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Plasma proteins of young African catfish (*Clarias gariepinus*, Burchell 1822)

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Abstract. The effect of feeding level and water supply on the total plasma protein (T.P.P.) and fractions of these proteins (P.P.F.) of young African catfish (*Clarias gariepinus*, Burchell 1822) was studied. It was found that T.P.P. can be divided into four distinct fractions (P.P.F. I-IV) of which P.P.F. I is predominant. Analysis of the results shows a strong effect of feeding level on T.P.P. and P.P.F. I-IV. There was a positive correlation between T.P.P. and the weight of P.P.F. I-IV and a negative correlation between P.P.F. I and P.P.F. II. P.P.F. I might be usuable as an indicator for the health status of young *Clarius gariepinus*.

Key words: Clarias gariepinus, plasma proteins, electrophoresis, feeding level, water flow rate

Introduction. In mammalian farm animals and poultry different health monitoring programmes are available with various (blood) parameters to assess animal health (Blackmore, 1986). In fish health research the need to use such parameters has been underlined in a review by Blaxhall (1972). However, interpretation of the results of the investigations are difficult because of the usually large variations of values of parameters used between and within fish populations. Main sources of such variations are differences in feeding level and genetic and environmental factors. In intensive recirculation systems as used in the Netherlands variation in environmental conditions might be less, facilitating the use of blood parameters to estimate fish health.

The present study was carried out to quantify the plasma proteins of young African catfish and to study their relation with feeding level and water flow rate as part of a study on feeding level-dependent incidence of the Ruptured Intestine Syndrome of unknown etiology (RISue) (Boon et al., 1987).

Material and methods. Larvae, full sibs, obtained by artificial reproduction (Hogendoorn & Vismans, 1980) were kept in aquaria placed in a recirculation system (Boon et al., 1987). On day 9 after hatching 15 groups of 300 larvae each were formed and each group was allocated to one out of three feeding levels, i.e. 1, 2 and 3 times optimally, which were fed from day 9 after hatching onwards and might in-

duce RISue. Within each feeding level the aquaria were randomly allotted to one out of five water flow rates: 1, 2, 3, 4 and 5 min^{-1} respectively. The experiment expired at the end of the 12th, 9th and 8th week after hatching when the incidence of RISue decreased to a low level and mean fish weight was 11.0, 12.0 and 13.5 g of feeding level 1, 2 and 3 respectively (Boon et al., 1987). On the last experimental day 10 fish per group were blood-sampled from the *Vena caudalis* with a heparinized syringe. Blood was centrifuged during 5 minutes at 4000 rpm and plasma was stored at −70 °C till examination for total plasma proteins (T.P.P.) and plasma protein fractions (P.P.F.). T.P.P. was measured in duplo with the biuret method (Gornall et al., 1949). Electrophoresis of plasma samples was done by using cellulose acetate paper in a Boskamp electrophoresis chamber powered with a Boskamp Pherostat 273.

The influences of feeding level and water flow rate on the various parameters were statistically analysed by using the BMPD 2V program (Dixon et al., 1983). Also Pearson coefficients of correlations were calculated.

Results. The mean content of T.P.P. was 26-45 ± 4.56 gl^{-1}. Electrophoresis clearly showed that plasma protein can be divided into four distinct fractions, P.P.F. I, II, III and IV (Fig. 1). With relation to the plasma proteins there seemed to be two different types of fish. One type with a high P.P.F. I (>50 %) (n = 96) and another with a low P.P.F. I (<50 %) (n = 14). Fish of the latter group had a high P.P.F. II

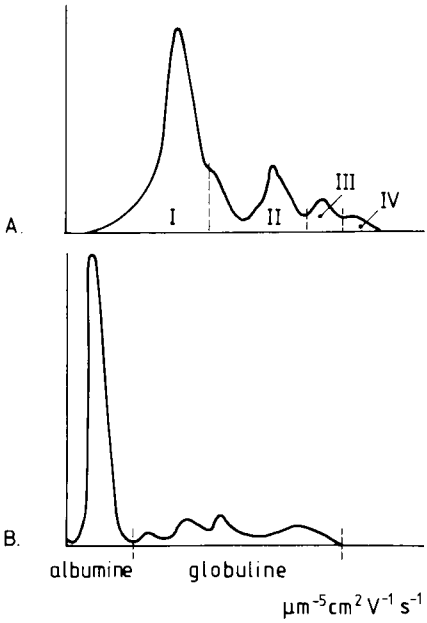

Fig. 1. Cellular acetate electropherogram of plasma proteins of larvae of African catfish (*Clarias gariepinus*) (A) and a human reference electropherogram obtained under the same conditions (B).

and showed clinical signs of RISue. Compared to human reference plasma proteins there was a shift to the right side.

The analysis of variance showed a strong effect of feeding level on T.P.P. and P.P.F. I-IV ($P < 0.02$). There was no significant influence of water supply on them. Significant correlations between T.P.P. and the weights of the P.P.F. I-IV have been found ($r = 0.78, 0.57, 0.38$ and 0.29 respectively; $P < 0.05$). Weights of P.P.F. I and II were negatively correlated ($r = -0.73$, $P < 0.05$).

Discussion. The electrophoretic patterns observed are more similar to those of man than to those of other fish species. This is in agreement with the findings of Boomker (1979, 1980). However the plasma proteins of *Clarias gariepinus* have a lower speed than those of mammals (Corbell, 1975; Moore, 1945), which ask for a longer running time.

T.P.P. levels measured in this experiment are lower than those found in most other investigations. Hattingh (1972) found in *C. gariepinus* 38.40 – 58.20 g l^{-1}. These values are in the same range as those found in other animals. The low values of the present study may be caused by the fish age (Moore, 1945; Blaxhall, 1972; Hille, 1982) in spite of the fact that Hattingh could not prove this relation.

The relative content of P.P.F. I is remarkably high. In the T.P.P. this fraction is much smaller in other fish species. In contrast to this, the part of P.P.F. IV is small compared to other fish species. Both may be influenced by the age of the experimental fish. P.P.F. I includes carrying proteins which are very useful in young growing fish. Under the experimental conditions the fish was not in contact with pathogens as present under practical circumstances in older fish. So the immune system was not stimulated resulting in a low level of immunoglobulins which are part of the P.P.F. IV (Craig & Clem, 1983; Hille, 1982; Post, 1966). The moderate negative relationship found between P.P.F. I and II suggests they might be complementary proteins. P.P.F. IV seems to be kept at a constant level as is shown in earlier experiments with carp kept under various conditions (Boon et al., 1986). This results in a low correlation with the other parameters and a low effect of the feeding level on the P.P.F. IV. Therefore, despite the importance of P.P.F. IV for fish health, it is less suitable as an indicator for the health status of young *C. gariepinus* compared to the P.P.F. I, which shows a big variation and a good relation with the other parameters. This is supported by the difference in percentage of P.P.F. I found between *C. gariepinus* with symptoms of RISue and fish without.

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