

**EFFECT of SAGE SUPPLEMENTATION FEEDS ON SOME GROWTH PARAMETERS
OF BROWN TROUT**

Muhammed ATAMANALP¹Esat Mahmut KOCAMAN¹, Gonca ALAK²,

Arzu UÇAR¹, Veysel PARLAK¹, Telat YANIK¹

¹Atatürk University, Fisheries Faculty, 25240, Erzurum, Turkey.

²Atatürk University, Agriculture Faculty, Agricultural Biotechnology Department,
25240, Erzurum, Turkey; galak@atauni.edu.tr

Abstract

*This study was carried out to determine the influence of supplemental sage on some growth parameters in brown trout (*Salmo trutta fario*). For these purposes, 280 brown trout randomly distributed into eight tanks at an initial density of 35 fish/ tank. The control group was fed with commercial diet without sage, and treatment group was fed 1% sage added diets. The well water at 9.0 ± 1.0 °C was supplied in water through system with constant aeration. The fish were fed two times a day at a readjusted-restricted rate (0.9% body weight/day) for a total of 8 weeks, with intermittent biomass measurements taken every 2 weeks. Feeding rate was re-adjusted every 3 days for each individual tank according to estimated weight increases.*

At the end of 60- days treatment period, the results showed that sage supplementation had significant effect on growth performance of brown trout. Fish fed sage diets had significantly higher final individual weight than control diets ($P < 0.05$).

Key words: sage, growth performance, feeding, brown trout, *Salmo trutta fario*

1. INTRODUCTION

Aquaculture has a rapid increase in Turkey and the world recently. In order to meet increasing production, there are some conducted studies for reaching a quality product in aquaculture and making the production economical. Being aware of the growth performance and meeting optimum improvement in aquaculture are the most important subjects among these studies (Alak, Hisar & Hisar 2010).

Growth and maturity of animals depend on many genetic, environmental and nutritional factors. Nutrition has particular importance on growth of poikilotherm vertebrata such as fishes (Thorpe et al. 1989; Sönmez et al. 2009; Alak, Hisar & Hisar 2010). Living organisms use energy they received in vital metabolism activities such as respiration, digestion, excretion, reproduction in order to maintain their lives. They use rest of the energy for growing. Although growing is accepted as increase in height and weight in general, it means increase in weight for fishes (Korkut et al. 2007; Alak, Hisar & Hisar 2010).

In order to meet fish requirements of increasing fish enterprises, procurement of easily obtainable and cost effective feeds is brought to the agenda; quality feed requirement with high protein content is appeared (Erdoğan 2008; Dulluç 2010; Alak, Uçar & Atamanalp 2012). In these conducted studies, we concentrated on different aromatic plants in addition to probiotics, prebiotics, enzymes and organic acids as alternative growth factors for positively affecting amount and quality of animal products, protecting animal health and increasing performance in feeding animals (Şengezer & Güngör, 2008).

Essential oils are obtained from leaf, flower, shell, seed and roots of plants by steam distillation or extraction; they are in liquid form at room temperature and are easily crystallizable, mostly colorless or straw yellow compounds. They are also lipoid mixtures which provide the plant characteristic feature, comprised by a number of chemical components of the plant and have a feature of washing away by water (Şengezer & Güngör, 2008).

The purpose of the study is to examine usage possibilities of herbal foods as feed additives and determine their effects on aquatic living beings by live weight gain parameters in aquaculture.

2. MATERIALS AND METHODS

Brown trout juveniles (100 ± 15 g initial weight) were obtained from the Research and Extension Center of Aquaculture Department at Ataturk University, Erzurum, Türkiye. Two experimental diets were prepared by supplementing commercial trout diet (Sibal Yem San., Türkiye) with sage (0 (H0, control); 1% (sage)). Diets were offered to the fish distributed randomly in four replicates 40-L fiberglass tanks per each of the two dietary treatments, for a total of 35 fish per tank. The well water at 9.0 ± 1.0 °C (mean $\pm$ SD, range 8.0-10.0 °C) was supplied in water through system with constant aeration. The fish were fed two times a day at a readjusted-restricted rate (0.9% body weight/day) for a total of 8 weeks, with intermittent biomass measurements taken every 2 weeks. Feeding rate was re-adjusted every 3 days for each individual tank including projected weight increases (Yanık et al. 2012). Live weight gain, daily specific growth and net live weight gain were calculated according to Yanık (1996).

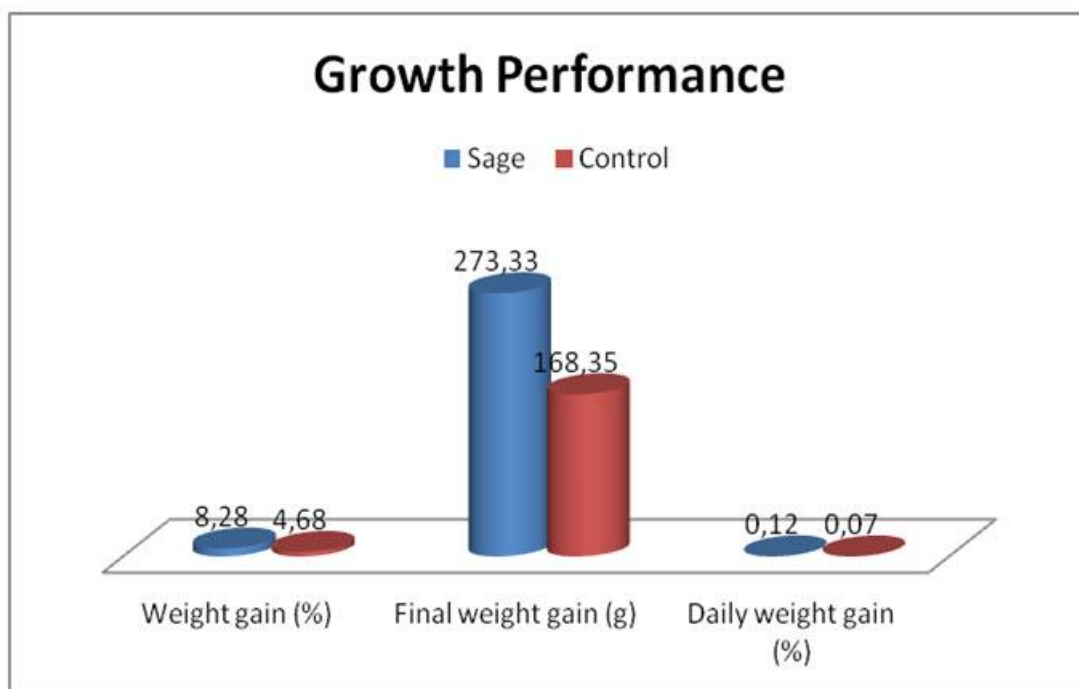
3. RESULTS AND DISCUSSION

Sage supplementation had significant effect on growth performance of brown trout ($P < 0.05$). Fish fed sage diet had significantly higher final individual weight from than control diet (Fig.1).

This results are presented that sage application increased the growth performance of brown trout at eight weeks as compared to the control values. There are a lot of study about of aquaculture and feeding application (Beklevik & Polat 2001; Tekelioglu et al. 2003; Oliveira & Cyrino 2004; Keskin & Erdem 2005; Yılmaz 2005; Harmantepe & Büyükhatoğlu 2007; Dalkıran 2008).

At the end of test period, live weight gains (%) were recorded respectively as 4.68 ± 0.15 and 8.28 ± 0.16 in control and sage added groups; and the difference between groups was found to be highly important at $p < 0.01$ level. Similar with our results, Aybal (2007), Aybal (2007) examined the effect of canola meal on tiddlers in his/her study conducted by tilapia (*Oreochromis niloticus* L.) tiddlers and stated that the best growth was seen in the treatment groups (15.86 ± 0.43 g) fed by feed (KN-1) 1 g/kg enzyme added to control group among the groups with 1.03 ± 0.01 g initial live weight averages by the end of period and groups fed by KN-0, KN-5, KN10-1, KN10-0, KN10-5, KN50-5, KN50-1 and KN50-0 followed this group as respectively 15.70 ± 0.92 , 15.43 ± 0.00 , 14.80 ± 0.14 , 14.51 ± 0.59 , 14.40 ± 0.35 , 10.42 ± 0.38 , 10.31 ± 0.42 and 9.73 ± 0.42 . In another conducted research, Beklevik & Polat (2001), revealed that feeds which were prepared by adding 1.5% DL-alanine and 1.5% betaine were given to small rainbow trout whose initial weights were 8.68 ± 0.71 g for 60 days, and at the end of testing, among the groups, the best performance was seen in betaine group by 343.20% while the lowest performance was seen in control group (226.27%) in percentile live weight gains. Dalkıran (2008) searched growth performance of *Cyprinus carpio* by adding 1.5% betain as vegetable protein weighted eating tempting item in his/her study. In the research, fish flour weighted control feed and vegetable weighted two test feeds were used and at the end of 60-day testing, it was stated that percentile live weight gain was 140.97 ± 4.36 % in control group while 215.57 ± 15.87 % in group fed by betain feed.

Fig.1



In our study, where daily specific growth percentile (%) was 0.07 ± 0.01 in control group while 0.12 ± 0.02 in treatment group, daily specific growths of test groups were found to be statistically important ($p < 0.05$). Atalayoglu & Çakmak (2010), examined usability of hazelnut kernel meal in small common carp (*Cyprinus carpio* L.) rations, and they fed totally 300 small common carps, whose average weights were 6.5 ± 0.1 g, by using hazelnut kernel meal at 0, 10, 20, 30 and 40 percentiles in respectively control, test 1, test 2, test 3 and test 4 groups for 4 months in this research. They stated at the end of test period that increasing hazelnut kernel meal percentile in the small common carp ration was an effective factor on live weight gain (LWG, %) and specific growth rate (SGR, %); and the highest live weight gain (LWG) was obtained in control and test 1 feeds. In another study conducted on fishes about feeding, molasses in different rates were added to diet of small rainbow trout and they were fed for 60 days; then no statistically important difference was found between treatment groups and control group at the end of test (Akyurt, Kırım & Şentürk 1993).

It was found among groups that while net live weight gain was 168.33 ± 2.50 g in control group, it was 273.34 ± 3.52 g in group fed by sage added feed, and the difference was found to be statistically very important ($p < 0.01$). In parallel with our results, rainbow trout, whose average live weight were 75 g, were fed by two different fish flours and feeds including soybean meals in another study searching alternative protein resources and it was stated at the end of research that fish flour level was highly effective on post feed live weight, live weight gain during feeding and feed conversion rate (Bilgüven 2006). In another study conducted by the same fish species, Harmanatepe et al.(2008) searched the effect of brown (anchovy, *Engraulis encrasicolus* L.) and white fish flour (codfish, *Gadus morhua* L.) used in trout feeds on the tiddler growth performance, and 120 tiddlers whose average weight was 10 g were fed twice a day until they were full for 30 days, they stated at the end of test that the best specific growth rate was obtained from the group fed by feed including white fish flour and the difference between groups were important.

4. CONCLUSION

As can be seen from the results of different researches, different results can be obtained depending on used alternative additive levels and fish species. Recent increase in the number and production capacity of fish production enterprises has led to searching cost effective and easily obtainable alternative animal and herbal resources.

Aromatic plants and essential oils obtained therefrom have many positive effects on animals such as durability to environmental conditions, feed flavoring, feed conversion ratio increase, and digestion stimulating and antiseptic (Şengezer & Güngör 2008).

Depending on the findings of the research, we think that aromatic vegetable oils can be used as growth increasing additive in feeding trout and other alternative vegetable oils which can have an effect on growth and development should also be used.

REFERENCES

- Akyurt, İ, Kırım, B, & Şentürk, E 1993, 'Ticari bir pelet alabalık yemine, farklı düzeylerde ilave edilen melasın gökkuşağı alabalığının (*Oncorhynchus mykiss*) büyümesi, yem değerlendirmesi ve yaşama oranı üzerine etkileri'. Doğu Anadolu Bölgesi I. Su Ürünleri Sempozyumu, 23-25 Haziran 1993, Erzurum.
- Alak, G, Hisar, SA, & Hisar, O 2010, 'Su Ürünleri Yetiştiriciliğinde Fotoperyot Uygulamaları', *Hasad Hayvancılık Dergisi*, vol. 26, no. 305, pp.58-61.
- Alak, G, Ucar, A, & Atamanalp, M 2012, 'Bacteria as an Alternative Protein Source in Aquaculture', *Turkish Journal of Scientific Reviews*, vol.5, no.2, pp. 106-108.
- Atalayoğlu, G, &Çakmak, MN 2010, 'The Investigation Possibilities of Using Hazelnut Kernel Meal in Scale Carp (*Cyprinus carpio* L. 1843) Diets', *Firat Univ. Journal of Science* , vol.22, no. 2, pp. 71-78.
- Aybal, NÖ 2007, *Tilapia (Oreochromis niloticus L.) yavrularının yemlerinde protein kaynağı olarak kanola (Brassica spp.) küspesi kullanma olanakları*. Doktora tezi. Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü.
- Beklevik, G, & Polat, A 2001, 'DL-Alanin ve Betain Katkılı Yemlerin Gökkuşağı Alabalığı (*Oncorhynchus mykiss*. W. 1972) Fingerlinklerinin Büyüme ve Vücut Besin Madde Bilesenlerine Etkileri', *Turk J. Vet. Anim. Sci*, vol. 25, pp. 301 – 307.
- Bilgüven, M 2006, 'The Effects of Feeds Containing Fish Oil or Soybean Oil At Different Levels of Fish Meal and Soybean Meal On The Fattening Performance of Rainbow Trout (*Oncorhynchus mykiss*, Walbaum)', *U.Ü. Ziraat Fakültesi Dergisi*, vol. 2, no. 21, pp. 25-30.
- Dalkıran, G 2008, *Effect of betaine supplementation in the plant protein based diets on feed intake and growth performance in Koi carp (Cyprinus carpio L.)*. Yüksek lisans tezi. Ondokuz Mayıs Üniversitesi Fen Bilimleri Enstitüsü. Samsun
- Dulluç A 2010. *Probiyotik ilaveli beslemenin tilapia (Oreochromis niloticus L.) ve aynalı sazan (Cyprinus carpio L. 1758) yavrularının büyüme ve yem değerlendirmesine etkileri*. Doktora Tezi. Süleyman Demirel Üniversitesi Fen Bilimleri Enstitüsü. Isparta.
- Erdoğan, F 2008, 'Alabalık Yemlerinde Alternatif Protein Kaynakları Kullanımı ve Kültür Balıkçılığının Geleceği Açısından Önemi', *Eğirdir Su Ürünleri Fakültesi Dergisi*, vol. 4, no.1-2, pp. 74-85.

Harmantepe, FB, & Büyükhatipoğlu, Ş 2007, 'Effect of two different feeds on growth of rainbow trout and feed cost', *Journal of Fisheries Sciences*.com DOI: 10.3153/jfscom.2007020. vol.1, no. 4, pp.168-175.

Harmantepe, FB, Doğan, G, Karşlı, Z, Aral, O, & Kaya, D 2008, ' Effects of Diets Containing of Brown Fish Meal and White Fish Meal on Growth of Rainbow Trout, *Oncorhynchus mykiss* (WALBAUM, 1792) Juveniles', *Süleyman Demirel Üniversitesi Eğirdir Su Ürünleri Fakültesi Dergisi*, vol. 4, no.1 – 2, pp. 22-28.

Keskin, EY., & Erdem, M 2005, 'The Effect on Fish Growth of Using Extruded Feed at Different Ratio on the Culture of Rainbow Trout (*Oncorhynchus mykiss*)', *Süleyman Demirel Üniversitesi Eğirdir Su Ürünleri Fakültesi Dergisi*, vol. 1, no. 1, pp.49-57.

Korkut, AY, Kop, A, Demirtaş, N, & Cihaner, A 2007, 'Balık Beslemede Gelişim Performansının İzlenme Yöntemleri', *E.U. Journal of Fisheries & Aquatic Sciences*, vol.24, pp. 201-205.

Oliveira, AMBMS, & Cyrino, JEP 2004, 'Attractants in Plant Protein-Based Diets For The Carnivorous Largemouth Bass *Micropterus salmoides*', *Sci. Agric. (Piracicaba, Braz.)*, vol.61, no.3, pp.326 – 331.

Sönmez, AY, Hisar, O, Aras Hisar, Ş, Alak, G, Aras, MS, & Yanık, T 2009, 'The effects of different photoperiod regimes on growth, feed conversion rate and survival of rainbow trout (*Oncorhynchus mykiss*) fry', *Journal of Animal and Veterinary Advances*, vol. 8, pp. 760-763.

Şengezer, E, & Güngör, T 2008, 'Essential oils and their effects on animals', *Lalahan Hay. Araşt. Enst. Dergisi*, vol. 48, no. 2, pp. 101-110.

Tekelioglu, N, Genç, MA, Tasbozan, O, Altun, T, & Yanar, Y 2003, 'Levrek (*Dicentrarchus labrax*) Karma Yemlerine Farklı Oranlarda Eklenen L-Glutamik Asit ve DL-Alaninin Genç Levreklerin Gelişimi Üzerine Etkileri', *Turk J. Vet. Anim. Sci*, vol.27, pp. 735 – 740.

Thorpe, JE, Adams, CE, Miles, MS, & Keay, DS 1989, 'Some influences of photoperiod and temperature on opportunity for growth in Juvenile Atlantic salmon, *Salmo salar* L.', *Aquaculture*, vol. 82, pp.119–126.

Yanık, T 1996,' *Gökkuşluğu alabalığı (Oncorhynchus mykiss) yavru yemlerinde balık unu yerine mezbaha yan ürünlerinin ikamesi üzerine bir araştırma*'. Doktora Tezi. Atatürk Üniversitesi Fen Bilimleri Enstitüsü. Erzurum.

Yanık, T, Arslan, M, Kocaman, EM, & Alak, G 2012, ' *Growth and antioxidant enzymes in juveniles of rainbow trout fed diets with varying levels of humate*'. AQUA 2012 - Prague, Czech Republic - September 1- 5, 2012.

Yılmaz, E 2005, 'The Effects of Two Chemo-attractants and Different First Feeds on the Growth Performances of African Catfish (*Clarias gariepinus*, Burchell, 1822) at Different Larval Stages', *Turk J. Vet. Anim. Sci*, vol. 29, pp. 309 – 314.