SpringerPlus
a SpringerOpen Journal

RESEARCH Open Access

Effect of dietary flaxseed oil level on the growth performance and fatty acid composition of fingerlings of rainbow trout, *Oncorhynchus mykiss*

Ali Masiha[1], Nasrollah Mahboobi Soofiani[1*], Eisa Ebrahimi[1], Mahdi Kadivar[2] and Mohammad Reza Karimi[1]

Abstract

This study evaluated the suitability of flaxseed oil as a source of supplemental dietary lipid for fingerlings of rainbow trout (*Oncorhynchus mykiss*). Triplicate groups of the 30 fingerlings held under identical culture conditions were fed twice daily by iso-nitrogenous, iso-calorific and iso-lipidic diets for 8 weeks. Experimental diets consisted of 30.2% protein, 18.6 kJ g^{-1} energy and 16.5% lipid from fish oil (FO), flaxseed oil (FxO) and 1:1 blends of the oils (FFxO). Moisture, ash, protein, final body weight, specific growth rate, weight gain, feed conversion ratio, survival and hepatosomatic index were not affected by treatments but the percent of lipids was significantly highest in fish fed the flaxseed oil diet (FxOD). The condition factors of fingerlings reared on FxOD and fish and flaxseed oils diet (FFxOD) were significantly lower than those fed the fish oil diet (FOD). Protein efficiency ratio (PER) was significantly higher than those fed the FOD and FFxOD. Whole body fatty acid compositions mirrored those of diet treatments. The highest amounts of highly unsaturated fatty acids (HUFAs) were detected in fish fed 100% FO, which was significantly different from other treatments. In all treatments polyunsaturated fatty acids/saturated fatty acids (PUFAs/SFAs) and n-6/n-3 ratios were higher than 0.45 and lower than 4, respectively. Present results indicate the fingerlings can be reared on diets in which FO has been replaced with FxO, with no significant effects on fish performance.

Keywords: Body composition, Fatty acid, Fish oil replacement, Rainbow trout, Vegetable oil

Introduction

In the course of just a few decades, fish farming has developed into a highly productive and efficient industry to produce animal protein for human consumption. In addition to good growing conditions, a prerequisite for productivity and economic sustainability in fish farming can be a reliable supply of effective feeds. For various reasons, fish meal and fish oil have historically been the dominant raw materials in the production of fish feeds. Due to the development of more energy dense feed types as well as general growth of the aquaculture industry, a significant proportion of the total global fish oil is used for its feed preparation. A lipid requirement equal to 100% of the world's total fish oil production is estimated by the year 2010 (New, 1999).

While marine oils are superior in their fatty acid composition they also contain a variety of toxic compounds including polychlorinated dibenzo-p-dioxins (PCDD), polychlorinated dibenzofurans (PCDF) and dioxin-like polychlorinated biphenyls (DL-PCB), particularly the non-ortho and mono-ortho substituted PCBs (Jacobs *et al.*, 2002a,b; Hites *et al.*, 2004a,b). These compounds are suspected to be carcinogenic and immunosuppressive in humans (Birnbaum and Tuomisto, 2000; Baccarelli *et al.*, 2002; Van Den Heuvel *et al.*, 2002).

It is also well-known that lipid oxidation is one of the major concerns in fish-derived food products. Polyunsaturated fatty acids (PUFAs) are more easily oxidized than saturated fatty acids (SFAs), and therefore, food products enhanced with the PUFAs n-3 are also more prone to lipid oxidation. There is potential human health risks associated with increased consumption of oxidized PUFAs n-3 products (Fritsche and Johnston, 1990; Kubow, 1993). Another important factor to limit a more common use of

* Correspondence: soofiani@cc.iut.ac.ir
[1]Department of Natural Resources, Isfahan University of Technology, Isfahan 84156-83111, Iran
Full list of author information is available at the end of the article