

Histological and Histochemical Studies of Liver of Caspian Miniature Horse from Point of View of Liver Glycogen

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Introduction

The Caspian Pony was rediscovered in the 1960's in a mountainous region of Northern Iran, an area between the Caspian Sea and the Elburz. Regarding to the importance of Caspian miniature horse, it is necessary to understand its characteristics.

The liver is the largest internal organ in the body and is present in vertebrates and some other animals. The liver is necessary for survival. It plays a major role in metabolism and has a number of functions in the body, including glycogen storage, decomposition of red blood cells, plasma protein synthesis, and detoxification. The liver is covered by a thin connective capsule (Glisson's capsule). The basic structural component of the liver is the liver cell or hepatocyte. Glycogen is a polysaccharide of glucose which functions as the primary short term energy storage in animal cells. It is made primarily by the liver and the muscles, but can also be made by the brain, uterus, and the vagina.

Materials and Methods

This study was carried out on the microscopic structure of liver of 10 adult and healthy horses. Tissue specimens were taken from different parts of livers. After fixation in 10% formalin, they were transferred into the tissue processor, paraffin blocks were made and thin sections of five microns were cut. The sections were subjected to stain by Hematoxylin and Eosin and P.A.S methods. They were studied under the light microscope and photomicrographs were taken.

Results and Discussion

A. macroscopic structure of liver: Liver in Caspian pony is in visceral surface of diaphragm and the right midline of body. It contains two surfaces and four edges. The surface includes visceral and parietal and edges are dorsal, ventral, right and left. The parietal surface of liver is convex and is expanded craniodorsal which is adapted with diaphragm. The visceral surface is concave and is expanded dorsoventrally. The dorsal and caudal edges are thick and extend to caudal. The visceral edge is thin and extends to cranial. The liver of Caspian pony is divided into right lateral lobe, left lobe and middle lobe

B. Microscopic structure of liver: In Caspian pony, liver is surrounded by a double layer capsule of connective tissue. Serous (outer) membrane originates from mesentery and contains a layer of epithelial

cells. Fibrosis (inner) membrane contains an irregular connective tissue that is called Glisson's capsule. This capsule is composed of collagen fibers, fibroblasts, and smooth muscle tissue. The connective tissue penetrates the capsule to interlobular space and protects vascular system and bile ducts. The interlobular loose connective tissue marks hepatic lobules which include functional unit of the liver (Fig. 1, 2).

The interlobular connective tissue makes portal area that surrounds portal vein, hepatic artery, bile ducts, lymphatic vessels and nerves (Fig. 3). The liver parenchyma is made of polygonal cells, which are called hepatocytes. These cells have a central oval nucleus with one or more nucleolus. Hepatocytes are placed ray-like in liver lobules. Sinusoidal capillary that are called liver sinusoids are located among hepatocytes. These spaces are lined with endothelial cells, and contain red blood cells. The endothelial cell nucleus seems long and dark and Kupffer nucleus looks polygonal all over the liver parenchyma (Fig. 4).

Liver parenchyma is fulfilled with a lot of fat cells, as well as the hepatocytes. Fat cells appear as hollow vacuoles in H&E staining. Stored liver glycogen is positive in P.A.S. staining and appears red (Fig. 5). Glucose is the stored form of glycogen in the body tissues especially sited in liver and striated muscle. Glucose absorption increases as its blood concentration rises and glucose releases in blood as blood glucose falls. So liver acts as a glucostat and adjusts blood glucose.

This study shows that envelope capsule of liver penetrates into liver parenchyma and divides it into lobules. The lobules are separated by interlobular connective tissue. The liver of Caspian pony is compared to camel and pig from this point of view (1, 5). Among domestic animals, only pig and camel have a recognizable interlobular connective tissue. In other mammals e.g. human, liver parenchyma seems to be integrated (8).

Fig. 5 shows that the hepatocytes have a lot of glycogen particles. These particles mostly can be observed around the central vein and gradually decrease in number to the outer part of the lobule. Glycogen is a polymer of glucose that appears red in PAS staining (6, 7). It is indicated that when diet is rich in carbohydrate contents, storage of glycogen in the liver is more compared with the lack of carbohydrate and high levels of fat and protein (2, 3, 8). As well, the time of sampling and the time

between feeding to sampling are important factors in the rate of liver glycogen and its replacement in different parts of the liver lobules.

In rat, it was found that, two hours after feeding, the glycogen particles were distributed throughout the liver lobules, while six hours after feeding, most of glycogen particle were aggregated in the middle and central parts of liver lobules. Passing the time, glycogen particles are more around the lobules. Most of the glycogen is stored in the liver 12 hours after feeding with the rate of %7.53. After that and without refeeding, liver glycogen will decrease, so that after 18 hours, the middle and peripheral lobule cells, have less glycogen contents than central lobule cells and the cells around the central vein (1, 4).

In this study high density of glycogen particles observed around central vein, indicates that glycogen storage in Caspian pony is more than other domestic animals.

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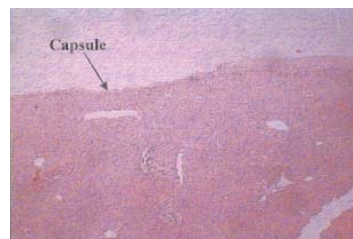


Figure 1. H&E ×40

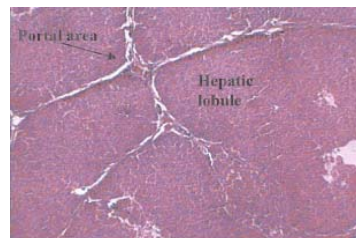


Figure 2. H&E ×40

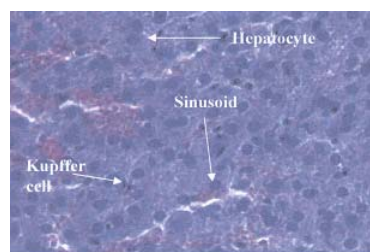


Figure 3. H&E ×100

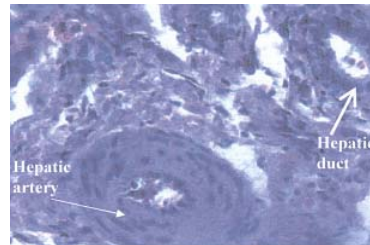


Figure 4. H&E ×400

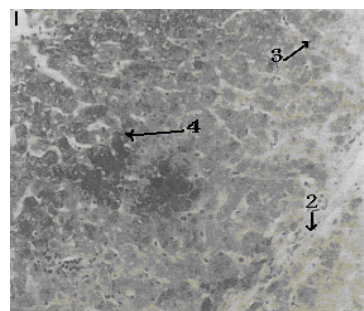


Figure 5. P.A.S ×400