



## Some Qualitative Properties of Rainbow Trout (*Oncorhynchus Mykiss* Walbaum, 1792) from Aquaculture Facility in Demir Hisar Region (Macedonia)

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Running title: **Qualitative Properties of Rainbow Trout from Coldwater Fishpond**

### Abstract

The main goal of this research was to determine some qualitative properties of rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) from an aquaculture facility – salmonid fishpond which is situated in Demir Hisar region (Republic of Macedonia). The qualitative properties of the rainbow trout are established by determination of the chemical composition of the fish meat, the energy value of the meat and the microbiological analysis for the total number of microorganisms on fish skin and presence of *Salmonella* sp. and *Listeria monocytogenes*. The main purpose of the research produced additional analyzes that determine the chemical composition of food used for feeding of the rainbow trout, the condition factor (CF) and the feed conversion.

The results obtained during the examination of the chemical composition (%) of the rainbow trout meat from this fishpond determined the mean value of  $71.70 \pm 1.003$  water,  $20.40 \pm 1.268$  protein,  $5.63 \pm 0.555$  fat and  $1.21 \pm 0.157$  ash. The energy value of the meat was 568.941 kJ/100 g.

### Practical applications

Aquaculture, Fish processing industry, Fish quality control

**Key words:** rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792), chemical composition, energy value



## Introduction

Trout farming is a specific branch of agriculture, requiring a wide range of knowledge of fish behavior and the aquatic environment.

Rainbow trout, as a carnivorous predator has adapted the gastrointestinal tract to digest animal protein and vegetable protein to a small degree. In natural waters its feed consists on crustaceans and larvae of adult forms of aquatic insects. Due to numerous studies, there has been significant progress in the production of high-energy and environmentally friendly feed. It has revolutionized the production and breeding of rainbow trout and other salmonids. Currently, feeding salmonids with pelleted feed is one of the most important breeding operations, requiring experienced breeders and significantly influencing the final outcome and cost-effective production (Szarek *et al.* 2013).

The main goal of this research was to determine some qualitative properties of the rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) from an aquaculture facility – salmonid fishpond which is situated near Demir Hisar (Republic of Macedonia). The qualitative properties of the rainbow trout are established by determination of the chemical composition of the fish meat, the energy value of the meat and the microbiological analysis for the total number of microorganisms on fish skin and presence of *Salmonella* sp. and *Listeria monocytogenes*. The main purpose of the research produced additional analyzes that determine the chemical composition of food used for feeding of the rainbow trout, the condition factor (CF) and the feed conversion.

## Materials and Methods

### Materials

Examinations were performed on rainbow trout (*Oncorhynchus mykiss* Walbaum, 1792) with consumption size of 250-300 g from an aquaculture facility – salmonid fishpond. The fishpond is located in the Demir Hisar region (Republic of Macedonia) and it is supplied with water from the river Crna, the spring Zheleznec. During these examinations, 18 samples from rainbow trout were analyzed for chemical composition of fish meat.

The average mass of rainbow trout samples from this fishpond was 285 g, while the average length, 29 cm.

In this fishpond pelleted food Aller silver (6 mm) from manufacturer Aller aqua (Poland) is used, with following content (per specification): fish meal, wheat, fish oil, soy, hemoglobin powder,

hydrolyzed protein, protein concentrate from sunflower and oil rape. Besides the main components, the food contains the following components (per specification): phosphate (1%), calcium (0.8%), sodium (0.2%), vitamin A (10,000 ie/kg), vitamin D3 (1000 ie/kg), antioxidant E 324 ethoxyquin (100 mg/kg), trace elements E2 iodine (3 mg/kg), E4 copper (5 mg/kg), E5 manganese (12 mg/kg), E6 zinc (70 mg/kg), and pigments Astaxanthin E161j (50 mg/kg) and Canthaxanthin E161g (25 mg/kg).

### Methods

During examinations, the following methods for determination of chemical composition of fish meat were used:

-Determination of moisture content - ISO 712:2009;

-Spectrophotometric determination of total nitrogen according Kjeldahl - HACH DR 400 procedure method 2410;

-Determination of total fat by gravimetric method (Soxhlet extraction) - AOAC method 2003.6;

-Determination of ash in an oven at 700°C - ISO 3593:1981;

Methods for microbiological analyses of fish meat that were used:

-Horizontal method for detection and enumeration of *Listeria monocytogenes* - ISO 11290 - 1:2008;

-Horizontal method for detection and enumeration of *Salmonella* sp. - ISO 6579 - 2008;

-Horizontal method for the enumeration of microorganisms - ISO 4833:2003.

Based on absolute indicators of mass and body length of the fish, the condition factor (CF) is calculated according to formula  $CF = (BW / L^3) \times 100$  (Ricker, 1975), where BW is fish body weight and L is total fish length.

The feed conversion (FCR) is calculated according to the formula  $FCR = F/G$ , where F is consumed food (kg) and G is fish growth (kg).

Energy value (EV) of rainbow trout meat is calculated according to formula  $EV (\text{kJ}/100\text{g}) = \text{proteins} (\%) \times 17.16 + \text{fats} (\%) \times 38.96$  (Vitčenko *et al.*, 1981).

### Results

Considering the results of the chemical composition of pelleted food used in this fishpond, we've obtained the following results (Table 1).

In this fishpond pelleted food Aller silver (6 mm) from manufacturer Aller aqua (Poland) is used. By analyzing the chemical composition of the food we



received the following results: 41% proteins, 24% fats, 18% carbohydrates and 7% ash.

It is noticed that application of high quality food is one of the most important factors affecting the fish growth, the feed conversion ratio and chemical composition of the fish meat.

Based on absolute indicators of mass and body length of the fish, the condition factor (CF) is determined as 1,1686.

In our examinations, we established a value of 1.10 for feed conversion ratio (FCR). We noticed that it is very important to determine the most way of diet that primarily reflects the chemical composition of fish meat.

Considering the results of the chemical composition of rainbow trout meat from this fishpond, we've obtained the following results (Table 2).

The results obtained during the examination of the chemical composition (%) of rainbow trout meat from this fishpond show the mean value of  $71.70 \pm 1.003$  water,  $20.40 \pm 1.268$  protein,  $5.63 \pm 0.555$  fat and  $1.21 \pm 0.157$  ash. The nutritional value of fish meat is determined by the amount of proteins, fats, minerals and vitamins, and it depends on the fish species, age, cultivation methods, the composition of the consumed food, as well as the season.

Energy value (EV) of rainbow trout meat is determined as 568.941 kJ/100 g.

According to the fat content, fish are classified in: lean fish (fat content of less than 5%), moderate fatty fish (5-10%) and fatty fish (more than 10% fat) (Jabeen & Chaudhry, 2011). According to the received amount of fat, rainbow trout from this fishpond is being classified as moderate fatty fish (5.63 % fat).

Considering the results of the microbiological analysis for the total number of microorganisms on fish skin and presence of *Salmonella* sp. and *Listeria monocytogenes*, we've obtained the following results (Table 3).

In terms of determining the total number of microorganisms on the skin of rainbow trout, in our examinations we obtained average value of 5.00 log cfu/cm<sup>2</sup>, which is in correlation with the findings of Adams and Moss (2008) which concluded that the total number of microorganisms on the fish skin surface ranged from 2.00 - 7.00 log cfu/cm<sup>2</sup>.

## Conclusions

The results obtained during the examination of the chemical composition (%) of rainbow trout meat from fishpond located in Demir Hisar region (Republic of Macedonia) show the mean value of  $71.70 \pm 1.003$  water,  $20.40 \pm 1.268$  protein,  $5.63 \pm 0.555$  fat and  $1.21 \pm 0.157$  ash.

Energy value of rainbow trout meat from this fishpond is determined as 568.941 kJ/100 g.

According to the received amount of fat, rainbow trout from this fishpond is being classified as moderate fatty fish (5.63 % fat).

In conditions of intensive farmed fish production, the application of high quality food is one of the most important factors affecting the fish growth, the food conversion ratio and chemical composition of the fish meat.

Overall, from the analysis of qualitative properties of rainbow trout meat from this fishpond which is supplied with water from the river Crna, spring Zheleznec, ambient conditions prevailing in the aquatic environment, and food used for fish feeding, it can be concluded that we obtain fish with high nutritional quality in terms of chemical composition. The low fat content, protein content of high biological value, as well as the content of a significant amount of essential fatty acids make the rainbow trout one of the most respected fish in the human diet.

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**Table 1.** Chemical composition of pelleted food Aller silver (6 mm) from manufacturer Aller aqua (Poland)

Components	Amount (%)
Proteins	41
Fats	24
Carbohydrates	18
Ash	7

**Table 2.** Chemical composition of rainbow trout meat

Chemical parameters	$\bar{x} \pm SD$	min	max
Water (%)	71.70 ± 1.003	70.30	72.60
Proteins (%)	20.40 ± 1.268	19.10	22.10
Fats (%)	5.63 ± 0.555	5.10	6.40
Ash (%)	1.21 ± 0.157	1.04	1.42

$\bar{x}$  - mean value; SD – standard deviation; min – minimum value; max – maximum value

**Table 3.** Microbiological analysis of rainbow trout surface

Parameters	Total number of microorganisms (log cfu/cm <sup>2</sup> )	<i>Salmonella</i> sp.	<i>Listeria monocytogenes</i>
I	3.90	0	0
II	6.80	0	0
II	4.30	0	0
$\bar{x}$	5.00	0	0

$\bar{x}$  - mean value



**Fig. 1. (*Oncorhynchus mykiss* Walbaum, 1792)**



**Fig. 2. Rainbow trout sample preparing for analysis**



**Fig. 3, 4. Salmonid fishpond in Demir Hisar region (Republic of Macedonia)**