

## ASSESSMENT OF NUTRITIONAL AND SENSORY PROPERTIES OF BROWN RICE

Prof. Dr. Abhijit .H. Joshi <sup>1</sup>Assistant Prof. Alisha .R. Shirole<sup>2</sup>Assistant Prof Prachi Damle<sup>3</sup>

<sup>1</sup>Professor, Department of Ayurveda & Yoga, Tilak Maharashtra Vidyapeeth, Pune

<sup>2</sup>Assistant Professor, Department of Ayurveda & Yoga, Tilak Maharashtra Vidyapeeth,  
Pune

<sup>3</sup>Assistant Professor, Department of Ayurveda & Yoga, Tilak Maharashtra Vidyapeeth,  
Pune

### Abstract-

Brown rice has numerous health benefits due to its high fiber content, making it a popular food choice. This study aimed to develop and analyze the sensory and nutritive value of Brown Rice based on the reference found in the ancient Ayurveda literature (*Ksemakutuhalam*). This study aimed to analyze the sensory and nutritive value of Brown Rice developed as per the reference found in the ancient Ayurveda literature (*Ksemakutuhalam*). Sensory analysis was conducted using water as per the reference, with a panel of 10 semi-trained judges on a 5-point hedonic scale. Nutritive value analysis was done on 100g of raw rice. Results showed excellent ratings in appearance and texture and high energy, carbohydrate, protein, and crude-cellulose fiber content. The primary objective of this study was to analyze the sensory and nutritive value of Brown Rice developed as per Ayurvedic literature. Sensory analysis was conducted using water as per the reference in *Ksemakutuhalam*. The analysis was carried out further by a panel of 10 semi-trained judges on a 5-point hedonic scale. For Nutritive value analysis, lab analysis was done on 100g of

raw rice. Sensory analysis showed excellent ratings in appearance and texture. Nutritive value analysis revealed that the Brown Rice is high in energy, carbohydrate, protein, and crude-cellulose fiber content. Brown Rice developed as per Ayurvedic literature has excellent ratings in appearance and texture and is a calorie-dense food high in energy, carbohydrate, protein, and crude-cellulose fiber content. It is recommended for patients with severe constipation, pregnant women who suffer from constipation, and disease-free individuals who are not diabetic or obese, as well as infants and adolescents.

**Keywords:** Brown Rice, Raw Rice, Obesity, Fibre, Constipation, Coronary Heart Disease, Diabetes Mellitus.

### **Introduction-**

Cereals, regarded as essential staple foods, play a crucial role in the Indian diet. Among these, rice, a type of cereal, has been a dietary staple for centuries. It is widely consumed on a daily basis, particularly in the southeastern region of India, and is available in various varieties. Rice also serves as a versatile ingredient for preparing a diverse range of traditional dishes such as idli, dosa, uttapam, and pongal.

Ayurveda, an ancient healing science, classifies grains into three categories known as *Dhanyaparakaran: Suka* (Grains), *Simbi* (Pods), and *Truna* (Grasses). Rice falls under the category of *Suka Dhanya*. According to *Bhojankutuhalam*, a text in Ayurvedic literature, brown rice is classified as *SukaDhanya*, which specifically refers to grains with awns, i.e., coverings.

*Bhojankutuhalam* describes *Suka Dhanya* (rice) as having the properties of being light (*laghu*) and strengthening, promoting memory and intellect, alleviating the three *doshas*, conferring virility, and imparting taste. Additionally, it is sweet (*madhura*), unctuous (*snighdh*), strengthening (*balya*), promotes the growth of the body, produces hard stools of small quantities (*baddhalpavarcas*), has a slight aggravating effect on *vata* and *kapha* (*alpanilakapha*), is cold (*sita*), alleviates pitta (*pittaghna*), and acts as a diuretic (*mutrala*).

The properties of rice are influenced by several factors such as the type of soil it is grown in (burnt soil, wet land, uncultivated soil, etc.), the cultivation process, and the stage of growth (fresh paddy or after harvesting). *Bhojankutuhalam* discusses various species of rice, including *Ranjana*, *Ksnasali*, *Raktasali*, *Mundasali*, *Sthulasali* or *Mahasali*, *Suksmasali*, *Tiriya*, *Sastikasali*, and *Gaurasali*, each with their unique set of properties.<sup>[1]</sup>

Among the various species of rice mentioned, brown rice falls under the category of *Mahasali*. *Mahasali* rice is described as having properties such as being sweet, delicious, and cold in nature. It is known to alleviate imbalances of pitta *dosha* and has a rapid effect in treating chronic fever, hyperthermia, and abdominal disorders. *Mahasali* rice is considered wholesome for individuals of all age groups, including children, youths, and the elderly, and is recommended for regular consumption. Additionally, it is believed to improve digestive power, enhance strength, and promote virility.

Ayurvedic literature mentions therapeutic rice preparations, including *Manda*, *Peya*, and *Vilepi*, in which brown rice can be utilized. The preparation of each dish involves adjusting the water-to-rice ratio during cooking. *Manda* is the clear liquid obtained after cooking and straining the grains. It is beneficial for conditions such as diarrhea and loose motions caused by *pittadosha*, as well as ailments like herpes zoster, ascites, knee lock, jaundice, fever, and postpartum recovery in women. *Peya* is a drink with a higher proportion of liquid and fewer food particles, heavier to digest than *Manda*. It is administered to children before introducing solid cooked food. *Vilepi* is a preparation with more food grains and less liquid content, often referred to as thickened *peya*. It is combined with vegetables, meat, or fruits and provides nourishment, satiety, and aphrodisiac properties. *Vilepi* prepared with specific medicinal herbs like dry ginger, *chitrakmool*, *rasna*, *salavan*, *palas*, *pushkarmool*, along with the addition of ghee and rock salt, is recommended for cough caused by vata dosha. *Manda*, *Peya* and *Vilepi* are heavy to digest one after one. So they should be prescribed or suggested only after considering strength of *agni* and their *dosha prakriti*.<sup>[1]</sup>

Brown rice, from a modern scientific perspective, is characterized as a whole grain rice variety that retains its bran layer while having the outer hull removed. It contains the seed coat, germ or

embryo, and endosperm. The bran layer, responsible for the brown coloration, is notably rich in vitamins such as thiamine, niacin, pyridoxine, and minerals including manganese, phosphorus, and iron. Brown rice also contains a range of other essential vitamins and minerals. However, its consumption is primarily observed among health-conscious individuals who prioritize nutrition, possibly due to factors such as longer cooking time, vulnerability to storage-related instability, a distinct bran flavor, and a somewhat less preferred texture. The production process involves de-husking the grains, grading, color-sorting, and the removal of damaged or broken grains from the mixture <sup>[2]</sup>.

One of the unique features of brown rice is its composition of  $\beta$ -sitosterol,  $\gamma$ -oryzanol, and tocotrienols-tocopherols, which distinguish it from other cereal grains. These components have been found to contribute to the reduction of total plasma cholesterol, triglycerides, and low-density lipoproteins, while increasing the levels of high-density lipoproteins. Brown rice is also abundant in soluble dietary fibers such as ferulic acid derived from non-lignified cell walls, as well as  $\beta$ -glucan and pectin. These dietary fibers have various health benefits and play a role in promoting digestive health and overall well-being. <sup>[3]</sup>

Brown rice can be categorized into three distinct types based on grain size:

#### 1. Long Grain Brown Rice:

Long grain brown rice is characterized by elongated and slender kernels, with a length that is four to five times greater than its width. After cooking, the grains retain their separate identity, resulting in a light and fluffy texture.

#### 2. Medium Grain Brown Rice:

Medium grain brown rice consists of kernels that are shorter and wider compared to long grain varieties. Cooked medium grain brown rice exhibits a moist and soft texture, with a tendency to stick together more than long grain rice.

### 3. Sweet Rice (Sticky Rice or Glutinous Rice):

Sweet rice, also known as sticky rice or glutinous rice, is distinguished by its short, chalky white, and opaque kernels. Upon cooking, sweet rice loses its individual grain structure and becomes exceptionally sticky in texture.

Each type of brown rice offers distinct attributes and finds application in various culinary contexts, depending on the desired texture and consistency requirements.

Brown rice offers various health benefits due to its rich content of bioactive compounds such as  $\gamma$ -oryzanol, tocopherols, tocotrienols, polyphenols, phytosterols, and carotenoids. It is a source of essential amino acids and micronutrients that contribute to overall health promotion. Research has shown that brown rice may aid in the prevention and control of chronic diseases through multiple mechanisms.

One of the notable health benefits of brown rice is its potential to improve cardiovascular health. It contains compounds like phytosterols, triterpene alcohols, tocopherols, and tocotrienols, which have been recognized for their cholesterol-lowering effects. The unsaponifiable components present in rice bran contribute to these cholesterol-lowering properties.

It may also reduce the risk of colon cancer. It is a good source of selenium, a trace mineral that supports DNA repair and synthesis in damaged cells and inhibits the proliferation of cancer cells. Selenium acts as an antioxidant and plays a crucial role in cancer prevention by functioning as a co-factor of glutathione peroxidase, an important antioxidant enzyme in the liver.

Furthermore, brown rice can help prevent atherosclerosis by increasing blood nitric oxide levels, which improves blood vessel dilation and reduces the formation of arterial plaque. Its high fiber content promotes weight loss by providing a feeling of satiety, slowing down the rate of digestion, and facilitating the faster elimination of fats through the digestive system.

Overall, incorporating brown rice into the diet can contribute to a range of health benefits, including cardiovascular protection, colon cancer prevention, atherosclerosis prevention, and support for weight management. <sup>[3]</sup>

Research suggests that brown rice can be beneficial for individuals with diabetes and hyperlipidemia compared to white rice. This is due to the lower sugar content released by brown rice, which is approximately 23.7% less than that released by milled white rice, primarily attributed to its low glycemic index. The physiochemical properties, high dietary fiber content, polyphenols, vitamins, and minerals present in brown rice contribute to its blood glucose-lowering effect. Substituting white rice with brown rice in the diet may be recommended to prevent the onset of type 2 diabetes. <sup>[4]</sup>

Brown rice is indeed a good source of dietary fiber, which can be classified into two types: insoluble fibers and soluble fibers.

Insoluble fibers, such as cellulose, have an increased water-holding capacity, aiding in the bulk formation of undigested material. They promote an increase in fecal volume, the frequency of bowel movements, and a decrease in gastrointestinal transit time. These properties make insoluble fibers beneficial for weight loss, managing diabetes, and reducing the risk of coronary heart disease. They have been associated with a reduction in serum fibrinogen levels, which in turn lowers the risk of blood clot formation. Additionally, insoluble fibers can help alleviate constipation and may play a role in the prevention of colon cancer by diluting bile acids or binding to them, thereby inhibiting their potential mutagenic effects and cell proliferation. Insoluble fibers also have the potential to reduce the risk of myocardial infarction (heart attack).

Incorporating brown rice, with its inherent insoluble and cellulose fibers, into the diet can provide these health benefits and support various aspects of overall well-being, including weight management, diabetes control, heart health, digestive health, and potentially reducing the risk of colon cancer.

Table-1 (Nutritive value of Indian Foods, NIN, 2011)<sup>[5]</sup>

Nutritional values of raw rice (per 100gm)	
Energy	345kcal
Moisture	13.7gm
Protein	6.8gm
Fat	0.5gm
Minerals	0.6gm
Crude fiber	0.2gm
Carbohydrates	78.2gm

## Materials and Methods

The raw materials used for the preparation of rice were of high quality and were sourced from an organic store. The specific quantity of raw material used for a single serving was 100 grams.

### Methodology-

The cooking of the brown rice for sensory analysis was carried out following the procedure outlined in '*Ksemakutuhalam*'. A quantity of 100 grams of raw rice was utilized for the nutritional analysis, which was conducted at the "National Accreditation Board for Testing and Calibration Laboratories." The analysis provided results for macronutrients such as energy content, protein, fats, carbohydrates, and crude fiber from cellulose.

### Lab methods used-

Nutritional biochemical biochemistry lab methods were done on raw rice. Through a local lab (UNIK LAB-PUNE)

Biochemistry laboratory methods are-

1. By calculation
2. FSSAI lab manual
3. IS-7219
4. IS-10226 part-1

The sensory evaluation of the Brown Rice involved a panel of ten trained panelists who assessed its characteristics, including appearance, aroma, taste, texture/mouthfeel, and overall acceptability. The panelists rated each characteristic using a five-point hedonic scale, allowing for subjective evaluation of the sensory attributes of the rice. The scores obtained for each characteristic were analyzed based on the hedonic rating scale, providing valuable insights into the sensory quality of the Brown Rice.

- Like very much-5
- Like a little-4
- Notsure-3
- Dislikealittle- 2
- Dislikeverymuch- 1

### Observation and Results-

Table-2 The sensory evaluation data of Brown Rice are as follows-

Sr.no.	Appearance	Aroma	Taste	Texture/mouth feel	Overall Acceptability
1	4	5	4	4	5
2	5	5	5	5	5



3	4	2	4	4	3
4	4	3	3	4	4
5	5	4	5	5	5
6	4	4	3	4	4
7	4	4	5	5	4
8	5	4	4	4	4
9	3	4	4	4	4
10	5	3	4	4	4

Table- 3 Mean of sensory attributes-

Sr.no.	Characteristic	Mean Score
1	Appearance	4.3
2	Aroma	3.8
3	Taste	4.1
4	Texture	4.3
5	Overall acceptance	4.2

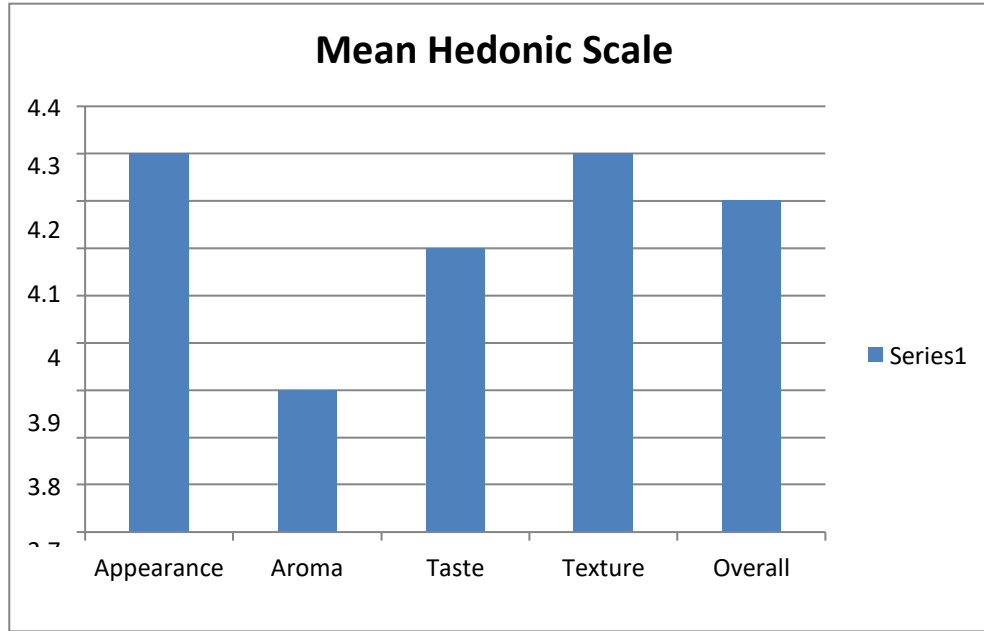


Figure1: Sensory Evaluation of Brown Rice

Table-4 Nutritive value of Raw Brown Rice (100gm) based on Lab reports

1. Energy	342.92kcal
2. Protein	9.18gm
3. Carbohydrate	75.6gm
4. Fats	1.20gm
5. Crude Fibre (Cellulose)	3.62gm

## Discussion

This study aimed to evaluate the sensory analysis and nutritional value of Brown Rice based on references found in the ancient Ayurveda literature "*ksemakutuhalam*" and contemporary scientific knowledge. The Brown Rice product used in the study was cooked according to the instructions mentioned in "*ksemakutuhalam*" and was obtained from a local organic store.

A sensory analysis was conducted with a panel of 10 semi-trained judges who evaluated the product using a 5-point hedonic scale. The sensory analysis revealed that the Brown Rice product received excellent ratings for its appearance, taste, and texture, indicating high acceptability. However, the aroma was rated as fair. Overall, the product demonstrated good acceptability based on the sensory analysis results.

These findings suggest that the Brown Rice product aligns well with the desired sensory characteristics outlined in "*ksemakutuhalam*" and is positively regarded by the judges.

### **Conclusion**

In conclusion, the development of a wholesome and nutritious rice product with therapeutic properties, inspired by ancient Ayurveda literature (*Ksemakutuhalam*), has shown promising results. The product exhibited excellent overall acceptability and has the potential to offer numerous health benefits, including the prevention of diseases such as constipation, diabetes, cardiovascular diseases, colon cancer, and obesity. Incorporating brown rice into one's daily diet can enhance the nutritional status and contribute to a healthier lifestyle.

While this study focused on the sensory analysis of the Brown Rice product, further investigations are warranted. Detailed physical-chemical analysis, proximate analysis, microbial analysis, clinical trials, and shelf-life testing should be conducted to ensure the product's safety, quality, and efficacy.

Moreover, a comprehensive nutritive value analysis encompassing macro and micronutrients would provide valuable insights into the specific nutritional composition of the cooked rice. Comparisons between different cooking methods, techniques, and utensils used in Ayurveda literature and modern nutrition science could shed light on their impact on the final product.

To fully evaluate the potential benefits of the Brown Rice product, rigorous clinical trials on obese and diabetic patients should be conducted. These trials would enable the assessment of blood glucose levels, HbA1c, postprandial glucose levels, and insulin resistance, providing a deeper understanding of its effects on managing blood sugar levels and insulin sensitivity.

Overall, this study sets the stage for further research and development of the Brown Rice product, offering a holistic approach that combines ancient wisdom with modern scientific advancements.

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