



**TAMIL NADU AGRICULTURAL UNIVERSITY**  
**COMMUNITY SCIENCE COLLEGE AND RESEARCH INSTITUTE**  
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**ALL INDIA COORDINATED RESEARCH PROJECT ON HOME SCIENCE**

**Germinated Brown rice (GABA Rice)**

Rice is the main staple in India and in many countries around the world and is mainly consumed as white rice which is highly polished and bereft of all the vital nutrients (B vitamins, dietary fibre,  $\gamma$ -oryzanol and other phytochemicals) which are concentrated in the rice bran and the germ. Though, brown rice is nutritionally superior, yet oils and rancidity can be problematic regarding storage quality and organoleptic properties. The surging prevalence of non-communicable diseases like diabetes mellitus, cardiovascular diseases, cancer and diseases of the gastro-intestinal tract is attributed to diet principally due to consumption of highly polished rice, which has high consumer acceptance as a staple and mainly for its sensory appeal in the South Indian dietary habits. Hence, in order to render brown rice as health food, germinating of brown rice is expected to overcome the limitations of brown rice with better sensory acceptance and storage quality.

Germinating brown rice leads to increase in several health-promoting compounds due to enhancement of bioactive and nutraceutical properties during the sprouting process. Germinated rice has improved level of dietary fibre and phytochemicals such as ferulic acid, gamma-amino butyric acid (GABA), acylatedsteryl glycoside (ASG),  $\gamma$ -oryzanol, phenolic compounds and antioxidant activity, in addition to better bioavailability of vitamins, minerals. Health benefits of germinated rice in reducing the risk of obesity, CVDs, type-2 diabetes and neurodegenerative diseases (Patil and Khan 2011; Chinma *et al.* 2015) has generated much interest in the utilisation of germinated rice in place of polished rice in the daily diet. Germinated brown rice also known as GABA rice is an economically feasible technological intervention to improve the health status of rice eating population by replacing refined rice with the health promoting germinated rice. The technology of germinated brown rice with emphasis on food safety aspects and the value added products developed from the germinated brown rice will help to revalorise the value of rice both in the dietary and in terms of market value which will benefit both the farmers and the food industry.

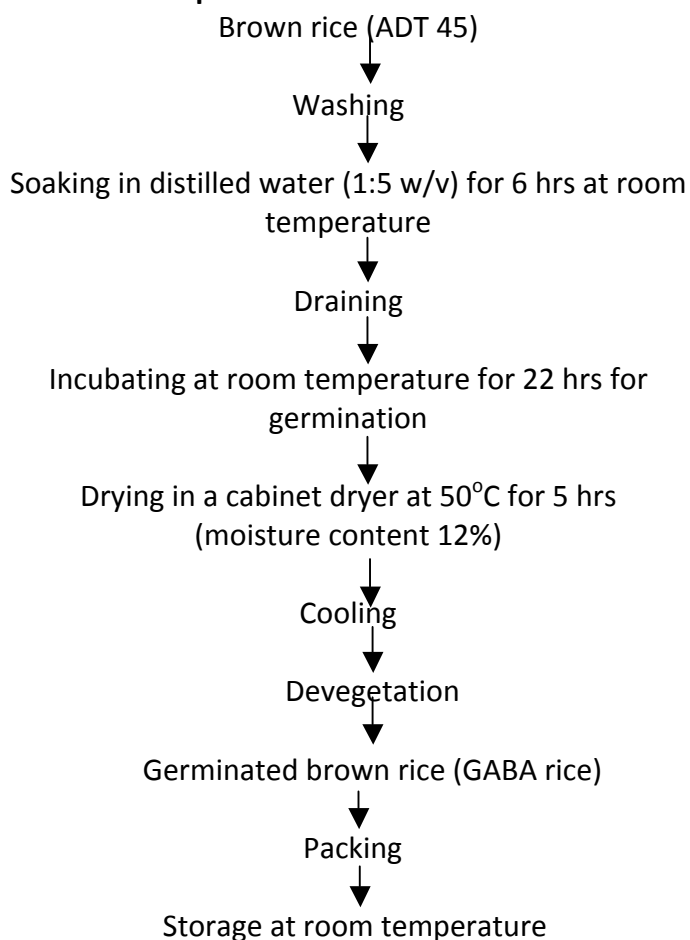
**Methodology**

Germination is a low cost technology which starts with seed water uptake and ends at the protrusion of radicle from the seed. Reactivation of metabolism occurs during seed germination process which results in the hydrolysis of storage proteins and carbohydrates and the synthesis/accumulation of metabolites with health-promoting properties.

### Processing of GABA Rice



### Flow chart for production of Germinated Brown rice



### Germinated Brown Rice (GABA Rice) based rava based uppma

GABA rice rava based uppma		
Ingredients		Procedure
GABA rice rava	100g	<ul style="list-style-type: none"> <li>➤ Roast GABA rice rava till it becomes light brown.</li> <li>➤ Fry all the ingredients except rava.</li> <li>➤ Add water, salt and allow to boiling.</li> <li>➤ Sprinkle roasted sorghum rava with continuous stirring to the boiling water.</li> <li>➤ Cook for 15 to 20 minutes with continuous stirring.</li> </ul>
Chopped onion	40g	
Chopped garlic	4g	
Chopped curry leaves	1g	
Salt	2g	
Oil	20ml	
Water	600ml	

### Germinated Brown Rice (GABA Rice) based flour based puttu

GABA rice flour based puttu		
Ingredients		Procedure
GABA rice flour	100g	<ul style="list-style-type: none"> <li>➤ GABA rice was cleaned and soaked in water for 1 hour and cooked for 30 minutes.</li> <li>➤ The cleaned GABA rice was sun dried for 6 hours (13% moisture content) and pulverized to pass through BS 40 mesh sieve to obtain uniform size particles.</li> <li>➤ Hot water was sprinkled on the rice flour, mixed well and tempered for 12 minutes in a closed environment.</li> <li>➤ Scrapped coconut and cardamom powder were added and mixed well to enhance the taste and flavor.</li> </ul>
Salt	1.8g	
Oil	10ml	
Mustard seeds	0.5g	
Shredded coconut	25g	
Cardamom	5g	
Chopped curry leaves	1.0g	
Water -required	Required	

### Mean proximate composition of the Germinated brown rice based food products.

Nutrient contents	Germinated Brown Rice (GABA)	Germinated Brown Rice rava based Uppma Mix	Germinated Brown Rice flour based Puttu mix
Moisture (%)	11.50	6.86	6.74
Carbohydrate (g / 100g)	67.43	67.36	66.45
Energy (K.cal / 100g)	340	344	330
Protein (g / 100g)	8.95	8.90	8.85
Fat (g / 100g)	1.17	1.06	1.14
Ash (g)	1.16	1.13	1.10
Crude fibre (g / 100g)	3.87	3.84	3.75
Total Dietary Fiber (g/ 100g)	10.98	10.72	10.60
Calcium (mg / 100 g)	9.95	9.84	9.93
Iron (mg / 100 g)	1.76	1.70	1.64
Zinc (mg)	1.62	1.59	1.50




### Bioactive components of Germinated Brown Rice (GABA Rice)

S.No	Bioactive components	
1.	Total Antioxidant capacity (mg TE / 100g FWB)	535.45
2.	Radical Scavenging Activity(% RSA)	72.85
3.	Total Phenolic content (mg GAE / 100g FWB)	90.31
4.	Total Flavonoid content (mg RE / 100g FWB)	30.87
5.	Gama Amino Butyric Acid (GABA)(mg/100g)	50.37

### Cooking quality of Germinated Brown Rice (GABA Rice)

Cooked GABA rice		
Parameters	Open Cooking	Pressure Cooking
GABA rice quantity	200 g	200 g
Soaking Time	10 min.	10 min.
Rice : Water Ratio	450 ml	1: 2.5
Cooking Time	20 min.	15 min.
Cooking Recovery	870 g	900 g
Recovery %	335	350

### Glycemic index and glycemic load of Germinated rice base products

Food products	Glycemic Index	
Cooked germinated brown rice	49.74	 GABA rice rava based upma  Cooked GABA rice
Germinated brown rice rava based uppma	56.25	
Germinated brown rice flour based puttu	51.43	 GABA rice flour based puttu

### Distinct advantages of Germinated Brown Rice (GABA Rice)

- Better nutritional profile and health benefits
- High resistant starch and fibre content
- Lower starch content
- Decrease in anti-nutrients
- Better nutrient bioavailability
- Lower glycemic index and glycemic load
- Better sensory characteristics
- Better shelf life
- Better market value and prospects for commercialization.