



E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2018; 6(1): 166-169

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www.fisheriesjournal.com

Received: 22-11-2017

Accepted: 23-12-2017

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Evaluation of nutritional parameters of feed formulated from Soyabean

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Abstract

Nutrition is the science that interprets the interaction of nutrients and other substances in food in relation to maintenance, growth, reproduction, health and disease of an organism. Good nutrition in production system is essential to produce a healthy and high quality product. Nutrition involves various chemical reactions and physiological processes which transform food into body tissues and activities.

The first consideration for formulation of feed is the quality of the feed ingredients. Hence, for present work Soyabean (*Glycine max*) has been selected as the raw material for formulation. It is probably the most promising alternative protein source for fish meal. It is widely used as the cost effective alternative for high quality fish meal in feeds for many aquaculture fish species due to its high protein content, excellent amino acid profile, low cost, availability and steady supply as compared to the other plant protein sources. The nutritional quality of feed or ingredients depends upon the availability of nutrients to the fish; hence the present study was carried out to assess the nutritional parameters in formulated feeds. The analytical result reveals that formulated feed was nutritionally rich as compared to conventional feed- deoiled groundnut cake.

Keywords: Formulated feed, soybean, deoiled groundnut cake

1. Introduction

The evaluation of nutritional status is one of the primary components of multidimensional geriatric assessment. Replacement of fish meal with cheaper ingredients of plant origin in fish feed is necessary because of rising cost and uncertain availability of fish meal^[1]. Inclusion of feedstuffs with relatively high levels of carbohydrate in formulated fish feed is preferred in view of its protein-sparing action that may make the diet more cost effective. According to Rumsey^[2], increased use of plant protein supplements in fish feed can reduce the cost of fish meal. The research has focused on utilizing less expensive and readily available plant resources to replace fish meal, without reducing the nutritional quality of feed^[3].

The nutritional quality is a nutritional rating system developed at the Yale-Griffin Prevention Research Center. Nutritional rating is between 1 and 100 to reflect the overall nutrition provided relative to the calories consumed. The system has been marketed commercially as NuVal, and some consumer foods in the United States are marked with ONQI values as "NuVal". Fish is a food of excellent nutritional value, providing high quality protein and a wide variety of vitamins and minerals, including vitamins A and D, phosphorus, magnesium, selenium, and iodine in marine fish. Its protein is easily digestible and favorably complements dietary protein provided by cereals and legumes that are typically consumed in many developing countries. Experts agree that, even in small quantities, fish can have a significant positive impact in improving the quality of dietary protein by complementing the essential amino acids that are often present in low quantities in vegetable-based diets. But recent research shows that fish is much more than just an alternative source of animal protein. Fish oils in fatty fish are the richest source of a type of fat that is vital to normal brain development in unborn babies and infants. Without adequate amounts of these fatty acids, normal brain development does not take place. The nutritional quality of feed depends upon the availability of nutrients which is accessed through the digestibility. Formulation of feed has been consistently improved, based on digestive physiology and nutritional requirement of fish. Soyabean meal has been the most frequently studied dietary ingredients as a fish meal replace in diets for many fish species because of its high protein content, relatively well balanced amino acid profiles, reasonable price and steady supply^[4].

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Oil and protein content accounts for about 60% of dry soybeans by weight; protein about 40% and oil about 20%. The remainder consists of 35% carbohydrate and about 5% ash^[5]. Fish like other animals, have requirements for the essential nutrients such as proteins, carbohydrates, fatty acids, vitamins and minerals in their diets, in order to grow properly. When fish is placed in an artificial environment (culture practices), feed containing these essential nutrients must be supplied for better growth. Conversely the feed may be given as supplementary feed, where part of nutritional needs is supplied by natural feeds present in the aquatic environment. People in developing countries are more dependent on fish as part of their daily diet than those living in the developed world. Survey of 2015 indicates that, fish provides 7% of fish protein in North and Central America; 9% in Europe; 17%, in Africa; 26% in Asia and 22% in China.

Nutritional analysis refers to the process of determining the nutritional content of foods and food products. The process can be performed through a variety of certified methods. These include the legal requirements relating to food nutrition labels, as well as a range of associated health and safety legislation.

2. Materials and Methods

Feed formulation is the processes of designing the mixture that will meet the specific goals of fish production. Choice of ingredients to be used in feed formulation should be based on their qualities such as protein content, energy level, types of amino acids etc. Protein is the main constituent of the fish body and plant sources are always higher in proteins hence soyabean was selected as plant protein sources in present formulation. The other ingredients such as milk powder, corn

flour, eggs, cod liver oil, vitamin mixture containing vitamin B Complex and E, agar powder, garlic paste, pepper powder, and cumin powder were used.

2.1 Formulation of feeds

Soyabean meal was taken in powder form as principal ingredient. Ingredients mentioned above were added. All the ingredients were boiled till the mixture becomes semisolid mass. Ingredients in semisolid form were kept under refrigeration for 12 hrs. Then it was squeezed over polythene sheet and dried at room temperature for 48 hrs. The dried nodules were crushed into small pellets. Pellets were sun dried to avoid fungal infection. Following the above procedure all the feeds were formulated, in the percentage composition of 25% (soyabean meal 25% +groundnut oil cake 75%), 50% (soyabean meal 50%+groundnut oil cake50%), 75% (soyabean meal 75% +groundnut oil cake 25%), 100% formulated (only of soyabean meal)and 100% conventional (only of groundnut oil cake).

2.2 Experimental set up

The formulated feeds of each combination were analyzed for moisture crude protein, crude lipid, crude fiber, carbohydrates and ash values⁶. Crude protein (N * 6.25) was determined after acid digestion by Kjeldhal method⁷, lipid after extraction with petroleum ether in a Soxhlet apparatus, dry matter after drying at 100-105 °C for 24 h and ash after combustion at 550 °C for 12 h. Gross energy values were calculated assuming the energy values of protein and lipid^[8].

3. Results

Table 1: Proximate analysis of formulated feeds

Parameters	100% conventional	100% formulated	75% formulated	50% formulated	25% formulated
Moisture (%)	5.46	7.43	6.37	9.12	7.54
Total ash (%)	4.71	4.59	4.58	4.32	4.13
Protein (%)	24.49	32.92	32.92	32.70	25.99
Fat (%)	7.71	9.8	7.42	6.05	7.88
Fiber (%)	0.14	0.15	0.14	0.15	0.13
Energy(K cal)	397.28	400.28	392.70	357.89	392.14

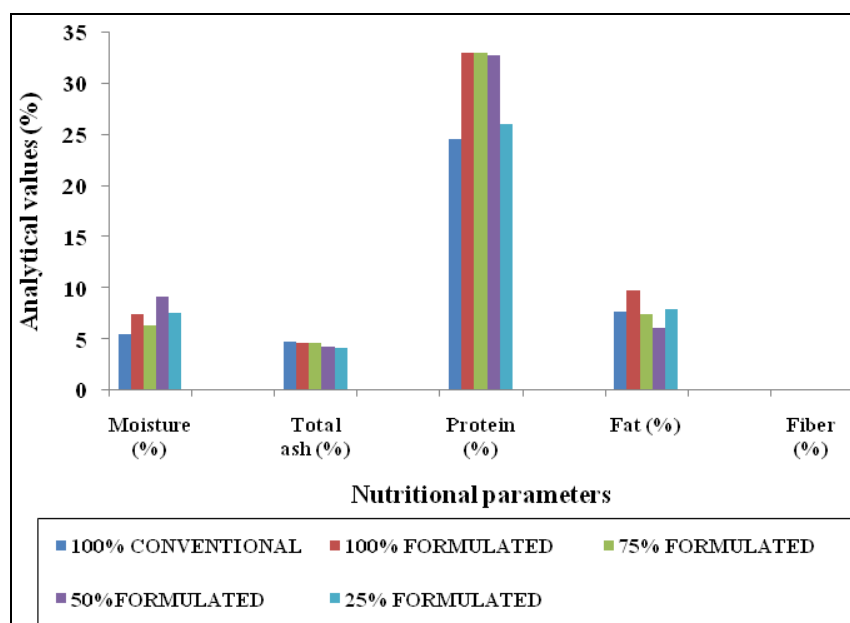


Fig 1: Graphical presentation of proximate analysis

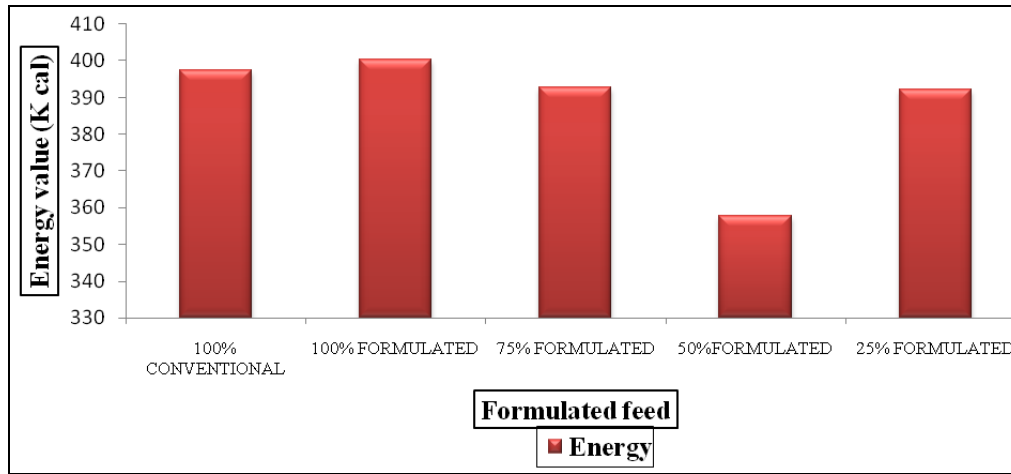


Fig 2: Graphical presentation of energy values

Nutritional analysis of formulated feed clearly reflects that, the 100% conventional feed contains 24.49% of protein, whereas, the feed formulated from soyabean contains 32.92% of protein. The other nutritional parameters like moisture, total ash and fat are also in higher proportion in 100%, 75%, 50% and 25% formulated feed as compared to 100% conventional feed (Table No 1 and Figure No 1). The total energy gained from 100% formulated feed is 400.28 Kcal/100gm while it is 397.28 Kcal/100gm for 100% Conventional feed (Figure No 2).

The results of feed analysis reveals that the formulated feed is nutritionally rich and preferentially consumed by the fishes as compared to conventional feed. It is more suitable and acceptable for the growth of fishes and can be introduced as aqua feed. The digestibility of particular feed ingredient is reflected in growth of fish.

4 Discussions

Fish feeds are the largest single operating cost in aquacultural production. Consequently, there is a continuing effort to reduce feed cost by using lower-priced ingredients. Fish meal is a major ingredient in many feeds and is commonly targeted for replacement because of its high cost and finite world supply. Several low-cost agricultural byproducts are produced in the Midwestern United States and replacing fish meal with these products in diets of fish. In India too, efforts are being geared up to formulated cost effective and nutritionally balanced feed for fishes [9]. Many plant byproducts contain lower protein levels and lower levels of essential amino acids than fish meals. In addition, plant protein feedstuffs contain antinutritional factors. For example, soybean meal contains as many as five trypsin inhibitors, non-digestible carbohydrates, lectins, saponins, phytates and possibly allergenic storage proteins.

There are several key components in ingredient assessment including ingredient characterization, ingredient digestibility, palatability, nutrient utilization and functionality. Ingredient functionality is crucial aspect of ingredient evaluation. Irrespective of the compositional or nutritional attributes of an ingredient, it cannot be functionally introduced into a feed in a manner that allows its processing in a suitable manner then it is of diminished value as a feed ingredient. Alternatively, some ingredients may add additional value to a diet, based on some functionality features that they contribute to a formulation. This is particularly the case with modern extruded feeds. A key reason for comprehensively characterizing ingredients is that, others can use the findings

from the study.

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 [10]. Over the years it has been documented that carefully formulated and well presented fish diet plays a significant role in fish culture. Essential or indispensable amino acids (EAAs) cannot be synthesized by fish and often remain inadequate but are needed for growth and tissue development [11].

As aquaculture continues to develop, there will be an increasing need to use alternative raw materials in aquaculture diets. This fact alone places great importance on the need for careful and constructive experiment design in evaluating the ingredients used in formulation of fish feed and its various combinations. However, there is a clear and present need to ensure that ingredient evaluation experiments are designed to answer specific questions. By formulating succinct strategies based on the key aspects of ingredient use and choice, digestibility, palatability, utilization and functionality then the development of sustainable alternatives will be ensured.

5 Conclusions

The result of the present study leads to the conclusion that 100% formulated feed of soybean as raw material of plant origin is nutritionally rich and more suitable for the growth of freshwater fish particularly herbivorous fishes like Grass carp, *Ctenopharyngodon idella*.

6. Acknowledgement

Authors are thankful to Head, Department of Zoology, Shivaji University, Kolhapur for providing laboratory and other infrastructure facilities and UGC SAP letter No F:3/10/2012 (SAP II) dated 29/07/2012 for financial assistance towards completion of said work.

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