Dietary Lipid Studies with Yellow Perch (Perca Flavescens)

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Introduction. The yellow perch is an important food fish in the Great Lakes Region of the US. Total commercial harvest from the Great Lakes was as high as 35.6 million pounds (16.18 million kg) in the later 1960’s. However, population levels and commercial harvest have declined significantly since then. Loss of supply coupled with traditional demand stimulated new interest in aquaculture. However, there are no diets formulated for the yellow perch and only a few nutritional requirements have been quantified.

Dietary lipid is an important source of energy, fat-soluble vitamins and fatty acids in fish. We conducted a series of studies designed to evaluate the efficacy of various lipid sources, provide an indication of the essential fatty acid requirement of perch, and evaluate the dynamics of conjugated linoleic acid (CLA). All studies were conducted in a scientifically valid manner. We used all-female fish originating from Lake Mendota and purified diets identified as appropriate in preliminary studies. We fed all fish to satiation and conducted all experiments at 22 ± 1°C.

Lipid Sources. In our dietary lipid studies, we incorporated various dietary lipid sources into diets at 6, 12 or 18% and adjusted carbohydrate concentrations to maintain similar gross energy levels. Lipid sources evaluated were menhaden oil, cold-pressed soybean oil, coconut oil, tallow and a 1:1 (wt:wt) mixture of menhaden and soybean oils. The study was designed as a 5 x 3 factorial. Weight gain was significantly affected by dietary source and level, but not the interaction of the two main effects. Within each of the single lipid sources, weight gain decreased as dietary lipid source increased from 6 to 18%. However, weight gain of fish fed the combination of menhaden and soybean oils did not exhibit decreased weight gain as dietary lipid concentration increased. Muscle lipid concentrations were low, regardless of dietary treatment. The highest value was 5.9% (dm basis) in fish fed 18% tallow, most values were between 1 and 2%. The EPA (20:5n-3) concentration was 6-9% in fish fed menhaden oil and 4-5.5% in fish fed the combination of menhaden and soybean oils. DHA (22:6n-3) concentrations were 23-36% in fish fed menhaden oil and 23-28% in fish fed the combination of menhaden and soybean oils. Total n-3 fatty acid concentrations were 28-44% in fish fed various lipid sources and total PUFA concentrations were 32-49%. The typical indicators of essential fatty acid deficiency in fish (fatty liver and increased 18:1n-9 concentrations) were not responsive in this study. Weight gain data suggests that perch may have a requirement for both n-3 and n-6 fatty acids as do chum salmon and common carp. Further, the n-3 and PUFA concentrations of perch muscle are among the highest of any fish.

CLA. CLA is an atypical n-6 fatty acid displaying significant health benefits in humans and whole animal benefits in farm animals. It occurs in many geometric configurations and naturally occurs in ruminant meat products. We fed a mixture of CLA isomers to perch and observed significant improvements in weight gain at both 0.5 and 1.0% CLA in the diet. Total CLA concentrations in muscle of perch were 1.19% and 2.60% of fatty acids in fish fed 0.5% and 1.0% CLA, respectively. EPA concentration in perch muscle was 6.3-6.4% and DHA concentrations were 35.1-37.8% in fish fed CLA. Total n-3 fatty acid concentrations were 43-46%. In a second study, various sources of CLA were fed to perch and, based on retention of isomers in liver fatty acids, 18:2(n-10, c-12) appeared to be the biologically active isomer in perch. CLA isomers first appeared in muscle samples at 14 days after initiation of feeding and were at maximum concentrations at 28 days. Thus, CLA could be fed as a finishing diet during the last 2-4 weeks of the production cycle.

In conclusion, perch appear to require both n-3 and n-6 fatty acids in their diet and regardless of dietary lipid concentrations, perch exhibit relatively low muscle fat concentrations. More importantly, the fatty acid profile of that retained lipid appears to be among the better fatty acid profiles for human consumption, with as much as 45% of fatty acids as n-3s. These facts indicate that perch diets will not be difficult to formulate or manufacture and there are significant marketing opportunities for perch as a health food.
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