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- RESEARCH ARTICLE -

The Effects of Rosemary Extract (Rosemaria officinalis) as a Feed Additive on Growth and Whole-body Composition of the African Catfish (Clarias gariepinus (Burchell, 1822))

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Abstract

A preliminary study was conducted to evaluate the effect of the Rosemary extract (*Rosemaria officinalis*) on growth performance, feed utilization and body composition of the African catfish (*Clarias gariepinus*, Burchell, 1822). Fish with an average body weight of 10.59±0.31 g were fed with different concentrations (0, 0.25 and 0.5 %) of Rosemary extract at dietary for 60 days. At the end of experiment, the highest values of weight gain, specific growth rate and food conversion rate were 17.23±0.08 g, 1.93±0.07 and 1.16±0.06 at 0.5% Rosemary extract dosage group respectively. The highest survival rates were 100% at 0.25% Rosemary extract dosage groups. No significant differences were shown in whole body protein and lipid content among the dietary treatments. These results indicate that treatment of Rosemary extract has positive effect on growth in African catfish with no apparent effects on health status.

Keywords:

African catfish, *Clarias gariepinus*, Rosemary, *Rosemaria officinalis*, Growth

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Introduction

Herbs have been used as traditional medicine and immune booster for human beings for thousands of years in the world. The herbal products are added in animal feeds instead of chemical products in order to stimulate or promote the effective use of feed nutrients which result in more rapid gain, higher production and better feed efficiency (Ghazalah & Ali, 2008; Sabra & Metha, 1990). There are various reports of herbal fish diets promoting growth performance (Kim et al., 2000; Ji et al., 2007), increasing stress tolerance (Ji et al., 2009), and

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enhancing immune system efficiency (Ji et al., 2007, Dibyendu et al., 2008; Bai et al., 2009). More recently such applications have begun to demonstrate positive effects in feeds for various fish species including African catfish, (*Clarias gariepinus*) (Turan & Akyurt, 2005; Turan & Cek, 2007), angel fish (*Pterophyllum scalare*) (Yılmaz & Ergün, 2012), rainbow trout (*Oncorhynchus mykiss*) (Cagıltay et al., 2011; Cagıltay et al., 2013) tilapia (*Oreochromis aureus*) (Turan, 2006), tilapia (*Oreochromis niloticus*) (Rawling et al., 2009), common carp (*Cyprinus carpio*) (Turan et al., 2007) and crayfish (*Astacus leptodactylus*) (Turan et al., 2012).

Rosemary *(Rosemaria officinalis)*, belonging to the *Lamiaceae* family, is well known for its antioxidative properties, and is also used in several pharmaceutical applications (Cheung & Tai, 2007).Biologically, rosemary extract improved feed conversion, efficiency of broilers fed diet supplemented with such herb (Ghazalah & Ali, 20081). Cagıltay et al. (2013) reported that parallel to the concentration of rosemary in fed has decreased crude fat and increased amount of crude protein. Also, there have been a few studies on the antioxidative effect of rosemary (*Rosmaria officinalis*) in fish (Pe´rez-Mateos et al., 2002; Valeria et al., 2010; Alvarez et al., 2012).

Although previous studies have mostly investigated on effects of rosemary extracts on egg hatching and chemical composition and deteriorationof fish, there is a lack of data on the use of rosemary extract in diets for fish growth. In the present study we intended to ascertain whether rosemary extract included in the diet enhance the growth performance, feed utilization and carcass composition of the African catfish.

Material and Methods

Full-sibling fish (initial mean weight 10.59±0.31 g), produced in Mustafa Kemal University Fisheries Research Unit were randomly stocked into 100 L aquaria at a density of 15 fish per aquarium. The aquaria were equipped with aeration and supplied with continuously flowing water (2 L min-1), and controlled temperature (25 ± 1 °C). The photoperiod was maintained on a 12-h light: 12-h dark schedule.

The plant material, Rosemary was obtained from a local market, Hatay, Turkey. The dried and powdered the leaves of rosemary 20 gr. were extracted in 400 ml chloroform by kept on a rotary shaker for 24 h. Then, it was filtered through Whatman filter paper. The samples were further concentrated to dryness under reduced pressure at 37ºC using a rotary evaporator (Mahansen, 1996). Three experimental diets were prepared: 0, 0.25% and 0.5% Rosemary extract. Percentage inclusions of ingredients of the experimental diets are given in Table I. Fish meal, soybean meal and blood meal were used as the protein sources. Yellow maize, fish oil and vegetable oil were used as the carbohydrate and lipid sources, respectively. The 0.25 and 0.5% of Rosemary extract were included in the experimental diets. The rosemary extract free feed was used as a control diet. All dietary ingredients were milled to a 3 mm particle size. The ingredients were thoroughly mixed in mixing machine after which the experimental diets were pelleted with a laboratory pelleting machine with a 0.9 mm die and dried at ambient temperature (27 to 30°C). All experimental diets satisfied the nutrient requirements for growth of African catfish fingerlings (Soosean et al., 2010). Proximate composition of diet was carried out as described by AOAC (1990) (Table 1). The pellets were stored in freezer until feeding and all the groups were fed with their respective diet to ca. 4% body weight day^{-1} twice daily for 60 days.

Table 1.

Ingredients	Rosemary extract (%)		
	Control (0)	0.25	0.5
Fish meal (65 %HP)	25	25	25
Soy bean meal (45 %HP)	35	35	35
Yellow maize	15	14.75	14.5
Binder (starch)	2	2	2
Blood meal (85%HP)	10	10	10
Vitamin and mineral mix	3	3	3
Fish oil	6	6	6
Vegetable oil	4	4	4
Rosemary extract	0	0.25	0.5
Proximate composition (%			
Moisture	7.05	7.68	8.20
Crude protein	41.25	38.70	39.86
Crude lipid	14.26	13.25	14.20
Crude fibre	5.24	7.12	4.35
Ash	13.15	12.00	11.28
NFE	19.05	21.25	22.11

Water temperature and oxygen content were measured daily with a thermometer and a model 55 YSI oxygen meter (Yellow Springs Instruments Cy. Ohio), respectively. Weekly water samples were collected for analysis: pH was determined with Accumet pH meter (Model 915, Fisher Scientific, Pennsylvania), ammonia nitrogen N-NH_4 (Nessler method) and nitrite nitrogen N-NO_2 (sulphanilmethod) were determined colorimetrically with a spectrophotometer. The average water temperature was 24±1 ºC, and the oxygen content of the water was 5.05±0.78. At pH 7.5±0.6, the ammonia nitrogen content did not exceed 0.1 mg N-NH_4/l, and nitrite nitrogen was not higher than 0.04 mg N-NO_2/l.

During the experiment, the mortality was recorded daily and fish in each aquarium were counted and weighed individually at biweekly intervals after anesthetization for 2.5 min in water that contained 0.4 g L^{-1}tricainemethanesulphonate (TMS) and 0.8 g L^{-1}sodium bicarbonate as a buffer. Growth was monitored to determine the growth in each treatment groups during the experiment. Each fish was individually weighed and measured (total length) to the nearest 0.01 g and 0.01 cm, respectively. Weight gain feed conversion ratio, specific growth rate, protein efficiency ratio and survival rate were calculated in this experiment.

At the start of experiment, 15 fish randomly were treated with an overdose of phenoxyethanol (1.5 mg l^{-1}) solution, and stored at –20 ºC for the determination of body proximate composition. At the end of the feeding trial, 5 fish from each dose group (n=20 fish\per dose) were analyzed for final whole body proximate composition (AOAC, 1990). All data were subjected to a one-way analysis of variance to determine if there is a difference in weight gain and body composition among treatments. Duncan test was used to compare the means of the treatments when differences occurred.

Results

At the start of experiment, there was no statistical difference between experimental and control groups in initial weights meaning the conditions of the groups were the quite similar. The effects of different concentrations of dietary rosemary extract on growth and survival of on the African catfish (*Clarias gariepinus*) for 60 days are shown in Table 2.

Table 2

Growth rate significantly increased in catfish fed with rosemary extract-supplemented

	Rosemary extract (%)		
	0	0.25	0.5
Initial weight (g)	10.29±0.45[a]	10.61±0.63[a]	10.88±0.62[a]
Weight gain (g)	13.82±0.26[a]	14.38±0.73[a]	17.23±0.08[b]
SGR	1.71±0.46[a]	1.69±0.12[a]	1.93±0.07[a]
FCR	1.45±0.28[b]	1.39±0.08[b]	1.16±0.06[a]
PER	1.44±0.03[a]	1.49±0.07[a]	1.79±0.09[b]
ADG	0.230±0.004[a]	0.287±0.001[b]	0.240±0.010[a]
Survival (%)	97.78±2.22	100	97.78±2.22

diets in comparison with the control groups ($P<0.05$). Among the rosemary extract-supplemented groups, the fish fed diet with 0.5% rosemary extract exhibited significantly higher growth than fish fed diets with 0.25% and controlgroups (Table 2). Specific growth rate (SGR) ranged from 1.71±0.46 (control) to 1.93±0.07 (0.5% rosemary extract-supplemented group) and there was no statistical difference between experimental and control groups. The highest ADG (0.287±0.001 g) was observed in fish fed with 0.25% rosemary extract when compared to control and 0.5% rosemary extract incorporated diet fed groups. Feed conversion ratio (FCR) and protein efficiency ratio (PER) were also significantly improved in group fed diet with 0.5% rosemary extract than that with control and 0.25% rosemary extract-supplemented groups ($P<0.05$, Table 2). The best feed conversion ratio and other growth parameters were observed at the 0.5% rosemary extract-supplemented group.

The effects of different concentrations of dietary rosemary extract on the chemical composition of the whole-body African catfish (*Clarias gariepinus*) for 60 days are shown in Table 3. No significant differences were shown in whole body moisture, protein, lipid and ash among the dietary treatments ($P>0.05$).

Table 3.

Chemical composition (%)	Initial	Rosemary extract (%)		
		0	0.25	0.5
Moisture	75.56±0.98	75.27±0.54[a]	75.61±0.44[a]	75.32±0.71[a]
Crude protein	17.48±0.86	18.42±0.60[a]	19.63±0.48[a]	19.85±0.56[a]
Crude lipid	5.87±0.55	4.95±0.31[a]	4.32±0.45[a]	4.07±0.63[a]
Ash	0.98±0.04	1.01±0.25[a]	1.04±0.24[a]	1.08±0.08[a]

Discussion

This finding indicated that the Rosemary extract is a positive dietary additive to induce effective technical and economical propagations for catfish culture. Yilmaz et al. (2011) showed that the addition of rosemary extracts promoted growth and enhanced some non-specific immunity indicators of tilapia, *Oreochromis mossambicus.* Similarly, rosemary extract improved feed conversion, efficiency of broilers fed diet supplemented with such herb (Ghazalah & Ali, 2008). Cristea et al. (2012) suggested that various types of feed additives enhance the digestibility and utilization efficiency of nutrients in aquaculture.

Phytoadditives are fodder additives obtained from medicinal plants or plants extract. They are being used on a wide range, by humans as well as by animals, including fish. Recent studies tried to show the effects of phytoadditives usage in all farmed animals. The main advantage of using these phytoadditives is that they are natural substances that don't pose any threat to fish health, human health or to the environment. Researchers are still in progress to determine their way of action and the possible side effects that can appear as a result of their use, and to determine the possibility of using other plants as phytoadditives (Gabor et al., 2011). Hence the present study investigated the effect of different concentrations of rosemary extract as a dietary supplement in African catfish. Several plants and natural compounds were tested for their growth promoting activities in catfish (Turan & Akyurt, 2005; Turan & Cek, 2007; Soosean et al., 2010; Dada et al., 2013).

To best of our knowledge, no work has been reported using rosemary extract as feed additive substance in catfish culture. This is a preliminary report to our knowledge regarding the potential use of Rosemary extract as a feed additive in catfish culture.

From a proximate composition point of view, rosemary extract not increased the level of whole body protein and lipid in catfish. Similarly, Turi et al. (2009) reported that fillet from sea bass fed with Rosemary diet showed protein, lipid and ash contents similar to one of fish fed diet without supplementation.

In conclusion, this study established the efficacy of Rosemary extract feed additives as a growth promoter in *C. gariepinus* and fish farmers should be encouraged to supplement these feed additives in fish diet. This would allow for faster fish growth leading to improved production time; however, research is required with different important aquaculture species and longer time scales to fully evaluate the value of including rosemary extract at industrial farming levels.

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