



ПРОУЧВАНЕ ВЪРХУ МОРФОЛОГИЯТА И СТРУКТУРНИТЕ ОСОБЕНОСТИ НА МУСКУЛАТУРАТА
НА ПЪСТЪРВА (*ONCORHYNCHUS MYKISS*) И СИВЕН (*SALVELINUS FONTINALIS*),
ОТГЛЕЖДАНИ В СЕВЕРОИЗТОЧНАТА ЧАСТ НА РУМЪНИЯ
RESEARCH REGARDING MORPHOLOGY AND STRUCTURE FEATURES OF THE MUSCLE FROM
ONCORHYNCHUS MYKISS AND *SALVELINUS FONTINALIS* BREED FARMED IN NE PART OF ROMANIA

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Резюме

Изследването е проведено върху два вида - дъгова пъстърва (*Oncorhynchus mykiss*) и сивен (*Salvelinus fontinalis*) – най-широко отглежданите пъстървови риби в Североизточната част на Румъния. За оценка на качеството на месото на пъстървата и сивена са направени хистологични проучвания на мускулните влакна. В изследването са използвани двулетни и трилетни риби. Мускулите са били подбрани с отчитане на възрастта и живата маса на рибите. Данните са обработени статистически, а резултатите са анализирани и интерпретирани. Сравнителният анализ показва, че са налице значителни различия между двата вида по отношение на телесното развитие и дебелината на мускулните влакна. Хистологичният анализ е показал съществени изменения на структурата и дебелината на мускулните влакна при изменение на масата и възрастта.

Abstract

Research was carried out on two trout species, rainbow trout (*Oncorhynchus mykiss*) 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 and brook trout we considered that it's necessary to make some histological investigations about muscle fiber diameter. The research was done using fish of two and three years old. Muscle was systematically sampled and differentiated by age and body mass and the results were statistically analyzed and interpreted. The comparative statistical analysis revealed significant differences between the two trout species and according to age was found a different evolution of body mass and implicitly of muscle fiber diameter. After the histological examination of rainbow and brook trout muscles the conclusion that emerges is whatever of species, the muscle fiber structure and fineness has a significant trend according to the dynamics of growth and age.

Ключови думи: морфология, хистология, мускули, влакна, пъстърва.

Key words: morphology, histological, muscle, fiber, 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 (Dal Pai-Silva, 2003; Boaru, 2010; Păsărin, 2011). Morphological and functional characteristics of muscle fiber differ according to species and the stage of evolution (Patruno, 1998; Bugeon, 2003; 2006). The analysis of the muscle fiber 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 (Dunajski, 1979; Bjørnevik, 2003; Boaru, 2010; Păsărin, 2011). To underline how meat texture is dependent of muscle fiber diameter, in this paper, we analyzed the muscle samples taken from rainbow (*Oncorhynchus mykiss*) and brook (*Salvelinus fontinalis*) trout, of one and two years age and the results were presented by species.

MATERIALS AND METHODS

For the histological analysis of rainbow 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 ANIVOS (Suceava County), both species were fed with the same type of food. Research was effectuated on a number of 200 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 labeled 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 species, age and body mass, and were processed in the Laboratory of Histopathology belonging to Faculty of Veterinary Medicine Iasi. Muscle fiber diameter was determined by inclusion technique in paraffin and staining with hematoxylin-eosin.

RESULTS AND DISCUSSION

To clarify the way, in which the meat texture is connected and correlated with the diameter of muscular fiber, were made analyses on muscle samples gathered from the two species.

Based on the realized measurements, we calculated the average values and statistical indices for muscle fiber diameter. Analyzing these results we discovered values very different at the two trout species, with the mention that the smallest values for muscle fiber diameter was found at the age of one year for both species taken in study.

So, after 12 month of growing the diameter of muscle fiber was $47.91 \pm 2.25 \mu$ in the case of rainbow trout

specimens and $68.39 \pm 1.33 \mu$ at brook trout specimens, values which fall into the limits mentioned in the literature (Nag, 1972; Bud, 2004; Boaru, 2010; Păsărin, 2011). After 24 month of growing the diameter of muscle fiber was $49.48 \pm 4.32 \mu$ in the case of rainbow trout specimens and $75.32 \pm 3.84 \mu$ at brook trout specimens (table 1).

The values we obtained for muscle fiber diameter for the two trout species 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 fiber diameter from the average of $47.91 \pm 1.66 \mu$ at one year age to $49.48 \pm 4.32 \mu$ at two years old. At brook trout we can see the same increase in muscle fiber diameter according to age but with higher amplitude. So, if at one year age the average was $68.39 \pm 1.33 \mu$, at two years old was higher with about 6.93μ . Summarizing, we can observe that the muscle fiber diameter increases between the two years with about 3.27% for rainbow trout and with 10.13% in the case of brook trout.

These results showed us that texture is most consistent for brook 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 trout.

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

Exception can be seen in both species between one year and two years where the differences appear to be insignificant. Explanation may be that the body mass

Таблица 1. Диаметър на мускулните влакна (μ)
Table 1. Diameter of the muscular fibre (μ)

Species / Вид	n	Age / Възраст	$\bar{X} \pm s_{\bar{x}}$	V%
<i>Oncorhynchus mykiss</i>	50	12 month / месеци	47.91 ± 2.25	30.18
<i>Salvelinus fontinalis</i>	50	12 month / месеци	68.39 ± 1.33	26.37
<i>Oncorhynchus mykiss</i>	50	24 month / месеци	49.48 ± 4.32	22.45
<i>Salvelinus fontinalis</i>	50	24 month / месеци	75.32 ± 3.84	23.35

Таблица 2. Достоверност на разликите на дебелината на мускулните влакна
Table 2. Significance of difference regarding the muscular fiber diameter

Breed / Вид	$\bar{X} \pm s_{\bar{x}}$	$\bar{X} \pm s_{\bar{x}}$	V%
<i>Sf12 vs Om12</i>	68.39 ± 1.33	47.91 ± 2.25	*** $p \geq 0.001$
<i>Sf12 vs Om24</i>	68.39 ± 1.33	49.48 ± 4.32	*** $p \geq 0.001$
<i>Om12 vs Om24</i>	47.91 ± 2.25	49.48 ± 4.32	n.s. $p < 0.05$
<i>Sf12 vs Sf24</i>	68.39 ± 1.33	75.32 ± 3.84	n.s. $p < 0.05$



accumulation between years was smaller, of only 137 g for brook trout and 185 g for rainbow trout, and in this context it is clear that for both species meat texture changes with the age according to body mass and studies and research conducted by Stickland, 1983; Weatherley, 1988; Kiessling, 1991; 2006, showed an intense correlation between body weight and muscle fiber diameter.

CONCLUSIONS

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

1. The analysis of rainbow and brook trout flesh revealed that the muscle fiber diameter varies by species and change as fish is older;
2. The muscles with the thick fiber are founded in the dorsal area of the body while the thin fibers were identified in the lateral muscles (ribs area);
3. Species, age and origin, type of food directly influences the fineness and density of muscle fibers;
4. Meat texture represents an important variable of quality, of who depends the increasing of trout production and species choose by the consumer;
5. Whatever the species, the fineness of muscle fiber has a significant trend according to the dynamics of growth and age.

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