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Efficacy of soyabean supplementation on nutritional indices

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Abstract
Fish nutrition certainly has an impact on the aquaculture industry. An experiment was conducted to determine the nutritional indices of Indian Major Carp *Catla catla*, fingerlings for period of 60 days. In the present study to investigate the effects of Soyabean on growth performance and survival in common carp (*Catla catla*). Soyabean was incorporated into diets at concentrations of 1%, 2%, or 3%. The control diet contained no supplement. Soyabean at 3% produced the best and statistically significant ($p<0.05$) weight gain. In general, Soyabean produced better nutritional indices than 1% and 2% supplementation. The present investigation shows that incorporation of soyabean in diets for common carp results in increased growth rate. Soyabean diet was most effective in stimulating fish growth.

Keywords: soyabean, supplementation, *catla catla*, nutritional indices

Introduction
Fish nutrition certainly has an impact on the aquaculture industry. The essential nutrients for fish are amino acids, fatty acids, vitamins, minerals and energy-yielding macronutrients (protein, lipid and carbohydrate). Diets for fish must supply all essential nutrients and energy required to meet the physiological needs of growing animals. Guidelines for nutrient adequacy for some farmed fish species suggest the minimum nutrient requirement to promote growth and prevent signs of nutrient deficiency (NRC, 2011) [1]. Protein is required in the diet to obtain amino acids, which are utilized to synthesize new proteins or maintain existing proteins in tissues while excess protein is converted to energy. Lipids supply essential fatty acids and energy in the diet. The requirement of essential fatty acids can only be met by supplying Long Chain (LC) Polyunsaturated Fatty Acids (PUFA) in the diet (Ganguly *et al*., 2013) [2].
Dietary lipids are also important structural components of membranes, and act as precursors of steroid hormones and prostaglandins in fish. Dietary carbohydrates can be a source of energy for fish; however their ability to utilize dietary carbohydrate for energy varies depending on the species and their natural diet. Therefore, depending on species, protein and lipid are the main source of energy for fish. Feeds in aquaculture are formulated with a balance of nutrients in order to meet specific nutrient requirements for different species, life stages and other purposes (Bureau and Hua, 2010) [3]. The Indian major carps *Lobea rohu*, *Catla catla and Cirrhinus mrigala* are the most important commercial fishes in India with a maximum market demand and acceptability as food by the consumers due to their taste and flesh. Among this, *Catla catla* contributes a major portion to the freshwater fish production in South India. The aim of the present study was to evaluate the effects of Soyabean on nutritional indices of *Catla catla* for the period of 60 days.

Materials and Methods
Collection and Acclimation of Experimental Fishes
Fingerlings of *Catla catla* (Average weight 4.70 ± 1.10 g) were procured from Fish farm, Thittai, Thanjavur District, Tamil Nadu, India, using cast net and maintained in the laboratory in a glass aquarium tank and acclimated in aerated tap water with continuous aeration for two weeks prior to experimentation. During this period, fishes were fed with a known amount of fish food.

Preparation of Diet
The *Glycine max* seed (Soyabean) purchased from Punniamoorthy Pillai Department Stores (PPDS), Near New Bus stand, Thanjavur, Tamil Nadu, India. Soyabean further formulate a fine powder and used to prepare the experimental diet. The fingerlings were fed 3% of their body weight twice a day for 60 days. Every third day, tanks were partially cleaned and water was partially changed. The temperature averaged 28±1.5°C, dissolved oxygen 7.4±0.6 mg/l, and total ammonia 0.5±0.2 mg/l. Table 1 shows the ingredients and proximate composition of formulated diets.

Table 1: Ingredients and proximate composition of formulated diets.

Ingredients (%)	All diets
Fishmeal	35.0
Soybean meal	17.0
Rice bran	11.0
Groundnut oil cake	10.0
Tapioca flour	10.0
Mineral premix	1.5
Vitamin premix	0.5

Table 2

Ingredients	Control	Soyabean 1%	Soyabean 2%	Soyabean 3%
Wheat flour	15	14.0	13.0	12.0
Soyabean		1	2	3
Proximate composition (%)				
Crude protein	36.2	37.2	38.0	38.3
Crude lipid	7.6	8.1	7.2	8.2
Crude carbohydrate	21.2	20.8	21.6	20.7
Ash	8.4	9.2	8.1	8.9

Growth Parameters

The specific growth rate was measured and weighted after 60 days. The growth performance was assessed using the following formulas:

Specific growth rate (SGR)

$$\text{Specific growth rate} = \frac{Ln\ (\text{Final weight}) - Ln\ (\text{Initial weight})}{\text{Experimental periods in days}} \times 100$$

Food conversion ratio (FCR)

$$\text{Food conversion ratio} = \frac{\text{Feed given (dry weight)}}{\text{Body weight gain (wet weight)}} \times 100$$

Statistical Analysis

Values were expressed as mean ± SD for three trials in the each group and statistical significant differences between mean values were determined by one way analysis of variance (ANOVA) followed by the Tukey's test for multiple comparisons. The results were statistically analyzed by SPSS ver. 20 was used $p< 0.05$ were considered to be significant.

Results

In the present work, analysis of nutritional indices as SGR and FCR of *C. catla* showed a highly significant difference for the different treatments and duration. Statistical analysis showed the significant variation in the treatments for the *C. catla* during the experimental period that differs from each other. In case of *C. catla*, the comparison of mean values of average SGR and FCR in different treatments, showed that it appeared to attain maximum under the influence of 3% diet significantly than control. While comparing the overall performance on the basis of mean values, it can be concluded that this fish species gave its best performance in terms of increase in SGR and decreases in FCR in the treatment of 3% diet when compared to control and other treatments. However the minimum increase in SGR and decreases in FCR were observed in 1% diet followed by 2% diet supplementation when compared to control.

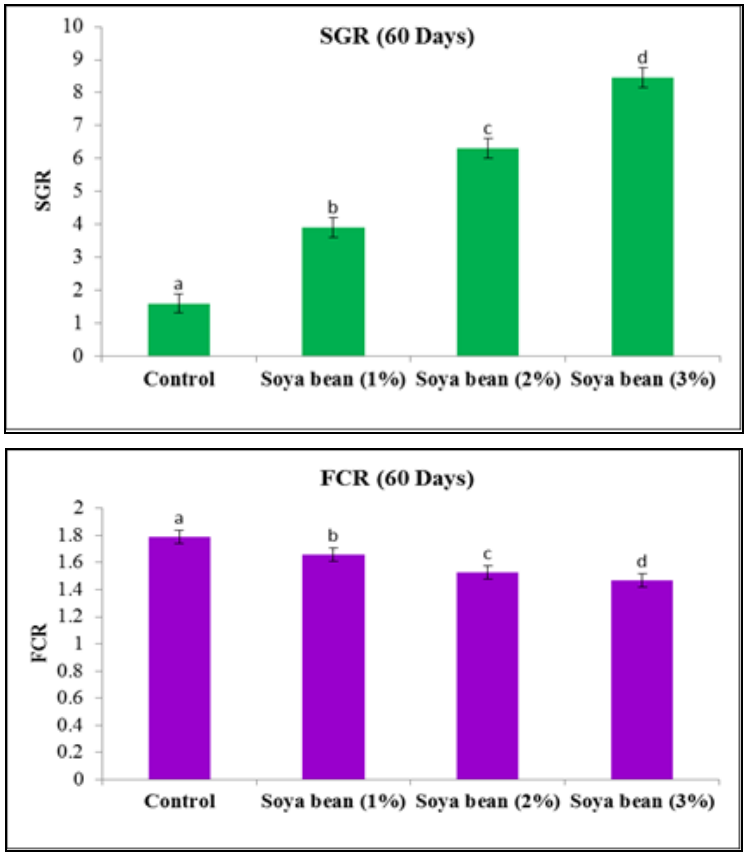

Fig 1: Impact of Soyabean on nutritional indices of freshwater fish *Catla catla* (Fingerlings) with different feeding regimes.

Values are expressed as Mean ± SD (Number of trials 3). Data were analyzed by one-way ANOVA followed by post-hoc Tukey test using SPSS ver. 20. Mean values within the column followed by different letters Superscript (homogeneous subsets) are statistically significant ($P<0.05$) from each other group and same letter was statistically non-significant ($P>0.05$). Significant level alpha 0.05.

Discussion

Growing fish accrete new tissues and some of the energy supplied in the diet is stored as protein, lipid and some glycogen. Protein deposition depends on the balance of available amino acids in protein and the digestible protein-to-digestible energy ratio. Excess energy intake and low protein levels result in the deposition of lipid as recovered

energy, which does not equate to faster growth and is an inefficient use of nutrients. Fish have the ability to utilize lipids for energy, saving protein for deposition and growth (Ganguly *et al*., 2013) [2] and therefore inclusion of lipids in diets for fish is important for both growth and energy purposes.

Most commercial feeds today are formulated to increase growth performance by exploiting the protein-sparing effect of high energy lipid, allowing as much of the dietary protein as possible to be converted into muscle protein. As a result, the production efficiency of farmed salmon has significantly improved over time (Tacon *et al*., 2011) [4]. Fish-meal based diets generally induce good growth. However, owing to the scarcity and escalating cost of fish meal, research on alternative sources is gaining importance (Shetty and Nandeesha, 1988) [5]. Soybean is regarded as one of the best protein source for having a good amino acid profile. It can be used to replace a considerable amount of fish meal diet in omnivorous fresh water such as carp tilapia and catfish. Soybean meal can replace about 67 -100% of fish meal depending on species and sizes of fish. Dietary protein level, source, processing methods and culture system employed without negatively influencing growth performance (EL-Sayed, 1999) [6].

In the present study, enhanced growth and feed utilization in terms of SGR and FCR was significant in *C. catla* fed with 3% diet. The result of the specific growth rate (SGR) could be due to differences in the Soyabean meal. The consumption of protein, vitamins and minerals contained in soyabean meal based diets are probably responsible for having enhanced the growth responses in the fishes. The decreased feed consumption rate (FCR) had positive effect on fish growth. This is in agreement with the work of common carp by Ramakrishnan *et al.,* [7]; Ramakrishnan *et al.,* [8]; Tongsiri *et al*., [9] and Ogbonna *et al.,* [10]. The results of this study indicate that soyabean could be incorporated in the feed for *C. catla* as supplement to their feed.

In conclusion, nutrition is one of the most important factors influencing the ability of cultured Catla to exhibit its genetic potential for growth the incorporation of soyabean in common carp diets improves growth rate. The 3% soyabean diet was most effective in stimulating fish growth performance compared to control. This might be due to high nutritional content and synergic effect of soyabean.

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