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RESEARCH ARTICLE

EFFECT OF DIETARY PROTEIN LEVELS ON GROWTH PERFORMANCE AND FEED CONVERSION RATIO OF *Schizothorax plagiostomus*

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ABSTRACT

The effect of different dietary protein levels on growth and feed conversion ratio was studied in the *Schizothorax plagiostomus.* The fishes weighing 45-52g were reared in happas and fed on experimental diet. In this completely randomized designed experiment, five formulated diets of different dietary protein levels (25%, 30%, 35%, 40% & 45%) were tested. The fishes were fed by hand and fed at 5% of biomass. The results showed that dietary protein had significant effect on body weight, weight gain percent and specific growth rate. The body weight gain and specific growth rate of fishes fed with diet with dietary protein level of 35% was significantly higher (0.05) than that of 25%, 30%, 40% & 45%. The feed conversion ratio varied between 7.5 to 9.6 and was lowest in 35% dietary protein diet. Among the formulated diets evaluated in the present study, 35% dietary protein diet proved best considering the growth and feed conversion ratio of the fishes.

INTRODUCTION

Schizothorax plagiostomus Heckel,1838 (local name Khont gad) is a cold water loving, hill stream snow trout cyprinid fish and proves to be morphologically, meristically and economically most variable and valuable promising indigenous food fish of the paradise vale. Before 1956, the fish was plentiful and formed the chief food fish but now a days it is facing tough competition for its survival and its population in Kashmir valley is declining day-by-day due to multiple factors (Gopal and Zutshi, 2000). Snow trout showed drastic declines due to anthropogenic activities like introduction of exotics, damming, destruction of their habitats and overfishing, and are therefore assessed as vulnerable (Vishwanath 2010; Rafique, and Khan 2012; basado and mohan, 2012) and endangered (Jha and Rayamajhi 2009), respectively, in the IUCN Red List of Threatened Species, Version 2011. Exploited and declining fisheries created a new impetus to expand production through aquaculture (Goldburg and Naylor 2005; Naylor *et al.,* 2009).

Now a days attempts are being made for rearing, breeding and other culture techniques of schizothorax. For culture of any fish species Understanding feed, feeding and nutrition suitable for that fishery and aquaculture development is one of essential preconditions for successful aquaculture production. Feed accounts for 40-60% of the production costs in aquaculture, with protein sources accounting for a significant proportion of the cost (Umer and Ali, 2009). And Protein is the major and expensive dietary nutrient affecting performance of fish (Lovell, 1989). However, excess protein in fish diet may be wasteful and cause diets to be unnecessarily expensive (Ahmad, 2000). As the population of genus Schizothorax is declining day by day, there is a pressing need to culture the fish under controlled conditions to propagate the overall population of the fish. Not much is known about the nutritional protein requirements, artificial food and growth response of *S. plagiostomus* The present study has aimed to generate baseline data on optimum protein requirements of *S. plagiostomus* for optimum growth and feed conversion ratio.

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MATERIALS AND METHODS

A study was carried out from november 2010-may 2011, fishes were reared in five rearing happas at Beerwah fish rearing unit, Budgam, to determine the effect of dietary proteins on the growth and feed conversion ratio of *S. plagiostomus.* 46-52g of *S. plagiostomus* were obtained from natural sources and were transferred immediately at the rearing site, Beerwah Budgam and acclimatized to rearing site conditions for about one week. Fishes were reared in five happas and each happa was stocked with ten fishes with one replicate of each. Water quality parameters such as pH, temperature, dissolved oxygen and alkalinity were monitored weekly following methods of APHA. Five experimental diets viz D1, D2, D3, D4 & D5 containing different dietary protein levels i.e 25%, 30%, 35%, 40%, & 45% respectively were made by Pearson's Square Method (Table 1). The diets were processed by kitchen meat mincer. The spaghetti like feed were dried in the oven at 40°C and broken into pellets to desired size. The fishes were fed daily at 5% body weight. The fish sampling were done fortnightly. The individual body weight were recorded. Mortality was also recorded. The data on body weight, feed conversion ratio (FCR), specific growth rate (SGR) were analyzed using One-Way Analysis of Variance (ANOVA).

Growth performance of the experimental fishes was calculated as described by Diyaware et al., 2009:-

1. Weight gain = Final weight (g) – Initial weight (g).
2. Average daily weight gain = Weight gain (g)/Time (days).
3. Weight gain % = Mean final fish weight – Mean initial fish weight ×100/mean initial weight.
4. Specific growth rate (SGR) = ln final fish weight (g) – ln initial fish weight (g) × 100/time (days)
5. Food conversion ratio (FCR) = Diet fed (g)/Total weight gain (g)

RESULTS

Data on growth performance are reported in Table 2. At the end of experimental trial, Final body weight (FBW) and specific growth rate (SGR) ranged from 76.0 to 84.3g and 0.195 to0.285 day-1, respectively with the highest values in fish fed with 35% protein.

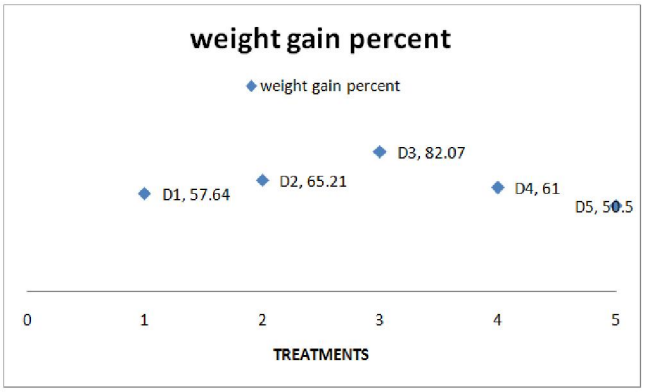
Table 1. Proportions of different ingredients of five experimental diets using Pearson's Square Method

Ingredients	Compositions (per 100g of feed).				
	D_1	D_2	D_3	D_4	D_5
1. Fish meal	12g	16.5g	21g	25.7g	30.3g
2. Soybean	12g	16.5g	21g	25.7g	30.3g
3. Mustard oil cake	12g	16.5g	21g	25.7g	30.3g
4. Rice bran	21g	16.5g	12g	7.3g	2.7g
5. Wheat bran	21g	16.5g	12g	7.3g	2.7g
6. Corn	21g	16.5g	12g	7.3g	2.7g
7. Vitamin & minerals	1.0g	1.0g	1.0g	1.0g	1.0g

Proximate composition of feed (%)

Parameters	D_1	D_2	D_3	D_4	D_5
Moisture	10.25	10.38	9.42	9.30	8.60
Protein	23.2	28.8	34.2	38.6	44.3
Lipid	6.45	6.81	7.46	6.36	6.84
Carbohydrates	45.39	39.90	33.80	28.34	21.66

The water quality parameters monitored were with the tolerable limits for *S.plagiostomus*. Water temperature ranged from 4□C TO 18^{0}C, dissolved oxygen from 8.2 to 12.4 mg/l, alkalinity from 46 to 80 mg/l and pH ranged from 7.2 to 8.3.The dietary protein levels had significant effects ($p<0.05$) on the body weight gain, specific growth rate and feed conversion ratio of *S.plagiostomus* which is presented in Table 2. Growth performance increased significantly ($p<0.05$) with increasing dietary protein levels from 25% to 35% but there was no significant increase with the diets of 40% and 45% protein. The feed conversion ratio of each diet ranged from 7.5 to 9.62.The lowest FCR was observed at 35% dietary protein and it was not significantly different ($p< 0.05$) than the rest of the diets. Also, the diet with 35% dietary protein gave the significantly highest specific growth rate (0.285) than other diets. The weight gain percent of reared fishes, fed on different dietary treatments was presented in Fig 1. The highest weight gain percent was recorded in 35% protein diet and lowest in 45% protein diet.

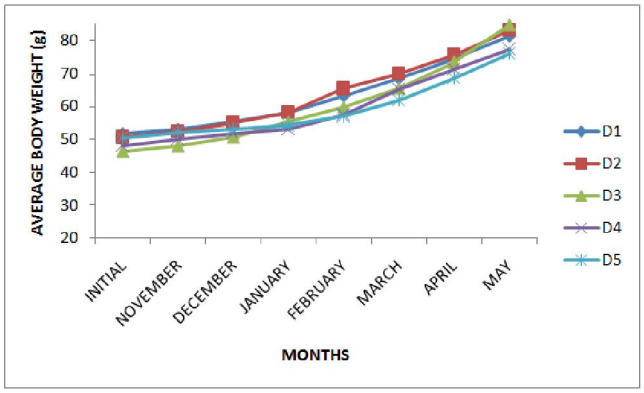


DISCUSSION

Pearsons square method is used for diet formulation for determining the optimum or proper dietary proportion of high and low protein feedstuff which are add to a feed and satisfying the nutritional requirement of fish. Sufficiect protein in the diet is essential for maximum growth as determined by (Lee and Putman, 1973; Jauncey, 1982; yang *et al.,* 2002). The present study revealed significant effects of dietary protein on growth performance of *S.plagiostomus* and indicated that the optimum dietary protein level for the growth of *S.plagiostomus* was 35%. This finding was similar to that reported by Joshi *et al.* (1989) for *Tor putitora*, Ahmad *et al*. (2004) El-sayed and Teshima (1991) for tilapia species. Weight gain increased significantly with increasing dietary protein levels from 25% to 35% with non-significant increase by the diets of 40% and 45% dietary protein. The specific growth rate obtained in this study were much lower than other cultured freshwater fish such as common *carp* (1.28%) and *Tilapia* (1.40%) as stated by Kaushik (1998). Misieng *et al*. in 2011 found the SGR of *T. tambroides* fingerlings in the range of 0.31±0.05 to 0.51±0.08. low SGR were also reported by shehgal,1999 and by ogale, 2002 for other cold water fishes T.tor and T.khudree respectively. lower growth of the fishes in the present study might be from the fact that the fish perhaps did not find a conducive environment being under stress due to rearing in closed happas. Also, these fishes were collected from natural wild conditions and then made acclimitaze these wild fishes on practical artificial diets. The specific growth rates of fishes were found to be very low which might be also due to high feed conversion ratio.

Table 2. Growth performance of *Schizothorax plagiostomus* fed on artificial diets having different levels of dietary protein.

S.No	Parameters	D1	D2	D3	D4	D5
1	Initial body weight	51.7±.65	50.6±.42	46.3±.45	48.2±1.4	50.5±.86
2	Final body weight	81.5±3.0	83.6±2.2	84.3±2.8	77.6±3.8	76.0±2.9
3	Mean weight gain	29.8±1.2b	33±.84c	38.0±.80d	29.4±1.4b	25.5±1.2a
4	Weight gain percent	57.64±1.4ab	65.21±2.0d	82.07±1.65e	61.0±.94c	50.5±1.2a
5	Average daily weight gain	0.142±.3a	0.160±.4a	0.181±.4a	0.140±.2a	0.121±.2a
6.	Specific growth rate	0.216±.03ab	0.241±.05b	0.285±.02c	0.230±.02b	0.195±.03a
7.	Feed conversion ratio	9.40±1.2a	8.42±2.3a	7.5±2.0a	8.84±2.4a	9.62±1.6a



Very slow growth rates of schizothorax species was also reported by Basade and Mohan (2012). In support to this Wilkinson in 2003 reported that the growth rate of juvenile *Tilapia* increases as dietary protein content is raised until a plateau is reached at around 30-35% further increase in dietary protein lead to decline in growth rate. Similar findings have been reported by (Marammazi and Kahkesh, 2011; Otchomou *et al.,* 2012; Kim and Lee, 2002; Wang *et al.,* 1998). Also Hossain *et al*. in (2002) found on *Tor putitora that* weight gain and specific growth rate of fishes increased proportionally with the increase in dietary protein levels and thereafter, decreased with further increase in dietary protein levels. Also lower growth of *Schizothorax plagiostomus* at higher dietary protein levels might be also due to the use of number of plant ingredients at a high inclusion level, because most plant protein are known to contain a wide variety of

antinutritional substances (Francis *et al.,* 2001) and causes amino acid imbalance, especially methionine and lysine defeciencies (Wee, 1991; James and Sampath, 2004). In the present research work, soybean and mustard oil cake, plant protein sources were used and their high inclusion rates in D4 and D5 dietary treatment could be one of the reasons of the lower growth of *Schizothorax* fishes. Feed conversion ratio found in the present study was comparatively higher than the values reported by many other workers High FCR values might be due to higher ration size (feed at 5% body weight), poor digestibility, inefficient utilization of feed, and wastage of feed. These FCR trends are in agreement with that obtained by Al-Hafedh (1999); Khattab *et al.* (2000) and Basade and Mohan (2012). Islam (2002) also reported very high FCR (5.28-9.55) for *T. putitora* when fed with supplementary feed containing 20-30% protein content under semi-intensive farming. However, Rahman *et al*. (2006) observed low FCR value among *T. putitora* which they attributed to small ration size. Wee and Tuan 1988 stated that better FCR values were obtained with increasing dietary protein levels (up to 42%) and deteriorated by diet containing 50%. The considerable variations in the results recorded previously for optimum dietary protein requirements in maximum growth must be due to the variation in fish size and age, stocking density, protein quantity, hygiene and environmental conditions different methodologies applied or other unknown factors which mask the standardization of the parameters (Ahmad *et al.,* 2004; Sa *et al.,* 2006; Akiyama *et al.,* 1997). Apparently, it can be concluded that the diet containing 35% protein appear to be more suitable and economical for growth performance, specific growth rate and feed conversion ratio of S. plagiostomus.

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