THE GROWTH PERFORMANCE AND HEMATOLOGICAL PROFILE TO SPECIES A. STELLATUS (PALLAS, 1771) IN TERMS OF VITAMIN C AND E IN THE DIET INCREASED IN THE INTENSIVE RECIRCULATING

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Abstract

The aim of this work presents the results of an experiment that was conducted over a period of 30 days (24.05.2013-22.06.2013), where we used specimens of A. stellatus (Starry) aged 13 months and 22 days. We have used two tubs: in the first tub were 40 species with a total biomass of 3916 g and in the second tub were 39 species with a total biomass of 4012 g. The fish from the two tubs were fed with fodder "Alterna Storione", the difference between the two tubs is: in the first tub we have to incorporated the vitamins C and E, and in the second tub we used the feed as it self. At the end of the experiment, in the first tub (C + E) we obtained a weight gain of 1199 g, and in the second tub we obtained weight gain of 1153 g. In the hematological profile we have obtained the following results: in the first tub (C + E) the hemoglobin 8.58±0.94 g/dl the glucose 69.46±7.12 ml glucose / 100ml blood, the proteins 3.83±0.28 g proteins/100 ml serum, hematocrit 26.46±3.67, the leukocyte 1.65±0.070 and the erythrocytes ranged from 0,77· 10^6 cells / µl blood and 0,875· 10^6 cells / µl blood; in the second bath(control): the hemoglobin 9.23±1.66 g/dl, the glucose 62.06±4.75 ml glucose/100ml blood, the proteins 3.7±0.33 g proteins/100 ml serum, the hematocrit 30.48±5.71, the leukocyte 1.69±0.085 and the erythrocytes ranged between 0,67 · 10^6 cells / µl blood and 0.745 · 10^6 cells / µl blood. In summary, we obtained different values referring to the gain, the increase of the specimens used in the both baths and their hematological profile was affected by the feed method used differently in the two baths.

Key words: Acipenser stellatus, weight gain, hematological profile, vitamin C and E, aquaculture

INTRODUCTION

In Romania, the first study on raising sturgeons in intensive recirculating systems (RAS) was performed in 2002. [1]

All over the world, the sturgeon production grew slowly in recent decades, the most common species and the most increased species in aquaculture systems [2] were the Siberian sturgeon (Acipenser baerii), Acipenser gueldenstaldtii, Acipenser ruthenus and Bester [3].

In the lower basin of the Danube, it has been a drastic decline of sturgeon stocks due to the negative human impact on natural spawning and fishing abusive, which imposed a research effort directed in particular to the protection and recovery of these stocks [4]. So, the stock of sturgeon restoration aims to achieve through artificial reproduction and growth in favorable environmental conditions.

This piece of work wants to present the intensive growth of the young species of Acipenser stellatus, a highly valuable species, in a recirculating system with enclosures, designed and built in the Department of Aquaculture and Fisheries.

The stocking density represents the key factor in rearing sturgeons process [5].

It has been demonstrated that a higher stocking density can suppress growth due to a stress status, which leads to non-consuming the amount of feed given and hence the deterioration of technological water quality parameters. [6,7,8,9]

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In order to obtain a satisfactory results there were taken into account both biological factors and the environment (pH, water temperature, dissolved oxygen, ammonia, nitrites, nitrates, etc...); that might influence the growth process.

MATERIAL AND METHOD

The present experiment lasted 30 days and it took place during (24/05/2013 - 22/06/2013) in a recirculating system with tubs enclosures, designed and built in the Department of Aquaculture and Fisheries, in Galati.

We used two tubs, each with a capacity of 600 liters of water and it was equipped with a pump system required for the optimal control and maintenance, the main physic-chemical parameters of the water.

The shelves were stocked with specimens aged 13 months and 22 days, obtained by artificial reproduction, in May 2012, in the artificial breeding station at Isaccea. In the first, tub we used 40 specimens with a total biomass of 3916 g, and in the second tub there were 39 specimens with a total biomass of 4012 g.

The fish were stocked with specimens aged 13 months and 22 days, obtained by artificial reproduction, in May 2012, the artificial breeding station at Isaccea. The bath I, and 40 samples were used with a total biomass of 3916 g, and a fall-II, 39 specimens with a total of 4012 g biomass.

The fish in the two baths were fed with feed "Alterna Storionii" with 48.0% protein, dry matter. (table 1)

Table 1 Biochemical composition of the fodder Alterna Storionii 2P

Composition	2P
Crude protein %	48.0
Crude fat %	16.0
Crude cellulose %	1.9
Crude ash %	8.5
Phosphorus %	1.3
Digestible energy (MJ/kg)	16.6

The difference between the two tubs is: in the first tub we have to incorporate the vitamins C and E, and in the second tub we used the feed as it self.

On incorporation of vitamin C we used gelatin and for the vitamin E were used 3-4 drops of methanol and 5 ml of ethanol.

In determining the chemical analyzes of water (nitrates, nitrites, ammonia, COD, SO_4^{2-}) we used the kits type Merk with spectroquant Nova 400.

The main water parameters (temperature, dissolved oxygen, pH) were determined with oximeter - Oxi315i and pH-meter type pH 315i. [10]

The hematological analyzes (hemoglobin, glucose, total protein, etc..) we used the spectrophotometer AnalytikJena (SPECORD 210).

For the determination of the hemoglobin we used the reagent Dropkin, for the glucose it has been used other method, for the protein we used the biuret method, for the hematocrit we used capillary tubes/the electrical centrifuge and the read pattern of capillaries, and for determine the quantity erythrocytes we used the Neubauer counting chamber and dilution fluid Vulpian.

RESULTS AND DISCUSSIONS

The growth performance may vary significantly depending on several factors such as: stocking density, type of feed used, water temperature, organic substance in water, pH of the water, concentration of dissolved oxygen, etc.

During the experiment, the physical-chemical parameters of the process water were within the acceptable limits for optimum growth. (tab. 2)

Table 2 Values of main water quality parameters

Water quality parameters	Vit. E+C	Witness
N-NO2 mg/l	0.119±0.0035	0.124±0.0013
N-NO3 mg/l	23.59±0.12	23.92±0.24
N-NH4 mg/l	0.555±0.18	0.292±0.15
pH – upH	7.823±0.094	6.116±0.065
T °C (°C)	24.5±0.63	24.9±0.82
O_2 mg/l	6.35±0.02	5.61±0.09

The optimum temperature for sturgeon growth 18-20ºC. [11, 12]

At the beginning, middle and end of the experiment were conducted biometric

measurements required in determining growth performance indicators (Sr, GR, FCR). The values obtained are presented in table 3.

Table 3 Growth performance parameters of both experimental variants

Experimental variants	Vit. E+C	Witness
Rearing units	C1	C2
Initial fish number	40	39
Final fish number	34	34
Survival (%)	85	87.179
Total initial biomass (g)	3916	4012
Initial stocking density (kg/m^3)	13.05	13.37
Total final biomass (g)	5115	5165
Final stocking density (kg/m^3)	17.05	17.22
Biomass gain (g)	1199	1153
Stocking density gain (kg/m3)	3.997	3.84
Initial weight mean (g/ex)	97.9	102.87
Final weight mean (g/ex)	150.44	151.91
Individual biomass gain (g)	52.54	49.04
Rearing days	30	30
Feed crude protein (PB %)	48	48
Feeding ratio (% biomass)	1.5	1.5
The total amount of feed distributed (g)	1755	1805.4
GR (daily growth rate) (g/day)	39.97	18.30
SGR (%/day)	0.42	0.84
FCR (g feed/g biomass gain)	1.46	1.57
PER (protein efficiency ratio) (g/g)	1.42	1.33

As you can see, the values were not very different, but the behavior of the specimens fed with vitamin supplement was slightly different and showed a more active swimming in the water from specimens fed without supplement.

The food administered one day in the first tub was 58.5 g/day forage "Alterna Storione" and the necessary of vitamins was 250 mg/kg forage, vitamin C, and 500 mg/kg forage, the vitamin E; in the second tub were used to 60, 18 g/day forage "Alterna Storione" calculated based on available biomass and the intensity of feeding which was 1.5%.

At intermediate weighing held on 07.06 2013 mid experiment we recalculated the need of food and vitamins, according to the then existing biomass.

The roles and characteristics of vitamin E are: strengthens the immune system, allows better blood irrigation in the entire body, alleviate tiredness, has anticoagulant action which prevents platelet aggregation, is fat-soluble and sensitive to alkaline and oxidation.

The name of vitamin C comes from the property to cure scurvy. The vitamin C is water-soluble oxidants, it is resistant to heat and ultraviolet rays, facilitates iron absorption, contributing to the removal of anxiety, fatigue, stress, contributes to the formation of antibodies and interferon, has anti-infective and anti-bullying action.

The hematological profile was affected by the feed method. The values of hematological parameters and erythrocyte constants obtained from analyzes performed on blood collected from nine specimens of each basin are presented in table 4.

Table 4 The values of hematological parameters and erythrocyte constants

Haematological parameters (mean ± standard deviation)						
Experimental variants	Ht (%)	Hb (g/dl)	Nr. E x 10^6/mm³	VEM (µm³)	HEM (pg)	CHEM (g/dl)
Vit. E+C	26.46±3.67	8.58±0.94	0.82±0.038	319.72±39.79	103.71±11.071	32.67±2.78
Witness	30.48±5.71	9.23±1.66	0.69±0.021	435.57±70.91	132.22±23.62	31.11±8.048

***Note**: Hb – hemoglobin, Ht – hematocrit, E – erythrocytes, L – leucocritul, VEM - mean corpuscular volume, HEM - mean erythrocyte hemoglobin, CHEM - mean erythrocyte hemoglobin concentration*

As you can see the vitamin supplementation given to the specimens in the first tub influenced favorably their growth and development, which is observed in both hematological values and erythrocyte constants obtained at the end of the experiment compared with those obtained from specimens of the tub control and of existing active swimming in the water and copies of the tub I noticed the (C + E) to a depressive behavior observed in specimens of the tub to II (witness).

To enhance growth, the survival and quality during early stages of juveniles is so important to avoid oxidation of lipids that are known like causes of diseases and illness [13].

DR Tocher, G. Mourente and his colleagues conducted a study that aimed to characterize and compare the antioxidant system in juvenile marine fish of commercial importance, namely in European aquaculture like turbot, halibut and Dorada Dorade.

The growth and survival was significantly affected only in Dorade where the diet with vitamin E was lower feeding, leading to decreased survival and growth. The vitamin E was determined by HPLC with fluorescence detection as described in Huo et al. (1996). [14] The growth was not affected by feeding with vitamin E. At Dorada, the survival and growth were positively affected by the presence of vitamin E in the diet, in contrast to the other two species, these effects were not observed, but no negative influence of vitamin E. [13]

A Safarpour Amlashi and his co-workers have carried out a study which lasted eight weeks were used 0, 25, 50, 100, 200 and 400 mg of vitamin E. At the end of the growth experiment, the parameters were significantly smaller in fish fed vitamin E supplement compared to those in fish fed without supplement. [15]

In a study by M. Tatina, M. Bahmani, M. Soltani, B. Abtahi and M. Gharibkhani, they obtained different of the growth parameters and not only, at the fish fed with vitamin E than those fed with vitamin C. [16]

In the experiment conducted by Wendy M. Sealey and Delbert M. Gatlin where they used 2500 mg vitamin C / kg and 300 mg vitamin E / kg, the vitamin C was productive in the immunity of fish, however the fish fed with vitamin E supplementation have deficiencies encountered growing recording showing a depressed mood and mortality. [17]

CONCLUSIONS

Being aware of the fact that the biological filtration is carried out, and transformation of organic matter mineralization in sequence to ammonium, nitrites and nitrates, which eventually accumulate in the system it is necessary to change the partial removal of water from the system for the latter, was applied at a rate of replacement of the water in the system, as shown in tend to stabilize the value of nitrates around 10 mg / l, is sufficient and meets the requirements of technology.

There have been different values in the gain, the increase of the specimens used in both baths and their hematological profile was affected by the feed method used differently but and physical-chemical process water, which explains the high values of hemoglobin in the control, due to lack of oxygen.

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REFERENCES

[1] Cristea V., Grecu I., Ceapă C., Talpeş M., Roşu A.: Research about Acipenser stellatus growth in superintensive system with aquarium units, Internațional Symposium „Eurofood", 2003, p. 815-834.

[2] Bronzi P., Rosenthal H., Gessner J.:Global sturgeon aquaculture production: an overview, Journal of Applied Ichthyology 27, 2011, p. 169-175.

[3] Mims S.D.A., Lazur W. L., Shelton B., Gomelsky, Frank Chapman: Species profile: Production of Sturgeon. Southern Regional Aquaculture Center, Publication 7200, 2002.

[4] Cristea V., Grecu I., Ceapă C., Veronica Cristea, Talpeş M., Roşu A: Cercetări privind creşterea speciei Acipenser Stellatus în module de creştere superintensivă de tip acvariu

[5] Mohler, J.W. (2000). Early culture of the American Atlantic sturgeon Acipenser oxyrinchus oxyrinchus Mitchill, 1815 and preliminary stocking trials. Bol. Inst. Esp. Oceanogr., 16(1-4): 203-208.

[6] Ellis, T., North B., Scott A.P., Bromage N.R., Porter M., Gadd D. (2002). The relationships between stocking density and welfare in farmed rainbow trout. J Fish Biol 61: 493–531. 254

[7] Lupatsch, I., Santos G.A., Schrama J.W., Verreth J.A.J. (2010). Effect of stocking density and feeding level on energyexpenditure and stress responsiveness in European sea bass Dicentrarchus labrax. Aquaculture 298: 245–250

[8] Papoutsoglou, S.E., Karakatsouli N., Pizzonia G., Dalla C., Polissidis A., Papadopoulou-Daifoti Z. (2006). Effects of rearing density on growth, brain neurotransmitters andliver fatty acid composition of juvenile white sea bream Diplodus sargus L. Aquac Res 37: 87–95.

[9] Tolussi, C.E., Hilsdorf A.W.S., Caneppele D., Moreira R.G. (2010). The effect of stocking density in physiological parameters and growth of the endangered teleost species piabanba, Brycon insignis (Steindachner, 1877). Aquaculture 310: 221–228.

[10] Vasilean I., Cristea V., Sfetcu L., Grecu I., Researches regarding rearing of Beluga fingerlings (Husohuso) in a recirculating system conditions. The annals of ,,Dunarea de Jos,, University of Galati. Fascicle VII Fishingand and Aquaculture, Galati, 2006, 1-7, ISSN 1221-6585.

[11] Van Eenenaam, J.P., Chapman, F. and Jarvis, P., Sturgeons and Paddlefish of North America. Aquaculture, In Le Breton et al., eds. Kluwer Academic Publishers Dordrecht/Boston/London, 2004, pp. 277-311.

[12] Mims, S.D., Lazur, A., Shelton, W.L., Gomelsky, B. and Chapman, F., Species profile: Production of Sturgeon. Southern Regional Aquaculture Center, Publication, 2002, 7200.

[13] D.R. Tocher, G. Mourente, A. Van Der Eecken, J.O. Evjemo, E. Diaz, J.G. Bell, I. Geurden, P. Lavens & Y. Olsen: Effecte of dietary vitamin E on antioxidant defence mechanisms of juvenile turbot (Scophthalmus maximus L.), halibut (Hippoglossus hippoglossus L.) and sea bream (Sparus aurata L.)

[14] Ji-Zeng Huo, Hans J. Nelis, Patrick Lavens, Patrick Sorgeloos and Andre P. De Leenheer: Determination of Vitamin E in Aquatic Organisms by High-Performance liquid Chromatography with Fluorescence Detection. Analytical Biochemistry 242, 123-128 (1996) Article no. 0437.

[15] A. Safarpour Amlashi, B. Falahatkar, M. Sattari, M.H. Tolonei Gilani: Effect of dietary vitamin E on growth, muscle composition, hematological and immunological parameters of sub-yearling beluga Huso huso L.

[16] M. Tatina, M. Bahmani, M. Soltani, B. Abtahi and M. Gharibkhani: Effects of Different Levels of Dietary Vitamins C and E on Some of Hematological and Biochemical Parameters of Sterlet (Acipenser ruthenus)

[17] Wendy M. Sealey and Delbert M. Gatlin: Dietary Vitamin C and Vitamin E interact to Influence Growth and Tissue Composition of Juvenile Hybrid Striped Bass (Morone Chrysops ♀ * M. saxatilis ♂) but Have Limited Effects on Immune Responses.