DEVELOPMENT OF FUNCTIONAL SEAFOOD PRODUCTS THROUGH DIETARY MODULATION IN AQUACULTURE. ENRICHMENT OF AFRICAN CATFISH WITH FUNCTIONAL SELENIUM: DOSE RESPONSE RELATION AND GROWTH PERFORMANCE

E. Schram[1], J.B. Luten [1,2]

[1] Netherlands Institute for Fisheries Research, Animal Sciences Group, Wageningen UR, PO Box 68, 1970 AB IJmuiden, The Netherlands
[2] Fiskeriforskning, Muninbakken 9-13, Breivika, Postboks 6122, 9291 Tromsø, Norway

Introduction

Functional foods have no universally accepted definition but can be described as fortified, enriched or enhanced foods that provide health benefits beyond the provision of essential nutrients (Hasler, 2002). The composition of the edible portion of fish is subject to many factors such as species, sex, degree of sexual maturation, size and diet (Botta and Siquires, 1986; Castro, 1988; Armstrong et al., 1991 in Heidmann Soccol and Oetterer, 2003). As all these factors can be controlled under farming conditions, aquaculture provides an excellent opportunity for the production of functional seafood products. However, the current aquaculture production of functional foods is, apart from fatty fish which is a functional feed in itself, limited to marine algae in Japan (Murata and Nakazoe, 2001). The potential of functional food production in aquaculture is underutilized while the market for foods positioned for their health benefits will continue to be strong for the next several decades (Hasler, 2002).
Within the frame work of Seafood plus the current research aims at the production of new, innovative functional aquaculture products through dietary modulation. The aim of this study was to create a functional seafood product with high levels of functional selenium. This trial was also set up to demonstrate the possibilities and potential of aquaculture production of functional seafood. Several studies report anti carcinogenic effects of dietary selenium in humans at levels above dietary requirement while the average daily intake is often marginal. Seafood already is an important source of dietary selenium for humans. Supplementing the human diet with functional seafood with high levels of functional selenium would enable full utilization of the health benefits. Aquaculture production of selenium enriched fish enables the incorporation of organic selenium compounds originating from garlic in human diets.

Materials and methods

The treatments consisted of different dietary levels of gamma-glutamyl-Se-selenonocysteine and Se-methylselenocysteine. Garlic can accumulate high levels of these functional forms of selenium and was used to fortify fish feeds with selenium. Garlic was grown and processed by Plant Research International, Wageningen UR, The Netherlands. Five treatments were defined as feeds with expected levels of bio-active selenium of 0, 0.3, 0.6, 0.9 and 1.9 mg/kg feed. A sixth treatment, a feed without garlic, was included to investigate the effect of garlic presence in the feed on growth performance and feed intake. African catfishes (104g) were stocked in 18, 32L glass tanks at a density of 24 fish per tank. Treatments were assigned to the tanks using a random number table, with triplicate tanks for each of the six treatments. Tanks were flown through with 25°C tap water at a rate of 0.6 tot 0.8L/min, yielding a renewal rate of approximately 1/hr for each tank. Tank effluents were discharged as recirculation might result in transfer of selenium compounds between tanks. Fishes were fed by hand to visually observed satiation, twice per day at 9.00 and 17.00 hours. The experimental period lasted for 47days. At day 1 five fishes in total and at day 47 5 fish per tank were randomly sampled. Sampled fish were filleted, fillets were pooled, homogenized and stored frozen at -70°C. Fillets will be analyzed for total selemium, gamma-glutamyl-Se-selenonocysteine and Se-methylselenocysteine.

Results

At present the fish and feed samples have not yet been analyzed for their organo-selenium or total selenium content. Hence the organo-selenium retention in the fish fillet in relation to dietary levels can not be presented. Figure 1 demonstrates that under the experimental conditions inclusion of garlic in the diet and different dietary organo-selenium levels did not significantly affect growth performance of African catfish (one-way ANOVA, $P = 0.096$).

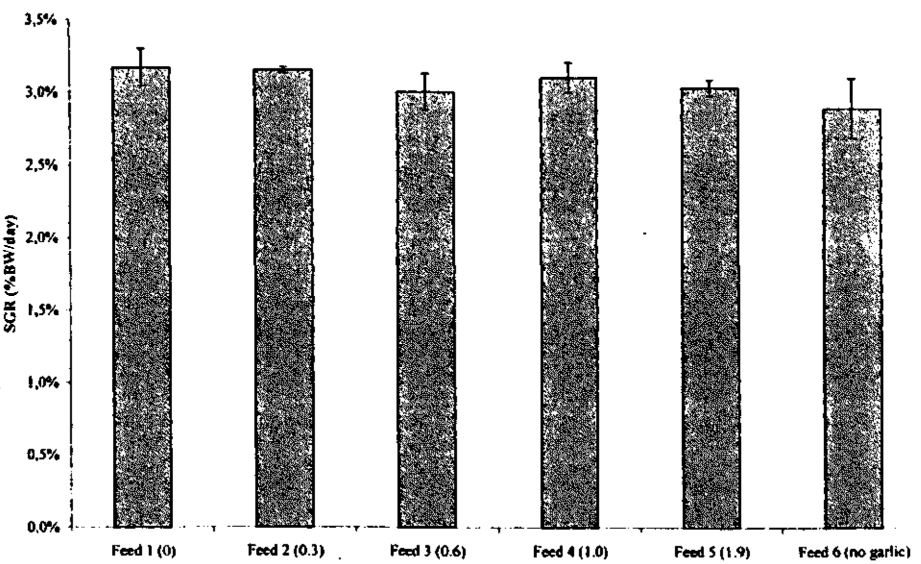

Fig. 1. Specific growth rate of African catfish fed different dietary levels of organo selenium (levels in parenthesis in mg/kg) originating from garlic.

References

Hasler, C.M. 2002. Functional foods: benefits, concerns and challenges – a position paper from the American council on sciences and health. Journal of Nutrition 132(12): 3772-3781.

Heidmann, M.C., Oetterer, M. 2003. Seafood as functional food. Brazilian archives of biology and technology 46(3): 443-454.

Murata, M., Nakazoe, J. 2001. Production of marine algae in Japan. Japan agricultural research quarterly 35(4): 281-290.