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**CHAPTER I**

**Nutritive value of rice polish**

**Abstract**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The present study was undertaken to observe the chemical composition of different types of rice polish available in the metropolitan areas of Chittagong, Bangladesh. Twenty different types of rice polishes were collected from study areas. Chemical analyses of the samples were carried out in triplicate for moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash in the animal nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh. Metabolizable energy (ME) was calculated mathematically for all samples by using standard formula. Results indicated that, there were no marked variations (P>0.05) in the moisture, dry matter and total ash contents of the samples. However, metabolizable energy, crude protein, crude fiber, nitrogen free extracts and ether extracts content significantly differed (P<0.01) from one sample to another. Moisture content varied from 4.0 to 11.4 g/100g, dry matter content varied from 88.6 to 96.0 g/100g, metabolizable energy content varied from 1321.8 to 3086.9, crude protein content varied from 4.73 to 14.9 g/100g, crude fiber content varied from 6.4 to 41.5 g/100g, ether extract content varied from 1.0 to 18.0 g/100g, nitrogen free extracts content varied from 25.1 to 52.9 g/100g and total ash content varied from 7.13 to 17.6. It could therefore, be inferred that, the chemical composition rice polish currently available in the local market are widely variable.

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**Key words:** Rice polish, moisture, dry matter, crude protein, crude fiber, nitrogen free extracts, ether extracts and total ash

**CHAPTER II**

**INTRODUCTION**

Poultry industry is an emerging agribusiness started during eighties in Bangladesh. Broiler and layer farming is an important part of commercial poultry enterprise. It provides a large part of increasing demand for animal protein, cash income and creates employment opportunities. Broiler production in Bangladesh is increasing day by day. The higher price and non-availability of feed ingredients are two major limitations to the growth of commercial broiler enterprises. The feed cost alone accounts 60-70% of total production cost and the broiler farming requires quality feed at reasonable cost to make farming profitable (Bulbul and Hossain, 1989). Therefore, it is imperative to explore cheaper locally available feedstuff to reduce feed cost. About 80% feedstuffs used in poultry ration are being imported. As a result, the cost of feed prepared for poultry using those grains stand high. Computing feed with conventional feed ingredients available hardly permits profitable poultry production.

Among grain by products, rice polish is most abundant in Bangladesh throughout year. It is also a cheaper ingredient and might be an alternative to wheat or maize. Polish constitutes about 10% of paddy and is available in large quantities in major rice growing areas of the world (Houston and Kohler, 1970). Raw rice polish produced in huller mills is not a good feed for poultry as they contain husk, saw dust, mud etc. Rice polish contains 13% crude protein and 3250 kcal ME/kg which is comparable to wheat or broken rice in chemical composition (Eshawaraiah *et al*. 1998). Therefore, rice polish is a promising alternative feed for livestock.

Despite wide range of advantages, the quality of rice polish available in the local market is questioned. Because, rice husk and saw dusts are frequently incorporated into it to make it cheap. Therefore, the present study was aimed to investigate the chemical composition of rice polish available in the markets of the metropolitan areas of Chittagong, Bangladesh.

**CHAPTER III**

**REVIEW OF LITERATURE**

**Nutritive value**

Rice polish is a byproduct of rice milling and is the cheapest source of energy and protein for poultry feeding. It constitutes about 10% of paddy and is available in large quantities in major rice growing areas of the world (Houston and Kohler, 1970). Rice polish is derived from the outer layers of the rice caryopsis during milling and consists of pericap, seed coat, nucleus, aleurone layer, germ and part of sub-aleurone layer of starchy endosperm (Juliano, 1988).

Rice polish supplies total digestible nutrients almost close to maize (Singh and Panda, 1988). Use of rice polish in poultry industry may reduce feed cost per kilogram weight gain (Khalil *et al*., 1997b; Shih, 2003).

Rice polish is a major cereal by-product available for animal feeding in rice-growing countries. It is a good source of protein (13.2 to 17.1%), fat (14.0 to 22.9%), carbohydrate (16.1%), fiber (9.5 to 13.2%), vitamins and minerals (Vargasgonzalez, 1995; Aljasser and Mustafa, 1996; Ambashankar and Chandrasekaran, 1998).

This chemical profile is comparable to other cereals like maize, wheat, sorghum and rice tips. It is also a rich source ofphosphorus, potassium, iron, copper and zinc, and the amino acid profile of the rice bran protein is generally superior to that of cereal grains. The fiber contents range from 10-15% (Farrell, 1994).

It also contains better assortment of amino acids, particularly lysine and methionine, compared to other cereal grains, including corn and wheat. (Khalique *et al*., 2004).

In addition to macronutrients, vitamins, minerals, medicinally important antioxidant and γ-oryzanol content of rice polish has recognized it as a potential source of edible oil (Iqbal *et al.,* 2005; Moldenhauer *et al.,* 2003; Chatha *et al.,* 2006).

Research conducted during the last two decades has shown that rice polish is a unique complex of naturally occurring antioxidant compounds (Iqbal *et al.,* 2005; Moldenhauer *et al.,* 2003).

**Inclusion level**

Ricepolish in the diet does not affect the health of chickens (Mahbub *et al*., 1989). In experiments with chicks, cereal grains have been replaced with rice polish , and it was found promising in certain substitutions (Dafwang and Shwarmen, 1996; Khalil *et al*., 1997a,b).

Rice polishing has great potential as an ingredient in poultry feed, with inclusion level varying from 25 to 40% (Singh and Panda, 1988). It is a good source of proteins, energy, vitamins and minerals (Saunders, 1990).

Rice polish could be used up to 30% in mash for broilers. Up to 30% rice polish in broiler diets replacing maize significantly improved live weight gain, whereas feed conversion efficiency was unaffected (Steyaert *et al*. 1989).

The decrease in weights of broiler chicks fed on diets containing more than 30% untreated RP might be due to higher fiber contents in the feed. Higher fiber concentration reduced the digestibility of fat, protein and carbohydrate and increased the transit time of feed from the gastro-intestinal tract (Siri *et al*., 1992; Smits, 1996).

**CHAPTER IV**

**MATERIALS AND METHODS**

**Study area**

Livestock and poultry feeds are mostly available in Pahartali, Khatungonja and Karnaphuli markets of Chittagong metropolitan areas. Almost all metropolitan farmers collect their livestock feeds from these three markets Therefore, these three markets were selected as the study are for collection of sample.

**Collection of sample**

Samples were collected by using simple random sampling technique. Twenty feed shops were selected randomly. Approximately 500 grams of rice polish was purchased from each shop. Samples were wrapped up by polythene bag and preserved in the laboratory for chemical analysis.

**Preparation of sample**

Samples were subjected to grinder to make it homogenous powder. Later on, it was mixed properly and exposed to shade to cool down for sampling.

**Analysis of sample**

Chemical analyses of the samples were carried out in triplicate for moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash in the animal nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh as per AOAC (1994).

**Calculation of ME**

ME was calculated separately for all 20 different rice polish samples. Calculation was performed by mathematical formula as per Ludhi *et al*. (1976)

**Data analysis**

Data related to chemical composition of rice polish were compiled by using Microsoft Excel 2007. One sample t-test was performed to analyze the data by using Statistical Package for Social Sciences (SPSS 16.0) and Stata 11C. For each t-test, reference value for the relative component was obtained from text book (Banerjee, 1995) to use as the test value for that particular component. Statistical significance was accepted at 5% level (P<0.05).

**CHAPTER V**

**RESULTS**

Chemical composition of rice polish particularly, moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash contents in different rice polish samples have been presented in this chapter.

**Table 1. Chemical composition (g/100g) of rice polish**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Parameters** | **Minimum** | **Maximum** | **Mean** | **STDEV** | **S.E** | **Sig.** |
| Moisture (g/100g) | 4.0 | 11.4 | 7.98 | 2.1 | 0.46 | NS |
| DM (g/100g) | 88.6 | 96.0 | 92.02 | 2.1 | 0.46 | NS |
| ME (kcal/kg) | 1321.8 | 3086.9 | 2088.0 | 661.3 | 147.9 | \*\* |
| CP (g/100g) | 4.73 | 14.9 | 8.767 | 3.7 | 0.83 | \*\* |
| CF (g/100g) | 6.4 | 41.5 | 25.24  | 13.2 | 2.96 | \*\* |
| NFE (g/100g) | 25.1 | 52.9 | 37.84 | 8.6 | 1.93 | \*\* |
| EE (g/100g) | 1.0 | 18.0 | 7.85 | 5.3 | 1.18 | \*\* |
| Ash (g/100g) | 7.13 | 17.6 | 12.5  | 3.7 | 0.84 | NS |

DMDry matter; CPCrude protein, CFCrude fibre, NFENitrogen free extracts, EEEther extracts; STDEVStandard deviation, SEStandard error; NSNon-significant (P>0.05); \*\*Significant at 1% level (P<0.01)

**Table 2. Reference values (g/100g) for chemical composition of rice polish recommended by different researchers**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Reference** | **DM**  | **CP** | **CF** | **EE** | **Ash** |
| Banerjee, G.C. (1995) | 91.8 | 12.7 | 11.2 | 13.9 | 13.6 |
| Malik *et al*. (1979) | 92.60 | 11.45 | 03.85 | 14.65 | 10.80 |
| Choo and sadiq (1982) | - | 11.00 | 12.00 | 09.50 | 09.80 |
| Rao and Reddy (1986) | 18.10 | 12.00 | 07.60 | - | 17.40 |
| Ghazi (1992) | 92.75 | 12.97 | 15.71 | 10.71 | 17.15 |
| NRC (1994) | - | 12.20 | 03.58 | 11.00 |  |
| Nadeem (1998) | 91.38 | 14.97 | 11.86 | 14.07 | 10.75 |
| Leeson and Summers | - | 11.00 | 02.40 | 15.00 | - |
| Present study | 92.02 | 8.767 | 25.24 | 7.85 | 12.5 |

Moisture content did not differ significantly (P>0.05). Minimum, maximum and mean values for moisture content were 4.0, 11.4 & 7.98 respectively. Similar to moisture, DM content did not differ (P>0.05). Minimum, maximum and mean values for DM content were 88.6, 96.0 and 92.02 respectively.

Unlike moisture and DM, CP content differed significantly (P<0.01). Minimum, maximum and mean values for CP content were 4.73, 14.9 and 8.787 respectively. Similar to CP, CF content differed significantly (P<0.01). Minimum, maximum and mean values for CF content were 6.4, 41.5 and 25.24 respectively.

NFE content also differed significantly (P<0.01). Minimum, maximum and mean values for NFE content were 25.1, 52.9 and 37.84 respectively. EE content did not differ significantly (P>0.05). Minimum, maximum and mean values for content were 1.0, 18.0 and 7.85 respectively.

**CHAPTER VI**

**DISCUSSION**

In present study, mean value for moisture in rice polish was 7.98 g/100g. The result is in agreement with Banerjee (1995) who found 8.2 g/100g moisture in rice polish. Malik *et al*. (1979) also obtained 7.4 g/100g moisture in rice polish. Other investigators (Anjum *et al*., 2007; Hamid el al., 2007; Sharif *et al*., 2005; Sirikul *et al*., 2009) also found closely similar results. However, the result of the current study is contradictory with Rao and Reddy (1986) who found 18.10 g/100g moisture in rice polish.

Mean value for DM in rice polish was 92.02 g/100g. The result is in agreement with Banerjee (1995) who found 91.8 g/100g DM in rice polish. Malik *et al*. (1979) also obtained 92.6 g/100g DM in another study. Anjum *et al*. (2007), Hamid el al. (2007), Sharif *et al*. (2005) and Sirikul *et al*. (2009) also found similar result. However, the result of the current study is inconsistent with Rao & Reddy (1986) who found 81.9 g/100g DM in rice polish.

In present study, mean value for CP was 8.787 g/100g. The result is consistent with other investigators (Anjum *et al*., 2007; Hamid el al., 2007; Sirikul *et al*., 2009) also found closely similar results. However, it differs with Rao and Reddy (1986) who found 12.7 g/100g CP in rice polish. Banerjee (1995) found 12.0 g/100g CP and Malik *et al*. (1979) found 11.45 g/100g CP. Similarly, result of the current study is inconsistent with other investigators (Alencar and Alvarenger, 1991; Gnanasambandam and Hetiarachchy, 1995; Kahlon and Smith, 2004; Saunder, 1990; Sekhon *et al*., 1997; Sharif *et al*., 2005; Sikka, 1990).

In present study, mean value for CF was 25.24 g/100g. The result is contradictory with Rao and Reddy (1986) who found 7.60 g/100g CF in the rice polish. Similarly Banerjee (1995) also found 11.2 g/100g CF and Malik *et al*. (1979) found 3.85 g/100g CF in the rice polish. Other researchers (Gnanasambandam and Hetiarachchy, 1995; Hamid el al., 2007; Saunder, 1990; Sekhon *et al*., 1997; Sharif *et al*., 2005; Sikka, 1990; Kahlon and Smith, 2004) also found similar results.

In present study, mean value for EE was 7.85 g/100g. The result is in agreement with Choo & Sadiq (1982) who found 9.5 g/100g EE in rice polish. Similarly, Hamid el al. (2007) also found 8.7-18.9 g/100g EE in rice polish. Anjum *et al*. (2007) also obtaine 9.72 g/100g ether EE in rice polish. However, the result of the current study is contradictory with Banerjee (1995) who found 13.9 g/100g EE in the rice polish. Malik *et al*. (1979) also found 13.65 g/100g EE in rice polish. Findings of other investigators (Kahlon and Smith, 2004; Saunder, 1990; Sharif *et al*., 2005; Sikka, 1990; Sirikul *et al*., 2009) are also inconsistent with present study.

In present study, mean value for Ash was 12.5 g/100g. The result is in agreement with Banerjee (1995) who found 13.6 g/100g ash in rice polish. Similarly Malik *et al*. (1979) also obtained 10.80 g/100g ash in rice polish. Other investigators (Anjum *et al*., 2007; Gnanasambandam and Hetiarachchy, 1995; Kahlon and Smith, 2004; Saunder, 1990; Sekhon *et al*., 1997; Sirikul *et al*., 2009) also found similar results. The result of the current study is contradictory with Rao and Reddy (1986) who found 17.4 g/100g ash in rice polish. Similarly Ghazi (1992) also who found 17.15 g/100g ash in rice polish. Anjum *et al*. (2007) obtained only 5.9 g/100g ash in rice polish.

**CHAPTER VII**

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**CHAPTER**

**APPENDIX**

**Table 1. Chemical composition (g/100g) of rice polish collected from study area (n=20)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample No.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** |
| Moisture (g/100g) | 11.4 | 8.0 | 9.6 | 8.2 | 9.4 | 7.6 | 10.0 | 10.2 |
| DM (g/100g) | 88.6 | 92.0 | 90.4 | 91.8 | 90.6 | 92.4 | 90.0 | 89.8 |
| ME (kcal/kg) | 2562.3 | 1321.8 | 3071.1 | 1496.4 | 3086.9 | 1353.1 | 2524.4 | 2516.2 |
| CP (g/100g) | 14.5 | 6.5 | 13.34 | 6.3 | 13.67 | 5.6 | 12.8 | 11.85 |
| CF (g/100g) | 8.0 | 36.0 | 8.5 | 34.5 | 6.4 | 40.6 | 12.0 | 12.8 |
| NFE (g/100g) | 52.9 | 25.5 | 47.0 | 31.0 | 49.4 | 25.1 | 46.7 | 47.4 |
| EE (g/100g) | 5.0 | 4.0 | 15.0 | 4.0 | 14.0 | 5.0 | 8.0 | 8.0 |
| Ash (g/100g) | 8.2 | 20.0 | 6.56 | 16.0 | 7.13 | 16.1 | 10.5 | 9.75 |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample No.** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
| Moisture (g/100g) | 6.8 | 5.2 | 9.0 | 7.2 | 9.2 | 4.8 | 5.8 | 5.4 |
| DM (g/100g) | 93.2 | 94.8 | 91.0 | 92.8 | 90.8 | 95.2 | 94.2 | 94.6 |
| ME (kcal/kg) | 1568.9 | 1886.2 | 1518.8 | 1542.5 | 2947.8 | 1649.6 | 1801.2 | 1501.3 |
| CP (g/100g) | 6.3 | 4.73 | 6.13 | 6.3 | 12.4 | 5.25 | 5.20 | 6.10 |
| CF (g/100g) | 33.5 | 30.67 | 31.37 | 34.6 | 9.2 | 34.55 | 32.8 | 36.8 |
| NFE (g/100g) | 37.7 | 44.4 | 38.6 | 32.4 | 44.2 | 32.2 | 39.1 | 29.1 |
| EE (g/100g) | 2.0 | 4.0 | 1.0 | 4.0 | 15.0 | 6.0 | 5.0 | 5.0 |
| Ash (g/100g) | 13.7 | 11.0 | 13.9 | 15.5 | 10.0 | 17.2 | 12.1 | 17.6 |

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Sample No.** | **17** | **18** | **19** | **20** | **Mean ± SD** | **SE** | **Sig.** |
| Moisture (g/100g) | 4.0 | 8.6 | 9.6 | 9.6 | 7.98 ± 2.1 | 0.46 | NS |
| DM (g/100g) | 96.0 | 91.4 | 90.4 | 90.4 | 92.02 ± 2.1 | 0.46 | NS |
| ME (kcal/kg) | 1740.2 | 2969.3 | 1664.4 | 3037.5 | 2088 ± 661.3 | 147.9 | \*\* |
| CP (g/100g) | 5.8 | 14.9 | 6.7 | 10.77 | 8.767 ± 3.7 | 0.83 | \*\* |
| CF (g/100g) | 41.5 | 10.2 | 35.8 | 11.6 | 25.24 ± 13.2 | 2.96 | \*\* |
| NFE (g/100g) | 25.4 | 35.6 | 31.2 | 41.8 | 37.84 ± 8.6 | 1.93 | \*\* |
| EE (g/100g) | 10.0 | 18.0 | 6.0 | 18.0 | 7.85 ± 5.3 | 1.18 | \*\* |
| Ash (g/100g) | 13.3 | 12.7 | 10.7 | 8.23 | 12.5 ± 3.7 | 0.84 | NS |