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Effects of Dietary Energy Level and Feeding Ration on Growth and Body Composition of Nile Tilapia, *Oreochromis niloticus* (L.)

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Introduction

Recently, possibility of low protein diet with high energy level for improvement of fish production has been proposed in several fish species, especially under restricted feeding rate, fish responded better on high energy diet than low energy diet. McGoogan and Gatlin (1999) stressed another benefit of low protein diet with high energy for fish production, in terms of reduction of nitrogen waste from fish metabolism. However, others reported no effect of high lipid in feed on performance of fish (Jover et al. 1999). This was probably because that energy availability o requirement for fish varied based on fish species, protein content or quality in feed, rearing water temperature condition and feeding ration.

The objective of this study was to evaluate the effects of dietary energy level and feeding ration size on the growth and body composition of Nile tilapia under limited natural food allowance during winter.

Materials and Methods

The feeding trial was conducted in recirculating system at Pukyong National University, Pusan, Korea during winter season. A unit of recirculating system consisted of 18 glass rectangular tanks (water volume: 220 L) was used for th feeding trial and water exchange rate was 10 L/min per tank. Sixty tilapia juveniles (13 g) were randomly distributed to each tank. Water temperature and dissolved oxygen before sunset during the feeding trial ranged from 17.7 to 23.5℃ and 3.1 to 8.39 mg/L, respectively.

A 2 (energy level) x 3 (feeding ration size) factorial experiment with 3 replicates was designed. Two energy levels of the experimental diets were formulated by using corn gluten meal, soybean meal and fishmeal as the primary protein source. Five percent of oil mixture (feed oil:squid liver oil = 4:1) was added to formulate the

medium energy (ME) diet and 13 % of oil mixture for the high energy (HE) diet, estimated energy level of 3.84 and 4.27 kcal/g diet, respectively, which were based on 4, 9, and 4 kcal/g diet for protein, lipid, and nitrogen-free extract (NFE), respectively. Protein levels were 37.0 and 35.3% for the ME and HE diets, respectively. Feeding ration size was divided into three groups. One group of fish was fed diet one meal with daily amount (13:30). Another group of fish was fed diet two meals with half of daily amount at 09:30 and 17:30. The other group of fish was fed diet three meals with one-third of daily amount at 09:30, 13:30 and 17:30.

Total weight of fish in each tank was measured in 2-week interval and the feeding trial lasted for 13 weeks. Fish were fed the experimental diets for 6 days a week. Feeding ratio was decreased to 3% total weight of fish for the initial 4 weeks, 2% for the next 4 weeks and 1% for the rest weeks. Protein, lipid, ash, and moisture contents of muscle of fish at the end of the feeding trial were measured based on standard method of AOAC (1984). One-way ANOVA, two-way ANOVA and Duncan's multiple range test (1955) was applied for statistical analysis on SAS version 6.12 (SAS Institute, Cary, NC, USA).

Results

Fish were all survived at the end of feeding trial. Weight gain of fish was significantly affected by dietary energy level ($P<0.03$), but not by feeding ration size Weight gain of fish fed the ME diet one meal with daily amount was significantly higher that of fish fed the HE diet one meal with daily amount and three meals with one-third of daily amount ($P<0.05$). No improvement in growth of fish with the HE diet indicated tilapia should not be fed the high energy diet to improve growth of fish at low temperature condition even under limited feed allowance. SGR was significantly affected by dietary energy level ($P<0.03$), but not by feeding ration size FER was significantly affected by dietary energy level ($P<0.01$), but not by feedin ration size. FER for fish fed the ME diet was significantly higher than for fish fed the HE diet at one meal ($P<0.05$). PER was not significantly affected by eithe dietary energy level or feeding ration size ($P>0.05$). However, protein retention was significantly affected by both dietary energy level and feeding ration size ($P<0.05$) This indicated that tilapia should not be fed the diet with high energy to improve growth of fish or expect protein-sparing effect of lipid at low temperature condition. The chemical composition (moisture, protein, lipid and ash) of muscle in fish was not significantly affected by either dietary energy level or feeding ration size ($P>0.05$). However, visceral fat content was significantly affected by dietary energ level ($P<0.01$), but not by feeding ration size. High visceral fat content of fish fed diet with high energy without improvement of growth of fish in this study indicated

that tilapia should not be fed diet with high energy even under limited feed allowance at low temperature condition.

Based on these results, it can be concluded that Nile tilapia should be fed the diet with or lower than the optimal energy level even under limited feed allowance at low temperature condition, but feeding ration size had no effect on fish performance and feed efficiency.

Reference

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