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Liver Micromorphology of the African Palm Squirrel *Epixerus ebii*.

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ABSTRACT

The normal liver histology of the African palm squirrel *Epixerus ebii* was investigated to fill the information gap on its micromorphology from available literature. The liver was covered by a capsule of dense connective tissue- the Glissons membrane. Beneath this capsule is the liver parenchyma were the hepatocyte were supported by reticular fibres. The hepatocytes in the lobules were hexagonal to polygonal in shape. Some hepatocytes were bi-nucleated. Clear spaces in the parenchyma must be storege sites for lipids in the liver. The classic hepatic lobules presented central vein surrounded by several liver cells. At the portal triad, hepatic vein, hepatic arteries and bile ducts were seen. While the hepatic arteries and veins were lined by endothelium, the bile ducts were lined by simple cuboidal cells. Nerve fibres were also seen in the region of the portal triad. Hepatic sinusoids lined by endothelium were seen in the liver parenchyma between liver lobules. The sinusoids contained macrophages. This report will aid wild life biologist in further inversigative research and Veterinarians in diagnosing the hepatic diseases of the African palm squirrel.

Keywords*: palm squirrel, Liver, histology, portal triad*

The liver is the largest internal organ (Akiyoshi and Inoue,2004), containing as much as four to five lobes surrounded by capsule of connective tissue fibres referred to as Glissons capsule (Petcoff *et al.*, 2006). The liver parenchyma within the lobules is supported by fine reticular fibres. At the hilus, blood vessels, lymphatics and nerve enter and leave the liver. Within the parenchyma are sinusoids lined by macrophages called Kupfer cells (Lopez *et al.*, 2011; Carollo *et al.*, 2012). These sinusoids are usually in between the hepatic plates (Motta, 1984). The liver cells – hepatocytes are usually polygonal in shape and usually binucleated mamalian adults (Prunescu *et al.*, 2002). The liver has both endocrine (protein secretion) and exocine (bile secretion) function. It also functions as a storage organ; synthesis of cholesterol, lipid portion of lipopreotein; metabolic activities like gyconeogenesis, deamination of amino acids, and detoxification of noxious substances (Akiyoshi and Inoue, 2004).

Rodents are the largest order in mammals. They are used as pets, laboratory animals and sources of animal protein (Nzalak *et al.*, 2012). The squirrel being a rodent has wide geographical distribution , but the African palm squirrel is seen mostly in West Africa. From available literature, few studies have been conducted on the squirrel. These include reports on necrosy finding of nematodes on captive African squirrel (Craig *et al.*, 1998), rabies in fox squirrel (Cappucci *et al.*, 1972), hepatocellular carcinoma in Black-tailed prairie dogs- *Cynomys ludivicionus* (Garner *et al.*, 2004), natural infection of the ground squirrel with Echinococcus granulosus (Yang *et al.*, 2009). But in the African palm squirrel, there is dearth of information on its basic biology from available literature, hence this microanatomic investigation on its liver, one of the important mammalian organs. The result from this study will fill the knowledge gap. It will help wild life biologist in understanding its adaptive physiology and Veterinarians in managing hepatic diseases of the species.

MATERIALS AND METHODS

Five adult African palm squirrels of both sexes captured in the wild from Olokoro Umuahia in Abia state, Nigeria from March to November 2012 using metal cage traps were used for the study. Olokoro umuahia is in the rainforest vegetation of southern Nigeria characterized by heavy rains and thick well grown mangrove forest trees. They were immediately transferred to the veterinary anatomy laboratory of Michael Okpara University of Agriculture ,Umudike, for acclimatization. During this period, the animals were fed with grasses, oil palm fruit and water ad libitum.

The squirrel on the day of sacrifice was sedated with chloroform. The weight of the animal was taken with Mettler balance (Model Ohaus scout PRO-200) with a sensitivity of 0.1gm. Each squirrel was euthanized by chloroform overdose and placed on dorsal recumbency. The animal was cut open through mid ventral incision from the inguinal region to the mandibular symphysis. The liver was dissected out and slices fixed in 10% neutral buffered formalin. The tissues were passed through graded ethanol, cleared in xylene, impregnated and embedded in paraffin wax. Sections 5µm thick were obtained with Leitz microtome model 1512. They were stained with haematoxylin and eosin for light microscopy examination (Bancroft and Stevens, 1977). The slides were examined and photomicrographs taken with – Motican 2001 camera (Motican UK) attached to Olympus microscope.

RESULTS AND DISCUSSION

Histologically, the liver was seen covered by a capsule composed of dense regular connective tissue fibres (fig.1). the liver parenchyma contained hepatocytes- the liver cells in a cord like arrangement. These hepatocytes were polygonal in shape (fig. 2). The liver lobule contained a central vein surrounded by hepatocytes (fig.2). Clear spaces were seen in the parenchyma between hepatocytes. The liver portal triad contained a hepatic vein, hepatic artery and bile ducts(fig. 3, 4). The hepatic vein lumen was wide and lined by simple squamous epithelium. The hepatic artery was was also lined by simple squamous epithelium, the smooth muscles of the

tunica media were separated by the tunica intima by internal elastic laminar. The bile duct was lined by simple cuboidal cells (fig.4). Some nerve fibres were also at the portal triad (fig.4). Hepatic sinusoids were seen between liver lobules (fig.5). These sinusoids were lined by discontinuous endothelium and macrophages were seen at the sub-sinusoidal space (fig. 5).

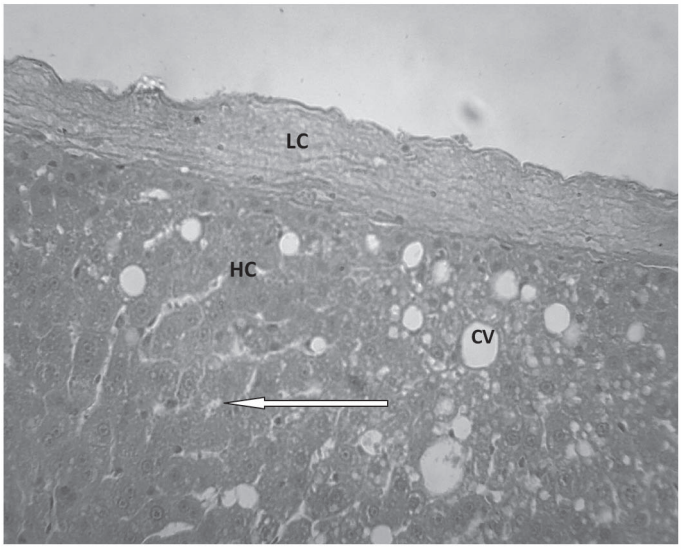

Fig. 1: Section of the liver region showing mucus cells MC, liver capsule LC, hepatocytes HC, clear lipid spaces (white arrow), and central vein CV. H&E x400

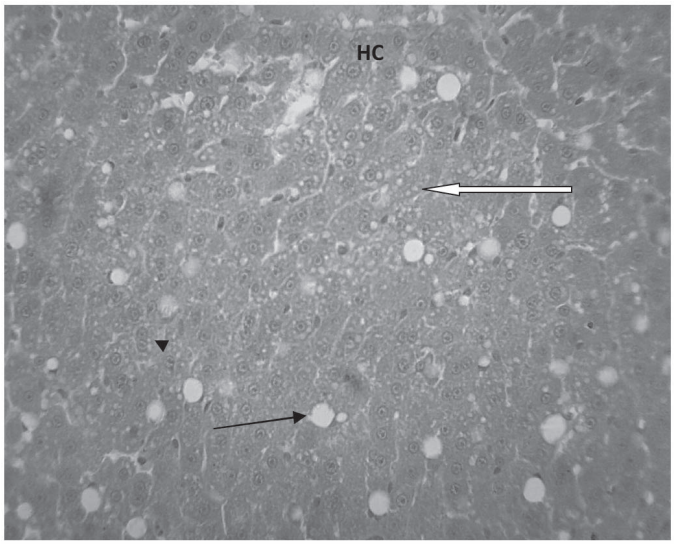

Fig. 2: Section of the liver parenchyma showing polygonal hepatocytes HC, central vein(black arrow), and clear lipid spaces (white arrow). Note the binucleated hepatocytes (black arrow head). H&E x400.

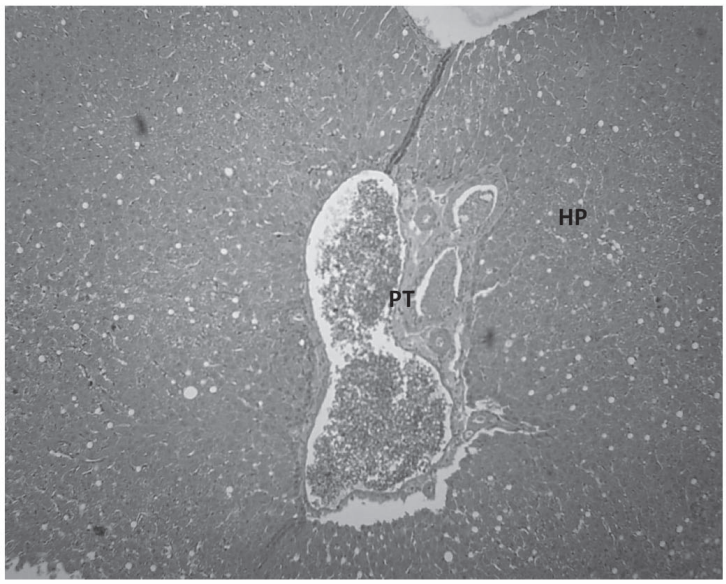

Fig. 3: Section of the liver showing hepatic parenchyma PC, portal triad PT, containing hepatic artery and vein, and bile duct. H&E x400

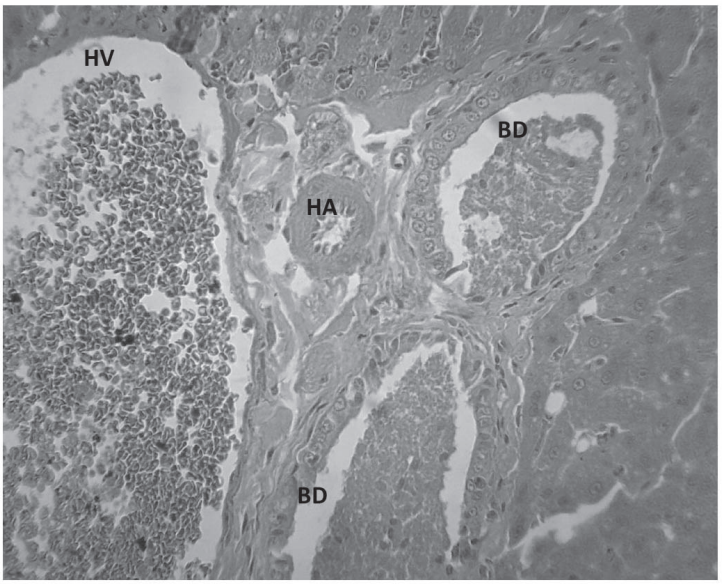

Fig. 4: Section of the liver showing hepatic portal triad PT, containing hepatic artery HA, hepatic vein HV, and bile duct BD. H&E x400.

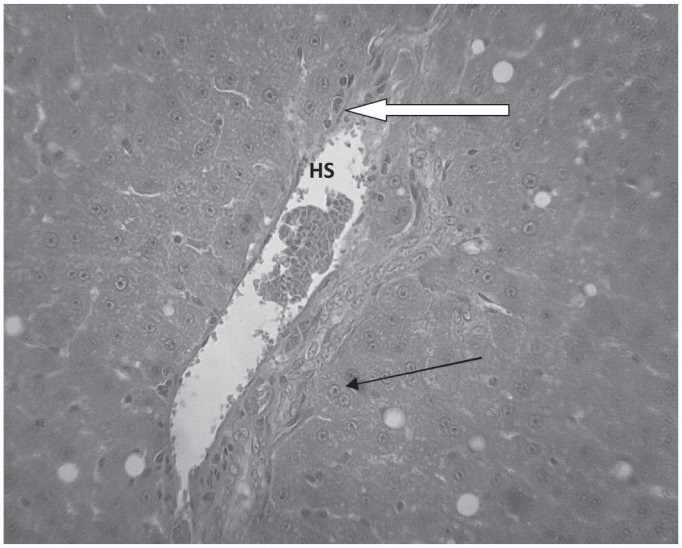

Fig. 5: Section of the liver showing hepatic sinusoid HS, subsinusoidal macrophages (white arrow). Note the binucleated hepatocytes (black arrow). H&E x 400.

The result of this study shows that the Palm squirrel liver histology is similar to most othe mammals. The Glissons membrane is for protection of the liver parenchyma. The dense regular connective tissue fibres seen in this liver has been reported in the adult European bison, *Bison bonasus* containing arteries and lymphatics (Prunescu *et al.,* 2002). The hepatocytes of polygonal shape is the liver cell reponsible for its physiologic functions(Ayikoshi and Inoue, 2012). The binucleated hepatocytes observed in this study has also been repoterd (Prunescu *et al.,* 2002). A classic hepatic lobule with a central vein has also been reported (Ayikoshi and Inoue, 2012), and is the livers' basic functional unit. The clear empty spaces seen in the liver parenchyma inbetween the hepatocytes may be the extracellular lipid storage sites in the liver, but more work should be done to acertain this claim. The sinusoids present is for free exchange of materials between the hepatocytes and the vascular system. The macrophages present in the subsinusoidal space of Disse is for local defence through phagocytosis of pathogens (Parker and Picut, 2005; Carollo *et al.,* 2012). These macrophages refered to as Kupfer cells have also been reported in other mammals (Carollo *et al.,* 2012). The portal triad of hepatic vein, hepatic artery and bile ducts has been reported in literature (Motta,1984; Parker and Picut, 2005). The prominent bile duct maybe an adaptation for easy passage of bile salts from the liver to the duidenum since a gall bladder is absent in some rodents as also seen in this study (Voss, 1991). The absence of lymphatics at the portal area suggest that lymphatics are not regular feature of squirrel portal triad, hence it is not a *tetrad* as reported in some mammals. The presence of nerve fibres in the portal area is unique as it has not been reported in other rodents from available literature.

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