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The Effects of Different Breeding Systems (Cage and Pond) on Blood Biochemistry of Rainbow Trout (*Oncorhynchus mykiss*)

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Abstract: In this research, the effects of different breeding systems (Cage and Pond) on some important biochemical parameters (AkP Alkaline phosphates, TP Total Protein, GOT Glutamic oxaloacetic transaminase, GPT Aspartate aminotransferase and Cho Cholesterol) of rainbow trout were investigated. Comparing with the pond fish blood samples, the cage samples took higher AkP and GPT values but lower GOT, Cho and TP values.

Key words: Cage, pond, rainbow trout, AkP, TP, GOT, GPT and Cho

Introduction

Haematological values are widely used to determine systematic relationships and physiological adaptations including the assessment of the general health condition of animals (Alkinson and Judd, 1978) and are more quickly reflected in the poor condition of fish than in other commonly measured variables (Katz, 1950).

The haematological parameters of fish are known to respond quickly to change in environmental conditions; therefore, they have been increasingly used in toxicological studies. They provide important information about the clinical status of the organism (Sharma and Gupta, 1994).

The haematological parameters of fish are used as an indicator of their physiological state and its study has become widespread in the control of pathologies and manipulation stress in fish farming (Aldrin *et al.,* 1982). Yet, interpreting or diagnosing haematological status is proving increasingly complex owing to the many factors that may affect blood parameters (Atamanalp *et al.,* 2002a).

Piscine haematology is increasingly gaining significance due to its importance in the study of fish health under different conditions of life and environment (Sakthivel, 1988).

The enzymes are indicative of various aspects of metabolism, which have been used to determine and evaluate the physiological and/or biochemical defects in the liver and muscle of fish. The GOT and GPT activity represents protein metabolism, AkP activity represents the energy aspects (Ahmad *et al.,* 1995). The purpose of this paper was to determine the alterations in AkP, GOT, GPT, Chol and TP levels of rainbow trout as a result of different breeding systems.

Materials and Methods

Fish Source, Maintenance and Water: Rainbow trout, for pond culture samples were captured in Ataturk University, The Faculty of Agriculture, Trout Breeding and Research Center. The samples for cage breeding systems were being held in cages, in Tercan Dam Lake for 5 weeks. Fish at the same age in two groups (both sexes weighing 140 ± 25 g) were used as fish material and fed with commercial trout feed. Water temperature was nearly in lake and ponds in that season (11.5 ± 1.5 °C). 11 fish were sampled from each group for blood biochemical parameters.

Blood Collection and Biochemical Analyses: Blood was collected from the caudal vein and set to vacutaineer biochemical tubes (Blaxhall and Daisley, 1973; Bridges *et al.,* 1976; Pottinger and Carrick, 1999; Atamanalp *et al.,* 2002a; 2002b). Blood samples centrifuged at 4.000 rpm for 10 minutes (Bricknell *et al.,* 1999), then analysed in autoanalyser (Merck-Mega/Toshiba).

Statistical Analyses: Differences between the groups were statistical tested with variance analyses and the averages of groups analysed with Duncan's test (SAS, 1996).

Results and Discussion

The average values that obtained in this research is given in Table 1.

The average AkP value of cage culture fish blood samples was found as 209.09 ± 19.68 u/l. This value for pond was 41.51 % lower and as 122.33 ± 54.10 u/l. The average GOT, Chol and TP values were higher in pond culture and found as respectively; 483.90 ± 41.80 u/l;

Table 1: The average values and differences of the research.

	AkP ** (u/l)	GOT ** (u/l)	GPT ** (u/l)	CHO** (mg/dl)	TP* (mg/dl)
Cages	209.09 ± 6.20	± 19.68 154.27	483.90 ± 10.93	± 41.80 3.29	36.36 ± 0.13
Pond	122.33 ± 4.43	± 54.10 258.66	1149.60 ± 34.79	± 176.94 5.00	18.66 ± 0.83
Differences (%)	+ 41.51	- 57.90	+ 48.68	- 40.35	- 34.20

* Important ($P<0.05$)
** Very Important ($P<0.01$)

154.27 ± 10.93 mg/dl; 3.29 ± 0.13 mg/dl; and these parameters for cage breeding rainbow trout were obtained as 1149.60 ± 176.94 u/l; 258.66 ± 34.79 mg/dl and 5.00 ± 0.83.
Studies on blood biochemical parameters of fish are limited. Because of this there is a few reports about AkP, GOT, GPT, Chol and TP values.

AkP: The alkaline phosphates values were found as 122.33 ± 54.10 (u/l) in pond and as 209.09 ± 19.68 (u/l) in cage. This value was reported as 1.13 ± 0.11 (IU/g) (13); 1.11 ± 0.07 (14) and 1.34 ± 0.14 (IU/g) (Mughal *et al.,* 1993) for *Ctenopharyngodon idella*.
Cage AkP value is 41.51 % higher than pond AkP value. The difference between two groups is very important ($P<0.01$). Decrease in AkP activity may be taken as an index of parenchymal damage in liver (Ahmad *et al.,* 1995). But it is important to know that whether what is the scale for this parameter. Because of having no report about this parameter it is impossible to compare.
The degree of increase in activity of the cellular enzymes in sera depends primarily on the magnitude and severity of cell damage (Nemcsok and Boross, 1982).

GOT: The samples that received from cages took lower values for GOT (483.90 ± 41.80 and 1149.60 ± 176.94 u/l). The difference between the cage and pond blood samples is very important ($P<0.01$). This decrease may depend on more fish stocking in cages comparing to ponds. This result is parallel with Shakoori *et al.* (Shakoori *et al.,* 1991); Mughal *et al.* (Mughal *et al.,* 1993); Shakoori *et al.,* (1994; 1997); Jeney *et al.* (1996) who observed that pollution agents decrease GOT levels.
The inhibition of GOT activity may affect the metabolism of different amino acids particularly of glutamate and oxaloacetate (Ahmad *et al.*, 1995). The GOT enzyme activity that increased in the blood following combined treatments may also indicate liver injury (Nemcsok and Boross, 1982). GOT was reported as 4.56 ± 0.31 (IU/g) (13); 4.89 ± 0.24 (IU/g) (Shakoori *et al.,* 1994) and 5.52 ± 0.53 (IU/g) (Mughal *et al.,* 1993) for *C. idella* 79.07 ± 12.75 (u/l) for *Rutilus rutilus* (Jeney *et al.,* 1996). The GOT value of this research and the value for *Rutilus rutilus* (Jeney *et al.,* 1996) are very distinctive. This may depend on the different fish species.

GPT: GPT was found as 36.36 ± 6.20 (u/l) in cages and as 18.66 ± 4.43 (u/l) in ponds. Like GOT value this result is parallel with the same reports (Nemcsok and Boross, 1982; Shakoori *et al.,* 1991; Mughal *et al.,* 1993; Shakoori *et al.,* 1994; Jeney *et al.,* 1996). These researchers obtained that unfavourable conditions increase GPT.

CHO and TP: Cholesterol showed higher values in ponds (258.66 ± 34.79 mg/dl and in cage; 154.27 ± 10.93 mg/dl). There is a statistically significant difference between groups ($P<0.01$). This value reported for *C. idella* as 10.19 ± 0.49 mg/g (Shakoori *et al.,* 1991).
The blood samples from cages took lower total protein values and the difference was important ($P<0.05$). This parameter alters depending on the fish species. For example; TP for *Oncorhynchus mykiss* was reported as 5,000 ± 0831 mg/dl (Atamanalp *et al.,* 2002a) and for *C. idella* as 201.14 ± 16.65 mg/g in (Shakoori *et al.,* 1991). As a result, having no report about comparing breeding systems, we consider reports about general fish blood biochemical and pollution studies. Because, stocking density of cages much than ponds and this situation cause more pollution in water according to ponds.

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