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Effect of Different Levels of Probiotic Primalac on Growth Performance and Survival Rate of Persian Sturgeon (*Acipenser persicus*)

Zoleykha Salaghi, Mohamadreza Imanpuor and Vahid Taghizadeh

Department of Fisheries,
Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran

Abstract: The effect of the probiotic Primalac (*Lactobacillus acidophilus*, *Lactobacillus casei*, *Enterococcus faecium* and *Bifidobacterium bifidium*) was investigated on growth performance and survival rate in Persian sturgeon juvenile. Three practical diets containing 0 (control), 0.05, 0.1 and 0.15% Probiotic Primalac were used to feed fish. 120 Persian sturgeon juvenile (14.676±0.813 g) were randomly distributed between 12 fiberglass tanks of 500 L capacity. During 105 days of feeding trial, the fish receiving Probiotic Primalac feeds showed significantly higher growth performance in terms of weight gain (WG), specific growth rate (SGR), protein efficiency ratio (PER), final weight (FW), body weight gain (BWG) and body weight increase (BWI) compared with those fed the control diet ($P<0.05$). No differences were observed for survival rate among the experimental diets ($P>0.05$). The results indicated that Probiotic Primalac could affect growth parameters in Persian Sturgeon juvenile ($P<0.05$). The differences in parameters were tested for significance by one-way analysis of variance (ANOVA) using SPSS 20.

Key words: Probiotic · Primalac · Persian Sturgeon · Growth Performance · Survival Rate

INTRODUCTION

Feed additive antibiotics have been used as growth promoters for > 50 years in the feed industry all over the world. Antibiotics induce their effect by stabilizing the intestinal microbial flora thereby preventing proliferation of specific intestinal pathogens [1].

The word probiotic is constructed from the Latin word pro (for) and the Greek word bios (life). The definition of a probiotic differs greatly depending on the source, but the first generally accepted definition was proposed as "a live microbial feed supplement which beneficially affects the host animal by improving its microbial balance" [2].

Although, the importance of probiotics in human and animal nutrition is widely recognized [3, 4], in recent years, the role of probiotics in nutrition and health of certain aquaculture species have also been investigated and subject of reviews [5-9].

Animal gut microflora consists of hundreds of different bacterial strains, Walker and Duffy [10] able to promote digestion and absorption of nutrients, to increase body resistance to infectious diseases [11], to yield positive effects on growth and to improve general animal welfare [12]. FAO has now designated the use of probiotics as a major means for the improvement of aquatic environmental quality [13].

Probiotics in aquaculture have been shown to have several modes of action:

competitive exclusion of pathogenic bacteria through the production of inhibitory compounds; improvement of water quality; enhancement of immune response of host species and enhancement of nutrition of host species through the production of supplemental digestive enzymes [6]. Because Bacillus bacteria secrete many exoenzymes [14], these bacteria have been used widely as putative probiotics.

Lactobacillus and *Bifidobacterium* are the most frequently genera used as probiotics [15] and different strains may affect their efficiency. Oral administration of *Lactobacilli* exerts a strong adjuvant activity, which is responsible for the enhanced host immune responses [16].

Corresponding Author: Zoleykha salaghi, Department of Fisheries,
Gorgan University of Agricultural Sciences and Natural Resources, Gorgan, Iran.

Different strains of *Lactobacillus* induce distinct mucosal cytokine profiles showing different intrinsic adjuvant capacity [17, 18].

The present study examined the effects of concentrations probiotic Primalac on growth and survival in Persian sturgeon juvenile (*Acipenser persicus*) by dietary feed.

MATERIALS AND METHODS

Probiotic Primalac Contains: *Lactobacillus acidophilus, Lactobacillus casei, Enterococcus faecium* and *Bifidobacterium bifidium*.

Persian sturgeon (*Acipenser persicus*) juvenile were obtained from the center of sturgeon culture of Marjani (Iran).

In this study, 120 Persian sturgeon (*Acipenser persicus*) 14.676±0.813 were fed with 3 level of Probiotic Primalac 0.05% (T1), 0.1% (T2) and 0.15% (T3)of the diet and control treatment(without any Probiotic Primalac) for 15 week (Table1). Ingredient and proximate composition of the diets are given in Table 1. Kilka fish meal was used as the protein source. wheat flour was used as dietary carbohydrate. Fish oil and soybean oil were used as the lipid sources. Four experimental diets (Table 1) were formulated to test the influence of Raftifeed IPS on the growth performance of the fish. All dry ingredients were mixed thoroughly for 30 min in a food mixer. Then oil was added in the diets and the ingredients were mixed again for 10 min and the pressure-pelleted dried in outdoor. The prepared diets were packed in separate plastic bags and stored at -4 °C until used. Fish stocked in the experimental fiberglass tanks (0.5m³) for 1 week before the beginning of the experimental regime, in order to condition the fish to the laboratory system and handling procedures.

During the acclimatization period the fish were fed a commercial feed containing 37% protein. Juvenile belugas (an average body weight as group 14.676±0.813 g) were randomly allocated to 12 tanks, with 10 fish in each tank, with three replicates per diet. The tanks were connected to continuous circulating system. Continuous aeration was provided to each tank through air stone connected to a central air compressor. During the trial, the fish were hand-fed to apparent satiation 3 times daily (9, 13 and 16 h). The daily weight of feed consumed by the fish in each tank was recorded at the end of each day. Water quality parameters such as dissolved oxygen (4.55±0.95 mg/l), temperature 25.45±1.28 °C), pH value (8.2±0.28) and salinity (1.52±0.50 g/l) were measured every day during the entire experimental period. Fish in each tank were weighed once every 2 weeks and counted to record growth and determine the daily ration. The feeding trial was carried out for 15 weeks.

The following variables were calculated according to Kofi *et al.* and Bekcan *et al.* [19, 20].

Specific growth rate (SGR % d^{-1}) = (Ln Wt -Ln W0)×100/t

Weight gain (WG%) = (Wt - W0) × 100/W0
Feed conversion ratio (FCR) = Wet weight gain in g/dry feed fed in g
Survival rate = 100 × (Nt /N0)
Body Weight Gain (BEG) = (Wt- W0) × N
Body Weight Increase (BWI) = Wt- W0
Protein Efficiency Ratio = g live weight gain / g protein intake in fish

The normality and homogeneity of data were explored by examining the residual plots. The data were subjected to one-way analysis of variance (ANOVA) and if

Table 1: Composition of test diets in the 15 weeks feeding trial.

Ingredients	Control	T1	T2	T3
Kilka fish meal	53	53	53	53
Wheat flour	23	23	23	23
Probiotic Primalac	0	0.05	0.1	0.15
Soybean oil	9	9	9	9
Gelatin	7	7	7	7
Vitamin/Mineral	1.75	1.75	1.75	1.75
Anti-fungi	18	18	18	18
Lysine	1.5	1.5	1.5	1.5
Methionine	1.5	1.5	1.5	1.5

Vitamin/mineral premix contains (multivitamin and trace minerals per 500 g mixture): vitamin A, 1000 IU; vitamin D3, 3000 IU; vitamin E, 3 mg/kg; vitamin B1, 2 mg/kg; vitamin B2, 2 mg/kg; vitamin B6, 1 mg/kg; nicotinamid,15 mg/kg; calcium pentotenate, 5 mg/kg; vitamin K3, 2 mg/kg; Cu+2, 3 mg/kg; Fe+2, 12 mg/kg; Zn+2, 15 mg/kg; Mn+2, 25 mg/kg.

Anti-fungi: Toxiban premix (Component: Alomino silicate, zeolite, bentonate, propionate ammonium).

Table 2: Growth parameters of Persian sturgeon (*Acipenser persicus*) juvenilein experimental treatments (trial 1-3) and control

Performance indices	Control	T1	T2	T3
Initial Weight (g)	14.676 ± 0.813	14.676 ± 0.813	14.676 ± 0.813	14.676 ± 0.813
Final Weight (g)	145±0.203^{b}	165.426±0.16^{a,b}	166.176±0.638^{a,b}	176.666±0.449^{a}
BWI (g)	130.583±0.819^{b}	150.676±0.55^{a}	157.806±0.731^{a}	161.356±0.852^{a}
Weight Gain (%)	899.943±0.949^{b}	1024.636±0.875^{a,b}	1030.704±0.859^{a}	1101.926±0.152^{a}
SGR (%/day)	2.09±0.058^{b}	2.021±0.103^{a,b}	2.194±0.118^{a,b}	2.262±0.005^{a}
FCR	1.116±0.129^{a}	1.168±0.12^{a}	1.079±0.125^{a}	1.114±0.429^{a}
PER	28.078±0.27^{b}	31.902±0.316^{a}	33.413±0.453^{a}	34.164±0.392^{a}
Body Weight Gain	99.994±0.394^{b}	112.463±1.387^{a,b}	113.079±1.415^{a,b}	120.192±0.715^{a}
Survival Rate(%)	100^{a}	100^{a}	100^{a}	100^{a}

Groups with different alphabetic superscripts at the same row differ significantly at p<0.05 (ANOVA).

significant (P<0.05) differences were found, Duncan's multiple range test [21] was used to rank the groups using the SPSS (version 20). Relationships between some performance indices of fish and inclusion level of Probiotic Primalac were examined using multiple linear regression.

RESULTS

The results clearly showed that the Primalac had beneficial effects on the growth parameters in *Acipenser persicus* juvenile. The feeding and growth parameters of Persian sturgeon juvenile are presented in Table 2. All the probiotic treatments resulted in growth performance better than that of the controls (p<0.05). The three different treatments of probiotic were not statistically different for any of the growth parameters. However, among the three different concentrations of probiotic Primalac fed in Persian sturgeon juvenile, the greatest effect appeared to be obtained in treatments 3. This is particularly true for average of weight gain, where the highest was obtained in the experimental treatment of T3. There was no mortality in the experiment.

DISCUSSION

Since the first use of probiotics in aquaculture, a growing number of studies have demonstrated their ability to control potential pathogens and to increase the growth rates and welfare of farmed aquatic animals [22, 23].

The probiotics in this experiment promoted the feeding and growth parameters in Persian sturgeon juvenile in experimental treatments in comparison to control treatment. Effects of commercial probiotic on aquaculture has been investigated by many researchers and some of these researches have not shown any positive effects on growth parameters or survival rate or any promising result on the cultural condition. For example, Shariff *et al*. [24], found that treatment of *Penaeus monodon* with a commercial *Bacillus* probiotic did not significantly increase survival.

Results of all the probiotic treatments showed better growth performance and some of feeding parameters than the control. The beneficial effect of probiotic Primalac on the feeding efficiency of *Acipenser persicus* juvenile was completely observed. The results indicated that the probiotic Primalac had significant effects on the growth and feeding parameters in experimental treatments. The better body weight and SGR for weight and length were obtained in experimental treatments. Similar finding were observed by Faghani [25], in using Probiotic Primalac and Protexinon Common Carp (*Cyprinus carpio*), that improved the specific growth rate (SGR) and the Final weight were higher in the juveniles fed the experimental diet than in control while mortality and conversion ratio were lower.

Mohamed *et al.* [26], who recorded that all the diets containing different probiotic groups significantly (p<0.05) improved Nile tilapia growth and feed utilization compared to the control diet, when four probiotic groups, *Bacillus subtilis* NIOFSD017, *Lactobacillus plantarum* NIOFSD018, a mixture containing bacterial isolates (*B. subtilis* NIOFSD017 and *L. plantarum* NIOFSD018) and a yeast, *Saccharomyces cerevisiae* NIOFSD019, isolated from healthy Nile tilapia, *Oreochromis niloticus* was used a probiotic.

Bagheri *et al.* [27], found that supplementation of trout starter diet with the proper density of commercial bacillus probiotic could be beneficial for growth and survival of rainbow trout fry. Faramarzi *et al.* [28], showed that larvae fed the probiotic *Bacillus* spp. had increased final body weight and specific growth rate in comparison to control treatment. This finding agrees with our results.

CONCLUSION

This experiment demonstrated that the probiotic Primalac have the ability to improve the growth parameters in *Acipenser persicus* juveniles. Different concentrations of probiotic did not have statistically difference effects on the growth and feeding parameters in Persian sturgeon juveniles. Overall, probiotics can be useful in the improving the performance of juveniles of this species.

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