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BIOCHEMICAL ANALYSIS OF LOCALLY AVAILABLE FISH FEED INGREDIENTS IN LAHORE, PAKISTAN

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Abstract: The present study was conducted to analyze the nutritional value and quality of fish feed ingredients which are commercially used by fish farmers. For biochemical analysis the fish feed samples were collected from local market in Lahore. Samples were prepared, ground and analyzed for evaluation of parameters *viz.*, moisture, crude protein, ether extract, ash, crude fiber and nitrogen free extract by using food and agriculture organization (FAO) standard methods. Comparisons were made for observed values with the standards given by FAO. The results obtained indicated that the nutritional values of the commercially available fish feed ingredients was comparable with the standard values. Minor differences observed during analysis may be due to errors in handling, temperature control, humidity and low quality raw material. The results of analysis reveal that quality of fish feed formulation. The availability of good quality raw material at an affordable price must e ensured for achieving high yields and optimum growth of fish stocks in public and private sector fish farms. It is further concluded that quality control laboratories should be established at regional level to ensure the good quality of raw material involved in fish feed preparations.
Key words: Fish, feed ingredients, proximate analyses.

INTRODUCTION

Food is the principal operating cost in the fish production. Fish requires adequate nutrition to grow and survive (Kaushik, 1990). Nature offers great diversity of food to fish including plants and animals but to get maximum food production from semi-intensive culture system, the application of artificial feed imparts a deciding role. Artificial feeding is required to maintain a density of fish than the natural fertility of water could support (Jhingran, 1974).

The nutritional value of feedstuffs is not solely on its chemical composition but also on the amount of nutrient or energy, the fish can

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absorb and use. The bioavailability of nutrient or energy in feed stuffs for many fish may be defined mainly in terms of digestibility (Hasan, 2001).

Good nutrition in animal production systems is essential to economically produce a healthy, high quality product. Fish nutrition has advanced dramatically in recent years with the development of new, balanced commercial diets that promote optimal fish growth and health. The development of new species-specific diet formulations supports the aquaculture (fish farming) industry as it expands to satisfy increasing demand for affordable, safe and high quality fish and seafood products.

Prepared or artificial diets may be either complete or supplemental. Complete diets supply all the ingredients (proteins, carbohydrates, fats, vitamins and minerals) necessary for the optimal growth and health of the fish. Most fish farmers use complete diets, those containing all the required protein (18-50%), lipid (10-25%), carbohydrate (15-20%), ash (<8.5%), phosphorous (<1.5%) and water (<10%) and trace amounts of vitamins and minerals (Craig and Helfrich, 2002). The efficacy of various fish feed has been investigated by many scientist (Mukhopadhyay and Ray, 1999; Bairagi *et al.*, 2002, 2004; Ramachandran *et al.*, 2005). During recent aquaculture development, the importance of economically least cost, high proximate profile ingredients for preparation of artificial feed increases. Keeping in view, the present study was planned to determine the proximate profile of locally and commonly available feed ingredients and comparison made with standard values proposed by food and agriculture organization (FAO) to check the nutritional quality of feed ingredients.

MATERIALS AND METHODS

The present study was carried out for the biochemical analysis of locally available fish feed ingredients (fish meal, linseed oil cake, maize gluten, rice bran, rice polish, soya bean meal, soya bean oil cake, sunflower meal, wheat bran, wheat grain) purchased from local market in Lahore by using the facilities of research laboratories at Fisheries Research and Training Institute, Manawan, Lahore.

All feed samples were placed in a Desiccator to prevent from moisture. Samples were ground to pass through a 1mm screen easily, prior to analysis. Samples were analyzed for moisture, protein, fat, ash, fiber contents and nitrogen free extract.

The fish feed ingredients samples were homogenized using a pestle and analyzed by following FAO standard methods (FAO, 1987).

Moisture contents

Sample (4-5g) was taken in a weighed, covered, flat aluminum dish and dry to constant weight at 100°C in an oven fitted with controlled ventilation. The loss in weight was recorded as moisture.

$$\text{Moisture content (\%)} = \frac{\text{Fresh sample weight - Dry sample weight}}{\text{Fresh sample weight}} \times 100$$

Crude protein

Sample (1g) was mixed with 10g potassium sulphate and 0.7g mercuric oxide as a catalyst and digested in a long neck Kjeldhal bottles with concentrated 20ml sulphuric acid for approximately 2 hours (one hour after contents are clear) at an inclined angle followed by the addition of 90ml distilled water and 25ml sulphide solution. 80ml of 40% NaOH were put in apparatus while tilting the flask so that two layers were formed. Connected rapidly to the condenser unit, liberated ammonia was collected in 50ml of boric acid solution with a drop of methyl red indicator. Ammonia was collected for about 2 minutes after the colour of indicator changed from pink to golden yellow. Then ammonia in boric acid solution was titrated against 0.1N HCl. Volume of HCl used was noted and nitrogen (%) calculated as under:

$$\text{Nitrogen content (\%)} = \frac{\text{Volume of acid used} \times \text{Normality of acid}}{\text{Weight of sample (g)}} \times 1.14$$

The crude protein content was calculated as:

$$\text{Crude protein} = \text{Nitrogen content of sample (\%)} \times 6.25$$

Crude fat

Dry feed samples (2g) were transferred to soxhlet thimble and thimble was placed into a soxhlet apparatus. Placed a dry, tared solvent flask in position beneath, added 250ml ether solvent and connect to condenser. Adjusted heating rate to give a condensation rate of 2-3 drops/second and extracted for 6 hours. On completion, removed the

thimble and reclaimed ether using the apparatus. The removal of ether was completed on a boiling water bath and flask was dried at 105°C for 30 minutes. Then cooled in a disiccator and weighed.

$$\text{Crude fat } (\%) = \frac{\text{Weight of fat}}{\text{Weight of sample (g)}} \times 100$$

Ash content

Feed samples (2g) was weighed into a dry, tarred porcelain dish and then placed in a muffle furnace at 600 °C for 6 hours. Cooled in a desiccators and weighed

$$\text{Ash } (\%) = \frac{\text{Weight of ash}}{\text{Weight of sample (g)}} \times 100$$

Crude fiber

Fat free 2g feed sample were weighed into a 600ml beaker following the addition of 200ml of hot sulphuric acid. Placed the beaker under the condenser and brought to boiling gently for 30 minutes using distilled water to maintain volume and to wash down particles adhering to the sides. This was filtered through Whatman paper No. 541 in a Buchner funnel using suction and washed well with boiling water.

Residue was transferred back to beaker and added 20ml hot sodium hydroxide solution. Replaced under the condenser and again was brought to boiling for 1 minutes. After boiling for exactly 30 minutes, filtered through porous crucible and was washed with boiling water, 1% HCl and then again with boiling water. Washed twice with alcohol, was dried overnight at 100°C, cooled and weighed. Ashed at 500°C for 3 hours, cooled and weighed.

$$\text{Crude fiber } (\%) = \frac{(\text{Wt. of crucible + Dried residue}) - (\text{Wt. of crucible + Ash residue})}{\text{Weight of sample (g)}} \times 100$$

Nitrogen free extract

The nitrogen free extract was calculated by subtracting % crude protein, crude fat, crude fiber, ash and moisture contents from 100.

Statistical analysis

Mean and standard deviation for the observed values for comparison was calculated by using "Minitab" a computer based software.

RESULTS AND DISCUSSION

In present study, the fish feed ingredients samples were collected from local fish feed market in Lahore (Pakistan).The biochemical analysis indicated that observed value of the fish feed samples like linseed oil cake, rice polish and soya bean oil cake almost met the FAO standard values. In case of fish meal and rice bran the observed values of moisture, ether extract and crude fiber were different from standard values (Table I).

Table I: Biochemical analysis of fish feed ingredients

Sr. No.	Parameters (%)	Fish meal	Linseed oil cake	Maize Gluten meal	Rice bran	Rice polish
1	**Moisture**	1.39±0.02 (1.24)*	0.63±0.01 (0.60)	0.85±0.02 (0.74)	0.85±0.01 (0.70)	0.88±0.00 (0.90)
2	**Crude protein**	49.4±3.02 (52.9)	28.4±0.70 (30.1)	31.4±0.01 (31.9)	15.4±0.09 (13.7)	12.3±0.20 (12.2)
3	**Crude fat**	8.20±2.05 (7.20)	6.50±0.44 (6.60)	11.2±1.15 (10.0)	6.80±0.96 (5.40)	15.8±1.06 (16.3)
4	**Ash**	24.2±0.01 (22.1)	9.80±0.06 (10.2)	9.65±0.30 (10.0)	17.5±0.44 (18.1)	15.0±0.45 (14.1)
5	**Crude fiber**	1.40±0.03 (1.20)	9.00±0.45 (9.30)	10.4±0.52 (12.2)	22.0±0.45 (20.0)	11.5±0.08 (12.0)
6	**NFE**	16.2±0.03 (15.6)	45.0±2.26 (43.2)	38.4±0.72 (35.2)	41.5±0.08 (42.1)	42.1±2.05 (44.5)

* Mean ± SD (FAO standard value)

The observed values of moisture and crude fiber of maize gluten were different from the standard values. The observed values of other tested parameters were slightly different from the observed values. But in

case of soya bean meal the observed values of all parameters *viz.*, moisture, crude protein, crude fat, ash, crude fiber and nitrogen free extract were different from standard (Table II). Feed ingredients of plant origin often contain less protein than those of animal origin but protein in many plant products appears to be digested by carnivorous and omnivorous fishes as efficiently as that in animal products (Tacon and Jackson, 1985; Cho and Cowey, 1991; Wilson, 1991; Sullivan and Reigh, 1995).

Table II: Biochemical analysis of fish feed ingredients

Sr. No.	Parameters (%)	Soya bean oil cake	Soya bean meal	Sun flower meal	Wheat bran	Wheat grain
1	**Moisture**	0.42±0.01 (0.40)*	0.80±0.02 (0.75)	0.68±0.07 (0.60)	0.90±0.02 (1.00)	1.10±0.02 (1.20)
2	**Crude protein**	45.6±0.32 (47.5)	47.3±0.06 (52.8)	41.6±0.67 (42.3)	15.1±0.95 (13.5)	12.6±0.81 (12.9)
3	**Crude fat**	6.80±1.06 (6.40)	1.20±0.10 (1.50)	5.00±1.04 (4.00)	9.20±0.86 (8.10)	2.00±0.20 (1.70)
4	**Ash**	6.00±1.04 (6.40)	9.45±0.08 (7.60)	8.05±0.43 (7.50)	3.9±0.43 (4.30)	1.50±0.80 (1.70)
5	**Crude fiber**	4.90±0.43 (5.10)	5.40±0.77 (6.60)	14.4±0.52 (16.1)	12.5±0.80 (13.1)	4.05±0.02 (3.10)
6	**NFE**	36.3±1.95 (34.6)	35.1±1.90 (46.7)	31.6±0.60 (29.5)	58.7±1.20 (60.0)	77.7±0.51 (79.4)

* Mean ± SD (FAO standard value)

The present study revealed that the nutritional value and the quality of the fish feed ingredients locally available in the market in Lahore was comparable with the FAO standard values. It was concluded that the fish feed ingredients commercially available were according to the fish farmer's requirements for optimum growth of fish. Minor differences might be due to some errors in processing like cooking, pressing, separation and drying. The results of biochemical analysis for nutrients can be affected by various factors collected including collection of a representative samples, sample preparation methodology, laboratory and instrument variation. In Pakistan,

availability of a research based good quality and ready to use supplementary diet is still a problem.

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