Addition of the papain enzyme to commercial feed against protein retention and feed efficiency in eels (Anguilla bicolor)

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Abstract. This study had the benefit of providing information about the influence of the papain enzyme on the retention of protein commercial feed and feed efficiency in eels (Anguilla bicolor). The method used in this study was an experimental method. The study design used was completely randomized (CRD). These results indicate that the addition of the papain enzyme to commercial feed showed there to be a highly significant difference (P <0.01) in the retention of protein and feed efficiency of the eels. The highest protein retention was achieved in treatment C (25.68%) and the highest feed efficiency was achieved in treatment C (44.02).

1. Introduction
Eels (Anguilla bicolor) are a type of fish that has a high economic value. It is also an export commodity from the fishery sector [1]. Eels have a high nutrient content, reaching 270 kcal / 100g, and with a vitamin A content reaching 4700 IU / 100 g, which is seven times more than chicken eggs and 45 times more than cow's milk. The vitamin B1 in eels is equivalent to 25 times the content in cow's milk and the vitamin B2 content is equivalent to five times the content in cow's milk. Compared to salmon, eels contain DHA by as much as 1,337 mg / 100 grams, while salmon only contains 820 mg / 100 grams or 748 mg / 100 grams as in mackerel. Eels contain EPA (Eicosapentaenoic Acid) up to 742 mg / 100 grams while in salmon, there is only 492 mg / 100 grams or 409 mg / 100 grams as in mackerel [1].

The amount of nutrient content in radical eels needs to be assessed. The main limitation in eel cultivation is the slow growth rate of the fish. To reach a weight of 120 grams takes about 8-9 months [3]. The papain enzymes that are a part of perfect peptides in a binary protein become simpler peptide bonds. This is because papain is able to catalyze substrate hydrolysis reactions [5]. This enzyme can be used to transform the proteins contained in feed into peptides or into amino acids that are easily digested and absorbed by the body, which can later be used for growth [4].

Based on the description above, it is necessary to conduct a study aimed to determine the level of protein retention and feed efficiency of stadia elver eels when there is the addition of papain to commercial feed.

2. Material and method
This research was conducted between June and July 2015 at the Wet Laboratory in the Faculty of Fisheries and Marine Affairs in Airlangga University, Surabaya. The tools used in this study included 20 aquariums (40 x 25 x 20) cm³, drums for the freshwater supplies, hoses for aeration, water hoses,
dips, basins, sprayers, shelter, baking sheets, analytical balance sheets, measuring cups, pH pens, thermometers, test ammonia kits, larvae nets and DO test kits for measuring the dissolved oxygen. The sample material used in this study totaled 102 eels, and the commercial feed was in the form of pasta and commercial papain enzymes. The research method used in this study was an experiment. The research design used was a Completely Randomized Design (RAL). This study consisted of five treatments, namely A, B, C, D and E which were repeated four times, so there were 20 experimental units; A1, A2, A3, A4, B1, B2, B3, B4, C1, C2, C3, C4, D1, D2, D3, D4, E1, E2, E3, E4. The maintenance container used was an aquarium measuring (40 x 25 x 20) cm³, with a maximum water capacity of 20 liters. The aquarium that was to be used was detergent washed, rinsed with 12 ppm chlorine as a disinfectant, washed with clean water and then dried in the sun. Each aquarium was then filled with 10 cm of water from the bottom of the aquarium, after which an aeration hose was installed. Selected eel fish seeds were put into an aquarium with a density of five tails in each aquarium. Feeding was done twice a day, in the morning and evening. The papain in the diet was done by mixing the doses of papain with five ml of water, and then adding ten grams of feed for each treatment.

2.1 Research parameters
The main parameters in this study were protein retention and the efficiency of the eel seed feed. The measurement of the protein retention was obtained by reducing the amount of protein in the body of the eel at the end of the study, reduced by the amount of protein in the body of the eel at the start of the study and then divided by the amount of protein consumed during the study. The form of the formula is as follows [6]:

\[
\text{Protein Retention} = \frac{\text{JPS END} - \text{JPS EARLY}}{\text{JPB}} \times 100\%
\]

Final JPS = the amount of protein stored in the body of the fish at the end of the study (g), the initial JPS = the amount of protein stored in the body of the fish at the beginning of the study (g), JPB = the amount of protein in the feed given during maintenance (g)

The value of the feed’s efficiency was calculated based on the difference in the fish biomass at the end of the study compared to the fish biomass at the beginning of the study divided by the weight of feed given by the following formula [7].

\[
\text{EP} = \frac{\text{Bt} - (\text{Bo} + \text{Bd})}{\text{F}} \times 100\%
\]

EP = feed efficiency (%), Bd = weight of dead fish (g), Bt = final weight of fish biomass (g), Bo = initial weight of fish biomass (g) and F = weight of feed given (g).

3. Results and discussion
The results of the analysis of variance showed that the addition of the papain enzyme to commercial feed showed there to be a very significant difference (P <0.01) in protein retention and eel fish feed efficiency.

Table 1. The results of the analysis of the addition of papain enzymes to commercial feed

| Treatment | Protein Retention ± SD |
|-----------|------------------------|
| A         | 12.60 ± 0.61           |
| B         | 21.96 ± 0.84           |
| C         | 25.68 ± 3.29           |
Based on Duncan's Multiple Range Test, it was found that the highest protein retention was achieved in treatment C (25.68%), which was significantly different (P <0.01) to treatments B (21.96%), D (21.73%), E (15.52%) and A (12.60%). The lowest protein retention value was achieved in treatment A (12.60), which was very significantly different (P <0.01) when compared to treatments C (25.68%), B (21.96%), D (21.73%) and E (15.52%).

The results showed that the feed efficiency of the eel fish (Anguilla bicolor) for 40 days ranged from 19.49% to 44.02%.

### Table 2. The results of the analysis of the addition of papain enzymes to commercial feed

| Treatment | Feed efficiency ± SD |
|-----------|----------------------|
| A         | 19.49 ± 1.06         |
| B         | 36.25 ± 3.25         |
| C         | 44.02 ± 1.32         |
| D         | 29.31 ± 1.62         |
| E         | 21.66 ± 1.83         |

The feed efficiency value with the addition of 0.75% - 3% papain enzyme was higher than the control treatment (0%), while the highest feed efficiency value of 44.01% was found in the addition of papain enzyme at 1.5%. According to Hasan [4], an increase in the concentration of the enzyme papain in the feed results in the fish’s body protein content increasing, which means that the growth rate increases to a certain extent.

The high value of protein retention in commercial feed with the addition of papain enzymes by as much as 1.5% is thought to be caused by the protein in the commercial feed being broken down into simple forms such as amino acids. This means that it is more easily absorbed and digested by the body of the eels. This is reinforced by the statement from Hasan [4], who said that the addition of the enzyme papain to the feed resulted in the hydrolyzed feed protein becoming a peptide, so then the feed was made easier to digest. The value of the protein retention in this study was directly proportional to the level of feed efficiency. This is presumably because the eel fish fed with the addition of the papain enzyme are better able to convert the protein in the feed into protein to be stored in the body, compared to the eel fish fed without the addition of the papain enzyme. This is in accordance with Maynard, et al. [8], who said that digestibility is a part of the food consumed. Anything that is not digested is released into the feces and protein retention is an example of protein digestibility.

### 4. Conclusion

The conclusion to be taken from this study was that the addition of papain enzyme to commercial feed had a very significant difference (p <0.01) on the level of protein retention in eel fish (Anguilla bicolor). The highest protein retention was achieved in treatment C (1.5%) 25.68% and this had a very significant effect (p <0.01) on the efficiency of the eel fish feed (Anguilla bicolor). Eel feed efficiency was best achieved in treatment C (1.5%), with a value of 44.02.

### 5. References

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