

The Effect on Growth Performance of Rainbow Trout Fry (*Onchorhynchus mykiss*, Walbaum 1792) of Rosemary and Clove Oils Added Diet

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Abstract

In this study was aimed to determine the growth performance of rainbow trout (*Onchorhynchus mykiss*, Walbaum 1792) fry fed with feed containing essential oils rosemary, cloves and rosemary + clove at different rates. In research, rainbow trout fries were used which initial weight 30 ± 5 g. Experimental groups are that rosemary, clove and rosemary + clove essential oils added the diets. These groups were as follow: **Control** group (no added any additive), 0.5% Rosemary oil added **R-0.5**, 1% Rosemary oil added **R-1**, 1.5 % Rosemary oil added **R-1.5**, 0.5% Clove oil added **C-0.5**, 1% Clove oil added **C-1**, 1.5% Clove oil added **C-1.5**, 0.5% Rosemary + Cove oil added **RC-0.5**, 1% Rosemary + Cove oil added **RC-1**, 1.5% Rosemary + Cove oil added **RC-1.5** group. Experiment lasted 60 days. At the end of the study it was calculated growth parameters; average live weight, daily absolute live weight gain, relative growth rates, specific growth rate, condition factor with viserosomatic and hepatosomatic factor. In the light of statistical data, daily absolute live weight gains with the viserosomatic and hepatosomatic index values were found to be significant differences between all groups ($p < 0.05$).

Keywords: Rosemary, clove, rainbow trout, growth performance.

Öz

Biberiye ve Karanfil Esansiyel Yağları İlave Edilen Diyetlerin Gökkuşacağı Alabalığı (*Onchorhynchus mykiss*, Walbaum 1792) Yavrularının Büyüme Performansına Etkisi

Bu çalışma, farklı oranlarda biberiye, karanfil ve biberiye + karanfil esansiyel yağları içeren yemlerin gökkuşacağı alabalığı (*Onchorhynchus mykiss*, Walbaum 1792) yavrularının büyüme performansını belirlemek amacıyla yapıldı. Araştırmada ortalama başlangıç ağırlıkları 30 ± 5 g olan gökkuşacağı alabalığı yavruları kullanıldı. Rasyona katılan biberiye, karanfil, biberiye + karanfil ekstraktı araştırma gruplarını oluşturdu. Herhangi bir katkı maddesi katılmayan grup **Kontrol** grubunu, % 0,5 biberiye ekstraktı katılan grup **B-0,5**; % 1 biberiye ekstraktı katılan grup **B-1**; % 1.5 biberiye ekstraktı katılan grup **B-1,5**; % 0,5 karanfil ekstraktı katılan grup **K-0,5**; % 1 karanfil ekstraktı katılan grup **K-1**; % 1,5 karanfilekstraktı katılan grup **K-1,5**; % 0,5 biberiye+karanfil ekstraktı katılan grup **BK-0,5**; % 1 biberiye+karanfil ekstraktı katılan grup **BK-1**; % 1,5 biberiye+karanfil ekstraktı katılan grup **BK-1,5** grubunu oluşturdu. Deneme 60 gün sürdü. Çalışma sonunda grupların büyüme parametrelerinden olan ortalama canlı ağırlıkları, oransal büyüme oranları, günlük mutlak canlı ağırlık artışları, spesifik büyüme oranı, kondüsyon faktörü ile hepatosomatik ve viserosomatik indeks değerleri hesaplandı. İstatiksel veriler ışığında günlük mutlak canlı ağırlık karşıtı ile hepatosomatik ve viserosomatik indeks değerlerinin bütün gruplar arasındaki farklılıkların önemli olduğu belirlendi ($P < 0.05$).

AnahtarKelimeler: Biberiye, karanfil, gökkuşacağı alabalığı, gelişim performansı.

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Introduction

Our country has a great potential in the development of the trout industry because it has good quality fresh water resources. The trout, among the species commonly cultivated in Turkey and maintains premier with an increase production in recent years. Rainbow trout (*Oncorhynchus mykiss*) is preferred according to other fishes for reasons of adaptation to culture conditions, ability to feed, resistance to stress, and good meat quality in intensive fish farming (Çelikkale, 1988; Yıldız, 2001). The main aim in the aquaculture is present to the market in the shortest period, healthy and at the lowest cost of kind production. In order to achieve this, the qualitative, quantitative nutrient (energy, protein and amino acids, fatty acids, vitamins and minerals) and environmental (water quality) requirements of the grown-up creature should be met as close as possible to the optimum (Şahin and Üstündağ, 2003). Growth also is affected by various factors such as feed rate, feed quality, feed consumption and water temperature. These factors affect nutritional requirements and nutrients in feed rate. The main factors affecting the consumption of feed are the water temperature and the energy content of it. Essential oils are used as aroma additives in feed as well as antimicrobial and antioxidant effects. The characteristic flavors of essential oils are advantageous in the taste and odor of the feeds, especially changing situation of feed content. Because of fish are sensitive to smell and taste, the smell and flavor effect of essential oils attracts more attention, so it is known that odor and taste affect feed intake. There are also reports that essential oils improve digestion. In many studies, essential oils found in the diet have been expression to stimulate digestive enzymes secreted from the intestinal mucosa

(Toroğlu and Çenet, 2006; Dalkılıç, 2007; Kutlu, 2010). Feed and nutrition in aquaculture is very important in reaching short, medium and long term goals. For this reason, it is on the top of list of factors that affect the health of the organism, productivity, quality and quantity of the product, the contribution of the organic waste to the environment and also the cost of production. There fore, it is aimed in this study determined the effect on growth performance of rosemary and clove oils added to the diet of rainbow trout fries.

Materials and Methods

This study was carried out in the hatchery unit of a private fish farm. In the experiment, 10 fiber tanks with dimensions of 100x200x50cm were used. The tanks are placed indoor and they were covered with net to prevent jumping of fishes. In this research, pure rosemary and clove essential oils were used. These oils were obtained from a private business (Agromiks, Turkey). In the experiment, 45% ham protein, 12% crude oil and different proportions of essential oil feed meal were prepared by a private company for fry. The zeolite in powder form, which is impregnated with plant essential oil, was made into pellet by mixing with fish meal. In this way, the volatility of essential oils was prevented by zeolite. Fishes were fed on this pellet prepared according the fish dimension.

In this study, 10 different experimental groups were planned. Randomly chosen 30 rainbow trout fry with 30 ± 5 g in weight were used in each group. No recurrence in the study. Experimental groups consist of the different combinations and concentrations of rosemary and clove essential oils that were added in the diets. These groups were as follow: **control** (no

added any additive), **R-0.5** (0.5% rosemary oil added), **R-1** (1% rosemary oil added), **R-1.5** (1.5% rosemary oil added), **C-0.5** (0.5% clove oil added), **C-1** (1% clove oil added), **C-1.5** (1.5% clove oil added), **RC-0.5** (0.5% rosemary + 0.5% clove oil added), **RC-1** (1% rosemary + 1% clove oil added) and **RC-1.5** (1.5% rosemary + 1.5% clove oil added). Later, the fish were fed on these diets for 3 times a day during 60 days. The amounts of daily food given to the fish were 2% of total fish weight. The tanks were weekly cleaned by siphoning.

During the study, dissolved oxygen, temperature, salinity and pH of water in tanks were daily measured with the YSI Professional Plus Series device. Total length and weight of fish were determined at the beginning and at the end of study.

The data obtained were evaluated in the light of the literature and calculated according to the formulas given below (El Sayed, 1990; Çetinkaya, 1995; Hoşsu *et al.*, 2001).

$$\text{Average weight gain (g)} = W1 - W0$$

$$W1 = \text{the mean individual weight gain (g)}$$

$$W0 = \text{Initial average individual weight (g)}$$

$$\text{Proportional growth rate (\%)} = (W1 - W0) / W0 \cdot 100$$

$$\text{The absolute daily live weight gain (g)} = (W1 - W0) / d$$

$$d = \text{Time of study (days)}$$

$$\text{Specific growth rate (\% day}^{-1}\text{)} = ((\ln W1 - \ln W0) / d) \cdot 100$$

$$\text{Condition factor} = (W / L^3) \cdot 100$$

$$W = \text{individual weight of fish (g)}$$

$$L = \text{total length of fish (cm)}$$

$$\text{Hepatosomatic index (\%)} = (\text{Liver weight (g)} / \text{Live weight (g)}) \cdot 100$$

$$\text{Visserosomatic index value} = [\text{Weight of internal organs (g)} / \text{Live weight (g)}] \cdot 100$$

The data were statistically analyzed according to the variance analysis. Evaluations are subjected to Duncan's multiple comparison test between different groups.

Results

During the study, the water measurement parameters were measured regularly every day and average water temperature is 11.7°C, pH: 8.45, dissolved oxygen 6.42 mg/L, dissolved oxygen saturation 59.3 (%) and salinity 0.20 ppt. At the end of the study, the weight of each fish fed with different feed groups was taken. Average live weights at the beginning and end of the study, proportional growth rate, live weight in Table 1, specific growth rates and daily absolute live weight gains are given in Table 2.

Table 1. Average live weights, average weight gains and proportional growth rates of the fish in the group at the beginning and end of study

Groups	Average initial weight (mean±SD)	Average final weight (mean±SD)	Average weight gain (g)	Proportional growth rate (%)
B-0.5	29.80±2.14	70.43±16.60	40.56 ^a	135.79
B-1	29.06±2.09	71.98±17.49	42.91 ^a	147.62
B-1.5	29.76±2.05	65.02±16.54	35.26 ^{ab}	118.50
K-0.5	29.71±2.27	62.00±16.45	32.28 ^b	108.63
K-1	30.11±2.48	59.00±13.93	29.09 ^b	96.60
K-1.5	29.83±2.04	68.53±15.85	38.70 ^a	129.72
B+K-0.5	30.00±2.40	62.68±18.01	32.68 ^b	108.96
B+K-1	29.91±2.03	61.47±12.54	31.56 ^b	105.50
B+K-1.5	28.89±2.16	64.24±13.42	35.35 ^{ab}	122.36
Control	29.05±1.92	70.50±12.37	41.44 ^a	142.63
P				*

*: P < 0.05 (Differences between group movements bearing different letters (a, b, ab) in the same column are significant.)

Table 2. The absolute daily weight gains and specific growth rates of the fishes in the group at the end of the study

Groups	Absolute live weight gain daily (g)	Specific growth rate (% day ⁻¹)
B-0.5	0.6760 ^a	1.4296
B-1	0.7151 ^a	1.5112
B-1.5	0.5877 ^b	1.3027
K-0.5	0.5380 ^c	1.2256
K-1	0.4849 ^d	1.1267
K-1.5	0.6450 ^{ab}	1.3862
B+K-0.5	0.5448 ^c	1.2283
B+K-1	0.5260 ^c	1.2004
B+K-1.5	0.5892 ^b	1.3319
Control	0.6907 ^a	1.4773
P	*	

*: P < 0.05 (The differences between group averages bearing different letters (a, b, c, d, ab) in the same column are significant.)

At the end of study, the average weight gain was highest in the group to which B-1 was added, but was lowest in the fish fed with the group containing K-1. The absolute daily weight gain was determined as B-1 > B-0 > K-1.5 > B + K-1.5 > B-1.5 > B + K-0.5 > K-0.5 > B + K-1 > K-1 groups respectively. At the beginning and end of the experiment, the length, weight and condition factors of the fish in each group were calculated and given in Table 3.

At the end of the experiment, length lengths of fish groups were Control > K-1.5 > B-0.5 > K-1 > B+K-0.5 > B+K-1 > B-1.5 > B-1 > B+K-1.5 > K-0.5 respectively. Condition factor increased in B-0.5, B-1, B-1.5 and B + K-0.5 groups but it decreased in all other groups. In addition, hepatosomatic and viserosomatic index values are calculated according to the values determined at the end of the study and given in Table 4.

The hepatosomatic index values of the fish groups fed with essential oil-containing feeds were B-0.5 > K-0.5 > B-1 > B + K-0.5 > Control > K-1.5 > B + K-1 > B-K-1 > B-1 > B-

1 while the viserosomatic index values were K-0.5 > B-0.5 > B-1 > 5 > K-1.5 > B-1.5 > B + K-1 > B + K-1.5 respectively.

Discussion

In this study, participation in food of rosemary, cloves and rosemary + cloves at different ratios and feeding of rainbow trout fries were carried out for a period of 60 days. At the end of the study, average length and weight gain, specific growth rates and daily absolute weight gain of rainbow trout fries were not different according to the control group. At the end of study, the average live weight gain was highest in the group fed with 1% rosemary supplement but lowest in the group containing 1% cloves. The rate of survival was not changed in the fish groups fed with the control group and the feeds containing essential oil and this ratio was found 100% in all groups. In the work done by Zırh and Hisar (2013) mint, thyme and sage oils were added to the rainbow trout feeds separately at 500 mg/kg, 1000 mg/kg and 1500

Table 3. The average length, weight and condition factors of fish groups fed with essentialoil-containing feeds at the beginning and end of experiment

Features	B-0,5	B-1	B-1,5	K-0,5	K-1	K-1,5	B+K-0,5	B+K-1	B+K-1,5	Control
Initial										
Length(cm)	13.82±0.46	13.83±0.49	13.82±0.48	13.82±0.48	13.85±0.49	13.85±0.49	13.83±0.46	13.83±0.48	13.82±0.48	13.85±0.51
Weight (g)	29.8±2.14	29.06±2.09	29.76±2.05	29.71±2.27	30.11±2.48	29.83±2.04	30.00±2.40	29.91±2.03	28.89±2.16	29.05±1.92
Condition factors	1.12±0.01	1.09±0.01	1.12±0.01	1.12±0.01	1.13±0.01	1.12±0.01	1.13±0.01	1.13±0.01	1.09±0.01	1.09±0.01
Final										
Length(cm)	18.32±1.41	18.00±1.76	18.03±1.47	17.95±1.29	18.19±1.60	18.87±1.31	18.14±1.41	18.08±1.18	18.00±0.98	18.95±1.15
Weight (g)	70.43±16.6	71.98±17.49	65.02±16.54	62.00±16.45	59.00±13.93	68.53±15.85	62.68±18.01	61.47±12.54	64.24±13.42	70.50±12.3
Condition factors	1.14±0.05	1.23±0.05	1.10±0.05	1.07±0.05	0.98±0.05	1.01±0.05	1.04±0.05	1.03±0.05	1.10±0.05	1.03±0.05

Table 4. Hepatosomatic and viserosomatic index values of fish groups

Rates	GROUPS									
	B-0.5	B-1	B-1.5	K-0.5	K-1	K-1.5	B+K-0.5	B+K-1	B+K-1.5	Control
HepatosomaticIndex	2.86	2.29	1.48	2.40	1.65	1.89	2.04	1.88	1.84	1.93
Viserosomatic Index	12.31	11.85	8.96	13.36	11.01	10.16	10.42	8.73	8.64	11.38

mg / kg and to examined the effect on growth parameters of rainbow trout fries. At the end of study, all the growth parameters of the feed additives with mint oil were found to be lower in all three levels than the control group. Thyme and sage added feed groups were higher than control group at all levels. Bilen and Bilen (2012) evaluated the effects of *Cotinus coggygia* and *Laurus nobilis* plants on the growth rate, feed rate and survival rate of cultured trout. Including the control group of fries trout, with an average weight of 66.13 ± 0.94 g was fed with five different test diets containing 1% and 1.5% *Cotinus coggygia* with 1% and 1.5% *Laurus nobilis*. As a result of feeding, they found that the effect of *Cotinus coggygia* and *Laurus nobilis* were negligible on growth performance of trout and utilization of feed. In another study, the effect of rainbow trout on growth, body composition and digestibility rates of feeds containing pomace oil at different ratios was investigated. Rate of pomace oil in feed weren't affected on viserosomatic index, carcass yield, condition factor but stated that a significant change in the index value of hepatosomatik. At the end of the experiment, body weight gain, specific growth rate, feed intake, feed conversion wasn't affected by pomace oil in the feed (Kaya, 2010). Bayır and Atamanalp (2011) examined some enzyme activities, HSI (hepatosomatic index) and live weight gain in rainbow trout (*Oncorhynchus mykiss*) fed with two different doses of saponin (150 mg kg⁻¹ and 300 mg kg⁻¹). At the end of the study, they stated that the highest value observed in the control group for HSI parameters and body weight gain.

Yiğit et al., (2013), added canola pulses at different ratios (12%, 22%, 32% and 42%) in the feeds of the *Cyprinus carpio* that 0.25 ± 0.01 g weighing. In this study were investigated feed rate, body composition, survival

rate and hepatosomatic index values of the constituent nutrient on growth. At the end of the experiment, the best average weight, weight gain and specific growth rate were obtained from the control group. The control group showed similar growth to the group containing 12% and 22% of canola seeds. Body composition, hepatosomatic index and survival rate were not affected by the use of canola broth in the feed. As a result, it has been stated that combination can be used with 22% canola pulp and 14.30% soybean paste in feed of the *Cyprinus carpio*.

Consequently, we must state that raising constitute the largest input of feed business. For this, the aim of the growers is to implement a quality feed and a successful feeding strategy. The reason for this is to get the product in the shortest time with the least amount of food. Therefore, it is becoming more and more important to utilize aromatic plants and the essential oils obtained from these plants. Because this plants contain antimicrobial and digestive stimulating properties of the active components of these oils. The use of these substances should be recommended.

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