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Histological studies on the liver of Marwari Goat (*Capra hircus*)

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Abstract
The histological studies were conducted on the liver of 15 Marwari goats. Histologically, the whole liver was invested by peritoneum, except where it was reflected as ligaments and where it adheres to the diaphragm. Underlying it, the liver covered by connective tissue covering called as glisson's capsule. It was composed of collagenous and reticular fibers and few smooth muscles. The reticular fibers formed the stroma. The hepatic lobules were made up of central vein, portal area and one cell thick cords, which were not delineated by connective tissue. The sinusoidals were narrow and somewhat cylindrical. These were lined by continuous endothelial cells resting on basal lamina. Kupffer cells were present attached to the endothelial cells. There were numerous mucous glands present in the mucosa of hepatic, cystic and common bile ducts. The centrilobular and the periportal hepatocyte were rich in the glycogen content.

Keywords: Histology, Marwari goat and Liver

Introduction
Marwari goat (*Capra hircus*) is a domestic animal distributed in the Marwar region of Rajasthan, comprising of Pali, Jodhpur, Jalore, Barmer, Bikaner, Nagaur, and Jaisalmer districts. The goat (*Capra hircus*), is one of the most important animal and the goat husbandry has been playing an important role in the economy of our country with special reference to milk, meat, manure and hide production. The Present study has been planned to justify the functional importance and essentially of the liver, the largest single organ. The resemblance of the structure of liver throughout the animal kingdom, from fishes up to higher vertebrates, encourages the interest to get factual structural details of that colossal gland. Important functions performed by the liver are secretion of bile, excretion of waste product, storage of glycogen and vitamins (Vit. A, D and B), synthesis of fibrinogen, prothrombin, albumin, globulin etc., phagocytosis of foreign particles, detoxification, intermediate metabolism of carbohydrates, proteins and fats and haemopoiesis in embryo. Liver plays an important role in digestion process of these nutrient matter and energy production. An understanding of the structure of liver is vital to the interpretation of these processes.

Materials and Methods
The present study was conducted on 15 apparently healthy adult Marwari Goat (*Capra hircus*) of either sex. The liver from the freshly slaughtered animals were procured from Municipal slaughter house, Bikaner. For the histological examination the small pieces of tissues (2mm size) were collected from 15 livers. From each liver, the tissues were collected from thirteen fixed anatomical regions to explore regional differences if any. The tissues were preserved in 10% formal saline for 48 hrs. Fixed tissue were later washed in running tap water for 6-10 hours followed by dehydration in ascending grade of alcohol, clearing, embedding in paraffin wax of melting point of 58-60 °C, preparation of blocks, section cutting (5-6 µm thick), and mounting of section on albuminized slides, drying of sections and finally stained with the following routine and special histological stains to demonstrate different components of liver.

Results and Discussion
The capsule and stroma
In present histological study the liver of Marwari goat was covered by outer peritoneal and the inner connective tissue covering. Similar findings were reported by (Leeson and Lesson, 1981) [6] and (Dellmann and Brown, 1981) [4] in domestic animals, (Pareek, 2000) [10] in sheep and

(Adibmoradi 2007) [1] in horse. The whole liver was covered by peritoneal covering except a bare area where it was directly related with the diaphragm. The covering was made by a continuous sheet of simple squamus mesothelial cels. Similar findings were also reported by (Leeson and Lesson, 1981) [6] and (Dellmann and Brown 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep. The connective tissue covering underlying the peritoneal covering, called as Glisson's capsule, which concurred with the finding of (Dellmann and Brown 1981) [4] and (Leeson and Lesson, 1981) [6] in domestic animals. The capsule composed of collagen and reticular fibers and a few smooth muscle cells, as also reported by (Dellmann and Brown 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

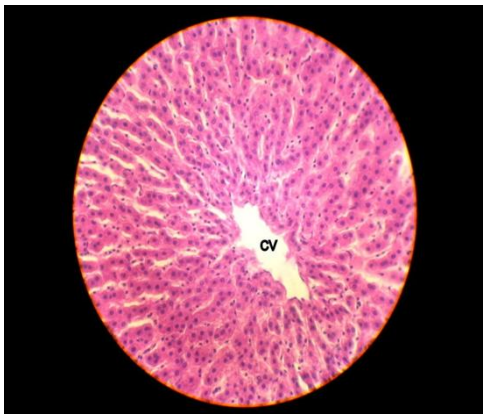
The connective tissue fibers extended into the gland mass and formed the stroma of the liver. Predominantly the reticular fibers formed the delicate framework around the hepatocytes and the vessel group in the interlobular spaces. The collagenous fibers were also arranged around each hepatocyte. Similar observations were also made by (Copenhaver *et al*. 1967) [3] in pig and camel, (Dellmann and Brown 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

A hepatic lobule was made up of a central vein, peripheral portal area and hepatic cell cords radiated from centre to the periphery (Photomicrograph 2). (Copenhaver *et al*., 1967) [3] mentioned in pig and camel that the portal lobule was the anatomical unit of liver with a single interlobular bile duct. However, (Dellmann and Brown 1981) [4] reported the hepatic lobule in domestic animals in three different ways as hepatic lobule, portal lolube and liver acinus which consisted of the central vein at each end of the acinus and a portal area on one side. In goat the classical hexagonal shape of lobule with portal areas at three angles appeared occasionally. Similar findings were also reported by (Dellmann and Brown 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

A portal area consisted of inter lobular portal vein, hepatic artery, bile ductule and lymphatics in present study (Photomicrograph 1, 3 & 4). It was supported by loose areolar connective tissue. Reticular fibers and collagenous fibers encircled the portal veins and the hepatic arterioles (Photomicrograph 3 & 4). This was also observed by (Copenhaver *et al*., 1967) [3] in pig and camel, (Dellmann and Brown 1981) [4] in domestic animals, (Hodges, 1974) [5] in fowl, (Pareek, 2000) [10] in sheep, (Mahata *et al.*, 2003) [7] in spotted deer and (Miss *et al*., 2003) [9] in mammals.

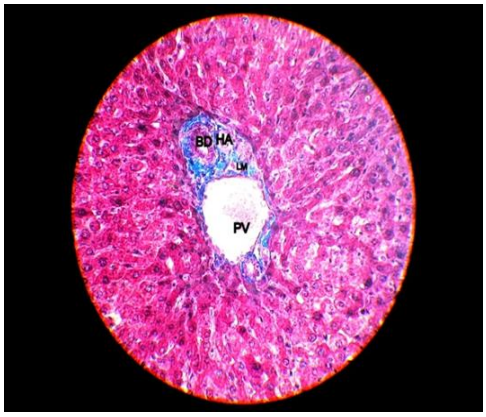
H&E stain X10

Photomicrograph 1: Histology of liver showing bile ductile (BD), hepatic artery (HA) and hepatic cells (HC).



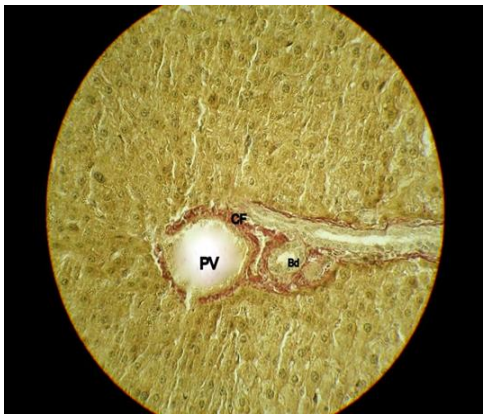
H&E stain X10

Photomicrograph 2: Histology of liver showing central vein (CV), sinusoids (S) and hepatic cell cords (H).



Masson's Trichrome stain X10

Photomicrograph 3: Histology of liver showing collagen fibers around portal vein (PV), bile ductile (BD), hepatic artery (HA) and lymphatics (LM)



Van Gieson stainX10

Photomicrograph 4: Histology of liver showing central vein(C) and reticular fibers (R) around hepatic cells (H) and hepatic sinusoids (S).

Parenchyma of Liver

In the liver of goat, cells appeared polygonal, having centrally placed large size nucleus with one or more nucleoli. This was similar to the findings of (Copenhaver *et al*., 1967) [3]) in pig and camel and Adibmoradi (2007) in horse whereas some hepatocytes were binucleated which was in accordance to findings of (Pareek, 2000) [10] in sheep, (Bevelander and Louis, 1961) [2] and (Copenhaver *et al*., 1967) [3] in pig and

camel (Dellmann and Brown, 1981) [4] in domestic animal.

The hepatocytes arranged in one cell thick rows that radiated from the central vein to the periphery of the lobule (Photomicrograph 2). (Pareek, 2000) [10] in sheep and (Dellmann and Brown, 1981) [4] in domestic animals also described one cell thick hepatic cell cords. (Leeson and Lesson, 1981) [6] reported one to two cell thick cell cords in domestic animals.

The sinusoids were spaces between hepatocyte cords which communicated with central veins (Photomicrograph 2). The central vein eventually drained into the hepatic venules. Similar type of observation was made by (Copenhaver *et al*., 1967) [3] and (Dellmann and Brown, 1981) [4] in domestic animals and (Mahata *et al.*, 2003) [7] in spotted deer. However (Leeson and Lesson, 1981) [6] mentioned in mammals that the central vein was a tributary of the posterior venaceva. A perisinusoidal space had also been observed between sinusoidal wall and endothelial lining. Similar type of observation was also made by (Dellmann and Brown, 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

There were discrete phagocytic cells present in liver called Kupffer's cells. They were oval or hexagonal cells with a distinct centrally placed nucleus attached to the inner wall of the sinusoids. These cells were also observed by (Copenhaver *et al*., 1967) [3] in pig and camel, (Dellmann and Brown 1981) [4] in domestic animals, (Pareek, 2000) [10] in sheep and (Mahata *et al.*, 2003) [7] in spotted deer.

Portal vein conveyed the functional blood to the liver. It was divided into interlobular branches which eventually drained into the capillaries which finally drained into the sinusoids. (Copenhaver *et al*., 1967) [3] and (Dellmann and Brown, 1981) [4] in domestic animals and (Ursic *et al.*, 2007) [11] in dog agreed with the above findings. The hepatic arterioles were the interlobular branches of hepatic artery, which either joined the capillaries within the portal area or directly entered into the sinusoids. Similar findings were also reported by (Copenhaver *et al*., 1967) [3] and (Dellmann and Brown, 1981) [4]. Lymphatics were found in the portal areas associated with portal vein and hepatic artery. Similar observation was made by (Copenhaver *et al*., 1967) [3] and (Dellmann and Brown, 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

The bile canaliculi appeared as expanded intercellular spaces between apposing hepatocytes. The bile canaliculi were spaced between adjacent liver cells. This finding was in concurrence with findings of (Leeson and Lesson, 1981) [6] in pig and (Dellmann and Brown, 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep.

In the present study the hepatic duct and cytic duct had simple columnar epithelium with occasional goblet cells. These findings simulated the finding of (Dellmann and Brown, 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep. (Mariappa, 1981) [8] stated that numerous goblet cells and tubular glands were found in the wall of ductus choledochus in adult calf which was in consonance with the present findings.

In present study the gall bladder was lined by tall columnar ciliated epithelium with occasional goblet cells. The lamina propria was composed of loosely arranged connective tissue fibers (Dellmann and Brown, 1981) [4] in domestic animals and (Pareek, 2000) [10] in sheep mentioned similar findings.The glycogen exhibited an irregular distribution within the cytoplasm of the hepatic cells. The hepatocytes of the peripheral, periportal and centrilobular regions were richer in glycogen content. This was in agreement with (Pareek, 2000) [10] in sheep. (Adibmoradi 2007) [1] also reported presence of extreme particles of glycogen in hepatic cells of the horse.

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