



ISSN 2347-2677

IJFBS 2017; 4(4): 01-03

Received: 01-05-2017

Accepted: 02-06-2017

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Effect of soybean incorporated diets on the performance of *Schizothorax curvifrons*

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Abstract

Due to the anthropogenic activities, the native fish species of Kashmir Schizothoracine is being declining day by day. Therefore an attempt has been made to culture the fish on artificial diets and evaluate the effects of artificial diet on the growth and feed conversion ratio. In the experiment, a total of 75 fishes were equally divided into five groups. A twelve week feeding trail was carried out in floating cages (1×1×1m), in five groups to evaluate the use of soybean as a dietary protein source for *Schizothorax curvifrons*. Soybean was incorporated at 0, 20, 30, 40 and 50% of total feed. Each dietary treatment was tested in five groups of fishes each group having 15 fish. Fish were fed daily at the rate of 1.5% of body weight. Percentage weight gain, specific growth rate (SGR), survival and feed conversion ratio (FCR) in fish fed diet with 20% and 30% substitution of dietary feed by soybean were significant ($P < 0.05$). No significant differences ($P > 0.05$) were observed in fish fed by 40% and 50% soybean meal. The results showed that soybean can be incorporated in diet of *Schizothorax curvifrons* up to 30% with no adverse effects on growth, survival and feed conversion ratio.

Keywords: Biomass; Growth rate; *Schizothorax*; Soybean; Survival rate

1. Introduction

Schizothorax curvifrons is a native fish of Kashmir valley commonly known as "Satter gad". It is very important fish species because of its survival and propagation under farm conditions, feed conversion ratio and high market value. The food of *Schizothorax curvifrons* mainly includes zooplankton and aquatic macrophytes as well as weeds that grow in lakes, streams and rivers.

Rapid development of global aquaculture has resulted in increased production of aqua feed which traditionally relies on fish meal as a main source [1]. However, fish meal is becoming limited due to increasing demand and decreasing marine fishery resources. Therefore alternative proteins have been studied by many fish nutritionists and feed industry [1]. However, plant protein inclusion has normally been limited due to deficiencies in essential amino acids, anti-nutrient factors and poor palatability [2]. Soybean meal is considered to be one of the most suitable alternative ingredients for replacing fish meal in commercial fish diets [3], because of high protein content, high digestibility, relatively well balanced amino acid profile, reasonable price and ready supply of soybean. Soybean meals are widely used as the most cost-effective alternative for high quality fish meal in feeds for many aquaculture animals [4]. However, soybean protein products contain several compounds that may interfere with the digestive process in fish [5]. Therefore suitable concentration of soybean can be incorporated in fish feed. Pervious workers used soybean as alternative to fish meal in the diets for cobia [6, 7]. The objectives of the present study were to evaluate growth performance of *Schizothorax curvifrons* fed different diets in which fish meal was gradually replaced by soybean.

2. Materials and methods

2.1. Diet formulation

Diet was prepared through square method. Diet is made up of mustard cake, soya meal, rice bran, fish meal and starch. The ingredients were dried and grinded to powder form. The proximate composition of ingredients is shown in the table I. Five experimental diets of different soybean concentration were formulated (Table II) for experimental trails. All the ingredients were mixed thoroughly in Hobert-type mixer in which water and lipid were added. 4-5 mm diameter pellets were made and then sealed in vacuum packed bags and stored at -20 °C until feeding.

Table I: Proximate composition of feed ingredients (dry bases)

Name of ingredient	Moisture (%)	Crude protein (%)	Fat (%)	Carbohydrate (%)	Nitrogen free extract (%)	Ash (%)
Soybean	11.3	47.8	22.2	10.7	3.5	4.5
Fish meal	10.02	61.20	22.62	0.65	1.19	4.32
Mustard oil cake	11.50	27.00	29.15	11.48	24.87	16.60
Rice Bran	10.90	10.80	20.6	15	37.35	5.35

Table II: Composition of ingredients in the experimental diets

S.NO	Ingredients	Diets in %				
		A	B	C	D	E
1	Soybean	0	20.00	30.00	40.00	50.00
2	Fishmeal	55.00	35.00	25.00	15.00	05.00
3	Wheat	14.00	14.00	14.00	14.00	14.00
4	Maize	8.00	8.00	8.00	8.00	8.00
5	Mustard oil cake	10.00	10.00	10.00	10.00	10.00
6	Rice polishing	10.00	10.00	10.00	10.00	10.00
7	Vitamins& minerals	3.00	3.00	3.00	3.00	3.00

2.2. Collection of fishes: Collection of fishes

Fingerlings of *Schizothorax curvifrons* were collected from fish seed hatchery Srinagar. They were transferred to operational site in oxygen bags. During early period the fingerlings were fed to commercial diets to acclimatize. After acclimatization they were transferred to operational site at Berwa Budgam Srinagar. A total of 75 fishes with initial mean body weight ($51.58 \pm 2.3g$) were stocked into five cages with 15 fishes per cage. The cages made by plastic profile in $1 \times 1 \times 1m$ and encircled with knotless net with 2cm mesh size were settled in same channel type pond with 80cm deep. Water temperature was $10-16^\circ c$ and pH was 7.33-7.37.

2.3. Feeding Trial

Five diets used in the experiment with soybean 0%, 20%, 30%, 40% and 50% and fish meal was 55%, 35%, 25%, 15% and 5% in diets A, B, C, D and E respectively. The trial continued for twelve weeks. The feed was applied at the rate of 4% body weight through out the experiment of three months. Fish was fed twice a day, at 8 o'clock in the morning and 6 o'clock in the evening.

2.4. Calculation of fish performance and statistical analysis

Feed conversion ratio (FCR) = Dry feed consumed (g)/wet weight gain (g)

Specific growth rate (SGR) = $\frac{FBW - \text{Initial body weight}}{\text{duration in days} \times 100}$

Where FBW = Final body weight

IBW = Initial body weight

Weight gain rate (WGR %) = $\frac{\text{Final mean weight} - \text{initial mean weight}}{\text{initial mean weight}}$

Survival rate = $\frac{\text{Final fish number}}{\text{initial fish number}} \times 100$.

Data was analyzed by one way analysis of variance (ANOVA) using SAS ANOVA procedure (SAS, 1987). The level of significance was chosen at $p < 0.05$ and results were presented as mean \pm standard error of the mean.

3. Results

All the fishes acclimatized slowly to the feed, the experimental diets. Table III summarizes the mean values of percentage weight gain, specific growth rate, survival rate and feed conversion efficiency of *Schizothorax curvifrons* fed experimental diets. Increased trend of weight gain percent was observed in trail diets containing soybean up to 30% and thereafter decreased again. The highest and the lowest weight gain percent was observed in 30% and 50% soybean diets respectively. Variation observed in weight gain % and weight gain per 90 days was highly significant ($P < 0.05$). Decreased specific growth rate was observed in all groups of fishes. However, significant difference ($P < 0.05$) was observed in diet C compared to other diets. Feed conversion ratio of the diet C appeared to be the best. Thus the combination of 30% soybean + 25% fish meal + 45% other ingredients has significantly improved food conversion. Significant difference ($P < 0.05$) between diets B-D and C-D was observed in the growth performance parameters indicating that soybean could be incorporated in fish diet up to 30% without causing any significant growth reduction and feed utilization. Survival rate of fish ranged from 80-93.33% being lowest in diet E. No significant difference ($P > 0.05$) in blood glucose was observed in fish fed on diets A, B and C. However significant difference ($P < 0.05$) was observed when C diet compared to diet D and E.

Table III: Mean and standard deviation of various parameters studied

Particulars	Diets				
	A	B	C	D	E
Average initial weight (g)	53.36	51.6	52.04	50.92	49.98
Average Final weight (g)	82.45	79.94	88.04 \pm	83.67 \pm	80.64 \pm
Weight gain (g)	29.09	28.34 \pm	36 \pm	32.75 \pm 5.03	30.66 \pm
FCR	31.43 \pm 7.29	20.61 \pm 6.02	18.64 \pm 5.23	28.93 \pm 6.23	49.21 \pm 7.83
SR%	70	66.6	76.66	73.34	73.34
SGR%/day	0.64 \pm 0.02	0.98 \pm 0.01	1.08 \pm 0.02	0.76 \pm 0.002	0.41 \pm 0.001

4. Discussion

Fishery products in the form of low-value trash fish or fish meal are presently the major sources of protein in grow out

culture of most fish species and constitutes up to 70% by weight of their diet. As the demand for fish meal and marine fishery products for aquaculture increases, their availability

decreases and the cost is expected to rise. Therefore dependable supplies of cost-effective non-marine, alternative sources to be profitable are needed. The results of the present study indicated that plant protein (soybean) could be incorporated in the diet of *Schizothorax curvifrons* up to 30% without affecting the growth performance. However increase in concentration of soybean beyond 30% decreases weight gain as also attributed by early authors [7-9]. The specific growth rate of fish in all treatments was found to be very poor, which might be due to low feed conversion ratio. However, highest specific growth rate (0.062) was found in diet C and lowest (0.025) in diet A. Poor performance of experimental diets containing high concentration of soybean could be attributed to partial digestibility of nitrogen containing compounds, decreased energy output, non-digestible oligosaccharides and antinutritional factors, similar to that described by early author [5]. In the present study diet C appeared to be the best diet because of efficient feed conversion ratio, high weight gain per cent, and specific growth rate. Increased concentration of soybean in diet D and E increased the value of feed conversion ratio. This might be due to decrease in food intake and indigestibility of proteins as soybean contains lactin which is a trypsin inhibitor and can lead to problems associated with growth and intestinal pathology [10-12]. Soybean also contains phytic acid which reduces protein digestibility as demonstrated in rainbow trout [13], in salmon [14]. Highest feed conversion ratio observed in diet A is attributed to high content of fish meal similar to growth performance of rainbow trout observed by early author [2]. Increased mortality of diet C and D fish may be attributed to high percentage of soybean which contains high concentration of alkaloids (oxidants). Data obtained in the present study confirms the results of several authors which showed that in Atlantic salmon and rain bow trout, soybean meal has been found to cause distinct morphological alterations in the intestine, in addition to impaired growth and feed utilization with increasing dietary level [15, 16].

5. Conclusion

In conclusion the present study demonstrated that soybean can be incorporated in *Schizothorax curvifrons* diet up to 30% without affecting the growth and survival of declining fish (*Schizothorax curvifrons*).

6. Acknowledgements

Authors are highly indebted to Dr Showket Ali Mir, Director JK Department of Fisheries for providing the pond and other necessary facilities.

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