

学位論文要旨 Dissertation Abstract

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学位論文題目：
Title of Dissertation

DEVELOPMENT OF LOW-FISH MEAL PRACTICAL DIET FOR
YELLOWTAIL
(ブリ用低魚粉実用飼料の開発)

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Dissertation Abstract

Yellowtail *Seriola quinqueradiata* is one of the economically important aquaculture fish species in Japan. Its carnivorous nature demands a high protein diet, which typically contains high concentration of fish meal (FM). Recently, high demand and limited supply for FM resulted in inflating FM cost. Therefore it is necessary to develop low-FM diet with inexpensive ingredients such as conventional plant proteins. In previous studies, application of low-FM with plant origin feed ingredients has never been succeeded. Later, it has been reported that a non- or low-FM soy protein concentrate (alcohol purified defatted soybean meal) based diet produced good growth performance and physiological conditions in yellowtail when taurine was supplemented in the diet. Thus, it is inferred that the reasons of unsuccessful results of low-FM with plant origin feed ingredients diet might be a taurine deficiency, whereas this hypothesis has never been tested.

In the present study, a series of experiments were conducted with the aims: to examine if low-FM diet with practical plant origin ingredient namely soybean meal (SBM) and corn gluten meal (CGM) supplemented with taurine maintains normal growth and physiological conditions of juvenile and one-year-old yellowtail, respectively.

Feeding soybean meal diet supplemented with taurine to yellowtail affects growth performance and lipid digestion

Feeding experiment was conducted to determine the effects of soybean meal with supplementation of taurine on growth performance and lipid digestion. Three diets (FM, SBM, and SBM + taurine;T) were fed to yellowtail (42 g). The mean body weight and specific growth ratio were significantly lower in SBM+T-fed fish compared with FM-fed fish at the end of experiment. Taurine supplementation of SBM improved lipid digestion and absorption, but did not improve growth performance.

These results indicate that apart from lack of taurine, SBM contains other factors responsible for inferior growth, and impaired lipid metabolism was not a major factor in the reduced growth of yellowtail fed SBM. Replacement of FM with SBM-based diet must be limited in appropriate proportion, even though taurine was supplemented in the diets and meet to require for yellowtail.

Effects of low-fish meal practical diet on growth and physiological condition of young yellowtail

The effects of taurine supplementation and palm oil replacement in low-FM diet for yellowtail were examined in a feeding experiment using four different diets. The control diet had an FM content of 600 g/kg (FM60). The low-FM diets contained 350 g/kg FM, 170 g/kg corn gluten meal, and 170 g/kg defatted soybean meal (FM35). Taurine was supplemented in FM35 at 7.5 g/kg (FM35T). Fish oil in the FM35T diet was replaced with palm oil (FM35TPO). Juvenile fish (initial body weight 236 g) were fed these diets for 36 weeks. The mean body weight and specific growth rate were not significantly different among the treatments until 24 weeks. However, they were significantly higher in FM35T-fed fish compared with FM35-fed fish at week 36. The feed intake levels of FM35- and FM35T-fed fish were comparable or higher than that of FM60-fed fish whereas the intake levels of FM35TPO-fed fish were always significantly higher than those of FM60- and FM35T-fed fish ($P < 0.05$). The tissue taurine concentrations of FM35-fed fish were significantly lower than those of FM60-, FM35T-, or FM35TPO-fed fish in all tissues examined at all sampling times ($P < 0.05$). FM35TPO-fed fish were leaner than FM35T-fed fish, as evident from the lower lipid concentration in the muscles and whole body. The lower feed conversion ratio of FM35TPO-fed fish compared with FM35T-fed fish suggested that the lower lipid absorption from the FM35TPO diet was due to the inclusion of palm oil.

These results suggested that taurine supplementation is necessary during long-term feeding of yellowtail with low-FM diet. Despite the economic advantage of palm oil compared with fish oil, use of palm oil should be limited because it has lower digestibility in cold-water conditions.

Effects of low-fish meal diet supplemented with taurine on growth and taste of one-year-old yellowtail

Three diets (FM60, FM35, and FM35T) were fed on one-year-old yellowtail (2.9kg) for 18 weeks during winter low water temperature season. Fish fed FM35 could maintain comparable growth and physiological conditions to fish fed FM60. There are no significant differences in hepatosomatic index (HSI), gallbladder somatic index (GBSI), viscera somatic index (VSI) and biliary bile salt concentrations among the treatment at weeks 7 and 18. The taurine concentration in the liver of FM35-fed fish was significantly lower than that of FM60- and FM35T-fed fish at week 18, suggesting that the dietary taurine concentration of FM35 diet was not enough to maintain the tissue taurine concentration. The taste test was performed with or without soy sauce in order to clarify the taste differences between fish. The taste of dorsal part was no significantly different among the treatments, whereas the taste of ventral part of FM35-fed fish had significantly different compared with FM60- and FM35T-fed fish.

The present study could be summarized that dietary taurine supplementation may not be necessary to maintain growth and physiological conditions of the one-year yellowtail at least for 18 weeks in winter season. The taste of FM35T-fed fish was better than FM-35 fed fish and comparable to FM60-fed fish.