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Rice – The Superfood

Dr Jessie Suneetha W^{1*}, Dr J. Hemantha Kumar¹, Dr V. Chaitanya¹, Dr K. Ravi Kumar¹, Mrs. P. S. M. Phanisri¹, Dr D. Nagaraju¹ and Dr R. Uma Reddy²

¹*Krishi Vigyan Kendra, PJTS Agricultural University, Wyra 507165, Khammam Dt.*

²*Regional Agricultural Research Station, PJTSAU, Warangal 506006*

***Corresponding author: wjsuneetha@yahoo.com**

Cereals play an important role as staple food in underdeveloped nations. In addition to being a relatively good source of minerals and vitamins, while containing protein content of 6 – 12%, cereals are regarded as an economical source of energy in our diets making up 70 – 80% of the daily energy requirement. It is noted that when cereals are ingested together with fruits and vegetables, the distinctive phytochemical makeup of cereal grains complemented that of fruits and vegetables.

The cereals, pulses and oilseeds are among the most primary foods in the world and make up a significant portion of the human diet. Many of these grains have high levels of bioactive components especially phenolic compounds with beneficial health effects to combat lifestyle diseases.

The world's second-most consumed cereal grain and primary source of protein is rice (*Oryza sativa* L.), a leading food crop that is a staple food in many regions of the world, particularly in East, South and South East Asia. The better protein content and adequate amino acid balance of rice adds nutritional value to poor man's diet.

Rice plays an important role in our national food security, the slogan "*Rice is life*" is more appropriate for India referring to the means of support for millions of rural households. In Asia, more than 2 billion people depend on rice to meet 80% of their energy needs, a grain that contains 80.0% carbohydrates, 6 – 8% protein, 3% fat and fiber each.



Rice (*Oryza sativa*) accounts for over 20% of all of the calories consumed by humans, where 95% of the world's rice is grown and consumed. India cultivates 43 million hectares of rice annually or approximately a third of the world's total rice-growing land making it one of the major rice-producing nations in the world, second only to China. The primary grain crop in India is *Oryza sativa* Linn, which comes in over 5000 varieties with differences in size, texture, sticky nature, aroma and cooking quality.

Cereal grains including rice, oats and wheat when subjected to germination, soften the grain texture prior to drying and cooking. The process of germination began with dry seeds absorbing water through imbibition while soaking and it was finished when an embryonic component typically the radicle, extended to pierce the framework surrounding it. When rice was soaked in water for a specific amount of time, the embryo began to develop. Rice's bioactive components included as antioxidants like tocopherols, carotenoids, vitamin C and phenolic compounds increased during germination. Germinated rice was simpler to prepare and cooked faster.

Rice is the most important cereal crop in the world and ranked second to wheat in terms of yearly food consumption. The world's rice production had increased from 520 million tonnes in 1990 to 605 million tonnes in 2004. Asia produced and consumed around 90.0 % of the world's rice with significant manifold crop in the continent.

Rice was domesticated approximately 8000 years ago and today was an important crop meeting everyday necessity for three billion people worldwide. It has proven its importance in building civilizations and shaping societies apart from feeding the world. Thousands of years ago, domestication of cultivated rice has been from wild rice (*Oryza rufipogon*). The genus *Oryza* consists of 23 species and the wild rice was believed to be the immediate progenitor of cultivated rice.

Records from the Han dynasty dating back over 2,000 years have distinguished between two types of rice which were Keng and Hsien, that now are known as japonica (short grained) and indica (long grained). Rice was a predominate food crop contributing more than a quarter of calories consumed by humans worldwide. It was grown in at least 114 nations, with a global production of 645 million tonnes and Asian farmers accounting for over 90.0 % of total production. It contained nutrients like protein, fat, dietary fibre and minerals such as iron, potassium and zinc necessary for the body.

Historians believe that indica variety of rice was first domesticated in areas covering the foothills of Eastern Himalayas, stretching through Burma, Thailand, Laos, Vietnam and Southern China whereas japonica variety was domesticated from wild rice in Southern China which was later introduced to India. Perennial wild rice still grows in Assam and Nepal. It appeared around 1400 BC in Southern India after its domestication in the Northern plains. It then spread to all the fertile alluvial plains watered by rivers. The word 'rice' may be derived from the Tamil word '*arisi*' (NFSM, 2015).

Rice belongs to grass family. The two species of rice that include *Oryza sativa* and *Oryza glaberrima* were native to tropical and subtropical south-eastern Asia and Africa. Together, these species provide more than one-fifth of the calories consumed by humans.

Importance of rice: More than 60.0 % of world's population consumed rice in their diets. More than 430 MMT of rice were consumed worldwide in 2008. The importance of rice included:

- Ready-to-eat foods made from rice include popped and puffed rice, instant rice, rice flakes, canned rice and fermented products.
- Rice straw was used as cattle fodder, roof thatching and in the cottage industry to make hats, mats, ropes, sound absorbing material, straw board and litter material.
- Rice husk was used as animal feed, paper making and fuel source.
- Rice bran was used for livestock and poultry feed. The defatted bran has high protein content, being used in making bakery items and as cattle feed. In the soap industry, rice bran oil was used. The preparation of cotton seed and corn oils use refined rice bran oil as a cooling medium.
- Rice bran wax which was a byproduct of rice bran oil was used in paper coatings, textiles, explosives, fruit and vegetable coatings, confectionary, pharmaceuticals, candles, carbon papers, typewriter ribbons, printings inks, lubricants, crayons, chewing gums as well as cosmetics.

Utilisation of rice: Rice can be polluted by harmful substances like arsenic and mercury, so certain care must be followed while cultivating rice. Rice bran oil and defatted rice bran were produced from rice bran. Defatted rice bran has high polysaccharides and dietary fibre that can help in cancer and cardiovascular diet therapy.



Rice can be processed into variety of products that improved the nutritional quality of rice-based foods. Rice puffing was aided by gelatinization and amylose-lipid complex formation but can be hampered by amylose retrogradation and likely starch breakdown caused due to use of high-temperature. The puffing ability of rice can be increased by adding different salt solutions. The use of microwave for puffing has been increasingly popularized in recent years.

Rice products in developing countries were often small-scale and have a short shelf life. Traditional rice products with value addition improved marketability and profitability along with creating jobs in rural regions and substituting for the export of country's products to niche markets throughout the world.

Countries like Japan, China and United States were successful in producing and utilizing a wide range of commercial rice-based products including pre-cooked convenience foods, extruded foods, noodles, canned products and traditional products. Rice's distinctive characteristics like hypoallergenicity and bland flavour make it ideal for a variety of food product development. Farmers will be benefited by developing value-added products through income generation and sustainability of low-grade varieties. Rice has a wide range of applications and consumed in a number of forms. It was a vital source of energy and revenue generation for the rural communities in India.

Rice byproducts and its utilization: Rice bran, the brown outer layer of rice kernel, is mainly composed of pericarp, aleurone, subaleurone layer and germ. The presence of antioxidants like tocopherols, tocotrienols and γ - oryzanol also brighten prospects of rice bran utilization for humans as functional ingredient to mitigate the life-threatening disorders. Moreover, in the developing countries, budding dilemma of food crisis arising due to lower crop yields and escalating population necessitate the need to utilize each available resource. To provide enough food to all people, a holistic approach of using the by-products generated during food processing and preparations can be taken up.

Rice by-products and their main components are especially intended to combat cancer, improve plasma lipid levels or control the blood glucose levels. Rice by-products like rice straw, rice husk, rice bran, rice germ and broken rice are abundant agricultural wastes from the rice industry and the percentage of their production depends on the milling rate and

type of rice. Among all rice by-products, rice bran has been extensively studied as it contains phytochemicals such as γ - oryzanol, tocotrienols and dietary fibre.

Rice by-products have higher amount of nutrients when compared to the polished rice. Rice bran is derived from the outer layer of the rice grain along with aleurone layer of the rice kernel some proportion of the endosperm and germ. It accounts for approximately 10% of the weight of the rice grain. It is composed of both lipophilic antioxidants like tocopherols, tocotrienols and γ - oryzanol as well as phenolics. These substances protect against chronic diseases like cardiovascular diseases and causes by quenching the free radicals.

Rice germ is also known as the embryo and germinates to grow into plants. The content of vitamin E in rice germ is five times higher than that in rice bran. Rice germ has vitamin E as α -tocopherol whereas rice bran it is γ -tocopherol. The level of γ -oryzanol in rice germ, however, was five times lower than the level in rice bran.

The fibres found in rice husks are mainly lignin, hemicellulose, cellulose and hydrated silica. They are not digested or absorbed by humans. However, their consumption does help to control blood glucose levels and lipid concentration by enhancing the viscosity of the gastrointestinal contents.