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Original Article

Suitability and efficacy of potato as prebiotic compound on the growth performance of rohu (*Labeo rohita)*

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A B S T R A C T

This study was carried out to determine the suitability and efficacy of the growth performance and survival rate of rohu (*Labeo rohita*) for a period of 63 days in the Wet Laboratory at Department of Aquaculture, BAU, Mymensingh. Four treatments were considered having three replicates containing different percentage of prebiotic (potato) in the diet *viz.*T_1 (0%), T_2 (5%), T_3 (10%), T_4 (15%). Initial weights of 1.74 ± 0.0 g were released at rate 15 fingerlings per aquarium. The result showed that the best weight gain of 2.73 ± 0.40 g was observed in T_4. Weight gain (g), %weight gain and SGR (%per day) varied from 1.29 ± 0.25 to 2.73 ± 0.40; 74.32 ± 14.17 to 157.01 ± 22.77 and 0.38 ± 0.06 to 0.65 ± 0.06, respectively. Survival rate were 97.78 ± 2.22%, 100%, 100% and 100% in T_1, T_2, T_3 and T_4, respectively. Values of FCR, FCE and PER were varied from 2.12 ± 0.22 to 3.49 ± 0.47; 0.29 ± 0.04 to 0.48 ± 0.05, and 0.68 ± 0.09 to 1.09 ± 0.11, respectively. The highest FCR (3.49 ± 0.47) was found in T_1 and lowest FCR (2.12 ± 0.22) was found in T_2. The highest PER (1.09 ± 0.11) was found in T_2 and lowest PER (0.68 ± 0.09) was found in T_1. The research findings suggested that supplementation of 15% potato containing diet which could be chosen by fish feed manufacture and fish farmers.

Introduction

Aquaculture has sustained a global growth at present and is expected to increasingly fill the shortfall in aquatic food products. Aquaculture activity is considered as the only alternative for the development and improvement of fisheries resources and revitalization of ecosystems (Okechi, 2004). Bangladesh is one of the world's leading fish producing country and is currently ranked 5th position in global aquaculture production after China, India, Vietnam and Indonesia (FAO, 2018). The total fish production of Bangladesh in 2017-18 was 42.77 lakh MT, where aquaculture contributed 56.24% (DoF, 2019). This sector is contributing significantly in food security through providing quality animal protein and almost 60 percent animal protein comes from fish. Aquaculture is a promising sector of our economy. Its role is increasing in generating job opportunities and earning foreign exchange has been reported. Growing urbanization, globalization and rapid changing of social structures had a impact on the fisheries and aquaculture sector in Bangladesh. The rui (*Labeo rohita*) is one of the most valued fish in Indian major carp. Due to its deliciousness the meat of rui is liked very much by the people. It is accustomed to live with other fishes therefore it is suitable to reared in ponds and reservoirs. It gets 500 gram to 1 kilogram weight in the period of one year rearing. It is considered as the best in taste, flavor appearance and quality so it is sold at high price and priority in the markets.

Good nutrition in fish production systems is essential to economically produce a healthy, high quality product. Fish feed is the most expensive input in aquaculture operations because feed represents 50-60% of the production costs. Fish nutrition has advanced dramatically in recent years with the development of new, balanced commercial diets that promote optimal fish growth and health. The improvement of nutritional interventions supports the aquaculture industry sustainable, economical and nutritious finfish and shellfish production.

Normally, a supplementary feed contributes often cheaper carbohydrate rich components. Prebiotics are compounds in food that induce the growth or activity of beneficial microorganisms such as bacteria and fungi (Hutkins *et al.*, 2016). The most common example is in the gastrointestinal tract, where prebiotics can alter the composition of organisms in the gut microbiome. They can feed the intestinal microbiota,

and their degradation products are short-chain fatty acids that are released into blood circulation, consequently, affecting not only the gastrointestinal tracts but also other distant organs. Prebiotics are non-digestible carbohydrates that are not absorbed in the intestine, such as RS (Resistance starch). RS is not absorbed in the small intestine; it provides the colonic microbiota with a fermentable carbohydrate substrate. It has been suggested that RS promotes a higher proportion of butyric acid than other indigestible carbohydrates. Butyrate constitutes a major energy substrate for the colonocytes and is associated with benefits in relation to colonic health (Leeman *et al.*, 2006). They travel to the colon where they promote the growth of specific advantageous microbiota by supplying food, while simultaneously influencing the microbiota's gene expression. Beneficial effect of prebiotics in fish include improved growth rate, feed efficiency, feed digestibility, survival, immunological status and resistance to bacterial and viral diseases, mainly due to modulation of the intestinal microbiota (Merrifield *et al.*, 2010; Dimitroglou *et al.*, 2011). Potato is best known for its carbohydrate content (approximately 26 grams in a medium potato). A raw potato is 79% water, 17% carbohydrates (88% is starch), 2% protein, and contains negligible fat. In an amount measuring 100 grams raw potato provides 322 kilojoules (77 kilocalories) of energy and is a rich source of vitamin B6 and vitamin C (23% and 24% of the Daily Value, respectively), with no other vitamins or minerals in significant amount. When a potato is baked, its contents of vitamin B6 and vitamin C decline notably, while there is little significant change in the amount of other nutrients.

A healthy, fiber-filled diet is paramount to a robust immune system and great health. As a prebiotic supplement, potato starch can play an important role in maintaining healthy levels of beneficial gut microbes. Raw potato starch is 60-80% resistant starch and is cheap, readily available, and easily made at home from raw potatoes. As such, it holds great potential to aid people in their efforts to obtain the benefits of prebiotics. The term potato as prebiotic compound is used to increase the fish production by enhancing growth rate of fish. It is very essential for improving FCR, reduction of mortality and to enhance digestion rate. Therefore the present study was designed to evaluate the suitability and efficacy of potato as prebiotic compound on the growth performance and survival rate of *L. rohita.*

Materials and methods

Experimental site

The study was conducted in 12 (twelve) experimental aquariums each having 0.61×0.30×0.30 m^3, of which were setup in the Wet Lab of Department of Aquaculture in the Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh.

Experimental design

The study was carried out for 63 days from 18 September to 19 November, 2017. The aquariums were equal in size and similar in shape, depth, and pattern type including water supply facilities. Twelve aquariums of 60L capacity containing 50L water were used for the experiment. All aquariums were placed in a row to facilitate better observation and accessibility and aerated for proper oxygenation. Tap water was added time to time to maintain the water level same all the time. In this experiment there were four treatments T_1, T_2, T_3, T_4 and each treatment conducted with three replications R_1, R_2 and R_3. For convenience, the tanks were marked as T_1R_1, T_1R_2, T_1R_3, T_2R_1, T_2R_2, T_2R_3, T_3R_1, T_3R_2, T_3R_3, T_4R_1, T_4R_2 and T_4R_3.

Sources of fry and acclimatization

Fry of rohu (*Labeo rohita*) were collected from the Sharnolota Agro Fisheries, Fulbaria, Mymensingh. Transportation of fry to the laboratory was accomplished in oxygenated plastic bag with great care to avoid stress and injury. During the period of acclimatization, adequate oxygen supply was maintained and fish were fed provita feed twice daily at 9.00 am and 5.00 pm.

Maintenance of fish and aquariums

The tanks were covered with netted to prevent the fish jumping or predatory animals attack. The fry of *L. rohita* was allocated at a rate of 15 fish per tank. The fish was fed with formulated diet as per design. The uneaten feed and faeces was removed daily by siphoning.

Feed formulation

The basal experimental diets were formulated with the commonly available ingredients are presented in Table 1. The selected ingredients for this experiment fish meal, rice bran, wheat bran, molasses, carboxy methyl cellulose, potato, chromic oxide and vitamin-mineral premix were purchased from local market of Mymensingh. The proximate compositions of the commonly available igredients in the experimental diets are presented in Table 2 and the proximate compositions of the formulated diet are presented in Table 3. Four graded levels of potato 0%, 5%, 10% and 15% were included in the basal diet. The ingredients were ground, weighed, mixed, making dough of feed ingredients and pelleted with meat mincer through a 0.5 mm diameter. After pelleting, the feed were air dried and put in an air-tight container and stored at -20°C until fed.

Table 1. Formulation of the basal diet (dry matter basis).

Ingredients	T_1 (%)	T_2 (%)	T_3 (%)	T_4 (%)
Fish Meal	30	30	30	30
Rice bran	30	25	20	15
Potato	0	5	10	15
SBM	20	20	20	20
MOC	12	12	12	12
Molasses	5.5	5.5	5.5	5.5
Vitamin premix	1	1	1	1
Mineral premix	1	1	1	1
Chromic oxide	0.5	0.5	0.5	0.5
Total	100	100	100	100

Proximate composition analysis

Proximate composition of different feed ingredients and prepared feeds were analyzed in the Fish Nutrition Laboratory, Department of Aquaculture, BAU following Association of Officials Analytical Chemists (AOAC, 2000) method.

Table 2. Proximate composition of formulated diet (dry basis).

Diet	Moisture (%)	Crude Lipid (%)	Crude protein (%)	Ash (%)	Crude fiber (%)	NFE
Treatment 1	12.15	8.90	37.39	15.69	4.40	21.47
Treatment 2	12.05	8.20	38.41	15.12	5.20	21.02
Treatment 3	12.79	8.20	38.74	16.99	4.60	18.68
Treatment 4	12.53	7.88	38.66	14.77	5.65	18.72

Analytical method

Moisture

Moisture content was determined in triplicate by placing an accurately weighed amount (about 2-3 g ground sample in a pre-weighed porcelain crucible in a hot air oven (Gallenkamp, HOTBOX, Model OVB-305) at 105°C for 24hr until a constant weight was obtained. The loss of weight was calculated as percent moisture content.

$$\text{Moisture (\%)} = \frac{\text{Original sample weight (g)} - \text{Dried sample weight (g)}}{\text{Original sample weight (g)}} \times 100$$

Ash

Ash content of the sample was determined by burning sample about 2 g in a muffle furnace (Philip Harris Ltd, England), for 6 hours at a temperature of 550°C. After cooling, the crucible was weighed again. The ash content was calculated and expressed as percentage of the original sample. Ash content was determined by using the following formula:

$$\text{Ash content (\%)} = \frac{\text{Weight of ash (g)}}{\text{Weight of sample (g)}} \times 100$$

Crude protein

Crude protein was determined indirectly by measuring total nitrogen content by standard kjeldahl method. Known quantities of sample (0.5 g), catalyst mixture (1.1 g) and concentrated H_2SO_4 (10ml) were taken in a kjeldahl flask and were digested in digestion unit (digestor, Model-2020) for 45 min to obtain a clear solution. The solution was then distilled in distillation unit (kjeldahl system, Distilling unit, Model-1026) using 33% sodium thiosulphate ($Na_2S_2O_3$), 40% sodium hydroxide (NaOH) and 40% boric acid solution and was titrated with standard hydrochloric acid (HCl). The percentage of total nitrogen was multiplied by the empirical factor of 6.25 or 5.87 assuming that protein contains.

$$\text{\% Nitrogen} = \frac{\text{Milliequivalent of nitrogen (0.014)} \times \text{titrant value (ml)} \times \text{strength of HCL}}{\text{Sample weight (g)}} \times 100$$

Crude protein (%) = 6.25 × % Nitrogen, for animal source
Crude protein (%) = 5.87 × % Nitrogen, for plant source

Crude lipid

Crude lipid content was determined by extracting the weighed sample in acetone for 6 hours in a Soxhlet apparatus (Quickfit, 40/38). The collected oil was transferred in a small pre-weighed beaker and kept in oven for 20 minutes to evaporate the acetone. Oil in the beaker was weighed in the electric balance and the percentage of total lipid was calculated using the following formula:

$$\text{Crude lipid (\%)} = \frac{\text{Weight of lipid (g)}}{\text{Weight of sample (g)}} \times 100$$

Crude fibre

A small amount of finely ground sample (0.5 g) was taken into a filter crucible, and inserted into the hot extraction unit (Hot extractor, Model 1017). About 150 ml of pre-heated 0.128M H_2SO_4 was added into the reagent heating cylinder and 2-3 drops of N-octanol, an anti-foaming agent was added and digested for 30 minutes. Acid were then removed by vacuum filtering followed by washing with boiling water. The residue in the flask was boiled with required amount of 0.223M KOH for 30 minutes and then filtered with subsequent washing in boiling water. Washed sample was then taken out from extractor along with filter and washed with 25 ml acetone. The residual sample was air dried at 105°C overnight and ignited in muffle furnace at 550°C for 6 hours. The loss in weight represented the crude fibre and was calculated by using the following formula:

$$\text{Crude fibre (\%)} = \frac{\text{Wt of sample after air drying (g)} - \text{Wt. of sample after ashing (g)}}{\text{Sample weight (g)}} \times 100$$

Growth Performance

Weight gain

Weight gained refers to as the difference between final weight and initial weight. Initial wt. and final wt. were measured by digital balance and were calculated by using the following formula:

Weight gain (g) = Mean final weight (g) – Mean initial weight (g)

Percent weight gain

Percent weight gain (%) = $(W_2 - W_1 / W_1) \times 100$

Where,

W_1 = the mean initial fish weight

W_2 = the mean final fish weight

Specific growth rate (SGR)

The SGR is the immediate change in weight of fish calculated as the percentage increase in body weight per day over given time interval. Growth in terms of weight was calculated by subtracting the initial weight of fish (at the time of release) from final weight of the same after. The SGR was determined by following formula:

$$\text{Specific growth rate (\%/day)} = \frac{\text{Ln } W_2 - \text{Ln } W_1}{T_2 - T_1} \times 100$$

Where,

W_1= Initial live body weight (g) at time T_1

W_2= Final live body weight (g) at time T_2

T_2-T_1= No. of days of the experiment

Feed Conversion Ratio (FCR)

The FCR is defined as the amount of dry fed per unit live weight gain. For calculation of FCR, the dry weight of the feed is obtained by using a correction for analyzed moisture content of the diet. FCR is a measure of degree of gross utilization of feed for growth. It was calculated as follows:

$$\text{Feed Conversion Ratio (FCR)} = \frac{\text{Feed fed (dry weight)}}{\text{Live weight gain (g)}}$$

Feed Conversion Efficiency (FCE)

FCE has no units and this time the higher the value the better the feed utilization. It was calculated as follows:

$$\text{Feed Conversion Efficiency (FCE)} = \frac{\text{Live weight gain (g)}}{\text{Feed fed (dry weight)}}$$

Protein Efficiency Ratio (PER)

PER is defined as the gain in weight of fish per gram of crude protein fed. PER gives an indication of the efficiency of the utilization of dietary protein. PER does not allow for the fact that weight gain may also be due to change in carcass lipid and moisture content rather than protein. It was calculated as follows:

$$\text{Protein Efficiency Ratio (PER)} = \frac{\text{Live weight gain (g)}}{\text{Crude protein fed (g)}}$$

Nitrogen free extracts (NFE)

NFE was calculated by subtracting the sum of the percentage contents of moisture, crude protein, lipid, ash, and crude

fibre from 100 (Castell and Tiews, 1980). It is a soluble carbohydrate and was calculated by using the following formula:

NFE (%) = {100-(moisture + crude protein + crude lipid + ash + crude fibre)}

Survival Rate

In each treatment survival rate of fry was estimated on the basis of number of fish remained at the end of the experiment in relation to the number stocked. Survival rate of fish was calculated by counting the actual number of fish survived divided by initial number of stocked fish and multiplying by 100. So the equation of survival rate calculation is as follows:

$$\text{Survival rate (\%)} = \frac{\text{Total number of fish harvested}}{\text{Total number of fish stocked}} \times 100$$

Experimental procedure

Feeding was done twice daily at 9.00 am and 5.00 pm at the rate of 5% of the body weight throughout the study period. About 30% water was changed daily at 9.00 am. Initial and final weight of fish in each aquarium was recorded. Fish weight was measured at every seven days interval to keep record. Fish were caught by used a fine mesh scoop net and excess water then removed from fish body gently by using a blotting paper before weighing to the digital balance. After weighing the fingerlings were released in the aquarium.

Estimation of growth performance

At the end of the experiment the growth performance of *L. rohita* in terms of weight (g), percent weight gain (%), specific growth rate (%/day), Fed Conversion Ratio (FCR), Feed Conversion Efficiency (FCE) and Protein Efficiency Ratio (PER) were calculated.

Water quality parameters

Fish is a poikilothermic animal. The good water quality is very essential for fish. The water quality parameters such as water temperature, dissolved oxygen (DO), pH were monitored weekly throughout the study period to evaluate the environmental quality of aquarium.

Temperature

Water temperature (°C) of the aquaria was measured with the help of a celsius thermometer (TL8009A).

Dissolved oxygen

Dissolved oxygen (mg/L) of the water was measured weekly by using an oxygen meter (Oxymeter WTW, Multi 340i).

pH

Electronic pH meter was used to measure the pH of water.

Statistical analysis

The collected data were subjected to a one way analysis of variance (ANOVA) by Microsoft Excel and XL-Stat (version 2013). The level of significance was set at $p<0.05$ to see whether the influence of different treatments on these parameters were significant or not. The means of different treatment were compared by Duncan Multiple Range Test (Duncan, 1955) to test the significance of variation between the treatment means.

Results

Physicochemical parameters of the aquarium water

Environmental parameters play an important role in fish production. The water quality parameters were recorded weekly through the experimental period. Temperature (ºC), dissolved oxygen (mg/L), pH, alkalinity (ppm) and ammonia (mg/L) were ranged 28.95 to 30.61,7.06 to 7.36, 7.25 to 7.59, 198.59 to 201.41, 0.18 to 0.24, respectively. In every treatment throughout the experiment they were within the limit of congenial for the growth of fish.

Table 3. Water quality parameters during the study period.

Water quality parameters	Value range
Temperature (ºC)	29.78 ± 0.83
Dissolved oxygen (mg/l)	7.21 ± 0.15
pH	7.42 ± 0.17
Alkalinity (ppm)	200 ± 1.41
Ammonia (mg/l)	0.21 ± 0.03

Growth performance of fish

Growth performance of *L. rohita* in terms of final weight gain (g), weight gain (g), percent weight gain (g), specific growth rate (SGR% per day) and survival rate under different treatments for a period of 63 days is presented in Table 4.

Weight gain (g)

There was no significant ($p<0.05$) difference in initial weight 1.74±00 g of fish under four the treatments. The mean weight gain of fish at the end of the experiment were 1.29 ± 0.25; 2.59 ± 0.31; 1.96 ± 0.23 and 2.73 ± 0.40 g in T_1, T_2, T_3 and T_4, respectively. Weight gains in the four treatments were significantly different each other. In this experiment, it was observed that highest final weight gain (2.73 ± 0.40 g) was recorded in T_4 (Table 4). This result showed the positive prebiotic correlation compound used in formulated feed.

Percent weight gain

The percent weight gain of *L. rohita* fry were 74.32% ± 14.17, 149.04% ± 17.55, 112.45% ± 13.23 and 157.01% ± 22.77 in T_1, T_2, T_3 and T_4, respectively (Table 4). The significantly highest percent weight gain value was recorded in T_4 (Table 4).

Specific Growth Rate (SGR)

The mean specific growth rates (%/day) of *L. rohita* fry were 0.38 ± 0.06, 0.63 ± 0.05, 0.52 ± 0.05 and 0.65 ± 0.06 in T_1, T_2, T_3, T_4, respectively (Table 4). The significantly highest SGR value was recorded in T_4 (Table 4).

Food conversion ratio (FCR)

FCR in different treatments ranged from 2.12 ± 0.22 to 3.49 ± 0.47 (Table 4). The highest FCR was obtained in T_1 and lowest FCR was obtained in T_2 (Table 4).

Food conversion efficiency (FCE) and Protein efficiency ratio (PER)

FCE in different treatments ranged from 0.29 ± 0.04 to 0.48 ± 0.05 (Table 4). The highest FCE was obtained in T_2 and lowest FCE was obtained in T_1 (Table 4). PER in different treatments varied from 0.68 ± 0.09 to 1.09 ± 0.11 (Table 4).The significantly highest PER was found in T_2 and lowest was in T_1 (Table 4). The FCE, PER results indicated that supplementing diets with the prebiotics significantly improved protein utilization in *L. rohita*.

Survival rate

Survival rate is an important indicator for fish production. The survival rate at T_1 was found 97.78% ± 22, But 100% survival rate were observed in prebiotic treated group T_2, T_3 and T_4 (Table 4).

Table 4. Growth performances of *L. rohita* fry observed in different treatment during the study period.

Variable parameters	T_1	T_2	T_3	T_4
Initial weight (g)	1.74 ± 00	1.74 ± 00	1.74 ± 00	1.74 ± 00
Final weight (g)	3.03 ± 0.25	4.33 ± 0.31	3.70 ± 0.23	4.47 ± 0.40
Weight gain (g)	1.29^a ± 0.25	2.59^b ± 0.31	1.96^a ± 0.23	2.73^b ± 0.40
% Weight gain	74.32^a ± 14.17	149^b ± 17.55	112.45^a ± 13.23	157.01^b ± 22.77
SGR (%/day)	0.38^a ± 0.06	0.63^b ± 0.05	0.52^a ± 0.05	0.65^b ± 0.06
FCR	3.49^a ± 0.47	2.12^b ± 0.22	2.61^b ± 0.20	2.15^b ± 0.15
FCE	0.29^a ± 0.04	0.48^b ± 0.05	0.38^a ± 0.03	0.47^b ± 0.04
PER	0.68^a ± 0.09	1.09^b ± 0.11	0.87^a ± 0.07	1.06^b ± 0.07
Survival rate (%)	97.78^a ± 2.22	100^b ± 00	100^b ± 00	100^b ± 00

Values are means ± SD. Different letters show significant differences among different treatments (p<0.05). The mean difference is significant at the 0.05 level.

Discussion

The effects of prebiotic on survival rate and fish growth performance of *L. rohita* were observed in the present study in laboratory condition. Fish stocked with different ratio of prebiotic (potato powder) showed different survival rate and growth performance during the experiment. For this study fifteen *L. rohita* fry were stocked per aquarium. In the present experiment fingerlings were stocked at densities of 15fry/ft^3. Rahman *et al.* (2008) found that catfish fingerlings were stocked at densities of 60, 70, 80, 90, 100, 110, 120, 130, 140 and 150 fish/m^3 in cage culture, which is higher than the stock of the present experiment.

The weight gain (g) of fishes were 1.29 ± 0.25, 2.59 ± 0.31, 1.95 ± 0.23, and 2.73 ± 0.40; percent weight gain (g) were 74.32 ± 14.17, 149.04 ± 17.55, 112.45 ± 13.23 and 157.01 ± 22.77; SGR (% per day) were 0.38 ±.06, 0.63 ± 0.05, 0.52 ± 0.05 and 0.65 ± 0.06 in T_1, T_2, T_3 and T_4, respectively were recorded in this study. The highest and lowest value of weight gain (g), percent weight gain and SGR (% per day) were found at T_4 and T_1, respectively. This result showed the positive prebiotic correlation compound used in formulated feed. Ali and Salim (2004) noted that *Labeo rohita* gained 2.63 ± 0.45g body weights on sunflower meal, which was higher than the weight gained by hybrids (1.62 ± 0.05). Sahzadi *et al*. (2006) observed better growth in hybrid (*Catla catla* × *Labeo rohita*) on sunflower meal (1.62 ± 0.0 g) than cotton seed meal (1.61±0.01 g) and bone meal (1.52 ± 0.0 g). Eidelsburger and Kirchgessner (1994) reported that calcium format alone or in combination with other acids when given at the rate of 0.5 and 1.5 %, increased FCR and growth performance up to 35 days of age. Benedetto (2003) also observed mix of organic acids (ACIDLAC) used as a replacer of growth promoters (AGPs) and improved production performance along with other beneficial effects. Mairoka *et al.* (2004) also reported that mixture of organic acids can be effectively used as a substitution of antibiotic growth promoters (AGPs) for improved physiological performance. Stanley *et al.,* (2004) found same type of effect with supplementation of 0.1 % MOS on body weight gain.

The mean survival rate for *L. rohita* in the present study was 97.78% ± 2.22 at T_1, but 100% survival rate at prebiotic treated group (T_2, T_3 and T_4). Keramat (2015) reported that the addition of 1 g kg^{-1} immunogen as a prebiotic improves growth performance and survival rate of *Rutilus kutum*. These are similar to results of Li and Gatlin (2005), Staykov *et al*. (2007), and Mohajer *et al.,* (2010), who observed higher feed efficiencies in hybrid striped bass, rainbow trout, and *H. huso* fed Grobiotic® prebiotic, mannan-oligosacchraide, and immunogen, respectively.

The feed conversion ratio (FCR) was recorded in this experiment were 3.49 ± 0.47, 2.12 ± 0.22, 2.61 ± 0.20 and 2.15 ± 0.15 in T_1, T_2, T_3 and T_4, respectively. The highest and lowest FCR value was recorded in T_1 and T_2, respectively. The food conversion efficiency (FCE) in T_1, T_2, T_3 and T_4 were 0.29 ± 0.04, 0.48 ± 0.05, 0.38 ± 0.03 and 0.57 ± 0.04, respectively. The highest and lowest FCE value was recorded in T_2 and T_1, respectively. Azimuddin (1998) investigated FCR from 1.73 to 2.04 in three months formulated feed feeding trial near the fisheries faculty building in Bangladesh Agricultural University, Mymensingh, which is higher than the value of present experiment. The reason of result variation might be species difference. Sahzadi *et al.* (2006) observed comparatively higher FCR on sunflower meal (1.78±0.05) than cottonseed meal (2.17 ± 0.01) in hybrid (*Catla catla* × *Labeo rohita*). FCR for sunflower meal (7.61 ± 0.45) was higher than for rice polish (8.16 ± 0.12) fed fish.

The protein efficiency ratio (PER) was recorded in this experiment were 0.68 ± 0.09, 1.09 ± 0.11, 0.87 ± 0.07 and 1.06 ± 0.07 in T_1, T_2, T_3 and T_4, respectively. The highest and lowest PER value was recorded in T_2 and T_1, respectively. The FCR, FCE, PER results indicated that supplementing diets with the prebiotics significantly improved protein utilization in *L. rohita*. Lara-Flores *et al.,* (2003) shown that the same results in which the addition of prebiotics improved feed utilization in practical terms. This means that prebiotic used can decrease the amount of feed necessary for animal growth which could result in production cost reduction.

Conclusion

The results of the present study demonstrated that prebiotic treated fish has high growth in comparison with none treated. The best results of survival rate, feed efficiency and growth performance were found at 15% potato supplementation (T_4) in feed. Dietary supplementation of different feed additives e.g. prebiotics usually in small quantities have been found to improve feed efficiency and growth performance of fishes. So, prebiotic used as alternatives to growth promoters but their combination strategy can be used to achieve good health and growth performance.

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