



Effects of Dietary Super Nutrients on Growth Performance and Selected Biochemical Indices in Juvenile Siberian Sturgeon (*Acipenser baerii*)

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Abstract

Super nutrients are dietary supplements containing fat-soluble vitamins, essential minerals, and growth-promoting compounds. The present study was conducted to evaluate the effects of dietary super nutrients on growth performance and selected biochemical indices in juvenile Siberian sturgeon (*Acipenser baerii*) at the International Sturgeon Research Institute. Fish were fed experimental diets containing different levels of super nutrients, and blood samples were collected on days 45 and 90 of the feeding trial. Plasma was separated and analyzed for selected biochemical parameters and ion concentrations. Growth performance was evaluated using final weight, final biomass, body weight increase (BWI), specific growth rate (SGR), condition factor (CF), and average daily gain (ADG). The results showed that all growth indices were significantly higher in the super nutrient-supplemented groups than in the control group ($p < 0.05$). In contrast, plasma sodium, potassium, and calcium concentrations were not significantly affected by dietary supplementation ($p > 0.05$). The findings indicate that dietary super nutrients can enhance growth performance in juvenile Siberian sturgeon without significantly altering major plasma ion levels. These results suggest that the inclusion of super nutrients in Siberian sturgeon diets may improve production performance under culture conditions.

Keywords: Siberian sturgeon (*Acipenser baerii*), super nutrients, growth performance, biochemical parameters, plasma ions, dietary supplementation

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Introduction

Super supplements are nutrients that consisting of fat-soluble vitamins (Vit. A, D₃, E, K), essential minerals: calcium, phosphorus, iron, copper, magnesium, manganese, cobalt, zinc, iodine, selenium, chlorine, sodium, potassium, growth promoters: betafin, choline, carnitine, coated vitamin C, coated micro-ionized proteins (these are indigestible proteins), essential amino acids: lysine, methionine, cysteine, threonine and essential fatty acids: linolenic, arachidonic and linolenic that are used in fish nutrition. One of the most important and reliable indicators of health status and physiology of fish is measuring of haematological and osmotic parameters that affected by nutrition, environmental factors, and etc. (Fanouraki *et al.*, 2007). Siberian sturgeon can be easily adapted to cultured conditions, is resistant to environmental changes, has a high growth rate and easily use available food sources (Pyka and Kolman, 2003). Because of low maturity age and rapid caviar reaching, this species is used in many studies and is one of the important species that is used in the aquaculture industry (Gross *et al.*, 1996). Siberian sturgeon is a sturgeon species that has a high growth rate and is very suitable for aquaculture, but little research has been done on its nutritional requirements. In this study, we have tried to evaluate the impact of super supplements on ionic and growth parameters in Siberian sturgeon.

Materials and methods

Practical phases this study was carried out in international Sturgeon Research Institute and glucose and cortisol levels measured in VIRO MED laboratory in Rasht during 6 months. Blood samples obtained in days 45 (stage I) and 90 (stage II) and plasma provided. In this study 180 Siberian sturgeon (mean weight 680.89 ± 29.93 gr and mean length 63.79 ± 1.18 cm) were prepared and two weeks of adaptation, fish were randomly introduced to 15 fiberglass tanks with a volume of 2000 litres. The fish were fed diet of Skretting Company. Super supplements at 2.5% (T₁), 5% (T₂) and 10% (T₃) were added to the diet and experiments were performed in triplicate. Immediately after transferring blood samples to the laboratory of the Hematology Department of the International Caspian Sea Sturgeon Research Institute, the blood plasma is immediately separated by a German-made Labofuge200 centrifuge (for 10 minutes at 3000rpm) (Bergleiter *et al.*, 2009) and inside a tube. Eppendorfs were stored at -20°C until tests to determine blood cortisol and glucose (Boshra and Sunyer, 2006). These centrifuges create a centrifugal force by their rotational motion and the cells are deposited. Super supplement from ATA Company and Oxy-tetracycline antibiotic 20 % from Aras Baran Company were used. This study was conducted in five treatments with triplicates, including control without antibiotic, control with antibiotic and super supplement at 2.5%, 5%, and 10% for 90 days and three times per day

(Yousefi Jourdehi, 2006; Bahmani *et al.*, 2012).

Evaluation of growth trend was calculated based on the available references of mathematical equations (Bekcan *et al.*, 2006):

- (ADG) (g/fish/day) (%) = $[(w_t - w_i) / w_i \times T] \times 100$ Average daily growth
- Percent body weight increase (PBWI) (%) = $[(w_t - w_i) / w_i] \times 100$
- Specific growth rate (SGR) (day) = $[\ln W_t - \ln W_i / T] \times 100$
- Feed Conversion Ratio = Feed intake (g) / $w_t - w_i$

Automatic osmometer (Nr. 9610003.Type-13, manufactured by Roebling, Germany) was used for measuring serum osmolality. Sodium and potassium ions were measured by Flame Photometer (C405) of Fater Electric and measurement of calcium ion was done by Pars Azmoon kit and Autoanalyzer (RA1000 model). Experimental data were examined by normality test. To determine significant differences one-way analysis of variance (Anova) was used and for non-normal data Kruskal - Wallis was used. One-way analysis of variance and Kruskal - Wallis were used to determine significant differences in blood parameters were normal. Statistical analysis and drawing graphs were done through software SPSS 16 and Excel 2010 (Atamanalp and Yanik, 2003).

Results

The mean initial weight, initial biomass, initial length, final length and FCR showed no significant difference

between control group with the other treatments ($p > 0.05$), but average final weight in the treatments of treatment 5% and 10% was significantly higher than other treatments ($p < 0.05$). The mean final biomass, mean body weight increasing (BWI%), specific growth rate (SGR), daily growth rate (DGR) and condition factor (CF) in super supplement 5% and control treatment without antibiotic was significantly more than other treatments ($p < 0.05$) (Table 1).

Significant difference was not observed in the amount of serum electrolytes and osmolality of Siberian sturgeon in the first culture phase between control group with any of the treatments ($p > 0.05$) (Table 2).

Serum electrolytes and osmolality changes showed no significant difference between control with the other treatments at the final phase of culture ($p > 0.05$) (Table 3).

Discussion

In the present study, according to the results, the highest effect of super supplements on average final weight, final biomass, increased body weight (BW%), specific growth rate (SGR), daily growth rate (GR) and condition factor (CF) was observed in treatment with super supplement 5%. In this study the duration of feeding storage was short. This also helps to keep the food quality which is of the basic standards in organic fish production (Otles *et al.*, 2010). Pahang *et al.* (2012) studied the impact of organic culture with 2.5 and 5% super supplement on some growth

parameters in Common Carp (*Cyprinus carpio*) and found that that average final weight, weight gain, condition factor, specific growth rate and average daily

growth showed significant differences ($p < 0.05$).

Table 1: Growth parameters of various treatments in Siberian sturgeon during experimental period.

Growth parameters	Control Without antibiotic	Control with antibiotic	Super supplement 2.5 %	Super supplement 5 %	Super supplement 10 %
Initial weight (g)	29.93 ^a ± 680.89	32.10 ^a ± 692.97	19.84 ^a ± 596.17	19.84 ^a ± 667.56	4.17 ^a ± 668.44
Final weight (g)	21.13 ^a ± 1839.27	17.48 ^{ab} ± 1935.23	15.96 ^{ab} ± 1983.13	30.87 ^b ± 2034.78	20.88 ^b ± 2077.30
Initial Biomass (g)	359.27 ^a ± 8170.67	385.22 ^a ± 8315.67	238.12 ^a ± 7154	357.07 ^a ± 8010.67	50.03 ^a ± 8021.33
Final Biomass (g)	1853.75 ^b ± 16577.82	724.32 ^{ab} ± 13855.27	85.14 ^a ± 11472.07	1023.44 ^b ± 16837.45	131.89 ^{ab} ± 13309.45
Initial length(cm)	1.18 ^a ± 63.79	0.66 ^a ± 63.58	0.37 ^a ± 61.38	0.94 ^a ± 64.01	0.26 ^a ± 63.83
Final length (cm)	0.58 ^a ± 70.93	0.15 ^a ± 71.20	0.13 ^a ± 70.67	0.92 ^a ± 71.47	0.21 ^a ± 71.14
BWI (%)	7.14 ^b ± 99.68	1.25 ^a ± 66.52	4.27 ^a ± 60.64	8.05 ^b ± 113.97	1.86 ^a ± 65.93
FCR	0.49 ^a ± 1.71	0.03 ^a ± 2.02	0.14 ^a ± 2.29	0.51 ^a ± 1.60	0.08 ^a ± 2.02
SGR (day)	0.05 ^b ± 0.73	0.008 ^a ± 0.57	0.029 ^a ± 0.53	0.03 ^b ± 0.79	0.01 ^a ± 0.56
GR	0.24 ^b ± 7.78	0.31 ^a ± 5.13	0.16 ^a ± 3.99	0.08 ^b ± 8.17	0.03 ^a ± 4.89
CF	0.04 ^b ± 0.71	0.007 ^a ± 0.59	0.007 ^a ± 0.54	0.004 ^b ± 0.73	0.01 ^a ± 0.54

Table 2: Ionic - osmotic indices changes in Siberian sturgeon at the first culture phase.

Growth parameters	Control Without antibiotic	Control with antibiotic	Super supplement 2.5 %	Super supplement 5 %	Super supplement 10 %
Ca ²⁺ (µg/mL)	0.58 ^a ± 9	0.88 ^a ± 8.8	1.85 ^a ± 8.73	0.33 ^a ± 8.46	2.65 ^a ± 8.93
Na ⁺ (mg/dl)	1.20 ^a ± 126.33	1.20 ^a ± 135.67	1.15 ^a ± 127	0.33 ^a ± 128.67	0.58 ^a ± 130
K ⁺ (mg/dl)	0.12 ^a ± 2.6	0.03 ^a ± 2.87	0.20 ^a ± 2.63	0.09 ^a ± 3.03	0.1 ^a ± 3
Osmolarity (mOsm/L)	1.52 ^a ± 298	6.55 ^a ± 311	1.15 ^a ± 297	2.64 ^a ± 298	0.88 ^a ± 299.66

Table 3: Osmotic indices of Siberian sturgeon in the final culture phase.

Osmotic indices	Control without antibiotic	Control with antibiotic	Super supplement 2.5%	Super supplement 5 %	Super supplement 10 %
Ca ²⁺ (µg/mL)	4.91 ^a ± 8.10	0.58 ^a ± 7.7	3.18 ^a ± 8.30	0.33 ^a ± 7.7	1.20 ^a ± 8.93
Na ⁺ (mg/dl)	1.20 ^a ± 128.33	2.19 ^a ± 127.33	2.60 ^a ± 129.33	0.88 ^a ± 129.33	0.89 ^a ± 131.33
K ⁺ (mg/dl)	0.15 ^a ± 2.50	0.14 ^a ± 2.23	0.03 ^a ± 2.03	0.09 ^a ± 2.23	0.14 ^a ± 2.23
Osmolarity (mOsm/L)	1.52 ^a ± 298	6.55 ^a ± 311	1.15 ^a ± 297	2.64 ^a ± 298	0.88 ^a ± 299.66

In this study, an increase in growth parameters such as BWI %, SGR, GR and CF observed in the treatment super supplement 5 % compared to other treatments, especially control with antibiotic may be due to increased food intake and improved digestion process because of various nutrients, especially vitamins and minerals in super supplement that stimulates growth in fish, probably due to a change in the composition of nutrients in the treatment super supplements 5 %. Various factors such as the composition of nutrients in the diet, method of feeding, environmental factors such as water temperature and dissolved oxygen, fish size (Jabeen *et al.*, 2004), and the combination of ingredients (Sahzadi *et al.*, 2006) affected feed conversion ratio (FCR).

Osmotic indices influenced by environmental factors, especially dissolved oxygen, salinity, temperature and so on. Many of the fish showed interactions in order to maintain its generation by changing the environmental conditions (Akimora and Ruban, 1993). Considering to the mentioned factors, Super supplements not affected on serum osmolarity and electrolyte indices. Mohammad nejad Shamooshaki *et al.* (2010) investigated the effect of feeding ratio on some biochemical parameters of carp (*Cyprinus carpio*) fingerlings. The results of this study showed that the frequency and percentage of feeding had no effect on the level of serum calcium in carp fingerlings.

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