

# Histological Studies on the Liver of Barbari Goat (*Capra hircus*)

Mayur Sudhirrao Nimgaonkar, Krishna Nand Singh\*, Mukesh Kumar, Surya Pratap Gond

## ABSTRACT

The present study was conducted on the liver of 6 healthy adult Barbari goats of either sex between the age of 1.5 to 3 years. All the samples were collected from local slaughter units of Ayodhya district, Uttar Pradesh. The liver of Barbari goat was covered with the connective tissue capsule called Glisson's capsule. Capsule was mainly made up of collagen fibers, while reticular fibers were mainly present in stroma of the organ. One cell thick hepatocyte chords framework was found between the peripheral portal veins and central vein which formed the hepatic lobule. Portal triad was formed by hepatic artery, portal vein and bile duct situated at the periphery of lobule. Between the hepatic chords hepatic sinusoids were found. Along with hepatocytes Kupffer cells were also present, which were the non-parenchymal cells having a large nucleus and pink cytoplasm. Few bundles of collagen fibers were found in the hepatic lobules & discontinuous endothelium of sinusoids was found.

**Key words:** Barbari Goat, Histology, Liver

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## INTRODUCTION

All around the world, goats are utilized for their milk, meat, fur, and skin. Because they are raised by small or marginal farmers and utilized for milk production, goats are often referred to as "poor man's cow." A short-haired domestic goat breed known as the Barbari or Bari finds its natural habitat in several Indian and Pakistani states. Goats of this breed are utilized for both milk and meat production. Its name is derived from the Somalian coastal city of Berbera, which is situated on the Indian Ocean (Umaraw *et al.*, 2017). The world population of this breed is about 2.4 million (Kumar, 2018). It is a small-headed variety of goats with tiny, upward-pointing ears and horns. The hair coat is short and primarily covered in white dots with a reddish brown background. It is employed in intensive farming and is a seasonal breeder. In a lactation period of roughly 150 days, it produces about 107 liters of milk. The goal of the current study is to understand the significance of the liver, more specifically, the investigation is intended for better understanding the liver histology.

## MATERIALS AND METHODS

Six liver samples from adult Barbari goats were collected from local slaughter units of Ayodhya district. For the histological examination, the small pieces of tissues (2 mm size) were collected from five fixed anatomical regions to explore regional differences, if any. The tissues were preserved in 10% formal saline for 48 h, Bouin's fluid for 12 h, and Zenker's fluid for 18 h (Singh and Sulochana, 1997). Fixed tissue was later washed in running tap water for 6-10 h followed by dehydration in ascending grade of alcohol,

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clearing, embedding in paraffin wax of melting point of 58-60 °C, preparation of blocks, section cutting (5-6 µm thick), and mounting of the section on aluminized slides, drying of sections and finally stained with the routine histological stains to demonstrate different components of liver (Luna, 1968). All the tissue processing and staining were carried out in the Department of Veterinary Anatomy and Histology, College of Veterinary Science and Animal Husbandry, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya-224229 (UP).

## RESULTS AND DISCUSSION

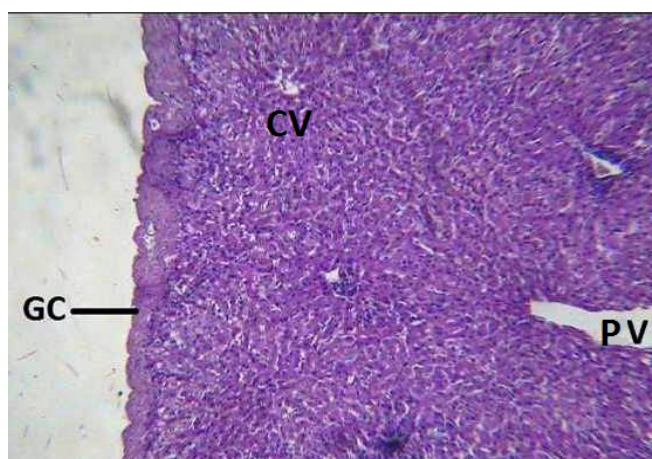
### Capsule

Liver was covered with the connective tissue capsule called Glisson's capsule. It was made up of two different layers

outer peritoneal covering and inner connective tissue covering. The capsule was mainly made up of collagen fibers (Fig. 1, 2). Dellman and Brown (2006) in domestic animals and Abdimerodi *et al.* (2008) in Caspian miniature horse noted similar findings.



**Fig. 1:** Photomicrograph of liver showing connective tissue layer of Glisson Capsule (Verhoeff's stain 100X)



**Fig. 2:** Photomicrograph of liver showing CV=central vein, PV=portal vein, GC=Glisson's Capsule, H & E stain 100X.

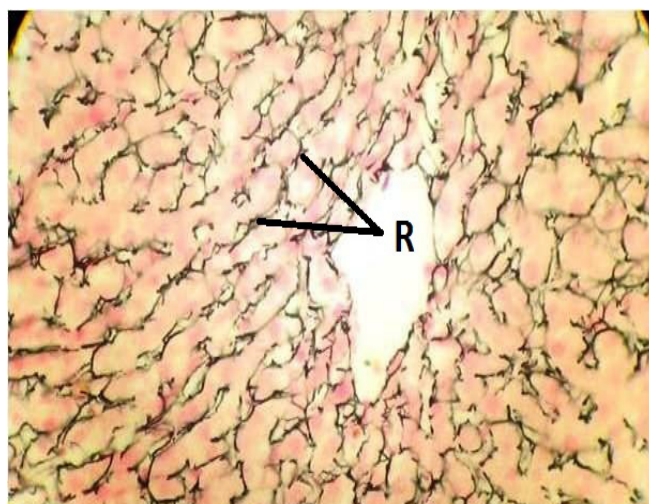
The outer peritoneal covering consisted of simple mesothelial lining. The peritoneal covering was found all over the surface of organ, except at the part of parietal surface where it was in direct contact with the diaphragm. Similar findings were noticed by Dellmann and Brown (2006), König and Liebich (2006) and Dyce *et al.* (2010) in domestic animals.

Immediately below the serous or peritoneal covering layer of connective tissue fibers consisting of collagen as well as reticular fibers, which truly formed the Glisson's capsule. Few smooth muscle fibers and fibroblasts were also present in between the reticular and connective tissue fibers. These findings were also reported by Dellmann and Brown (2006) and König and Liebich (2006) in domestic animals, Rana Alaa Al-Aamery *et al.* (2020) in squirrel & wessel, Bamaniya *et al.*,

(2020) in Marwari goat, Abdimoradi *et al.* (2008) in Caspian miniature horse, and Thakur *et al.* (2021) in buffalo.

### Stroma

The inner connective tissue layer surrounding the liver invaded it interiorly and formed rough framework of liver known as stroma. Reticular fibers were predominant in forming a delicate network around hepatocytes and vessels of the organ (Fig. 3), while collagen fibers were found encircling the individual hepatocytes. Collagen fibers were also present along with the reticular fibers and surrounded the individual hepatocyte. Similar findings were made by Dellmann and Brown (2006) and König and Liebich (2006) in domestic animals.



**Fig. 3:** Photomicrograph of liver showing reticular fibre (R), Silver impregnation method 400X

### Lobulation

The main structural unit of liver was hepatic lobules. One cell thick hepatic chord forming a framework in between the peripheral portal veins and central vein formed the hepatic lobule. The numbers of lobules were identified with number of central veins. Hepatic lobule was having the hexagonal or polygonal shape (Fig. 4). Similar findings were noticed by Bamaniya (2020) in Marwari goat, Mahata *et al.* (2003) in spotted deer, and Abdimoradi *et al.* (2008) in Caspian miniature horse.

### Portal Area

The loose areolar connective tissue covered team of hepatic artery, portal vein, bile ductuli and lymphatics in an interlobular space formed the portal area (Fig. 4). Loose framework of areolar connective along with collagen and reticular fibers supported it. Similar findings were noted by Modekar *et al.* (2003) in broilers, Mahata *et al.* (2003) in spotted deer, Dellmann and Brown (2006) and König and Liebich (2006) in domestic animals.





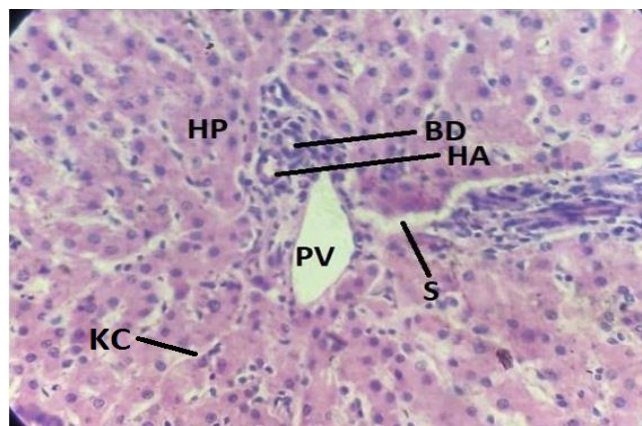
**Fig. 4:** Photomicrograph of liver showing BD-bile duct, PV- portal vein, CF- collagen fibers, PT- portal triad, CV- central vein (Masson's Trichome Stain 100X)

### Hepatic Parenchyma

**Hepatocytes and their arrangement:** Hepatocytes were roughly polygonal in shape and mostly uninucleated. Cytoplasm was rough due to presence of granules and was acidophilic. Few hepatocytes were binucleated. All these hepatocytes were arranged in chords of one cell thickness. These chords anastomosed with each other and formed the hepatic sinusoid between them (Fig. 5). The single cell thickness lining of hepatocytes was organized as radiating manner around the central vein. Similar type of findings were noted by Dellmann and Brown (2006) and Konig and Liebich (2006) in domestic animals., Rana Alaa Al-Aaamery *et al.* (2020) in squirrel & Wessel, Abdimoradi *et al.* (2008) in Caspian miniature horse and Bamaniya *et al.* (2020) in Marwari goat.

Reticuloendothelial cells lined the walls of central vein which was connected with sub lobular veins and further directed towards sinusoids. Central vein was also surrounded by the connective tissue fibers. The one cell thick radiating chords of adjacent hepatocytes anastomose to form sinusoids. Peri-sinusoidal space was found between hepatocytes and sinusoids (Fig. 5). Space between hepatic chords was known as sinusoids. Between endothelial lining and sinusoids peri-sinusoidal space was found. After the whole circulation the blood was pumped into the hepatic venules from the central vein which was consistent with findings of Dellmann and Brown (2006) and Konig and Liebich (2006) in domestic animals.

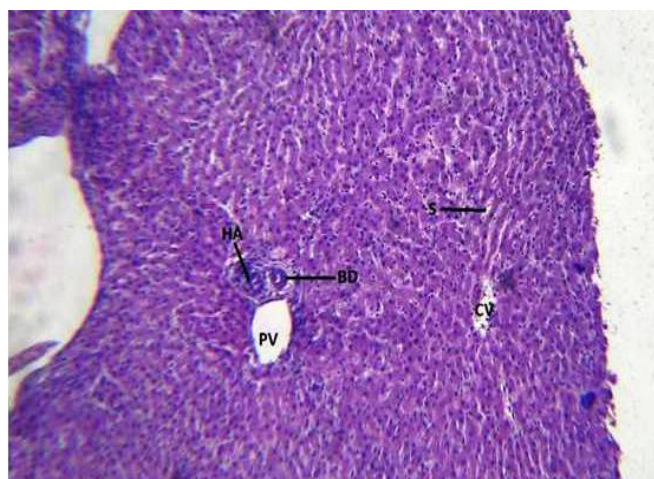
**Kupffer cells:** These were the non-parenchymal cells found in cytoplasm having large nucleus and pink cytoplasm having the phagocytic activity (Fig. 5). Similar findings were noted by Rana Alaa Al-Aaamery *et al.* (2020) in squirrel & Wessel, Abdimoradi *et al.* (2008) in Caspian miniature horse, and Bamaniya *et al.* (2020) in Marwari goat.



**Fig. 5:** Photomicrograph of liver showing PV-portal vein, KC- Kupffer cells, S- Sinusoids, HA- hepatic artery, HP- hepatocyte, BD- bile duct (H&E stain 400X)

**Portal vein:** It was observed that after passing through the hilus and entering the liver, it split into interlobular portal veins, and then split once more to form dispersing branches, before finally supplying sinusoids. It had internal elastic lamina and endothelium, thin tunica media made up of bundles of collagen fibers, and tunica adventitia made up of collagen, smooth muscle fibers, and elastic fibers. Its internal structure was identical to that of any vessel (Fig. 5, 6). Similar findings were noted by Bamaniya *et al.* (2020) in Marwari goats, Dawood and Khamas (2017) in indigenous gazelle, and Dellmann and Brown (2006) and Konig and Liebich (2006) in domestic animals.

**Hepatic arteriole:** It was found that upon entry of hepatic artery through portal fissure it got branched and formed arterioles. It had smaller lumen and thicker muscular wall. Mostly it got joined with capillaries within portal area and fewer joined directly to sinusoids (Fig. 5, 6), which was in consonance with findings of Bamaniya *et al.* (2020) in Marwari goat, and Konig and Liebich (2006) in domestic animals.



**Fig. 6:** Photomicrograph of liver showing portal vein, S- sinusoids, BD- bile duct, HA- hepatic artery, CV- central vein (H&E Satin 100X)

**Lymphatics:** These were found in portal area, encircled with smooth muscle cells, collagen fibers and had big lumen and underlying basement membrane. Similar kind of observations were made by Dellmann and Brown (2006) and Konig and Liebich (2006) in domestic animals.

**Bile canaliculi and Bile ductules:** Through blood, bile pigments reached the hepatocytes and gets conjugated and reach the sinusoids and then got released in bile canaliculi and transported to portal area by the way of bile ductules. Bile canaliculi were formed between opposing surface of hepatocytes. The lumen of bile ductules was found to be lined by low cuboidal cells (Fig. 6). Several ductules joined to form intrahepatic ducts and exit the liver via main hepatic duct. Similar findings were noted by Dellmann and Brown (2006) and Konig and Liebich (2006) in domestic animals.

## CONCLUSION

It is concluded from the study that the distribution of connective tissue fibers in liver capsule was mainly collagen fibers and both collagen and reticular fibers were found in stroma of liver. Epithelium lining in portal vein and hepatic artery was simple squamous, while lumen of bile ductules were lined by low cuboidal cells.

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