ESTIMATION OF NUTRITIONAL VALUE OF MANDA (LIQUID GRUEL) W.S.R TO DIFFERENT VARIETIES OF RICE

Lily Meher[1], Abhishek Hota[2]

[1]Lecturer, Dept. of Rasashastra & Bhaisajya Kalpana, Govt. Ayurvedic college &Hospital, Tulsinagar, Balangir.

[2]2nd Professor, BAMS, Govt. Ayurvedic college & Hospital, Balangir.

Corresponding Author:

Dr. Lily Meher, Dept. of Rasashastra & Bhaisajya Kalpana, Govt. Ayurvedic college &Hospital, Tulsinagar, Balangir, odisha, 767001, Email id: meher.lily@gmail.com

Abstract:

Background: *Manda*, a thin rice gruel, is a classical *Ayurvedic* dietary formulation prescribed during convalescence, digestive impairment, and post-detoxification therapy. While traditional texts attribute distinct therapeutic properties to various rice types, empirical evidence on their comparative nutritional composition in *Manda* form remains limited. Objective: This study aimed to evaluate and compare the nutritional profiles of *Manda* prepared from red (*Raktashali)*, black *(Krushna Vrihi)*, and white (*Shashtika*) rice varieties. Methods: *Manda* was prepared using a 1:14 rice-to-water ratio, following Ayurvedic guidelines. The strained liquid was analysed for carbohydrates, proteins, fats, dietary fibre, iron, potassium, vitamin C, calorific value, and thiamine using standard laboratory methods. Results: White rice *Manda* showed the highest carbohydrate (63.85 g/100 g), caloric value (173.87 kcal/100 g), and thiamine (2.00 mg/100 g). Red rice *Manda* contained the highest dietary fibre (10.9 g), iron (5.5 mg), and potassium (80 mg). Black rice *Manda* exhibited superior protein (4.63 g) and vitamin C (1.55 mg) content, but the lowest thiamine (1.00 mg/100 g). Conclusion: Each rice-based *Manda* offers unique nutritional advantages. Red rice *Manda* is micronutrient-rich and aligns with classical descriptions of *Raktashali*. White rice *Manda* is ideal for rapid energy restoration, while black rice *Manda* provides a balanced profile with potential antioxidant benefits. These findings support condition-specific applications of *Manda* in therapeutic

Keywords

Ayurveda, Manda, Red rice, Black rice, White rice, Pathya Kalpana.

INTRODUCTION:

Ayurveda, the traditional Indian system of medicine, emphasizes the pivotal role of diet (Ahara) in disease prevention and health promotion. Pathya Kalpana, or therapeutic dietary formulations, are tailored to support physiological states and facilitate recovery from illness.[1] Classical Ayurvedic texts assert that medication is ineffective without appropriate dietary support.[2] Among the diverse dietary preparations described, Manda—a thin, strained rice gruel—is considered the lightest and most easily digestible. It is particularly

recommended in conditions of digestive weakness, such as during fever, after fasting, or following detoxification therapies like Vamana and Virechana.[3] Prepared traditionally by boiling rice in a 1:14 rice-to-water ratio and extracting the liquid, Manda serves as both a rehydrating and nourishing agent.[4] The nutritional profile of Manda varies significantly with the type of rice used. While Ayurvedic literature describes therapeutic distinctions among rice varieties such as Raktashali (red rice), Krushna Vrihi (black rice), and Shashtika (white rice)—modern comparative nutritional analyses are lacking. This study was undertaken to evaluate and contrast the nutritional composition of Manda prepared from these three rice types, thereby offering scientific validation to classical Ayurvedic claims and informing clinical and dietary applications.

LITERATURE REVIEW:

RED RICE (RAKTASHALI):

In Ayurveda, red rice is identified as Raktashali, a grain esteemed for its therapeutic and nutritional properties. Acharya Charaka classifies it under Shukadhanya Varga, a group of spike-bearing grains. These grains are characterized by its Madhura Rasa (sweet taste), Kashaya Anurasa (astringent secondary taste), Madhura Vipaka (sweet post-digestive effect), Sheeta Veerya (cold potency), Snigdha (unctuous), and Laghu (light to digest) qualities. It is considered Vrishya (aphrodisiac), Brihana (nourishing), Balya (strength-promoting), Ruchya (appetizing), and Pathya (wholesome), with benefits extending to voice enhancement, act as Mutrala (diuretics), but may cause constipation and reduce stool volume and Dosha pacification—especially of Pitta and Kapha.[5]

Acharya Charaka regarded Raktashali as the best among grains, especially for Tridosha pacification and managing thirst.[6] Acharya Sushruta emphasized its use in enhancing semen quality (Sukrala), improving vision (Chakshushya) and complexion (Varnya), promoting cardiac health (Hrudya), aiding fever, and detoxification.[7] Acharya Vagbhata and Bhavaprakasha further affirmed its Balya, Tridoshaghna, and detoxifying qualities, highlighting its effectiveness in conditions like Kasa (cough), Swasa (asthma), and Daha (burning sensation).[8,9]

According to Chakrapani, grains that grow in Hemant Ritu are referred to as Shalidhanya.

Modern nutrition supports these claims. Red rice, typically unpolished and rich in anthocyanins, retains its bran and germ, contributing to its high antioxidant and polyphenol content. It contains approximately 70.19 g carbohydrates, 10.49 g protein, 1.81 g fat, and 2.71 g fiber per 100 g. It is also a good source of calcium (8.71 mg), iron (13.45 mg), and zinc (1.91 mg), contributing to anti-cholesterol, anti-inflammatory, and anti-diabetic effects.[10]

BLACK RICE:

In Ayurvedic literature, black rice is identified as Krushna Vrihi and is classified under Vrihi Dhanya. According to Bhavaprakasha, Vrihi grains mature in Varsha Ritu (monsoon), while Chakrapani extends this to Sharad Ritu (autumn). Acharya Charaka includes Vrihi under Shukadhanya Varga, whereas Acharya Sushruta classifies it under Shalidhanya Varga.

Krushna Vrihi is considered the best among Vrihi varieties. According to Acharya Sushruta and Bhavaprakasha, the grains of Vrihi groups possessing Madhura (sweet) and Kashaya Rasa (astringent), Madhura Vipaka (sweet post-digestive effect), and mild Sheeta Veerya (cold potency), Laghu (light to digest) but mildly Abhishyandi (channel-clogging) and may induce constipation.[11] While Acharya Charaka notes that Vrihi Dhanya are Pittakara (Pitta-aggravating) and Guru (heavy).[12] Acharya Sushruta highlights the unique properties of Krushna Vrihi, especially its Kashaya Anurasa and lightness in digestion.[13] Acharya Bhavaprakasha specifically identifies it by the dark coloration of both grain and husk.[14]

From a modern standpoint, black rice (Oryza sativa L. indica) is notable for its high anthocyanin content, responsible for its dark purple color and potent antioxidant properties—six times more than white or red rice. It contains 8.16% protein, 0.07% fat, and is rich in essential amino acids**,** dietary fiber, and vitamins **(**B1, B2, E, folic acid).[15] It also provides important minerals like iron**,** zinc**,** calcium**,** phosphorus, and selenium**,** making it beneficial in preventing or managing inflammatory diseases, obesity**,** diabetes, and liver disorders.[16,17]

WHITE RICE:

This variety is considered under the Shashtika group of rice in Ayurveda. The name Shashtika is given to those types of rice that ripen in sixty days. These rice varieties are cultivated during the summer season and ripen in the rainy season.[18]

Shashtika has been mentioned by Acharya Charaka in the Shukadhanya Varga, while Acharya Sushruta has listed it in the Shalidhanya Varga.

The Shashtika variety is regarded as superior among all rice types due to its properties like Madhura Vipaka (sweet post-digestive effect), Kashaya Anurasa (astringent secondary taste), Laghu (light to digest), Mridu (soft), Snigdha (unctuous), Tridoshanashaka (pacifies all three Doshas), strength-promoting, and mildly constipating in nature.[19] Dalhana explained that Shashtika varieties are Sheeghrapaki (quick cooking).

In Ashtanga Samgraha and Ashtanga Hridaya, two types of Shashtika are described: Gour Shashtika and Asitagour Shashtika. Hemadri, in his commentary, mentioned three types: Gour, Krishna, and Krishnagour.[20]Acharya Bhavaprakasha also mentioned qualities of Shashtika similar to those described by Acharya Sushruta.[21]

Nutritionally, white rice is refined and polished, which removes the husk, bran, and germ—resulting in lower micronutrient content. Per 100 g, it contains 78.34 g carbohydrates, 7.6 g protein, 0.62 g fat, and 0.23 g fiber, along with 10–80 mg calcium, 3.75 mg iron, and 3.75 mg zinc.[22] While it provides quick energy, it lacks the micronutrient richness of red or black rice.

PATHYA KALPANA & MANDA KALPANA:

The term Pathya originates from the root Patha, meaning "way" or "channel." As per Shabdakalpadruma, it denotes that which is beneficial for the patient, while Apathya refers to that which is harmful. In Ayurveda, Pathya encompasses not only wholesome food but also therapeutic regimens that facilitate recovery and restore physiological balance.[23]

In the Charaka Samhita, Pathya is often equated with Chikitsa (treatment), as it promotes health, supports organ function, nourishes the mind, and aids in disease management.[24] Acharya Sharangadhara details several Pathya Kalpanas—including Manda, Peya, Vilepi, and Yavagu—prescribed according to the disease state and the individual's digestive strength. These preparations help regulate Agni (digestive fire), prevent Ama (toxins), and support metabolic functions.[25]

Manda, the lightest among these, is prepared by cooking rice in a 1:14 water ratio and collecting only the strained liquid.[26] It is described as Laghu (light), Sheeta (cooling), and exhibits actions such as Deepana (appetizer), Pachana (digestive stimulant), Grahi (absorbent), and Vatanulomaka (Vata-regulating). It is indicated in conditions like Jwara (fever), Atisara (diarrhea), and Trishna (excess thirst), especially after procedures like Vamana and Virechana, or during convalescence.[27]

MATERIALS AND METHODS:

This study comprised two primary components:

The preparation of Manda (rice gruel) from three rice varieties—red rice (Raktashali), black rice (Krushna Vrihi), and white rice (Shashtika), and

The comparative analysis of their nutritional profiles using standard biochemical methods.

Preparation of Manda[28]

Red Rice (Raktashali)

Duration: 32 minutes

Materials: Red rice (50 g), Water (600 mL)

Yield: 130 mL

Equipment: Weighing balance, cooking vessel, stove, spatula, strainer, sterile bottles

Method: Red rice was washed and soaked in water for 3–4 hours, then boiled in a 1:14 ratio until soft. The liquid portion (Manda) was strained and stored for analysis.

Observation: Reddish-brown in color with moderately thick consistency.

Black Rice (Krushna Vrihi)

Duration: 31 minutes

Materials: Black rice (50 g), Water (600 mL)

Yield: 200 mL

Equipment: Analytical balance, stainless-steel vessel, stove, strainer, collection bottles

Method: Black rice was washed, soaked for 6–8 hours, then boiled until softened. The Manda was separated by straining.

Observation: Blackish, thick consistency; highest yield due to better gelatinization and water retention.

White Rice (Shashtika)

Duration: 28 minutes

Materials: White rice (50 g), Water (600 mL)

Yield: 150 mL

Equipment: Weighing balance, stainless-steel container, stove, strainer, storage bottle

Method: White rice was cleaned and boiled directly without soaking. After cooking, the liquid Manda was strained and collected.

Observation: Whitish, thinner consistency; moderate yield attributed to polished grain and lower starch content.

ESTIMATION OF NUTRITIONAL VALUE

The nutritional profiling of Manda prepared from red, black, and white rice varieties was conducted using standard laboratory techniques. Each sample underwent analysis for macronutrients, micronutrients, and selected vitamins using validated biochemical procedures.

CARBOHYDRATE ESTIMATION[29]

Total carbohydrate content was determined by the anthrone method. One gram of dried Manda was hydrolyzed with 5% hydrochloric acid, followed by neutralization using solid sodium carbonate. The solution was diluted to 100 mL, filtered, and 1 mL aliquots were reacted with 4 mL anthrone reagent. After incubation in a boiling water bath for 10 minutes and cooling, absorbance was measured at 620 nm. Carbohydrate concentration was extrapolated from a glucose standard curve and expressed as mg/100 g of sample.

PROTEIN ESTIMATION[30]

Protein content was quantified using the Lowry method. One gram of sample was homogenized in distilled water, centrifuged, and 1 mL of the supernatant was treated with 5 mL of Lowry reagent. After incubation, 0.5 mL of Folin–ciocalteu reagent was added. Following a 30-minute development period, absorbance was recorded at 660 nm. Protein content was calculated against a BSA standard and expressed as mg/100 g.

FAT CONTENT ANALYSIS[31]

Total lipid content was estimated via Soxhlet extraction using n-hexane as the solvent. Approximately 15 g of oven-dried sample was extracted for 3–4 hours. The solvent was evaporated, and the fat residue weighed. Fat content was expressed as a percentage of the initial sample weight.

CALORIFIC VALUE[32]

The gross energy of the samples was assessed using a bomb calorimeter. One gram of dried sample was combusted in an oxygen-rich environment. The resulting temperature rise (ΔT) of the surrounding

water was used to calculate the calorific value using the formula: Calorific value (in kJ/g) =Q/m

Where m is the mass of the food sample (in grams).

$Q=C\times\Delta T$

Where: Q is the heat generated by combustion (in kJ), C is the heat capacity of the calorimeter (obtained during calibration with benzoic acid), ΔT is the change in water temperature.

Crude Fibre Determination[33]

Crude fibre content was estimated through sequential acid (1.25% H_2SO_4) and alkali (1.25% NaOH) digestion of 2 g dried sample. The residue was filtered, dried (W_1), ashed (W_2), and the difference in weights calculated. Fibre content was reported as a percentage using the formula:

CALCULATION:

Weight of crude fibre in the sample = Weight of acid and alkali digested residue minus weight of the ash = W1 – W

$$\text{Crude fibre \%} = \frac{(W1 - W2) \times 100}{W}$$

W = Weight of the sample

SODIUM AND POTASSIUM ESTIMATION[34]

Sodium and potassium concentrations were measured using flame photometry. Diluted gruel samples were filtered and analysed against prepared Na^+ and K^+ standards (5–20 ppm). Results were reported in milliequivalents per 100 g.

IRON ESTIMATION[35]

Iron was quantified using the 1,10-phenanthroline method. One gram of sample was digested with nitric acid, and the clear filtrate was reacted with hydroxylamine hydrochloride, sodium acetate buffer (pH 4.5), and 1,10-phenanthroline. The resulting complex's absorbance was measured at 510 nm. Iron content was expressed as mg/100 g.

VITAMIN C ESTIMATION[36]

The ascorbic acid content was measured via DCPIP dye titration. Samples homogenized in 3% metaphosphoric acid were titrated with standardized DCPIP until a faint pink endpoint appeared. Results were calculated based on dye consumption and reported as mg/100 g.

B-Complex Vitamins by HPLC[37]

Thiamine (B1), Riboflavin (B2), Niacin (B3), Pantothenic Acid (B5), Pyridoxine (B6), Folic Acid (B9), and Cyanocobalamin (B12) were quantified using High-Performance Liquid Chromatography (HPLC). Samples were extracted in water or 0.1N NaOH, sonicated, filtered, and injected into a reverse-phase column. Mobile phases comprised phosphate buffer (pH 3.0) and acetonitrile in gradient mode. Detection wavelengths were 205 nm and 275 nm, and vitamin concentrations were reported in mg/100 g.

RESULTS: (TABLE NO.1)

The comparative nutritional analysis of Manda prepared from red rice, black rice, and white rice

demonstrated notable variations in their macro- and micronutrient compositions.

MACRONUTRIENTS:

White rice Manda exhibited the highest carbohydrate content (63.85 g/100 g), followed by black rice Manda (58.97 /100 g), with red rice Manda showing the lowest (31.15 g/100 g). In terms of protein content, black rice Manda recorded the highest value (4.63 g/100 g), slightly exceeding white rice Manda (4.33 g/100 g), while red rice Manda had the lowest protein content (2.75 g/100 g). Fat content across all samples was minimal, with red rice Manda containing the highest (1.13%), black rice Manda intermediate (0.47 %), and white rice Manda the lowest (0.13%).

DIETARY FIBRE AND ENERGY:

Red rice Manda demonstrated the highest dietary fibre content (10.9 g/100 g), followed by white rice Manda (6.33 g/100 g) and black rice Manda (4.9 /100 g). The calorific value was highest in white rice Manda (173.87 kcal/100 g), followed by black rice Manda (166 kcal/100 g), and red rice Manda (123.74 kcal/100 g).

MICRONUTRIENTS:

Red rice Manda showed a significantly higher iron content (5.5 mg/100 g), compared to black rice Manda (3.5mg/100 g) and white rice Manda (1.2 mg/100 g). Potassium content was also highest in red rice Manda (80 mg/100 g), with black and white rice Mandas each containing 50 mg/100 g and 50 mg/100 g, respectively.

VITAMINC:

Among the three, black rice Manda contained the highest amount of vitamin C (1.55mg /100 g), followed closely by white rice Manda (1.09 mg/100 g) and red rice Manda (1.08 mg/100 g).

VITAMIN B:

The white rice Manda exhibited thiamine concentration with 2.0 mg/100 g, and black rice Manda with 1.0 mg/100 g. These values reflect a significant variation in thiamine retention based on rice type and processing characteristics.

DISCUSSION:

This study aimed to evaluate and compare the nutritional profiles of Manda, a classical Ayurvedic rice gruel, prepared from red (Raktashali), black (Krushna vrihi), and white (Shashtika) rice varieties. Despite standardized preparation, notable variations were observed in yield, consistency, and nutritional composition, attributable to inherent differences in grain structure, processing, and biochemical composition.

Black rice Manda yielded the highest volume, likely due to its elevated fiber and starch content enhancing water absorption and gelatinization. In contrast, red rice Manda yielded the least, potentially due to its coarse bran limiting liquid extraction. Consistency varied similarly, with black rice Manda being thickest—possibly due to anthocyanin content—followed by red and white rice variants.

Nutrient analysis revealed distinct macronutrient and micronutrient profiles. White rice Manda contained the highest carbohydrate (63.85 g/100 g) and caloric value (173.87 kcal/100 g), aligning with its traditional use for quick energy replenishment. However, it exhibited the lowest micronutrient density, consistent with nutrient loss from polishing.

Red rice Manda, though lower in carbohydrates, was richest in dietary fiber (10.9 g), iron (5.5 mg), and potassium (80 mg), supporting its traditional classification as raktashali renowned for rejuvenative and tridosha-balancing properties in Ayurvedic texts. Its micronutrient richness suggests suitability for convalescence and nutritional rehabilitation.

Black rice Manda demonstrated the highest protein (4.63 g) and vitamin C (1.55 mg/100 g) content, though it showed the lowest fiber (4.9 g) and thiamine (1.0 mg/100 g) levels. Despite this, its anthocyanin-rich profile (not quantified here) positions it as a potential antioxidant and immunonutrient intervention.

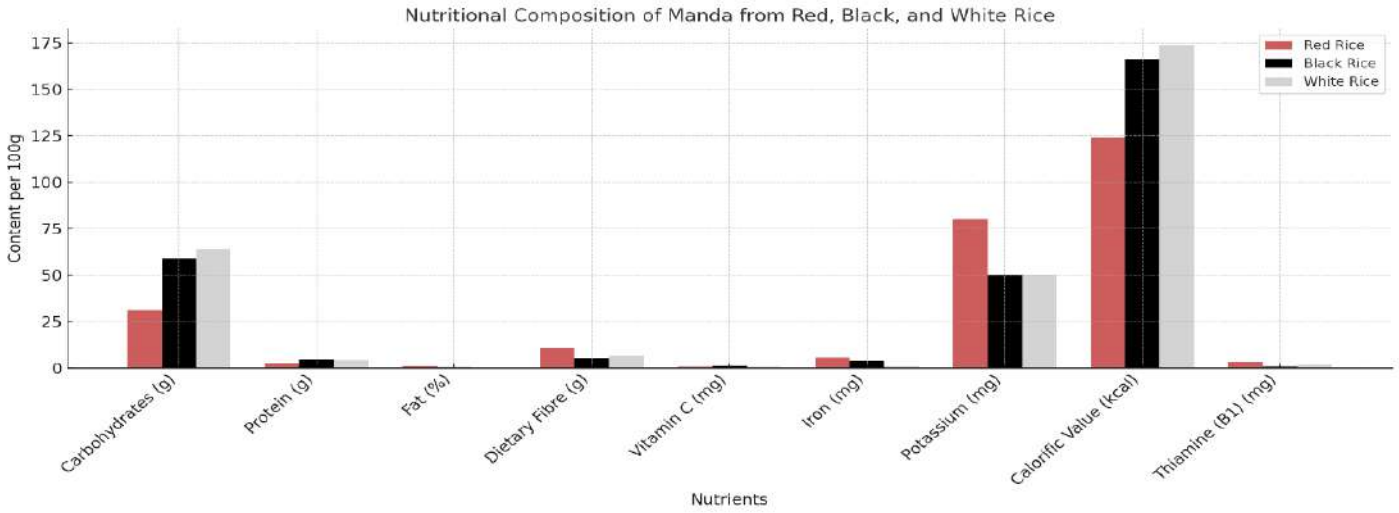
All three variants of Manda were low in fat, consistent with their Ayurvedic classification as Laghu (light) and Agni-Deepaka (stimulating digestive fire). Protein content, although modest, contributes to tissue repair and immune function, particularly in debilitated individuals. Vitamin C levels remained under 2 mg/100 g in all samples, indicating the need for supplementation if Manda is used as a primary diet over extended periods.

From an Ayurvedic perspective, Manda serves the dual function of nourishment and digestive support. This study affirms the wisdom of classical texts that recommend rice gruel post-therapy or during convalescence, especially in cases of digestive weakness. The modern nutritional findings align with Ayurvedic classifications: red rice Manda, being richest in nutrients, supports the traditional view of raktashali as the best among rice varieties.

Nutrients	Red Rice *Manda*	Black Rice *Manda*	White Rice *Manda*
Carbohydrates (g)	31.15 ± 0.20	58.97 ± 0.03	63.85 ± 0.13
Protein (g)	2.75 ± 0.40	4.63 ± 0.41	4.33 ± 0.12
Fat (%)	1.13 ± 0.06	0.47 ± 0.05	0.13 ± 0.03
Dietary Fibre (g)	10.9 ± 0.23	4.9 ± 0.47	6.33 ± 0.31
Vitamin C (mg)	1.08 ± 0.02	1.55 ± 0.01	1.09 ± 0.05
Iron (mg)	5.5 ± 0.05	3.5 ± 0.01	1.2 ± 0.04
Potassium (mg)	80 ± 0.17	50 ± 0.21	50 ± 0.11
Calorific Value (kcal)	123.74 ± 0.80	166 ± 0.89	173.87 ± 0.23
Thiamine (Vitamin B_1) (mg)	Not detected	1.00 ± 0.02	2.00 ± 0.03

Values expressed per 100 g of sample (mean ± SD)

Table 1: Nutritional Composition of *Manda* Prepared from Red, Black, and White Rice



RED RICE

BLACK RICE

WHITE RICE

STEPS OF PREPARATION OF MANDA (RED RICE):

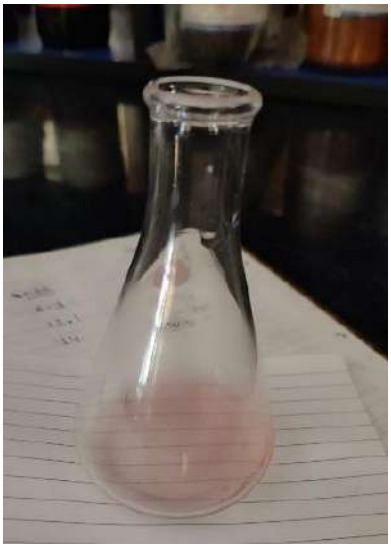
STEPS OF PREPARATION OF MANDA (BLACK RICE):

STEPS OF PREPARATION OF MANDA (WHITE RICE):

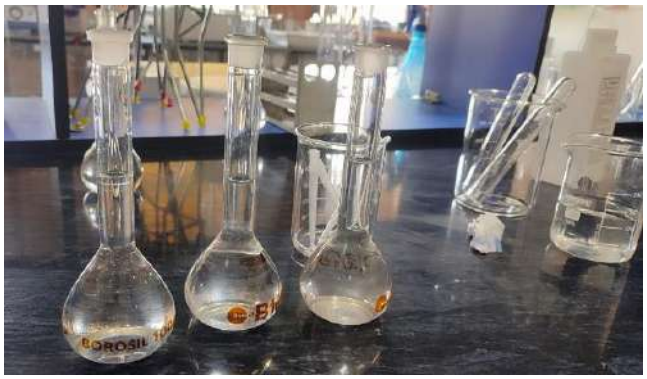
PHOTOS DURING EXPERIMENTS:

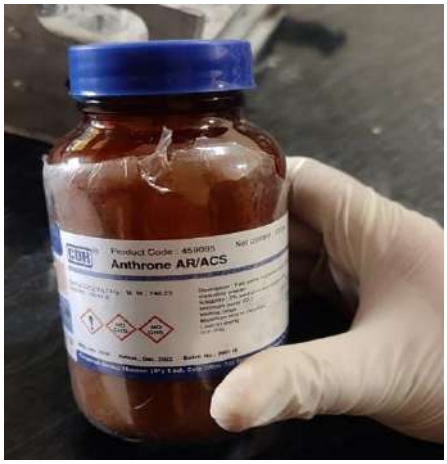
DURING FAT ANALYSIS-

DURING VITAMIN C ANALYSIS-



DURING CARBOHYDRATE ANALYSIS-





DURING ENERGY CALCULATION

SAMPLE PREPARED FOR EXPERIMENTATION

P.G. DEPARTMENT OF FOOD SCIENCE TECHNOLOGY AND NUTRITION
Prof. Pradeep Kumar Naik
Course Coordinator,
Food Science Technology & Nutrition
Mobile No:- 9479268802
Email.:cordcfst@suniv.ac.in

SAMBALPURUNIVERSITY
JYOTIVIHAR-768019,
BURLA,ODISHA, INDIA

Letter No.2413/FSTN **Dated: 29.04.2025**

To
Mr. Abhishek Hota
Balangir Gov. Ayurvedic College and Hospital,
Balangir, Odisha

Sub: Regarding Nutrition Profiling of food products.

Product Details

Product Name	Red rice, Black rice, White Rice Gruel
Product Developer	Abhishek Hota
Receiving date of the sample	19.02.2025

Sl No.	Ingredients	Quantity (in grams)
1	Red rice	100
2	Black rice,	100
3	White rice	100

Sample Name	Total Carbohydrate content (g/100g)	Total Protein content(g/100 g)	Total Fat (%)	Calorific value (Kcal/100g)	Dietary fibre (g/100g)	Vitamin C(mg/100g)	Potassium (mg/100g)	Iron(mg/100g)
1	31.15385±0.2	2.7453±0.4	1.1286± 0.06	123.74±0.8	10.9±0.23	1.08±0.02	80±0.17	5.5±0.05
2	58.97436±0.03	4.627±0.41	0.468±0.05	166±0.89	4.9±0.47	1.55±0.01	50±0.21	3.5±0.01
3	63.84615±0.13	4.3264±0.12	0.1256±0.03	173.87±0.23	6.33±0.31	1.09±0.05	50±0.11	1.2±0.04

Note:

1.This report pertains only to the sample submitted for the test.

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29/04/25

Coordinator, FSTN
Sambalpur University
Co-ordinator
P.G. Department of
Food Science Technology & Nutrition
Sambalpur University

HPLC Calculated Data for Vitamins

Thiamine Y.

White Rice Gruel – 0.002%

Black Rice Gruel – 0.001%

17/04/25

Co-ordinator COE-NPT

Coordinator, COE
Natural Products & Therapeutics
Sambalpur University
Jyotivihar, Odisha, India

17/04/2025

Signature

CONCLUSION:

This study affirms the nutritional and therapeutic relevance of *Manda*, a classical *Ayurvedic* rice gruel, as a light, digestible dietary intervention suitable for individuals in various stages of recovery, particularly post-detoxification and during convalescence. Among the three rice variants evaluated, red rice *Manda* (*Raktashali*) emerged as the most nutrient-dense, particularly in dietary fibre, iron, and potassium, supporting its traditional *Ayurvedic* classification as a rejuvenating and *Tridosha*-pacifying grain.

White rice *Manda*, with its high carbohydrate and calorific content, was best suited for rapid energy restoration, though its lower micronutrient profile limits its role in long-term nutritional support. Black rice *Manda* presented a balanced profile with higher protein and vitamin C content, suggesting potential utility in antioxidant and immune-supportive dietary regimens.

These findings underscore the importance of selecting rice varieties for *Manda* preparation based on individual constitution (*Prakriti*), clinical needs, and therapeutic objectives. The simplicity, affordability, and accessibility of *Manda* highlight its potential as an integrative nutrition solution, bridging traditional *Ayurvedic* wisdom with modern dietary science

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