen, running along the gastric surface of spleen. Dorsal surface of the left lobe was related to celiac, hepatic and cranial mesenteric arteries. Al-Saffar and Al-Zuhairy (2017) revealed that in cats, the body of the pancreas was very small nearly square-shaped part situated beside the first duodenal flexure where it formed a notch traversed by the portal vein while the right lobe extended downward from the body adjacent to the mesenteric border of the descending duodenum and shortly continues with the ascending duodenum. The left lobe of pancreas extended from the body to the left side of abdominal cavity till the spleen and left kidney.



Fig 3: Pancreas suspended by mesentery (in situ)- arrow.

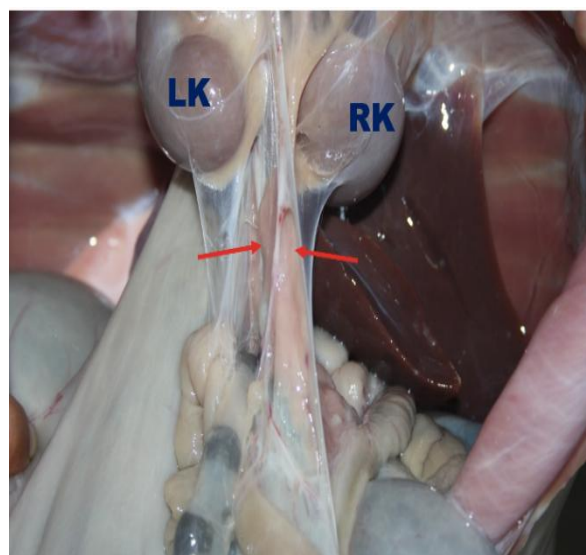


Fig 4: Left and right pancreatic lobes in relation to kidneys (LK and RK). Pancreas (young).

The pancreas of Gurez sheep received the branches from cranial mesenteric and celiac artery directly and from each of the three divisions of celiac, the left gastric, the hepatic and the splenic arteries. The pancreaticoduodenal lymph nodes were situated on the right and ventral surface of the pancreas in relation to the duodenum. The nerve fibres to the pancreas arose from the coeliac plexus and the dorsal vagal trunk. Sultan (1999) observed that the pancreas of the camel received its blood supply from the hepatic and the splenic arteries, branches of the celiac artery.

Dissection of pancreas revealed that the gland contained only the ventral pancreatic duct that traversed along the cranial border of the duodenal lobe before emerging from the right lobe in Gurez sheep. It consequently joined the common bile duct before it reached the duodenum where it opened in folds of duodenum after coursing in its wall for a short distance. This was demarcated by moderately thick wall compared to duodenal wall. This finding was in line with the observations of Nickel *et al.* (1973) who reported the presence of only the ventral (pancreatic) duct in sheep and goats that merged with the common bile duct before reaching the duodenum. The presence of a single pancreatic duct has also been documented by Grace *et al.* (1988) in sheep, goats and deer and Iniyah *et al.* (2019) in pigs.

Table1: Grouping of animals on the basis of age

S. No.	Group	Age	No. of specimens
1	Neonatal	0-3 months	10
2	Young	3-11 months	10
3	Adult	1 year and above	10

The average weight of the pancreas increased with the advance in age. Habel (1975) reported that the average weight of pancreas in sheep and goats was about 60 g, whereas in the ox it was about 425 g. The average length and breadth of the three lobes and the total weight of the gland is described in Table 2.

Table 2: Biometrical parameters of pancreas in different age groups of Gurez sheep

Groups	Right lobe (cm) (Mean $\pm$ S.E)		Body (cm) (Mean $\pm$ S.E)		Left lobe (cm) (Mean $\pm$ S.E)		Total weight (gm) (Mean $\pm$ S.E)
	Length	Breadth	Length	Breadth	Length	Breadth	
Adult	13.01 ^a $\pm$ 3.29 (6.24-19.77)	5.91 ^a $\pm$ 0.14 (5.62-6.20)	6.12 ^a $\pm$ 0.27 (5.56-6.69)	3.41 ^a $\pm$ 0.12 (3.14-3.68)	7.30 ^a $\pm$ 0.21 (6.86-7.73)	3.93 ^a $\pm$ 0.12 (3.66-4.19)	52.40 ^a $\pm$ 0.74 (50.86-53.94)
Young	6.91 ^b $\pm$ 0.34 (6.21-7.61)	3.38 ^b $\pm$ 0.13 (3.11-3.66)	4.70 ^b $\pm$ 0.13 (4.43-4.97)	3.16 ^a $\pm$ 0.13 (2.91-3.42)	3.98 ^b $\pm$ 0.13 (3.69-4.26)	3.78 ^a $\pm$ 0.27 (3.22-4.34)	41.68 ^b $\pm$ 1.62 (38.34-45.01)
Neonatal	4.61 ^b $\pm$ 0.14 (4.32-4.91)	2.47 ^b $\pm$ 0.17 (2.33-2.60)	4.06 ^c $\pm$ 0.23 (3.57-4.55)	2.75 ^b $\pm$ 0.08 (2.57-2.93)	3.95 ^b $\pm$ 0.30 (3.32-4.58)	2.60 ^b $\pm$ 0.13 (2.31-2.88)	22.35 ^c $\pm$ 1.09 (20.09-24.60)

Values having same superscripts did not vary significantly ($P < 0.05$)

CONCLUSION

The pancreas of Gurez sheep was a compact lobulated gland, light pink in colour and located almost entirely to the right of the median plane. The average weight of the gland increased with the advance in age. The gland consisted of three irregularly quadrilateral lobes of which the right or the duodenal lobe was largest in all the age groups. Several pancreatico-duodenal lymph nodes were present on ventral surface of the body. The pancreatic duct in Gurez sheep joined the bile duct in the right /duodenal lobe of pancreas. The blood supply to the pancreas of sheep was chiefly from the cranial mesenteric and celiac arteries and the nerve supply from the coeliac plexus.

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