ИЗСЛЕДВАНЕ НА ВЛИЯНИЕТО НА ВЪЗРАСТТА ВЪРХУ КАЧЕСТВОТО И КОЛИЧЕСТВОТО НА МЕСОТО ПРИ ДЪГОВА ПЪСТЪРВА ОТ СЕВЕРОИЗТОЧНАТА ЧАСТ НА РУМЪНИЯ
RESEARCH CONCERNING AGE INFLUENCE OVER THE QUANTITATIVE AND QUALITATIVE MEAT PRODUCTION AT ONCORHYNCHUS MYKISS BREED FROM THE NE PART OF ROMANIA

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Резюме

През еволюцията на човека месото от риба е имало значителен принос към задоволяване на нуждите от животински протеини. В настоящото изследване е направена оценка на физико-химичния състав на месото от *Oncorhynchus mykiss*. От три възрастови групи риба (двулетни, трилетни и четирилетни) са отбрани по 20 индивида, при които е определено pH на месото, съдържанието на сухо вещество, протеини и липиди в него. Съдържанието на сухо вещество е между 23,88 и 27,14%. Най-ниската стойност е отчетена при екземпляри от група 2. Най-високи стойности на съдържание на протеини (19,81%) е установено при индивиди от група L_3. Съдържанието на липиди е варирало между 4,14% и 5,99%. Най-висок кланичен рандеман след размразяване (82,35%) е отчетен при третата група дъгова пъстърва (L_3), докато при първата група (L_1) е отчетена най-високата стойност на висцерално-соматичния индекс (17,56). Най-висок процент на месото (straight cutting) – 73,65%, е регистриран при четирилетните дъгови пъстърви. Установеният физико-химичен състав поставя *Oncorhynchus mykiss* в класа на рибите с висока хранителна стойност.

Abstract

During human evolution, fish meat contributed to a considerable extent at assuring the needs for animal protein. On our current research we aimed to evaluate the physical-chemical composition of the meat gathered from *Oncorhynchus mykiss* breed. Were used 20 individuals for each group of age (2nd summer, 3rd summer and 4th summer), the pH of meat, dry matter, content in proteins and lipids, for all three age groups were determined. The obtained values were between 23,88 and 27,14 for dry matter with a minimum value of 23,88% which was recorded at rainbow trout individuals of 2th. Content in proteins recorded the best values (19,81%) at individuals from batch L_3, and content in lipids oscillated between 4,14% and 5,99%. The best efficiency at cold slaughtering (82,35%) was recorded at the third batch of rainbow trout (L_3), while at the first batch (L_1) we obtain the greatest value of the viscera-somatic index (17,56). Following the cutting as torso, the best meat percentage was obtained from straight cutting, respectively 73,65%, and was recorded at 4th summer specimens of rainbow trout. The obtained values regarding physical-chemical composition placed *Oncorhynchus mykiss* breed in the class of fishes with high nutritional value.

Ключови думи: физико-химичен състав, кланичен рандеман, дъгова пъстърва, труп.
Key words: physical-chemical composition, slaughter yield, rainbow trout, torso, carcass.

INTRODUCTION

Meat, no matter of the origin animal (beef, sheep, pig, poultry or fish), have a chemical composition in according with age and nutrition status of animal. Meat contains around 20% proteins and the fat content is in connection with breed, age and animal nutrition status.

Knowing the physical-chemical composition of fish meat has a great importance, because on its basis could be made appreciations on general physiological state of fishes and also on the efficiency of feed capitalization. Physical-chemical composition is the main element based

on which we could evaluate the nutritive value of fish meat (Mocanu, 2012).

The goal of the current research was to determine the physical-chemical composition of rainbow trout of second, third and respectively fourth summers, reared in similar environmental conditions.

Oncorhynchus mykiss breed is one of the most spread non-native fish breed at world level. This breed is originally from the affluent of Pacific Ocean both from Asia and North America (Jonsson, 1993; Păsărin, 2007).This breed has a growing rhythm superior to other salmonicol breeds from Romania, reaching in the 4th summer a corporal mass of 350-500 g (Păsărin, 2004; Bud, 2007; Bud, 2010).

MATERIALS AND METHODS

Biological material was represented by 60 individuals of rainbow trout *(Oncorhynchus mykiss)* of both sexes, reared in one salmonicol exploitation from Neamț County. To achieve the proposed goals, from the biological material which was studied during 2010-2012, were made up three experimental batches L_1, L_2 and L_3, each of 20 individuals per batch, on three age categories, 2nd summer (Pc_{2+}), 3rd summer (Pc_{3+}) and 4th summer (Pc_{4+}).

To determine the physical-chemical composition of rainbow trout meat were gathered samples from side musculature of fishes from all three batches. For establishing the pH of rainbow trout meat at cold we worked with extract prepared from the muscular tissues provided from the rainbow trout individuals from experimental batches.

A certain quantity from these extract was double diluted with water and then the pH was measured using a pH-meter, calibrated for ph values very close to the ones of meat extract.

Proteins were identified by using the Kjeldahl method, which consists in heating of nitrogen from organic combinations and its' transforming in ammonium sulphate, with the help of concentrate sulphuric acid in the presence of a catalyser. By adding a strong alkaline, ammonium is released, and by distillation could be caught into a certain quantity of acid with a well-known normality. Excess of acid it is titrates with an alkaline solution of same normality and, through difference is established the quantity of total nitrogen (Vacaru-Opriş, 1994; SR ISO 937:2007).

Determination of lipids content was realised using Soxhlet method, which consists in fat extraction from the analysed sample using petrol ether.

Were made envelopes from filter paper, which were previous dried in oven at +105°C temperature, for one hour, after that were chilled in desiccators and weighted. After that in each envelope was placed a quantity 3-5 g of meat. The envelopes with samples were placed in oven for drying, for 2 hours, and after chilling in desiccators were weighted again (SR ISO 1443:2008).

The ash was determined by calcinations at a temperature of 550ºC in calcinations oven.

Determination of dry matter was realised through the method of drying in oven, which is the most used indirect method and suppose the drying of sample in oven at +100 - +105°C, till reaching a constant weight. It is a standardized method in all countries because it is characterized by a very good precision.

Determination of rainbow trout carcasses' weight at warm was realised at the fishery unit after maximum one hour from gathering, and for determination of carcasses' weight after refrigeration weighting was repeated after 24 hours.

RESULTS AND DISCUSSION

Physical-chemical composition of trout meat could be influenced by many factors such as: breed, size, age, environment and feeding conditions. As regarding the quality of water, during our research the physical-chemical parameters of water were maintain in the optimal limits for *Oncorhynchus mykiss* breed. Rearing conditions offered by the semi-intensive system, the quality of the administrated fodders and the distribution way of the fodders were evaluated by analysing the main physical-chemical parameters of rainbow trout meat: pH, raw proteins, lipids, moisture content and ash, the results being presented in the current paper.

The pH of meat was calculated for each experimental batch (table 1).

The obtained values for pH at warm were very close, being of 5,81 at batch L_1, 5,92 for the rainbow trout individuals from batch L_2, and 5,99 for batch L_3.

As regarding the pH at cold, this one had and ascendant evolution at the same time with aging as follows: 6,44 for trout from batch L_1, 6,50 for individuals of 3rd summer from batch L_2, respectively a value of 6,55 for individuals from batch L_3.

The values for variation coefficient both for pH at cold and warm were well below the threshold of 10% fact which shows a good homogeneity for all three batches.

The mean value obtained for dry matter from rainbow trout meat was of 23,88±0,18% for rainbow trout individuals from batch L_1, 26,14±0,25% for batch L_2, and respectively 27,14±0,03% for batch L_3 (table 2), values in according with the limits cited in literature (Bud, 2008).

The studied character was homogenous, the value of variation coefficient oscillating between 3,34% and 4,24%.

When raw ash quantity was determined we observed a certain uniformity between batches, the recorded values being 1,14±0,02 % for batch L_1, 1,15±0,02 for batch L_2 and 1,17±0,03 in the case of batch L_3 (table 3). The minimum

Таблица 1. Стойности на pH на месото на Oncorhynchus mykiss
Table 1. Values of pH in Oncorhynchus mykiss breed

Specification Показатели	n	*Oncorhynchus mykiss* Pc_2+ (L_1)		*Oncorhynchus mykiss* Pc_3+ (L_2)		*Oncorhynchus mykiss* Pc_4+ (L_3)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
Live weight Жива маса (g)	20	160.06±4.17	11.66	255.60±4.78	8.36	478.83±10.28	9.60
pH at warm След улова	20	5.81±0.04	2.33	5.92±0.02	1.10	5.99±0.02	1.14
pH at cold След размразяване	20	6.44±0.02	0.82	6.50±0.01	0.67	6.65±0.01	0.51

Таблица 2. Сухо вещество в месото на *Oncorhynchus mykiss*
Table 2. Dry matter in Oncorhynchus mykiss breed

Specification Показатели	Batch Група	n	Live weight Жива маса (g)	Dry matter Сухо вещество (%)	V%	Min	Max
Oncorhynchus mykiss Pc_{2+}	L_1	20	160.06±4.17	23.88±0.18	3.34	22.43	25.52
Oncorhynchus mykiss Pc_{3+}	L_2	20	255.60±4.78	26.14±0.25	4.24	23.54	27.25
Oncorhynchus mykiss Pc_{4+}	L_3	20	478.83±10.28	27.14±0.03	3.56	24.83	29.13

Таблица 3. Съдържание на сурова пепел в месото на *Oncorhynchus mykiss*
Table 3. Raw ash in Oncorhynchus mykiss breed

Specification Показатели	Batch Група	n	Live weight Жива маса (g)	Ash Сурова пепел (%)	V%	Min	Max
Oncorhynchus mykiss Pc_{2+}	L_1	20	160.06±4.17	1.14±0.02	7.24	1.01	1.33
Oncorhynchus mykiss Pc_{3+}	L_2	20	255.60±4.78	1.15±0.02	7.31	1.05	1.31
Oncorhynchus mykiss Pc_{4+}	L_3	20	478.83±10.28	1.17±0.03	9.70	1.02	1.37

Таблица 4. Съдържание на протеин в месото на Oncorhynchus mykiss
Table 4. Content in protein of the meat from Oncorhynchus mykiss breed

Specification Показатели	Batch Група	n	Live weight Жива маса (g)	Protein Протеин (%)	V%	Min	Max
Oncorhynchus mykiss Pc_{2+}	L_1	20	160.06±4.17	18.81±0.10	2.47	17.66	19.50
Oncorhynchus mykiss Pc_{3+}	L_2	20	255.60±4.78	19.42±0.07	1.60	18.91	19.88
Oncorhynchus mykiss Pc_{4+}	L_3	20	478.83±10.28	19.81±0.06	1.45	19.23	20.23

Таблица 5. Съдържание на мазнини в месото на Oncorhynchus mykiss
Table 5. Content in lipids of the meat at Oncorhynchus mykiss breed

Specification Показатели	Batch Група	n	Live weight Жива маса (g)	Lipids Мазнини (%)	V%	Min	Max
Oncorhynchus mykiss Pc_{2+}	L_1	20	160.06±4.17	4.14±0.08	8.80	3.37	4.81
Oncorhynchus mykiss Pc_{3+}	L_2	20	255.60±4.78	4.90±0.11	9.82	4.31	5.80
Oncorhynchus mykiss Pc_{4+}	L_3	20	478.83±10.28	5.99±0.13	9.97	5.03	7.11

Таблица 6. Кланичен рандеман при Oncorhynchus mykiss
Table 6. Slaughter yield calculated for Oncorhynchus mykiss breed

Specification Показатели	n	*Oncorhynchus mykiss* Pc_2+ (L_1)		*Oncorhynchus mykiss* Pc_3+ (L_2)		*Oncorhynchus mykiss* Pc_4+ (L_3)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
Live weight Жива маса, (g)	20	160.06±4.17	11.66	255.60±4.78	8.36	478.83±10.28	9.60
Warm slaughter yield Кланичен рандеман след улова (%)	20	79.72±0.19	1.04	82.24±0.13	0.71	84.14±0.24	1.27
Cold slaughter yield Кланичен рандеман след размразяване (%)	20	77.73±0.18	1.03	80.43±0.11	0.60	82.35±0.29	1.59

Table 7. Маса на трупа при различни видове (три типа) разрязване
Table 7. Torso mass resulting from the application of the three types of cutting

Specification Показатели	MU	*Oncorhynchus mykiss* Pc_2+ (L_1)		*Oncorhynchus mykiss* Pc_3+ (L_2)		*Oncorhynchus mykiss* Pc_4+ (L_3)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
Torso Труп (profiled cutting)	%	66,62±0,38	2,54	70,48±0,16	1,00	73,65±0,39	2,34
Torso Труп (straight cutting)	%	63,03±0,31	1,79	68,27±0,12	0,86	72,14±0,71	2,12
Torso Труп (oblique cutting)	%	61,80±0,24	1,32	65,87±0,11	1,73	69,95±0,66	4,12

value for this character was of 1,01% and was recorded at batch L_1. The values of variation coefficient did not overpass 10% fact which shows a good homogeneity for this character.

At fish, protein represent between 12 and 28% from the total meat mass, existing a direct correlation between water content and protein quantity from fish meat (Ionescu, 2006).

As regarding the protein content in rainbow trout meat, this one was around the value of 19%, with values of 18,81±0,10% recorded at individuals from batch L_1, 19,42±0,07% for batch L_2, and a maximum of 19,81±0,06% in the case of batch L_3.

The studied character was very homogenous, the value of variation coefficient oscillating between 1,45% and 2,47%, which shows a high homogeneity inside the three studied batches (table 4).

For lipids, the effectuated determinations show a quite good homogeneity of the character, the values of variation coefficient being under the threshold of 10%. Concretely the determinate values were placed between 4,14-5,99%, minimum value being recorded in the case of batch L_1, and the maximum one in the case of batch L_3 (table 5).

The obtained values after determination of physical-chemical composition for all three batches are in the limits cited in literature, resulting that rainbow trout meat gathered from the studied individuals have a very good nutritive value (Bud, 2008; Cocan, 2008; Bugeon, 2010; Mocanu, 2012).

By weighting the carcasses from the rainbow trout individuals from the three batches could be observed that after refrigeration those ones suffered losses between 1,79 and 1,99% from the initial weight. The lowest differences were recorded at rainbow trout of 4th summer (table 6).

The calculated values for slaughter yield at all three batches are in the limits cited in the literature, 66,56–86,48%.

Following the cutting as torso, the best meat percentage was obtained from profiled cutting, respectively 73,65%, and was recorded at 4th summer specimens of rainbow trout (table 7).

CONCLUSIONS

1. The values obtained after physical-chemical determinations enlightened the fact that rainbow trout individuals from the three experimental batches are into the limits cited in the literature for these breed.
2. After evaluation of physical-chemical composition of rainbow trout meat, was observed that the individuals from batch L3 presented a superior quality, reflected by a higher content in dry matter and protein. The best values for meat production indicators were obtained at rainbow trout individuals of 4th summer from batch L3, fact which show that from quantitative point of view the rainbow trout individuals are recommended to be capitalized at the age of 4th summer.

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