

ANATOMICAL AND HISTOLOGICAL STUDY ON DIGESTIVE ORGANS OF TREE SHREW (*Tupaia javanica*)

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Abstract. Squirrels are members of the class of mammals which are also included in the Scandentian order. This study aims to determine the anatomical structure and histology of the digestive organs of the squirrel kekes (*Tupaia javanica*). The research consisted of the stage of making histology slides of the digestive organs of squirrel kekes using the paraffin method and the Hematoxylin-Eosin staining method. The digestive organs in this study consist of the esophagus, stomach, small intestine, large intestine, and liver. Histological observations show that the organs of the esophagus (esophagus), stomach, small intestine, and large intestine are found in some of the same tissues, among others, epithelium tissue, lamina propria, mucosa, submucosa, serosa and adipose. While the liver is found in several tissues including the hepatic sinusoid, central vein, portal vein, hepatic arteries and lymphatic vessels.

Keyword: anatomical, histological, tree shrew

INTRODUCTION

Squirrels are a group of small mammals that are classified into the Scandentians, which have similarities with the lemur (the Dermoptera nation) and the Primates above, composing a group of animals called Euarchonta. Squirrels are insectivorous animals, and have relatively large brains, in addition, squirrels have a large ratio of brain to body when compared to other mammals (Corbet and Hill, 1992).

Morphologically, squirrels have a length of 10 cm to 11 cm, and a tail 14 cm to 15 cm, hind legs 4 cm to 5 cm. The hair on the body is striated and the base is black at the tips slightly brownish. On the front from head to shoulder, the color is paler or yellowish gray. On the back there is a line that gets darker up to the buttocks. The underside is yellowish gray. *Tupaia javanica* is active foraging during the day, especially those who forage above ground, and the animals live in pairs. The main food of *Tupaia javanica* is insects, fleas, beetle larvae, termites, ants, earthworms and fruits. *Tupaia javanica* is active in the soil (Gayus et. Al., 2017).

RESEARCH METHOD

This research was conducted at the Zoological Laboratory of UIN Sunan Kalijaga Yogyakarta in January-February 2020. The tools used in this study included a set of surgical instruments consisting of; surgical scissors, tweezers, razors, and scalpels, flakon bottles, paraffin tubs, microtomes, warmer slides, paraffin ovens, microscopes, slides, cover glasses, personal protective equipment consisting of latex gloves and masks, optilab, computer, stationery, camera, and laptop.

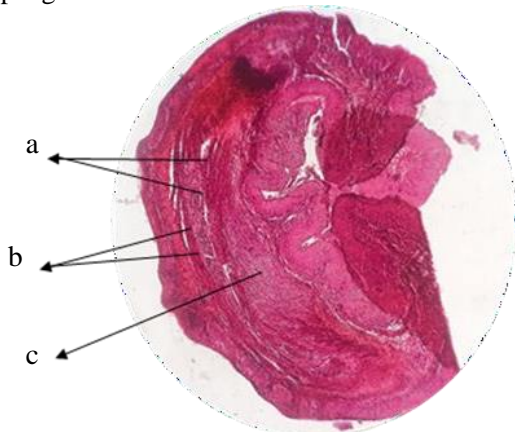
Histological observations of the digestive organs of the squirrel kekes were carried out using the paraffin method and the staining method using Hematoxylin and Eosin. After surgery, the digestive organs of the squirrel kekes were removed and washed, then the organs were fixed in 24- hour Bouin solution and washed in running

water. Then the organs are dehydrated using alcohol levels from a concentration of 30% - 96% then clearing with toluene for approximately one night. After clearing one night, the paraffin infiltration stage is in an oven at 65°C. After paraffin infiltration, the organs are placed into blocks containing liquid paraffin for the embedding process. After the embedding process, the organs were cut using a microtome with a thickness of 4-5µ. The last stage is staining, using a solution of Hematoxylin and Eosin, then the organs are dehydrated up using an alcohol concentration of 30% - absolute. After finishing the coloring, the object glass is dripped with entellant and then covered with a cover glass and the last one is observed under a microscope.

RESULT AND DISCUSSION

This study produced a histological structure image of the digestive organs of the squirrel kekes which consists of the esophagus, stomach, small intestine, large intestine and liver. The results of the observation of the histological structure of the digestive organs of the kekes squirrel in the esophagus found the external muscular tissue consisting of the inner circular muscle layer (skeletal), outer longitudinal muscle layer (skeletal), and submucosa. The outer wall of the esophagus, the muscularis externa, contains a mixture of different types of muscle fibers. In the upper third of the esophagus, the muscularis externa contains striated skeletal fibers. In the middle third of the esophagus, the muscularis externa contains skeletal fibers and smooth muscles, while the lower third of the esophagus consists entirely of smooth muscle fibers (eroshenko, 2005). The structure of the muscularis externa esophagus in *Tupaia javanica* is almost the same as that of humans, the muscularis externa in the upper third of the esophagus mainly consists of striated skeletal muscles. In the middle third of the esophagus, the inner circular layer and the outer longitudinal layer show a mixture of smooth muscle and skeletal muscle fibers. In the lower third of

the esophagus, only smooth muscle is present (Badirul, 2012). The following is the histological structure of the esophagus:



Gambar 1. Histology of esophagus in squirrel kekes (Muscularis externa: a. Inner circular muscle layer (skeletal), b. Outer longitudinal muscle layer (skeletal), c. Submucosa).

In the stomach there are three histological areas including the cardia, fundus, body, and pylorus. The fundus and body are the largest areas in the abdomen. The stomach wall shows four general areas: mucosa, submucosa, muscularis externa, and serosa. The mucosa consists of the epithelial surface, lamina propria, and muscularis mucosa. The surface of the stomach is lined by simple columnar epithelium that extends inward and lines the gastric opening, which is a tubular fold of the surface epithelium in the fundus, the gastric orifice is not deep and extends to the mucosa about a quarter of its thickness. Beneath the epithelium is the loose connective tissue of the lamina propria that fills the space between the gastric glands (Gusti Ayu, 2014). The following is gastric histology in kekes squirrels:

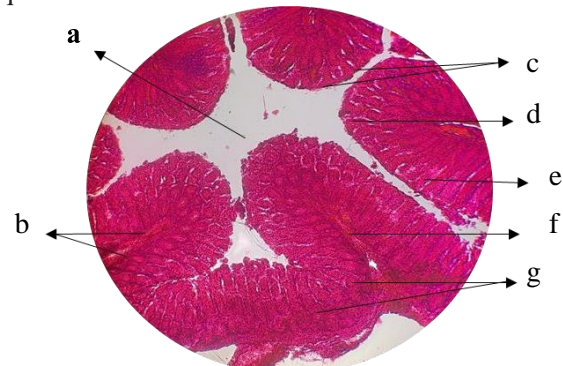


Gambar 2. Histology of the stomach in squirrel kekes (a. Adipose cells, b. Serosa (visceral peritoneum), c. Gastric pits, d. Rugae, e. Surface epithelium, f. Submucosa, g. Lamina propria, h. Muscularis mucosae).

or elevation of the mucosa (with a submucosal nucleus) that extends into the intestinal lumen. The circular plicae are most prominent in the proximal part of the small intestine, where most of the absorption occurs; they decrease prominently towards the ileum (Eroschenko, 2005).

Smooth muscle fibers of the muscularis mucosa extend to the nucleus of individual villi and are responsible for their movement. This action increases

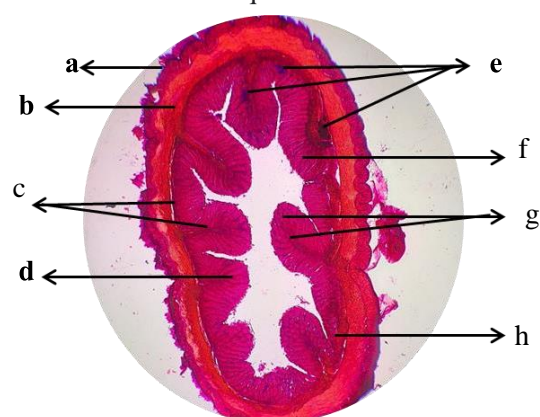
the contact of the villi with digested food products in the intestine. Microvilli are cytoplasmic extensions that cover the apex of the intestinal absorption cells. They are visible under a light microscope as striated borders (brushes). Microvilli are coated by mantle glycoprotein glycocalyx, which contains brush border enzymes such as lactase, peptidase, sucrase, lipase, and others which are important for digestion (Eroschenko, 2005). The following is the histology of the small intestine in squirrel kekes:



Gambar 3. Histology of the small intestine in squirrel kekes (a. Plica circularis, b. Muscularis mucosae, c. Intervillous spaces, d. Lining epithelium (with goblet cells), e. Lamina propria, f. Submucosa, g. Intestinal glands).

The wall of the large intestine has the same basic lining as the small intestine. The mucosa consists of simple columnar epithelium, intestinal glands, lamina propria, and muscularis mucosa. The underlying submucosa contains connective tissue cells and fibers, various blood vessels, and nerves. Two layers of smooth muscle make up the muscularis externa.

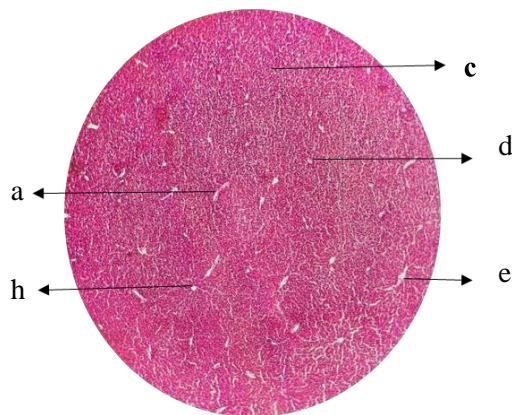
The serosa (visceral peritoneum and mesentery) includes the transverse colon and sigmoid colon. (Eroschenko, 2005). The submucosa has many blood vessels. Muscularis externa consists of an inner circular layer and an outer longitudinal layer. The parasympathetic ganglia of the myenteric plexus lie between the inner and outer smooth muscle layers of the external muscularis. In the lamina propria and submucosa of the large intestine are lymphatic nodules (Eroschenko, 2005). The following is the histology of the colon in the kekes squirrel:



Gambar 4. Histology of the large intestine in squirrel kekes (a. Serosa, b. Muscularis externa, c. Muscularis mucosae, d. Epithelium, e. Lymphatic nodule, f. Lamina propria, g. Temporary fold, h. Submucosa).

In the liver, in the center of each lobule is a central vein. Radiating from each central vein towards the periphery of the lobule are the liver cell plates. Located between the liver plates are blood vessels called the hepatic sinusoids. Arterial and venous blood mix in the sinusoids of the liver and then flow into the central veins of each lobule. From the central vein the liver cell plates radiate toward the peripheral lobules. Located between these plates the liver cells are blood vessels called sinusoids. Sinusoids carry blood from the portal vein and hepatic artery to the central vein. Both central and sinusoid veins are limited by discontinuous endothelium type and fenestration (Blagojevic, 2019).

On the side of each lobule can be seen several portal areas within the interlobular septa. Within the interlobular septa are also found small lymphatic vessels and nerves, which are small and only occasionally seen. The following is the histology of the liver in the kekes squirrel:



Gambar 5. Histologi hati tupai kekes (a. Portal vein, b. Central vein, c. Hepatic sinusoid, d. Central vein, e. Portal vein).

CONCLUSION

Based on the research that has been done, it can be concluded that the researcher can find out the histology of the digestive organs of the kekes squirrel which shows that the organs of the esophagus, stomach, small intestine and large intestine are found in some of the same tissues, among others, epithelium tissue, lamina propria, mucosa, submucosa, serous and adipose. While the liver is found in several tissues including the hepatic sinusoid, central vein, portal vein, hepatic arteries and lymphatic vessels.

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