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Full Length Research Paper

The effect of different levels of prebiotic on the length of fingerling rainbow trout

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This work was carried out to evaluate the effect of different levels (0.0, 0.5, 1, 1.5 and 2 kg per ton) of prebiotics (yeast culture concentrate derived from the outer cell wall of *Saccharomyces cervisiae*) on the length trait of the fingerling rainbow trout. This experiment was conducted in split plot with complete randomize design (CRD) amid 500 rainbow trout (each 40 g). The length of fishes was recorded in four biometry periods (each for ten days). The result shows that the prebiotic intake had significant effect on fish length and treatment with 0.5 kg per ton showed better performance than others. Also, the results indicated that the best time for prebiotic intake was in the first biometry period. Generally, the result of this study suggested the use of prebiotic for improved health, production yield and economic profit in aquaculture industry.

Key words: Prebiotic, length, rain bow.

INTRODUCTION

Protein is an essential nutrient for growth and development of living organisms, including humans. Based on the recommendation of the Food and Agricultural Organization (FAO), each adult human should have an intake of one gram protein per kg body weight, but half of this should be obtained from animal resources (FAO, 2007). Meanwhile, fish can play a very important role in providing the main part of this source. However, the aquaculture industry has been developed to meet this need and it encounters many problems, such as widespread diseases and lack of quality feed, resulting in poor feed conservation and growth rate (Subasinghe, 1997; Fegan, 2001; Gaiotto, 2005). This is mainly caused by the farmers' attitude to embark on large-scale production without corresponding quality facilities, thus leading to stressful conditions, problems related to diseases and inadequate and unbalanced artificial diets, since the physiological stress is a primary factor of disease, poor growth and mortality in fish (Balcazar et al., 2004; El-Haroun et al., 2006; Rollo et al., 2006). In recent years, the principal aims of this study, which are increasing the growth or survival performance, feed efficiency and resistance to diseases, led to a positive effect of production costs (Gatlin, 2002). However, hormones, antibiotics, ionophers and some salt compounds have been used to achieve these goals (Gongora, 1998).

Functional additive, as prebiotics, is a new concept on aquaculture (Li and Gatlin, 2004). Prebiotic is a live microorganism food supplement which improves the microbial balance of the host intestinal flora (Fuller, 1992; Vine et al, 2006; Ziaei-Nejad et al, 2006) and shows a positive effect on growth caused by use of carbohydrates, protein, and energy (Moriarty, 1998; Skjermo and Vadstein, 1999; Chang and Liu, 2002; Irianto and Austin, 2002 a, b), thereby diminishing mortality by disease and antagonism to pathogen (Subasinghe, 1997; Moriarty, 1998; Holmström, 2003). However, the positive effect of prebiotics has been proven in poultry, cattle, sheep and adult fishes, but no study was conducted in low age fishes, though this is not certain.

The aim of this study was to determine the effect of prebiotic on the length of fingerling rainbow trout.

MATERIALS AND METHODS

Fish, rearing conditions and calculations

The experiment was carried out in the fish industry farm close to

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Table 1. Composition of FFT2 diet and prebiotic.

Experimental diet composition	Value
Crude protein percent	40
Digestible protein percent	37
Gross energy(Kcal/Kg)	4400
Digestible energy(Kcal/Kg)	3700
Ether extract percent	12
Crude fiber percent	4
A-max prebiotic composition (percent)	
Crude protein	25.77
Ether extract	3.44
Crude fiber	10.44
Ash	3.22
ADF	12.33
NDF	37
TDN	83.77

ADF, Acid detergent fiber; NDF, neutral detergent fiber; TDN, total digestible nutrients.

Tabriz, Iran at 2008 for 50 days. During the experiment, the physico-chemical parameters of water were tested weekly and were maintained on relatively constant optimal levels for rainbow trout to include water temperature (12 ± 0.35), content of dissolved oxygen in water (7.98 ± 0.29) and pH (7.84 ± 0.21). The biological material, which consisted of the rainbow trout fingerling, was obtained from the commercial farm in west Azerbaijan provenance with an average individual weight of 40 g. The experiment was carried out with complete random design in five levels of prebiotics (0, 0.5, 1, 1.5 and 2 kg per ton) as treatments. Each of the level was replicated four times in twenty tanks with a size of 1.30 × 1.30 × 0.8 m. Six liters of water were allowed into the tanks and kept for some minutes to provide enough oxygen for the fish. The biometric traits of the four periods were measured separately for 10 days.

Statistical analysis

The repeated measurements' analysis with the following model and MIX proc of SAS (9.1) software was used for data analysis (Gaiotto, 2005), while the Tukey mean separation test was used to determine the significant differences between the mean values of:

$$y_{i\,kl} = \mu + \sigma i_k + \beta_i + (\alpha\beta)_{kl} + \varepsilon_{i\,kl}$$

Where, $y_{i\,kl}$ = all dependent variables; μ = overall mean; α_k = effect of the experimental diet; β_i = effect of the biometric period; $(\alpha\beta)_{kl}$ = interaction of the experimental effect and period; and εi_{kl} = the random effect of the residual period.

Diet preparation

Experimental diets were formulated with five levels of prebiotic A-max (0.0, 0.5, 1, 1.5 and 2 kg/ton). The basal diet composition is shown in Table 1. Basal diet was obtained from Behsan Co, Tabriz, Iran.

RESULTS AND DISCUSSION

One of the most important parameters in the fish farming industry is measuring fish length and then fish grading (Balcazar et al., 2004). Today, quality along with quantity is considered in developed countries and producers used condition factor (weight*100/length^3) for fish quality evaluation. So, length assessment is a criterion index in fish production. Thus, the analysis of variance results in the biometry model with prebiotic and the time of biometry effects on the length trait of fish were significant ($p<0.0001$). However, the means of treatment groups and the time of biometry are shown in Tables 2 and 3.

Comparison of treatment with different levels of prebiotics showed that addition of prebiotics had a significant effect on fish length during the experimental period. However, all treatment groups with prebiotic and those with 2 kg per tons prebiotic had a significant difference with the control treatment. Thus, treatment with 0.5 kg per ton prebiotic was 32, 12.5, 0.21 and 27% higher in length than treatments with 0, 1, 1.5 and 2 kg per ton prebiotic, respectively (Table 2).

Comparison of the length means in different biometry periods (Table 3) also showed that consumption of prebiotics in the first period had better performance attainment than in the later periods. So, fish length in the first biometry period was indicated to be 10, 13.5 and 23% higher than that in the second, third and fourth biometry periods. Also, the length gain was assessed over the entire period of the experimental trials and the result is given in Table 4. The results show that there were

Table 2. Length means of different prebiotic groups in fingerling rainbow trout.

Treatment (kg per ton prebiotic)	Length (cm)
0 (control)	0.65[d]
0.5	0.856[a]
1	0.756[d]
1.5	0.709[bc]
2	0.672[cd]
SEM	0.025
P value	<.0001

Table 3. Length means of different biometry periods in fingerling rainbow trout.

Biometry	Length (cm)
First	0.808[a]
Second	0.735[b]
Third	0.713[b]
Fourth	0.660[c]
SEM	0.011
P value	<.0001

Table 4. Length means of different prebiotic groups in fingerling rainbow trout in the entire test period.

Treatment (kg per ton prebiotic)	Length (cm)
0 (control)	2.6[e]
0.5	3.42[a]
1	3.02[b]
1.5	2.84[c]
2	2.69[d]
SEM	0.008
P value	<0.0001

significant differences between the control group and groups with prebiotics. However, treatment with 0.5 kg of prebiotic had better performance than others.

Findings of this research are consistent with those of Assadi et al. (2009) which showed that 0.5, 1, 1.5 and 2 kg per ton of the *Saccharomyces cervisiae* yeast periodic supplement increased the length in the fingerling rainbow trout. The fish length is the best indicator of the production farm efficiency and therefore, in this study, it was investigated. The length increase of the rainbow trout upon the prebiotic consumption is not completely understood, but it seems that prebiotics improved the gastrointestinal microbial populations and then increases utilization of nutrients and protein anabolism as the length and weight gain occurs in fish. This study also showed that the best time of prebiotics treatments is in the first 15 days of the growing period. However, this period is among the main days in rainbow trout production.

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