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## Comparative Study of Biochemical Properties of Non-Conventional Plant Sources to Prepare Low Cost Fish Feed

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**Abstract:** Biochemical analysis of non-conventional plant sources, Bermuda Grass, Nursery Grass (sages), Typha and Maize Spike (without grains) was done to determine the nutritional value to replace conventional sources such as rice bran, wheat bran and rice polish to prepare low cost fish feed. Analysis was carried out in the research lab of Institute of Biochemistry, University of Sindh, Jamshoro. It was observed that Bermuda grass and Nursery grass (sagas) have good protein value as 2.84 and 10.97, respectively. It is also observed that these non-conventional plants are a good source of energy and easily available around the year.

**Key words:** Biochemical analysis, bermuda grass, sages

### INTRODUCTION

Natural food in any water body can support only a small population of fish. But intensive culture of any fish species with quality fish feeds, prepared from indigenous cheaper sources of plant and animal food materials allow high stocking density and thereby increase production of fish in many folds (Sanaullah *et al.*, 1986). The high demand and low supply of fish meal in the market due to intensive trash fish catching and increasing animal feed industry it is highly needed to find the non conventional feed ingredients which are locally available and can be used as alternate protein sources to replace the existing commercial bran and animal protein sources while the cost of feed reduced to an affordable limits.

Plant origin alternate ingredients include local grasses, leaves, oil girds and aquatic plants. These non conventional alternate plant ingredients are good source of protein and energy can use to replace existing conventional sources in feed for major carps (Rashid *et al.*, 1996).

The biochemical composition (proximate analysis) of protein, fat and carbohydrate of any feed stuff helps to formulate nutritionally well balanced diet for the rearing of any fish species. The plant origin feed stuffs including Bran, Polishes, grains, leaves, stoves, cobs, roots and grasses are placed in energy rich feed stuffs with high carbohydrate and fiber content, while plant origin cakes are low cost and easily available protein sources as compare to animal protein source (fish meal). In fresh water aquaculture fish farmers consider these cakes

suitable feed ingredient than fish meal. Most of the plant origin protein is obtained from plant seeds (bran, cakes, grains, flour) placed in energy rich ingredients as these have less than 20% protein content except oil cakes have more than 20% protein content. These plant origin protein and energy sources now widely used in carp fish feed industries due to their availability and low cost. Shaheen *et al.* (2000) applied and reported that the overall production of aquaculture increased with artificial balance diet. Jagdesh and Madan (1984) reported the rearing of grass carp, *Ctenopharyngodon idella* with cattle fodder. In present study attempt is made to analyze some non conventional plant sources which are locally and cheaply available to fish farmers and to prepare fish feed of high efficiency and low cost.

### MATERIALS AND METHODS

Four non-conventional plant samples, Bermuda grass, Nursery grass, Typha and Maize spike (without Grains) were collected from fish hatchery ChilyaThatta, while two conventional sources, wheat bran and rice bran were purchased from Thatta market. Plant samples were cut into small pieces, air dried, grinded and saved for further process. Biochemical analysis such as protein, fat, Ash, Moisture, Energy and aflatoxin were carried out in the research lab of Institute of Biochemistry University of Sindh.

**Protein analysis:** It was done by following Kjeldhal's method (Kjeldahl, 1883).

**Fat analysis:** Fat was extracted from samples by soxhlation method and total fat was calculated through formula:

$$\text{Percentage of moisture} = \frac{\text{Weight of fat}}{\text{Sample weight}} \times 100$$

**Ash analysis:** Four gram of grinded sample was taken in a pre-weighed clean empty crucible and placed in pre-heated muffle furnace at 600°C for 6 h. After cooling ash was weighed with known weight crucible and ash content was calculated by using formula:

$$\text{Weight of sample} - \text{Weight of crucible} + \text{ash} = \text{Weight of ash}$$

$$\text{Percentage of Ash} = \frac{\text{Weight of ash}}{\text{Weight of sample}} \times 100$$

**Moisture analysis:** Ten grams of the fine grinded sample was taken in a pre-weighed Petri dish and placed in oven at 105°C for overnight, followed by placed in desiccators for half an hour. Moisture free sample was weighed to calculate the percentage of moisture as follows  $\text{Weight of sample before moisture extraction} - \text{weight of sample after moisture extraction} = \text{weight of moisture}$ .

**Energy analysis:** It was carried out by using "Parr bomb calorimeters model No 6400. It is an automatic instrument which widely used in research to calculates the metabolic energy.

**Total aflatoxin analysis:** Total aflatoxin analysis was done by VICAM Series-4EX Fluorometer.

**RESULTS AND DISCUSSION**

The results of protein percentage of plant origin non conventional feed stuffs in comparison with existing commercial conventional feed stuffs reveals that the protein percentage in Bermuda grass, nursery grass and typha is more than conventional sources that is 12.84, 10.97 and 10.50%, respectively. While in maize spike (without grains) low protein content was found as 2.75%. Fat extraction was carried out by soxhlation apparatus the total fat percentage of non conventional plant source feed stuffs in comparison with conventional sources. The highest fat content found in dried maize spike (without grain) followed by typha as 7.56 and 6.26%, respectively. The lowest fat content was present in Bermuda grass that is 4.65% while nursery grasses (Sages) have 4.75% fat content. The results of non conventional feed stuffs reveals that their fat content suits the fish feed requirements and could be used as cheap and easily available feed ingredient. The highest amount of ash found in nursery grasses as 12.90%

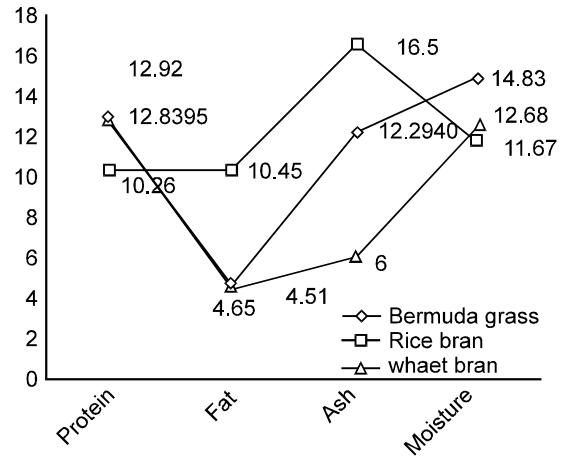


Fig. 1: Comparative biochemical analysis of Bermuda grass

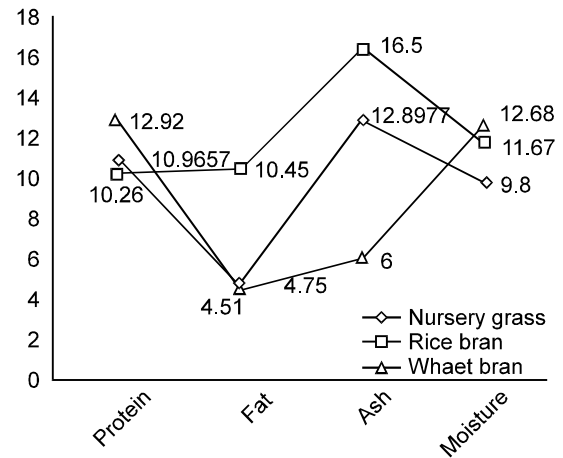


Fig. 2: Comparative biochemical analysis of Nursery grass

while lowest found in maize spike as 3.05%. Moisture analysis of non conventional plant origin source is presented in table shows the highest amount of moisture was observed in Bermuda grass followed by typha plant as 14.83 and 13.06%, respectively. While the lowest moisture percentage was present in nursery grasses (SAGES) as 9.8%. The moisture content of these Non-conventional plants was also in the range of conventional sources.

The total energy content (Cal/kg) of plant origin non conventional feed stuffs was found slightly lower than that of commercial ingredients. the comparative energy content of non conventional feed stuffs with conventional ingredients shows that the highest amount of energy is found in nursery grasses that is 2848.07 Cal/kg while lowest amount was found in Bermuda grass as 2409.23 Cal/kg.

Table 1: Biochemical analysis of conventional and non-conventional plants sources

Samples	Protein (%)	Fat (%)	Ash (%)	Moisture (%)	Energy Cal/kg	Aflatoxin
Bermuda grass	12.84	4.65	12.30	14.83	2409.23	7
Nursery grass	10.97	4.75	12.90	9.80	2848.07	9
Typha	10.50	6.26	12.74	13.06	2588.20	11
Maize spike	2.75	7.56	3.05	10.33	2810.68	6
Rice bran	10.26	10.45	16.50	11.67	3176	-
Wheat bran	10	4.51	6	12.68	3176	-

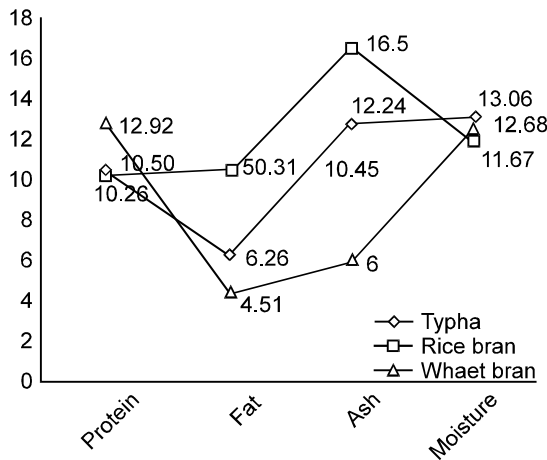


Fig. 3: Comparative biochemical analysis of Typha

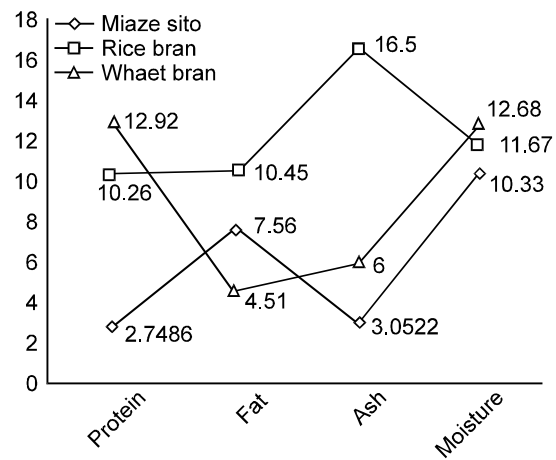


Fig. 4: Comparative biochemical analysis of Maize sito

Total Aflatoxin analysis was carried out by VICAM Series-4EX Fluorometer analyzer. The highest Aflatoxin level present in typha plant as 11 ppb while lowest was found in Maize spike (without grains) that is 6 ppb.

The Research findings on the nutritional requirements of fishes and the advances in fish feed composition reveals that there is the provision of partial or complete replacement of fishmeal and existing conventional bran with novel protein from other plants. Several researchers also made attempt for partial or complete replacement of fish meal without loss of growth performance (Webster *et al.*, 1992).

During the present research four plant sources were selected for the biochemical analysis to find out the potentially good sources of proteins, includes Bermuda grass, nursery grass, Typha, maize spike (without grains).

The plant protein can be similar in terms of protein content but the amino acid profile is quite different so it does not completely replace the fish meal. Complete and partial replacement can be done with combination of protein sources or with the addition of supplemented amino acid (Webster *et al.*, 1992).

The biochemical analysis of plant sources were carried out to find their nutritional potential. The nutritional analysis of Bermuda grass includes protein, fat and Ash% content. The present results correlates with previous results reported by Butterworth (1963), Caceres and Kalous (1986), Xande *et al.* (1989), Arieli and Werner (1989), Nasrullah *et al.* (2003), Prado *et al.*

(2004) and Babayemi Bamikole (2006). Sultan *et al.* (2007) and Krueger *et al.* (2008). The protein content of Bermuda grass is 12.84% which slightly higher than the commercial fish feed bran including rice bran and wheat bran. The fat percentage, ash percentage and moisture percentage resembles with the existing bran which is encouraging to replace conventional sources with non conventional sources. As Bermuda grass has high growth potential and resistance to salinity and water logging can be a good replacement of conventional bran sources.

The Nursery grasses (sages) are easily available plant source for fish farmers as these are available around the year and have high growth potential can be use as one of the replacement of conventional bran sources for that purpose the biochemical analysis of nursery grasses were carried out to find their nutritional value. The biochemical analysis of these grasses includes protein, fat, ash and moisture%. The protein content of nursery grasses was 10.97% while ash%. Moisture% and fat percentage also correlate with the findings of Ahmed and Ahmed (1983), Gowda *et al.* (2004), Aguiar *et al.* (2006) and Fulkerson *et al.* (2008). The nutritional content of nursery grasses also resembles with slightly variation with existing bran sources specially protein content and energy content. The availability around the year and free of cost availability makes these grasses more valuable for aquaculture feed preparation.

Biochemical analysis of typha was carried out to find its nutritional value due to its abundant growth and

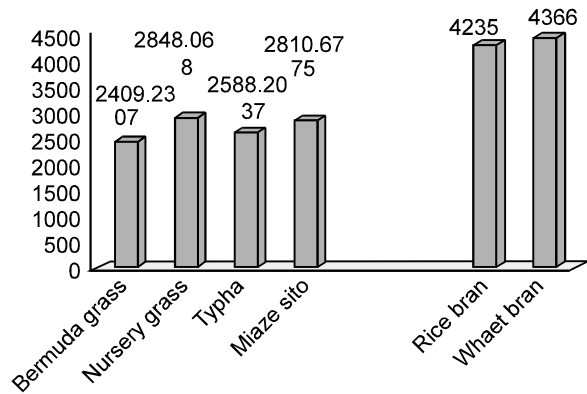


Fig. 5: Total energy analysis of conventional and non-conventional plants sources

availability. The outcomes of analysis are very encouraging. The protein, ash, fat and moisture content of typha are 10.50, 12.74, 6.26 and 13.06%, respectively while the aflatoxin level is also under recommended range for animal feeds. Typha is perennial herbaceous plant various researchers had reported about its reproduction (Smith, 1962; Keddy and Ellis, 1985) had reported about its germination while Harris and Marshall (1963) had reported its ecological impacts, but no any significant study is carried out about its nutritional value and its digestibility. The present study reveals it can be use as feed ingredients to replace existing plant feed sources but before use it commercially in feed preparation study should be carried out about its digestibility and its effect on animal biology.

The maize dried spikes (without grains) is another non conventional source which can be used as complete or partial replacement of bran. The maize dried spike collected from the domestic field were carried out for nutritional analysis that includes protein content, ash content, fat content and moisture content. The results are as 2.75, 3.05, 7.56 and 10.33%, respectively, previously number of researchers reported the chemical composition of maize dried cobs includes (Ohlde and Becker, 1982; Tisserand and Alibes, 1989; Richard *et al.*, 1989; Alibes and Tisserand, 1990; Roa *et al.*, 1997; Abdulrazak *et al.*, 1997). The protein percentage of observed samples is little lower than the reported content that is may be due to different varieties or agronomical factors while the ash percentage resembles with slightly variation with already observed values. The maize Stover is used as feed for animal while dried spike have no any potential use in animal feed. The biochemical analysis of dried spike suggests that the protein content is lower than commercial sources and fat content is slightly higher than existing conventional bran. The proximate composition suggest that these dried maize spike (without grain) can be used along with any other protein rich source as partial replacement of commercial bran.

The metabolic energy content of Bermuda grass is 2409 Cal/kg which is little lower than the commercial fish feed bran including rice bran and wheat barns may be due to high fiber content. The energy content of sages was 2848 Cal/kg presented in also correlate with the previously reported data by different researchers (Ahmed and Ahmed, 1983; Gowda *et al.*, 2004; Khanum *et al.*, 2007). The energy content of typha and maize spike was 2588 and 2810 Cal/kg, respectively. The biochemical analysis of dried spike suggests these have good energy content which almost resembles with conventional sources including rice bran and wheat bran.

**Conclusion:** The results of primary biochemical analysis of selected non-conventional plant origin Bermuda grass, Typha, Nursery grasses, maize spike (without grain) reveals that these are good source of protein and energy could be used as partial or complete replacement of existing conventional sources. The Aflatoxin analysis of plants, suggests that these all Non-convention feed ingredients are fine and safe for feed preparation and utilization by animal and fishes. These ingredients are very cheap (Low-cost) and easily available to Fish farmers throughout the year.

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