



## Effect of *Vigna mungo* and *Vigna unguiculata* on growth and biochemical performance

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### Abstract

An experiment was conducted to determine the growth and biochemical performance of Indian Major Carp *Catla catla*, fingerlings for a period of 30 days. In the present study to examine the effects of *Vigna mungo* (Black gram) and *Vigna unguiculata* (Black-eyed pea) on survival, feed conversion ratio (FCR), specific growth rate (SGR) and biochemical parameters such as carbohydrates, protein, and in common carp (*Catla catla*). *Vigna mungo* (Black gram), *Vigna unguiculata* (Black-eyed pea) and combined feed were incorporated into diets at concentrations of 1%. The control diet contained no supplement. Combined diet at 1% concentration produced the best and statistically significant ( $p < 0.05$ ) weight gain, survival, FCR and SGR in *Catla catla* as compared to *Vigna mungo* (Black gram), *Vigna unguiculata* (Black-eyed pea) and control diet. *Vigna mungo* (Black gram) and *Vigna unguiculata* (Black-eyed pea) at 1% produced the best and statistically significant ( $p < 0.05$ ) carbohydrate, protein and lipids, in *Catla catla* as compared to soya bean and control diet. The present investigation shows that incorporation of *Vigna mungo* (Black gram) and *Vigna unguiculata* (Black-eyed pea) in diets for common carp results in increased growth rate and biochemical performance. The combined diet was most effective in stimulating fish growth than individual *Vigna mungo* (Black gram) and *Vigna unguiculata* (Black-eyed pea) diets.

**Keywords:** *Vigna mungo* (black gram), *Vigna unguiculata* (black-eyed pea), *Labeo Rohita*, growth and biochemical performance

### Introduction

Aquaculture is one of the fast growing systems in the world, which has emerged as an industry possible to supply protein rich food throughout the world. Fish is an important dietary animal protein source in human nutrition. Production of aquatic species through freshwater fisheries and aquaculture for protein supply is being encouraged throughout the world. According to nutritionists, fish is an excellent substitute of protein for red meat. Fish flesh contains all the essential amino acid and minerals viz., iodine, phosphorus, potassium, iron, copper and vitamin A and D in desirable concentrations (Sandhu, 2005) [1]. Black gram (*Vigna mungo*) is one of the most nutritious beans and is commonly used in India for its wide health benefits. It is both, consumed by cooking and used in Ayurvedic medicine, and is equally beneficial when used either way. It offers a ton of health benefits. Black gram can improve your digestion as it is filled with fibers that help with the bulking up and movement of your stool. It can therefore be used to combat both, constipation and diarrhea. It boosts your energy by helping provide more oxygenated blood to your organs. It increases your bone mineral density, making your bones stronger and healthier as you grow older (Nitin *et al.*, 2012) [2]. Cowpea (*Vigna unguiculata*), an indigenous legume to sub-Saharan Africa, is mainly grown in the dry savanna areas as an intercrop with millets, sorghum, groundnut and maize. Cowpea grains rich in protein are consumed in different forms in several parts of the tropics. Cowpea is well adapted to stress and has excellent nutritional qualities. It is a key dietary staple for the poorest sector of many

developing countries and greatly improves an otherwise bland and unbalanced diet. It is one of the most ancient human food sources and has probably been used as a crop plant since Neolithic times (Som and Hazra, 1993) [3]. The Indian major carps *Catla catla*, *Labeo rohita* 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. They contribute about 67% of total freshwater fish production (Parthasarathy and Ravi, 2011) [4]. 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 1% concentration of *Vigna mungo* (Tamil: Ulunthu) and *Vigna unguiculata* (Tamil: Thattapayuru) and combined (Black gram (0.5%) and Black-eyed pea (0.5%)) feed on survival, growth and biochemical performance of common carp as *Catla catla* for the period of 30 days.

### Materials and Methods

#### Collection and acclimation of experimental fishes

Fingerlings of *C. catla* (average weight  $4.65 \pm 1.12$  g) were procured from Fish farm, Karanthai, 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

Four diets were prepared: an unenriched control diet plus three diets containing either *Vigna mungo* (Black gram),

*Vigna unguiculata* (Black-eyed pea) and combined (Black gram (0.5%) and Black-eyed pea (0.5%)) at a concentration of 1% (Table 1). The Black gram and Black-eyed pea purchased from General stores, Kelavasal, Thanjavur, Tamil

Nadu, India. Black gram and Black-eyed pea further formulate a fine powder and used to prepare the combined diet.

**Table 1:** Table A Ingredients and proximate composition of diets

Ingredients (%)	Control Diet	1% Diet I	1% Diet II	1 % Combined Diet (I and II)
Fishmeal	35.0	35.0	35.0	35.0
Soybean meal	17.0	17.0	17.0	17.0
Rice bran	11.0	11.0	11.0	11.0
Groundnut oil cake	10.0	10.0	10.0	10.0
Tapioca flour	10.0	10.0	10.0	10.0
Mineral premix	1.5	1.5	1.5	1.5
Vitamin premix	0.5	0.5	0.5	0.5
Wheat flour	15	14	14	14
<i>Vigna mungo</i> (Black gram)	-	1.0	-	0.5
<i>Vigna unguiculata</i> (White cowpea)	-	-	1.0	0.5
Proximate composition (%)				
Crude protein	36.20	39.46	37.91	41.72
Crude lipid	7.60	9.24	8.19	10.04
Crude carbohydrate	21.20	25.63	23.47	27.86
Ash	8.40	9.18	8.94	9.73

1% Diet I: *Vigna mungo* (Black gram)

1% Diet II: *Vigna unguiculata* (White cowpea)

The fingerlings were fed 3% of their body weight twice a day for 30 days. Every third day, tanks were partially cleaned and water was partially changed. The temperature averaged  $28 \pm 1.5^\circ\text{C}$ , dissolved oxygen  $7.4 \pm 0.6$  mg/l, and total ammonia  $0.5 \pm 0.2$  mg/l. Fingerlings were weighed at 15-day intervals to determine weight gain, specific growth rate (SGR) and feed conservation ratio (FCR), survival. At the end of the experiments, analysis of body homogenate of the *Catla catla* fingerlings were carried out for Protein (Lowry *et al.*, 1951) [5], Carbohydrate (Roe, 1955) [6] and Lipid (Folch *et al.*, 1957) [7].

### Growth Parameters

The growth parameters of the *Catla catla* fingerlings were assessed by taking their body weight at 45 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)

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

### Survival percentage

Survival percentage was calculated at the end of the experiment by counting the number of fishes in each tub and is calculated as follows:

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

### Statistical Analysis

Values were expressed as mean  $\pm$  SD for six rats 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 Graphpad InStat Software (Graphpad Software, San Diego, CA, USA) version 3 was used  $p < 0.05$  were considered to be significant.

### Results

The results of the growth and biochemical parameters of *Catla catla* fingerling with different feeding regimes are presented in Table 2 and 3. Growth parameters of *Catla catla* fingerling with different concentration of *spirulina* clearly showed significant enhancement with combined diet when compared with other diet of feed and control. *Catla catla* fingerling showed maximum increase in weight gain, survival, FCR and SGR were observed in 1% combined fed as compared to *Vigna mungo*, *Vigna unguiculata* diets and control. *Catla catla* fingerlings showed maximum increase in weight gain, survival, FCR and SGR were observed in 1% combined fed as compared to *Vigna mungo*, *Vigna unguiculata* diets and control (Table 2).

The biochemical composition of the fish revealed a significant increase in carbohydrate, protein and lipid over the initial carbohydrate, protein and lipids in 1% combined diet when compared with other diet. Significantly highest carbohydrate, protein and lipid in *Catla catla* was recorded in fish fed feed 1% combined fed as compared to *Vigna mungo*, *Vigna unguiculata* diets and control. Significantly highest carbohydrate, protein and lipid in *Catla catla* was recorded in fish fed feed 1% combined fed as compared to *Vigna mungo*, *Vigna unguiculata* diets and control (Table 3). These results indicated that enhancement of biochemical performance quality by combined feed may be due to enzymatic activity in the gut and thereby better nutrient utilization.

**Table 2:** The morphometric and growth parameters of freshwater fish *Catla catla* (Fingerlings) with different feeding regimes.

Types of Feed	Initial weight (g)	Final weight (g)	SGR	FCR	Total length of fish (mm)	Survival (%)
Control	4.50±0.31 <sup>a</sup>	5.20±0.36 <sup>b</sup>	22.33±0.14 <sup>a</sup>	2.00±0.11 <sup>a</sup>	50.00±1.14 <sup>a</sup>	70
<i>Vigna mungo</i> (1%)	4.70±0.32 <sup>a, ns</sup>	5.80±0.40 <sup>c, *</sup>	3.66±0.28 <sup>b, *</sup>	3.00±0.14 <sup>a</sup>	61.00±4.27 <sup>c, *</sup>	80
<i>Vigna unguiculata</i> (1%)	4.50±0.33 <sup>a, ns</sup>	5.70±0.38 <sup>c, *</sup>	4.00±0.28 <sup>b, *</sup>	3.40±0.12 <sup>a, *</sup>	63.00±4.35 <sup>c, *</sup>	90
Combined diet (1%)	4.70±0.32 <sup>a, ns</sup>	6.40±0.44 <sup>c, *</sup>	6.00±0.42 <sup>b, *</sup>	4.33±0.15 <sup>a, *</sup>	68.00±4.76 <sup>c, *</sup>	98

1% Diet I: *Vigna mungo* (Black gram); 1% Diet II: *Vigna unguiculata* (White cowpea); 1% Combine Diet: 1:1 ratio Diet I + Diet II.

Values are expressed as Mean ± standard deviation for triplicate experiments (each experiment 10 fish).

Mean values within the column followed by different letters (superscript) are statistically significant ( $P < 0.05$ ) from each other day and same letters are statistically non-significant

( $P > 0.05$ ) are compared by one-way ANOVA, followed by post-hoc Tukey HSD test, significant level alpha 0.05.

Mean values within the row data were analyzed by one-way ANOVA followed by post-hoc Tukey HSD test. Statistically significant variation was derived by comparing Group I versus Group II, Group III and Group IV. Significance level alpha 0.05.

\* $P < 0.05$  statistically significant and NS= Non significant ( $P > 0.05$ ) compared with Group I (Control Diet).

**Table 3:** The proximate composition of freshwater fish *Catla catla* (Fingerlings) with different feeding regimes.

Types of Feed	<i>Catla catla</i>		
	Protein (mg/gm)	Carbohydrate (mg/gm)	Lipids (mg/gm)
Control	3.58±0.16 <sup>a</sup>	1.29±0.04 <sup>a</sup>	0.46±0.02 <sup>a</sup>
<i>Vigna mungo</i> (1%)	3.85±0.21 <sup>b, *</sup>	1.62±0.05 <sup>b, *</sup>	0.51 ± 0.03
<i>Vigna unguiculata</i> (1%)	4.02±0.25 <sup>b, *</sup>	1.60±0.05 <sup>b, *</sup>	0.55±0.02 <sup>b, *</sup>
Combined diet (1%)	4.52 ± 0.30	1.66±0.06 <sup>b, *</sup>	0.53±0.02 <sup>b, *</sup>

1% Diet I: *Vigna mungo* (Black gram); 1% Diet II: *Vigna unguiculata* (White cowpea); 1% Combine Diet: 1:1 ratio Diet I + Diet II.

Values are expressed as Mean ± standard deviation for triplicate experiments (each experiment 10 fish).

Mean values within the column followed by different letters (superscript) are statistically significant ( $P < 0.05$ ) from each other day and same letters are statistically non-significant ( $P > 0.05$ ) are compared by one-way ANOVA, followed by post-hoc Tukey HSD test, significant level alpha 0.05.

Mean values within the row data were analyzed by one-way ANOVA followed by post-hoc Tukey HSD test. Statistically significant variation was derived by comparing Group I versus Group II, Group III and Group IV. Significance level alpha 0.05.

\* $P < 0.05$  statistically significant and NS= Non significant ( $P > 0.05$ ) compared with Group I (Control Diet).

## Discussion

Carp farming has attained commercial culture status in India and many of its neighbouring countries. With the intensification of culture, feed has become the most important component of the culture system from the viewpoint of both fish production and cost. 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 Nandeesh 1988) [8]. *Spirulina* are the useful microorganisms promoting growth performance and protecting the host against pathogens. These microorganisms are included in the diets and have the beneficial effects on host's gut micro flora. On the other hand, probiotics can be considered as a microbe to improve food nutritional value (Ibrahim *et al.*, 2004) [9].

Results of this study substantiate the fact that % combined diet have direct growth promoting effects on *Catla* which is accordance with the reports. Among the three diet (*Spirulina*, Soya bean and combined), 1% combined diet possess potential growth and biochemical performance were

observed. The significant growth performance of combined diet might be due to the combination of *Vigna mungo* and *Vigna unguiculata*. In the present study, enhanced growth increment and feed utilization in terms of SGR and FCR was significant in *Catla* fed with 1% combined diet. This is an agreement with the work of common carp on Ramakrishnan *et al.*, (2008) [10]; Ramakrishnan *et al.*, (2007) [11] and Tongsir *et al.*, (2010) [12]. The results of this study indicate that the 1% combined diet could be incorporated in feed for *Catla* fingerlings as supplement to their feed.

The biochemical analysis indicated that 1% combined diets results in significant increase in the level of carbohydrate, protein and lipids when compared to control. The changes in carbohydrate, protein and lipid contents of fish body could be related to the changes in their synthesis and deposition rate in fish muscles (Abdel-Tawwab *et al.*, 2006) [13]. The biochemical analyses often provide vital information for health-assessment and management of cultured fish (Cnaani *et al.*, 2004 [14]; Ghosh *et al.*, 2003) [15].

In conclusion, the incorporation of *Vigna mungo* and *Vigna unguiculata* in common carp diets improves growth and biochemical performance. The 1% combined diet was most effective in stimulating fish growth and biochemical performance. This might be due to high nutritional content of 1% combined diet due to rich protein content of *Vigna mungo* and *Vigna unguiculata*.

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