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Overview of Digestive Enzyme Activity in the Digestive Tract Carnivorous Fish

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ABSTRACT

Catfish and cork fish are a type of carnivorous fish. Carnivorous fish need protein-rich feed for their growth and survival. The purpose of this review article is to get an overview of amylase and protease activity in the digestive tract of carnivorous fish. Based on the results of a review of several studies that have been practiced obtained an image that the activity of amylase enzymes in the digestive tract of carnivorous fish is very dependent on the type of feed. which entered his digestive tract. Natural feed can stimulate increased activity of amylase enzymes rather than artificial feed. The activity of protease enzymes in the digestive tract of carnivorous fish remains high both naturally fed and artificial feed. Protease activity will decrease if in the digestive tract of the fish no feed enters and will increase again when the feed is already in the digestive tract.

Keywords: Amylase, Protease, Artificial Feed, Natural Feed.

INTRODUCTION

Freshwater fish is a fish that is much loved and consumed by most Indonesians. Some types of freshwater fish that are much loved by the people of Indonesia include Cork Fish (*Channa striata*) and Catfish (*Clarias batrachus*) (Oktavianto *et al*. 2014). Both types of fish belong to the group of carnivorous fish, namely fish whose food sources come from animals.

Cork fish (*Channa striata*) is one of the freshwater commodities that has a high economic value. This fish has a head shape resembling a snake so it is called *Snakehead* and is also known by the local name delak fish or arun fish (Yuniarti *et al.* 2013). Cork fish becomes an economically important aquaculture commodity because this fish has a high selling value. In addition, the various benefits of cork fish cause this fish to be in great demand by the public, including for processed various types of food, curing various diseases, and also the potential to be cultivated (Rahmawanty *et al*. 2014).

Catfish (*Clarias batrachus*) is one type of freshwater fish that has high economic value. This type of fish has been cultivated commercially by the people of Indonesia, and is one of the potential sources of income among fish farmers. This fish is widely consumed because it is easy to process, much liked, and has a high protein content. In addition, this fish is also cultivated because it has a relatively fast growth time (Amri and Khairuman 2008).

The ability of cork fish and catfish in digesting food depends heavily on the completeness of the digestive organs and the availability of digestive enzymes. The content of nutrients in feed seems to also have an effect on the activity of digestive enzymes (Fitriliyani 2011). The purpose of this review article is to get an overview of amylase and protease activity in the digestive tract of carnivorous fish.

Catfish Morphology

Catfish or also referred to as catfish are classified as *nocturnal* animals, which is actively foraging at night. Catfish generally have an ash to blackish color and have an elongated and flattened body. Catfish have a flattened head shape, have breathing apparatus called *arborescent* and do not have scales. Catfish eyes are 1/8 of the length of their head. Catfish have gills located on the back of the head with a small size. It has 4 pairs of sungut / misai, the number of catfish dorsal fins is 68-79, the pectoral fins are 9-10, in the abdominal fins 5-6, and anal fins as much as 50-60. The pectoral fins are equipped with sharp spines referred to as patils that have a maximum length of up to 400 mm. The teeth are villiform and attached to their jaws (Suyanto 2007).

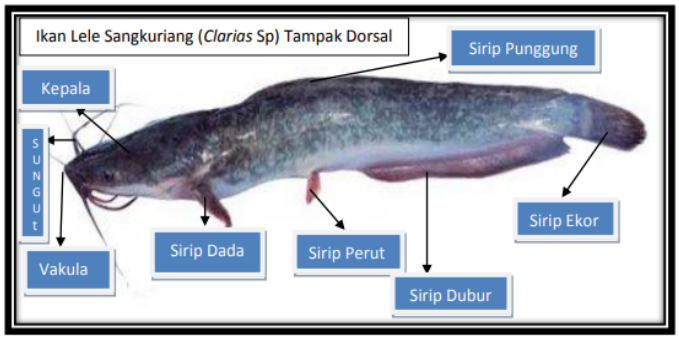

Figure 1. Catfish

Source: Khairuman and Amri (2009)

Cork Fish Morphology

This fish usually lives in rivers, lakes, and ponds / ponds, and used to make nests in swamp areas or among the thickets found on the banks of ponds and rivers. Morphologically, the body shape of the cork fish is elongated, the surface of the body tends to be rough and covered by thick scales up to the head. The head of the cork fish has a snake head-like shape. The length of the dorsal fin that basically reaches the base of the tail, the beginning of this fin is above or slightly behind the chest comb. Between the base of the dorsal fin and the lateralis linea there are 4 - 5 rows of scales, dorsal 38 - 43, anal 23 - 27, linea lateralis (Lt) 52 - 57. The length of the pectoral fin is shorter than the head behind the eyes. Generally, the back of the back of the cork fish is dark and the abdomen (abdominal) is white. Round tail fin *(rounded)* (Saanin 1986). Cork fish is a labyrinth fish that is able to survive outside the water, because it has an additional breathing apparatus in the form of thin skin folds that wind around like a maze (Soeseno 1988).

Figure 2. Cork fish

Source: www.minapoli.com

Digestive Enzyme Activity

Carnivorous fish need protein-rich feed for their growth and survival. The ability of fish to digest food depends heavily on the completeness of the digestive organs and the availability of digestive enzymes (Fitriliyani 2011). Knowledge of the development of digestive enzymes in fish larvae is very important in understanding the mechanism of growth and survival of fish larvae, because the digestive tract of fish in general undergoes very rapid changes, both morphology and function during ontogeny so as to affect the survival of larvae during cultivation conditions (Yulintine *et al.* 2012).

The activity of digestive enzymes can provide information about the digestibility of feed (Caruso *et al.* 2009). Studies of the activity of digestive enzymes such as proteases and

amylases can be used to determine the ability of a species to digest proteins and carbohydrates (Hidalgo *et al*. 1999, Klahan *et al*. 2009).

Amylase enzyme is an enzyme that is able to catalyze the process of starch hydrolyzing to produce simpler molecules such as glucose, maltose, and dextrin. Starch is the largest group of carbohydrate reserves owned by plants after cellulose (Nangin and Sutrisno 2015). Meanwhile, protease enzymes are enzymes that function to catalyze the hydrolysis of peptide bonds in proteins. Known sources of protease enzymes come from animals, microbes, and plants (Fathimah and Wardani 2014).

Amylase Activity in the Digestive Tract of Catfish

Based on research conducted by Nurhayati *et al.* (2014) regarding the development of the digesting enzyme and the growth of dumbo catfish larvae, which are given a combination of silk worms and artificial feed, it is explained that in dumbo catfish larvae fed 75% natural feed and artificial feed 25% (PA75 + PB25) showed an increase in the observation of day 2. On observations of the 4th to 8th day enzyme activity tends to decrease, but in the natural feeding treatment 100% (PA) enzyme activity increases higher than other treatments. On observations of days 10 to 15 amylase enzyme activity in all treatments tended to increase and PA administration treatment experienced an increased peak on day 15 observations.

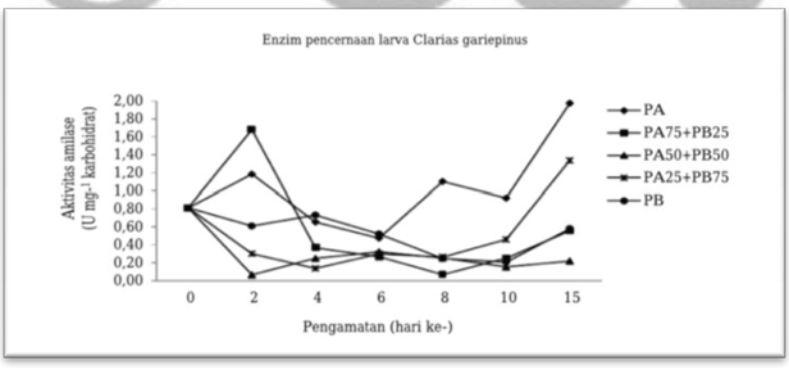

Figure 3. Amylase enzyme activity of dumbo catfish larvae (Nurhayati *et al.* 2014)

On the observation of the 2nd day amylase activity tends to increase in the treatment of PA75 + PB25. This is suspected, the contribution of artificial feed and silk worms as a substrate of food that stimulates the digestive tract to produce endoenzymes. In addition, it is suspected that catfish larvae are able to utilize carbohydrates in small amounts in the early stages. It is seen that amylase activity decreases with the age of the larvae. The same is obtained by Yulintine *et al.* (2012) that betok fish larvae (*Anabas testudineus*) have the ability to digest carbohydrates in the early stages.

Amylase Activity in The Digestive Tract of Cork Fish

Based on research conducted by Mikdarullah and Nugraha (2019) regarding the test of amylase enzyme activity in cork fish larvae with different feeding it is explained that amylase activity in larvae fed *Moina* sp. is relatively higher compared to amylase activity given artificial feed.

Amylase activity in the larvae of cork fish fed *Moina* sp. is relatively higher because the availability of proteins available in *Moina* sp. is high enough that the larvae of cork fish that have just developed their digestive organs can develop properly because their digestive enzymes are available from *Moina* sp. (Micale *et al.* 2006). Amylase activity during the transition from natural feed to artificial feed decreased. This is suspected that the larvae of cork fish undergo a period of transition to digested feed. After the 15th day, the larvae of cork fish already have a high ability to digest artificial feed. This is related to amylase activities that are already well available.

Protease Activity in The Digestive Tract of Catfish

Based on research conducted by Hanum *et al*. (2013) protease enzyme activity decreased significantly when the fish were hungry or not fed. Conversely, by the time the fish are fed, protease activity increases again. Chong *et al.* (2002) it emerged that proteases are enzymes that will increase their activity if there are inducting compounds, namely food in animal digestive channels.

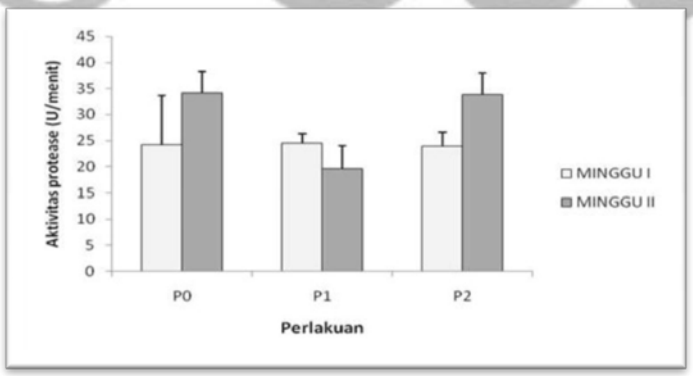

Figure 4. Protease activity of dumbo catfish in the treatment of weeks I and II P0: fish is not satisfied, P1: fish are satisfied dan P2: fish are re-fed (Hanum *et al* 2013).

Protease Activity in The Digestive Tract of Cork Fish

Based on research conducted by Mikdarullah and Nugraha (2018) regarding protease enzyme activity tests in cork fish larvae, with different feeding it is explained that enzyme activity in larvae fed *Moina* sp. is relatively higher compared to protease enzyme activity during the transition period for feed turnover. Protease enzyme activity increases again after

the 15th day and has been given artificial feed (pellets). The activity of protease enzymes in cork fish larvae fed *Moina* sp. is relatively higher. It is suspected that the availability of protein available in *Moina* sp. is quite high. So that the larvae of cork fish that have just developed their digestive organs can develop well because their digestive enzymes are available from *Moina* sp. (Micale *et al.* 2006).

Enzyme activity during the transition from live feed to artificial feed decreases. It is suspected that cork fish larvae undergo a transition period to digested feed. While the availability of protease enzymes in his body is still very limited. After the 15th day, the larvae of cork fish already have a high ability to digest artificial feed. This is related to the activity of protease enzymes that are already well available.

According to Taufik *et al.* (2017), the change of enzyme activity can be affected by the concentration of enzymes and the concentration of substrates. The concentration of enzymes has an impact on the catalytic reaction speed of enzymes, when the concentration of enzymes increases then the reaction speed also increases, otherwise if the enzyme concentration is low then the reaction speed will be slower. The increasing concentration of the substrate will increase the reaction speed to a certain point (V max). The presence of digestive enzymes is a biological indicator of the ability of fish to digest their food. When enzyme activity is high, then physiologically the fish body has been able to digest the nutrients of the feed provided (Gawlicka *et al.* 2000).

Carnivorous fish need feed rich in protein and lipids, while carbohydrate consumption is low. According to Furne *et al.* (2005) that enzyme activity in the digestive tract of fish is influenced by eating habits.

CONCLUSION

Based on the results of a review of several studies that have been conducted, it is obtained that the activity of amylase enzymes in the digestive tract of carnivorous fish depends largely on the type of feed entered in the his digestive tract. The natural feed can stimulate increased activity of amylase enzymes rather than artificial feed. The activity of protease enzymes in the digestive tract of carnivorous fish remains high both naturally fed and artificial feed. Protease activity will decrease if in the digestive tract of the fish no feed enters and will increase again when the feed is already in the digestive tract.

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