

RESEARCH ON PHYSIC-CHEMICAL INDICES OF THE MEAT OF THE STURGEON SPECIES *POLYODON SPATHULA*

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Abstract

The research was conducted on a total of 40 sturgeon of *Polyodon spathula* (paddlefish), of different ages (10 copies Ps_{0+} , 10 copies Ps_{1+} , 10 copies Ps_{2+} and 10 copies Ps_{3+}), from a farm in the county of Botoșani. pH level of the fill site (side muscle), derived from *Polyodon spathula* analyzed, and was determined on fresh meat, respectively, at 24 hours after slaughter. pH value of meat varied: between 6.90 and 7.11 and between 6.77 and after slaughter from 6.89 to 24 hours after slaughter. The chemical composition of fish meat of *Polyodon spathula* analyzed to determine the fill site from paddlefish, of different ages. Water content of the fill site, the species of sturgeon *Polyodon spathula* for four summers of growth analyzed ranged between 75.41% for Ps_{3+} and 78.37% for Ps_{0+} ; water content varying in the same fish species according to age. Protein content of the fill site from *Polyodon spathula* species, for the four summers of growth was values between 18.08% for Ps_{0+} and 19.89% Ps_{3+} , the protein content of sturgeon meat of *Polyodon spathula* analyzed species within this group of fish protein. Fat content of the fill site to paddlefish sturgeon analyzed, ranged from 2.45 to 3.96%, these values fall into the category of sturgeon fish low in fat.

Key words: sturgeon, filet, chemical content

INTRODUCTION

Polyodon spathula is a breed with a natural spreading habitat in North America in the basin of Mississippi River. It is a fish with large waist, plankton eater, feeding himself with filtered zoo-plankton from water; its growing potential is superior to many breeds from freshwater in conditions in which food is not a restrictive factor. Growing potential at a large scale of this fish is huge in fisheries and in poly-culture with other breeds. The meat and roe of the breed is very close to the other sturgeons.

In human nutrition, fish have an important rate, assuring a proportion of 12 – 15% from the total consummated proteins. Fish meat present remarkable sensorial qualities and a good nutritive value, offered by the high content in complex proteins, lipids with a high un-saturation degree, vitamins and mineral salts [12].

MATERIAL AND METHODS

In the current study were analysed a number of 40 sturgeons from *Polyodon spathula* breed

with different ages (10 individuals $P.s_{0+}$; 10 individuals $P.s_{1+}$, 10 individuals $P.s_{2+}$ and 10 individuals $P.s_{3+}$), provided from Hudești fishery, Botoșani County.

For evaluating the pH value of meat was used the electrometric method by measuring the potential difference between a control electrode and a measuring one, both of them placed in the researched extract.

Water determination was realised through the stove drying method, in according with SR ISO 1442/1997 standard.

Protein determination was realised using Kjeldhal method, adapted to Velp Scientifica system, made by a digestion unit DK6 and a distillation unit UDK7 (method specified by the equipment producer – 981:10, AOAC Official methods of analysis/1990, compatible with SR ISO 937:2007).

Fat determination was effectuated through Soxhlet method, Velp Scientific – SER 148 model (method specified by the device producer, AOAC Official methods of analysis/1990 and compatible with SR ISO 1443:2008).

To determinate the mineral substance was used the method of calcinations in electric oven (in according with SR ISO 936:1998 standards).

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RESULTS AND DISCUSSIONS

pH value

After fish was slaughtered, by ending the oxygen supply and sanguine flow, muscular tissue passes in anaerobiose and glycolyse is going up to lactic acid, which is step by step accumulated in meat, fact which will influence the pH value [3].

The acidity of fishes muscular tissue just after slaughter could be between 7 and 7.3, and at full rigidity is placed between 5.4 and 5.8 or even more, 6.2 – 6.5. In general, pH values at different after fishing periods are higher than the ones from mammals, due to a formation of a lower quantity of lactic acid and due to a greater capacity of muscles buffering [1].

Acidity had an influence on meat quality under sensorial, hygienic and technologic features. Those ones determinate and reflects the state meat chemical compounds and it is close connected with colour features. Acidity have a direct and indirect connection also with other sensorial features (tenderness, consistency, flavour, taste) and influence the water retain capacity and also meat storage period [8].

pH level from the studied muscles (dorsal epaxial, coastal epaxial, coastal hipaxial and abdominals hipaxial), was determinate on fresh meat, respectively at 24 hours after

slaughter. The obtained values at the two tests, were in the normal limits cited in the literature (7 – 7.3 just after fishing) [1], [9], [12].

So, meat pH value (table 1) oscillated between the values:

- 6.90 and 6.92, after slaughter and at 24 hours between 6.77 and 6.80 for P.s.₀₊;
- 6.93 and 6.95, after slaughter and at 24 hours between 6.77 and 6.79 for P.s.₁₊;
- 7.01 and 7.02, after slaughter and at 24 hours between 6.85 and 6.87 for P.s.₂₊;
- 7.10 and 7.11, after slaughter and at 24 hours between 6.88 and 6.89 for P.s.₃₊.

The obtained values for variation coefficients showed a good homogeneity for the studied batches (V % < 5).

Chemical composition of the studied meat

Chemical composition of *Polyodon spathula* fish meat was analysed on filet (side muscles) gathered from the studied paddlefishes.

Side muscles are the main mass of somatic musculature, being fixed on the sides of body, under the tegument. In the profound area, they are in contact with the axial skeleton, in anterior side are inserted in the occipital region of neurone-head and on the superior margin of the scapular belt and at the posterior area are inserted at the base of caudal fin [11].

Table 1 pH value of the studied muscles gathered from *Polyodon spathula* at different ages

Age	Analysed muscles	After slaughter		At 24 hours	
		$\bar{X} \pm s_{\bar{X}}$	V%	$\bar{X} \pm s_{\bar{X}}$	V%
<i>Polyodon spathula</i> of 1 st summer - P.s. ₀₊	ED	6.92±0.05	1.91	6.80±0.09	1.40
	EC	6.91±0.04	1.55	6.78±0.10	1.09
	HC	6.91±0.07	1.87	6.77±0.07	1.52
	HA	6.90±0.06	1.65	6.77±0.05	1.82
<i>Polyodon spathula</i> of 2 nd summer - P.s. ₁₊	ED	6.95±0.09	1.75	6.79±0.06	1.89
	EC	6.94±0.04	1.95	6.78±0.03	1.58
	HC	6.94±0.06	1.79	6.77±0.08	1.29
	HA	6.93±0.02	1.86	6.77±0.10	1.84
<i>Polyodon spathula</i> of 3 rd summer - P.s. ₂₊	ED	7.02±0.05	1.72	6.87±0.05	1.69
	EC	7.02±0.06	1.93	6.86±0.04	1.80
	HC	7.01±0.03	1.84	6.85±0.09	1.74
	HA	7.01±0.05	1.59	6.85±0.03	1.29
<i>Polyodon spathula</i> of 4 th summer - P.s. ₃₊	ED	7.11±0.02	1.57	6.89±0.08	1.36
	EC	7.09±0.09	1.71	6.89±0.06	1.68
	HC	7.10±0.04	1.63	6.88±0.05	1.73
	HA	7.10±0.08	1.81	6.88±0.03	1.92

Note: n=10; ED – dorsal epaxial muscles; EC – coastal epaxial muscles; HC – coastal hipaxial muscles; HA – abdominals hipaxial muscles.

Water from muscular tissue. Due to the high participation degree in chemical composition and to its various roles, water is

the main component of all live organisms, with a capital importance in their organisation and function.

Content in water of filet gathered from *Polyodon spathula* sturgeon breed, for all the four summers of growing, had values between 75.41% for Ps₃₊ and 78.37% for Ps₀₊ (table 2); water content varying at the same breed function of fish age (higher content in water at younger ages); those values are in the limits cited in the consulted literature [6].

Variation testing enlightened significant statistical differences only between the sturgeons of 1st summer and the ones of 4th summer.

Relative high content in water of fishes, in general, and in particular of *Polyodon spathula* breed, could favour the development of the majority of micro-organisms, fact which made the refrigeration storage to be more diminished, being recommended to consume the meat as fresh as possible.

Proteins from the muscular tissue. In chemical composition of muscular tissue, after water, proteins represents the most important constituents of animal organisms; having

varied functions, which reflects a high degree of structural organization and specialization.

Proteins are the basic substances which offer to foodstuff their nutritional value. Therefore, the quality of foodstuff is appreciated, mainly after their content in proteins [10].

Content in proteins of filet gathered from *Polyodon spathula* breed, for the four summers of rearing, had values between 18.08% for Ps₀₊ and 19.89% for Ps₃₊, similar values with the ones from the consulted literature [6]. Protein content of the analysed *Polyodon spathula* sturgeon meat, frame this breed in *proteic fish* group (15-20% proteins) [5].

For this parameter didn't enlightened significant statistical differences between the four analysed ages categories.

Lipids from fish meat varies in very large limits (0.1-28.0%), fishes being classified in: fat fishes, with over 8% fats; fishes with medium state of weight gain, between 4-8%; thin fishes, with less 4% fats [8].

Table 2 Chemical content of filet gathered from *Polyodon spathula*

Specification		<i>Polyodon spathula</i> 1 st summer - P.s. ₀₊	<i>Polyodon spathula</i> 2 nd summer - P.s. ₁₊	<i>Polyodon spathula</i> 3 rd summer - P.s. ₂₊	<i>Polyodon spathula</i> 4 th summer - P.s. ₃₊
Water (%)	$\bar{X} \pm s_{\bar{X}}$	78.37 ^a ±4.78	77.81±5.23	76.65±4.37	75.41 ^b ±5.04
	V%	2.67	2.28	2.19	2.72
DM (%)	$\bar{X} \pm s_{\bar{X}}$	21.63 ^b ±2.53	22.19±2.69	23.35±2.47	24.59 ^a ±2.83
	V%	2.97	3.01	2.35	2.61
Proteins (%)	$\bar{X} \pm s_{\bar{X}}$	18.08±1.83	18.12±1.98	18.21±1.73	19.89±1.88
	V%	3.41	3.52	3.28	2.71
Fats (%)	$\bar{X} \pm s_{\bar{X}}$	2.45 ^{cd} ±0.32	2.80 ^{ad} ±0.25	3.96 ^a ±0.22	3.45 ^{ad} ±0.18
	V%	3.19	3.21	2.58	2.63
Mineral substances (%)	$\bar{X} \pm s_{\bar{X}}$	1.1±0.075	1.27±0.090	1.18±0.092	1.25±0.089
	V%	2.48	3.16	2.93	3.17
Collagen (%)	$\bar{X} \pm s_{\bar{X}}$	3.83 ^c ±0.29	3.92±0.32	4.05±0.28	4.14 ^a ±0.36
	V%	3.75	3.84	4.07	3.71

Note: n=10;
ANOVA test – for each analysed character, comparison between ages

^{ab} significant differences ($\hat{F} > F$ tab. α 0.05 at 1;3 GL).

^{ac} distinct significant differences ($\hat{F} > F$ tab. α 0.01 at 1;3 GL).

^{ad} very significant differences ($\hat{F} > F$ tab. α 0.001 at 1;3 GL)

Content in lipids of filet for the analysed *Polyodon spathula* sturgeons was between 2.45-3.96%, values which place these sturgeons in category of *fishes with low content in lipids*. Also this time, the obtained

data were between the limits from the consulted literature [6], [4], [7].

After testing the variance were enlightened very significant differences between fat content of sturgeons of third summer and

those from the other summers of growing; also the same very significant differences were recorded between fat content of sturgeons of fourth summer and the ones of first and second summer. Between fat content at younger ages (first and second summer), the differences were distinct significant.

Collagen is the most resistant and abundant protein from conjunctive tissues, which contributes to maintain the structural integrity of tissues, and from chemical point of view, is an incomplete protein with reduced biological value [2], [3].

In the case of the analysed *Polyodon spathula* breed, the rate of collagen in filet had the following values: at *Polyodon spathula* – first summer - P.s.₀₊ - 3.83%; at *Polyodon spathula* – second summer - P.s.₁₊ - 3.92%, at *Polyodon spathula* – third summer - P.s.₂₊ - 4.05% and at *Polyodon spathula* – fourth summer - P.s.₃₊ - 4.14%.

Fraction of collagen proteins (unbalanced from the of view of content in essential amino-acids), is placed for the majority of breeds between limits 3-10% while in the meat of animals with hot blood could reach the level of 17% from the total protein [8]. In the case of studied sturgeon breed proportion of collagen was between 3.83% and 4.14%, being in the cited values.

By applying the ANOVA test were enlightened distinct significant differences between collagen content of the sturgeons of fourth summer and the ones of first summer.

CONCLUSIONS

Evolution of meat acidity (side muscles: dorsal epaxial, coastal epaxial, coastal hipaxial and abdominals hipaxial), translated through by pH value, after slaughter recorded values which varied between 6.90 – 7.11 and between 6.77 and 6.89 at 24 hours after slaughter for the four analysed ages. The lowest pH values were recorded at paddlefishes of first and second summer fact due to the stress at which these ones were submissively during fishing.

Water content of filet gathered from *Polyodon spathula* sturgeon breed, for all four summers of rearing, had close values, between 75.41% for Ps₃₊ and 78.37% for Ps₀₊; these values are in the limits cited in the consulted literature.

Protein content of from *Polyodon spathula* sturgeon breed, for all four summers of rearing, had values ranged from 18.08% for Ps₀₊ and 19.89% for Ps₃₊, values which place these fishes in the group of proteic fishes.

Content in lipids of analysed *Polyodon spathula* sturgeon breed was between 2.45-3.96%, values which placed those sturgeons in category of fishes with low content in lipids.

Having in view the fact that at studied sturgeon proportion of collagen in filet was placed between 3.83% (P.s.₀₊) and 4.14% (P.s.₃₊), we can conclude that these fishes have a meat with a very high digestibility degree.

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