Protein quality of rice by-product

Subramanian R¹[^1], Manivannan S²[^2], Rajasek R³[^3], Suganya K⁴[^4]

1. Research scholar, Dept. of Environmental & Herbal Science, Tamil University, Thanjavur, Tamil Nadu, India
2. Assistant Professor, PG & Research Dept. of Biotechnology, Bharath College of Science and Management, Thanjavur, Tamil Nadu, India
3. Research Scholar, PG & Research Dept. of Biotechnology, Bharath College of Science and Management, Thanjavur, Tamil Nadu, India
4. Research Scholar, PG & Research Dept. of Biotechnology, Bharath College of Science and Management, Thanjavur, Tamil Nadu, India

[^1]: Corresponding author: Research scholar, Dept. of Environmental & Herbal Science, Tamil University, Thanjavur, Tamil Nadu, India. Mail: rajmani375@yahoo.com, Mobile No: (+91-7373958853

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ABSTRACT

Rice is a basic food for a large part of the world’s population. It is stable food for more than half of humanity. In this present study raw rice bran and parboiled rice bran were taken, the proximal compositions of rice also studied in both rice bran samples. Proximal composition of raw rice bran recorded higher content of moisture, ash, fiber, carbohydrates and mainly in proteins. The protein isolates were obtained by alkaline solubilization process with sodium hydroxide was recorded higher of protein in 0.3N concentration SDS-PAGE was carried out in protein isolates of rice bran samples. The amino acids profile was done by using High performance thin layer chromatography (HPTLC) for the sample.

Key words: Rice bran, Oryza, Physico - chemical parameters, SDS PAGE, protein Quality

1. INTRODUCTION

The proteins are building blocks of all muscles of our body. They are important constituents to tissues and cells of the body, these macronutrients are essential for building up the human health. These waste protein sources are available from food industries, agro industries, oil industries etc., like rice byproduct are low value but are rich in proteins which are highly medicinal value. Every continent of the planet produces rice except Antarctica. The major rice growing countries are china, Indonesia, Bangladesh Thailand, Burma, Vietnam, Japan and Philippines more over India is second largest country of producing rice. Rice bran is an underutilized milling co-product of rough rice. At present large amount of rice bran has been discarded and used as animal feed. Our study highlights the protein content their extraction and characterization. Several researchers have undertaken in a white rice in an attempt to increase the utilization of rice bran as human food. Rice bran accounts for 60% of the nutrients found in each rice kernel. Since rice bran has little economic value, a high degree of milling is not practiced in many countries unless the white rice is used to meet special needs of export market frequently as a 40% of the maximum yield of bran is recorded Saunders, 1986. It is the pale yellow, odorless with pleasant flavour, highly sweet nutritious and also rich in protein, minerals, vitamins, fibers, fat and newly discovered disease lighting antioxidants are found.

Rice brand consist of protein with 12-17% (Saunders, 1990) protein digestibility is greater than 90%. Rice bran is considered as good source of hypoallergenic proteins and such rice bran may serve as a suitable ingredient for infant food formulation (Burks and Helm 1994) although the nutritional and pharmaceutical potential of rice bran has been recognized (Houston, 1972) rice bran are also considered as a vegetable protein sources for nutritional enrichment of the bakery products (Chavan and Kadam, 1993). The protein composition of the rice bran is quiet different from milled rice mainly composed of albumin 37% globulin 36% glutelin 22% about 20 amino acids are present in nature of these arginine, isoleuene, leucine, bran is essential for nutritional adaptation (Farrell 1994) it is reported that rice bran provides health promoting effects against chronic diseases as well as functional properties, (Abdul Hamid and Laun, 2000). Here the work is highly focused on the preparation of rice bran protein concentrate which are nutritional-potential. As rice bran protein constitutes lots of medicine as hypoallergenic proteins, infant foods and also included in human source. Rice bran protein concentrates and isolates are not commercially available but our work put efforts on preparing the rice bran protein in an optimal condition (Guanasambandam and Hettiarchy, 1999). In this present study two different rice bran samples as raw rice bran and parboiled rice bran were collected, and the samples were sieved well through No.22 BSS and finally cleaned and were analyzed. Thus the main aim of this paper is to review the available data on pharmacology and toxicology of rice bran and its main compounds.

2. MATERIALS AND METHODS

Two different raw rice bran and parboiled rice bran samples were collected; these samples were fully cleaned, well through No.22 BSS Without impurities. The protein content of sample was determined by kjeldhal method, Protein is complex organic substances. Weigh one gram of test protein in kjeldhal flask, mix with one gram of mercuric acid, 10 gram of powdered sodium sulphate, one gram of copper sulphate and 25ml of con.sulphuric acid. The digestion tubes were placed by digestion chamber and warmed slowly to minimize fortifying and then the temperature was increased to boil for 3 hrs and digested sample until solution clear with greenish lint. Turn off the digester and removed the tubes, cool and add 20ml of distilled water. 40%
sodium hydroxide solution was placed in alkali tank of distillation unit connect the digestion flask to distilling unit and distilled. After the completion of distillation it was titrated against standard 0.01N sulphuric acid. The amount of protein present in the samples were expressed as

\[
\text{Protein(%) } = \frac{A \times N \times 0.0014 \times 100 \times 6.25}{S}
\]

Where,  
\( A = \) Titrate value of the sample  
\( N = \) Strength of the titrant  
\( S = \) Weight of the sample taken

### 3. RESULTS AND DISCUSSION

Rice bran has high nutritional value with 12-15% protein content (Saunders, 1990). Rice bran protein is higher in lysine content than rice endosperm protein or any other cereal bran proteins (Juliano, 1985). Rice is a staple food for more than half of humanity. According to the Association of Japanese Agricultural Scientific Societies (1975), every continent on the planet produces rice except Antarctica. Rice bran is a by-product obtained from outer rice layers and is a good source of protein, mineral, and fatty acids, and dietary fiber content (McCaskill and Zhang, 1999). Also rice bran is used for the enrichment of some foods, due to its high dietary fiber content. Since the middle of the 1970s, the role of dietary fiber in health and nutrition has stimulated a wide range of research activities and captured public attention. Accumulating evidence favours the view that increased intake of dietary fiber can have beneficial effects against diseases, such as cardiovascular diseases, gastrointestinal disease, decreasing blood cholesterol, diverticulosis, diabetes and colon cancer (Burton, 2000; Cara et al., 1992; Chen and Anderson, 1986; Cummings, 1985; Wrick et al., 1983). Although the nutritional and pharmaceutical potential of rice bran has been recognized (Houston, 1972), at present, rice bran protein concentrates and isolates are not commercially available. This lack of availability could be due to the following: (1) the proteins in rice bran are of a complex nature. Rice bran proteins contain 37% albumin, 36% globulin, 22% glutenin, and 5% prolamin (Betschart et al., 1977). Several researches have been undertaken in an attempt to increase utilization of rice bran as human foods. For the protein aspect, most of the literature available is focused on preparation and functional property study of rice bran protein. The commonly used preparation method of extracting rice bran protein is solvent extraction. The solvent extraction of protein from rice bran employs alkaline condition and this method is often less successful due to the complex nature of the rice bran proteins. The nutritional quality of three extracted proteins was limited in egg protein. The calculated amino acid scores showed that the soluble protein from broken rice was 26.07% as compare with casein and 20.43% as compare with egg. The scores of soluble protein from defatted bran were 27.03% as compare with casein and 30.93% as compare with egg. The extracted soluble protein from broken rice had higher scores, as compare with casein and egg, 75.56% and 85.74% respectively (Tantratian, 1990).

The components of rice have been considered hypoallergenic since antiquity. Rice is often substituted for wheat and soy proteins for children with sensitivity to either. The amount of soluble protein extracted from bran was the highest; the yield was about 42.53% of the total protein contained in bran. The extracted soluble protein from broken rice was about 7.20% of the total protein in broken rice while the defatted bran was 18.67% of the total protein in defatted bran. The amounts of extracted soluble proteins were agreed with other researchers who worked with other species of rice. The soluble protein or albumin extracted from broken rice was 5.8% (Cagampang et al. 1966), bran was 37.40% (Betschart et al., 1977; Cagampang et al. 1966) and heat treated bran was 26% (Betschart et al., 1977). The nutritional quality of three extracted proteins was limited in lysine, methionine and phenylalanine when compared with egg protein. The proximal analysis of rice bran and parboiled rice bran are depicted in figure 1. The optimal extracting conditions of the rice bran protein were determined at a moisture content of 12.25% of protein (Figure 1). According to the results, it reveals that raw rice bran contains higher protein content 15.23%, whereas parboiled rice bran contain least amount of protein as 12.25%. Isolation of the protein concentration extracted by alkali solubilization process (Johnson and Brekke, 1983) was determined for the total protein content using nitrogen analyzer. As the raw rice bran recorded higher amount of protein content alkaline extraction was carried out on them. This study shows that the protein concentration extracted using 0.1N 0.2N, 0.3N standardized sodium hydroxide moreover the results show that the 0.3 N sodium hydroxide perceived higher protein content then the 0.1N, 0.2N standardized sodium hydroxide. Hamada (1997), suggest that the optimal extracting

### Table 1

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Amino acids</th>
<th>RF</th>
<th>Peak area</th>
<th>Concentration µg/g Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Arginine</td>
<td>0.01</td>
<td>912.84</td>
<td>0.316</td>
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<tr>
<td>2.</td>
<td>L- Threonine</td>
<td>0.02</td>
<td>7230.85</td>
<td>6.200</td>
</tr>
<tr>
<td>3.</td>
<td>Glycine</td>
<td>0.09</td>
<td>7549.03</td>
<td>23.09</td>
</tr>
<tr>
<td>4.</td>
<td>Alanine</td>
<td>0.46</td>
<td>14827.25</td>
<td>13.324</td>
</tr>
<tr>
<td>5.</td>
<td>Phenyl alanine</td>
<td>0.58</td>
<td>22283.25</td>
<td>78.89</td>
</tr>
<tr>
<td>6.</td>
<td>Leucine</td>
<td>0.85</td>
<td>5383.51</td>
<td>157.46</td>
</tr>
</tbody>
</table>

### Figure 1

Proximal analysis of raw rice bran and parboiled rice bran
conditions were P1 11 and 45 mins resulting in high amount of rice bran protein concentrate with 3 N sodium hydroxide. Connor et al., (1976), extracted the full fat rice bran with dilute sodium hydroxide at 24°C the protein concentrates contain 23-31%. Thus the results shown that the protein extraction was higher when the strength of alkali (sodium hydroxide) used for the extraction process was higher in strength. The highest protein concentration was obtained from 0.3N sodium hydroxide and was recorded as 27% protein in raw rice bran. The proteins are determined by using SDS-PAGE. The amino acid profiling was determined (Table 1) for the raw rice bran by using High Performance Thin Layer Chromatography (HPTLC). The results show that the raw rice bran was more nutritious than the parboiled rice bran. The protein quality of the rice bran samples were analyzed by alkali extraction and SDS-PAGE. The amino acid was determined by HPTLC. In conclusion, the protein extraction from rice bran using P1 11 and 45 min was selected as optimal condition when considering the protein content and percent yield simultaneously. They could be potential sources of non allergenic proteins. Rice bran showed the highest amino acid scores and the soluble protein could be extracted to the amount of 6.10% of the total weight of bran.

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