Research Regarding Content in Amino-acids and Biological Value of Proteins from *Polyodon spathula* Sturgeon Meat

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Polyodon spathula sturgeon breed is successfully reared in Romania in many fishery farms for meat production and it is capitalized on domestic market as consumption fish. In the current paper were studied a number of 1400 sturgeons from Polyodon spathula breed (1200 individuals of one summer - P.s.$_{0+}$ and 200 individuals of fourth summers - P.s.$_{3+}$). From this flock were weighted around 10%, for each age group, and for laboratory determinations were chosen 10 fishes for each age with the corporal mass close to the group mean. After analysing the fillets gathered from the studied fishes for establishing the chemical characteristics, nutritive and biological values of proteins were drawn some interesting conclusions. So, regarding chemical composition we notice that in the meat of analysed fishes water is in a rate of 75.41% at P.s.$_{3+}$ and 78.37% for P.s.$_{0+}$; proteins - between 18.08% for P.s.$_{0+}$ and 19.89% for P.s.$_{3+}$, values which place those fishes in the group of protein fishes; lipids - between 2.45% and 3.45%, values which situated those sturgeons in category of fishes with a low content in lipids; collagen – 3.83% at P.s.$_{0+}$ and 4.14% at P.s.$_{3+}$ which indicate low values for proteins of weak quality in the meat of those sturgeons. Study of nutritive value for the analysed fishes indicate the fact that fishes P.s.$_{0+}$ have a mediocre nutritive value, having the ratio w/p of 4.33 while sturgeons P.s.$_{3+}$ were placed in the 2nd category – fishes with a good nutritive value (rate w/p = 3.79). Energetic value of the studied fillets was 97.39 kcal/100 g for P.s.$_{0+}$ and 114.31 kcal/100 g for P.s.$_{3+}$, which enlightened an increase of nutritive value with aging, fact especially due to accumulation of adipose tissue. Study of proteins quality, through the presence of those 8 essential amino-acids in the meat of analysed fishes, show the fact that at sturgeons P.s.$_{0+}$ proportion of essential amino-acids was 20.88% from total amino-acids, while at sturgeons P.s.$_{3+}$ was 26.23%, fact which enlightened an increasing of proteins' biological value with fish aging. This fact was also shown by calculation of proteins' biological value through chemical methods (EAA index); calculated value for sturgeons P.s.$_{0+}$ was a little bit lower (118.73) than the one calculated for sturgeons P.s.$_{3+}$ (118.79).

Keywords: amino-acids, biological value, chemical content, sturgeons, fillet

Polyodon spathula (*Walbaum, 1972*) is the unique representative of *Polyodontidae* family in North America. Natural area of breed *Polyodon spathula* is represented by hydrographical basin of Mississippi River, from Greatest Lakes to Florida. *Paddlefish, spoon-fish, spoonbill* are some of the names given to those unique pre-historical fish. *Polyodon spathula* is one of the biggest fresh water fishes in USA, at maturity reaching a length of around 1.5-2.0 m and a weight of almost 50-70 kg. Morphologically is similar with the other sturgeons, with the exception of head which present a rostrum much prolonged, compressed dorsal-ventral, with a paddle aspect, and its length at adult individuals is around 1/3 from the total body length; both opercula as well as rostrum, are covered with a network of tactile or electrical receptors [1, 2]. Fish body is devoid of scales, with the exception of some small scales placed along lateral line, at the dorsal base, and at base of pectorals [3]. Have a smooth skin, its colour varying from light grey till black on flanks and dorsal; abdomen being white-grey. Eyes are small, placed at rostrum base, the visual acuity being reduced [1]. Skeleton is cartilaginous, the only bony pieces being at the skull level (maxillary). Brachial apparatus is well developed at adults, presenting the adaptations of planktonfagus fishes. Mouth is big and placed in a ventral position. Digestive tube present a spiral valve, specific for *Acipenseriformes* [4] and it is specialised for filtration and utilisation of waters' zoo-plankton. *Polyodon spathula* consume mainly plankton organisms through filtration. The main feed consist in zoo-plankton and aquatic insects, then phyto-plankton and insects' larvae, consumption of detritus is passive and is exclusively due to life environment, respectively due to material quantities in suspension which exist in river waters after floods [5, 6].

Polyodon spathula reach the sexual maturity of age of 7-8 years males and 10-13 years females [7]. Roes' diameter is 2.5-3.0 mm, females depositing around 100,000 roes [8]. Reproduction took place in spring at waters' temperatures of 11-14°C, fishes migrating on the upper flow of river and its affluent, at distances which sometimes could be of hundreds of kilometres [9]. The rapid growth in first year of life occurs even in winter [4, 10]. After first year, growing rhythm is slower. Till the age of 5 years, growing rate in length is around 5 cm/year, after age of 5 years, weight growing rate is rapid and in the next 5 years frequently they double or triple their weight [1, 11-13].

Alternative of capitalization of *Polyodon spathula* sturgeon breed, in Romanian aquaculture, have the advantage of a successful acclimatization of those breed at Romania's environmental conditions by an efficient capitalization of aquatic eco-system, and obtain of production similarly with the ones obtained in natural spreading area, using similar rearing technologies. In Romania, were imported from USA, staring with 1992 till 1999, between 5,000-20,000 individuals/year (larvae) at

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Research Station for Pisciculture Nucet and around of 40 individuals with older ages, from Republic of Moldova, at S.C.D.E.A. Ciurea, Iasi. Results of the experiments realised at S.C.D.P. Nucet and at S.C.D.A.E.A. Iaºi allowed elaboration of some rearing technologies at different ages in poly-culture with carp and Asian cyprinids, as well as reproduction, pre-development and juvenile rearing in protected spaces till the age of one year. Rearing in poly-culture with carp (*Ciprinus carpio*) and grass carp (*Ctenopharyngodon idella*), make possible to obtain some important productions [14].

Nowadays paddlefish in Romania is successfully reared in many fishery farms for meat production and it is capitalized on domestic market as consumption fish. So, it is necessary a profound knowledge of this breed, regarding rearing technologies and obtained productions, as well as the knowledge about quality of obtained meat and roes.

Meat of *Polyodon spathula* breed is firm, white and boneless, with a taste and structure similar with the meat of others sturgeons [15]. After meat processing, will result 57% from fish body as carcass or „bullet" (beheaded, eviscerated and without fins), and 27% as fillet (red meat and removed skin) [16, 17]. From historical point of view, sturgeon meat was known and accepted by the USA early emigrants with European origin, in the last period of 1800 years, but meat from paddlefish was less appreciated. Today, paddlefish meat is commonly sold as *boneless catfish meat*, in order to associate the product with a popular fish in the Southern part of USA. So, paddlefish meat is quite unknown for the majority of consumers and market still remained limited [18]. Paddlefish is classified as a fish with a low content in fats, those one being between 1 and 4.5% function of corporal mass [17]. Content in proteins of fillet (lateral muscles) gathered from *Polyodon spathula* breed, has values between 18.08-19.89%, values which placed those fishes in the group of protein fishes [19, 20]. Meat is quite stable and could be stored by refrigeration up to 7 days and up to 7 months by freezing [17].

Having in view the above mentioned things, by current paper we intend to complete the information already existed in the literature through a study of proteins' biological value in the meat gathered from *Polyodon spathula* sturgeons reared in Romania.

Experimental part

Material and method

In the current paper were studied 1400 sturgeons from *Polyodon spathula* breed (1200 individuals P.s.$_{0+}$ and 200 individuals P.s.$_{3+}$), reared in Hudesti Fishery Farm from Botosani County. From this flock of fishes were weighted around 10%, for each category of age. For measurements and laboratory determinations were chosen 10 fishes from each category of age with close weights to group mean.

Determination of meat chemical composition

Water determination was realised by *oven drying method* which consist in drying of the analysed sample at a temperature of +105°C, in according with standard SR ISO 1442/1997.

Protein determination was made through *Kjeldhal method*, adapted to system Velp Scientifica, composed by a DK6 digestion unit and a UDK7 distillation unit (method specified by the producer of devices – 981:10; AOAC Official methods of analysis/1990 [21], compatible with SR ISO 937:2007).

Fat determination was done by *Soxhlet method* which consists in extraction of fats with organic solvent using Velp Scientific–SER 148 device (method specified by the producer of device, AOAC Officinal methods of analysis/ 1990 [21] and compatible with SR ISO 1443:2008) [22].

For determination of dry matter was utilised *calcinations method in electric oven* at a temperature of +550°C (in according with standard conform SR ISO 936:1998).

To determine the nutritive value of meat gathered from the studied paddlefishes was made the calculus of muscles caloricity, using a theoretical formula based on quantity of raw caloric energy liberated at burning of one gram of proteins, fats and carbohydrates in calorimetric bomb, in according with the formula: RE (kcal/kg) = 5.70 kcal x g protein + 9.50 kcal x g fats +4.2 kcal x non-nitrogenous extractive substances [23, 24].

For determination of meat content in collagen was utilised Food-Check infrared spectrophotometer.

For amino-acids analysing was utilised method of liquid chromatography analyse (High Precision Liquid Chromatography–Thermo Electron) in according with standard SR EN ISO 13903:2005 [25-27].

The obtained results were statistically processed by statistic calculus (arithmetic mean, variance, mean standard deviation and variability coefficient) [28]. To test the significance of statistical differences between means of studied characters was used the ANOVA Single Factor algorithm included in Microsoft Excel software.

Appreciation of proteins' biological value was realised by chemical methods which appreciate their value based on content in essential amino-acids. After dosing of essential amino-acids, appreciation was made by rating the amino-acids of the studied protein with the ones from etalon protein [23, 29, 30]:

$$Ic = \frac{content\ in\ amino\text{-}acid\ A\ of\ studied\ protein}{content\ in\ amino\text{-}acid\ A\ of\ etalon\ protein} \times 100$$

As standard protein usually is utilised protein from egg or etalon protein FAO/WHO.

After calculation of chemical indexes for those 8 essential amino-acids for adults we calculate Oser index or EAA Index (*Essential Amino-acid Index*) [30, 31]:

$$EAA\ Index = \sqrt[n]{Ic_1 \times Ic_2 \times Ic_3 \times \ldots \times Ic_n}$$

Results and discussions

Chemical composition of analysed *Polyodon spathula* fish meat was determined on fillet gathered from paddlefishes of 1st summer and 4th summer.

Muscular tissue is the most valuable part of fish meat, consisting in 40-50% from the mass of live organism and includes: trunk musculature, composed by lateral muscles, red muscles and muscles of impaired fins; head musculature, composed by muscles of mandibles and brachial arches; musculature of belts and paired fins, composed by muscles of scapular belt and pectoral fins and muscles of pelvic belt and ventral fins [32].

Lateral muscles are the main mass of somatic musculature, being placed on the body laterals, just underneath tegument. In profound zone, are in contact with axial skeleton, in anterior zone are inserted in occipital region of neuro-cranium and on the superior edge of scapular belt, and at posterior zone are inserted at the base of caudal fin.

Water from muscular tissue. Due to high participation rate in chemical composition and its multiply roles, water is the main component of all living organisms, with a major importance in their organization and function.

Water content of fillets (lateral muscles) gathered from *Polyodon spathula* sturgeon breed, for those two rearing

summers, had values between 75.41% for P.s.$_{3+}$ and 78.37% for P.s.$_{0+}$; water content varying for the same breed function of fish age (higher water content at lower ages); those values being in the limits cited by the literature [17].

Testing of variance enlightened significant statistical differences between sturgeons of 1st summer and the ones of 4th summer.

The quite high content in water of fishes, in general, so also of *Polyodon spathula* breed show the fact that this one could be favourable for the development of micro-organisms which make that storage period by refrigeration to be much diminished, recommending the consumption of meat in a fresh state.

Proteins from muscular tissue. In chemical composition of muscular tissue after water, proteins are the most representative constituents of animal organisms; those ones fulfilling extremely variated functions, which reflects a high level of structural organization and specialization.

Proteins are basic substances which offer nutritive value to food products. So, the quality of food products is mainly appreciated by their content in proteins [33].

Content in protein of fillet (lateral muscles) gathered from *Polyodon spathula* breed, for those two rearing summers, had values between 18.08% for Ps$_{0+}$ and 19.89% for Ps$_{3+}$, values similar with the ones from literature [17]. Content in protein of analysed *Polyodon spathula* sturgeon meat, place this breed in category of protein fishes (15-20% protein) [34].

For this parameter weren't observed significant statistical differences between those two analysed ages.

Lipids from fish meat vary in very large limits (0.1-28%), fishes being classified in: fat fishes, with more 8% fats; fishes with medium fattening state, between 4-8%; weak fishes with less 4% fats [34].

Content in lipids of fillet (lateral muscles) at analysed *Polyodon spathula* sturgeons was between 2.45-3.45%, values which place these sturgeons in category of fishes with low lipids content. Also now the obtained data were in the limits cited in the literature [17, 36, 37].

After variance testing were highlighted very significant differences between fat content of sturgeons of 4th summer and the ones of 1st summer (table 1).

Collagen is the most resistant and abundant protein in conjunctive tissues, which contributes to maintain the tissue structural integrity. From chemical point of view collagen is an incomplete protein, with a reduced biological value [38].

In case of analysed *Polyodon spathula* breed, the collagen rate in fillet (lateral muscles) had the following values: at *Polyodon spathula* – 1st summer - P.s.$_{0+}$ - 3.83% and at *Polyodon spathula* – 4th summer - P.s.$_{3+}$ - 4.14% (table 2).

By application of ANOVA test were enlightened distinct significant differences between collagen content of sturgeons of 4th summer and the ones of 1st summer.

Fraction of collagen proteins, unbalanced from the point of view of content in essential amino-acids, is ranking for majority of breeds between 3-10%, while in the meat of animals with warm blood could reach at 17% from total protein content [35]; for the sturgeon breed studied by us the collagen rate was between 3.83 and 4.14%, being in the cited limits.

Rate water/protein (w/p) is a criteria for appreciation of nutritive value of fish meat, and in according with it, fishes are divided in 5 categories: 1st category – fishes with high nutritive value (w/p – 2.5-3.5); 2nd category – fishes with good nutritive value (w/p – 3.5–4.2); 3rd category – fishes with mediocre nutritive value (w/p – 4.2–4.7); 4th category – fishes with low nutritive value (w/p – 4.7–5.2); 5th category – fishes in an advanced inanition state (w/p higher than 5.2) (table 3).

Rate w/p is an insufficient criterion for establishing of fish nutritive value so must be taken in account also the fat content from fish meat. At fish proteins represent 12.3–28% from the total meat mass, and there is a direct

Specification		*Polyodon spathula* 1st summer - P.s.$_{0+}$	*Polyodon spathula* 4th summer - P.s.$_{3+}$
Water (%)	$\bar{x} \pm s_{\bar{x}}$	$78.37^{a} \pm 4.78$	$75.41^{b} \pm 5.04$
	V%	2.67	2.72
Dry matter (%)	$\bar{x} \pm s_{\bar{x}}$	$21.63^{b} \pm 2.53$	$24.59^{a} \pm 2.83$
	V%	2.97	2.61
Proteins (%)	$\bar{x} \pm s_{\bar{x}}$	18.08±1.83	19.89±1.88
	V%	3.41	2.71
Lipids (%)	$\bar{x} \pm s_{\bar{x}}$	$2.45^{d} \pm 0.32$	$3.45^{a} \pm 0.18$
	V%	3.19	2.63
Minerals (%)	$\bar{x} \pm s_{\bar{x}}$	1.1±0.075	1.25±0.089
	V%	2.48	3.17

n=10; ANOVA test – for each assessed trait, compared between ages

[ab] significant differences ($\hat{F}$ >F crit. α 0.05 at 1;3 DF).

[ad] highly significant differences ($\hat{F}$ >F tab. α 0.001 at 1;3 DF).

Table 1
CHEMICAL COMPOSITION OF FILET GATHERED FROM *POLYODON SPATHULA*

Specification		*Polyodon spathula* 1st summer - P.s.$_{0+}$	*Polyodon spathula* 4th summer - P.s.$_{3+}$
Collagen (%)	$\bar{x} \pm s_{\bar{x}}$	$3.83^{c} \pm 0.29$	$4.14^{a} \pm 0.36$
	V%	3.75	3.71

n=10; ANOVA test – for each assessed trait, compared between ages

[ac] distinguished significant differences ($\hat{F}$ >F crit. α 0.01 at 1;3 DF).

Table 2
COLLAGEN CONTENT OF STUDIED MEAT

Specification	Water/protein ratio
Polyodon spathula – 1st summer - P.s.$_{0+}$	4.33
Polyodon spathula – 4th summer - P.s.$_{3+}$	3.79

Table 3
RATIO WATER/PROTEINS OF FILLET ISSUED FROM *POLYODON SPATHULA*

correlation between water content and protein content [34].

From those two analysed development stage (1st summer and 4th summer), the first one was ranked in 3rd category – fishes with mediocre nutritive value, rate w/p being of 4.33 at 1st summer, sturgeons of 4th summer being ranked in 2nd category – fishes with good nutritive value (rate w/p = 3.79).

Nutritive value and meat digestibility are influenced by muscles structure and their chemical composition. Proteins which determine meat structure had a different digestibility. The sarcoplasmatic ones are easy digestible, and the ones of stroma (collagen and elastin) had a reduced digestibility. Meat digestibility is influenced by the blood quantity remained in musculatures' capillaries, as well as by the inner-muscular fat quantity.

Meat nutritive value also depends on chemical composition, especially by the quantities of nutritive substances which it contains. From all the nutritive principles, the highest caloric value belonged to fats which influence, quite much, the meat nutritive value. Between two meat categories, with the same nutritive value, the one which present a higher digestibility will also have a higher nutritive value.

Energetic value of fillet (lateral muscles) gathered from studied *Polyodon spathula* sturgeon is represented in table 4. In according with the recorded data, energetic value of studied fillet was 97.39 kcal/100 g for P.s.$_{0+}$ and 114.31 kcal/100 g for P.s.$_{3+}$, with 17.37% higher face to P.s.$_{0+}$, which show an increase of at the same time with age and corporal development of individuals. This fact is mainly due to accumulations of adipose tissue.

In comparison with nutritive value of others sturgeons (105 kcal/100 g) [39], the calculated values were close, which show a strong genetic influence for the presented aspect.

Content in amino-acids of the meat gathered from *Polyodon spathula* sturgeons with age of one or four summers is presented in table 5. From those 18 presented amino-acids, 9 are essential for children and adults (histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan and valine), two semi-essentials (cysteine and tyrosine) and 7 non-essential (alanine, arginine, aspartic acid, glutamic acid, glycine, proline and serine) [29, 30, 40, 41].

From the presented data could be observed that the highest values were recorded at older sturgeons (4th summer – P.s.$_{3+}$), values which are in close correlation with the dynamics of water and protein content (table 1).

Even were observed differences for all amino-acids between those two case, weren't significant from statistically point of view.

In case of those two studied ages was observed that amino-acid content order from high to low was as follows:

Table 4
NUTRITIVE VALUE OF FILET GATHERED FROM THE STUDIED *POLYODON SPATHULA* STURGEONS

Specification	Nutritive value	
	kcal/100 g	Mj/100 g
Polyodon spathula – 1st summer - P.s.$_{0+}$	97.39	407.09
Polyodon spathula – 4th summer - P.s.$_{3+}$	114.31	477.81

Table 5
CONTENT IN AMINO-ACIDS OF THE FILLET GATHERED FROM THE STUDIED *POLYODON SPATHULA* STURGEONS

Amino-acids	*Polyodon spathula* 1st summer - P.s.$_{0+}$	*Polyodon spathula* 4th summer - P.s.$_{3+}$
Tryptophan	0.203±0.03	0.223±0.04
Threonine	0.793±0.07	0.872±0.05
Isoleucine	0.833±0.05	0.917±0.06
Leucine	1.470±0.09	1.617±0.08
Lysine	1.661±0.07	1.828±0.09
Methionine	0.535±0.04	0.589±0.04
Cysteine	0.194±0.03	0.213±0.02
Phenylalanine	0.706±0.05	0.776±0.06
Tyrosine	0.611±0.03	0.672±0.04
Valine	0.932±0.11	1.025±0.06
Arginine	1.082±0.09	1.190±0.07
Histidine	0.532±0.06	0.585±0.03
Alanine	1.093±0.08	1.202±0.04
Aspartic acid	1.852±0.05	2.037±0.09
Glutamic acid	2.700±0.10	2.970±0.11
Glycine	0.868±0.06	0.955±0.07
Proline	0.640±0.04	0.704±0.04
Serine	0.738±0.07	0.812±0.07
∑ amino-acids	17.443	19.187
∑ essential amino-acids	3.643	5.033
∑ semi-essential amino-acids	0.805	0.885
∑ non-essential amino-acids	12.995	13.269

Amino-acids	Chemical indexes	
	Polyodon spathula 1st summer - P.s.$_{0+}$	*Polyodon spathula* 4th summer - P.s.$_{3+}$
Tryptophan	112.28	112.11
Threonine	109.65	109.60
Isoleucine	115.18	115.26
Leucine	116.15	116.13
Lysine	167.03	167.10
Methionine + Cysteine	115.20	115.20
Phenylalanine + Tyrosine	121.40	121.33
Valine	103.09	103.06
EAA index	118.73	118.79

Table 6
CALCULATED CHEMICAL INDEXES AND EAA INDEX FOR STUDIED STURGEONS

glutamic acid (2.7% at 1st summer and 2.97% at 4th summer), aspartic acid, lysine, leucine, alanine, arginine, valine, glycine, isoleucine, threonine; and at the end of the list of those 18 analysed amino-acids was tryptophan with 0.203% for P.s.$_{0+}$ and 0.223% for P.s.$_{3+}$. The first three amino-acids (glutamic acid, aspartic acid and lyzine) were presented in the same order also by other authors [42, 43, 44]. Glutamic acid is not only an amino-acid which provide a special taste, but also have an important role in brain metabolism participating at synthesis of many physiological substances [45-50].

Finally we calculated for each case the sum of amino-acids (ΣA), essential amino-acids (ΣEA), semi-essential amino-acids (ΣSEA) and non-essential ones (ΣNEA). Rating ΣEA, ΣSEA and ΣNEA to total content in amino-acids (ΣA) we observe that in case of young sturgeons (P.s.$_{0+}$) essential amino-acids represent 20.88%, semi-essential amino-acids 4.26% and the non-essential ones 74.5%. In case of sturgeons - P.s.$_{3+}$ rate of amino-acids from total sum was 26.23% for essential amino-acids, 4.61% for semi-essential amino-acids and 69.16% for non-essential amino-acids, which show an increase of protein biological value with fish aging.

For establishing the protein biological value through chemical methods was necessary to calculate the content in essential and semi-essential amino-acids in g/100 g protein and then rating the obtained value, for each amino-acid, with the content of the same amino-acid in etalon protein defined by FAO and WHO. Comparing the content in amino-acids (g/100 g protein) of etalon protein with those two studied situations was observed superior values at analysed fishes for all calculated amino-acids. The greatest differences were founded in case of lysine where in etalon protein is founded in a rate of 5.5 g/100 g protein and in studied sturgeons meat was with around 67% more. The lowest differences were recorded in the case of tryptophan were in etalon protein was 1 g/100 g protein and in studied fish meat was higher with around 12%.

At the end, the obtained values for chemical indexes for each amino-acid allowed us to calculate the biological value of proteins using Oser index or obtained EEA index (table 6).

Calculated values for EAA index enlightened the fact that those sturgeons are in the group of protein fishes and also that their protein is one with a good quality because the rate of essential and semi-essential amino-acids recorded values of over 100 (118.73 for P.s.$_{0+}$ respectively 118.79 for P.s.$_{3+}$). The final result shows a light better score for 4th summer sturgeons' meat.

Having in view the presented data we consider that those ones are in concordance with other similar studies regarding content in amino-acids and nutritive value of *Polyodon spathula* sturgeons' meat [44, 51,52, 53], as well as others sturgeons [54].

Conclusions

One of the most actual problems in human nutrition, debated and studied in large circles of contemporary society is the problem of protein nutrition and, especially, the existent lack in assuring the human organisms with proteins, fact due to remarkable increasing of world population.

In human nutrition, fish have an important rate, assuring a ratio of 12–15% from the total consummated proteins. Fish meat has remarkable sensorial qualities and high nutritive value, conferred by high content in complete proteins, lipids with a high unsaturated level, vitamins, and mineral salts.

As a result of own research and from the analysis of the obtained data and presented in the current paper, which aimed to establish the chemical characteristics, nutritive and biological value of proteins from *Polyodon spathula* sturgeons breed meat, were drawn and formulated the following conclusions.

Fillets gathered from studied *Polyodon spathula* sturgeons had the following chemical content:

-in water – close values between 75.41% for P.s.$_{3+}$ and 78.37% for P.s.$_{0+}$; those values are in the limits cited by literature;

-in proteins – values between 18.08% for P.s.$_{0+}$ and 19,89% for P.s.$_{3+}$, which place them in group of protein, being similar with the ones from literature;

-in lipids – between 2.45-3.45%, values which place those sturgeons in category of fishes with low content in lipids; also in this case the obtained data were in the limits from literature;

-in collagen – were obtained values of 3.83% for P.s.$_{0+}$ and 4.14% for P.s.$_{3+}$ which indicate low values of weak quality proteins in the meat of those sturgeons.

From those to analysed development stages (first and fourth summer), the first one was placed in 3rd category – fishes with mediocre nutritive value, having the rate w/p of 4.33 while sturgeons of 4th summer were placed in 2nd category – fishes with good nutritive value (rate w/p = 3.79).

In according with the recorded data, energetic value of studied fillets was of 97.39 kcal/100 g for P.s.$_{0+}$ and of 114.31 kcal/100 g for P.s.$_{3+}$, with 17.37% higher face to P.s.$_{0+}$, which shows an increase of nutritive value with aging. This fact is due, especially, to accumulations of adipose tissue.

Proteins' quality is based on its content in amino-acids and on the rate of those 8 essential amino-acids. So in the case of studied fish meat was observed that at sturgeons of first summer the rate of essential amino-acids was

20.88% from total amino-acids, while at sturgeons of fourth summer reached the value of 26.23%, fact which enlightened an increase of proteins' biological value with fish aging. This fact is also enlightened by calculus of proteins' biological value through chemical methods (EAA index); calculated value for first summer sturgeons was a little bit lower (118.73) than the calculated value for fourth summers sturgeons (118.79).

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