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Research Article

PREPARATION OF FISH MEAL IN THE FORMULATION OF FISH FEED INGREDIENTS ESSENTIAL FOR GROWTH PERFORMANCE OF *LABEO ROHITA*

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ABSTRACT

Fresh water aquaculture in India is mainly carp-based and accounts for a considerable proportion of total aquaculture production. Feeding constitutes a major factor in fish culture since the fish obtain the maximum nutritional requirement through the food they consume. Diet-1 have protein forms one of the main components of fish feed and hence formulation of feeds that contain a high amount of protein using cost-effective natural ingredients is very essential to achieve efficient production from fish culture. *Labeo rohita* is an extensively studied fish and contributes to a considerable proportion of fish production in India. In the present investigation, four different kinds of fish feed (using Fish meal, Soybean meal, Coconut oil cake, Rice bran, Tapioca flour, Egg albuminake, Azolla, rice bran and tapioca powder) were formulated with varying protein concentrations and given to *L. rohita* to assess the impact of the protein diet on its growth and bioenergetic parameters. The fish were fed with the formulated feed at a rate of 4% of their body weight for a period of treatment days. It was observed that the fish fed with formulated feed containing 40% protein content showed better growth results and improvement in bioenergetic parameters, compared to the other three feeds.

Keywords: Formulated feed, Ingredients, *Labeo rohita*, Fishes wastes.

INTRODUCTION

Indian fisheries and aquaculture is an important sector of food production, providing nutritional security, contributing to the agricultural exports and engaging about fourteen million people in different activities. Constituting about 4.4% of the global fish production, the sector contributes to 1.1% of the GDP and 4.7% of the agricultural GDP. The general approach adopted to reduce cost has been to develop low-cost diets by replacing expensive animal protein sources such as fish meal with relatively cheaper plant protein sources (Kumar *et al*., 2013). The industrial development and rapid urbanization have led to development of polluted zones discharging potentially toxic compounds in the environment. Especially, indiscriminate use of pesticides resulted in contamination of aquatic system has now become a global problem and is being extensively researched worldwide (Tamizhazhagan & Pugazhendy, 2016) Aquaculture has a great role to play in the welfare of mankind. It is emerging as one of the most viable and promising enterprises for providing notional and food security for humans. Food production from agricultural resources cannot keep pace with the ever-increasing human population around the globe. *Labeo rohita*, commonly called as Rohu and one of the three Indian major carps, is an important freshwater fish species normally cultured in Asia, particularly in the Indian subcontinent (Khan *et al*., 2006). Rohu culture contributes to about 35% of the total Indian major carp production (Jones & Thornton, 2003). The intensification of fish culture has led to dependence on artificial feeds. Protein is the most expensive component in fish feeds and also the most important factor affecting growth performance of fish and feed cost (Wang *et al*., 2004). Reducing the feeding costs could be a key factor for the successful development of aquaculture. Fish have a high dietary protein requirement

L. rohita belongs to the family Cyprinidae and is common in rivers and freshwater lakes of South Asia and

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South- East Asia (Jhingran *et al*., 1971). Among all Indian major carps, *L. rohita* is the most popular and delicious food fish in Asia and rich in protein content. On the other hand, duck weeds are the world' s smallest angiosperms, faster growing and simplest of flowering plants, usually reproduce by budding and multiply very quickly (Patra *et al*., 2015). Fisheries have played a very vital role in improving the food security status of the people; it contributes about 15-16% to the total animal protein consumed by 2.9 billion people in low income and food-deficient countries. An estimated 520 million people nearly 8% of the world population surely on income from fisheries for sustenance. With the continued increase in the awareness of health benefits, the global demand for aquatic foods, even in developed countries is expected to continue to rise (Kurhekar *et al*., 2016). Aquaculture production is responsible for 50% of the global fishery production Fish is highly nutritive and rich source of animal proteins. For the improvement of fisheries and to achieve maximum yields from resources of fresh water, it is necessary to provide artificial feed, by which fish grows rapidly and attains maximum weight in shortest possible time. Among commonly used feed ingredients, fish meal is considered to be the best ingredients, due to its compatibility with the protein requirement of fish (Bhosale *et al*., 2012).

The production of quality protein is associated with the development of fisheries on a commercial basis. Fish production sector is very important not only as the main source of animal protein to ensure food security (Padmapriya & Devi, 2016). *L. rohita* is a member of Indian major carp group. The species is of commercial significance due to its aquaculture potential and high consumer preference. Nowadays, it is necessary to increase fish production for satisfying the increasingly growing demand for protein. Therefore, fish breeding has been found necessary to increase fish production in order to make fish/protein available to the population. However, one of the major constraints facing aquaculture is feeding. The prominence of fish meal in the production of animal feeds cannot be disputed but constitute the highest cost, thereby making the price of the feed to rise exponentially (Olaniyi & Salau, 2013).

In formulating a nutritive diet for fish breeding, fish meal is used as the main dietary protein source because of its nutritional quality and palatability properties (Hardy & Tacon, 2002). It is, therefore, very crucial to find an alternative to replace fish meal to reduce fish feeding cost and halieutics resources pressure (Monebi & Ugwumba, 2013). Many studies have shown considerable success in partially replacing fishmeal with soybean meal and other soybean products in the diet for various fish species (Boonyaratpalin *et al*., 1998; Garland *et al*., 2007; Quartararo *et al*., 1998).

MATERIALS AND METHODS

Collection and processing of fisheries waste

The wastes including head, skin, fin, and tail of fish fishes *Labeo rohita, Catla catla, Colossoma brachypomum* and *Clarias batrachus* were collected from the daily fish market in Dharmapuri, Tamil Nadu. The waste materials of each species packed in a separate polythene bags and transported to the laboratory. The collected fisheries wastes were sundried for 2 weeks to remove the moisture. Further, the dried waste materials were powered finely using mixer grinder and stored individually in airtight plastic containers at -20°C until further analysis.

Preparation of fishmeal replacement diets

Experimental feeds were prepared using locally available feed ingredients. As a first step, the basal ingredients (fishmeal, coconut oil cake, rice bran meal, and rice bran and tapioca flour) were separately grounded using a micro pulverizer and sieved through a 60 µm mesh. Each ingredient was weighed at desired concentrations (Table 1) to formulate 40% protein diets which are optimum requirement for the rearing of *L. rohita.* These weighed feed ingredients were thoroughly mixed at different ratios for preparing four different diets (one control fish meal diet and four 100 % fish meal replacement diets (diet-1, diet-2, diet-3 and diet-4 fish meal replaced with *L. rohita*, *Catla catla*, *Colossoma brachypomum*, and *Clarias batrachus* waste meal respectively). The blends were cooked in a closed aluminum container at 105 °C for 15 min, followed by cooling at room temperature. Further, Cod liver oil, vitamins and egg albumin were added and thoroughly mixed until the stiff dough was obtained. The dough was pelleti zed by an indigenous hand pelletizer with a mesh size of 0.1-mm diameter (Pigeon manufactures, Kolkata, India) and was cut into 3.0 ± 0.47-mm-sized pieces. The pellets were dried at room temperature (27°C) until constant weight was reached. The prepared feeds will be stored individually in airtight plastic containers at -20°C until to use the feeding trials. The proximate composition of the prepared feeds was analyzed according to the standard methods of (Almeida *et al*., 2005).

RESULTS AND DISCUSSIONS

Fish meal is one of the most expensive ingredients in prepared fish diets. Fish nutritionists have tried to use less expensive plant protein sources to partially or totally replace fish meal. Of all the plant protein feedstuff, soybean meal is considered to be the most nutritious and is used as the major protein source in many fish diets (Lovell, 1988). Determination of palatability of a feed ingredient is an important criterion in the evaluation of that ingredient for fish. The growth of fish depends upon the ingredients and its percentage in the formulated feed (Glencross *et al*., 2007). The digestibility of a particular feed ingredient reflects in the growth of fish. Digestibility depends upon various factors like nature, a dietary component, and type of nutrient and level of inclusion (De Silva *et al*., 1990).

Continuous efforts are being made by the nutritionist to reduce the feed cost as a strategy to sustainable aquaculture. The choice of dietary protein to be used in practical rations is an economic decision, which depends on the protein source as well as on the expected returns from fish growth and value. The particular characteristics of protein sources used in fish diet are another factor that has to be considered when selecting an economical protein level (Beckles *et al*., 1986). Bulletin of Food and Agriculture Organization (FAO) and United Nation of Development Programme (UNDP) had also mentioned about feed formulation. Finding alternative protein sources to replace fishmeal in fish feed is important if the growth of the aquaculture industry is to be sustained (Andersen *et al*., 2001). Soybean meal is one such potential alternative (Gatlin *et al*., 2007). Soybean meal are widely used as the most cost-effective alternative for high quality fish meal in feeds for many aquaculture fish species due to its high protein content (Approx. 48%) and excellent amino acid profile low cost, availability and steady supply as compared to the other plant protein sources (Storebakken *et al*., 2000). Essential or indispensable amino acids (EAAs) cannot be synthesized by fish and often remain inadequate but are needed for growth and tissue development (Fagbenro *et al*., 2000). While formulating the feed vitamin mixture is added as it was clearly demonstrated that there are some interactions between vitamins. This is an important factor to be considered while formulating the feed with vitamin mixture (Aoe *et al*., 1971). Antibacterial properties of the ingredients resist the growth of microorganisms thus preventing different disease due to bacteria, fungi and protozoa (Kingston *et al*., 2008).

Table 1. Ingredients of different experimental diets.

Ingredients (g/100g)	Control (FM)	Diet-1	Diet-2	Diet-3	Diet-4
Fish meal	25	0	0	0	0
Soybean meal	25	32	32	32	32
Coconut oil cake	25	20	20	20	20
Rice bran	10	8	8	8	8
Tapioca flour	5	5	5	5	5
Egg albumin	7	7	7	7	7
Cod liver oil	2	2	2	2	2
Vitamin mix* Vitamin-B capsule	1	1	1	1	1
Fisheries waste	0	25	25	25	25

In the past few decades, feeds from plant origin have been accepted for Indian major carps because the body growth observed has been reported to be as good as that obtained with the traditional feed. In tropical countries, where algal production rates are high, algae have been receiving increasing attention as an alternative protein possessing relatively high protein content (50-60%), which may be regarded as balanced fish feeds (Mohapatra *et al*., 2013). The present study demonstrated that the inclusion level of duckweeds experimental feed supported the growth for *L. rohita.* The protein content (Yang *et al*., 2017) reported that *Lemna minor* was estimated to be the highest in comparison to *Eichhornia crassipes* and *Pistia stratiotes.* It is to be noted in this study that fingerlings of *L rohita* fed with formulated *L. minor* leaf meal grew more in width than in length, thus incorporating more flash to the fingerlings. Apart from this, the survival rate was found to be 80-85% in this case. It was also observed by Yilmaz & Shah (2005) and (Robinson, 2001) that the most favorable use of water hyacinth and duck weed as a supplement to vitamin-deficient diet at the rate of 5% to 10% increases growth and reduce mortality of the fingerlings of cat fish. The significance of qualitative and quantitative feeds is well recognized and the level of dietary protein is of fundamental importance, because it significantly influences growth, survival and yield of fish (Tavares *et al*., 2013).

CONCLUSION

The results of the present study could help fish feed industrialists to prepare cheap and specific feed from the locally available raw materials for the better growth and survival rate of *L. rohita* (Hamilton) and also help the fish farmers to get maximum yield in a minimum period of time for the fish waste fed with cheap and proper feed no side effect.

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