Comparison of Chemical Contents and Consumer Acceptance of Albino Rainbow Trout (*Oncorhyncus mykiss* Walbaum, 1782) with Brook Trout (*Salvelinus fontinalis* Mitchill, 1814) and Normal Pigmented Rainbow Trout

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Özet: *Albino gökkuşağı alabalığının* (**O.** mykiss*) kimyasal içerik ve tüketici beğenisi bakımından kaynak alabalığı (**S.**fontinalis*) ve normal pigmentli gökkuşağı alabalığına olan avantaj ve dezavantajlarının karşılaştırılması*: Günümüzde, albino gökkuşağı alabalığı nadiren Türk balık çiftliklerinde görülmektedir. Bu çalışmada, bu alabalığın tüketici tercihi ve kimyasal içerik bakımından normal gökkuşağı alabalığı ve kaynak alabalığına olan avantaj ve dezavantajları araştırılmıştır. Bu amaçla, bu üç balık türünün protein, yağ, su ve kuru madde oranları belirlenmiştir. Ayrıca, balıklar temizlenip paketledikten sonra pazara sunup, paketlere yerleştirilen bir anket formu ile tüketici tercihleri tespit edilmeye çalışılmıştır. Araştırma sonunda, en fazla tüketici talebini kaynak alabalığı, ikinci sırada albino gökkuşağı alabalığı almıştır. Normal pigmentli alabalıklar ise tüketici tercihinde en son sırayı almıştır. Albino ile normal alabalıklar arasında kimyasal içerik bakımından önemli bir fark gözükmemiştir, ancak kaynak alabalığına göre protein ve yağ içerikleri biraz daha düşük çıkmıştır. Sonuçlara göre, kaynak alası diğerlerine nazaran avantajlı görünse de, bu tür balığın daha uzun bir sürede pazar boyuna ulaşması maliyeti artıracaktır. Maliyet artışı pazar fiyatını artıracağından, tüketici talebini olumsuz yönden etkileyecektir. Albino gökkuşağı alabalığının normal gökkuşağı ile aynı sürede pazar boyuna ulaşması ve tüketici beğenisi normal gökkuşağı alabalığından daha fazla olması nedeniyle bu balığın pazarlanmasının diğerlerine göre daha ekonomik olduğu sonucuna varılmıştır.

Anahtar Kelimeler: albino alabalığı, gökkuşağı alabalığı, kaynak alabalığı, kimyasal içerik, tüketici beğenisi

Abstract: Recently, albino rainbow trout rarely occurs in fish farms in Turkey. In this study, it was aimed to find the advantages and disadvantages of this species of trout over normal rainbow trout and brook trout in terms of chemical composition and consumer acceptance. For this purpose, protein, fat, moisture and dry matter contents of these species were determined. Furthermore, consumer acceptance were surveyed by selling the fish in cleaned and packed conditions using a questionnaire form placed under the packs. It was found out that brook trout had the highest consumer acceptance, albino rainbow trout were in the second place and normal pigmented trout had the lowest acceptance. Protein and fat contents of brook trout were also slightly higher than the others. There were no significant differences in chemical contents between albino and normal rainbow trout. Although, brook trout shows advantages over both types of rainbow trout in terms of consumer acceptance and chemical contents, it reaches to its marketable size much longer compare to others. Therefore, it is not economical to market this trout with the same price. Albino rainbow trout reaches to the marketable size at the same time with normal rainbow trout and quicker than brook trout. It also had better consumer acceptance compared to normal one. In conclusion, the study showed that albino trout will sell better compare to other types of trout.

Key words: Albino trout, rainbow trout, brook trout, consumer acceptance, chemical contents

Introduction

The Black Sea region, which has many rivers and has an important place in aquaculturing of rainbow trout both in the sea, and fresh waters. Rainbow trout (*O. mykiss*) came originally from the Pacific area of North America, was introduced into other parts of NA, and then in 1980 into Europe and other parts of the world (Bristow, 1992). Rainbow trout culture has started in inland waters and ponds in 1970's in Turkey (Okumuş et al., 1998a). In 1990's sea cage growing method of rainbow trout has become increasingly popular (Çelikkale et al., 1998). Rainbow trout reaches marketable size in about 12-16 months in freshwater. In the sea cages, the same size could be reached within 8 to 12 months (Çelikkale et al., 1997; Okumuş et al., 1998b). Rainbow trout is the most cultured fish species in Turkey. According to 1996 statistics, it constitutes the 56 % of the total aquaculture production (DIE, 1996).

Brook trout (*S. fontinalis*) is one of the most attractively coloured fresh water fishes. It is also originated from North America like rainbow trout (Bristow, 1992). It has been introduced to Europe at the end of the last century. It came to Turkey about a decade ago. They grow slower than rainbow trout in nature and culture environment. For example, in the Eastern Black sea region, it takes 12-16 months to reach marketable size for rainbow trout, but it takes about two years for brook trout to reach the market size. On the contrary, it is more tolerant to low oxygen levels and acidic water conditions with low pH conditions if the water is cold enough (not more than 16°C). Also, its distinguished look may give it better selling chance than rainbow trout (Okumuş et al., 1998 & Okumuş et al., 1999).

Albino trout is an albino form of rainbow trout. Albinizm happens due to the missing oxidation activity of tyrosinase enzyme (Thorgaard et al.,

1995). The customers do almost not know albino trout. Because albinizm is a recessive character and albino fish constitutes very little part of the population. Albinos have almost no chance to survive in the nature because of their colour disadvantages. However, in the farms, they have a much better chance to survive. Their number also can be increased through selective breeding. Their yellow pattern might be interesting for the customers.

The main purpose of this study was to investigate the consumer behaviour towards the introduction of albino and normal rainbow trout and brook trout, and their acceptability and chemical contents in comparison with normal rainbow trout. With this purpose, it was aimed to help to the trout farmers for their decision on cultivation of albino rainbow and brook trout, and to retailers on whether they should be encouraged marketing these products.

Materials And Methods

Three types (two species) of trout, namely, albino rainbow trout (*O.mykiss*, Walbaum, 1792), normal pigmented rainbow trout and brook trout (*S. fontinalis*, Mitchill, 1814) were used in this study.

Polystyrene plastic trays with suitable absorbent pads and cling-film were used to pack the fish. A questionnaire form was prepared to survey the consumer acceptance of fish under investigation.

Fat content was analysed using the Bligh & Dyer method (1959) as modified by Aitken *et al.*, (TAN, No. 89). Kjeldahl method was used to analyse protein content (Aitken *et al.*, TAN, No. 89). Moisture content was analysed according to Nortwitz (1970). Ash was determined by the method described by Akyıldız (1984).

The fish was packed and sold at the region's supermarkets' cold store section. A survey was conducted by using a questionnaire form in order to test the consumer behaviour towards the introduced products. Two different supermarkets were chosen for this survey covering different consumer profiles.

The fish with varying size and weight (120-280 g for brook trout, 150, 350 g for both albino and normal rainbow trout) were firstly kept in a tank without feeding for a week, then harvested. After harvesting, they were washed, gutted and washed again. They were placed in seawater about 15 minutes and drained before packing.

The gutted and washed fish were packed in an expanded polystyrene plastic tray (13.5 x 28.0 x 1.5 cm; width x length x depth). Absorbent pads were used to prevent oozing and keeping inside of the pack more dry and appealing. Two of each type of fish were put to the same tray, weighed and covered with cling-film after placing the enveloped questionnaire under the tray. The pack was labelled with the information of the type, weight and the price of the fish. The approximate market price of the region for the used fish was used as a reference for the calculation of the value of the each fish pack.

The questionnaire form included sixteen questions. The questions were mainly multiple choice type and the customers were asked to tick the box of their selection for the related question. At the beginning of the questionnaire, the aim and the importance of this research were explained to the customers. At the end of the questionnaire, a note of appreciation for the help of the attendees and correspondence names and telephone number was added. Each questionnaire form was placed in a post stamped and addressed envelope.

Results and Discussion

Table 1 represents the comparison of the chemical composition of albino, brook trout and normal rainbow trout. As it can be seen from the table, the percentage chemical composition of the both rainbow trout were very close to each other. In comparison, brook trout has slightly higher moisture and fat content, but has a marked increase in the protein level. This can be explained as a variation between two different species.

Various questions mainly about albino and brook trout were asked by the customers. The main questions for all types of trout were 'whether the fish was fresh', if it was, 'how fresh it was, when they were cleaned, whether the price was calculated after gutting, where and how they have been grown, whether sea water or fresh water been used for culturing them, which one tasted better, why 4 fish was not placed in one pack, whether the marketing was going to be continued regularly' (if so, they claimed to continue to buy). There were also some questions related to health. 'Whether the fish was good for health, whether people with hearth disease can eat it, whether it was poisonous or fattening'. The specific questions were asked for albino trout were 'whether they were artificial, whether they were aquarium fish, whether they had been dyed, how they tasted, what kind of fish they were and why the colour of the fish was like that'. For brook trout, people wanted to know 'whether we have put the red spots on the fish and whether the fish was from their rivers, i.e whether or not they were an endemic species.

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Table 1. Comparison of proximate chemical composition of fish used in the study

Fish Type	Moisture (%)	Protein (%) DWB	Fat (%) WWB	Dry matter (%)
Normal Rainbow Trout	74.51	71.44	5.32	1.37
Albino Rainbow Trout	74.31	72.21	4.85	1.34
Brook Trout*	76.94	81.15	5.83	1.39

* *Çelikkale et al. (1997)*

Varying comments were made for all types of fish we have sold. Generally, they said that they prefer the fish in the way we sold because it looked good and clean in the package, and also it was ready to cook. It was found out that the customers prefer brook trout because of its appearance being firmer and more viable than others and also its resemblance to river trout due to its red spots. There were positive and negative comments for albino rainbow trout. Some said that 'they tried it before and they knew it tasted good'. Some people found 'its colour very attractive'. Quite a number of people said that 'they had not seen such fish in this colour before'. Some customers claimed that 'this fish can be sold with a higher value than others because of its colour'. People, who tried albino rainbow trout before,

commented that 'its taste was good and its appearance was nice, and wanted to buy it again'. However, one customer found 'its colour suspicious and did not wanted to buy it'. One customer also claimed that 'this fish would not be look nice if it was fried because of its colour' although he has not tried it.

Total of 150 packs were sold, 22.7 % of them was normal rainbow trout, 28.7 % of them was albino rainbow trout and 48.6 % of them was brook trout. 39 people answered the questionnaire related to 75 packs. 26.9, 38.5 and 34.6% of them represented normal rainbow, albino rainbow and brook trout, respectively. Table 2 shows the number of the pack, which the customers claimed to have bought. As it can be seen from Table 2, the customers mainly bought one (48.7 %) or two packs (30.8 %).

Table 2. The number of the pack which the customers claimed to have bought

Number of packs which are bought	Number of people	Total number of packs which are sold	%	Number of people in a household	%
1	19	19	48.7	<3	10.5
2	12	24	30.8	3	34
3	1	3	2.6	4	28.9
4	4	16	10.3	>4	26.3
5	0	0	0		
6	2	12	5.1		
Not given	1	1	2.6		
Total	39	75			

64% of the people who responded to the questionnaire had higher education. The responders were in the wide range of age groups as 6 % of them being under 20, 27 % between 20 and 29, 31 % between 30

and 39, 24% between 40 and 49, and 12 % 50 and over it.The questionnaire results showed that the main reason for buying the fish was curiosity (35.9%). Appearance also played high role in the

selection (30.8%). Only 28.2 of customers have bought the fish because of familiarity. 5.1 % of the customers reported that the fish have given to them by a friend.

One of the questions was whether they have tried the each type of the fish sold. 51.3 % of the customers claimed that they have tried brook trout, 43.6 % of them tried normal rainbow trout. Only 5.1% of them reported that they tried albino rainbow trout. These results indicate the main reason for people who tried normal rainbow and brook trout was due to the familiarity, for albino rainbow trout it could be the either curiosity or appearance.

Cooking method of the fish has usually an effect on the fish taste. Most of the people who answered the questionnaire preferred fish fried in butter (66.6%) which is the common way of cooking trout in the area. Frying in oil took the second place (33.3%) in the selection. The other ways were grilling, steaming in oil, steaming in butter, cooking with vegetables, 15.4, 2.3, 2.3, 2.3 %, respectively. Generally, the customers liked the taste of the fish they bought. 35.9 % of them rated it as very good, 46.2% rated as good. Only 15.4% said that they were fair and 2.5% found the fish tasted as poor quality. One other question was which of the trout they would choose if they saw them in the market. Brook trout got the highest rate as 41.0 %, secondly albino rainbow trout as 33.3 % and normal rainbow trout was rated in the third place as 15.4%. However, since the high percentage of the customers claimed to have tried brook trout before, this result can be changed towards albino rainbow side if the marketing of these three types of fish continues.

Table 3 represents the percentage of fish species, which were reported to be generally consumed. 23.8% of the customers reported that they prefer trout. This results is found to be a normal response since this was a trout market survey. Although anchovy and whiting are sold commonly in the area they followed trout.

Table 3. The percentage of preference rate of fish species which were reported to be generally consumed

Fish Type	% of preference
Trout	23.8
Whiting	21.4
Anchovy	21.4
Horse mackerel	16.6
Atlantic Bonito	4.76
Stripped mullet	4.76
Seasonal fish	4.76
Carp	2.3

There was a variation in the fish consumption. According to the survey results, only 15.4% of people consume less than 10 kg fish per year. About 33.3 % claimed to consume fish between 10-20 kg per year. About 30.7%, 10.2 % and 10.2% of people claimed to consume fish in between 20-30 kg, 30-50 kg and over 50 kg per year, respectively. In Turkey, the average amount of fish consumed person / year was reported to be very low. In 1995, it was reported as around 9.7 kg/person/year (Anonymous, 1995). Our results indicate that consumer preference is very important in fish consumption. According to our survey, most of people prefer to buy beef (51.2 %) while only about 23% prefer to buy fish. Poultry are rated in the third place just after the fish as 20.5 %. Only 5.1 % people said that they prefer to consume lamb. This survey is important to find out that Turkish people is still not aware enough of the healthy diet.

According to Okumuş *et al.*(1998b) brook trout reaches to a marketable weight in about 18 to 22 months compare to both types of rainbow trout which reach to the same

weight in about 12-14 months. This situation is a disadvantage of brook trout in terms of economical reason to market it with the same price as the others. For this reason, fish farmers will want to sell it with higher price. The other reason for higher value could be its popularity because of its similarity with the endemic species. Therefore, it will be useful to do another market research on the consumer attitude on buying this species with higher price than rainbow trout.

At the end of the study, we have found out that people prefer to buy fish cleaned, packed and sold in a cold store; and supermarkets' staff informed us that there has been a big demand in buying the fish sold at the condition we have sold since we have finished the study. For this reason, they are thinking considering to carry on marketing fish with the same way we did.

In conclusion, the study showed that albino trout will sell better compare to normal pigmented one because of its colour. Therefore, fish farmers should be encouraged to cultivate this type of rainbow trout.

Acknowledgements

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