

# Serum lipid, free fatty acid, and proteins in juvenile sturgeons: *Acipenser persicus* and *Acipenser stellatus*

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Received: 4 December 2007 / Accepted: 10 December 2008 / Published online: 16 January 2009  
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**Abstract** Serum biochemical parameters are important aspects in the management of endangered species such as *Acipenser persicus* and *Acipenser stellatus*. Serum samples of 14 juvenile *A. persicus* and *A. stellatus* were analyzed and their serum parameter values were determined as mean±SD in both groups. We compared the levels of phospholipid (26.73–42.79 mmol/L), triglyceride (2.38–2.37 mmol/L), total cholesterol (3.04–3.55 mmol/L), total lipid (32.09–50.11 mmol/L), total protein (32.22–27.78 g/L), albumin (7.25–6.85 g/L), globulin (24.86–20.62 g/L), Alb:Glb ratio (0.39–0.18), glucose (7.45 mmol/L), and free fatty acid (110.25–32.58 mg/L) in the two species. We have shown that there was no difference between groups in terms of any parameters ( $p>0.05$ ).

**Keywords** Serum · Analyte · Fish

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## Introduction

The sturgeon (Acipenseridae) is an ancient group of chondrosteian fishes with fossil records dating back to the lower Jurassic period. Sturgeons are similar morphologically and this similarity may exist on a physiological level. However, this has not been fully examined (Baker et al. 2005).

*Acipenser persicus* and *A. stellatus* exist in the Caspian basin (north of Iran). Unfortunately, nowadays, these fishes have become an endangered species and listed as threatened, vulnerable, and endangered throughout their ranges (Asadi et al. 2006a; Moghim et al. 2002; Billard and Lecointre 2001). Population numbers of these fishes have suffered a decline as a result of natural and anthropogenic factors such as the construction of dams, water pollution, over-fishing and commercial operations for Caviar production. These activities had depleted their population to non-economic levels by the beginning of this century.

The study of blood parameters is a method of diagnosing diseased conditions in fishes (Bullis 1993). There is a paucity of information on the serum biochemistry of these sturgeons. Thus, there is an increased demand for information on all aspects of biology and serum biochemistry of these sturgeons (Baker et al. 2005). Hence, the purpose of the present study was to provide basic serum biochemistry information on juvenile *A. persicus* and *A. stellatus*.

## Materials and methods

Juvenile *A. persicus* ( $n=7$ ) and *A. stellatus* ( $n=7$ ) were netted from the Iranian fishing area of the southern margin of the Caspian basin between 4 and 7 AM in winter 2006. Fishes were bled on the boat immediately after capturing,

with their head covered with a wet cloth to reduce stress, by a manual blow to the head. After about 30 min, blood was transferred to the coast for centrifugation. After separation all sera were stored in liquid nitrogen while waiting for transfer to the Department of Biochemistry, School of Veterinary Medicine, University of Tehran (Tehran, Iran). Blood samples were collected from the behind of the anal fin using a syringe. Serum samples were analyzed for phospholipid (PL), triglyceride (TG), total cholesterol (TC), total lipid (TL), glucose (GLC), free fatty acid (FFA), total protein (TOP), albumin (Alb), globulin (Glb), and albumin to globulin ratio (Alb:Glb).

Serum samples were analyzed for TG concentrations using the glycerol-phosphate oxidase *p*-aminophenazone method, for TC concentrations using the cholesterol oxidase *p*-aminophenazone method and, for GLC concentrations using the glucose oxidase *p*-aminophenazone method. All reagents were prepared by the Anzan Biochemistry Company (Khozestan, Iran). To check the accuracy and precision of the assays all samples were measured in duplicate and a serum control (Randox Laboratories, Crumlin, Co. Antrim, UK) was assayed between each of the two samples. Moreover, for each test, the spectrophotometer was calibrated by means of a corresponding blank.

Total protein concentrations were measured based on the biuret method, a formation of a violet complex between cupric ions and protein (Silverman and Christenson 1995). Alb values were determined using a dye binding technique between Alb and bromocresol green that results in a colored complex (Doumas et al. 1976). Glb values were calculated by difference. Alb:Glb ratios were determined by dividing Alb concentrations by Glb. FFA concentrations were

determined by colorimetric microdetermination of FFA based on the estimation of copper in chloroform extract of their cupric salts with oxalic acid bis- (cyclohexylidene hydrazide; Soloni and Sardina 1973). PL concentrations were measured using the method of Rouser et al. (1970).

Statistical analysis for each value was performed using the Mann–Whitney Rank Sum test between fishes using Sigma Stat 2.0 (Systat Software, Point Richmond, CA, USA).

## Results

Weight, total length, fork length, serum levels of TG, TC, PL, TL, GLC, FFA, TOP, Alb, Glb, and Alb:Glb ratios are shown in Table 1. There is no difference between fishes in terms of any of the parameters ( $p>0.05$ ).

## Discussion

Glucose is probably the most studied of the non-enzymatic and protein components of fish serum. The GLC values of both fishes were higher than those values reported in *A. oxyrinchus* (3.8 mmol/L), *A. brevirostrum* (3.7 mmol/L; Baker et al. 2005), and *A. naccarii* (2.6 mmol/L; Cataldi et al. 1998). Furthermore, their TOP values were higher than those values reported in *A. oxyrinchus* ( $2.7\pm 0.1$  mmol/L) and *A. brevirostrum* ( $1.8\pm 0.1$  mmol/L; Baker et al. 2005), but there was no significant difference between the serum proteins of *A. persicus* and *A. stellatus*.

Baker et al. (2005), Giberson and Litvak (2003), and Hardy and Litvak (2003) discussed that these higher values

**Table 1** Serum parameters of juvenile *Acipenser persicus* ( $n=7$ ) and *Acipenser stellatus* ( $n=7$ )

Parameter	<i>A. persicus</i>			<i>A. stellatus</i>			<i>p</i> value (difference between groups)
	Minimum	Maximum	Median	Minimum	Maximum	Median	
Total length (cm)	42	77	58.50	61	99	67.50	0.18
Fork length (cm)	37	69	52	51	87	56.50	0.24
Weight (g)	170	1650	800	400	2750	725	0.699
PL (mmol/L)	18.1	193.08	26.73	36.43	163.20	42.79	0.366
TG (mmol/L)	1.24	4.75	2.38	0.81	2.97	2.37	0.534
TC (mmol/L)	1.66	8.15	3.04	1.4	5.19	3.55	0.945
TL (mmol/L)	23.79	198.06	32.09	41.89	165.41	50.11	0.628
TOP (g/L)	16.22	51.11	32.22	16	48	27.78	0.534
Alb (g/L)	1.43	18.41	7.25	3.84	10.47	6.85	1
Glb (g/L)	9.83	32.7	24.86	12.16	39.32	20.62	0.731
Alb:Glb ratio	0.05	0.65	0.39	0.18	0.52	0.28	0.181
GLC (mmol/L)	5.77	7.63	7.45	5.09	7.63	7.45	0.366
FFA (mg/L)	5.01	195.45	110.25	2.51	142.83	32.58	0.836

PL phospholipid, TG triglyceride, TC total cholesterol, TL total lipid, TOP total protein, Alb albumin, Glb globulin, GLC glucose, FFA free fatty acid

for GLC and TOP may reflect higher growth rates or higher conversion efficiency in these species.

The Alb values were lower than those reported for juvenile *A. persicus* ( $26.05 \pm 1.63$  –  $43.20 \pm 2.5$  g/L ; Bahmani et al. 2001). This discrepancy is due to the method applied to determine the Alb concentrations. In this regard, Bahmani et al. (2001) used absorption of UV light at 260–280 nm. This technique has been designed to determine the total protein and is not applicable for Alb. Thus, it seems that they determined total protein concentrations and reported those values as Alb concentrations.

Despite Mills and Taylaur's (1978) and Asadi et al.'s (2006b) reports on serum lipid parameters in mature *A. stellatus*, *A. guldenstadtii*, and *Huso huso*, there are no reports on the lipid parameters in juvenile sturgeons. Hence, these data can be used as normal values for healthy juvenile *A. persicus* and *A. stellatus*. Moreover, while we have not found any difference between these species of juvenile Acipenserides in terms of any of the parameters, there is agreement that different kind of fishes vary in the total plasma proteins and in the distribution of the various fractions. In line with our findings, Bahmani et al. (2001) showed that juvenile Acipensers have similar blood parameters.

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