RESEARCH REGARDING VARIATION OF MUSCULAR FIBER DIAMETER FROM *ONCORHYNCHUS MYKISS, SALMO TRUTTA FARIO* AND *SALVELINUS FONTINALIS* BREED FARMED IN NE PART OF ROMANIA

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Abstract

Research was carried out on three trout breeds, rainbow trout (Oncorhynkus mykiss), brown trout (Salmo trutta fario) and brook trout (Salvelinus fontinalis), which are the most farmed salmonid species in N-E part of Romania. To assess the meat quality of rainbow, brown and brook trout we considered that it's necessary to make some histological investigations about muscle fibre diameter. The research was done using fish of two years old. Muscle was systematically sampled and differentiated by breed and body mass and the results were statistically analyzed and interpreted. The comparative statistical analysis revealed significant differences between the three trout breeds. After the histological examination of rainbow, brown and brook trout muscles the conclusion that emerges is whatever of breed, the muscle fibre structure and fineness has a significant trend according to the dynamics of growth.

Key words: morphology, histological, muscle, fibre, trout

INTRODUCTION

Studying and understanding the muscle growth mechanism of fish is very important and relevant for in the intensive farming of species for human consumption [5, 8, 15]. Morphological and functional characteristics of muscle fibre differ according to species and the stage of evolution [3, 4, 14]

The analysis of the muscle fibre diameter offers the possibility to appreciate some features such as texture, which is an important variable of meat quality and is a constant concern for the aquaculture sector [1, 5, 7, 9, 15].

To underline how meat texture is dependent of muscle fibre diameter, in this paper, we analyzed the muscle samples taken from rainbow (*Oncorhynchus mykiss*) brown *(Salmo trutta fario)* and brook (*Salvelinus fontinalis*) trout, of one and two years age and the results are presented by breed.

MATERIAL AND METHOD

For the histological analysis of rainbow, brown and brook trout flesh, samples were collected from fresh biological material, originating from two trout farms from the NE part of Romania, Cheița (Neamț County) and Vicovu de Jos (Suceava County), the three breeds were fed with the same type of food. Research was effectuated on a number of 300 male and female individuals of one and two years old, with body weight ranging between 225 and 428 g.

The research was done using fish of one and two years old. The muscle strips of 10 mm long and 7-10 mm thick were put into labelled containers in a formalin solution Muscle was systematically sampled and differentiated by age and body mass and the results were statistically analyzed and interpreted by using Tukey test. Samples were taken from lateral muscle, separately on breed, age and body mass, and were processed in the Laboratory of Histopathology belonging to Faculty of Veterinary Medicine Iasi.

Muscle fibre diameter was determined by inclusion technique in paraffin and staining with haematoxylin-eosin [6]. Histological

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examination and interpretation of data was performed using Leica DM 750 microscope equipped with Leica Las Software Version V4.2 2012, equipped with microphotography system.

RESULTS AND DISCUSSIONS

To clarify the way, in which the meat texture is connected and correlated with the diameter of muscular fibre, were made analyses on muscle samples gathered from the three trout breeds.

Based on the realized measurements, we calculated the average values and statistical indices for muscle fibre diameter [12, 17]. Analyzing these results we discovered values very different at the three trout breeds, with the mention that the smallest values for muscle fibre diameter was found at the age of one year for all breeds taken in study.

So, after 12 month of growing the diameter of muscle fibre was 64.39±4.73 µ in the case of rainbow trout specimens, 79.25±5.66 µ for brook trout specimens and 83.64±4.94 µ at brown trout specimens, values which fall into the limits mentioned in the literature [2, 5, 13, 15]. After 24 month of growing the diameter of muscle fibre was 69.54±6.20 µ in the case of rainbow trout specimens, 94.94±3.84 for brook trout specimens and 98.45±6.72 µ at brown trout specimens (table 1) and figure 1-6.

Table 1 Diameter of the muscular fibre (µ)

Breed	n	Age	$X \pm s_x$	V%
Oncorhynkus mykiss	50	12 month	64.39±4.73	30.18
Salvelinus fontinalis	50	12 month	79.25±5.66	22.58
Salmo trutta fario	50	12 month	83.64±4.94	17.65
Oncorhynkus mykiss	50	24 month	69.54±6.20	22.45
Salvelinus fontinalis	50	24 month	94.94±3.84	23.35
Salmo trutta fario	50	24 month	98.45±6.72	27.48

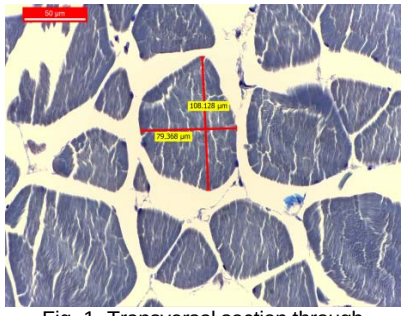

Fig. 1. Transversal section through musculature at brown trout of 1 year old (50 X, OC 10 X OB 10)

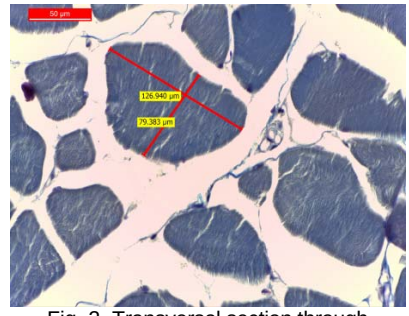

Fig. 2. Transversal section through musculature at brown trout of 2 years old (50 X, OC 10 X OB 10)

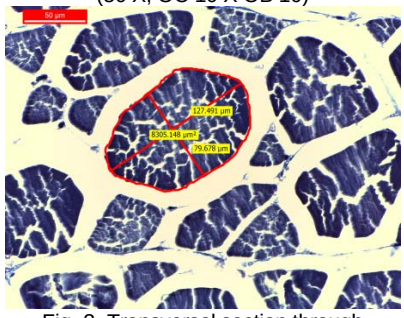

Fig. 3. Transversal section through musculature at brook trout of 1 year old (50 X, OC 10 X OB 10)

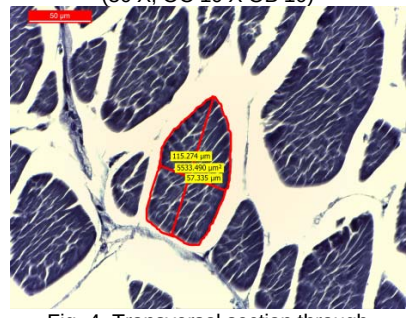

Fig. 4. Transversal section through musculature at brook trout of 2 years old (50 X, OC 10 X OB 10)

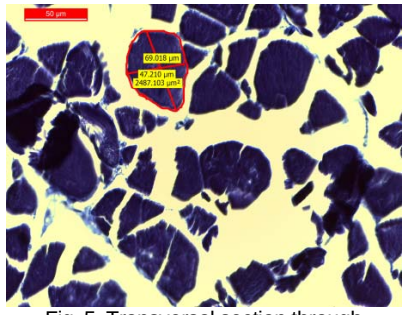

Fig. 5. Transversal section through musculature at rainbow trout of 1 year old (50 X, OC 10 X OB 10)

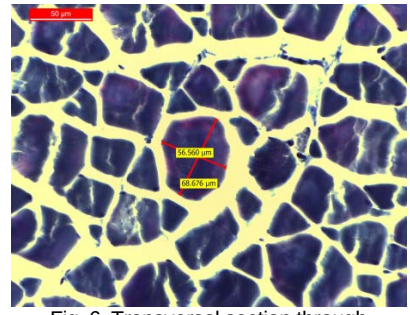

Fig. 6. Transversal section through musculature at rainbow trout of 2 years old (50 X, OC 10 X OB 10)

The values we obtained for muscle fibre diameter for the three trout breeds highlights the changes that appear in meat texture according to evolution of age and body mass. Thus, in rainbow trout, it can be seen a slow increase in muscle fibre diameter from the average of 64.39±4.73 μ at one year age to 69.54±6.20 μ at two years old. At brook and brown trout we can see the same increase in muscle fibre diameter according to age but with higher amplitude. So, if at one year age the average fibre diameter for book trout was 79.25±5.66 μ, at two years old was higher with about 15.69 μ, and in the case of brown trout with about 14.81 μ.

Summarizing, we can observe that the muscle fibre diameter increases between the two years with about 7.81% for rainbow trout, 19.79% for brook trout and with 17.70% in the case of brown trout.

These results showed us that texture is most consistent for brook and brown trout meat in comparison with rainbow trout meat, and we consider that these result mainly appear due to the lower degree of genetic improvement in this direction of brook and brown trout.

The comparative statistical analysis by muscle fibre diameter revealed major differences between the three trout breeds. The values of these measurements are not absolute because, during the histological processing, fixation and staining, the muscle fibres reduce their volume. Significant and highly significant statistically are the differences according to breed, age and body mass that can be observed in table 2.

Table 2 Significance of difference regarding the muscular fiber diameter

Breed	$X \pm s_x$	$X \pm s_x$	Significance
Sf*12 vs *Om 12	79.25±5.66	64.39±4.73	*** **p < 0.001**
Sf*12 vs *Om 24	79.25±5.66	69.54±6.20	*** **p < 0.001**
Sf*12 vs *Stf 12	79.25±5.66	83.64±4.94	** **p < 0.050**
Sf*12 vs *Stf 24	79.25±5.66	98.45±6.72	*** **p < 0.001**
Sf*12 vs *Sf 24	79.25±5.66	94.94±3.84	**n.s. p<0.05**
Sf24 vs Om 12	94.94±3.84	64.39±4.73	*** **p < 0.001**
Sf24 vs Om 24	94.94±3.84	69.54±6.20	*** **p < 0.001**
Sf24 vs Stf 12	94.94±3.84	83.64±4.94	*** **p < 0.001**
Sf24 vs Stf 24	94.94±3.84	98.45±6.72	** **p < 0.050**
Om12 vs Stf12	64.39±4.73	83.64±4.94	*** **p < 0.001**
Om12 vs Stf24	64.39±4.73	98.45±6.72	*** **p < 0.001**
Om24 vs Stf12	69.54±6.20	83.64±4.94	*** **p < 0.001**
Om24 vs Stf24	69.54±6.20	98.45±6.72	*** **p < 0.001**
Om12 vc Om 24	64.39±4.73	69.54±6.20	**n.s. p<0.05**
Stf*12 vs *Stf 24	83.64±4.94	98.45±6.72	**n.s. p<0.05**

Exception can be seen at all breeds between one year and two years where the differences appear to be insignificant. Explanation may be that the body mass accumulation between years was smaller, of only 137 g for brown trout, 152g for brook

trout and 185 g for rainbow trout, and in this context it is clear that for all breeds meat texture changes with the age according to body mass and studies and research conducted by different scientists [5, 10, 11, 16, 18] showed an intense correlation between body weight and muscle fibre diameter.

CONCLUSIONS

Following histological research carried out on rainbow, brown and brook trout meat we can withdraw several conclusions:

1. The analysis of rainbow, brown and brook trout flesh revealed that the muscle fibre diameter varies by breed and change as fish is older;
2. The muscles with the thick fibre are founded in the dorsal area of the body while the thin fibres were identified in the lateral muscles (ribs area);
3. Comparing the three trout breeds in terms of muscle fiber fineness we found to be significantly higher in rainbow trout than brook and brown trout due to a high degree of genetic improvement of this breed.
4. Meat texture represents an important variable of quality, of who depends the increasing of trout production and breed choose by the consumer;
5. Whatever the breed, the fineness of muscle fibre has a significant trend according to the dynamics of growth and age.

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