



SHORT COMMUNICATION

The negative effect of the chicken feather meal in the diet on growth performance of the shortfin eel *Anguilla bicolor* larvae

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ABSTRACT

The aim of these study was to examine the effect of the replacement fish meal with chicken feather meal (CFM) for eel *Anguilla bicolor* larvae. The study was conducted at the Laboratory of Ichthyology, Faculty of Marine and Fisheries of Syiah Kuala University on September to October 2017. The Complete Randomized Design (CRD) with 7 treatments and 4 replications were used in this study. The tested dosage of CFM were of 0% CFM (control), 10% CFM, 20% CFM, 30% CFM, 40% CFM, 50% CFM and 60% CFM, where each treatment were contained of protein 32.26% (0% CFM), 33.09% (10% CFM), 36.20% (20% CFM), 39.10% (30% CFM), 41.22% (40% CFM), 45.43 (50% CFM) and 40.02% (60% CFM). The experimental fish were stocked in the plastic container at the stocking density of 15 fish container⁻¹ and fed the experimental diets at the feeding level of 10% body weight a day for 60 days. The results showed that the application of CFM in the diet was not given a significant effect on the weight gain, daily weight gain, specific growth rate ($P>0.05$). In addition, the fish fed on CFM did not show growth rate even reduces the body weight of the experimental fish. It is concluded that the application of the CFM in diet gave the negative effect on the growth performance of the eel larvae.

Keywords: Eel elver, Feather meals, Growth rate, Survival rate, Fish feeding

INTRODUCTION

A total 18 species of eels (Anguillidae) are reported worldwide (Aoyama, 2009); of these, 7 species are reported from Indonesia waters (Sugeha *et al.*, 2008) where 3 species are recorded in Aceh Province waters (Muchlisin and Siti-Azizah, 2009; Muchlisin *et al.*, 2015; Muchlisin *et al.*, 2016a; Muchlisin *et al.*, 2017; Muchlisin *et al.*, 2018). The eel is the commercial migratory fishes, they are growing in fresh water and spawning in seawater (Deelder, 1984; Masroni *et al.*, 2015).

Presently, the eels have been cultured in Indonesia and the larvae is supplied from the wild (Muchlisin *et al.*, 2016a). In aquaculture system, the fish fed on the commercial diet which has high protein content (approximately 45% crude protein), and therefore the feed has higher selling price; this is because of the feed contains a higher proportion of fishmeal that costly for small-scale farmers. Therefore, it is very crucial to explore other potential protein sources to substitute the fishmeal in the diet for the eels, while one of the potential sources is chicken feather meal that has approximately of 83.74% crude protein (Adiati *et al.*, 2004). Chicken feathers are a waste material from broiler industry and its can pollute the environment if not well treated, therefore this is very promising material for feedstuff as a cheap source of protein for fish feed industry.

Studies on the substitution of feather meal in feed has been carried out on *Paralichthys olivaceus* fish with the best substitution of 12% and 25% in fish feed (Kikuchi *et al.*, 1994), in *Oncorhynchus mykiss* (Steffens, 1994; Bureau *et al.*, 1999), *Oreochromis niloticus* (Bishop *et al.*, 1995), *Bidyanus bidyanus* (Allan *et al.*, 2000), *Labeo rohita* (Hasan *et al.*, 1997), where the results of previous

study showed the feather meal gave a positive effect as a protein source to replace fish meal in the diet. However, there was no report on the tropical eel *Anguilla bicolor*. Hence, we have evaluated the application of the chicken feather meal in the diet of the eel. Herein, we reported the negative impact of the chicken feather meal on growth performance of the tropical shortfin eel *A. bicolor*.

MATERIALS AND METHODS

Time and site

The study was conducted from September to October 2017 at the Laboratory of Ichthyology, Faculty of Marine and Fisheries, Syiah Kuala University, Indonesia.

Experimental design

The completely randomized design (CRD) with 7 levels of treatment and 4 replications are used in this study. The tested treatment was the differences proportion of the chicken feather meal (CFM) in the diet as follows: (A) diet without CFM (control), (B) diet with 10% CFM, (C) diet with 20% CFM, (D) diet with 30% CFM, (E) diet with 40% CFM, (F) diet with 50% CFM, (G) diet with 60% of CFM.

Feather meal and diet preparation

The chicken feather was washed and steamed for 1 hour then sun-dried for 2 days. The dried feather was fermented for 15 days using 10% EM4 (Mulia *et al.*, 2016). The fermented feather was grinded and sieved. The sieved feather was sun-dried for one day then analyzed for proximate compositions. The feathers meal were mixed with other raw materials as presented in Table 1.

Experimental fish and feeding

The eel larvae were purchased from Aquaculture Center in Kawarang West Jawa. The fish was acclimatized for one day prior used in the experiment. The initial weight and length of the fish larvae were 2.05 g and 71.5 mm, respectively. The fish larvae fed on the experimental diet two times a day (08.00 AM and 06.00 PM) at a feeding level of 10% body weight for 60 days. The feces and unconsumed feed were siphoned 2 hours after feeding.

Table 1. Proximate composition of raw materials and diet composition

Raw materials	Proportion (%)						
	A (0)	B (10)	C (20)	D (30)	E (40)	F (50)	G (60)
Chicken feather meal	0	10	20	30	40	50	60
Fishmeal	60	50	40	30	20	10	0
Soybean meal	10	10	10	10	10	10	10
Cornmeal	5	5	5	5	5	5	5
Starch	5	5	5	5	5	5	5
Fine bran	10	10	10	10	10	10	10
Fish oil	7	7	7	7	7	7	7
Vitamins	2	2	2	2	2	2	2
Minerals	1	1	1	1	1	1	1
Total	100	100	100	100	100	100	100
Crude protein (%)	32.26	33.09	36.20	39.10	41.22	45.43	48.02
Crude lipid (%)	4.59	8.87	9.04	10.20	12.45	9.31	9.53
Fibre (%)	1.91	2.19	2.26	2.25	2.82	2.37	2.17

The crude protein content of the raw materials: Chicken feather meal (80.15%), fish meal (42.41), soybean meal (33.7%), cornmeal (10.15%), starch (0.26%), fine bran (10.86%).

Parameters

The weight gain was calculated based on Muchlisin *et al.* (2016a) as follow: $Wg = Wt - Wo$, where; Wg is weight gain (g), Wt is body weight at the end of the experiment (g), Wo is initial body weight (g). The Daily Growth Rate (DGR) was calculated based on Muchlisin *et al.* (2016b; 2016c) as follow: $DGR = Wg/t$ where DGR = daily growth rate (g/day^{-1}), Wg = weight gain (g), t = experimental duration (day). Specific Growth Rate (SGR) was calculated by using the formula: $SGR (\% day^{-1}) = (Ln Wt - Ln Wo)/t \times 100$

Data analysis

The data were Analyzed of Variant (ANOVA) followed by Duncan's multiple range test using SPSS Software Ver. 21.0

RESULTS

The ANOVA test showed that there was no significant effect of the CFM on weight gain, daily growth rate and specific growth rate ($P > 0.05$). The results showed that the positive weight gains were recorded at control diet only (without feather meal) but not for the diet containing feather meal even the fish weight was reduced gradually based on feather meal proportion in the diet where the higher reducing were found in fish fed on higher feather meal contains (Table 2).

Table 2. The average weight gain, daily growth rate and specific growth rate of the *Anguilla bicolor* fed on the experimental diet containing varies levels of the feather meal.

Feather meal proportion (%)	Weight gain (g)	Daily growth rate ($g day^{-1}$)	Specific growth rate ($\% day^{-1}$)
0 (control)	0.245±0.26	0.004±0.004	14.2±23.93
10	-0.19±0.37	-0.003±0.006	-14.37±67.12
20	-0.320±0.15	-0.005±0.003	-6.57±13.36
30	-0.185±0.37	-0.003±0.006	-1.28±35.05
40	-0.005±0.19	-0.001±0.003	-17.03±25.99
50	-0.34±0.55	-0.006±0.009	-37.15±21.06
60	-0.2875±0.38	-0.005±0.006	-19.20±20.7

DISCUSSION

The study revealed with the application of CFM in diet inhibits the growth performance of the shortfin tropical eel *A. bicolor* even reduces the body weight. This negative effect was increasing as the proportion of CFM increases. The similar result was reported on rainbow trout *Oncorhynchus mykiss*, in which feed containing high chicken feathers meal gave lower growth rates compared to feeds containing low or without feather meals (Rahnema and Borton, 2007). In addition, Obasa *et al.* (2009) reported that increasing the proportion of CFM reduced for the growth rate of the African catfish (*Clarias gariepinus*). However, these result showed that eel larvae fed on diets with CFM did not give growth response, indicate of CFM was not suitable for eel larvae in present form.

It was suspected that eel larvae cannot digest the feed containing CFM, although CFM contains high crude protein, it cannot be utilized by eel larvae because it is difficult to digest. According to Rahayu and Bata (2014), CFP was containing high crude protein (approximately 73-78%), but the protein formed as keratin (scleroprotein or the fibrous protein) and this material

was insoluble in water and organic solvents (Fraser, 1972). It also contains an indigestible cysteine which has a sulfide bond causing of CFM is difficult to digest by proteolytic enzymes in the gastrointestinal tract (Mulia *et al.*, 2016). In this study the CFM has fermented by using Effective Microorganisms 4 (EM-4) for 15 days, this solution contains *Lactobacillus*, *Saccharomyces*, and *Actinomyces*, but has not been able to increase digestibility. Therefore, it is necessary to explore for other ways to increase the digestibility of CFM, for example by adding probiotic and proteolytic enzymes in feed.

CONCLUSIONS

The application of the CFM in the diet gave the negative effect on the growth performance of eel larvae and therefore in the present form this material is unsuitable for a raw material of the eel feed.

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