



Development And Nutritional Evaluation Of Instant Idly Mix Incorporated With Sprouted Moongdal And Black Rice

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Abstract: The preparation of an “Instant Sprouted Moong Dal [*vigna radiata*] and black rice[*oryza sativa* L.*indica*] Idly Mix” offers a nutritious, convenient, and quick meal alternative to traditional idly preparation. Sprouted moong dal and black rice is rich in proteins, vitamins, minerals, and dietary fiber, making it an ideal base for a healthy idly mix. “This instant idly mix undergoes ready -to-cook product”. The sprouting process enhance nutrient bioavailability and reduces anti-nutritional factors while dehydration ensures extended shelf life without compromising nutritional quality. This instant idly mix not only reduces preparation time but also contain health benefits because sprouted moong dal and black rice contain high fiber help to reduce constipation and low glycemic index suitable for maintain sugar levels in diabetic patients and also maintain insulin levels in children and pregnant women .The process involves cleaning, sprouting, drying, and milling moong dal into a fine powder using pulverizer which is then blended by using blender with other essential ingredients such as urad dal, leavening agents like baking soda for flavour. The mix is designed for instant preparation by simply adding water or yogurt, followed by steaming to produce soft and fluffy idlys. The final product is evaluated based on texture, taste, aroma, and shelf stability. The study highlights the nutritional advantages, processing techniques, and quality control measures essential for commercial production and market acceptance of this ready-to-cook product.

Keywords: sprouted moong dal, black rice, yogurt, pulverizer, ready-to-cook product.

I. INTRODUCTION

Ready-to-eat and ready-to-cook food products have gained a significant market share in recent years due to their strong resemblance to our everyday meals. The past few years have seen a significant shift in eating patterns and culinary techniques due to urbanization, cultural shifts, and social development (Temgire et al., 2021)¹ Mung beans, often known as green grams (*Vigna radiate*), are a significant food legume that grows in tropical and subtropical regions. It is a great source of protein and virtually free of things that cause flatulence. Green gram seeds are hence the best option for feeding infants. Compared to other legume seeds, these seeds have a higher percentage of lysine. The seeds are processed and eaten as flour, sprouts, immature seeds, cooked whole beans or splits (dhals), and in a variety of cuisines.(Adsule et al., 1986)². Green grams have a low fat content and are high in proteins, carbohydrates, dietary fiber, vitamins, and minerals. It can be regarded as a meat substitute for vegans due to its high protein content. Green grams are not only a nutrient-dense meal but also have anti-inflammatory, antioxidant, anti-cancer, and hypolipidemic properties (see above). (Sudhakaran & Bukkan, 2021)³. Germination, another name for sprouting, is a historical process that dates back 5,000 years. A natural, adaptable, economical, and sustainable method of enriching grains with the macro and

micronutrients needed to cure malnutrition is sprouting. Under ideal circumstances, it is a sustainable, green, and efficient intervention to improve the grains' nutritional value and health advantages while lowering or eliminating some of their main drawbacks, including indigestibility, allergenicity, and anti-nutrients. Additionally, it works very well to reduce issues with grain processing such dehulling, lengthy cooking times, and unfavorable taste. (Chima et al.,2021 ; Erba et al., 2019 ; lemmens et al 2021)^{4,5}. Sprouting has a significant impact on nutritional quality by increasing nutrient bioavailability and digestion and the way nutrients are used. Black rice, is well-known for its abundance of nutrients. This rice is also known as royal's rice, emperor's rice, and prohibited rice. This rice primarily comes from Asian nations. China is the country that cultivates the most black rice (62%), followed by Sri Lanka (8.6%), Indonesia (6.2%), and India (5.1%), in order of precedence. (Sangma & Parameshwari, 2021)⁶. It has a lot of tocopherols, which are among the strongest antioxidants and are commonly referred to as vitamin E, and anthocyanins, which are antioxidants. Antioxidant-containing foods are dark purple or black in color. Additionally, it has high levels of fiber, protein, carbs, potassium, and B vitamins. Another class of chemical molecules known as "antioxidants," which are found in the foods we habitually eat, naturally dominate the activity of "free radicals" in our bodies. Thus, including black rice in your normal diet can help prevent a number of non-communicable diseases (NCDs), such as the development of cancer cells, atherosclerosis, high blood pressure, diabetes, osteoporosis, asthma, problems with the digestive system, and lower the risk of stroke in women. Additionally, black rice is used to create new, innovative food products. (Sangma & Parameshwari, 2021)⁶. Black rice is growing in popularity these days due to its many health advantages. Among the many health advantages of black rice are prolonging the quality of life and preventing and treating illnesses and ailments like diabetes, high blood pressure, cancer, and heart disease. Components of black rice may help maintain health and prevent disease, according to several studies. (Adom KK et al.,2002)⁷. Black and brown rice are both high in dietary fiber, vitamins, and minerals. But black rice is better when compared to brown rice since it has higher levels of fiber and protein. Additionally, black rice has a very high antioxidant content, which offers several other health advantages. Compared to brown rice, pigmented black rice has almost six times as many antioxidants. Types of rice (*Oryza sativa* L). with pigments, including Compared to other types of rice, black rice has a higher concentration of phenolic chemicals.

2.MATERIALS AND METHODS:

Raw materials: The materials that are required in the preparation of idli are moong dal, black rice, urad dal, rice flakes, chitti muthyalu rice, baking soda, salt.

preparation of sprouted moong dal powder:

To make sprouted green gram flour, clean, high-quality green gram is washed and soaked in water for 12–24 hours. After soaking, it's drained and left to sprout for 1–2 days in a warm, humid environment. The sprouts are then dried at 50–60°C in a tray dryer until fully dry. Once dried, they are ground into a fine powder using a pulverizer, then packed in airtight, moisture-proof containers and stored at room temperature. This powder is ready for idli preparation.

processing of raw materials:

The process of making sprouted moong dal and black rice idli mix begins with selecting nutrient-rich black rice and urad dal. These are soaked in clean water for several hours to enhance digestibility and activate enzymes. After soaking, they are dried at 50–60°C in a tray dryer to preserve nutrients and remove moisture. The dried grains are then ground separately using a pulverizer to a fine 5 mm particle size, suitable for batter preparation. The powders of black rice and urad dal are then ready for mixing.

Processing of chitti muthyalu rice:

Parboiling is a hydrothermal process used to enhance the nutrition, shelf life, and milling quality of Telangana's aromatic Chitti Muthyalu rice. It begins with cleaning the paddy to remove impurities. The rice is then soaked in hot water (60–70°C) for 6–8 hours to soften the grains. This is followed by steaming for 5–10 minutes to partially gelatinize the starch and reduce microbial activity, taking care not to over-steam and lose aroma. After steaming, the rice is dried (sun or mechanical drying) to a moisture level of 12–14%, with regular turning during sun drying to prevent fungal growth. Once dried, the rice is milled. Parboiling improves grain hardness, reduces breakage, retains nutrients, and boosts shelf life.

Preparation of idli:

To ensure quality and safety, high-grade moong dal, urad dal, and black rice are selected and cleaned to remove impurities. The grains are soaked to enhance hydration, digestibility, and texture. Moong dal is sprouted and then dried, along with soaked black rice and urad dal, at 50–60°C to retain nutrients and prevent spoilage. Once dried, all ingredients are finely ground into powder. The powders are sieved for uniformity and then blended thoroughly. Optional functional or nutritional ingredients may be added. The final blended powder is tested for moisture content, nutrient composition, and microbial safety. It is then packed in LDPE pouches to extend shelf life and stored in suitable conditions to preserve quality. The mix is designed for instant preparation by simply adding water or yogurt, followed by steaming to produce soft and fluffy idlys.

Filling and Sealing:

Tetra-pouches or Low Density Polyethylene pouches are used to hold the final products. The top of the pouch is secured by a zip lock. The merchandise is packed in accordance with the size of the pouch. A continuous sealer machine is used to seal the product that has been filled into the bag. For stability in storage, the sealed product is retained.

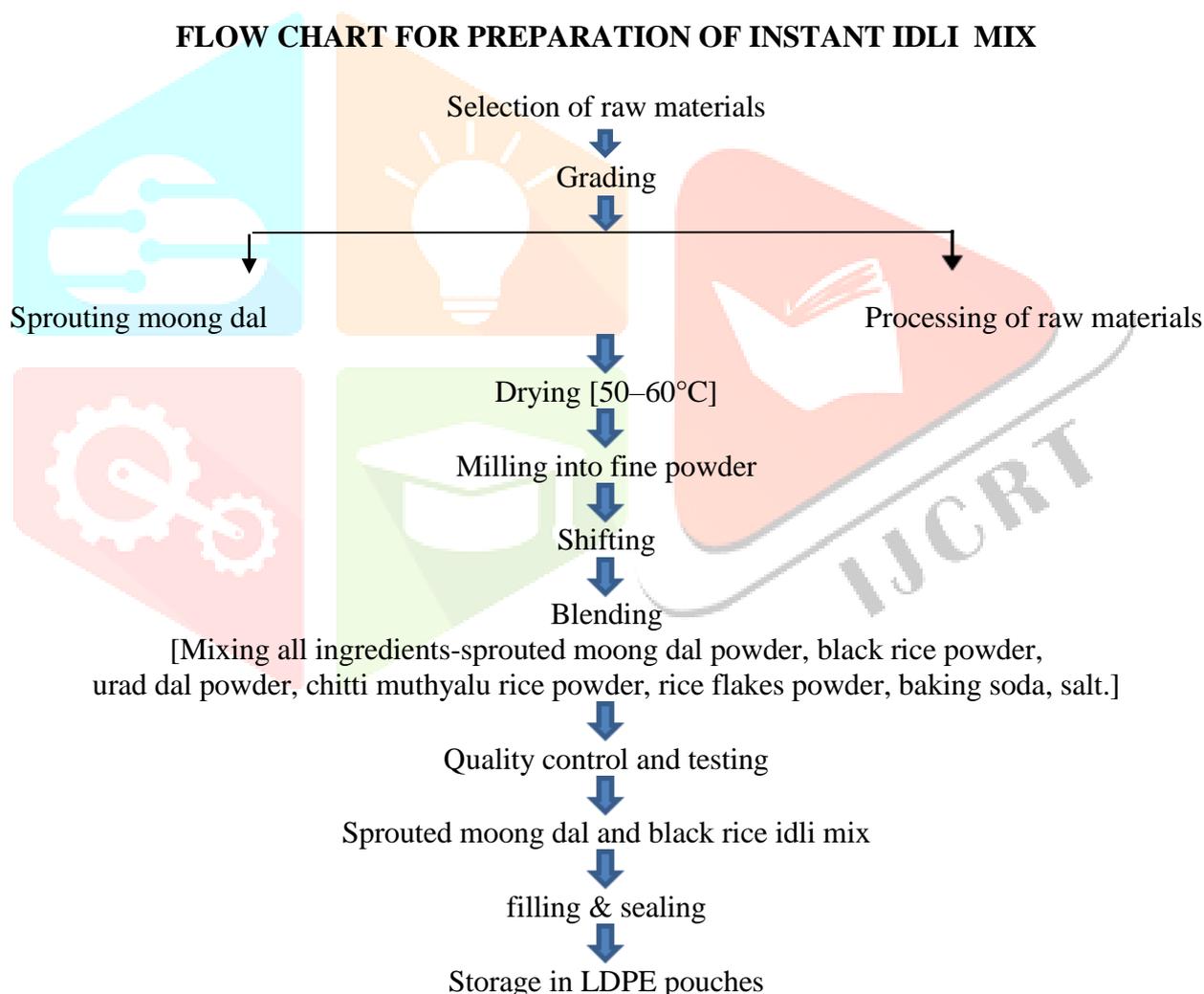




Figure 1: sprouted moog dal and black rice instant idli mix dal and black rice idli



Figure 2 : sprouted moong dal and black rice idli

formulations

The formulation is developed with the consideration that the main ingredient, sprouted moong dal, should have a higher percentage than the other ingredients, as it is rich in protein and enhances the nutritional profile of the idli. Black rice, known for its high antioxidant content and fiber, is also added as a key component. Wheatgrass powder is included as a source of iron. The difference in formulation 3 and 4 lies in the mesh size used for grinding. From formulation 1 to 4, the variation is primarily in increasing the amount of sprouted moong dal while decreasing the amount of black rice. The total formulation is made up to 250g.

Table:1 formulations

INGREDIENTS	F1	F2	F3	F4
sprouted moong dal powder	57	63	73	80
black rice powder	49	43	33	26
Uraddal powder	50	50	50	50
Rice flakes powder	40	40	40	40
Chitti muthyalu rice powder	50	50	50	50
Baking soda	1	1	1	1
Salt	3	3	3	3

METHODS

Moisture Content:

Moisture content in the product can be measured using a hot air oven method in a TS analyzer. This method provides accurate and consistent results by drying the sample to a constant weight.

$$\text{Moisture content (\%)} = \frac{(W1-W2) \times 100}{W1}$$

Where : W1 = weight (g) of sample before drying
W2 = weight (g) of sample after drying

Protein:

The protein content can be measured by the using kjeldhal method. Protein content can be calculated by using the following.

$$\text{Protein (\%)} = \text{Nitrogen (\%)} \times 6.38$$

Titrateable acidity:

To calculate the acidity of the product.

$$\text{Formula: Acidity} = \frac{\text{Titrate value} \times \text{equivalent weight of NaOH} \times \text{normality of NaOH}}{\text{weight of the sample}}$$

Ash:

The ash content can be determined by using the muffle furnace method.

$$\text{Ash (\%)} = \frac{\text{weight of ash} \times 100}{\text{Weight of sample}}$$

Carbohydrates:

The carbohydrates content can be determined through Fehling Solution.

$$\text{Total Carbohydrates (\%)} = \text{Volume of sample used (ml)} \times \text{dilution factor} \times 100$$

pH :

The ph content determined by the ph meter.

Acid insoluble ash:

Acid insoluble Ash is an indicator of the external impurities present i.e., the silicates present due to manufacturing ideally.

$$\text{Acid insoluble ash} = \frac{\text{weight of residue after acid treatment} \times 100\%}{\text{Original weight of the sample}}$$

Crude fiber

Acid-alkali digestion method used for the determination of crude fiber

$$\text{Crude fibre} = \frac{\text{Weight of the fibre [(W2-W1) - (W3-W1)]} \times 100}{\text{Weight of the sample (g)}}$$

Iron

Iron is determined by using UV-Visible spectrophotometer

$$\text{Iron (mg/100g)} = \frac{\text{concentration (mg/L)} \times \text{volume (mL)}}{\text{Weight of sample (g)}} \times 100$$

Calcium

Calcium detrmined by using UV-Visible spectrophotometer

$$\text{Calcium (mg/100g)} = \frac{\text{concentration (mg/L)} \times \text{volume (mL)}}{\text{Weight of sample (g)}} \times 100$$

Sensory evaluation

Sensory evaluation involves assessing the appearance, flavour, texture, colour and overall acceptability of the idly by trained panel members. It provides valuable feedback on the formulated product's organoleptic characteristics. Sensory analysis is a scientific method used to evaluate and understand the sensory characteristics of various products, such as food, beverages, cosmetics, and more.

Table 2 Hedonic scale

Panelist hedonic rating	score
Like extremely	9
Like very much	8
Like moderetly	7
Like slightly	6
Neither like or dislike	5
Dislike slightly	4
Dislike moderately	3
Dislike very much	2
Dislike extremely	1

3.RESULTS AND DISCUSSION

Sensory analysis :

Sensory evaluation involves assessing the appearance, flavour, texture, colour and overall acceptability of the idly by trained panel members. It provides valuable feedback on the formulated product's organoleptic characteristics. Sensory analysis is a scientific method used to evaluate and understand the sensory characteristics of various products, such as food, beverages, cosmetics, and more. It involves using human senses like sight, smell, taste, touch, and sometimes even hearing to gather 36 information about a product's attributes. This method helps in making informed decisions related to product development, quality control, and consumer preferences. The panellists were instructed to use the 9- point hedonic scale and to clean their tongues in between each assessment of a new sample. 4 formulations of the idli where surved to the panellists for sensory quality evaluation and the product where evaluated for clour, flavour, taste, and overall quality by adapting a 9-point hedonic scale method.

Table 2: sensory analysis

Sensory Attributes	Formulation-1	Formulation-2	Formulation-3	Formulation-4
Colour	8	8	8	8
Flavour	7	7.5	8	9
Consistency	8.5	8.5	8.5	9
Taste	7.5	8	7	9
Appearance	7.5	8	8	8
Overall acceptability	7.5	8	8	9

physico chemical analysis

According to the results of physico-chemical analysis, it clearly states that developed and optimized variation was rich in fiber and protein compared to control due to addition of sprouted moong dal and black rice. It was also expressed that the moisture content and acidity of optimized variation was less compared to the control. Less moisture content gives longer shelf life to idli powder. With less moisture, the flavours can be more pronounced. The results of physico-chemical analysis were shown in table no. 3

The physico-chemical analysis reveals that all optimized samples (F1–F4) showed improved nutritional and stability characteristics compared to the control. The moisture content in the formulations was lower (F4 being the lowest at 8.0%) than the control (8.6%), suggesting better shelf life. Ash content was slightly higher in samples (F1: 1.2%, F3: 1.4%) indicating higher mineral content. The acid-insoluble ash was also lower in samples (lowest in F3: 0.24%), suggesting better digestibility and purity. The pH of the control was higher (5.6) compared to samples (F1–F4 ranged from 4.2 to 4.5), which means the samples were more acidic, correlating with reduced microbial risk. The acidity was also lower in optimized samples (lowest in F4: 0.04%), enhancing taste stability and safety.

Table 3: physico-chemical analysis

parameters	control	F1	F2	F3	F4
Moisture	8.6%	8.1%	8.4%	8.5%	8.0%
Ash	1.0%	1.2%	1.0%	1.4%	1.1%
Acid insoluble ash	0.40%	0.36%	0.33%	0.24%	0.38%
pH	5.6	4.2	4.4	4.5	4.5
Acidity	0.07%	0.04%	0.06%	0.05%	0.04%

Nutritional analysis

According to the nutritional analysis, it clearly states that developed and optimized formulation was rich in fiber and protein compared to control sample due to the addition of sprouted moong dal black rice idly. The developed formulations (F1–F4) showed enhanced nutritional quality compared to the control. Carbohydrate content was highest in the control (72.5 g), while the formulations had lower values (F1: 50.7 g to F4: 69.8 g), suggesting a reduction in caloric density. In contrast, protein content increased significantly in all formulations, especially F1 (12.68 g) and F4 (12.58 g), indicating improved protein quality.

Fiber content was absent in the control and ranged from 5.1 g to 7.9 g in the samples, with F3 and F4 showing the highest fiber—improving digestive and functional benefits. Iron and calcium contents were also notably higher in the formulations, particularly F4 (iron:4.5 mg, calcium: 95 mg), enhancing the micronutrient profile and nutritional value of the product.

Table 4: nutritional analysis

Parameters	Control	F1	F2	F3	F4
Carbohydrates[g]	72.5	50.7	55.6	60.1	60.8
Protein[g]	10.1	12.68	11.6	11.8	12.58
Fiber[g]	-	6.3	5.1	7.9	7.8
Iron[mg]	-	5.6	3.8	4.3	4.5
Calcium[mg]	-	75	76	85	95

Microbial Analysis:

The microbial analysis was done in 0 days and 30 days and 60 days.”

This indicates a time-based microbial evaluation to check the microbial load or contamination over a storage period.

Table 5 Microbial Analysis

0 days	30 days	60 days
Nil	7.4×10^3 CFU/ml	7.6×10^3 CFU/ml

Interpretation:**0 Days (Fresh Sample):**

No microbial growth detected, which is expected for a fresh and properly prepared/stored food product.

30 Days:

Microbial count rises to 7.4×10^3 CFU/ml (Colony Forming Units per milliliter), indicating initial microbial growth due to storage.

60 Days:

Microbial count is 7.6×10^3 CFU/ml, a very slight increase from 30 days. This suggests the product has relatively stable microbial activity between 30 and 60 days.

Product Shelf Life:

The product appears microbiologically stable for at least 60 days with only minimal microbial growth. However, whether this is within safe limits depends on the acceptable CFU limits for that specific food product

DISCUSSION

The present study focused on the formulation and standardization of a sprouted moong dal and black rice-based idli, a functional, nutrient-dense, and natural fermented food product. The primary objective was to develop a palatable, health-promoting idli by utilizing underutilized functional ingredients. The formulated idli was analyzed for its organoleptic properties, nutritional composition, and overall acceptability. Sprouted moong dal was selected as a major ingredient due to its enhanced nutritional profile. Sprouting improves the bioavailability of nutrients, increases the protein content, enriches vitamin C levels, and reduces anti-nutritional factors like phytic acid. Moong dal is naturally rich in plant protein, fiber, and essential micronutrients, supporting muscle repair, digestive health, and immunity. Black rice was incorporated for its exceptional antioxidant content, particularly anthocyanins, and its complex carbohydrate profile. Black rice provides a low glycemic index alternative to white rice, supporting blood sugar regulation and offering anti-inflammatory benefits. Its inclusion also contributes to a distinctive visual appeal and unique flavor profile. Together, sprouted moong dal and black rice promote a functional, nutrient-dense, and sustainable food solution. Both ingredients complement each other nutritionally — moong dal enhancing the protein profile and black rice boosting antioxidant and fiber content.

CONCLUSION

Development and nutritional evaluation of instant idly mix incorporated with sprouted moong dal and black rice has successfully completed. The formulation 4 in this study is high in antioxidants, calcium, fiber and protein and also acceptable in taste. The nutrient enriched instant idly mix can maintain blood sugar levels because of low glycemic index and also prevent cancer and maintain heart health. This idly mix is easy to make and use for home makers who are in job.

In conclusion, the sprouted moong dal and black rice idli is a valuable addition to the functional foods market, bridging traditional flavors with contemporary nutritional needs to promote better health through simple and natural dietary habits.

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