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Histological structures of the accessory glands of the digestive system in adult farmed African catfish (*Clarias gariepinus* B.).

[1] Ikpegbu, E., [2] Nlebedum, U. C., [3] Nnadozie, O. And [4] Agbakwuru, I.O.
[1,2,3,4] *Department of Veterinary Anatomy, Michael Okpara University of Agriculture Umudike, Abia State, Nigeria.*

Abstract: *The accessory glands of the adult farmed African catfish were studied. The dark brown coloured liver histologically was covered by simple squamous cells. The hepatic parenchyma presented hepatocytes in a diffuse or radial arrangement. Some hepatocytes surrounded the central vein in a rosette–like pattern. The hepatic sinusoids contained erythrocytes and leukocytes. The liver was PAS positive. The club shaped gall bladder was green coloured. It presented simple columnar epithelium containing intra-epithelial lymphocytes. The lamina propria contained loose connective tissue. The diffuse pancreas was histologically seen to span from the borders of the stomach to the proximal intestine. The main pancreatic duct whose luminal surface was modified into mucosal folds emptied into the proximal intestine. The pancreatic parenchyma was mostly of basophilic serous acini containing zymogen granules. Islets of Langerhans were seen interspersed in the majority exocrine cells. These accessory glands are involved in exocrine and endocrine secretions; bile, lipid, and glycogen storage.*
Key Words: *Liver, Gall Bladder, Pancreas, Farmed African Catfish, Histology.*

I. Introduction

The liver, gall bladder and pancreas of some teleosts have been studied, and their role in digestion and storage of metabolites, detoxification of injurious compounds, synthesis of proteins and lipoproteins, endocrine and exocrine secretions and bile salts storage have been reported [1,2,3,4,5].

The histological analyses of the digestive system are used as biomarkers in nutritional status of fish [6, 7, 8]. The liver histology also has been used in assessing effect of feed in fish [9]. Available information from literature indicates that studies on the liver and kidney histopathology have been used as biomarkers in fuel toxicosis [10].

Whereas the commercial culture of African catfish in concrete tanks is becoming very popular in Nigeria [11, 12], the problems of intensive animal production which includes feed management and disease control is occurring but is largely unreported in available literature. This is because farmers practice polypharmacy and even fish clinicians lack baseline data on the normal histology of the organs especially those of digestive system. This is not the case with other teleosts as there are extensive reports in literature [5,13,14], just to mention a few. A hepatopancreas has been reported in the iridescent shark catfish *Pangasius hypophythalmus* [15]; and a spleenopancreas in *Barbus pectoralis* [16].

In this paper, the normal histomorphology and carbohydrate mucin histochemistry of these organs from apparently healthy African catfish sourced from commercial aquaculture is reported. The information will fill the knowledge gap, help fish pathologist in disease diagnosis and generate baseline data for further investigative research.

II. Materials And Methods

Ten apparently healthy adult African catfish of both sex sourced from a commercial aquaculture in Eastern Nigeria were used for the study. They weighed an average of 900g and measured a standard body length of 45cm in length. The fish were euthanized with chloroform. The body cavity was cut open through a mid ventral incision and the digestive system dissected out. The specimen under study – the liver, gall bladder and digestive tract (Fig.1) were excised and sections were immediately 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 [17]. Mucins and glycogens were demonstrated using alcian blue (AB) at pH 2.5 [18,19] and periodic acid Schiff (PAS) procedure with and without prior digestion with diastase [20,21]. In addition, the PAS technique was employed in combination with AB for neutral and acid mucin [17]. Photomicrographs were taken with – Motican 2001 camera (Motican UK) attached to Olympus microscope.

III. Results

The liver grossly was dark brown in colour. Histologically, it was covered by simple squamous cells (fig.2). The hepatic parenchyma contained hepatocytes. The hepatocytes were polyhedral in shape and each contained very basophilic central nucleus. The hepatocytes were arranged in a diffused or radial pattern (fig.2,3). Some hepatocytes surrounded the central vein while others surrounded the erythrocyte and leukocyte containing sinusoids (Fig2,4). There was no trabecula in the lipid and glycogen rich parenchyma (Fig. 3). The hepatic parenchyma was PAS positive (Fig.5).

The club-shaped gall bladder was grossly green in colour (fig 1). It was lined by simple columnar epithelium containing intraepithelial lymphocytes and goblet cells (Fig 6,7). The relatively large lamina propria contained loose connective tissue, lymphocytes and blood vessel (Fig.7). The goblet cells were PAS positive.
Grossly, the parenchyma was not a discrete organ. The diffuse pancreas was histologically seen to span from the borders of the stomach to the proximal intestine. The organ was covered by loose connective tissue (fig.8). The pancreatic parenchyma contained mostly basophilic serous acini containing zymogen granules (fig. 8, 9). The few Islets of Langerhans were seen interspersed in the exocrine cells of the parenchyma (Fig 9). The interlobular duct was lined by simple cuboidal to columnar epithelium with brush border (fig. 10).The main pancreatic duct whose luminal surface was modified into mucosal folds emptied into the proximal intestine (11). These mucosal folds were lined by simple columnar epithelium containing mucous cells while the laminar propria core contained collagen fibres (12). The mucous cells were PAS positive but after AB reaction, the mucous cells at the base of the fold were strongly AB positive while those at the tip were weakly AB positive. The pancreatic parenchyma was PAS and AB negative.

FIGURES

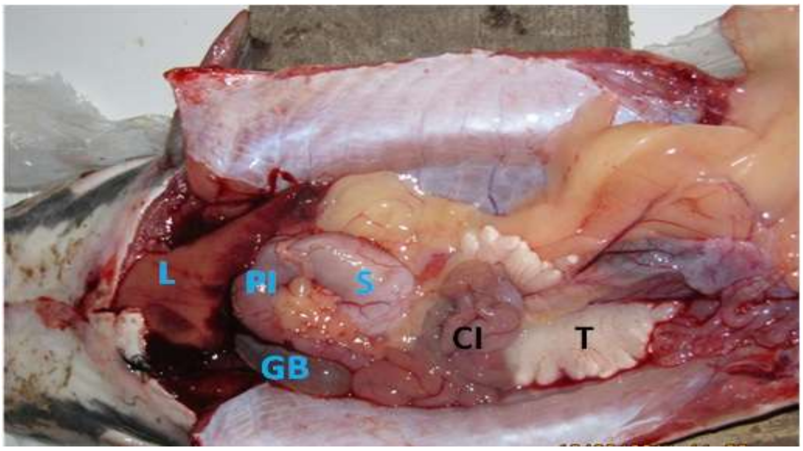

Fig.1. Dissected specimen of the adult male fish showing the viscera in situ. L,liver; PI, proximal intestine; S, stomach; CI,convoluted intestine; GB,Gall bladder; T, Testis

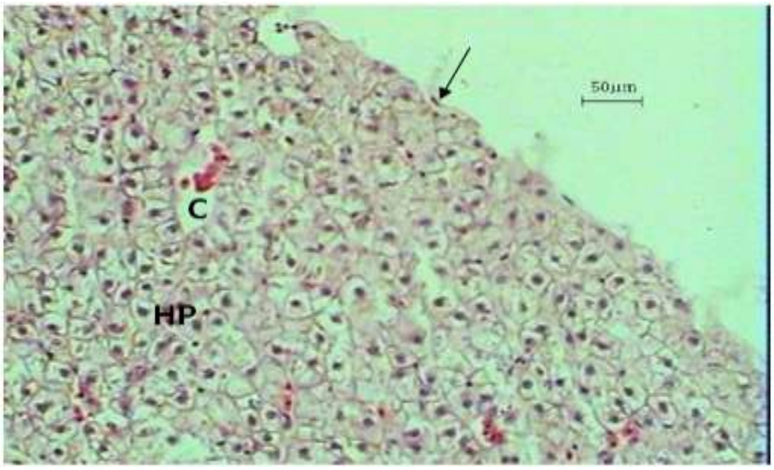

Fig.2. Section of liver showing hepatocytes HP, in difuse partern. Note the central vein C, simple squamous cell (arrow) capsule covering the liver. H&E x400

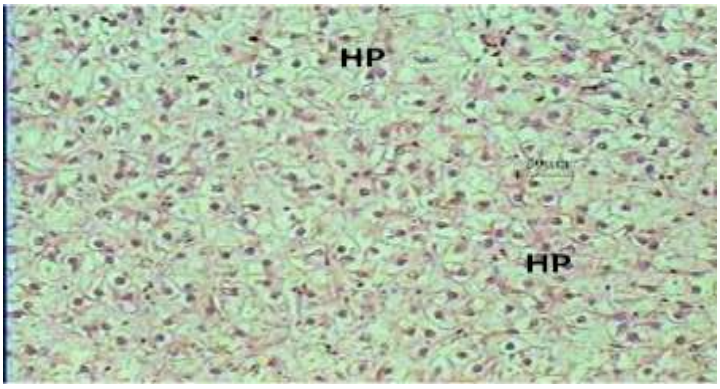

Fig. 3. Section of liver showing hepatocytes HP, in diffuse and radial arrangement. Note the absence of hepatic trabeculae. H&E x400

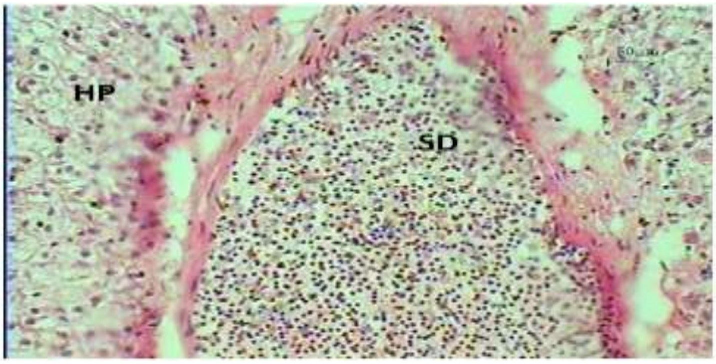

Fig.4. section of liver showing erythrocyte containing hepatic sinusoid SD. Note hepatocytes HP arround it. H&E x4000

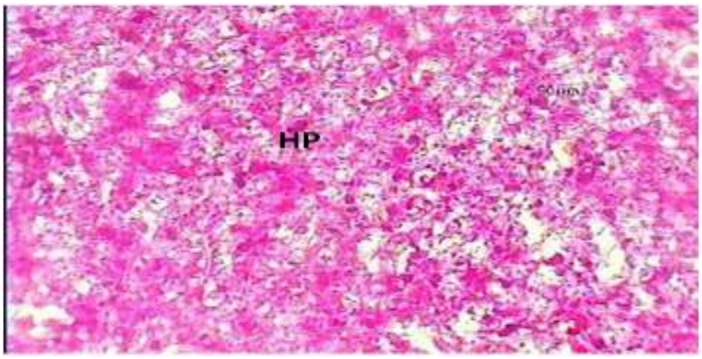

Fig.5. section of liver showing PAS positve hepatocytes HP. Note the clear areas that contain lipids. PAS x400

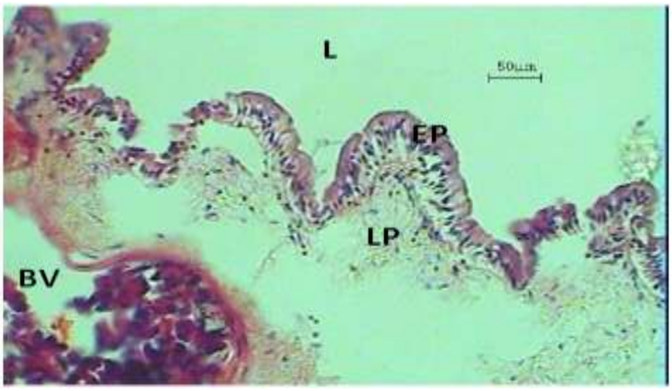

Fig.6. Transverse section of the gall bladder showing lumen L,epithelium EP, and lamina propria LP. Note the blood vessel BV. H&E x100

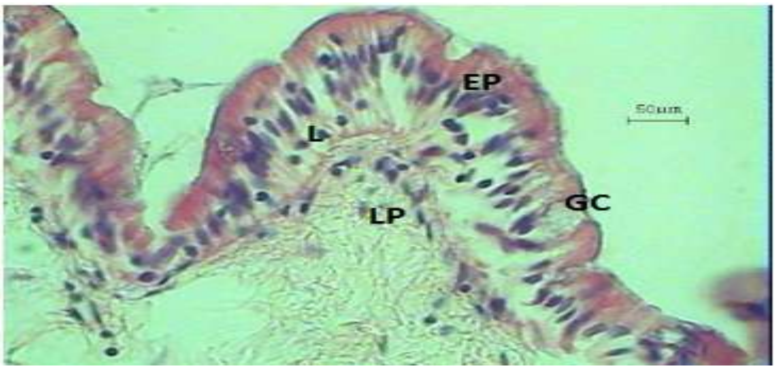

Fig.7. Transverse section of the gall bladder showing simple columnar epithelium EP containing goblet cells GC, and lamina propria LP. Note the intraepithelial lymphocytes L. H&E x1000

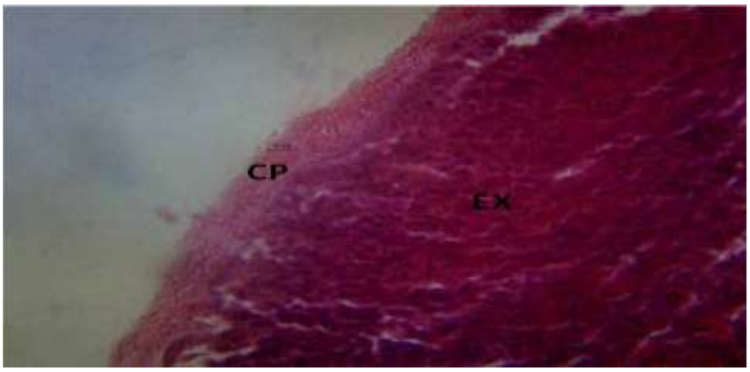

Fig.8. Section of the pancreas showing capsule CP of loose connective tissue. Note the basophilic exocrine pancreas EX. H&E x400

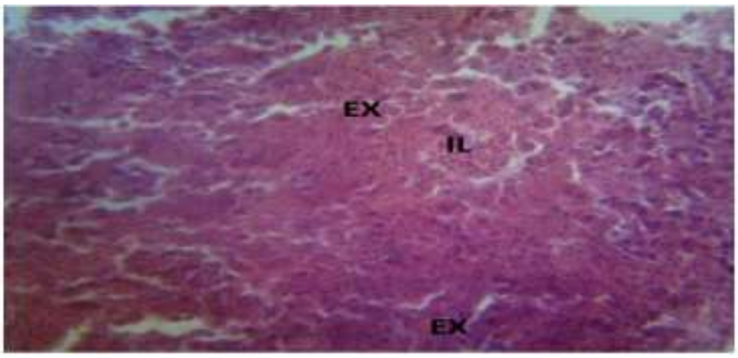

Fig.9. Section of pancreas showing exocrine glands EX, and Islet of Langerhans IL. Note the abundance of the exocrine portion relative to the endocrine portion. H&E x400

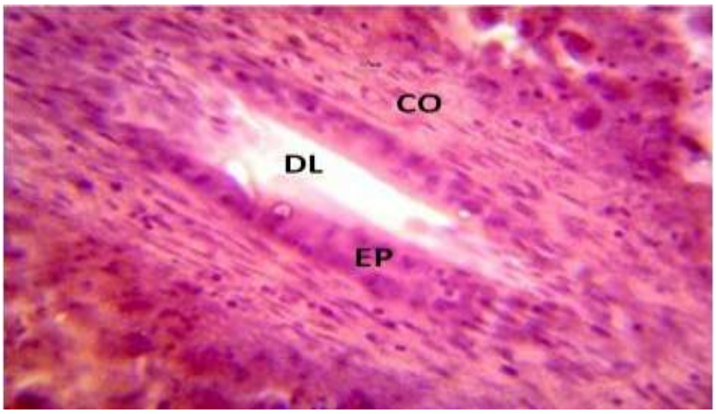

Fig. 10. Section of pancreas showing the interlobular duct lumen DL, epithelium EP and collagen fibres CO. H&E x1000

Fig.11. Section of pancrease PP, showing the main pancreatic duct MD entering the proximal intestine. AB x400

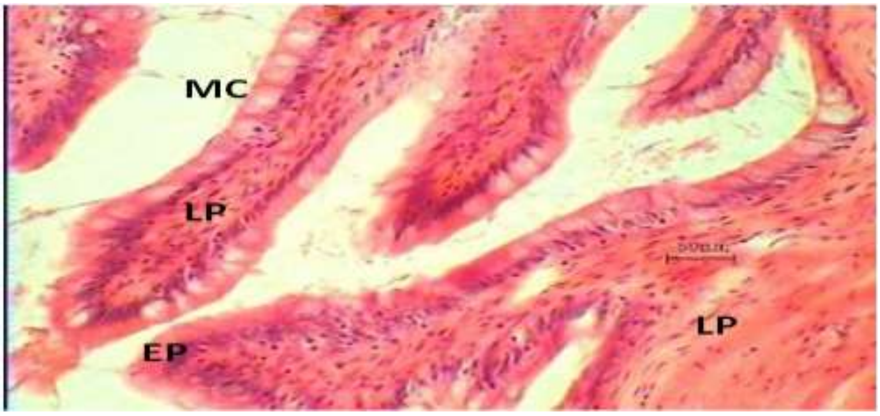

Fig. 12. Section of the main pancreatic duct mucosal folds showing epithelium EP, containing mucous cell MC. Note the lamina propria LP, core of collagen fibres and fibrocytes. H&E x400

IV. Discussion

The hepatocytic arrangement in this study differed from the mammalian type by lacking lobules , trabeculae and portal triads. The diffuse to radial arrangement has been reported in other teleosts [9,22]. This diffuse arrangement may help in the rate of liver functions especially that of detoxification and metabolite storage, as more cells will be reached faster in an aquatic environment that ingestion of food and water is very frequent. But this may also quickly expose the liver to injurious materials –thus making it the organ of choice in researches on teleosts toxicology, histopathologies and nutritional status [9,10,23]. The polyhedral shaped hepatocytes and their rosette-like arrangement around the central vein of this species has been reported in other teleosts [24,25]. Liver sinosoids containing erythrocytes has been reported and may suggest active involvement of the liver in blood circulation [24]. These sinusoids are for easy exchange of materials between the vascular system and hepatocytes [5]. The PAS positive result that became negative after diastase treatment indicates the presence of glycogen. This correlates with earlier documented researches of the liver being involved in glycogen storage [5, 26, 27].

The gall bladder club shape is for accommodation of more bile produced by the liver. The presence of a gall bladder suggests the need to regulate emulsification of fats as the main cystic duct was seen emptying into the proximal intestine. The simple columnar epithelium may suggest an organ involved in reabsorption of materials from the stored bile. The goblet cells may serve as source of carbohydrate to the fish or lubrication of luminal surface. A simple squamous epithelium resting on lamina propria containing loose connective tissue and smooth muscle cells has been reported in *Diplodus pantazzo* and *Pandora pagellus* [25], but a simple columnar epithelium as seen in this study has been reported in *Seriola lalandi* [28]. The lymphocytes are for local specific defense as part of gut associated lymphoid tissue - GALT [29].

The non-discrete form of pancreas as an organ in teleost is known and this has made most research in fish pancrease difficult [28, 30]. But with this report of diffuse pancreas located along the borders of the stomach and proximal intestine, researchers on teleost pancreas can now use this species as their specimen of choice. The basophilic zymogen containing cells of the exocrine pancreas is for production and storage of pancreatic enzymes like trypsinogen, elastase and amylase [5]. The eosinophilic Islets of Langerhans are for hormone production like insulin. The epithelium of the interlobular duct was simple columnar is also in literature [5]. The brush border will help move the pancreatic juice towards the main duct. The presence of PAS positive mucous cells suggests transport of molecules across the cell membrane. The strong AB positive mucous cells at the base of the main pancreatic duct mucosal fold may suggest and adaptation for protection against pathogens as more bacteria may accumulation at this location more than at the tip [31].

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