

Comparative analysis of blood and seminal plasma composition of Persian sturgeon, *Acipenser persicus*

Mohammad Sadegh ARAMLİ^{1*} Mohammad Reza KALBASSI¹ Rajab Mohammad NAZARI²

¹ Aquaculture Department, Faculty of Marine Sciences, Tarbiat Modares University, Noor, Iran

² Rajaei sturgeon Fish Farm, Sari, Iran

*Corresponding author
Email: msaramli@gmail.com

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Abstract

Sturgeon are currently generating interest, as most belong to endangered or critically endangered species and are listed in The International Union of Conservation of Nature Red List of Threatened Species. Blood and seminal biochemical parameters are important aspects in the management and conservation of endangered species such as *Acipenser persicus*. In this research, comparison of blood and seminal plasma compounds including sodium (Na⁺), chloride (Cl⁻), potassium (K⁺), calcium (Ca⁺⁺), magnesium (Mg⁺⁺), total protein, glucose, cholesterol and triglyceride in Persian sturgeon were studied. Results indicated that the concentrations of all parameters of blood plasma were significantly (P<0.05) higher than seminal plasma except Potassium. Differences found can be ascribed to the existence of a blood-testis barrier.

Keywords: blood and seminal plasma, Persian sturgeon, blood-testis barrier

INTRODUCTION

Persian sturgeon, *Acipenser persicus* (Borodin) is an anadromous fish widely distributed in the southern Part of the Caspian Sea [1]. Unfortunately, in recent years this valuable fish has become an endangered species because of excessive fishing, decrease of input water from the rivers due to anthropogenic and agricultural consumptions, and water pollution [5]. In order to protect this species from extinction, it is important to determine the normal physiological values, including the blood and seminal plasma properties. On the other hand, previous studies have shown that there are significant differences between blood and seminal plasma properties [7,8]. The significant differences existing are probably due to the existence of a blood-testis barrier [7]. However, there are no report about comparison of blood and seminal composition in sturgeon seminal plasma especially Persian sturgeon. Therefore, in this study, we investigated the chemical and biochemical characteristics in both the blood and seminal plasma of Persian sturgeon. The results were statistically evaluated in an effort to determine whether differences in values were present which could indicate the existence of a blood-testis barrier.

MATERIALS AND METHODS

Broodstocks

The Persian sturgeon males (TL= 143.38±5.47cm, TW=15.81±0.57= kg, n=17) were captured in the southern part of the Caspian Sea during March- April 2011 and transported to the Rajaei sturgeon fish farm, Sari, Iran. The semen and blood were collected from the fishes 12-18 h after inductions of spermiation by intramuscular injection of LHRH-A₂ hormone (5µgKg⁻¹) [6]. The samples were immediately stored in glass tubes separately for each fish and transferred in dry ice (4 °C) to the laboratory of marine sciences faculty of Tarbiat modares university, Noor, Iran.

Protocol and preparation of blood and seminal samples

To analyse the ionic concentration and biochemical components in the seminal plasma, the semen samples were centrifuged (Spectrafuge16M, USA) using a Two-step method, firstly at 500 rpm for 2 min, and secondly at 3000 rpm for 10 min. The blood samples were centrifuged (5000 rpm for 10 min) to separate the serum. The supernatants were stored as frozen in 20 °C until use for analysis.

The concentration of Mg^{++} , Cl^- and Ca^{++} were measured with colorimetric procedure using an Autoanalyser (Technican,USA). Also, K^+ and Na^+ were determined with a flamephotometer (Jenway, England). The osmolality of samples were measured in duplicates per sample with osmometer (Osmomat 030-m, Germany) using a freezing point depression. Biochemical parameters of the seminal plasma including total protein, glucose, triglyceride and cholesterol were determined by Autoanalyser (Eurolyser vet, AUSTRIA, standard analysis kits from Parsazmun, Tehran, Iran). The data were analyzed using one-way analysis of variance (ANOVA), followed by Duncan's multiple range test (DMRT) at $P < 0.05$.

RESULTS AND DISCUSSION

The chemical and biochemical parameters as well as osmolality (as a physicochemical factor) differed considerably between the blood and seminal plasma (Table 1). The concentrations of all parameters of blood plasma (Na^+ , Cl^- , Mg^{++} , Ca^{++} , total protein, glucose, cholesterol, triglyceride and osmolality) were significantly higher than seminal plasma except potassium.

The higher chloride concentration in the blood plasma of Persian sturgeon compared with that of the seminal plasma, is the opposite of values found in *Barbus aeneus* [8]. Also in the blood plasma sodium concentration is nearly double the value of sodium concentration in the seminal plasma. This is in agreement to results obtained in *B. aeneus* (Burchell., 1822) [8]. Furthermore, K^+ is the only cation with a higher concentration in the seminal than in blood plasma. Similar results obtained in Asian catfish, *Clarias macrocephalus* (Gunther) by Tan-Fermin et al. 1999 [7].

Calcium and magnesium are divalent cations and act as a cofactor in enzyme reactions. These ions are possibly involved in the sperm contra-cellular metabolism during

activation when energy is needed for sperm movement [3]. On the other hand, all the above-mentioned ions play a role in maintaining osmolality in the sperm cells. In this study, in comparison with seminal plasma, Ca^{++} and Mg^{++} concentrations were significantly higher than those for the blood seminal.

Biochemical parameters varied significantly between the blood and seminal plasma. Similar to Common carp, *Cyprinus carpio* (L.,1758) and *B. aeneus* [2,8] the concentrations of glucose and cholesterol in the blood plasma of Persian sturgeon are higher than in the seminal plasma. Also, total protein and triglyceride analysis show that the value this parameters in blood higher than seminal plasma. In comparison, the results of research on *C. carpio* (L.,1758) by Darvish Bastami et al. 2012 [2] indicated that blood plasma parameters of glucose, cholesterol, and Ca^{++} were significantly higher than those of seminal plasma, while no significant differences were observed between the seminal and blood plasma levels for total protein and Mg^{++} ion.

Finally, differences in the chemical and biochemical composition of the seminal and blood plasma may be due to a blood–testis barrier (abbreviated as BTB, which is a physical barrier between the blood vessels and the somniferous tubules of the animal testes) [4,8]. This is evident in the specific regulation of ion and organic component concentration levels. Furthermore, it is necessary that in future research this event is investigated in detail in the Persian sturgeon.

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Table 1. Chemical and biochemical composition of blood and seminal plasma of Persian sturgeon, *A. persicus* (statistically significant differences, * $P < 0.05$)

Parameters	Seminal plasma			Blood plasma		
	Mean	SEM	N	Mean	SEM	N
Sodium (mEq L ⁻¹)*	59.53	2.56	16	123.20	1.31	16
Chloride (mEq L ⁻¹)*	9.10	1.42	16	97.18	1.23	16
Potassium (mEq L ⁻¹)*	4.72	0.31	16	2.77	0.088	16
Calcium (mg dL ⁻¹)*	1.45	0.075	16	6.67	0.24	16
Magnesium (mEq L ⁻¹)*	0.70	0.072	16	1.29	0.074	16
Osmolality (mOsm Kg ⁻¹)*	86.90	4.22	17	244.62	3.66	17
Glucose (mg dL ⁻¹)*	18.22	4.16	17	198.49	18.03	17
Cholesterol (mg dL ⁻¹)*	6.67	1.04	17	127.11	6.94	17
Triglyceride (mg dL ⁻¹)*	15.20	0.65	17	214.22	13.38	17
Total protein (g dL ⁻¹)*	0.11	0.021	17	3.62	0.23	17

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