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# Effect of plant feed ingredients (soybean and sunflower meal) on the growth and body composition of *Labeo rohita*

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**Abstract:** A 90-day feeding try out was conducted to estimate the effect of test diet 1 (soybean meal), test diet 2 (sunflower meal) and reference diet on the growth and meat quality of *Labeo rohita*. Two replicates for each diet were followed. Fish fed on test diet 1 gained highest average body weight (5.75 ± 0.08g) followed by test diet 2 (4.72 ± 0.3g) and reference diet (2.88 ± 0.07g) and statistical differences among effects of three diets were highly significant. Similarly, average length obtained by rohu fingerlings was highest (5.2 ± 0.4 cm) on test diet 1 followed by test diet 2 (4.7 ± 0.45 cm) and reference diet (2.8 ± 0.05 cm) showing non-significant differences among diets. Dry matter, crude fat, ash and gross energy deposition was highest in experimental fish body raised on reference diet while ash content deposition was higher for test diet 1 compared to test diet 2 and gross energy retention for test diet 2 was better than test diet 1. These findings can be concluded as sunflower meal and soybean meal can be effectively used in the feed formulation of *Labeo rohita* replacing expensive fish meal.

**Keywords:** Soybean Meal, Sunflower Meal, *Labeo Rohita*, Growth, Body Composition

## 1. Introduction

The development of fish in culture conditions depends upon the availability of essential nutrients in the diet, digestibility and its effect on meat quality of fish. These parameters are considered as the basis for growth of the fish '[1]'. The success of intensive fish culture depends on the formulation of a diet that contains an optimum level of protein and energy necessary for the development of fish and cost effective. Therefore, it is necessary to formulate fish feed from locally available feed ingredients. This type of feed prepared from such ingredients should serve as a source of all essential minerals, vitamins, amino acids, growth promoting ingredients and energy.

Major carps are the most extensively reared fish in Pakistan. These constitute nearly 40%of the local freshwater species of fish '[2]'. Among the various species of carps; Thaila, morakhi and Rohu, have got a very high demand for their palatability. The knowledge on the protein necessities of these fish species is essential for the formulation of a balanced diet for successful intensive culture. Conventionally, fishmeal has been the major source of protein in artificial fish feeds around the world. There are some ingredients which are locally available that can replace the fishmeal without changing the protein level, essential nutrients. The findings of the present research will help to prepare a cost effective and a complete feed from plant protein sources for improved growth of *Labeo rohita* and fish farmers can get maximum yield in a minimum period of time for the carps. Sunflower and soybean meal are the most important locally available protein rich ingredients, which can be used instead of fish meal in rohu diets for their fast growth, required size, delicious taste and high market demand in Pakistan. The present study has been undertaken to observe the effect of soybean meal and sunflower meal on the growth and meat quality of *Labeo rohita.*

## 2. Materials and Methods

### *2.1. Collection of fingerling*

*Labeo rohita* fingerlings purchased from government fish seed hatchery, Satiana road, Faisalabad were allowed to acclimate ambient conditions fed on reference diet for one week before initiating the trial.

### *2.2. Feed ingredients and Diet Preparation*

Three iso-nitrogenous diets were prepared: reference diet, test diet 1 and test diet 2. Reference diet contained fish meal as a sole source of protein whereas test diet 1 and 2 also contained soybean meal and sunflower meal, respectively. Each test diet was formulated by mixing 70% reference diet and 30% of each of the test ingredients (soybean meal and sunflower meal). Two test diets and reference diet was prepared by linear formulation method through Winfeed 2.6 (WinFeed (UK) Ltd., Cambridge, UK). The ingredients used in reference and test diets were ground, sieved for incorporation into diets and mixed in a mixer for 30 minutes, where after fish oil will be gradually added, while mixing constantly. Eighty five (85ml) of water per 100g of feed was slowly blended into the mixed resulting in a suitable texture dough, as for fish food. Drying of feed was carried out in a convection oven at 35 0ºC for 48 hrs. The percentage composition of reference and test diets is shown in table 1.

***Table 1.*** *The percentage composition of reference and test diets.*

| Ingredients | Reference Diet | Test diet 1 (Soybean meal) | Test diet 2 (Sunflower meal) |
|---|---|---|---|
| Fish meal | 38 | 19.87 | 22.93 |
| Rice polish | 19.34 | 16.14 | 15.13 |
| Wheat bran | 20.78 | 17.59 | 16.34 |
| Rice broken | 15.05 | 9.57 | 8.77 |
| **Fish oil** | 4.83 | 4.83 | 4.83 |
| Vitamin premix | 1.00 | 1.00 | 1.00 |
| Chromic oxide | 1.00 | 1.00 | 1.00 |
| Test ingredient-1 | – | 30 | – |
| Test ingredient-2 | – | – | 30 |
| Total | 100 | 100 | 100 |

### *2.3. Feeding Protocol*

After acclimatization, fingerlings were transferred randomly into glass aquaria [90L×30W×45H (cm) with 29 L water capacities each]. For each treatment: (reference diet, test diet 1 and test diet 2) there were two replicates and in each replica forty fingerlings were stocked. Fish were given reference and test diets at the rate of 4% live wet body weight twice a day (morning and afternoon) in the feeding aquarium [3].

### *2.4. Growth Studies*

The morphometric characteristics i.e. body length (cm) and body weight (g) of fingerlings taken from each replicate on fortnight basis were measured and recorded. After obtaining the data, the fishes were released back into their respective aquaria.

### *2.5. Meat Quality Test*

At the end of the experiment, representative samples of fish body meat from each replica were homogenized individually using a mortar pestle and analyzed chemically by AOAC (1990) procedures: dry matter (DM) by oven drying at 105°C; crude protein (CP) by microkjeldahl analysis, crude fat by chloroform methanol extraction method through 10454 soxtec system HTz, crude fiber by ash-free residue digested with alkali and acid, ash through electric furnace. After finding the possible results, data of growth and body composition was subjected to analysis of variance (ANOVA), SPSS for statistical analysis and mean ± SE values were calculated.

## 3. Results

### *3.1. Growth*

Values of average increase in body weights of fish fed on three diets are given in table 2 and in Fig. 1. Experimental fish reared on test diet 1 (soybean meal) showed better growth results in the present study as compared to test diet 2 and reference diet.

Maximum and minimum weight gain in test diet 1 was 1.27g and 0.5g during the 6th fortnight (July) and 1st fortnight (April), respectively. In test diet 2 maximum and minimum weight gains were recorded as 1.09g and 0.4g during 6th fortnight (July) and 1st fortnight (April), respectively while for reference diet maximum gain in weight was 0.88g during 6th fortnight (July).

Values for average total length and gain in total length of rohu for all diets are in table 3 and in Fig. 2. Maximum length increment in test diet 1, test diet 2 and reference diet was 1.0cm, 1.0cm and 0.7cm, respectively.

### *3.2. Meat Quality*

The results obtained after body meat analysis of rohu (table 4) and its body composition compared under all diets is shown in fig. 3 - 5. The result of this analysis showed that all diets and their interaction have pronounced effect on body of fish. Dry matter deposition was higher (96%±1.00) in experimental fish raised on reference diet and test diet 2 (96%±1.0) while comparatively lower deposition was recorded in test diet 1(90%±1.00). Present study results also showed that protein content deposition in rohu body meat fed on sunflower meal was 52.51%±0.01 almost same as in test diet 1(52.49%±1.09) whereas for reference diet it was 50.28%±0.01.

Reference diet showed better deposition of crude fat (61%±0.01) in *Labeo rohita* body meat. While crude fat value for test diet 2 was 22.49%±0.01 and for test diet 1 it was 18.07%±0.07. Ash deposition was higher in fish meat fed on reference diet (23%±1.00) compared to test diet 1 (14.5%±3.5) and test diet 2 (12%±1.00). Gross energy retention was better (598.35%±0.01) in rohu body meat fed on reference diet followed by sunflower meal (590.855±0.01)

and soybean meal (546.52%±0.01).

***Table 2.*** *Fortnightly increase in average body weight (g) of Labeo rohita raised on reference and two test diets (test diet 1& test diet 2).*

| | | Reference diet | | Test diet 1 (Soybean meal) | | Test diet 2 (Sunflower meal) | |
|---|---|---|---|---|---|---|---|
| **Fortnights** | **Date of observation** | **Average body wt.(g)** | **Inc. in body wt. (g)** | **Average body wt. (g)** | **Inc. in body wt. (g)** | **Average body wt. (g)** | **Inc. in body wt. (g)** |
| Initial | 17-04-12 | 2.25 | - | 2.19 | - | 1.96 | - |
| 1 | 30-04-12 | 2.6 | 0.35 | 2.69 | 0.5 | 2.42 | 0.46 |
| 2 | 16-05-12 | 3.08 | 0.48 | 3.37 | 0.68 | 3.13 | 0.71 |
| 3 | 1-06-12 | 3.44 | 0.36 | 4.10 | 0.73 | 3.89 | 0.76 |
| 4 | 17-06-12 | 3.97 | 0.53 | 5.28 | 1.18 | 4.83 | 0.94 |
| 5 | 1-07-12 | 4.25 | 0.28 | 6.67 | 1.39 | 5.59 | 0.76 |
| 6 | 16-07-12 | 5.13 | 0.88 | 7.94 | 1.27 | 6.68 | 1.09 |
| | Total | | 2.88 | | 5.75 | | 4.72 |

***Table 3.*** *Fortnightly increase in average body length (cm) of Labeo rohita raised on reference and two test diets (test diet 1& test diet 2).*

| | | Reference diet | | Test diet 1 (Soybean meal) | | Test diet 2 (Sunflower meal) | |
|---|---|---|---|---|---|---|---|
| **Fortnights** | **Date of observation** | **Average total length (cm)** | **Inc. in total length(cm)** | **Average total length(cm)** | **Inc. in total length(cm)** | **Average total length(cm)** | **Inc. in total length(cm)** |
| Initial | 17-04-12 | 2.1 | - | 1.7 | - | 1.8 | - |
| 1 | 30-04-12 | 2.5 | 0.4 | 2.5 | 0.8 | 2.5 | 0.7 |
| 2 | 16-05-12 | 3.0 | 0.5 | 3.4 | 0.9 | 3.4 | 0.9 |
| 3 | 1-06-12 | 3.6 | 0.6 | 4.4 | 1.0 | 4.3 | 0.9 |
| 4 | 17-06-12 | 3.8 | 0.5 | 5.4 | 1.0 | 5.0 | 0.7 |
| 5 | 1-07-12 | 4.2 | 0.4 | 6.1 | 0.7 | 6.0 | 1.0 |
| 6 | 16-07-12 | 4.9 | 0.7 | 6.9 | 0.8 | 6.5 | 0.9 |
| | Total | | 2.8 | | 5.2 | | 4.7 |

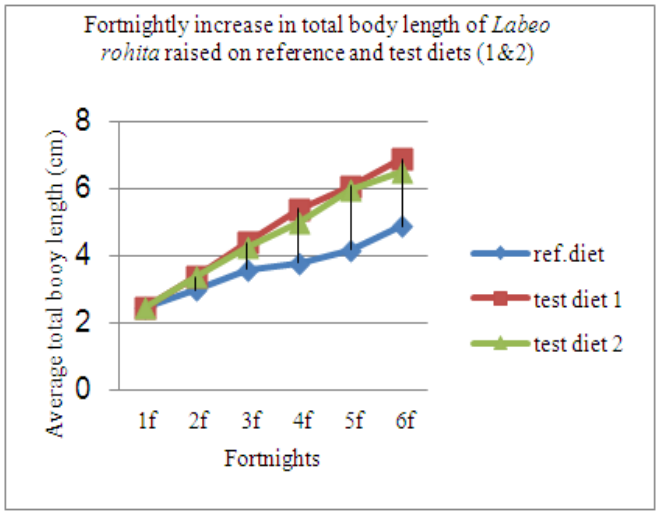


***Fig 1.*** *Fortnightly increase in average body weight (g) of Labeo rohita raised on reference and two test diets (test diet 1& test diet 2.*

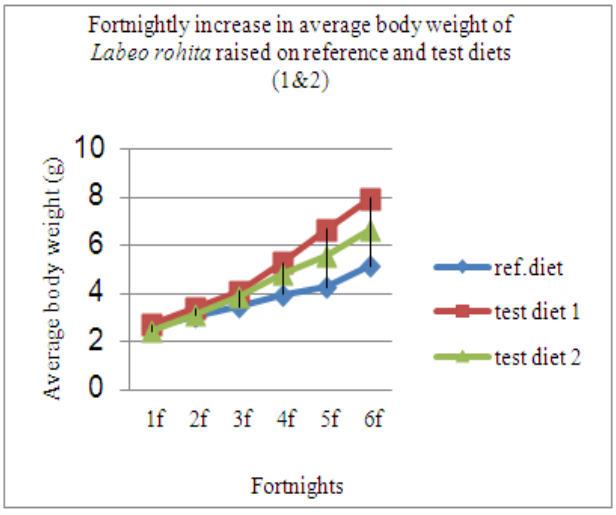


***Fig 2.*** *Fortnightly increase in average body length (cm) of Labeo rohita raised on reference and two test diets (test diet 1& test diet 2.*

### *3.3. Body Composition of Labeo Rohita under All Treatments*

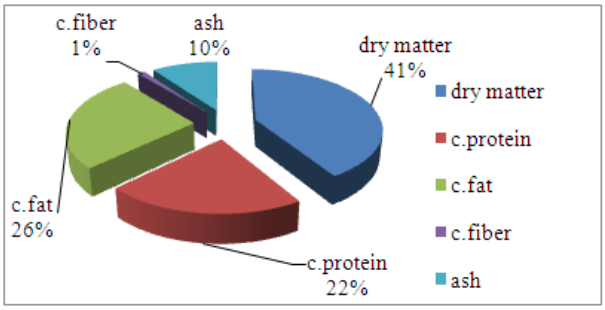


***Fig 3.*** *Reference diet*

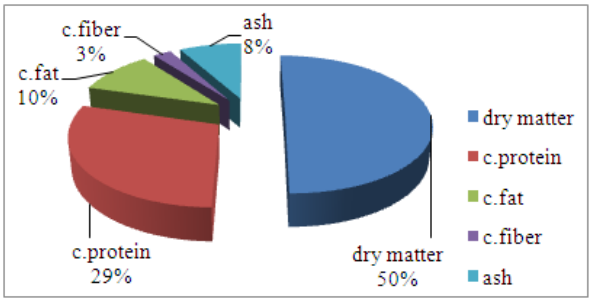


***Fig 4.*** *Test diet 1(soybean meal)*

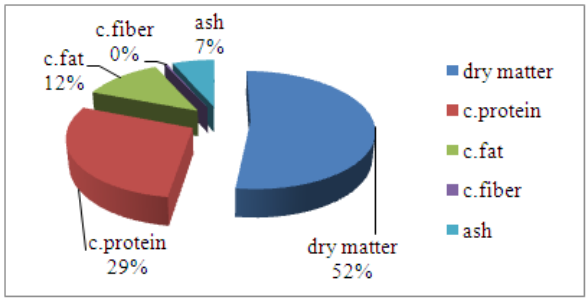


***Fig 5.*** *Test diet 2 (sunflower meal)*

## 4. Discussion

Results from the experiment of '[4,5]' revealed that growth rate of rohu increased when plant proteins were used in combination with fish meal and higher growth also observed in *Channa punctatus* in '[6]' from soybean compared to fish meal. Reference '[7]' also observed higher increase in body weight from soybean meal comparatively to sunflower meal using rainbow trout (*Oncorhynchus mykiss*). Reference '[8]' observed that amount of fat up to 9% in diet showed comparatively better growth in *Labeo rohita* while '[9]' reported that the high fiber content from sunflower seed meal decreased the growth of tilapia agreeing with the results of the present study.

A comparative decrease in fat content of fish body meat fed on plant protein sources was also reported by '[10, 11]' using *Sparus aurata*. However, the effect of plant protein sources on fat in fish meat is still under investigation and is probably related to different protein sources and different lipid metabolism'[12]'. Reference '[13]' observed that dietary crude protein contents below 41.3% account for increase in the fat contents of carcass of carp. The fiber in plant ingredients is known to decrease feed intake and the time the feed spends in the gut, consequently minerals assimilation'[14]'. Reference '[15]' reported in an experiment that fish meal was a more readily digested and assimilated ingredient than sunflower meal that have higher fiber content.

## 5. Conclusion

Soybean meal proved as a promising fish feed ingredient being more efficiently utilized and gave better growth results in *Labeo rohita* in the present study. The palatability of soybean meal and its excellent nutritional value including high level of protein, corresponding amino acid profile and relatively high nutritional digestibility, proved to be a high-quality ingredient for this fish. Findings from present study could be useful as starting point for formulating cost effective nutritionally balanced fish diets by replacing fish meal with plant origin ingredients.

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