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THE EFFECTS OF FODDER ADDITIVES (ACTIGEN, SELPLEX, YEA-SACC 1026) ADMINISTERED IN THE DIET OF THE SIBERIAN STURGEON (*Acipenser baerii*) ON MEAT QUALITY

C. SVERINCIUC, M.I. BENŢEA, A. ŞARA, L. CLAPA, C.O. COROIAN

University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca
3-5 Mănăştur Street, Cluj-Napoca, 400372, Romania, Fax +40-264-593792

Corresponding author email: sverinciuc@gmail.com

Abstract

The research has followed the effects of the feeding bio-additives Actigen, SelPlex and Yea-Sacc-1026 on the quality of the Siberian sturgeon (Acipenser baerii) meat. The experiments were carried out on a number of 108 Siberian sturgeons distributed in four groups, each with 27 individuals per group. In the experimental group 1 (1E), probiotic Actigen was added 0.08% to the fodder in the combined fodder, 0.03% organic selenium (SelPlex) was added to the experimental group 2 (2E), and to the third experimental group (3E) probiotic Yea-Sacc-1026 in proportion of 0.2% was added. The experimental period lasted 68 weeks, from 1st of July 2016 to 2nd of November 2017. At the end of the experiment control slaughters were made, 5 sturgeons from each group, the meat quality being determined but also its chemical composition. In terms of slaughter yield, equal values have been found between the experimental and control groups, the differences being not statistically represented. The administration of bio-additives (Actigen, SelPlex and Yea-Sacc 1026) resulted in a decrease in water content in experimental groups, 1E (Actigen) 28.71%, 2E (SelPlex) 26.39% and 3E (Yea-Sacc 1026), while the control (C) has 31.20%. The average percentage of crude protein of the 3E (47.31%) increased by 11% compared to the control group (36.29%) and by 6.5% compared to the experimental groups 1E and 2E. The highest gross fat value was observed in 2E group (31.75%) exceeding the control group score (30.27%), while the 3E group has shown the lowest value (23.3%) followed by experimental group 1E with 26.33%. The crude ash content did not show statistically represented differences between the experimental groups and the control group.

***Key words**: Siberian sturgeon, Actigen, SelPlex, Yea-Sacc 1026, meat quality, meat composition.*

INTRODUCTION

As an alternative strategy for antibiotic use, in aquaculture, prebiotics and probiotics are more recently used in feeding fish species of culture through their beneficial effects on production and health performance.

In a series of tests, one of the firsts dating from 2011 (Hung et al.), it appear that the effect of Actigen prebiotic on survival rate in pangasius (*Pangasianodon hypophthalmus*) artificially infected with *Edwardsiella ictaluri* bacteria was evaluated.

There was observed a high immunity rate to this bacterium, so the Actigen prebiotic increased the survival rate from the control group. The positive effects of Actigen administration at a dose of 0.04% in Nile Tilapia (*Oreochromis niloticus*) feeding on growth rate improvement were highlighted by Yutharaksanukul P. (2011, cited by Ringo et al., 2010), and 0.08% and 0.12% concentrations were found to reduce feed conversion, to improve the immune status and health, and reduce sleep mortality (Hung et al., 2012).

A new trend in aquaculture is to use probiotics with positive effects on growth and health such Yea-Sacc-1026. The use of this probiotic in aquaculture is relatively new, but in terrestrial animals Yea-Sacc-1026 has been used with good and very good results to improve the growth rate. Mohsen Abdel (2010) shown that using yeast as a probiotic in fish fodder increases their resistance to bacterial infections and increases digestive enzyme activity in the intestine. The administration of organic selenium (Sel-Plex) to carp (*Cyprinus carpio* L.) has positively influenced the survival rate and the accumulation of biomass (Ani et al., 2008; Ani et al., 2009). When feeding the fountain trout (*Slvelinus fontinalis* M.) organic selenium (Sel-Plex) had positive effects on growth performance and survival rate (Şara et al., 2009b; Şara et al., 2010a, b; Barbu et al., 2009).

In the literature we have not found data on the influence of some additives on the quality of the meat in the sturgeon. In the present paper, we suggested that the effects of the mentioned bioadditives on some meat quality indices in the Siberian sturgeon should be highlighted.

MATERIALS AND METHODS

Research has been done at the Forestry Research Institute in Gilău, Cluj county, Romania between July 2016 and November 2017 on a number of 108 sample individuals distributed in three experimental groups (Actigen 0.08%, Sel-Plex 0.03% and Yea-Sacc 0.2%) and a control one. The species of interest was represented by the Siberian sturgeon (*Acipenser baerii*) by the age of 10 months at the beginning of the experiment. At the beginning of the experiment, the fish had an average body weight of 400 g/specimen and 50 cm body length. All four groups were maintained under the same environmental conditions in identical concrete basins (4/1/1.3 m basins) with a surface area of 4 m^2 and a water flow rate of 20 l/min/basin. Recorded chemical parameters of the water were dissolved oxygen, pH, sulphates, ammoniacal nitrogen, nitrites and nitrates (Table 1).

Table 1. Chemical parameters of the water from the experiment

Specification	Unity measure (U.M.)	Values
O_2	mg/l	8.74
pH	pH	7.45
Sulphates	mg/l	32
NO_2	mg/l	0
NO_3	mg/l	0
NH_3	mg/l	0.09

The fodder used was the Skretting grain fodder without addition of bio-additives for the control group, respectively with addition of Actigen 0.08% for experimental group 1, Sel-Plex 0.03% for experimental group 2 and Yea-Sacc 0.2% for experimental group 3.
The nutritional characteristics of the fodder are shown in Table 2.
The fodder was administered in two servings/day at 9 am and 18 pm. Distributed fodder availability varied based on water temperature and total biomass. At the end of the experiment, control slaughters were made, five individuals of each group, whose body weight has the average values of the group they were part of.

Table 2. Nutritional characteristics of Skretting fodder

Specification	Unity measure (U.M.)	Values
Crude proteins	%	41
Crude ash	%	7.8
Crude fat	%	12
Crude cellulose	%	2.5
Phosphorus	mg	1.1
Copper	mg	6
Vitamin A	U.I.	10000
Vitamin E	mg	150

Slaughter yield, meat quality and chemical composition were established as a result of the slaughters. To determine the slaughter yield, specific operations have been performed on this parameter, such to measure various anatomic regions. Meat samples were collected from each individual to determine the chemical composition of the meat. Laboratory analyzes determined dry matter, crude fat, crude protein and raw ash in meat. Raw experimental data were statistically analyzed by T test using GraphPad InStat 3.

RESULTS AND DISCUSSIONS

The proportion of different body parts (expressed by weight and percentage) as well as the slaughter yield are shown in Tables 3, 4 and 5, respectively.
Analyzing Tables 4 and 5 we can conclude that the administration of additives (Actigen, SelPlex and Yea-Sacc) did not significantly affect the slaughter yield, its values being relatively equal. The chemical composition of the Siberian sturgeon meat at the end of the experimental period is shown in Table 6.

Table 3. The proportion of different body parts of fish

Specification	Group							
	Control		1E (Actigen 0.08%)		2E (SelPlex 0.03%)		3E (Yea-Sacc 0.2%)	
	g	%	g	%	g	%	g	%
Body weight	870	100	955	100	890	100	1165	100
Head	134	15.40	148	15.49	124	13.93	151	12.96
Viscera	51	5.86	50	5.23	66	7.41	87	7.46

Table 4. The slaughter yield at the four batches at the end of the experimental period (trunk)

Specification	Control	1E (Actigen 0.08%)	2E (SelPlex 0.03%)	3E (Yea-Sacc 0.2%)
Slaughter yield	77.40%	78.01%	78.08%	78.97%

Table 5. Slaughter yield at the four batches, trunk and head

Specification	Control	1E (Actigen 0.08%)	2E (SelPlex 0.03%)	3E (Yea-Sacc 0.2%)
Slaughter yield	93.05%	93.50%	93.06%	93.73%

Table 6. The chemical composition of Siberian sturgeon meat in the four batches

Specification	Control	1E (Actigen 0.08%)	2E (SelPlex 0.03%)	3E (Yea-Sacc 0.2%)
Dry matter (%)	68.8± 3.38	71.29±2.19	73.61± 0.74 *	70.3± 3.09
Crude protein (%)	36.29±2.95	40.88± 1.14*	40.72± 1.39*	47.31 ± 2.15 ***
Crude fat (%)	30.27±4.32	26.33± 3.99	31.75±3.66	23.33 ± 5.75 *
Crude ash (%)	2.83± 0.19	3.44± 0.65	3.07± 0.17	2.83± 0.69

*** *P* <0.001, ** *P* <0.01, * *P* <0.05

Lower water content was observed in E3 group by comparing with control group; significant differences were observed between groups 3E and 2E, the highest dry matter value was recorded in group 2E which was fed with organic selenium (SelPlex) (Table 7).

Table 7. The statistical significance of the differences between the four batches regarding the chemical composition of Siberian sturgeon meat (Student test)

Comparison	Average differences	q value	*P* value
Dry matter			
Control vs 2E	-4.812	4.189	*<0.05
3E vs 2E	3.319	4.712	*<0.05
Crude protein			
Control vs 1E	-4.598	5.046	*<0.05
Control vs 2E	-4.436	4.868	*<0.05
Control vs 3E	-11.020	12.094	***<0.001
1E vs 3E	-6.422	7.048	***<0.001
2E vs 3E	-6.584	7.225	***<0.001
Crude fat			
Control vs 3E	8.716	4.509	*<0.05
2E vs 3E	8.422	4.357	*<0.05

* significant differences; ** distinct significant differences; *** highest significant differences

When meat protein content is analyzed, there are very significant differences between group 3E (Yea-Sacc) and group 1E (Actigen), also between 2E group (Selplex) and control group. Significant differences can be seen between batches 1E and control group as well as between group 2E and control group. All three experimental groups showed an increase in protein content, the highest value being recorded in group 3E (Yea-Sacc).

Analyzing crude fat, significant differences were observed between group 3E (Yea-Sacc) and control group, respectively between group 2E (SelPlex) and group 3E (Yea-Sacc); the highest crude fat value was observed in experimental group 2E (31.75%), exceeding the control group (30.27%), whereas experimental group 3E had the lowest value (23.3%).

Crude ash content of Siberian sturgeon meat analysis revealed that no significant differences among all experimental groups were recorded. Overall, there is an improvement in meat quality as a result of the protein content increase and fat reduction in experimental groups 1E and 3E.

CONCLUSIONS

Administration of various bio-additives to Siberian sturgeon did not favorably influence the slaughter yield, the differences between experimental and control groups being insignificant.

The water content of Siberian sturgeon meat was lower in all 3 experimental groups compared to the control group.

Administration of bio-additives has led to an increase in the crude protein content of Siberian sturgeon meat in all three experimental groups compared to the control group. 3E Yea-Sacc group recorded very significant differences based on meat protein content analysis of 47.3%, 11% higher than the control group.

The highest crude fat value in Siberian sturgeon meat was observed in the experimental group 2E (SelPlex) (31.75%), exceeding the values recorded in the control group (30.27%), while the experimental group 3E (Yea-Sacc) has recorded the lowest value (23.3%).

Crude ash content of Siberian sturgeon meat analysis revealed that no significant differences among all experimental groups were recorded.

The results obtained demonstrate the beneficial effects of Actigen, Yea-Sacc-1026 bio-additives and organic selenium on the quality of Siberian sturgeon meat.

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