Disgestive enzyme profile of jelawat fish larvae (*Leptobarbus hoevenii*, Bleeker 1851)

Nur Asiah[1*], *Sukendi*[1], *Nofrizal*[2], and *Masrurotul* Khoirin Najah[3]

[1]Department of Aquaculture, Faculty of Fisheries and Marine, Riau University, Pekanbaru, Indonesia
[2]Department of Aquatic Resources Utilization, Faculty of Fisheries and Marine, Riau University, Pekanbaru, Indonesia
[3]Department of Masters in Chemistry Education, University of Riau, Pekanbaru, Indonesia

Abstract. The ability of fish larvae to digest the appropriate type of feed can be seen through enzymatic activity. The digestive tract contains active enzymes including amylase, lipase and protease. This research was conducted at the Fish Hatchery and Breeding Laboratory, Faculty of Fisheries and Marine, Riau University and sample analysis at the Nutrition Laboratory, Bogor Agricultural Institute. The research aims to evaluate the ability of jelawat fish larvae (*Leptobarbus hoevenii*) to digest external feed through digestive enzymes. Newly hatched larvae are reared in fiber tanks measuring 2x1x0.5m with a density of 10,000 individuals, volume 1000 L. In rearing containers, larvae from 2 to 6 days old are given artemia food, starting from 7 days old they are given artificial F0 food. Feed was given twice a day in the morning and evening ad libitum. Observations were made on 0 day old larvae (D-0), (D-1) – (D-4), (D-6) and (D-8). Observation of protease, amylase and lipase enzyme profiles was carried out by sampling 1 gram of larvae. The results of observations on the activity of amylase, lipase and protease enzymes in jelawat fish were positively correlated with larval growth. Digestive enzyme activity increases when the larvae receive food from outside the body.

1 Introduction

Jelawat fish (*Leptobarbus hoevenii*, Bleeker 1851) is an economically important freshwater fish native to Indonesia. Many people have tried to raise these fish, both on a traditional scale and on a business scale especially in Riau, Jambi and South Sumatra Provinces [1]. According to [2] habitat Jelawat fish is found in Kalimantan and Sumatra, this fish is very popular among the people, especially in the provinces of Jambi, Riau, South Sumatra and Central Kalimantan.

Market demand for jelawat fish is increasing, but the availability of jelawat fish in nature is starting reduced due to high fishing which was not balanced by restocking. To solve the problem Jelawat fish cultivation activities must be carried out. However,

* Corresponding author: nur.asiah@lecturer.unri.ac.id

© The Authors, published by EDP Sciences. This is an open access article distributed under the terms of the Creative Commons Attribution License 4.0 (https://creativecommons.org/licenses/by/4.0/).

jelawat fish cultivation is still hampered by seed availability and productivity levels are still low [3].

The development of jelawat fish cultivation is often faced with problems fish grow slowly, get stressed easily, and have a high level of sensitivity. This is because Feeding jelawat fish tends to be less than optimal, plus nutritional requirements are high contained in the feed has not been fulfilled. To develop jelawat fish well, then Correct cultivation methods are needed, such as providing feed with good nutrition [1].

Knowledge of the development of digestive enzymes in fish larvae are things which is very important in understanding the mechanics stimulate growth and survival of larvae fish, because the fish's digestive tract is in generally undergo very rapid changes pat, both morphology and function during ontogeny thereby influencing continuity larval life during cultivation conditions [4]. The activity of digestive enzymes is a good indicator to determine digestive capacity, when enzyme activity high digestibility, it can be indicated that Physiologically the larvae are ready to process food. from outside [5].

The presence of digestive enzymes including protease, amylase and lipase, is a bio logical indicator of the ability of larvae to digest food exogenous which each plays a role in digestion of proteins, carbohydrates and fats. High enzyme activity can indicates that physiologically The larvae are capable of processing food exogenous. By hence, the activity of digestive enzymes can be an important parameter for evaluating feed utilization and fish growth [6].

Several studies have been conducted on the activity digestive enzymes serve more purposes to determine the enzyme profile linked to development growth in certain types of larvae, good in fish [7, 8, 9], as well as in other marine organisms [10]. However, research of associated enzyme activity with early exogenous feed is still very limited. In fact, information regarding associated digestive enzyme activity with exogenous feeding and growth in jelawat fish larvae Early stages have not yet been obtained. Therefore, This research was conducted to find out influence of early exogenous feeding on the activity of digestive enzymes and growth of jelawat fish larvae on early stage.

2 Research Methods

2.1 Time and Place of Research

This research was carried out for 30 days in July-August 2024 includes research preparation, research implementation, data processing and discussion of research results. This research was conducted at the Fish Hatchery and Breeding Laboratory, Faculty of Fisheries and Marine, Riau University and sample analysis at the Nutrition Laboratory, Bogor Agricultural Institute.

2.2 Larval Rearing

Larval rearing is carried out in hatchery at the Faculty of Fisheries and Marine, Riau University uses 1 each square tub maximum capacity 1,000 L. Density initial larvae around 10 individuals/L. Every tub equipped with an aeration system as source of dissolved oxygen supply.

2.3 Larval Samples

Larvae aged 1 to 8 days after hatches were used as inner samples this research. A total of 10 larval at each age used for enzyme activity analysis. The larvae are removed carefully, then washed with a mesh plankton net 120 µm to clean samples from dirt. The sample is then placed into in micro tubes with a volume of 2 ml and weighed. Samples are stored in the freezer at a temperature of -80^{o}C until carried out analysis. Besides that, at every age larvae were also used for 10 larvae measurement of endogenous food and total larval length. Measurement of endogenous feed is F0 feed carried out based on [11].

2.4 Parameter

The parameters observed are digestive enzyme activity which includes protease, amylase and lipase; absorption exogenous feed and growth consists of total length and body weightlarvae. Analysis of digestive enzyme activity carried out in the Nutrition laboratory of the Bogor Agricultural Institute

2.5 Data analysis

The data is presented in graphical form and explained using descriptive methods.

3 Results and Discussion

3.1 Result

Protease, amylase and lipase activity in larvae aged 1 to 8 days after hatching shows a range of values between 0.023-2,101 units/larva (Figure 1-3).

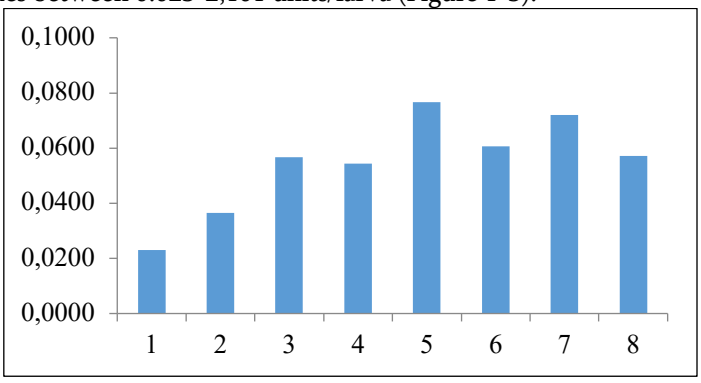

Fig. 1. Protease activity in jelawat larvae aged 1-8 days fed exogenous feed in the form of jelawat fish larvae for 1-6 days and F0 feed for 7-8 days

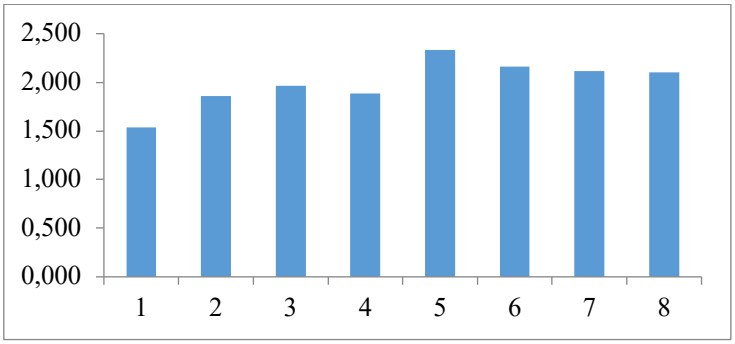

Fig. 2. Amilase activity in jelawat larvae aged 1-8 days fed exogenous feed in the form of jelawat fish larvae for 1-6 days and F0 feed for 7-8 days

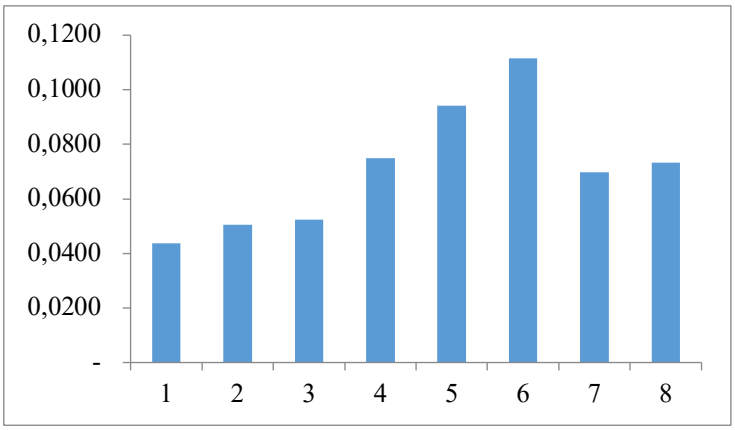

Fig. 2. Lipase activity in jelawat larvae aged 1-8 days fed exogenous feed in the form of jelawat fish larvae for 1-6 days and F0 feed for 7-8 days

3.2 Discussion

The activities of lipase and protease enzymes tend to fluctuate with increasing larval age. Lipase activity the highest during maintenance was obtained at day 6. It is suspected that the larvae are able to digest fat from artemia food as well exogenous enzymes carried by natural feed artemia is relatively high so that the enzyme activity detected is also high [12].

Protease activity fluctuated on days 1 to 8 of observation on day 5 which increased significantly compared to other days. High protease activity in the treatment is caused by the development of organs digestion and the presence of protein content in the feed. Cara *et al.* [13] mentioned that the high pattern of protease activity is due to changes in feed, because the synthesis of the main digestive enzymes in fish larvae and fry is dependent on the quantity and quality of feed. The activity of each digestive enzyme in

fish develops in various ways depending on the fish species, feeding habits and biochemical composition of the feed. Apart from that, it's an improvement the activity of this protease enzyme is suspected as well due to the presence of a food substrate eaten by larvae mainly contribute Endogenous enzymes from natural feed consumed to increase activity these enzymes in the digestive tract [14].

Amylase activity in larvae fed exogenous feed tends to be higher compared with protease activity and lipase. This shows that the process carbohydrate hydrolysis is more active than hydrolysis of proteins and fats. Structure simpler carbohydrate molecules and the absence of a specific structure, allows the hydrolysis process amylase can be done quickly [15]

Decreased enzyme activity at 6 days of age due to the growth of potential back spines and pectoral spines, where the larvae at this age is the second critical phase after goes through the first critical period at the age of 2-3 days when there is a change in food source from inside the body (endogenous) to food from outside the body (exogenous) [16]

The activity of digestive enzymes is influenced by several factors, namely the age of the larvae, type and composition of feed [16]. Exogenous enzymes generally varies depending on the type feed consumed by larvae, enzymes exogenous can activate increased enzyme activity by activating zymogen, produces protease [17]. Production of digestive enzymes closely correlated with the development of the digestive system structure and larval age.

According to [18], the type of feed given has an influence on the activity of digestive enzymes, where certain types of feed can improve activity of larval digestive enzymes. Giving Artificial feed must be adapted to physiological readiness of larvae due to food artificial consists of nutrients that have complex molecular structures and not contains enzymes so it is necessary availability of enzymes to digest it. The ability of fish to digest food very dependent on the completeness of the organ digestion and the availability of digestive enzymes. The development of the digestive tract takes place gradually and after the fish reaches a certain size or age, then the digestive tract will reach perfection. On early larval stage, structure of the digestive system which is still simple in larvae also correlates with low enzyme production digestion [19].

4 Conclusion

The results showed that the activities of protease, lipase and amylase enzymes were positively correlated with larval growth. Digestive enzyme activity increases when the larvae receive food from outside the body. Larvae that have been given artificial food at the age of 7 days tend to have lower enzyme activity than larvae before being given artificial food. It is suspected that the structure of the digestive system of jelawat fish larvae is still simple.

References

1. N. Rizki, M. Sugihartono, M. Ghofur, Blood glucose response of jelawat fish seed (*Leptobarbus hoevenii* Blkr) in media treated with sweet potato leaf extract (*Ipomoea*

batatas). Jurnal Akuakultur Sungai dan Danau. **5**, 50-54 (2020). http://dx.doi.org/10.33087/akuakultur.v5i2.68

2. E. Prasetio, E.I. Raharjo, Ispandi, The effect of stocking density on the growth and survival of jelawat fish seed (*Leptobarbus hoeveni*). Jurnal Ruaya. **4**, 1-9 (2016). http://dx.doi.org/10.29406/jr.v4i1.722
3. A. Riyoma, R. Diantari, A. Damai, Analysis of water suitability for cultivating jelawat fish (*Leptobarbus hoevenii*) (Bleeker, 1851) in Way Jepara Lake, Way Jepara District, East Lampung Regency. Jurnal Sains Teknologi Akuakultur. **3**, 19-32 (2020)
4. Yulintine, E. Harris, D. Jusadi, R. Affandi, Alimuddin. Development of enzyme activity in the digestive tract of betok fish larvae (*Anabas testudineus bloch*). Jurnal Ilmu Hayati dan Fisik. **14**, 1, 59-67 (2012)
5. Y.P. Kotzamanis, E. Gisbert, F.J. Gatesoupe, J.Z. Infante, C. Cahu, Effects of different dietary levels of fish protein hydrolysates on growth, digestive enzymes, gut microbiota, and resistance to Vibrio anguillarum in European sea bass (*Dicentrarchus labrax*) larvae. Comp. Biochem. Physiol. A. Mol. Integr. Physiol. **147**, 205-214 (2007). https://doi.org/10.1016/j.cbpa.2006.12.037
6. B. Hazman, K. Gokcek. The Effect of Different First Feeds on Proteolytic Activity of the Northern Pike, Esox lucius Linneaus 1758, Post-Larvae. Turkish Journal of Fisheries and Aquatic Sciences. **14**, 875-878 (2014). https://doi.org/10.4194/1303-2712-v14_4_04
7. R. Martinez-Lagos, D. Tovar-Ramirez, V. Gracia-Lopez, J.P. Lazo, Changes in digestive enzyme activities during larval development of leopard grouper (*Mycteroperca rosacea*). Fish Physiol. Biochem. **40**, 773-85 (2013). https://doi.org/10.1007/s10695-013-9884-5
8. C. Suzer, D. Coban, S. Yildirim, M. Hekimoglu, H.O. Kamaci, K. Firat, S. Saka, Stage-specific ontogeny of digestive enzymes in the cultured common dentex (Dentex dentex) larvae. Turkish Journal of Fisheries and Aquatic Sciences. **14,** 759-768 (2014). https://doi.org/10.4194/1303-2712-v14_3_18
9. A.O. Teles, A. Couto, P. Enes, H. Peres, Dietary protein requirements of fish a meta analysis. Reviews in Aquaculture. **12**, 1-33 (2019). https://doi.org/10.1111/raq.12391
10. N. Andi, S. Komsanah. Development of digestive enzyme activity in crab larvae *Portunus pelagicus*. Jurnal Ilmu dan Teknologi Kelautan Tropis. **9**, 443-452 (2017). http://dx.doi.org/10.29244/jitkt.v9i2.19280
11. S. Bejo, A. Titiek, Development of digestive enzyme activity of king sunu grouper larvae (*Plectropomus laevis*). Jurnal Ilmu dan Teknologi Kelautan Tropis, **8**, 1-10 (2016)
12. Nurhayati, B.P.U. Nur, Development of digestive enzymes and growth of African catfish larvae, *Clarias gariepinus* Burchell 1822, which were given a combination of silk worms and artificial feed. Jurnal Iktiologi Indonesia. **14**, 167-178 (2014). https://doi.org/10.32491/jii.v14i3.78
13. J.B. Cara, F.J. Moyano, S. Cardenas, C. Fernandez-Diaz, M. Yufera, Assessment of digestive enzyme activities during larval development of white bream. Journal of Fish Biology. **63** (2003). https://doi.org/10.1046/j.1095-8649.2003.00120.x

14. R. Melianawati, R. Pratiwi, N. Purniawati, P. Astuti. The effect of various kind of live feeds to digestive enzymes activity of coral trout *Plectropomus leopardus* (Lacepède, 1802) larvae. Journal fisheries and aquatic studies. **3**, 83-88 (2015).

15. R. Melianawati. R. Pratiwi, The effects of initial exogenous feed on digestive enzymes activity and growth of *Epinephelus fuscoguttatus* (Forsskal, 1775) Larvae. J. Ilmu dan Teknologi Kelautan Tropis, **14**, 131-146 (2022). https://doi.org/10.29244/jitkt.v14i1.39801

16. C. Navarro-Guillen, F.J. Moyano, Y. Manuel, Diel food intake and digestive enzyme production patterns in Solea senegalensis larvae. Aquaculture. **435**, 33-42 (2015). https://doi.org/10.1016/j.aquaculture.2014.09.017

17. S. Manee, T. Chutima, V. Vichai, M. Poramet, Digestive enzyme activity during ontogenetic development and effect of live feed in green catfish larvae (*Mystus nemurus Cuv*. & *Val*.). Songklanakarin J. Sci. Technol. **34**, 247-254 (2012)

18. S.C. McBride, R.J. Price, P.D. Tom, J.M. Lawrence, A.L. Lawrence, Comparison of gonad quality factors: color, hardness and resilience, of Strongylocentrotus franciscanus between sea urchins fed prepared feed or algal diets and sea urchins harvested from the Northern California fishery. Aquaculture. **233**, 405-422 (2004). https://doi.org/10.1016/j.aquaculture.2003.10.014

19. S. Handayani, Bioakumulasi Logam Berat dalam Mangrove *Rhizophora mucronata* dan *Avicennia marina* di Muara Angke Jakarta. Jurnal Teknik Lingkungan. **7**, 266-270 (2006)