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Studi Perbandingan Histologi Kulit *Clarias gariepinus* dan *Oreochromis niloticus*

A Comparative Histological Study of Skin in Clarias gariepinus and Oreochromis niloticus

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ABSTRAK

Penelitian ini bertujuan untuk mengevaluasi perbandingan gambaran histologis pada kulit *Clarias gariepinus* dan *Oreochromis niloticus*. Sebanyak 18 sampel diamati dan diambil kulit yang diawetkan. Pewarnaan hematoksilin-eosin dilakukan untuk mengetahui struktur histologis. Hasil penelitian menunjukkan bahwa terdapat perbedaan struktur lapisan epidermis dan dermis antara kulit *C. gariepinus* dan *O. niloticus*. *Club cell* mendominasi pada lapisan epidermis *C. gariepinus*. Sel berpigmen terlihat jelas pada *lamina basalis C. gariepinus* dibandingkan dengan *O. niloticus*. Stratum compactum pada *O. niloticus* juga menunjukkan struktur yang rapat dibandingkan C. gariepinus.

Kata Kunci: *Clarias gariepinus*; *Oreochromis niloticus*; kulit; histologi

ABSTRACT

This study aimed to evaluate the comparative of histological figures in *Clarias gariepinus* and *Oreochromis niloticus* skin. A total of 18 samples were observed and collected the skin preservation. The hematoxylin-eosin staining performed to determine the histological structure. Results showed that there were different structures in the epidermis and dermis layer between *C. gariepinus* and *O. niloticus* skin. Club cells showed dominated in the epidermis layer of *C. gariepinus*. The pigmented cell showed clearly in the basement layer of *C. gariepinus* compared to *O. niloticus*. Stratum

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compactum in *O. niloticus* also showed more tightly arranged compared than *C. gariepinus*.

Keywords: *Clarias gariepinus*; *Oreochromis niloticus*; skin; histology

INTRODUCTION

African catfish (*Clarias gariepinus*) is the result of interbreeding between female catfish *C. fuscus* native to Taiwan and male *C. mossambicus* originating from Africa and growing so fast (Dauda *et al.*, 2018). In fact, *C. gariepinus* does have superior characteristics, can grow rapidly and reach large sizes in a shorter time than local catfish (Fauji *et al.*, 2018). The number of eggs of *C. gariepinus* can reach 30,000-40,000 eggs / kg of female parent, while local catfish is only 1,000-4,000 eggs per kg of female parent (Hassan *et al*., 2018). Therefore, *C. gariepinus* is widely cultivated by the community today. Moreover, the consumption of catfish from year to year is increasing (Engle *et al*., 2020).

Tilapia (*Oreochromis niloticus*) is also a freshwater fish that has a high consumption rate. *O. niloticus* is in demand by the public because the meat is dense, thick and the price is relatively cheap (Suryani and Arya, 2017). *O. niloticus* cultivation is faced with the constraints of high feed costs and long cultivation times (Effendi *et al*., 2020).

In general, vertebrate skin consists of several layers, with two main layers i.e. the outer layer called the epidermis layer and the inside is called the dermis layer. The epidermis layer in fish always looks wet because of the mucus produced by the cup-shaped cells that are found all over the body surface (Romano *et al*., 2019). In the dermis layer there are blood vessels, nerves, and connective tissue. *O. niloticus* skin has a high collagen content. Collagen is a fibrous protein which is the main component of connective tissue and is the most abundant protein in mammals. Collagen is also found in bones, tendons, skin, blood vessels and corneas (Zhou *et al*., 2017). This study was conducted to evaluate the differences in the histological structure of the skin of *C. gariepinus* and *O. niloticus*.

MATERIALS AND METHODS

Ethical approval

The ethical approval for this study was not required due to in accordance with the native protocol in fish skin preservation.

Samples

A total of 18 samples *C. gariepinus* and *O. niloticus* were used as samples. All samples were reared in a different pond with standard protocol. This study conducted for 40 days to obtain the age of adult fish. The skin sample collected from adult fish using a blade surgery along 2 cm x 2 cm. A 15% of formaldehyde used for the fixation solution for each collected sample.

Hematoxylin-eosin (HE) staining

The skins were stored in formaldehyde 15% for 48 h. Furthermore, alcohol was used as a dehydration agent

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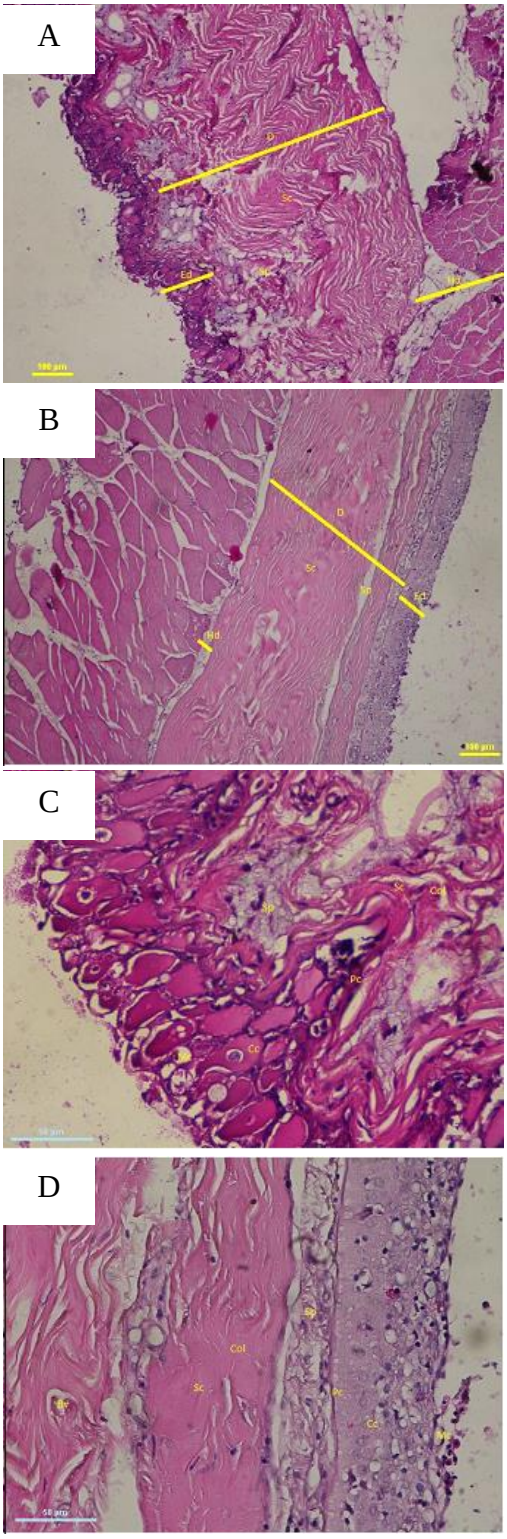
with concentration of 70%, 80%, and 96%. Xylol was used for the clearing process and continued making paraffin block at a temperature of 60°C. The skin tissue that has received paraffin blocks then sliced using a microtome machine and then transferred into a water bath before being placed on a glass object. The HE staining performed for 2 h then mounting the glass object for further observation (Purnama *et al*., 2019).

Data analysis

This study evaluated descriptively and observed using Binocular Microscope (LED CX22, Olympus). The histological figure captured in 100, 400 and 1000 magnification.

RESULT

Based on the results of microscopic observations, the skin of *C. gariepinus* and *O. niloticus* consists of the epidermis, dermis, and hypodermis layers (Figure 1A-B). Pigment cells on the dorsal part of *C. gariepinus* are more commonly found than *O. niloticus*. Pigment cells appear blackish-brown on the dorsal and brown on the abdomen. In addition to providing a color pattern to fish skin, pigment cells also function to absorb and reflect radiation thereby contributing to regulating body temperature in fish. The dermis layer of both fish skin is composed of connective tissue, blood vessels, pigment cells and fat tissue (Figure 1C-D). Mucus cells on the dorsal part of *O. niloticus* skin are more commonly found than *C. gariepinus* (Figure 1E-F).



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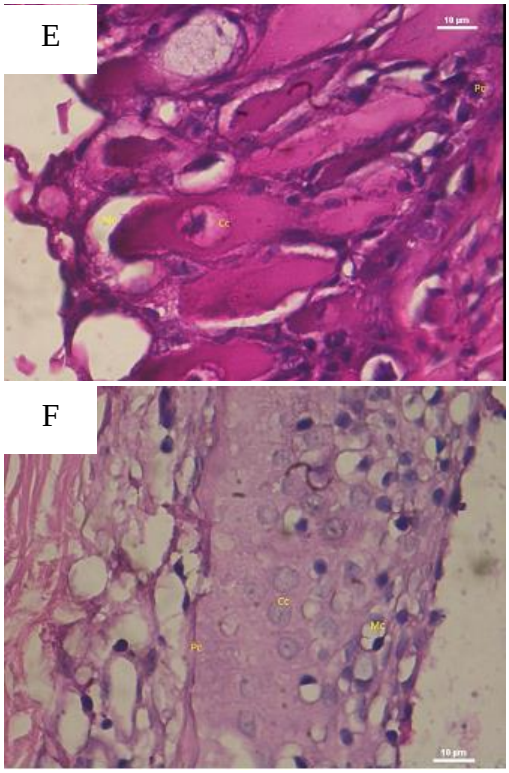

Figure 1. Histological overview of *C. gariepinus* (A) 100; (C) 400; (E) 1000 magnification. Histological overview of *O. niloticus* (B) 100; (D) 400; (F) 1000 magnification, respectively. Ed= epidermis; D= dermis; Hd= hypodermis; Mc= mucus cell; Cc= club cell; Pc= pigmented cell; Col= collagen fiber; Sc= stratum compactum; Sp= stratum spongiosum.

DISCUSSION

The epidermis layer consists of stratified squamous epithelial cells, mucus cells, club cells, and pigment cells (Dash *et al*., 2018). The basement layer of the epidermis is called the stratum germinativum. The constituent epithelium of this layer is composed of basal cells. There are no blood vessels in the epidermis layer. In accordance with the statement of Tiralongo *et al.* (2018), that the blood vessels are not found in the epidermis layer, thus the metabolic needs are obtained by diffusion.

The thickness of the epidermal layer varies greatly depending on the part of the body, age, sex, stages of the reproductive cycle, and environmental conditions (Lauder *et al*., 2016). The fish epidermis layer consists of squamous and cuboidal epithelial cells, mucus cells, lymphocytes, macrophage cells, and specific cells in certain fish species (Brinchmann, 2016). The epithelial cells in fish skin are active metabolic tissues. The outer epithelium of the fish skin is very actively proliferated so that it is reformed regularly and always maintains a balance between proliferation and differentiation (Wainwright and Lauder, 2017).

Mucus cells have a role as a lubricant for the surface of the skin, the mucus produced can act as a deterrent to the entry of various pathogens and their colony formation in the epidermis. Mucus acts as a lubricant to reduce body surface friction in the water, helps in swimming and also protects the body from abrasion when digging nests (Reverter *et al*., 2018). Excessive mucus secretion occurs in fish that live in hiding and muddy dwellings. Mucous cells can be distinguished from the basal epidermis and then as they increase in size they move towards the surface where they secrete their fluid (Guardiola *et al*., 2016).

Club cell functions as a chemical alarm that gives a signal if there is a threatening danger or often called "alarm cell". These cells will burst when there is a threat from a predator and will release pheromones that produce a fear reaction when the skin is physically damaged, thereby triggering an avoidance response

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to the predator. Club cells help in the healing of epithelial cells and mucosal cells that are damaged during injury caused by pathogenic agents (Rasmussen and Sagasti, 2018).

The dermis is divided into two parts i.e. the stratum spongiosum on the outside and the stratum compactum on the inside. In the stratum spongiosum that leads to the relatively loose part of the epidermis, it is composed of fatty tissue, blood vessels, and there is also collagen connective tissue. Stratum compactum is found collagen connective tissue that is arranged regularly and is thicker (Drelich *et al.*, 2018).

Collagen fibers are scattered in the dermis layer of the skin, in the stratum spongiosum the collagen fibers are looser, while in the stratum compactum the collagen fibers are very tightly arranged (Arumugam *et al*., 2018). On the dorsal skin, the collagen fibers are thicker than in the abdomen based on the thickness of the stratum compactum. Apart from being rich in collagen, the dermis layer is where the scales form in fish. The scales form in the dermis so that they are termed the dermis skeleton, and usually, the scales are covered by epidermal tissue (Ali *et al.*, 2018).

CONCLUSION

In conclusion, based on this finding there was a comparative morphology on the epidermis layer between *O. niloticus* compared to *C. gariepinus*. Mucus cell and club cell showed adequately in the epidermis layer of *O. niloticus*. In contrast, only club cells showed dominated in the epidermis layer of *C. gariepinus*. On the other hands, pigmented cell showed clearly in the basement layer of *C. gariepinus* compared to *O. niloticus*.

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