

DETERMINATION OF PROTEIN FRACTIONS IN THE BLOOD OF THE HIGH ECONOMIC VALUE FISH FARMED SPECIES IN ROMANIA

DETERMINAREA FRAȚIUNILOR PROTEICE ÎN SÂNGE LA SPECILE DE PEȘTI DE CULTURĂ CU VALOARE ECONOMICĂ MARE DIN ROMÂNIA

PATRICHE T., PATRICHE N.

** Institute of Research and Development for Aquatic Ecology, Fishing and Aquaculture Galati, Romania*

In aquaculture, as in any other sector where work is carried out on live bodies, to get a high production yield depends upon maintenance and monitoring of an unaltered health condition of the biological material. To monitor the health condition of the biological material in a fish farm allows us to establish the preventive measures required to stop the spread of disease and the treatment to be applied in case a mass disease occurs. For this reason to know the value of the total protein and the protein fractions in serum enables us to differentiate the normal physiological condition of the fish material under research, from the eventual pathological modifications having occurred due to the defence reaction of the body. The most part of diseases have but a little influence on the concentration of the total protein in the blood, but some influence on certain protein fractions, and they alter the ratio between albumins and globulins. The level of the total protein in serum is, first of all, a synthetic indicator of the nutritional condition of the body, presenting, at the same time, ample qualitative and quantitative variations depending on species, age, sex, stage of sexual maturity, water temperature and especially in correlation with the health condition of fish. Alterations of the ratio albumins/globulins or of the ratio between different protein fractions have important pathological implications, especially concerning the immunity capacity of fish, a decrease below 0.3 in value of the ratio albumins/globulins in serum being significant for the health condition of fish

Key words: protein fractions, electrophoresis, carp, sturgeons, disease.

Introduction

As per the illustrated elements, the main elements of blood are the proteins in plasma, that is why to know their value represents an essential factor in determining the health condition of fish.

With some fish species, the proteins in plasma represent 1.6-3.5% from the total volume of plasma. This value is influenced by several factors that alter both

the global level of proteins in plasma and the ratio between the protein fractions in serum, such as the ratio albumins/globulins.

The value of the different protein fractions in serum presents quite ample variation, depending on a series of factors, such as: the massive degree of infection, the etiological agent of disease, species, age, the food diet, season, degree of sexual maturity, water temperature and others.

Materials and Methods

Blood samples have been collected from healthy and unhealthy fish material of different age and weight, representing the most numerous species in fish farms, in order to determine the value of the protein fractions in fish serum:

- Cyprinidae family;
- Acipenseridae family.

The most applied method to separate the protein fractions from serum is the electrophoresis method. This method makes use of different solid supports (paper, agarose gel, cellulose gel acetate) and of a buffer solution with pH=8.6.

At this pH all protein components are negatively charged and migrate from cathode (-) towards anode (+). The electrophoregram, after coloration, presents the protein fractions in the form of colored strips.

In case of fish, the arrangement of protein fractions on electrophoregram varies depending upon species (figure 1).

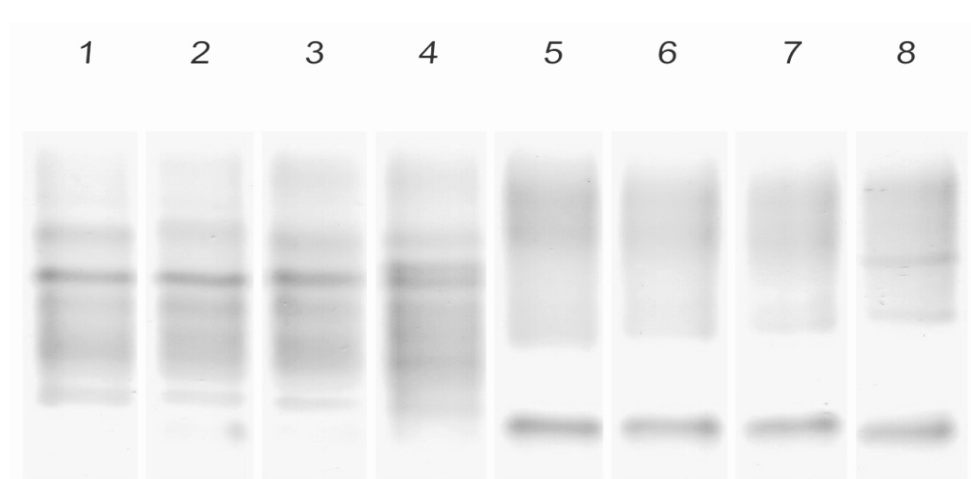


Figure 1. Electrophoresis of proteins in serum at fish:
1-4 carp species (*Cyprinus carpio*); 5-8 morun species (*Huso huso*).

In case of carp species (*Cyprinus carpio*), 6 protein fractions have been found: albumins, globulins α_1 , α_2 , β_1 , β_2 and γ .

In case of sturgeons (beluga sturgeon, osseyetra sturgeon, sevruga sturgeon) and of Asian cyprinids (silver carp, grass carp, big head carp), 5 protein fractions have been found, as with the superior vertebrates: albumins, globulins α_1 , α_2 , β and γ .

Results and Discussions

The specialized literature presents normal and pathological values for the protein fractions in serum, especially for teleosteens.

The causes leading to a decrease in the level of albumins in serum are, mainly, the same as those leading to a decrease in the total protein in serum. While the decrease in the total protein in serum indicates, especially, an improper input of protein from food, the decrease in the value of the ratio albumins / globulins (A/G) indicate a possible disease. The decrease in the content of albumins leads to a relative increase in the content of globulins. The actual increase in the globulins in serum is specific to a series of acute and chronically microbial diseases, to diseases produced by viruses and parasites, to affections of the liver and it is produced by an increase in the level of immunoglobulins (antibodies) in blood, as a response to defend the body against the invading pathogenic agents.

In case of the carp species (*Cyprinus carpio*), the unhealthy fish having the spring viremia had a decrease in the albumins of 43% and implicitly the ratio albumins / globulins (A/G) of 67% in comparison with the values of the healthy fish. The decrease in the concentration of albumins of 25% and in the ratio albumins / globulins (A/G) of 38% found with the carp having infectious hydropsy (*Aeromonas punctata*) occurs as a result of the lower defense resistance of the body. The carp contaminated with *Hepaticola petruschewski*, which is to be found in the hepatopancreas, presented a disproteinemy revealed by a hiperglobulinemy α - β due to the syndrome excretory-biliary generated by this nematode. The registered average values are given in table 1.

Table 1

Average values of the protein fractions at the carp species (*Cyprinus carpio*)

Electrophoresis (%)	Healthy carp	Invalid carp
Albumins	41,5	20,6
Globulins	α_1	2,6
	α_2	4,8
	β_1	19,6
	β_2	15,4
	γ	16,1
Raportul A/G	0,7	0,26

In case of the Eastern-Asian species, the values registered for the protein fractions are close in values.

In case of silver carp (*Hypophthalmichthys molitrix*), the unhealthy fish presenting wounds at the level of tegument, operculum and mouth indicating a possible bleeding septicemia, had a low level of β -globulins (table 2).

Table 2

Average values of the protein fractions at the silver carp species
(*Hypophthalmichthys molitrix*)

Electrophoresis (%)	Healthy silver carp	Invalid silver carp
Albumins	43,6	39,4
Globulins	α_1	13,2
	α_2	6,4
	β	21,2
	γ	15,6
Ratio A/G	0,8	0,64

In case of sturgeons, the values registered for the protein fractions are close in values between species (beluga sturgeon, ossyetra sturgeon, sevruga sturgeon). Low values of albumins and of the the ratio albumins / globulins (A/G), have been found at the fish intoxicated with nitrites originated from the supply water. In case of sturgeons, simultaneously with aging, the albumins and α -globulins are progressively decreasing, while the β and γ -globulins are progressively increasing.

Conclusions

1. With the carp species, 6 protein fractions were found, while in the case of sturgeons (beluga sturgeon, ossyetra sturgeon, sevruga sturgeon) and of Asian cyprinids (silver carp, grass carp, big head carp) 5 protein fractions were found.

2. The unhealthy cyprinids presented low values of albumins in serum, while α and β -globulins increased. The area of globulins α and β represent the area in which the antibodies migrate electrophoretically. This is explained by appearance in serum of antibodies formed by the antigenic stimulation that was produced when fish went through the disease or by its direct contact with other unhealthy fish.

3. The unhealthy sturgeons increased values of β and γ -globulins to the detriment of albumins. The increase in globulins β and γ indicate formation of antibodies, meaning that the organism reacted to stimulus with a specific immune response.

4. The decrease in the ratio albumins / globulins (A/G) below 0.3 indicates a disease with significant physiological implications, especially concerning the immunitary capacity.

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