



Jeopardize induced by use of carotenoides in small scale trout farms in the Ohrid Lake Catchment (Albania)

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Keywords

Carotenoides
Oxidative stress
Authenticity
Fish feeding
Trout

Abstract

Due to chemical features additional fish food ingredients and particularly carotenoids are considered able to protect against oxidative stress, while are also were investigated in terms of disease prevention and treatment. The color of Ohrid Lake trout (*Salmo letnica*) and Ohrid belvica (*Salmo ohridanus*) is one of their most important quality criteria. In their natural ecosystems this is naturally induced particularity due to their food diet i.e., copepod calanoid (*Eudiaptomus gracilis*). The application of carotenoides as a nutrient impute to the feeding system of rainbow trout (*Oncorhynchus mykiss*) has other side of authenticity associated within fish marketing at the small-scale farms.

Introduction

The aim of this paper is to present the experimental try conducted in four different small scale trout farms in vicinity to Lake Ohrid area where carotenoides as a food supplement were employed. The typical pink muscle color is determined by astaxanthin, a carotenoid coming from dietary compounds that fish cannot synthesize in the aquaculture systems [1,2]. In natural conditions the color of Ohrid Lake trout (*Salmo letnica*) and Ohrid belvica (*Salmo ohridanus*) is one of their most important quality criteria. In their natural ecosystems this is naturally induced particularity due to their food diet i.e. copepod calanoid (*Eudiaptomus gracilis*). In addition to the pigmentation contribution, carotenoids are important in fish life, contributing for the proper function of some complex biological processes. Most of the time, the color of farmed trout is induced by adding cantaxanthin and astaxanthin which are two synthetic carotenoids, but this process is often too expensive [1]. For this reason, it is important to find some new and cheaper alternatives to improve the meat fish color. Carotenoid concentration in rainbow trout depends on fish weigh, can reach 6-7 mg/kg in the flesh at specimens weighing 0.1-0.5 kg, and to 25 mg/kg at larger trout. According to [3] it was noticed that improving the fish feed with a carotenoid concentration above 50 mg/kg dry matter does not induce a significant increase of meat fish pigmentation.

Rainbow trout (*Oncorhynchus mykiss*) is a highly commercial sport and market fish (FAO, 2011). Following official data [4,5] in 2018 aquaculture produced 6 258 tonnes, consisting of marine fishes (77 percent), rainbow trout (13 percent) and mussels (10 percent). There are currently 24 marine fish farms for sea bass and sea bream, 22 trout farms, several enterprises that farm mussels in Lake Butrint and 4 hatcheries for carp fingerlings that are grown in inland natural and artificial reservoirs.

Trout farming (*Oncorhynchus mykiss*) in raceways is concentrated in the north and southeast of Albania, where about 60 companies have their facilities. Most of them try to hold down costs by allowing the fish to reproduce naturally. Cultivation of the endemic fish koran (*Salmo letnica*) is restricted to the area near lake Ohrid. A few hatcheries are involved in the cultivation of common carp (*Cyprinus carpio*), Chinese carps such as grass carp (*Ctenopharyngodon idellus*), bighead carp (*Hypophthalmichthys nobilis*), and silver carp (*Hypophthalmichthys molitrix*) for restocking purposes. Carps are farmed in ponds. Aquaculture plays an important role in the Albanian economy. The government supports restocking policy, with carp and salmon family fingerling restocking every year. During the past decade, the national aquaculture sector has been creating a new vision, structure, and technology to meet consumer demand for fish products. This creates benefits for the farmers, increasing fish consumption by the local population and facilitating local employment and economies of

scale in rural areas. In fact, it seems that rainbow trout (*Oncorhynchus mykiss*) in Albania has been introduced in mid 70s. Currently the largest trout farm in Albania is that of Vau i Dejes, operated by Turkish company “Kilic” (established in 2013), while all others are of small-scale type of farming located in Tamara, Sina, Ulza, Qarishta, Bushtrica, Xhyra, Rajca, Bistrice, etc. The capacity of Kilic Aquaculture Albania is at 15 milion fingerlings per year with production capacity of 2500 tonnes, while 95% of production is exported.

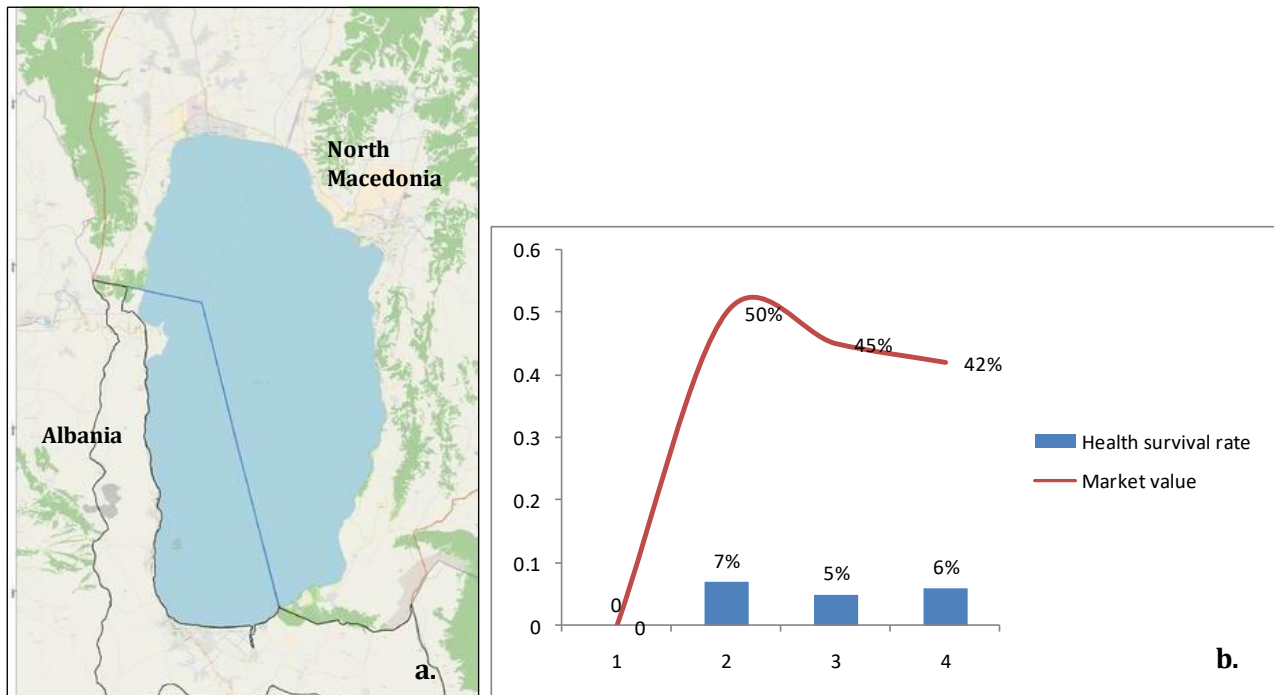


Figure 1. (a) Lake Ohrid settings; (b). The effects of carotenoids use in feeding trout expressed as percentage of increased survival and market price

Material and Methods

The experimental try with application of carotenoids as food additional ingredients to the commercial trout food was conducted in four different trout farms in vicinity of Lake Ohrid area. One of the farms was considered as a control one. Further data for compiling this survey is based on analyse scientific papers and online resources in the area of aquaculture development focused in trout farming in Albania, use of additional diet components, carotenoids, fish species employed in aquaculture practices, food types used, fish diet and ingredients. All data are sourced with aim to perform a concise literature review of natural sources including those rich in carotenoids in the farmed trout feed.

Results and Discussions

The natural food of rainbow trout depends on the age and size of fish, on the size of food item and on the habitat occupied [6,7]. Rainbow trout are aggressive and greedy in feeding. They are opportunistic feeders that grab and eat almost anything. Following [8,9,10], the terrestrial insects are also consumed when they fall into the water. These insects are adult beetles (Coleoptera), flies (Diptera), ants (Formicidae) and larvae of Lepidoptera (moths and butterflies).

Our finding (Figure 1,b) revealed significant increase in fish survival rate and small scale trout farm incomes. The experimental try done in four different farms (farm 1 used as a control one) concluded in a survival rate increase from 5-7% and generated income from 42-45% compared to the farm where was not applied carotenoid supplement. Similar results have been confirmed priory by [3] and [1].

Following the communication with local farmers, use of home-made feeds in some occasions seems to be feasible (fish based one-*Alburnus* sp., mainly). Home-made feeds seem to be a good solution, especially where commercial trout feeds are not readily available (Rajca farms). The commercial food used is completely imported from Greece, Turkey and other countries. The usual feeding daily feed rations are offered in 2-12/24 equal portions, where the younger fish are fed more frequently than older ones.

Conclusion

Is there any ethical dimension in use of carotenoids in case of Ohrid lake area?

Firstly, due to the fact that rainbow trout (*Oncorhynchus mykiss*) is alien species and Lake Ohrid is been assigned as hotspot of biodiversity and other designations it is prohibited to be farmed in wider catchment. Secondly, due to existence of naturally feeding based species (Ohrid trouts), the price of marketed rainbow trout mystifies the authenticity.

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