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MORPHOLOGICAL AND TOPOGRAPHICAL STUDIES IN THE PANCREAS OF THE DROMEDARY CAMEL (*Camelus dromedarius*)

Khalid M. Al Khodair[1] and Abdelrahman M.A. Elseory[*1,2]

[1]Department of Anatomy, College of Veterinary Medicine, King Faisal University, Al-Ahsa, Saudi Arabia

[2]Department of Anatomy, Faculty of Veterinary Medicine, University of Khartoum. PO Box: 32, Postal code: 13314 Shambat, Khartoum North, Sudan

ABSTRACT

A morphological study examined the overall characteristics of the dromedary camel's pancreas. The topographical, weighing and measuring investigation samples were from 15 camels (*Camelus dromedarius*) of both sexes and ages (4–15 years). The results showed that the camel pancreas was grayish pink in colour, weighing about 150 – 600 gm and had no definite shape. It was composed of a quadrilateral body, a long tongue-shaped left lobe, a short right lobe and a small accessory lobe. It was situated at the level from the first up to the fifth or sixth lumbar vertebrae. It has only one pancreatic duct, which is entirely embedded in the substance of the gland. The arterial blood supply of the camel pancreas was via the celiac trunk and the cranial mesenteric artery. In conclusion, the dromedary camel's pancreas resembled other domestic animals in terms of shape and topography. However, it was distinguished by the existence of a small accessory lobe.

Key words: Dromedary camel, morphology, pancreas, topography

The pancreas has a pivotal role in the digestive physiology of ruminants , specially in the digestion of ruminal fermentation products (including microbial cells) and ingested nutrients that escape fermentation in the rumen. As a digestive gland, the pancreas is composed of the endocrine part secreting hormones such as insulin and glucagon (Jenstad and Chaudhry, 2013) and the exocrine part secreting digestive enzymes such as amylase, protease and lipase, which play an important role in the growth, development, reproduction and production processes of animals (Long *et al,* 2021).

The pancreas in healthy camels has been studied grossly (Mostafa *et al,* 1983), histochemically (Qayyum *et al,* 1987) and ultrasonographically (Lakhel *et al,* 2025). In view of possible pathologies involving pancreas of camels, it is imperative to carry out an elaborate study on the gross anatomy of pancreas in camels. The present study was therefore aimed to study the morphology and topography of pancreas in camels.

Materials and Methods

Pancreatic samples were taken from 15 healthy dromedary camels (*Camelus dromedarius*) of both sexes (2- 12 years of age) from the Camel Research Centre at King Faisal University's College of Veterinary Medicine and Al Omran abattoir, Al-Ahsa.

For the gross anatomical study, measurements of the pancreas were taken from 13 fresh glands. The lengths of lobes were measured using a standard measuring tape. The electronic balance was used to weigh the samples. The means of the lengths of lobes and weights of the pancreas were calculated.

The topography and the arterial blood supply of the camel pancreas was studied in two animals. These were perfused with 10% formalin and dissected as described by Mohamed *et al* (2017).

The sample collection was followed in accordance to the guidelines of King Faisal University's ethical committee.

Results

It the gross anatomical study the camel's fresh pancreas was found grayish pink and weighed about 150 to 600 gm. It was covered with a significant amount of fat. The gland showed no definite shape and was composed of a quadrilateral body, long tongue-shaped left lobe, short right lobe and small accessory lobe (Fig 1A). The length of the body was 6-10 cm, the left lobe 22-38 cm, the right lobe 9-17

SEND REPRINT REQUEST TO ABDELRAHMAN M.A. ELSEORY email: amamohamed@kfu.edu.sa

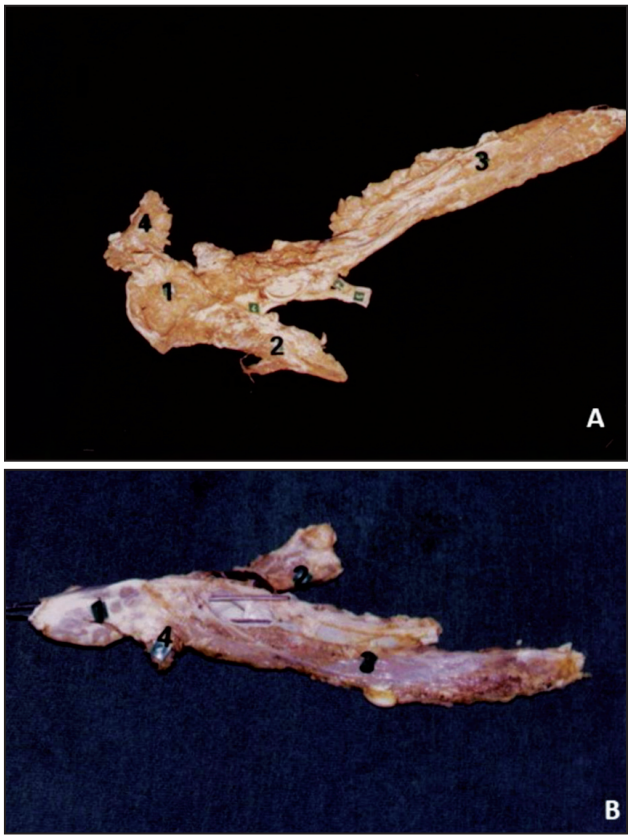

Fig 1. A. Photograph of the pancreas of the camel showing the different lobes: the body of the pancreas (1), the right lobe (2), the left lobe (3) and the accessory lobe (4).
B. Photograph of the pancreas of the camel showing the portal vein passing through the portal ring (the forceps). The body of the pancreas (1), the right lobe (2), the left lobe (3) and the accessory lobe (4) are shown.

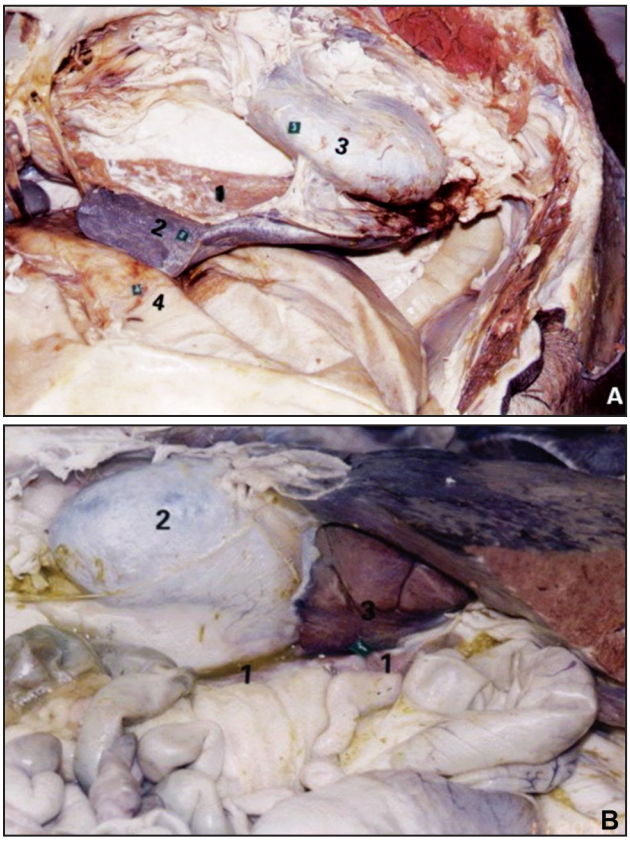

Fig 2. A. Photograph of the left view of the abdominal cavity of the camel showing the relationship of the left lobe of the pancreas (1) with the spleen (2), the left kidney (3) and the caudodorsal sac of the rumen (4).
B. Photograph of the right view of the abdominal cavity of the camel showing the relationship of the right lobe of the pancreas (1) with the right kidney (2) and the caudate lobe of the liver (3).

cm and the accessory lobe 3-7cm. The accessory lobe formed a small part that crossed dorsally over the portal vein from the right lobe to the left lobe and extended slightly lateral. It formed a ring through which the portal vein passes (Fig 1B).

The pancreas was extended from the level of the first to the fifth or sixth lumbar vertebrae. The body was related dorsally to the portal vein, the left crus of the diaphragm and the visceral surface of the liver and ventrally, it was related to the descending duodenum and the transverse colon. Cranially, it was associated with the ampulla of the duodenum. The left lobe was related cranially and ventrally to the caudodorsal sac of the rumen, while caudally and laterally, it was related to the spleen, left kidney and left adrenal. It was related dorsally to the ventral surface of the left kidney, spleen and descending colon (Fig. 2A). The right lobe of the pancreas was related dorsally to the right kidney, visceral surface of the caudate lobe of the liver, portal vein and cranial mesenteric artery (Fig 2B). Caudally, it was related to the second duodenal flexure, the transverse and descending colon.

There was only one pancreatic duct, which was entirely embedded in the gland's substance. The pancreatic duct joined the bile duct in the gland's substance to form the hepatopancreatic duct, which opened into the cranial duodenal flexure.

The pancreas's arterial blood supply emerged from the hepatic and splenic arteries of the celiac trunk and two branches of the cranial mesenteric artery.

Discussion

The present investigation revealed the morphological features of the pancreas of the adult camel of both sexes. The fresh pancreas of the camel was grayish-pink in colour. Similar findings were reported in this animal by Mostafa *et al* (1983), Sultan (1999) and Massad (2002). However, in domestic animals, it was reddish cream in horses (Bradley,

1946), pinkish yellow in sheep and ox (May, 1970; Dyce and Wensing, 1971; Terzić-Avdagić *et al,* 2023) and pinkish white or grayish-red in men (Williams, 1973; Terzić-Avdagić *et al,* 2023) and grayish pink to pale brown in donkey (Dhoolappa *et al,* 2004).

The weight of the camel pancreas ranged between 150 and 600 gm, which conforms with previous observations of the camel pancreas by Hegazi (1945) and Smuts and Bezuidenhout (1987). However, it showed slight variation in the ox and horse, in which the pancreas weighed about 350-500 gm (Habel, 1975) and 350 gm (Bradley, 1946). Meanwhile, in humans, it was 41 - 174 grams (Caglar *et al,* 2014).

In this study, the gland showed no definite shape and was composed of a quadrilateral body, long tongue-shape left lobe, short right lobe and small accessory lobe. Overall, our results aligned with earlier studies on the camel pancreas, while our results differed in the presence of the accessory lobe (Sultan, 1999; Taha and Magied, 1998). In contrast, the shape of the pancreas in the other animals and men showed some differences. The pancreas was triangular in shape in man (Cunningham and Romanes, 1977; Terzić-Avdagić *et al,* 2023), irregular triangle shape in the horse and donkey (Bradley, 1946; Dhoolappa *et al,* 2004), irregular quadrilateral shape in the ox and sheep (May, 1970; Frandson, 1986; Rafiq *et al,* 2024) and v-shaped in dog (Getty, 1975; Mostafa and Mohammed, 2022).

According to this study, the camel pancreas was located in the abdominal cavity between the first and fifth or sixth lumbar vertebrae. Mostafa *et al* (1983), Sultan (1999), Taha and Magied (1998) and Massad (2002) reported similar findings. However, the pancreas was situated ventral to the upper part of the last rib and the first lumber transverse process in sheep (May, 1970; Rafiq *et al,* 2024), ventral to the sixteenth, seventeenth and eighteenth thoracic vertebrae in the horse and donkey (Bradley, 1946; Dhoolappa *et al,* 2004) and ventral to the first, second and third transverse processes of the lumbar vertebrae in ox (Frandson, 1986).

The findings of present study showed only one pancreatic duct, which was entirely embedded in the gland's substance. This duct joined the bile duct to form the hepatopancreatic duct. There have been prior reports of equivalent results in the camel pancreas (Mostafa *et al,* 1983; Sultan, 1999; Taha and Abdel Magied, 1998). In mammals, the pancreas is generally drained by two ducts, the greater and the accessory pancreatic duct. Nonetheless, the terminal portion of one of these ducts regresses in certain animals. Cows, Swamp buffaloes and pigs only have the accessory duct (Wass, 1965; Rung-ruangkijkrai and Klomkleaw, 2014), while small ruminants only have the larger duct (Dyce *et al,* 1987; Rafiq *et al,* 2024). Two ducts were found in humans, dogs, cats, donkeys, horses and monkeys (Millis, 1949; Nielson and Bishop, 1954; McMinn and Kugler, 1961; Neto, 1977; Dhoolappa *et al,* 2004).

This study has demonstrated that the hepatic and splenic arteries of the celiac trunk and two branches of the cranial mesenteric artery are the source of the camel's pancreatic arterial blood supply. These results support previous studies on camels by Sultan (1999) and Mostafa *et al* (1983) and other species by Bertelli *et al* (1997) and Carioto (2016).

Conclusion

In conclusion, the macroscopic findings of the camel pancreas were grayish pink, weighing about 150 – 600 gm and had no definite shape. It comprised a quadrilateral body, a long tongue-shaped left lobe, a short right lobe and a distinctive small accessory lobe. It was situated at the level from the first up to the fifth or sixth lumbar vertebrae and has only one pancreatic duct, which is entirely embedded in the substance of the gland. The arterial blood supply of the camel pancreas was via the celiac trunk and the cranial mesenteric artery.

Conflict of interest

None declared

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