STUDIES CONCERNING THE BIOMETRICS, HAEMATOLOGY AND BIOCHEMISTRY OF MEAT IN CARP *(CYPRINUS CARPIO)*

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Abstract

The study aims at presenting partial data obtained in 2011 after biometric, haematological and biochemical measurements on meat of carps from river Jijia, Iasi County. Determined characteristics in carps investigated through biometric studies are: metric characteristics (length, thickness) and gravimetric characteristics (weight) on 45 individuals of one-summer, two summers and three summer's fishes. Haematological analysis is difficult in fish due to sampling techniques, seasonal variations and population density, factors that can alter the final results. After morphological examinations of blood cells, the aspects of erythrocytes, thrombocytes and lymphocytes were recorded. Determinations concerning the chemical composition of carp meat was performed with the automatic analyzer Food Check, the working method being concurrent with the standard manual of the spectrophotometer. Chemical composition of healthy fish meat is generally constant. Variation limits of meat compounds can vary between 15-22% for proteins, 0.5-26% for lipids and over 70% for water, proteic and non-proteic nitric substances stand for about 0.8-3% and minerals reached 1%.

Key words: carp, biometrics, haematology, meat biochemistry

INTRODUCTION

Fish has always held an important proportion in human alimentation, due to its nutritive qualities offered by the high protein and lipid content with superior biological value and high digestibility. Fish meat production is conditioned by maintenance of an unaltered health of the biological material [4].

Nationally, an increase of the import of several fish species is observed, but it lacks information referring to their meat qualities. This was seen as a great research opportunity concerning meat quality in *Cyprinus carpio* (carp), keeping in mind blood parameters in normal physiological conditions. [1, 2]

In order to accomplish a correct monitoring of the fish health status, haematological analysis can offer valuable knowledge. Changes in haematological parameters depend upon the aquatic biotope, fish species, age, and sexual maturity cycle and health status [3, 8, and 9]. It is well known that blood is 1.3-7% of the total body weight of fish and it represents one of the most active components which, accompanied by haematopoietic organs, contributes in metabolic processes by ensuring gas exchange between the organism and the environment.

MATERIAL AND METHODS

Studies concerning biometrics, haematology and biochemistry of the meat were performed on 45 carps (1 September – 31 October 2011) raised in a semi-intensive farm in Larga Jijia, fed with water from river Jijia, Iasi county.

Carps were aged 1-3 years old, being raised in ponds of 5-25 ha, and fish density varying between 2500 – 4000 individuals for 2-3 summers' carps.

During the period of the research, physic-chemical parameters of the water were also monitored (temperature, pH, soluble oxygen, organic compounds, nitrogen and phosphorus compounds) but they fit normal values and ensured fish comfort.

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Determined characters through biometric studies were: metric characteristics (length, thickness) and gravimetric characteristics (weight).

Blood sampling was performed through punction of the caudal vein and, in isolated cases, through heart puncture, in Vacuette recipients with EDTA.

Working methods:

- **cellular morphology:** slides stained May-Grünwald-Giemsa,

- **erythrocyte count:** Potain pipette was used, a Bürker – Türk counting chamber and Hayem dilution liquid,

- **leukocyte count**: Potain pipette was used, a Bürker – Türk counting chamber and two dilution liquids. The mixture suggested by Natt – Herrich and modified by Prochazka (sodium chloride, sodium sulphate, disodic phosphate crystallised with 12 H_2O, monopotassic phosphate, formaldehyde 37%, Kresylblau brilliant, distilled water) and a liquid made of two solutions (A: neutral red, sodium chloride, distilled water and B: crystal violet, sodium citrate, formaldehyde, distilled water)

- **haemoglobin determination**: Sahli method,

- **constants and erythrocyte parameters**: VEM, HEM, CHEM, with mathematical formulas. [5], [6], [7].

Measurements of chemical composition of carp meat was carried out using automatic analyzer Food Check the manual corresponding standard working method of use of spectrophotometer.

RESULTS AND DISCUSSIONS

Determined characteristics are metric characteristics (length, thickness) and gravimetric characteristics (weight) (Fig. 1, Fig. 2).

Fig. 1 Measuring the total body length

Fig. 2. Measuring the maximum height in the tallest point of the body

Medium results of the measurements are presented in the following table: (Table 1)

As for the expression of the chemical composition, there is a direct connection with the degree of body development.

In 1 summer old carps we registered a medium weight of 50-60g, with a body length of 10-14cm, and we obtain a percent of 22 % proteins and 1,5% fat.

In 2nd summer old carps that weight 10 times more than the previous year, their body length was about 18-25 cm, protein percent was of 21%, and fat stood for 5,7%.

In the third year, the variation of body weight was 1500-1800g and we noticed a decrease of the protein percent up to 20,8% and an increase of fat to 6,4% (Table 2).

Election sites for blood prelevation are represented by the caudal vein, brachial vein or the heart. Heart punction is not recommended in fish that are released in their natural environment since it is a traumatising experience.

Table 1 Medium value of biometric measurements in carps *(Cyprinus carpio)*

Carp age	Medium values															
	L (cm)	SL (cm)	H (cm)	h (cm)	p (cm)	c (cm)	r (cm)	o (cm)	i (cm)	op (cm)	x (cm)	z (cm)	D_1l (cm)	P (cm)	V (cm)	G (g)
1 summer	10-14	7-9	4-7	3-4	2-4	4-6	2	0.5-1.5	2-2.5	2-3.5	4-7	4-6	6-8	2-4	2-4	50-60
2 summers	18-25	14-20	7-11	4-5	3-5	7-10	3	2	2.5-4	3-5	7-10	7-9	9-12	3.5-5	3.5-5	500-600
3 summers	35-40	25-33	10-15	5-7	5-7	8-12	3	2-3	4-6	4-6	12-16	8-11	13-15	5-7	5-7	1500-1800

Notes: L-total length of the body measured as a straight line from the top of the mouth to the top of the caudal; SL-standard length as a straight line from the top of the mouth to the end of the scales on the body; H-maximum height in the point where the body is the tallest; h-minimum height at the level of the caudal peduncle; p-length of the caudal peduncle from the vertical of the posterior margin of the anal to the base of the caudal; c-length of the head from the top of the mouth to the posterior edge of the operculum; r-length of the mouth from the top of the mouth to the posterior edge of the opercula system; o-longitudinal diameter of the eye, inter-orbital space; i- distance between the eyes measured as a straight line on the dorsal of the head; op-postorbital space; x-predorsal distance; z-pre-ventral distance; D_1l-length at the base of the dorsal wing; P-length of the pectoral; V-length of the ventral; G-weight in grams.

Table 2 Medium variation of the chemical composition of carp meat *(Cyprinus carpio)*

Carp age	Weight (g)	Proteins (%)	Lipids (%)	Collagen (%)	Water (%)
1 summer	50-60	22	1.5	20.4	56.1
2 summers	500-600	21.0	5.7	19.4	53.9
3 summers	1500-1800	20.8	6.4	19.1	47.76

In our research, we chose the caudal vein and used the classical prelevation system, the syringe. (Fig. 3)

Fig. 3 Blood prelevation through punction of the caudal vein

Literature recommends the use of both heparine and EDTA as anticoagulants; we used vacutainers with EDTA.

Haematological analysis in fish is hard to interpret due to prelevation techniques, seasonal variations and population densities, which can all influence the final results. Erythrocyte and leukocyte nuclei overlap, making the use of automatic methods almost impossible.

Morphological examination of figurate elements showed the aspect of erythrocytes (Fig. 4), which are nucleate; thrombocytes have clear cytoplasm and condensed nucleus (Fig. 5). Lymphocytes are usually small, with a condensed nucleus and a dark blue cytoplasm. They are round with frequent pseudopodia along the cytoplasmatic edge (Fig. 6).

Granulocytes are the biggest cells in the blood stream, their cytoplasm is pale blue and their nuclei are shaped as beans. Specific granulations in the cytoplasm have variable sizes (Fig. 7).

Monocytes are round, with the nucleus in the shape of a hoof, blue cytoplasm and frequent vacuoles. (Fig. 8).

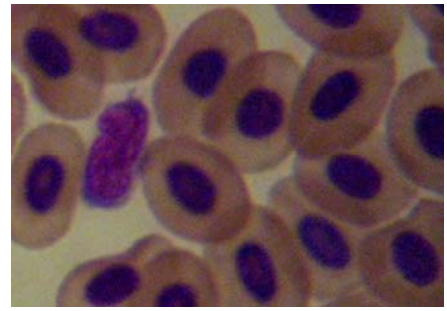

Fig. 4 Erythrocytes and thrombocyte. MGG, x200

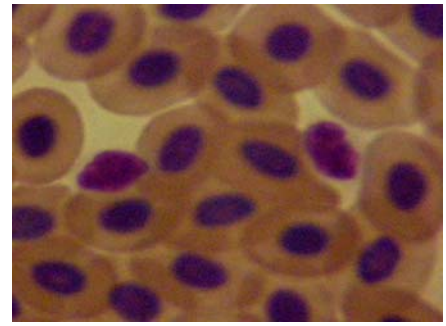

Fig. 5 Thrombocytes with translucid cytoplasm and condensed nuclei. MGG, x200

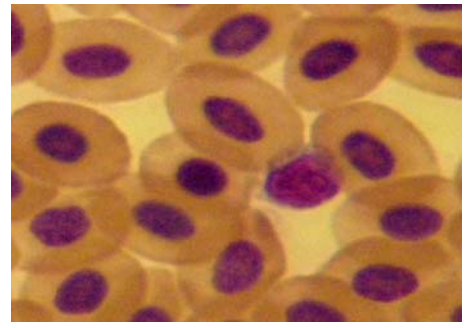

Fig. 6 Lymphocytes with light blue cytoplasm and small condensed nucleus. MGG x 100

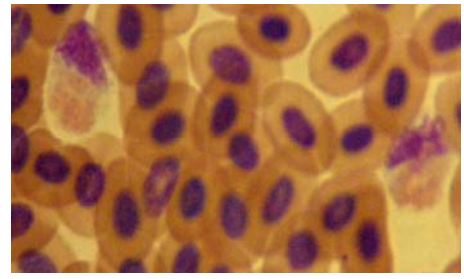

Fig. 7 Granulocytes with big red granulations, with oval nucleus. MGG x 100

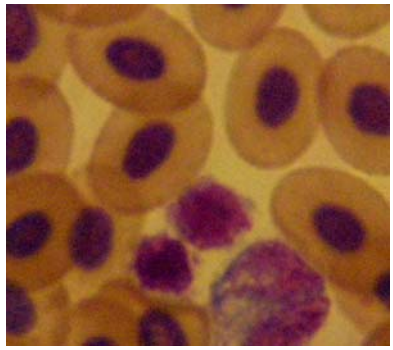

Fig. 8 Monocytes with abundant cytoplasm, dark blue, with frequent vacuoles. MGG x 100

Haemoglobin stands for 80-90% of the dry substance of erythrocytes. In determinations performed on carp blood a medium value of 7.5 g/dL was obtained. Literature recommends a physiological interval of 6.3-7.6. The medium value of the total number of erythrocytes was 1.92 x $10^6/mm^3$, the leukocytes reaching the medium vale of 4.00 x $10^3/mm^3$. The number of erythrocytes, haemoglobin concentration and haematocrite decrease significantly in different pathological processes (erythrodermatitis in carps and Asian cyprinids). A very important indicator in the haematological diagnostic in carps is the report between erythrocytes/leukocytes which is 30/1 in physiological conditions, but is considerably changed when the organism suffers from different disease. (Table 3)

Table 3 Variation of the haematological profile in carps

Parameter	Medium values	Reference values
Total number of erythrocytes x $10^6/mm^3$	1.92	1.69-1.91
Total number of leukocytes x $10^3/mm^3$	4.00	
Haemoglobin (g/dL)	7.5	6.3-7.6
Haematocrit (%)	32.6	29.7-33.8
VEM	169.79	166-190
HEM	39.06	37.7-42.7
CHEM	23	20.4-22.9

Biochemical determinations showed a medium value of total proteins of 22.4 g/L. Lipids are used as energetic materials by most of the tissues. They are deposited in the cytoplasm of adipose cells which are specialised in synthesis and deposit of fat acids as TAG, when the organism has energetic resources and in mobilisation of fat acids from the deposits when they are transported through blood to the tissues and used as source of energy. Medium values obtained in carps were 101.3 mg/dL for triglycerides and 70.4 for cholesterol. (Table 4)

Table 4 Variation of the biochemical profile in carps

Parameters	Medium values
Total proteins (g/L)	22.24
Cholesterol (mg/dL)	70.4
Triglycerides (mg/dL)	101.3
Calcium (mg/dL)	11.71
Magnesium (mg/dL)	3.64
ALT (U/l)	10.2
AST (U/l)	88.8
Albumins	9.1

CONCLUSIONS

The research was aimed at correlating environment parameters to body development criteria, metabolic profile and meat quality.

During the research period (1 September – 31 October 2011) haematological and biochemical profiles recorded values within the limits mentioned in literature.

Correlation between body development and chemical composition of meat showed that during the first 2 years there is a direct connection between the degree of body development and the percent of protein.

For 3 summers old carps, a decrease of protein percent was noticed, correlated with an increase in the fat percent, these fish being generally directed rather to the reproductive system than to consumption.

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REFERENCES

[1] Asadi F., Masoudifar, M., Vajhi A., et al.: Serum biochemical parameters of Acipenser persicus. Fish Physiology and Biochemistry, 2006 32:43–47;

[2] Bahmani M., Kazemi R., Donskaya P.: A comparative study of some hematological features in young reare sturgeons (Acipenser persicus and Huso huso). Fish Physio Biochem, 2010, 24:135–140;

[3] Blaxhall, P.C.: The haematological assessment of the health of freshwater fish, J. Fish. Biol. 1972, 4:593-604;

[4] Farahi A., Kasiri M., Sudagar M., et al.: Effect of garlic (Allium sativum) on growth factors, some hematological parameters and body compositions in rainbow trout (Oncorhynchus mykiss). AACL Bioflux, 2010 3(4):317-323;

[5] Ghergariu S., Pop Al., Kadar L., Marina Spînu: Manual de laborator clinic veterinar. Ed. All, 2000;

[6] Hrubec T.C., Smith S.A., Robertson J.L., et al.: Comparison of hematologic reference intervals between culture system and type of hybrid striped bass. Am. J. Vet. Res. 1996, 57: 618 – 623;

[7] Knowles S., Hrubec T.C., Smith S.A.: Hematology and plasma chemistry reference intervals for cultured shortnose sturgeon (Acipenser brevirostrum), Vet. Clin. Pathol., 2006, 35: 434 – 440;

[8] Patriche Tanţi, Patriche N., Bocioc Elena, and Coada M.T.: Serum biochemical parameters of farmed carp (*Cyprinus carpio*). AACL Bioflux, Volume 4, Issue 2., 2011, 137-140.

[9] Radu Daniela, Oprea L., Bucur Cecilia, Costache Mioara, Oprea D.: Characteristics of Haematological Parameters for Carp Culture and Koi (Cyprinus carpio Linneaus, 1758) Reared in an Intensive System. Bulletin UASVM Animal Science and Biotechnologies, 2009, 66 (1-2);