

PHYSICOCHEMICAL CHANGES IN RAINBOW TROUT (*ONCORHYNCHUS MYKISS*) AFTER FREEZING

MARIYANA STRATEVA

DEPARTMENT OF VETERINARY ANATOMY, HISTOLOGY AND EMBRYOLOGY,
FACULTY OF VETERINARY MEDICINE, TRAKIA UNIVERSITY

INTRODUCTION

- The physicochemical characteristics of fish meat are a key factor in determining its safety and quality.
- Due to its lipid composition, fish meat is considered to be a major source of nutrients for humans.
- The nutritional value of fish meat may be lost after the onset of hydrolysis and oxidation of fats that occur when stored frozen.
- Poor quality of meat after freezing is associated with changes in colour, texture and moisture loss.

INTRODUCTION

- Organoleptic characteristics such as tenderness and juiciness of meat are directly related to protein loss and their functionality in frozen storage.
- Proteins are denatured after forming bonds with lipid oxidizing compounds.
- As a result, there is a change in the water retention capacity of meat.
- Proteins can also undergo oxidation and form protein aggregates.

PURPOSE

- The objective of the present study was to compare some physicochemical changes in the dorsal and ventral muscles in rainbow trout (*Oncorhynchus mykiss*) after freezing once and twice.

MATERIALS AND METHODS

- For the experiment, 45 fresh rainbow trout (*Oncorhynchus mykiss*) were purchased from the stores with an average weight of 400 g.
- The fish were transported in refrigerated bags to the laboratory where the analyses were performed.
- The study material was taken from the dorsal and abdominal anatomical region of fresh fish and fish frozen once and twice, determining water content, water activity, protein content, fat and ash content.
- Fifteen of the fish (n=15) were analyzed immediately after delivery to the laboratory.

MATERIALS AND METHODS

- The remaining thirty fish (n=30) were frozen in conventional freezers at - 18 °C for 15 days.
- Then they were thawed at 4 °C for 24 hours.
- Material for subsequent analyses was taken from fifteen fish (n=15).
- The remaining fifteen thawed fish (n=15) were frozen again under the same conditions.
- After the second freezing period had expired, the fish were thawed at 4 °C for 24 hours and material was taken for the analyses.

MATERIALS AND METHODS

- **Determining water content**

- The test was carried out by means of an analytical weighing method of drying at 104 ± 2 °C to a constant mass according to BDS 5712-74.

- **Determining water activity (A_w)**

- Water activity (A_w) was determined using a Hygrolab device (Rotronic AG, Switzerland).

- **Determining protein content**

- Protein content was determined by the Kjeldahl method according to BDS - EN ISO 5983 on a Kjeltect™ 8400 device (Foss, Denmark).

MATERIALS AND METHODS

- **Determining fat content**

- Fats were extracted according to BDS ISO 6492 and determined on a SoxtecTM 2050 device (Foss, Denmark).

- **Determining ash content**

- The method was based on burning a meat sample in a muffle furnace followed by weight determination according to BDS 9373:1980.

- **Statistical analysis**

- The results were statistically processed using GraphPad InStat 3 (GraphPad Software, San Diego, CA) and presented as average values with standard deviations. Dispersion analysis was performed to compare the significance of differences between the different experimental groups. Statistical significance was determined at $p < 0.05$.

RESULTS

Comparing physicochemical indicators of abdominal and dorsal muscles of rainbow trout (*O. mykiss*)

Indicator	State of fish	Abdominal muscles	Dorsal muscles	Significance
		$\bar{x} \pm SD$	$\bar{x} \pm SD$	(p)
Water activity	fresh	0.967±0.007	0.969±0.003	ISD
	frozen once	0.960±0.014	0.975±0.002	*
	frozen twice	0.967±0.006	0.967±0.006	ISD
Water content (%)	fresh	73.91%±3.94	76.08%±2.04	ISD
	frozen once	73.69%±2.82	74.99%±1.35	ISD
	frozen twice	73.37%±1.58	73.22%±1.73	ISD
Ash (%)	fresh	1.23%±0.52	1.30%±0.18	ISD
	frozen once	1.61%±0.14	1.54%±0.42	ISD
	frozen twice	1.33%±0.15	1.29%±0.09	ISD
Crude protein (%)	fresh	19.27%± 0.31	19.82%±0.25	ISD
	frozen once	20.11%±0.25	20.33%±0.24	ISD
	frozen twice	19.29%±0.40	19.98%±0.41	ISD
Fat (%)	fresh	3.80%±0.43	3.25%±0.63	ISD
	frozen once	4.52%±0.69	3.25%±0.45	ISD
	frozen twice	5.02%±0.44	3.83%±0.16	*

*p<0.05; differently marked values show significant differences;

ISD – insignificant difference, p>0.05

RESULTS

Comparing the physicochemical indicators of fresh rainbow trout (*O. mykiss*) and trout frozen once and twice

Indicator	Muscles	Fresh trout $\bar{x}\pm SD$	Trout frozen once $\bar{x}\pm SD$	Trout frozen twice $\bar{x}\pm SD$	Significance (p)
Water activity	Abdominal muscles	0.967±0.007	0.960±0.014	0.967±0.006	ISD
	Dorsal muscles	0.969±0.003 ^{ab}	0.975±0.002 ^{ac}	0.967±0.006 ^{bd}	**
Water content (%)	Abdominal muscles	73.91%±3.94	73.69%±2.82	73.37%±1.58	ISD
	Dorsal muscles	76.08%±2.04 ^a	74.99%±1.35 ^{ab}	73.22%±1.73 ^b	*
Ash (%)	Abdominal muscles	1.23%±0.52	1.61%±0.14	1.33%±0.15	ISD
	Dorsal muscles	1.30%±0.18	1.54%±0.42	1.29%±0.09	ISD
Crude protein (%)	Abdominal muscles	19.27%±0.31 ^a	20.11%±0.25 ^b	19.29%±0.40 ^a	*
	Dorsal muscles	19.82%±0.25	20.33%±0.24	19.98%±0.41	ISD
Fat (%)	Abdominal muscles	3.80%±0.43	4.52%±0.69	5.02%±0.44	ISD
	Dorsal muscles	3.25%±0.63	3.25%±0.45	3.83%±0.16	ISD

*p<0.05; differently marked values show significant differences;

**p<0.01; differently marked values show significant differences

ISD – insignificant difference, p>0.05

CONCLUSION

- Freezing and frozen storage affect water activity, water content, crude protein and fat content of rainbow trout (*Oncorhynchus mykiss*).
- Changes in the chemical composition are observed in freezing once and twice.
- Freezing once over a period of 15 days affects less the physicochemical indicators than freezing twice.