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Histological and micrometrical observation on the liver of indigenous pig of Tamil Nadu

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Abstract
The present histological observation is carried out in the liver of indigenous pigs of Tamil Nadu. Liver tissue samples of adult age groups were collected, processed and stained for Histological, Histochemical and Micrometrical studies. The liver is noticed on the right side of the abdomen and gross anatomically divided into five lobes. The liver was invested by the outer capsule. From the capsule the septa arise and divides the parenchyma of the organ into lobules. The thickness of the capsule measured from 15.04 to 50.59 with the mean value of 34.30 ± 13.36 micron. The hepatic lobules were polyhedral in shape. The central vein was noticed in the lobules with the plates of hepatic cells radiating away from the central vein towards the periphery of the lobule. In some lobules two central veins is also noticed. The diameter of hepatic lobules varied from 942.41 to 1508.28 with the mean value of 1193.20 ± 196.65 micron. Hepatic cells are stained acidophilic with large rounded nucleus and vacuolated cytoplasm. The diameter of the hepatic cells measurement varied from 9.73 to 23.52 micron with the mean value of 17.43 ± 4.75 micron. The diameter of the central vein ranged from 40.45 to 115.00 micron with the mean value 79.90 ± 24.51 micron. The portal triad was located at the periphery of the lobule. The triad contains hepatic artery, hepatic vein and hepatic duct. The luminal diameter of the hepatic artery ranged from 18.43 to 43.71 micron with the mean value of 31.40 ± 10.36 micron and the thickness of the hepatic artery range varied from 17.94 to 39.37 micron with mean value of 28.60 ± 6.07 micron. The luminal diameter of hepatic vein ranged from 16.37 to 45.85 micron with the mean value 33.10 ± 12.30 micron. The luminal diameter of hepatic duct range varied from 20.80 to 72.45 micron with the mean value of 52.70 ± 20.74 micron. The capsule, trabeculae and the regions of portal triad were rich in collagen fibres. There fibres are also noticed surrounding the central vein. The capsule, trabeculae and the parenchyma of the liver showed positive reaction to periodic acid Schiff reaction. Whereas the capsule showed less positive reaction to alcian blue staining method.

Keywords: Histology, micrometry, liver, capsule, hepatic cells, indigenous pig

Introduction
Pig rearing is one of the most profitable occupations for poorest people of the society. It aids in improving the socio-economic status of the weaker sections of the society as well as poor farmers. Indigenous pigs are wild in nature and have good reproductive performance and production potential. The coat colour was black. Most of these pigs were black and only few are with black and white and black and brown (Sangli *et al*., 2017) [8].
The liver is the largest organ which occupies the abdominal cavity and lies on the right of the median plane. It is an important part of gastro intestinal system. It carries out important functions for survival, including the process of metabolism, digestion and cleansing the blood. It is divided into five lobes. Histologically the parenchyma of the liver is comprised of liver cells known as hepatocytes. The liver is covered by Glisson's capsule. The liver consists of multiple lobes in animals, the number and arrangement is varies, considerably among domestic animal species and 70-80% of the liver mass is composed of hepatocytes (Robert H Dunlop, 2004) [7].

Methodology
The study was carried out in the indigenous pig breed of Tamil Nadu. The liver of adult healthy pigs was collected from the PGRIAS, Kattupakkam, Chennai, during slaughter. The tissue pieces was fixed in different fixatives and processed for routine paraffin embedding. The paraffin sectioning of the tissues of 5-6 µm thickness is done and subjected for normal routine, special and histochemical staining.
The following are the stains used for the Histological and Histochemical studies

For histological and special techniques

1. Standard Haematoxylin and Eosin for routine histological observation (Bancroft and Stevens, 1996) [1].
2. Masson trichrome for connective tissue fibres (Luna, 1968) [3].
3. Perls Prussian blue reaction for ferric iron (Bancroft and Stevens, 1996) [1].

For histochemical study

1. PAS (Periodic Acid Schiff's technique) for mucopolysaccharides (Mc Manus, 1946) [4].
2. Alcian blue method for acid mucopolysaccharides (Luna, 1968) [3].

Micrometry

Olympus (Cx41) is used for capturing the images and then micrometrical measurements were carried out.

The following regions of the liver is analyzed for micrometry and measured in microns. They are,

1. Hepatic lobules – Diameter is measured
2. Hepatocytes – Diameter is measured
3. Central vein – Diameter is measured
4. Hepatic artery – Luminal diameter and thickness is measured
5. Hepatic vein – Luminal diameter is measured
6. Hepatic duct – Luminal diameter is measured
7. Capsule – Thickness is measured

The statistical analysis of data was done as per Snedecor and Cochran (1994) [9].

Results and Discussion

Liver is enveloped by the capsule called Glisson's capsule. The septa arises from the capsule and divides the parenchyma of the liver into lobules. The lobules are hexagonal shaped. The hexagonal shaped lobules are clearly visible as distinct lobules. The central vein which is the largest vein is found in the center of each lobules. The hepatic cells are found surrounding the central vein. Hepatic cells are arranged in form of hepatic cords radiating away from the central vein (fig.1). Hepatic cells are polyhedral shaped which is similar to the findings of Metwally *et al*. (2015) [5] in albino rats and is against the findings of Purton (2010) [6] in avian liver where he stated the hepatic cells were polygonal in shape. Each hepatic cell were vacuolated. The nucleus was larger rounded in shape and stains basophilic which located in the center of the cell. Usually only one central vein is noticed in each lobules, In few lobules two central veins is also noticed (fig.2).

The spaces which appeared between the radiating cords of cells are filled sinusoidal capillaries. The portal triad comprises of hepatic duct, hepatic artery and portal vein. The portal triad is noticed at the periphery of the lobule where a single portal triad is been shared between by many lobules and was located in the connective tissue trabeculae (fig 3). In this study central vein was located away from the portal triad (fig.3). Whereas the central vein was located close to the portal triad in sheep liver (Madhan KE and Raju S, 2013) [4].

Collagen fibres form a rich network in the portal triad surrounding the blood vessels and the hepatic duct (fig 4). Collagen fibres are more densely distributed in the capsule. These fibres from the capsule extend into the trabeculae. The collagen fibres from the trabeculae extends into the portal triad, where the dense network of collagen fibres is noticed. Around the central vein region collagen fibres are noticed in the study (fig 5).

Glycogen is abundantly packed in the lobules of the liver (fig. 6). Hepatic cells are distributed with the glycogen material. This is similar to the findings of Devendra Singh *et al*. (2018) [2] in the liver of Large White Yorkshire pig (*SUS SCROFA*). Glycogen deposits is noticed in the capsule as well as in the trabeculae. The glycogen deposits is also found in the lumen of some central vein (fig 7).

The capsule showed less positive reaction for acid mucopolysaccharides (fig7.).Whereas the trabeculae also showed very less positive reaction. Except the capsule and trabeculae, the acid mucopolysaccharide activity is absent in the other regions of the liver.

Ferric iron activity is absent in the capsule, trabeculae and the parenchyma of the liver.

Micrometrical measurements of various components in the liver (Values are in µm)

S. No.	Capsule thickness	Hepatic lobules	Hepatic cells	Central vein	Luminal diameter of hepatic artery	Luminal diameter of hepatic vein	Luminal diameter of hepatic duct	Thickness of hepatic artery
1	15.04	942.41	9.73	40.45	18.43	16.37	20.8	17.94
2	18.49	975.67	11.62	49.44	19.45	19.11	26.11	23.46
3	20.54	998.40	13.86	60.67	21.65	20.41	30.18	25.73
4	29.67	1072.12	14.05	79.35	25.12	24.00	42.30	25.86
5	30.81	1198.28	18.88	80.33	28.53	45.85	58.67	26.11
6	36.98	1200.21	19.61	80.11	30.78	32.61	65.86	29.98
7	44.13	1244.54	19.89	85.88	40.61	38.15	68.56	30.55
8	46.15	1380.62	21.13	101.43	42.64	44.22	71.00	31.88
9	50.02	1412.41	22.10	107.82	42.29	44.81	71.12	35.06
10	50.59	1508.28	23.52	115.00	43.71	45.85	72.45	39.37
Mean	34.30	1193.20	17.43	79.90	31.40	33.10	52.40	28.60
SD	13.36	196.65	4.75	24.51	10.36	12.30	20.74	6.07
SE	4.22	62.18	1.50	7.75	3.27	3.89	6.55	1.92

The thickness of the capsule measured from 15.04 to 50.59 with the mean value of 34.30 ± 13.36 micron.

The diameter of hepatic lobules varied from 942.41 to 1508.28 with the mean value of 1193.20 ± 196.65 micron.

The diameter of the hepatic cells measurement varied from 9.73 to 23.52 micron with the mean value of 17.43 ± 4.75 micron.

The diameter of the central vein ranged from 40.45 to 115.00 micron with the mean value 79.90 ± 24.51 micron.

The luminal diameter of the hepatic artery ranged from 18.43 to 43.71 micron with the mean value of 31.40 ± 10.36 micron the thickness of the hepatic artery range varied from 17.94 to 39.37 micron with mean value of 28.60 ± 6.07 micron.

The luminal diameter of hepatic vein ranged from 16.37 to

45.85 micron with the mean value 33.10 ± 12.30 micron. The luminal diameter of hepatic duct range varied from 20.80 to 72.45 micron with the mean value of 52.70 ± 20.74 micron.

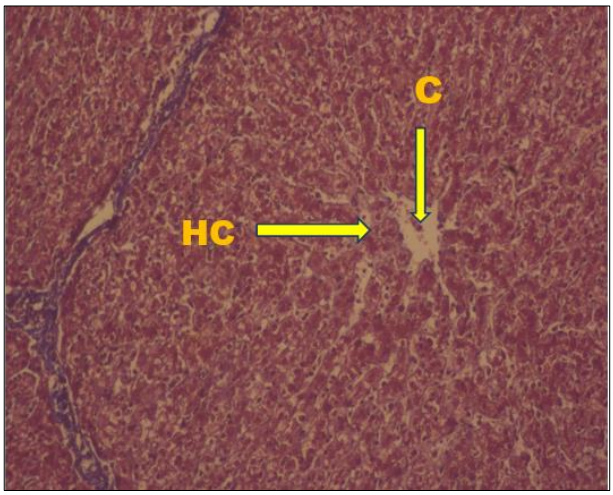

Fig 1: Photomicrograph of the Liver showing hepatic cells are radiating away from the central vein. C – Central vein, HC – hepatocytes (Masson trichrome X 40)

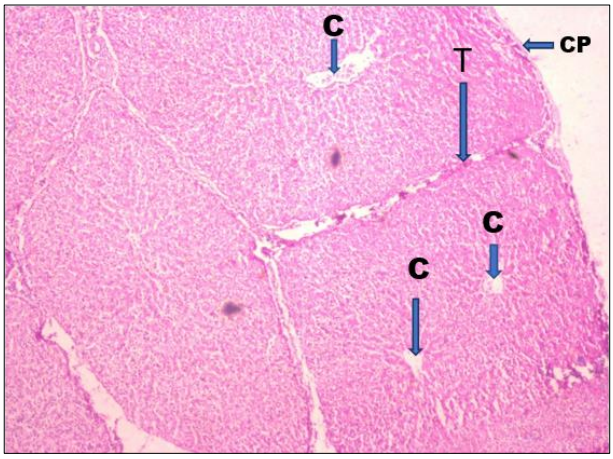

Fig 2: Photomicrograph of the Liver showing two central veins which is arrow marked. C – Central vein, CP – Capsule, T – Trabaculae (PAS X40)

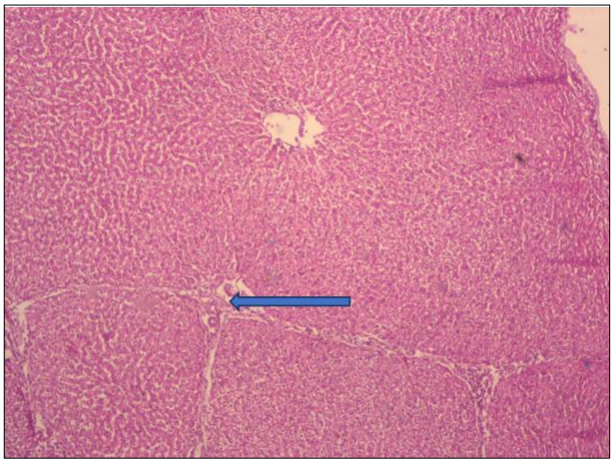

Fig 3: Photomicrograph of the liver showing portal triad which is arrow marked. (H & E X 40)

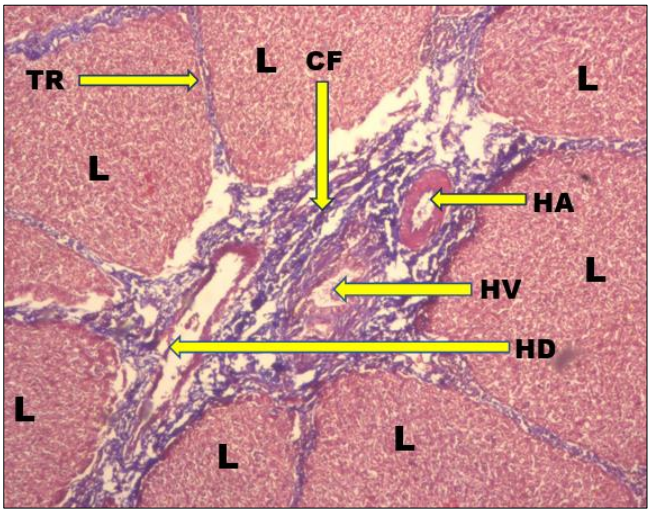

Fig 4: Photomicrograph of the liver showing Collagen fibres form a rich network in the portal triad. L – Hepatic Lobules, TR-Trabaculae, HA-Hepatic artery, HV-Hepatic vein, HD-Hepatic duct, CF-Collagen fibres (Masson Trichrome X 40)

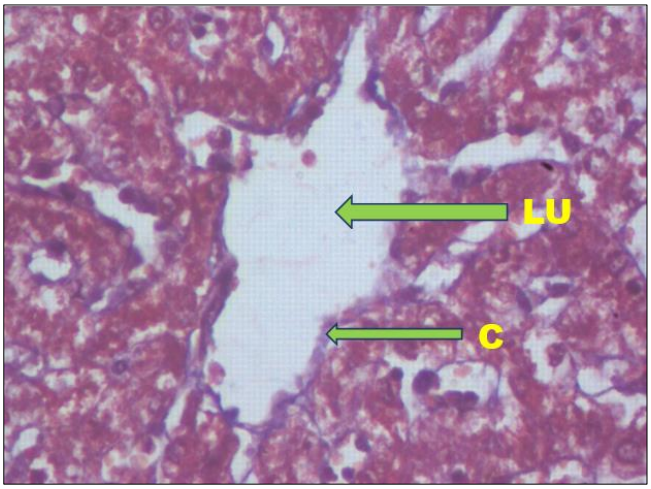

Fig 5: Photomicrograph of the liver showing collagen fibres around the central vein LU – Lumen (large arrow), C- collagen fibres (small arrow) (Masson Trichrome X 100)

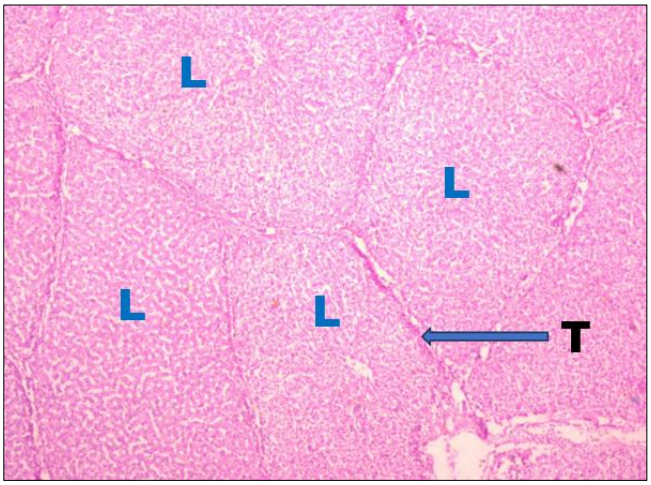

Fig 6: Photomicrograph of the liver showing the glycogen deposits in the lobules and trabaculae of the liver. L - Lobule, T- Trabaculae. (PAS X 40)

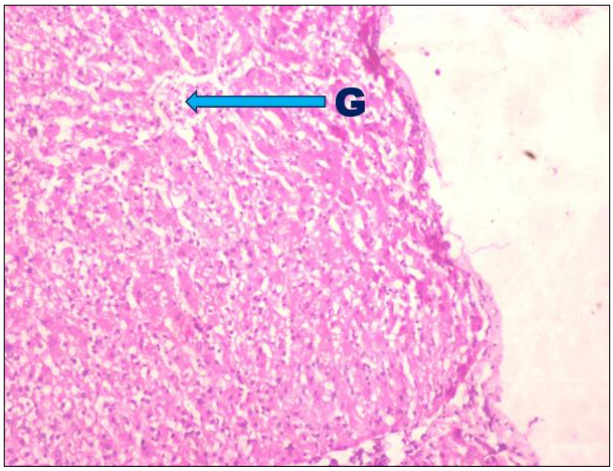

Fig 7: Photomicrograph of the liver showing the glycogen deposits is also found in the lumen of central vein. G – Glycogen deposits in the central vein (PAS X 100)

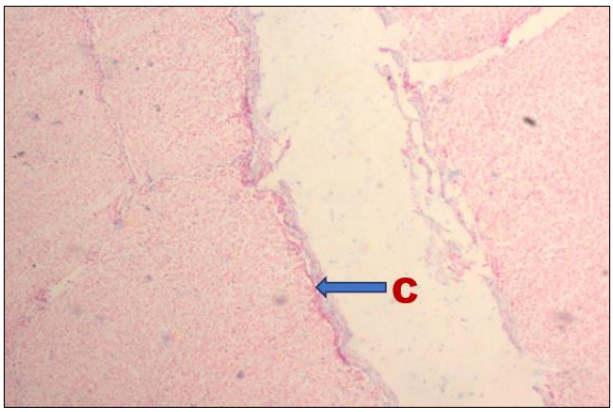

Fig 8: Photomicrograph of the liver showing the capsule showed less positive reaction for acid mucopolysaccharides. C – Capsule (Alcian blue X 100)

Conclusion

Histological structure of the liver in this present study provides valuable information to compare the liver of various species. Glycogen distribution in the liver is also analysed. The luminal diameter of hepatic duct is greater than the luminal diameter of artery and vein. The diameter of the central vein is larger than the hepatic duct. The micrometrical values in the present study differ with other species.

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