ABSTRACT

Fish meat always represented a basic food for human nutrition assuring over 15% from the total consumed proteins. During mankind evolution contributes in a considerable way at assuring the necessary quantity of animal protein.

By fish meat we understand the muscular tissue together with all tissues natural adherent to it, bones, fat, conjunctive tissue, blood vessels and nerves. Proportion of those tissues determines fish meat quality which is in return affected by a series of factors (breed, age, physiological status, feeding, environment factors, etc.) which actions both during animal life and also after its slaughtering.

The most valuable fish breeds from fresh mountain waters belong to *Salmonidae* family, one of the ancestral fish families from Caspian Sea-Black Sea area.

Literature enlightened the existence of various studies, having as study material rainbow trout, but the great majority are about rearing technologies, mainly aiming to establish some optimal technologies for Romania's climatic conditions without a presentation of evidences regarding capitalization age and corporal weight for this breed.

So in this context, the current paper aim to obtain, as originally elements, new data and to provide a scientific argument for a series of aspects regarding optimal age and corporal weight at which rainbow trout could be efficient capitalized and the main aspects regarding biology of rainbow trout (*Oncorhynchus mykiss*) and factors which influence the quantitative and qualitative production of meat gathered from this breed.

To achieve the proposed goals were analysed a number of 600 individuals of rainbow trout (*Oncorhynchus mykiss*), of different ages, reared in semi-intensive and intensive systems, in two trout farms from Neamţ County.

Our research were carried out on an experimental design which involved a number of five series of experiences and aimed to create an objectively image on optimal age and corporal weight for rainbow trout capitalization.

Those five experiment series of research were:

- **1st series of experiments** - *„Contribution to knowledge of natural and technologic specific environment characteristics for rearing farm rainbow trout";*

➢ **2nd series of experiments** - *„Contribution to knowledge of morph-productive characteristics of farm rainbow trout";*

➢ **3rd series of experiments** - *„Contribution to knowledge and evaluation of meat quantitative production at farm rainbow trout, function of age and corporal weight";*

➢ **4th series of experiments** - *„Contribution to knowledge and evaluation of meat qualitative production at farm rainbow trout, function of age and corporal weight";*

➢ **5th series of experiments** - *„Checking out the best experimental results and calculus of economic efficiency".*

In the first series of experiences are presented data regarding natural and technologic specific environment for rearing farm rainbow trout in both exploitations.

Geographical area in which are placed both trot farms (Neamţ County) is characterized by a continental climate, with rich rainfall, especially during cold season. Air temperature, during summer, could reach up to 25-30ºC while in winter could decrease up to -25ºC.

Thermal regime of Borca-Fărcaşa area was monitoring during two research periods, first one between September 2010 and August 2011, and the second one between September 2011 and May 2012.

Optimal growing and development of salmonids depend in a great measure by physical-chemical quality of technological water, so were determined a series of specific physical-chemical parameters of water. The obtained results offer a series of great important information regarding water quality from trout ponds and also permit to establish the improving measures for water quality and trout rearing.

As a result of monitoring of climatic and hydrological parameters from both trout farms was observed that the obtained mean values of those parameters are optimal for a normal growing and development of rainbow trout.

Rearing of rainbow trout (*Oncorhynchus mykiss*), which was the aim of the current research, was carried out in two exploitations specialized in growing of rainbow trout for consumption from Neamţ County, noted in the paper with E1 and E2.

Maintenance of rainbow trout, with different ages, in those two exploitations, 2nd summer (Pc_{1+}), 3rd summer (Pc_{2+}) and 4th summer (Pc_{3+}) was realised in monoculture.

In exploitation E1 is applied a *semi-intensive* rearing system, characterized by the existence of ground ponds, with own systems for water supply and exhaust. This rearing system is specific to the majority of trout farms from Romania.

In trout exploitation E2 is applied an *intensive* rearing system, which is one of the most used systems nowadays in Romania. Ponds for trout rearing have an oval shape, with central supply and

perimeter exhaust, being easily to exploit and maintain. These ponds have the advantage of forming a circular current on all surface, fact which facilitates maintenance and disinfection.

To concrete the stocking density were taken in account a series of factors such as: breed, development status (age), physiological status, breed genotype and etiology, rearing system, shape and size of rearing ponds.

Trout feeding, in both units, was made manually with the best quality granulated fodders, with a protein level between 40-45% crude proteins.

During **2nd series of experiments** were studied the morph-productive characteristics of farm rainbow trout from both exploitations.

For rainbow trout individuals from those six batches first was examined general shape, colouring and corporal dimensions, and after that different corporal regions (head, torso, caudal peduncle, fins).

Colouring of the studied rainbow trout was in the breed standard, the general background has a green-grey colour, with light blue shadows, darker on the dorsal side and lighter on the ventral side, with specification that the trout reared in E1 exploitation presented a dark coloured tegument, due to the environment in which they are living.

Head, at studied rainbow trout individuals, presented quite great dimensions representing between 17-21% from total length of body. Torso is well covered by musculature, has a conical shape and represents the corporal segment which lies from posterior part of opercular apparatus till the level of anal orifice. Caudal peduncle at the analysed individuals had values between 18 and 20% from total length of body.

The effectuated somatic measurements, for rainbow trout, by biometric studies are represented by metric or dimensional characters (total length, standard length, head length, caudal peduncle length, body maximum thickness, maximum height, minimum height and maximum circumference) and by gravimetric characters (corporal mass).

Corporal dimensions are those determinations which, together with gravimetric ones, show the quantitative and qualitative evolution of fishes, in connection, with their genetic potential, maintenance technique and technology, applied feeding, environment quality and the existent health state.

Corporal mass, at the end of growing period, didn't present significant differences between the compared three pair of batches; so for individuals of 2nd summer, mean weight at slaughtering was 160.62 g for batch S1 respectively 159.51 g, as it was recorded for batch B1, for individuals of 3rd summer the recorded values were 251.03 g (batch S2) and 260.07 g (batch B2), and for trout of 4th summer the recorded mean weight was 492.20 g batch S3 respectively 457.46 g batch B3.

Using the corporal measurements effectuated for rainbow trout individuals from all six batches, were calculated a series of corporal and productive indexes such as: profile index (*Ip*), thickness index (*Ig*), quality index (*IC*), Fulton index (*Ii*) and carnosity index (*Ic*).

The best value for profile index was 3.21 recorded for individuals of 3rd summer from batch S2, this thing showing a better corporal format for trout reared in exploitation E1.

For thickness index the high value was 49.02% obtained for individuals of 4th summer batch B3. Quality index, for studied trout, was placed between 1.31 for batch S2 and 1.48 for batch B1.

Fulton index, calculated for studied rainbow trout individuals oscillated between 1.74, value for batch B1 respectively 2.07, as it was at batch S3.

Regarding the quality index the best calculated value was 1.31%, recorded for rainbow trout of individuals of 3rd summer batch S2, differences between batches being 0.09 at individuals of 2nd summer, 0.02 at rainbow trout individuals of 3rd summer and, respectively, 0.03 at individuals of 4th summer.

Data regarding weight gain were recorded at the end of one growing period (45 days), when were made individual weightings to establish the corporal mass, after was calculated the average for all six studied batches.

As regarding the daily mean gain, the best values were 1.89 g and 1.75 which were recorded for individuals of 4th summer batches of S3 and B3, unlike the recorded values for 2nd summer individuals, which were 1.04 g and 1.1 g, respectively, 1.21 and 1.30, value recorded for 3rd summer trout.

Relative gain represents the rate between total growing recorded at the end of growing period (45 days) reported to initial weight.

Growing intensity represents the rate of corporal mass at realisation of weight gain, at the end of 45 days period. Those one varied function of rainbow trout dimension, so at trout of 2nd summer was recorded a superior growing intensity (0.340-0.371%) in comparison with the ones of 3rd summer (0.243% and 0.255%) and 4th summer (0.180-0.189%).

During research, after a complete ihtyo-pathological examination, were discovered two diseases, *Yersiniosis* and *Mixobolus* respectively, which were symptomatic only for rainbow trout reared in exploitation E1, and lead to 21.35% from the total losses for 2nd summer trout, 14.50% for 3rd summer individuals and, respectively, 11.07% at 4th summer individuals.

Losses of rainbow trout were mainly caused by the stress caused by repetitive manipulations (stocking, thinning, control fishing, treatments), some technological problems, cannibalism and diseases (case of exploitation E1).

In **3rd series of experiments** are presented data regarding evaluation of meat quantitative production for farm rainbow trout, on age and weight categories.

The obtained data regarding the rate of different body parts, related to total weight enlightened the fact the some corporal components had a descendant evolution, with corporal weight increasing, while others had ascendant evolutions.

Head rate had a significant influence on slaughtering yield, which at rainbow trout individuals presented a proportion between 12.79% and 12.90% for trout of 2nd summer, between 11.69-11.85% for trout of 3rd summer and between 10.76 and 10.97% for individuals of 4th summer.

Percentage participation of torso had an ascendant evolution in concordance with trout age, so the lowest rate, 66.61%, was recorded at batch S1 and the greatest rate, 74.31%, was recorded at individuals of 4th summer batch S3.

Slaughtering yield represents the percentage rate between carcass weight at warm or after refrigeration and the live weight of trout before slaughtering, being considered the most important indicator which characterize meat quantitative production at rainbow trout.

Determination of warm yield was realised in trout farms, at around one hour from slaughtering, for trout from all six experimental batches, and determination of cold yield was realised after a previous refrigeration of trout carcasses for 24 hours at temperature between 0 and +4ºC. During refrigeration trout carcasses presented losses between 1.54% (batch S3) and 2.05% (batch B3) from the initial trout weight, and the recorded statistical differences between all three pairs of batches were insignificant.

Analysis of quantitative rainbow trout meat production included also the establishment of internal organs and visceral mass weights. From trout were gathered the following organs: liver, kidneys and heart. Also was weighted the visceral mass composed of internal organs, gonads and viscera.

Weight of visceral mass at the studied trout was between 27.87 g (batch B1) and 62.83 g (batch B3). To rate these values to live weight of studied trout could be remarked a ratio of visceral mass which oscillated between 12.71% and 17.49%.

Proportion of bones reported to total corporal mass had a significant influence on slaughtering yield, this one varying function of corporal dimensions and also with fish skeleton development.

During research we diversified the cutting methods of rainbow trout in trunk shape to enlighten the most efficient modality of cutting from yield angle. These one proved to be the profiled cutting, which presented very good values between 66.62%, as was recorder for batch S1 and 74.08% value recorded for individuals of 4th summer batch S3.

4th series of experiments had some research realised to know and to evaluate quality of rainbow trout meat, function of age and corporal weight.

During our research, for determining pH value of rainbow trout meat, both at warm and cold, we worked with an extract prepared from the muscular tissue gathered from the studied rainbow trout individuals.

Chemical composition of rainbow trout meat was realised on samples gathered from side musculature, both for recently slaughtered trout and also for the ones warm smoked. Samples were chemical analysed, in according with the methodological laboratory norms, respecting all the imposed recommendations and the current standards.

The best obtained results for fresh rainbow trout meat were 27.16% (batch B3) for dry matter, 19.82% (batch S3) for proteins and 4.09% (batch S1) for lipids.

Also, in according with our research, was determined the content in five minerals, the high mean values were recorded for phosphorous (P), between 105.62 (batch S1) and 224.87 mg/kg^{-1} (batch B3), on second place being calcium (Ca) with mean values which varied between 26.39 mg/kg^{-1} as were recorded for batch S1 and, respectively, 39.65 mg/kg^{-1}, for the individuals from batch B3, on third place magnesium (Mg), which had the highest values (22.36±1.79 mg/kg^{-1}) for individuals of 4th summer (batch B3), followed by sodium (Na) which presented very close values between batches with a minimum of 8.87 mg/kg^{-1} (batch B3) and a maximum of 11.54 mg/kg^{-1} (batch S1) and on the last place was zinc (Zn) with very low values, didn't exceeded 0.97 mg/kg^{-1}.

As regarding the smoking yield, this one was determined for each batch after a previous chilling of smoked rainbow trout carcasses. By weighting of smoked carcasses provided from rainbow trout was obtained a smoking yield between 50.98% (batch B1) and 61.45% (batch B3).

After exposure of rainbow trout at smoke action, we observed that were some interrelations with environment, which were decisive on trout meat qualities, so rainbow trout smoked meat had a mean content of dry matter between 35.85% at individuals from batch S3 and 41.27% for trout in batch B1, protein content increase in comparison with the one from rainbow trout fresh meat, reaching the maximum value 30.87% (batch B1) and lipids content presented a minimum of 6.53% (batch S3) and a maximum of 9.51% (batch S2).

Trout side musculature (epaxial and hipaxial muscles) was studied under the aspects of its structure, realising citometric and histometric measurements. Obtained data were used to determine muscular fibre diameter and muscular fibres density per square unit.

5th series of experiments involved economical efficiency calculation for each age category, by modelling outcomes and incomes for producing *one tone of fresh trout* for each age category and exploitation.

To establish outcomes and incomes were taken in account the obtained results for both trout farms, during one year.

The main expenditures for both exploitations are represented by: variable costs (expenditures with fodder and with biological material) and fixed costs (wages, costs of electricity and fuel, unpredicted expenditures).

Incomes were realised by direct selling of fresh or smoked rainbow trout at market price. Capitalization of production in both exploitations were realised as fresh rainbow trout, and in exploitation E1 also as smoked rainbow trout at weights between 170 and 500 g.

Prediction of realised profit at the end of rearing and capitalization of one tone of fresh rainbow trout represented a very important action and aimed to analyse the activities realised for increasing economic efficiency. Indicators of economic efficiency which justify the rearing activity of rainbow trout enlightened the fact that gross profit, the highest one, obtained after capitalization of one tone of trout was 5,645 lei/tone and were obtained at batch S3.

By the effectuated research was scientifically proven the main aspects regarding optimal age and corporal weight at which farm rainbow trout is efficiently capitalized, and a series of aspects regarding the influence of some factors on quantitative and qualitative meat production for the studied breed.