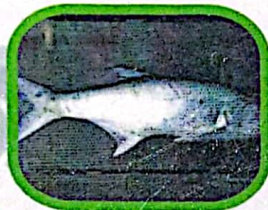


2nd National and International Seminar of Fisheries and Marine
"Managing Aquatic Resources Towards Blue Economy"

6-7 November 2013

The Premiere Hotel, Pekanbaru



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INDONESIA



FAPERIKA UR

MANAGING AQUATIC RESOURCES TOWARDS BLUE ECONOMY

PROCEEDING

2nd International Seminar on Fisheries and Marine (2nd ISFM)

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Fakultas Perikanan dan Ilmu Kelautan
Universitas Riau

ISBN 978-979-792-437-9

Penerbit
UR PRESS PEKANBARU
2013

Title : *Proceeding 2nd International on Fisheries and Marine (2nd ISFM) "Managing Aquatic Resources Towards Blue Economy"*

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Cover and Lay Out: **Deni Efizon and Ronald Hutahuruk**
Issued by **UR PRESS**, November 2013

Publisher address:

Badan Penerbit Universitas Riau
UR PRESS, Jl. Pattimura No. 9, Gobah Pekanbaru 28132
Riau, Indonesia
Telp. (0761) 22961, Fax. (0761) 857397
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First edition: November 2013

Perpustakaan Nasional RI: Katalog Dalam Terbitan (KDT)

Ronald Hutahuruk, Deni Efizon, Rahman Karnila, Syafruddin Nasution, Henni Syawal, Windarti, Joko Samiaji, Benny Heltonika dan Rival Junaidi

Proceeding 2nd International on Fisheries and Marine (2nd ISFM) "Managing Aquatic Resources Towards Blue Economy"
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Pekanbaru: UR Press, 2013
xii + 230 hlm.: 29 cm.

ISBN 978-979-792-437-9

1. Proceeding
I. Title. 2. Managing, 3. Aquatic Resources 4. Blue Economy

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 catfish*, fish cage, carcass quality and growth performance

INTRODUCTION

Mystus catfish (*Mystus nemurus*) is a populer and demanded local spesies 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 caught from the wild (river and lake), however, the catches in the wild was becaming decreased due to overfishing and environmental damage, 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; breeding 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 composiation 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 catfish* 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

floating 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 analyzed according to AOAC method (AOAC, 1990). Moisture was determined after oven-drying at 105°C until the sample weight was constant; and ash was determined after muffle-incinerating at 500°C for 24 hours. Protein content was analyzed using Kjeldahl procedure; and crude protein was estimated as $N \times 6.25$. Crude fat was determined after Soxhlet extracted 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) x 100

Edible flesh (%) = (Flesh weight/body weight) x 100

Dressing percentage (%) = (Body weight – head – skin – viscera) / (Body weight) x 100

Carcass waste (%) = (Fish waste 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 than 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 difference 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 difference 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
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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

Table 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 (Jantrartoi 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), rainbow 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 (Jantrartoi 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 flesh, 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.

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