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Biochemical study on the meat and oil of Mongolian fishes

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ABSTRACT: The objective of this study was to determine the meat quality and fish oil's physical and chemical characteristics of the Mongolian fishes: Syrok (*Coregonus peled*), and Lenok (*Brachymystax lenok*). Lipid content was 3.1 to 14.15%, moisture was 72.14 to 80.5%, protein content was 8.54 to 9.8% and total mineral element was 0.5 to 3.1%. The caloric value Lenok (*Brachymystax lenok*) was 68.7 and Syrok (*Coregonus peled*) - 142.8 KJ/100g, respectively. Minerals included potassium (46.32 to 52.22%), phosphorous (39.06 to 41.3%), calcium (3.26 to 5.87%), magnesium (2.08 to 3.97%) and silicon (1.14 to 2.24%), while zinc, iron and copper were present in trace amounts. Eight non essential amino acids with total amount of 58.61 to 59.64% were identified, and histidine detected as in highest value in all the species, followed by arginine. The data showed that the Mongolian fishes are of high nutritional value and good source of proteins, minerals as well as non essential amino acids. The physical and chemical characteristics of Syrok (*Coregonus peled*), and Lenok (*Brachymystax lenok*) fish oil were analyzed. These parameters are: iodine value (IV), peroxide value (PV), acid value (AV), saponification value (SV), percentage of free fatty acid (%FFA), refractive index (RI) and colour.

The extracted lipid content obtained from muscles of Syrok and Lenok was about 14.15% and 3.1%. The percentages of unsaturated fatty acids were higher than saturated fatty acids accounting for 74.37% and 25.6%, 83.83% and 16.46% respectively.

Keywords: Syrok (*Coregonus peled*), Lenok (*Brachymystax lenok*), protein, fish oil, macro- and micro-elements, amino acid, infrared spectrophotometer

INTRODUCTION

Fish and other sea foods remain an important source of white meat for the human diet to its beneficial effect in reducing coronary heart diseases. This effects especially, due to the fat for the fish. Fishes living in fresh water and ocean are contained oils which used as food and in medicine. Fresh water's and ocean's fish oil are contained 14-35 highly unsaturated fatty acids. The fatty acid pattern of triacylglycerol and phospholipids of various fish oils were also assessed [1]. Epidemiological studies on the last assure that omega-3 fatty acids are derived from fish and fish oil to decrease the risk of coronary heart disease, hypertension and stroke, and their complications [2]. The liver obtained from fish has high pharmacological activity (serve as

hypolipidemic agent an antiarthritic agent) [1]. It is known to be that Mongolia is rich in fishes. From ancient times Mongolian people have been used fish oil as food and remedy in traditional and physical treatment of some illnesses. Therefore, we have used fish Syrok (*Coregonus peled*) and Lenok (*Brachymystax Lenok*) which are widely distributed in Mongolia. The purpose of our study was biochemical study of meat obtained from two species of Syrok (*Coregonus peled*) and Lenok (*Brachymystax Lenok*)

EXPERIMENTAL

Methods. Moisture content was determined by gravimetric method. The ash content was determined by incinerating in a muffle furnace at 550°C. Composition of the ash was measured

by the using an X-ray fluorescence. The total protein and protein nitrogen amount were determined by the Kjeldahl method [1]. Amino acids were determined by paper chromatography method using standard amino acid as a standards [3]. The total lipid was determined by the Folch extract method [4].

RESULTS AND DISCUSSION

Biochemical characteristics of fish's meat is shown in table 1.

Table 1. Biochemical characteristics of Syrok's and Lenok's meat

Characteristics	Syrok (<i>Coregonus peled</i>)		Lenok (<i>Brachymystax lenok</i>)	
	Our research	Kleimonov et al	Our research	Kleimonov et al
	Content	[5]	Content	[5]
Moisture (%)	72.14	70-78%	80.5	-
Mineral element (%)	2.95	1,3-1,5	3.07	1.1
Protein (%)	8.54	18-19.2	9.8	18.2
Fat (%)	14.15	3,1-11	3.1	3.8-7.7
Calories (ccal)	142.8	141.8	68.7	146

A study result has been shown that the component of the minerals were 2.95%, 3.07%; protein - 8.54%, 9.8%; and fat - 14.15%, 3.1%, respectively compared to result of study of Kleimonov. However, the lipid content in the meat of Syrok was relatively high (14.15%). This is very valuable data and it is possible to be used as fat source. The concentration of mineral element was determined by using HORIBA X-ray Fluorescence analyzer MESA-500W (at the Laboratory of Chemical Analysis, school of material and Technology, MUST). The results of investigation were shown at table 2 and Fig 1a, b.

Table 2. Mineral content in meat of Syrok and Lenok

Elements	Content,%		
	Syrok (<i>Coregonus peled</i>)	Lenok (<i>Brachymystax lenok</i>)	<i>Oreochromis niloticus</i> [6]
Macro elements	Mg	3.97	2.62
	Si	1.42	2.24
	P	41.30	39.06
	K	46.32	52.22
	Ca	5.87	3.26
Micro elements	Na	0.064	6.88
	S	0.35	-
	Mn	-	0.01
	Se	-	-
	Fe	0.42	0.75
	Cu	0.025	0.07
	Zn	0.26	0.22
	Al	-	0.08
	Pb	-	0.06

Ash content was emerged by total 12 mineral elements in meat of Syrok and Lenok. The content of potassium was (39.06%, 52.22%) and phosphorus - (41.30%, 46.32%), respectively. In all species the highest content calcium, magnesium and silicon were observed; the medium concentration - zinc, iron and copper - intrace amount.

The composition of mineral elements of *Coregonus peled* and *Brachymystax lenok* were similar to the mineral composition of *Oreochromis niloticus*.

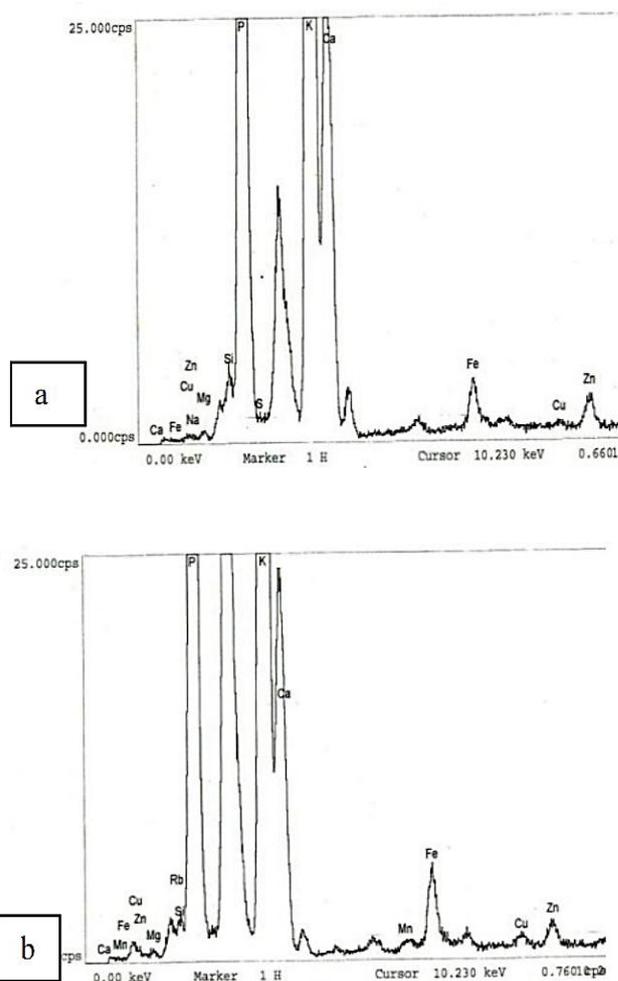


Figure 1. X-ray Fluorescence spectrum in meat of Syrok (a), Lenok (b)

The contents of free and protein amino acids were determined by paper chromatographic method, Results of study was shown in table 3. From results of this study we detected totally 14 amino acids in protein of two fish's meat. There are 6 essential amino acids and 8 non essential amino acids.

Table 3. The content of amino acids of Syrok's and Lenok's meat

№	Amino acids	Estimated in 100 g protein, %	
		Syrok	Lenok
Essential amino acid			
1	Cystine + Cysteine	5.8	5.12
2	Glycine	4.08	3.79
3	Alanine	7.48	6.2
4	Aspartic acid	6.24	10.05
5	Glutamic acid	10.66	11.3
6	Serine	6.02	4.87
	Total amino acids	40.28	41.33
Non essential amino acid			
7	Lysine	7.74	6.37
8	Leucine	7.09	6.54
9	Methionine	4.68	4.15
10	Phenylalanine	8.45	7.34
11	Tryptophan	7.37	6.5
12	Valine	6.54	6.16
13	Arginine	9.6	8.47
14	Histidine	8.17	13.08
	Total amino acids	59.64	58.61

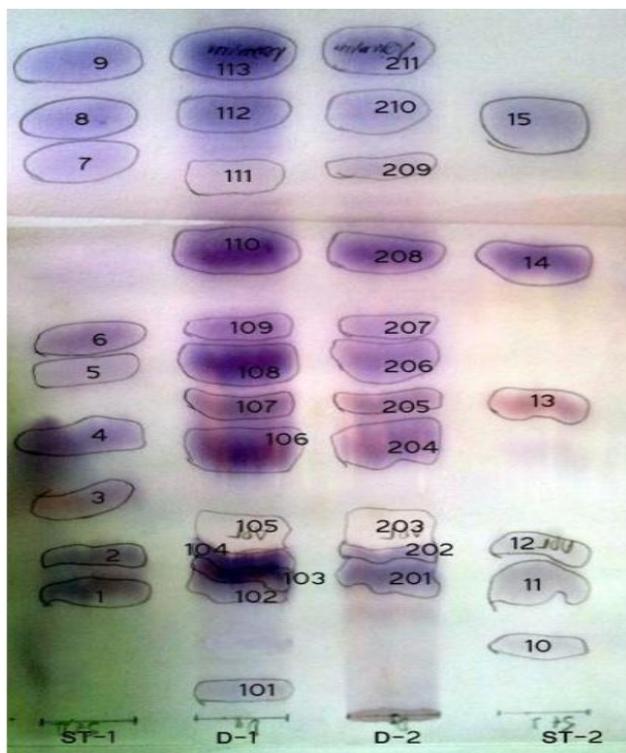


Figure 2. Chromatogram of amino acids

Table 5. The content of saturated and unsaturated fatty acids of fish's oil, %

Sample	Weight of fish oil, g	Unsaturated section		Saturated section	
		weight, g	amount, %	weight, g	amount, %
Syrok (<i>Coregonus peled</i>)	8.0	5.95	74.375	2.05	25.625
Lenok (<i>Brachymys tax lenok</i>)	3.230	2.698	83.838	0.532	16.462

The results showed that the content of unsaturated fatty acid's in Syrok's and Lenok's oil were 74.37%, 83.83%, respectively.

The protein are contained the highest value of glutamic (10.66%, 11.3%), phenylalanine (8.45%, 7.34%), arginine (9.6%, 8.47%) and histidine (8.17%, 13.08%); the total non essential amino acid ranged 58.61-59.64%.

In generally, the quality of oil was determined by its chemical characteristics. Chemical characteristics in oil of twospecies of fishes are shown in table 4. The results showed that the iodine value of Syrok's oil (137.3 J₂%) is relatively lower than lenok's oil (207.6 J₂%). This iodine value is depended on content of unsaturated fatty acids. On the other hand, unsaturated content of Syrok' oil was lower than lenok's oil.

Table 4. Chemical characteristics of fish oil

Characteristics	Syrok	Lenok
Acid value (mg KOH/g)	2.4852	1.96
Iodine value (J ₂ %)	137.2881	207.6271
Saponification value (mg KOH/g)	168.7734	117.5815
Peroxide value (mg eqH ₂ O ₂ /kg)	0.3543	0.6233
Esterification value (mg/g)	166.2882	115.6215

Infrared spectra of the fish's oil were obtained on FT-IR spectrophotometer (at the Associate Laboratory of Nature Science, MAS) for samples dispersed in KBr discs.

Figure 4 shows the infrared spectrum of the fish's oil (Syrok and Lenok). Among the absorption bands are observed common bands at 2950-3000 cm⁻¹ C-C-H (sp³) (stretching vibration) and 1730-1750 cm⁻¹ C=O (stretching vibration of ester group), 1465 cm⁻¹ -CH₂- (σ) (stretching vibration) as well as at 665-730 cm⁻¹ RCH=CHR¹ (cis-orientation of double bond). This explanation of spectrogram shows the all unsaturated fatty acids presented in cis-stereoisomer form in both oils.

CONCLUSIONS

1. The content of proteins and mineral elements of both fishes were similar. The Syrok's total oil amount was 14.15% and Lenok's - was 3.1%. Ash content was emerged by total 12 mineral elements in

meat of Syrok and Lenok. The content of potassium was (39.06%, 52.22%) and phosphorium - (41.30%, 46.32%), respectively

2. The Syrok's protein contained non essential amino acid 59.6%, essential amino acid 40.2%; the Lenok's protein - non essential amino acid is 58.6%, essential amino acid is 41.3% , respectively.
3. It is shown to be that Lenok' oil has high iodine value (207.62 J₂%) due to high amount of unsaturated fatty acids thereas Syrok' oil has low iodine value (137.28 J₂%).
4. The content of saturated and unsaturated fatty acids of the Syrok's and Lenok's oils were 25.6%, 16.5% and were - 74.4%, 83.8%, respectively.

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