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An Improvement Of Carcass Quality Of Harvested Cage Cultured Catfish (*Mystus nemurus*) By Increasing Protein Level in The Diets

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ABSTRACT

Two diets containing 40% protein, P/E ratio 1.30 g/kcal (high protein) and 34% protein, P/E 1.07 g/kcal (low protein), which produced the best growth at our previous experiment, were fed to *Mystus catfish* to determine their carcass quality. The fish ranging from 40.14 g to 42.64 g in size was grown in commercial fish cages (4x4x1.5 m) at a density of 50 fish per m3 for 90 days. The fish were fed the experimental diets at libitum twice daily, at 9.00 and 16.00. The harvested fish was evaluated for carcass quality characteristics and growth performance. Edible flash, dressing percentage and water holding capacity of harvested fish were higher for the fish fed higher protein diet than that for lower protein diet ($P<0.05$); but carcass waste was higher for the fish fed lower protein diet than that for higher protein diet ($P<0.05$). There was no significant different in hematosomatic index between the two fish groups ($P>0.05$). Proximate composition of the harvested fish was significantly different between fish fed higher and lower protein diet, except moisture. Protein and ash composition was higher for fish fed higher protein diet than that fed lower protein diet ($P<0.05$), however, fat composition was higher for the fish fed lower protein diet than for that fed higher protein diet ($P<0.05$). The fish fed higher protein diet consumed less feed but more protein ($P<0.05$); however, feed and protein efficiency as well as protein retention were not different between the two fish groups ($P>0.05$). Weight gain was higher for fish fed lower protein diet but protein gain was higher for fish fed higher protein diet ($P>0.05$).

Keywords: *protein diet, Mystus catfsh, fish cage, carcass quality and growth performance*

INTRODUCTION

Mystus catfish (*Mystus nemurus*) is a populer and demanded local spesis in Riau Province, not only for consumption fresh but also for smoked fish. The fish has a high dress-out percentage as well as high economic value; and when processed into smoked fish, it produces a final product of high flavor, odor and color quality. Usually, the fish was cought from the wild (river and lake), however, the catches in the wild was becaming decreased due to overfishing and environmental demage, therefore, the latter supply of the fish whould be dependant on the culture of the fish.

A commercial culture of the fish now has developed; breading and rearing techniques have been available (Sukendi, 2005; Saridanti *et al*, 2003; Nuraini, 2008); and the fish has been adaptable to artificial feed diet (Khan et al., 1994 and Hasan, et al., 1999). However, quality characteristics of the harvested fish are less acceptable by consumer due to soft flesh and high content of body fat. Body compositian characteristic of farm-raised fish is highly correlated to nutrient composition of the fish diet. High composition of fat in the diet will cause fat deposition in the fish body, therefore the harvested fish will be low in product yield and quality, soft flash, oily flavor and short storage life (Lovell, 1976 dan Stickney, 1977; Hasan dan Boer, 1994). Moreover, the fatty fish is difficult to be filleted; and when hot-smoked, the body fat will melt and burn (Hasan dan Edison, 1996). As the culture of this species is being developed, the increase of production should be followed by quality improvement of the harvested product,

Research on dietary protein and energy requirements in the diet for *Mystus catfish* has been conducted, however, most of the experiments were concentrated on growing performance of small fish in circulated tanks. Eguia (1998) fed Mystus catfiah larva (45-85 mg) with diets containing various protein and energy levels; and found 55% protein and 4.40 kcal gross energy (1.25 mg/kcal) as the best diet for the fish lava. Moreover, Khan et al (1994) reported 42% protein in the diet as an optimum protein level for growing fish fingerling. Hasan, et al (1999) also found a sparing effect of protein and energy at at 42% protein and 4.25 kcal gross energy (1.05 mg/kcal) for *Mystus catfish* fingerlings (2 – 8 gr)/ grown in circulated tanks. However, there was no information available in carcass quality characteristics of harvested fish. This research therefore is proposed to determine carcass quality characteristics and growth performance of the harvested fish fed different protein diets.

MATERIALS AND METHODS

Feeding trials

Two diets (Table 1) producing the best growth at our previous experiment, 40% protein, P/E ratio 1.30 g/kcal (P-40) and 34% protein, P/E ratio 1.07 g/kcal (P-34) were tested to the fish in a commercially cultured cage. Mystus catfish, ranging from 40.14 g to 42.64 g in size was stocked in the

floting cages (4x4x1.5 m) at a density of 50 fish per m3. The fish were fed the experimental diets at libitum twice daily, at 9.00 and 16.00 up to harvest size 150-200g per fish for 90 days.

Sample collection and analyses

Twenty five fish were weighed at the beginning and at the end of the experiment. At the beginning of the experiment, 5 fish were randomly sampled and analyzed for body protein, fat, moisture and ash composition. At the end of the experiment, 10 fishes were randomly collected from each cage; five fishes were ground for final whole body composition analyses and another five fishes were slaughtered for edible flesh, dressing percentage, carcass waste hematosomatic index and water holding capacity calculation. Protein, fat, ash and moisture composition was analized according to AOAC method (AOAC, 1990). Moisture was determined after oven-drying at 105^{o}C until the sample weight was constant; and ash was was determined after murfle-incinerating at 500^{o}C for 24 hours. Protein content was analyzed using Kjeldahl procedue; and crude protein was estimated as Nx6,25. Crude fat was determined after Soxhlet extacted using petroleum ether. Growth performance and carcass quality were calculated using the following formulas:

Food consumption (g/fish) = (Total feed consumption per fish)
Protein consumption (g/fish) = (Total feed consumption per fish) x (Protein per g diet)
Weight gain (g/fish) = (Final fish weight) – (Initial fish weight)
Protein gain (g/fish) = (Final fish weight x Final % fish protein) – (Initial fish weight x Initial % fish protein)
Feed efficiency = (Weight gain, g)/ (Food consumed, g)
Protein efficiency = (Weight gain, g)/ (Protein consumed, g)
Protein retention = (Protein gain, g)/ Protein consumed, g) x100
Edible flesh (%) = (Flesh weight/body weight) x 100
Dressing percentage (%) = (Body weight – head – skin – viscera)/(Body weight) x 100
Carcass weste (%) = (Fish weste weight/body weight) x 100
Hematosomatic Index = (Liver weight, g) x 100/(Fish weight, g)
Water Holding Capacity = (Flash mince weight - Flash mince weight after centrifuging for 5 minutes, 210 x g) 100/ (Flash mince weight)

Data analyses

Triplicate data (Carcass characteristics and growth performances were analyzed using SPSS (2000). Differences between treatment means were determined using T-test (Steel and Torrie, 1980).

RESULTS

Carcass quality characteristics of the fish fed different protein levels were presented in Table 2. Edible flash, dressing percentage and flash water holding capacity of harvested fish fed higher protein diet were higher that the fish fed lower protein diet ($P<0.05$); but carcass waste was higher for the fish fed lower protein diet than that fed higher protein diet ($P<0.05$). There was no significant different in hematosomatic index of the both groups of the harvested fish ($P>0.05$).

Proximate composition of harvested fish was significantly different between fish fed higher and lower protein diet, except moisture. Protein and ash composition was higher for fish fed higher protein diet than that fed lower protein diet ($P<0.05$), however, fat composition was higher for the fish fed lower protein diet than for that fed higher protein diet ($P<0.05$)

Growth response of fish fed different protein levels was shown in Table 3. There was a significant difference in weight gain, protein gain, feed consumption and protein consumption ($P<0.05$), but no significant different in feed efficiency, protein efficiency and protein retention ($P>0.05$). Weight gain was higher for the fish fed lower protein diet than that fed higher protein diet. The fish fed lower protein diet (P-34) consumed more feed and less protein; however, feed and protein efficiency as well as protein retention were not different between the two fish groups.

Table 1. Proximate composition of experimental diets

Composition	Diet	
	P-34	P-40
Dry matter	94.49	94.88
Protein	34.62	39.55
Fat	9.24	6.55
Ash	8.62	9.62
Estimated Energy (kcal DE/g)	3,23	3,04

P/E ratio (g/kcal)	1.07	1.30

Table 2. Carcass quality characteristics of harvested fish fed the experimental diets.

Carcass quality characteristics	Composition (%)	
	P-34	P-40
Head	22.12a	22.94a
Visceral organs	18.61b	15.82a
Skin	6.14a	6.12a
Edible flash	41.20a	42.45b
Dressing percentage	51.99a	53.71b
Carcass waste	48.52b	46.29a
Hematosomatic Index	1.66a	1.42a
Water Holding Capacity	11.77a	14.73b
Moisture	71.08a	70.99a
Protein	51.03a	54.98b
Fat	42.98b	36.44a
Ash	5.99a	8.58b

Tabel 3. Growth performance of the harvested fish fed the experimental diets

Growth parameter	Diets	
	P-34	P-40
Initial weight	42.64	40.14
Final weight	160.65	149.59
Feed consumption (g/fish)	230b	210a
Protein consumption (g/fish)	79.63a	83.05b
Weight gain	118.01b	109.45a
Protein gain	57.39a	59.08b
Feed Efficiency	1.95a	1.92a
Protein efficiency	1.48a	1.37a
Protein retention (%)	72.07a	71.14a

DISCUSSION

Our previous study on smaller fish (*Mystus nemurus*) grown at experimental floating nets indicated that the diets containing 40% protein, P/E ratio: 1.30 g/kcal and 34% protein, P/E ratio: 1.07 g/kcal produced the best growth performance. In the present study, the both diets were tested to the bigger fish in a commercial cultured cage up to market size; and their carcass quality as well as growth performance were discussed below.

High yield and carcass quality of harvested fish as a result of protein and energy balance in fish diet has been proved by many workers (Conwey, 1993, Silver et al, 1993, Alliot et al., 1979; Morales dan Oliva Tales, 1995, Reinitz and Hizel, 1980; Refstie dan Austreng, 1981, Lovell et al, 1974; Page dan Andrews 1973; Garling dan Wilson, 1976 dan Mangalik 1986) dan Lele (Jantrarotai et al, 1998). Our study showed that an increasing protein to 40%, P/E ratio: 1.30 g/kcal) in the diet improved carcass quality of the harvested fish. Edible flash, dressing percentage and flash water holding capacity increased as the protein level increased. In contrast, carcass waste decreased as the protein level in the diet increased. There was no significant different in hematosomatic index of the two fish groups.

Proximate composition of the harvested fish was significantly different between fish fed higher and lower protein diet. Protein composition was higher for fish fed higher protein diet than that fed lower protein diet, however, fat composition was higher for the fish fed lower protein diet than for that fed higher protein diet. Increasing protein level in the diet improve body protein and decrease body fat have been reported in many species of fish such as Chinook salmon (Silver et al, 1993), seabass (Alliot et al., 1979; Morales dan Oliva Tales, 1995), raibow trout (Reinitz and Hizel, 1980; Refstie and Austreng, 1981), Channel catfish (Lovell et al, 1974; Page dan Andrews 1973; Garling and Wilson, 1976 and Mangalik 1986) and clarias catfish (Jantrarotai et al, 1998).

Feed consumption and weight gain were lower for the fish fed higher protein diet than that for lower protein diet; however, feed efficiency and feed conversion as well as protein retention was not different between the two diets. Higher weight gain for the fish fed lower protein diet may be correlated to high feed consumption as the feed efficiency and feed conversion values for the two fish groups were similar. The fish fed lower protein diet consumed more feed to meet their protein

requirement for growth. As the feed consumption increased, at the same time, the energy intake also increased, therefore lead to high fat deposition in the fish body. Higher weight gain for the fish fed lower protein is contributed by fat deposition as indicated by proximate composition analysis of the fish body.

A criterion usually used to determine feed quality for fish growth is weight gain (Garling and Wilson, 1976; Page and Andrews, 1973; Prather and Lovell, 1973 and Takeuchi et al., 1979). In the present study the increase in weight gain is not followed by protein gain, therefore protein gain is more accurate index of growth as the weight gain may be composed of fat rather than protein.

CONCLUSION

Increasing protein level/to 40%, P/E ratio: 1.30 g/kcal in the diet improve edible flash, dressing percentage, flash water holding capacity and body composition of harvested fish but do not affect weight gain, feed efficiency and feed conversion. Since the diet containing 40%, protein, P/E ratio: 1.30 g/kcal do not influence weight gain, feed efficiency and feed conversion, a lower protein diet with sufficient energy level need to determine for low feed cost.

REFERENCES

AOAC (Association of Official Analytical Chemists). 1990. Official methods of analysis of the Association of Official Analytical Chemists. Helrich, K. Editor. 15th ed. Arlington: Association Analytical Chemists. 1298 p.

Alliot. E., Pastoureaud. A., Nedelec. J. 1979. Etude de l'apport calorique et du rapport calorico-azotê dans l'aliment du bar (*Dicentrachus labrax. L.*). Influence sur la croissance et la composition ciorporelle. In : Halver, J.E., Tiews, K. (Eds.), Finfish Nutrition and Fishfeed Technology, Vol. I. Heenemann. Berlin, pp. 241-251.

Conwey, C.B. 1993. Some effects of nutrition on flesh quality of cultured fish. In: Kaushik. S.J., Luquet. P. (Esd.). Fish Nutrition in Practice. Les Colloques. No.61. INRA Edns., Paris. Pp. 227-236.

Eguia, PLV. 1998. Development of artificial diet and optimum feeding strategy for Malaysian catfish (*Mystus nemurus*) larvae. Master thesis, University Putra Malaysia, Serdang, Malaysia.

Garling, D.L.JT. and ILP. Wilson. 1976. Olifimm dietary protein to energy ratio for channel catfish fingerlings. J. Nutr. 106: 1369-1375.

Hasan, B., C.R. Saad, AA. Alimon, M.S. Kamarudin dan Z. Hassan. 1999. The Effects of various dietary energy levels and protein concentrations on growth performance of river catfish (*Mystus nemurus).* Malaysian Journal of Animal Science, 5(1 & 2) 83-92.

Hasan. B. dan Edison. 1996. Mutu dan Penerimaan Konsumen Terhadap Ikan Asap. Jambal Siam hasil budidaya (*Pangasius sutchi*). Lembaga Penelitian Universitas Riau Pekanbaru.

Hasan, B. dan I. S. Boer. 1994. Masa simpan ikan Bating *(Macrones, sp)* dalam es (50). Berkala Perikanan Terubuk, No. 59, Juni, 1994 Himpunan Alumni Fakultas Perikanan Universitas Riau, Pekanbaru.

Jantrarotai, W., P. Sitasit, P. Jantrarotai, T. Viputhanumas and P. Sarabua. 1998. Protein and energy levels for maximum growth, diet utilization, yield of Edible flesh and protein sparing of hybrid Clarias catfish (Clarias macrocephalus x Clarias gariepinus. Journal of the World Aquaculture Society 29: 281-289.

Khan, M.S., K.J. Ang, M.A. Ambak and C.R. Saad. 1994. Optimum dietary protein requirement of a Malaysian catfish, *Mystus nemurus*. Aquaculture 112: 227-235.

Lovell, R.T. 1976. Fish feed and nutrition. Energy Commercial Fish Farmer 2:40-41.

Lovell, R. T. and G. R. Ammerman. 1974. Processing farm raised catfish. Bug. 193. Southern Cooperative Series. Auburn University, AL.

Mangalik, A. 1986. Dietary energy requirements *of* channel catfish. Ph.D. Dissertation, Auburn University, Auburn, AL.

Morales. A.E., Oliva Tales. A.1995. Resultados preliminaries sobre la utilizacion metabolica de dietas con dos nivelos lipidicos en Lubina (*Dicentrarchus labrax*). In: Castello i Orvag, Calderer i Reig (Eds.), Proceedings of the Fifth Nacional Congreso on Aquaculture, 10-13 Mayo, 1995, Sant Carles de la Rapita, España.

Nuraini. 2008. Pertumbuhan dan Kelulushidupan Benih ikan baung yang diberi pakan Bokhasi. Jurnal *Teroka Riau* 8 (2).

Page, JW. and JW Andrews. 1973. Interaction of dietary levels of protein and energy on channel catfish. J. Nutt. 103: 1339-1346.

Prather, E.E. and R.T. Lovell. 1973. Response of intensively fed channel catfish to diets containing various protein-energy ratios. Proceeding of the 27' Annual Conference Southeastern Association of Game and Fish Commissioners. pp. 27,455-459.

Refstie. T., Austreng. E. 1981. Carbohydrate in rainbow trout diets: III. Growth and chemical composition of fish from different families fed four levels of carbohydrate in the diets. Aquaculture 25. 35-49

Reinitz. G., Hizel. F.1980. Formulation of practical diets for rainbow trout based on desired performance and body composition. Aquaculture 19, 243-252.

Saridanti, L., Usman, M. Tang., dan Mulyadi. 2003. Teknik Bioenkapsulasi Artemia yang Diperkaya dengan Asam Lemak ω-6 terhadap Pertumbuhan dan Kelulushidupan Larva Ikan Baung (*Mystus nemurus CV*). Jurnal Perikanan dan Kelautan Faperika Universitas Riau, 8 (1): 24-32.

Silver. G.R., Higgs. D.A., Dosanjh. B.A., McKeown. B.A., Deacon, G., French. D., 1993. Effect of dietary protein to lipid ratio on growth and chemical composition of chinook salmon (*Oncorhynchus tdhawytscha*) in sea

water. In: Kaushik. S.J., Luquet. P. (Eds.). Fish Nutrition in Parctice. Les Colloques. No. 61. INRA Edns., Paris. Pp. 459-468.

SPSS. 2000. SPSS for Windows, Release 10. SPSS Inc, Chicago, IL.

Stickney, R.R. 1977. Lipid in catfish nutrition. In R.K Stickney and R.T. Lovell (eds) Nutrition and Feeding of Channel Catfish: 1313- 14-18. Southern Cooperative Series no. 21 B.

Steel, R. G. D. and J. H. Torrie. 1980. Principles and procedures of statistics. McGraw-Hill book Company, New York, NY.

Sukendi. 2005. Keberhasilan Teknologi Triploidisasi pada Ikan Baung (*Mystus nemurus CV*). Jurnal Perikanan Terubuk. Vol 32:2 1-8.

Takeuchi, T., T. Watenabe and C. Ogino, 1979. Optimum ratio of energy to protein for carp. Bull.Jpn. Soc. Sci. Fish, 45:983-987.

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