# RESEARCH REGARDING CHEMICAL FEATURES OF RAINBOW TROUT MEAT, DIFFERENTIALLY FEED

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**Abstract**

*Trout meat present a series of nutritive qualities, which are mainly conferred by its high content in complete proteins, lipids with a high unsaturation degree, in lipo and hydrosoluble vitamins, as well as in mineral salts. To achieve the goals of the current paper was chemically analysed meat gathered from 60 individuals of rainbow trout, 20 individuals for each age stage (2nd summer, 3rd summer and 4th summer), so the evaluation of chemical features of meat gathered from three rainbow batches were realised in according with the actual standards. Research consists in determination of content in water, dry matter, proteins, lipids and raw ash. Trout from analysed batches were reared in salmonid units situated in Neamț County, and during research those ones were differentially feed from qualitative and quantitative point of view. At the end of chemical composition determination of the meat gathered from rainbow trout individuals from those three experimental batches were obtained values between 23.76 and 27.08% for dry matter, between 18.47 and 19.92 % for proteins, respectively between 4.22 and 5.86 % for lipids.*

**Key words:** chemical composition, rainbow trout, proteins, dry matter, lipids

## INTRODUCTION

*Oncorhynchus mykiss* breed is one of the most non-native fish breeds spread at world level. Normally this breed is native in tributaries of Pacific Ocean both in Asia and in North America [6, 14, 4, 11, 14].

Quality of meat gathered from fishes reared in intensive systems is influenced, mainly by quality and quantity of assured feed, by assured micro-climate, by fattening state, by corporal mass and by slaughtering age as well as a series of internal factors [2, 15, 21, 16].

Feeding represent one of the most important factors which influence fish rearing, quality of utilised fodders having a major influence on sensorial and physical-chemical features of rainbow trout meat from intensive exploitations [10].

Chemical features of fish meat represent one of the most important elements which are at the base of nutritive value evaluation for fish meat [8, 11].

Fish meat present a very good nutritive value, conferred especially by high content in complete proteins, in lipids with a high unsaturation degree, by lipo and hydrosoluble vitamin, as well as by mineral substances [17, 20, 9].

Chemical composition of trout meat derives from characteristics of muscular tissue. Muscle is a biological tissue with a high organisation, with a complex intrinsic structure, with a unique composition and very active from biochemical point of view [5, 9].

## MATERIAL AND METHOD

Biological material utilized for realization of the current paper was represented by 60 rainbow trout (*Oncorhynchus mykiss*) individuals of both sexes, but with different ages, which were reared in two trout fisheries from Neamț County. To reach the proposed goals, from the biological material which were subjected to the current study were settled up six experimental batches $L_1$, $L_2$, $L_3$, $L_4$, $L_5$ and $L_6$ each with 10 individuals per batch, on three age categories, 2nd summer ($Pc_{1+}$), 3rd summer ($Pc_{2+}$) and 4th summer ($Pc_{3+}$).

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During research trout from experimental batches were differentially feed, so rainbow trout from batches $L_1$, $L_3$, $L_5$ were reared in ground ponds with natural feed and also with artificial feed. Feeding of trout was manually made, with extruded granulated fodders, having a protein level between 40-45% raw protein, feed being administrated in one meal per day (10 o'clock in the morning), and the daily administrated feed, function of fish weight and water temperature, represented up to 1.2% from corporal mass of trout.

Individuals of rainbow trout from batches $L_2$, $L_4$, $L_6$ were reared in concrete ponds, consumption feed being represented by extruded granular fodders with a protein level between 40-45% raw proteins. Fodders were daily administrated in 2 meals, (at 10 am and at 16 pm). Daily quantity of administrated feed represented up to 1.8% from corporal mass of trout.

Samples' processing was realised in according with the nowadays research methods, in research laboratories from UASVM Iaşi [18, 22, 23, 24, 17, 1, 25].

Corporal mass of rainbow trout individuals from those six batches was determined by individual weighting using a precision balance.

For determination of chemical features for trout meat were gathered samples from side musculature of individuals from those six experimental batches.

Determination of water content in rainbow trout meat was realised through indirect method, as follows: first was determined dry matter and moisture content was calculated by the difference between sample weighted before drying and the weighted sample after drying. Samples' drying in oven was made at a temperature between +100 - +105°C, till a constant mass was reached. This referential method is standardized in all countries because it is characterized by a very good precision [17, 25].

Meat content in proteins was determined through Kjeldahl method which consists in warming of nitrogen from organic combinations and its transformation in ammonium sulphate, using sulphuric acid in presence of a catalyser. By adding a strong base, ammonium is released, and by distillation could be caught in a certain quantity of acid, with a known normality. Acid in excess is titred with a base solution with the same normality and by difference can be obtained the total nitrogen quantity [17, 22].

Regarding trout meat content in fat, those one was determined using Soxhlet method which consists in fat extraction from meat samples analysed with petroleum ether. So, were made filter paper envelopes, which were previously dried at oven at a temperature of +105°C, for a period of one hour, after that being chilled in dessicator and weighted. Further, in each envelope was introduced a quantity of 5 g of trout meat. Envelopes with analysed samples were placed in oven, for 2 hours, and after chilling in dessicator were again weighted [23].

Mineral content (raw ash) was determined through calcinations method. Crucibles with analysed samples were burned on a gas device till samples' carbonization, after that were placed in calcinations oven at a temperature of +550°C, for 4-5 hours. Were taken from oven, chilled in dessicator and weighted at an analytical balance. In the end crucibles with analysed samples were replaced in oven for 1-1½ hours, at same temperature, operations being repeated till a constant mass [24, 1].

The obtained data were statistical processed, calculating: arithmetic mean, variance, standard mean deviation, variability coefficient, and difference signification was establish with Fischer test.

## RESULTS AND DISCUSSIONS

To establish chemical features were collected samples from side musculature of rainbow trout, which were subjected to chemical determinations. The obtained data were utilised for evaluation of chemical features and global quality of fish meat.

Corporal mass of rainbow trout individuals presented mean values between 165.33-172.57 g for 2$^{nd}$ summer individuals, between 249.53-264.01 g for 3$^{rd}$ summer individuals, respectively between 472.40-480.06 g for 4$^{th}$ summer individuals (table 1).

Analysing the data presented in table 1 could be observed some differences in evolution of mean values for corporal mass at trout of third summer.

Table 1 Mean corporal mass (g) and signification between mean of studied batches

| Specification | Experimental batches | n | $\bar{X} \pm s_{\bar{X}}$ (g) | V% | Min.(g) | Max.(g) |
|---|---|---|---|---|---|---|
| $Pc_{1+}$ | $L_1$ | 10 | 172.57±4.80 | 8.80 | 153.29 | 190.04 |
| | $L_2$ | 10 | 165.33±4.33 | 8.28 | 149.07 | 181.39 |
| Signification between batches' mean | | $L_1$ vs. $L_2$ = n.s.; F(1.2555) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{2+}$ | $L_3$ | 10 | 264.01±4.36 | 5.22 | 249.17 | 282.81 |
| | $L_4$ | 10 | 249.53±4.53 | 5.75 | 229.31 | 268.14 |
| Signification between batches' mean | | $L_3$ vs. $L_4$ = *; F(5.2930) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{3+}$ | $L_5$ | 10 | 480.06±21.14 | 13.93 | 405.45 | 574.09 |
| | $L_6$ | 10 | 472.40±11.75 | 7.86 | 418.50 | 516.72 |
| Signification between batches' mean | | $L_5$ vs. $L_6$ = n.s.; F(0.1003) < Fα(4.4138) for 1:18 GL | | | | |

The analysed character was homogenous in case of five batches, obtained values being in all cases lower than 10%, and for the sixth batch $L_5$, evaluation coefficient was of 13.93, which show a medium homogeneity.

In according with data from table 2, content in dry matter for trout from analysed batches were between 23.76±0.23% (batch $L_2$) and 27.08±0.09% (batch $L_6$).

Table 2 Trout meat content in dry matter

| Specification | Experimental batches | n | Moisture (%) $\bar{X} \pm s_{\bar{X}}$ | D.M. (%) $\bar{X} \pm s_{\bar{X}}$ | V% | Min.(%) | Max.(%) |
|---|---|---|---|---|---|---|---|
| $Pc_{1+}$ | $L_1$ | 10 | 76.05±0.13 | 23.95±0.13 | 1.74 | 23.45 | 24.52 |
| | $L_2$ | 10 | 76.24±0.23 | 23.76±0.23 | 3.09 | 22.66 | 25.19 |
| Signification between batches' mean | | $L_1$ vs. $L_2$ = n.s.; F(0.4694) < Fα(4.4138) for 1:18 GL | | | | | |
| $Pc_{2+}$ | $L_3$ | 10 | 74.33±0.35 | 25.67±0.35 | 4.31 | 23.36 | 27.07 |
| | $L_4$ | 10 | 74.01±0.41 | 25.99±0.41 | 5.02 | 23.14 | 27.03 |
| Signification between batches' mean | | $L_3$ vs. $L_4$ = n.s.; F(0.3629) < Fα(4.4138) for 1:18 GL | | | | | |
| $Pc_{3+}$ | $L_5$ | 10 | 73.07±0.14 | 26.93±0.14 | 1.68 | 26.11 | 27.51 |
| | $L_6$ | 10 | 72.92±0.09 | 27.08±0.09 | 1.08 | 26.69 | 27.53 |
| Signification between batches' mean | | $L_5$ vs. $L_6$ = n.s.; F(0.8289) < Fα(4.4138) for 1:18 GL | | | | | |

Values obtained for variation coefficient didn't over pass 10%, which shown a high homogeneity inside those six studied rainbow trout batches.

The recorded statistical differences between those three pairs of batches for dry matter were insignificant.

Table 3 Trout meat content in proteins

| Specification | Experimental batches | n | $\bar{X} \pm s_{\bar{X}}$ (%) | V% | Min.(%) | Max.(%) |
|---|---|---|---|---|---|---|
| $Pc_{1+}$ | $L_1$ | 10 | 18.47±0.14 | 2.39 | 17.81 | 19.03 |
| | $L_2$ | 10 | 18.96±0.08 | 1.29 | 18.38 | 19.15 |
| Signification between batches' mean | | $L_1$ vs. $L_2$ = *; F(9.3632) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{2+}$ | $L_3$ | 10 | 19.16±0.13 | 2.23 | 18.45 | 19.73 |
| | $L_4$ | 10 | 19.53±0.12 | 1.98 | 18.74 | 19.95 |
| Signification between batches' mean | | $L_3$ vs. $L_4$ = n.s.; F(4.2800) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{3+}$ | $L_5$ | 10 | 19.58±0.12 | 2.17 | 18.78 | 20.05 |
| | $L_6$ | 10 | 19.92±0.09 | 1.44 | 19.27 | 20.21 |
| Signification between batches' mean | | $L_5$ vs. $L_6$ = n.s.; F(4.3457) < Fα(4.4138) for 1:18 GL | | | | |

In according with realised research regarding trout meat content in proteins, analysed trout meat had a mean content in proteins between 18.47±0.14%, as it was recorded for batch $L_1$ and 19.92±0.09%, as it was determined for individuals of fourth summer from batch $L_6$ (table 3).

Significant statistical differences were recorded only between batch $L_1$ and $L_2$, at trout of second summer.

At the end of determinations for lipids content in trout meat were obtained mean values of 4.22% and 4.60% for rainbow trout individuals of second summer, mean values of 4.98% and 5.31% for individuals of third summer, respectively mean values between 5.73-5.86% in case of trout of forth summer (table 4).

Table 4 Trout meat content in lipids

| Specification | Experimental batches | n | $\bar{X} \pm s_{\bar{X}}$ (%) | V% | Min.(%) | Max.(%) |
|---|---|---|---|---|---|---|
| $Pc_{1+}$ | $L_1$ | 10 | 4.22±0.11 | 8.25 | 3.69 | 4.98 |
| | $L_2$ | 10 | 4.60±0.12 | 8.38 | 3.98 | 5.11 |
| Signification between batches' mean | | $L_1$ vs. $L_2$ = *; F(5.4045) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{2+}$ | $L_3$ | 10 | 4.98±0.11 | 7.01 | 4.37 | 5.45 |
| | $L_4$ | 10 | 5.31±0.13 | 8.02 | 4.56 | 5.89 |
| Signification between batches' mean | | $L_3$ vs. $L_4$ = n.s.; F(3.5709) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{3+}$ | $L_5$ | 10 | 5.73±0.10 | 5.25 | 5.19 | 6.22 |
| | $L_6$ | 10 | 5.86±0.12 | 6.52 | 5.26 | 6.45 |
| Signification between batches' mean | | $L_5$ vs. $L_6$ = n.s.; F(0.6932) < Fα(4.4138) for 1:18 GL | | | | |

Significant statistical differences were observed only between mean values obtained for trout of second summer from batches $L_1$ and $L_2$, and variation coefficient didn't over pass 10%, which indicate an increased homogeneity inside analysed batches.

As a result of determination of raw ash content in trout meat weren't observed major differences between studied trout batches, so the obtained mean values were between 1.12-1.21% (table 5).

Studied character was homogenous, fact proven by the lower values of variation coefficient (V%=4.55-7.71), and recorded statistical differences being insignificant.

Table 5 Trout meat content in ash

| Specification | Experimental batches | n | $\bar{X} \pm s_{\bar{X}}$ (%) | V% | Min.(%) | Max.(%) |
|---|---|---|---|---|---|---|
| $Pc_{1+}$ | $L_1$ | 10 | 1.12±0.03 | 7.70 | 0.98 | 1.22 |
| | $L_2$ | 10 | 1.17±0.03 | 6.78 | 1.06 | 1.35 |
| Signification between batches' mean | | $L_1$ vs. $L_2$ = n.s.; F(1.4748) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{2+}$ | $L_3$ | 10 | 1.15±0.03 | 7.71 | 1.01 | 1.28 |
| | $L_4$ | 10 | 1.18±0.02 | 6.06 | 1.08 | 1.29 |
| Signification between batches' mean | | $L_3$ vs. $L_4$ = n.s.; F(0.4802) < Fα(4.4138) for 1:18 GL | | | | |
| $Pc_{3+}$ | $L_5$ | 10 | 1.21±0.03 | 6.93 | 1.05 | 1.37 |
| | $L_6$ | 10 | 1.15±0.02 | 4.55 | 1.06 | 1.23 |
| Signification between batches' mean | | $L_5$ vs. $L_6$ = n.s.; F(4.1776) < Fα(4.4138) for 1:18 GL | | | | |

The obtained mean values at the end of determinations of chemical features of rainbow trout meat for all those six experimental batches are in according with the values cited in literature for this fish breed [7, 3, 19, 8, 12, 9].

## CONCLUSIONS

Chemical features of analysed trout meat were influenced both by slaughtering age of trout but mostly by the quantity and quality of administrated feed.

As a result of the current research we recommend feeding of rainbow trout with granulated artificial feed in two allowances per day and with a daily feed administrated quantity of 1.8% from trout corporal mass and its capitalization at the age of third summer, because at this age trout meat present the best values for chemical features.

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