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**Dr. Gitanjali**

Department of Food and Nutrition, College of Community Science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

**Dr. Vishakha Singh**

Department of Food Science and Nutrition, College of Community and Applied Science, Maharana Pratap Agricultural University and Technology, Udaipur, Rajasthan, India

## Development and nutritional evaluation of low glycemic index recipe from ragi and pulses for diabetes

**Dr. Gitanjali and Dr. Vishakha Singh**

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### Abstract

Refined carbohydrates, such as white rice and white flour, are the mainstay of the modern Asian Indian diet and may contribute to the rising incidence of Type- 2 diabetes and other life style diseases in this population. Low-glycemic index foods and high fibre content might play a significant role as functional foods in reducing the risk of such chronic diseases such as diabetes, cardiovascular diseases, obesity and cancer etc. In this study, two breakfast/ lunch items were targeted to modify and develop a low glycemic index recipe that can be consumed by diabetic individual. The prepared foods were investigated for organoleptic evaluation and proximate composition (moisture, protein, fat, crude fibre and ash content). Both the prepared products were organoleptically fell in the category of “liked very much” and nutritionally have a good potential for use as low glycemic food. The concept of glycemic index of various foods has emerged as a boon to dietary therapy of diabetes mellitus, indicating the beneficial aspect of foods consumed both individually and as mixed meals.

**Keywords:** Diabetes, low glycemic food, ragi, pulse

### Introduction

Diabetes mellitus is a universal health problem affecting human societies at all stages of development. At least 2.8 million adults die each year as a result of being overweight or obese (44% diabetes, 23% ischemic heart disease, 7-41% certain cancers) (WHO 2013) [16]. Diabetes has a strong genetic basis but, environmental influences are equally important for its manifestation. Diabetes cannot be cured completely but it can be kept under control by using combination of diet, drugs and exercise. Proper diet helps in maintaining normal blood sugar level in diabetes. It is recognized that a good control over blood sugar level is essential for prevention or postponement of long term complications of diabetes (Saraniya and Jeevaratnam, 2014) [12]. Therefore, while planning the diet for diabetic people the food low in glycemic index should be used. The glycemic index is an important parameter of food quality which compares the hyperglycemic effect of a tested meal with pure glucose or another defined standard food (Queiroz, *et al.*, 2012) [8].

A low glycemic index suggests slow rates of digestion and absorption of the food's carbohydrates and may also indicate greater extraction from the liver and periphery of the products of carbohydrate digestion (Brouns, *et al.*, 2005) [1]. A lower glycemic response usually equates to a lower insulin demand but not always, and may improve long-term blood glucose control and blood lipids. Epidemiological data indicate that a low glycemic index diet protects against the development of type II diabetes, coronary heart disease and metabolic syndrome. Recent studies have shown that the high Glycemic Index food is positively associated with the risk of developing type II diabetes (Villegas, *et al.*, 2007) [15] and coronary heart diseases (Mente *et al.*, 2009) [6].

Millets are the basic cereals in India and eaten by a large section of the poor community. Ragi is nutritious millet containing very high amount of calcium along with good amount of protein, fibre and minerals. In spite of ragi being nutritious, it is not being utilized due the lack of time for preparing food items from it. Increasing number of working women is one of the reasons for it. Pulses are nutritional powerhouses. They are rich in protein, fibre and complex carbohydrates, low in fat and sodium and contain a variety of vitamins and minerals.

**Corresponding Author:****Dr. Gitanjali**

Department of Food and Nutrition, College of Community Science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar, India

Besides fibre, pulses contain other complex carbohydrates like resistant and slowly digestible starch as well as oligosaccharides (Gajula *et al*, 2008) [2]. Pulses have a low glycemic index. Pulses are nutrient dense foods; they provide high amounts of vitamins and minerals. Pulses are low in fat, saturated fat and are free of trans fats and cholesterol. Pulses are a good food choice for diabetes and research has shown that pulse consumption can help with managing blood sugar levels.

A wide variety of foods are in common use by Indians. The stunning nutritional composition of rice cereals and pulses has led the research around the world in discovering the many and varied health benefits of these crops particularly in reducing the risk of diseases such as coronary heart disease, cancer and diabetes. The glycemic indices also vary widely depending on the composition of food items. Legume pulse have low glycemic index (30- 40%). Fruits have an intermediate glycemic index (45-55%). Cereals like wheat, rice and root vegetables such as potato, carrots have a high glycemic index (65 -75%) (Khan *et al.*, 2011) [5]. Thus for the present study, the foods containing low glycemic index ragi (finger millets), lentils and bengal gram dhal were selected for the development and nutritional evaluation of the low glycemic index recipe.

### Materials and Methods

The present study was carried out in the Department of Foods and Nutrition, College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology, Udaipur. Raw materials required for the development of

products was purchased from the local market of Udaipur city. The food sample was cleaned and removed from dust and other foreign materials, and then used for preparation of recipe.

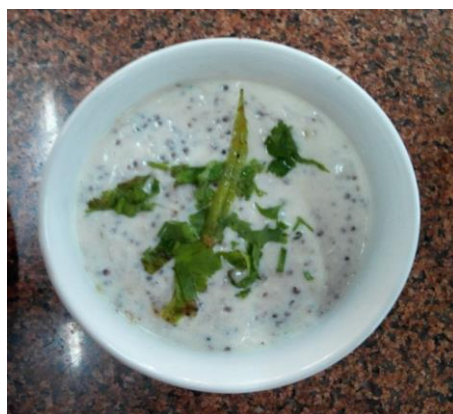
### Preparation of recipe

Two recipe Ragi curd rice and lentil Bengal gram uttapam were selected and standardized for this purpose.

#### a. Ragi curd rice

Preparation time : 10 minutes  
Cooking time : 15 minutes  
Serving size : 1-2

Ingredients	Amount (g)
Ragi	90
Rice	30
Curd	200
Onion	50
Green chilly	5
Ginger garlic paste	4
Curry leaves (for seasoning)	3-4
Mustard seeds (for seasoning)	1
Black gram dal (for seasoning)	2
Coriander leaves (for garnishing)	3
Refined oil	3
Asafoetida	1 pinch
Salt	according the taste
Water (for cooking of rice)	3-4 cups



### Method

1. Clean and soak ragi overnight.
2. Next day wash the ragi properly in running water using a big strainer.
3. Take ragi, required amount of salt and 2.5 cups of water in a pressure cooker and cook for 4-5 whistles.
4. Wash rice and cook it separately.
5. Chop all vegetables and keep it ready.
6. Mix cooked ragi and rice properly.
7. Mix curd in cooked ragi rice mixture.
8. Now heat oil and add asafoetida, urad dal, mustard seeds and curry leaves once the mustards seeds have popped add green chilli.
9. To this hot oil Add ginger garlic paste and finely chopped onion.
10. Mix well and let the onions cook till it become light brown.
11. Add this seasoning of mustard, curry leaves & onion to the curd ragi rice mixture. Mix it thoroughly.
12. Add salt to taste

13. Decorate it with coriander leaves and serve hot.

#### b. Lentil, Bengal Gram Uttapam

Preparation Time: 12 hrs  
Cooking Time: 15 Min  
Serving size: 1-2

Ingredients	Amount (g)
Lentil	40
Split bengal gram	40
Rice	40
Tomato	75
Onion	50
Green chilli	5
Coriander leaves (chopped)	5
Curry leaves (chopped)	4-5
Salt	according to taste
garlic	5
refined oil	10
Water (for grinding)	



### Methods

1. Wash the rice and lentils well separately and soak them 3-4 hours in a separate bowls.
2. Drain the water and grind the rice dal mixture to a fine by adding sufficient water along with green chillies, salt and garlic.
3. Add water little by little and make a not too thick or too thin batter. The batter should be slightly runny but not more.
4. Leave this batter overnight for fermentation.
5. Add finely chopped onion, tomato, chopped curry leaves and chopped coriander leaves along with some salt to the batter. Mix well and set aside.
6. Heat a non stick pan, make the flame to medium low.
7. Add a ladle full of batter. Spread it in a circular motion from centre to outside in a circular motion
8. After a minute, drizzle few drops of oil in the centre and around the edges of uttapam.
9. Flip the uttapam and cook other side.
10. Serve hot along with coconut chutney / coriander chutney.

### Organoleptic evaluation of developed products

The acceptability of developed low glycemic index recipe likely ragi curd rice and lentil Bengal gram uttapam were evaluated by 10 Semi trained panel judges using 9-point

hedonic Scale to test the liking or disliking of products. On the basis of mean score of organoleptic evaluation obtained both acceptable products were selected for further nutritional analysis.

### Proximate composition of developed products

The nutrients such as energy, carbohydrate, protein, fat and fibre content were analyzed. All the estimation was done in triplicates. .

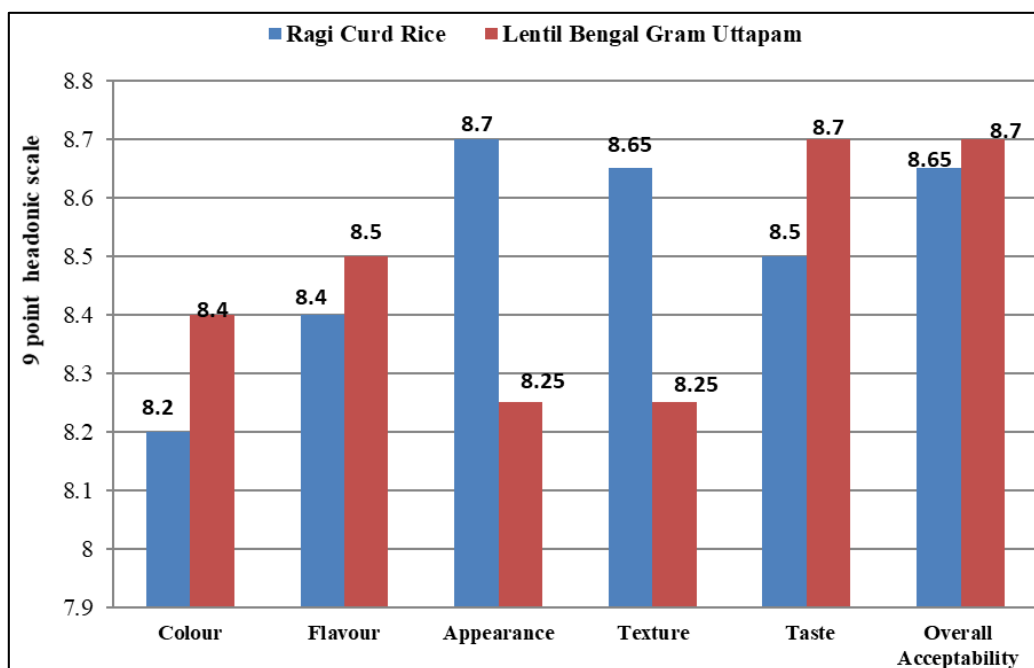
- a. Moisture content:** The moisture content was determined by employing the standard method of analysis (AOAC, 2000).
- b. Crude protein:** Crude protein was estimated by standard method (Micro Kjaldhal method) of analysis (AOAC, 2000), using KEL PLUS Automatic Nitrogen Estimation System.
- c. Crude fat:** Crude fat was estimated by employing the standard method of analysis (AOAC, 2000) using the Automatic SOCS plus Solvent Extraction System.
- d. Crude fiber:** The crude fibre was estimated by employing the standard method of analysis (AOAC, 2000).
- e. Ash Content:** The ash content was determined by employing the standard method of analysis (AOAC, 2000).
- f. Total Carbohydrate:** Amount of total carbohydrate was calculated from the sum of moisture, crude protein, crude fat, ash and crude fibre and lastly subtracting it from 100.

### Results and Discussion

The present study was undertaken to develop and evaluate the low glycemic index recipe; ragi curd rice and lentil bengal gram uttapam. The findings of the study are presented in the following figures:

### Organoleptic evaluation

Ragi curd rice and Lentil bengal gram uttapam were served to the panel members for organoleptic evaluation and the results obtained were –

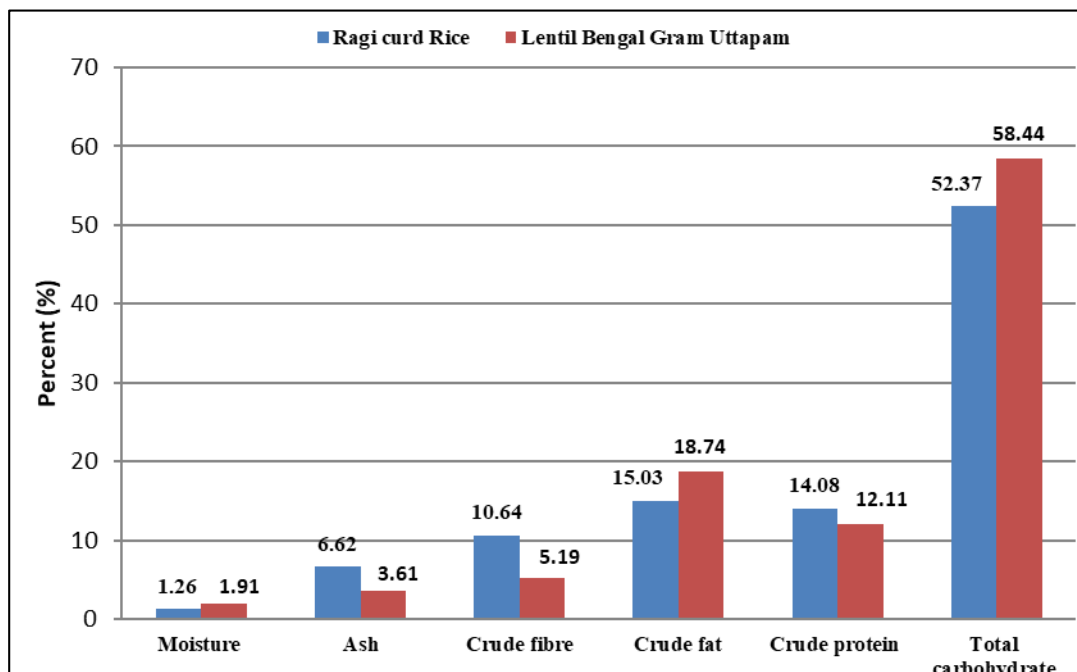


**Fig 1:** Mean score of organoleptic acceptability of developed recipe

It is indicated from Fig-1 that the mean score of overall acceptability obtained by organoleptic evaluation of the ragi curd rice and lentil Bengal gram uttapam was 8.65 and 8.7 respectively, at zero days. These results are in agreement with the earlier worker (Saha *et al.*, 2011 and Shukla and srivastava, 2014) [11, 13], they found that ragi wheat composite biscuit and ragi based noodles were improved sensory attributes such as colour, flavour, texture, taste and overall acceptability.

### Proximate composition

Organoleptically acceptable low glycemic index recipe were analysed for proximate composition (moisture, protein, fat, crude fibre and ash content). The nutrient content of both developed low glycemic index recipes are presented in the Figure-2.



**Fig 2:** That proximate composition such as moisture content of ragi curd rice and lentil Bengal gram uttapam were 1.26 and 1.91 percent, respectively.

Figure-2 shows that proximate composition such as moisture content of ragi curd rice and lentil Bengal gram uttapam were 1.26 and 1.91 percent, respectively. The ash and crude fibre content were found 6.62 percent, 10.64 percent and 3.61 percent, 5.19 percent in ragi curd rice and lentil Bengal gram uttapam, respectively. The crude fat content of ragi curd rice and lentil Bengal gram uttapam were found 15.03 and 18.74 percent, respectively. The crude protein of ragi curd rice and lentil Bengal gram uttapam were found 10.64 and 5.19 percent, respectively. The total carbohydrate content of ragi curd rice and lentil Bengal gram uttapam were found 52.37 and 58.44 percent, respectively. These results are in agreement with those of earlier workers (Saha *et al.*, 2011, Shukla and srivastava, 2014 and Rane *et al.*, 2014 Taynath *et al.*, 2018) [11, 13, 9, 14], who reported incorporation of ragi improves the nutritional quality and palatability of the products.

In ragi curd rice developed recipe, 75 percent of amount of rice is replaced with ragi, because of hypoglycaemic effects of ragi. The nutritional composition of small millets like ragi compares well with other cereals, are even nutritionally superior to rice and wheat (Kang *et al.*, 2008) [4]. They are especially rich in calcium, fiber and low glycemic index. Small millets (Ragi) are nutritionally superior to conventional food grains and exhibit hypoglycemic effect due to presence of higher proportion of unavailable complex carbohydrate, resistant starch and release sugar slowly (James *et al.*, 2009) [3].

Uttapam is a thick slightly crisp pancake consumed as a palatable and pleasant breakfast or lunch which is popular

mainly in South India. Traditionally, the uttapam is prepared from rice and urad dahl (*Vigna mungo*) in the proportion of 3:1. In present study batter prepared for uttapam are from lentil, Bengal gram and rice in 1:1:1 ratio. In developed uttapam the amount of pulses are increased due to its low glycemic index. Most of the carbohydrates in pulses are fibre, resistant starch and slowly digested starch that prevent blood sugars from rising quickly after a meal or snack. Eating foods with a low glycemic index can help to control blood glucose levels, also control appetite and thus lowers the risk of developing type 2 diabetes. Uttapam is a zero trans-fat fermented food and being a cholesterol-free food item, uttapam may be prescribed food for high sugar and cholesterol patients (Saraniya and Jeevaratnam, 2014 and Ray *et al.*, 2016) [12, 16].

### Conclusion

The study concluded that two types of low glycemic index recipe which were formulated based on ragi and pulses also had desirable nutritional quality as well as sensory properties. In order to appropriately address the specific issues facing Indians within the realm of chronic disease, clinicians must offer their patients practical tools to incorporate into their daily lives. While an Indian patient may be hesitant to adopt a completely new diet portrayed, she or he may be more willing to work within the traditional recipes and preparation methods of Indian culture. The need to eliminate food items from diet is not necessary, replacement or addition of millets and pulses adds to the health benefits. The fermented rice-based food formulation may be the God's gift, as this improves the



overall nutritive capacity and has an added advantage of physiological functions. The traditional cofermentation of rice with other cereals, leguminous seeds and vegetables can further improve the amino acid and mineral profiles, and therapeutic potentialities, on account of complementary actions. It can be concluded that these low glycemic index developed recipe can be effective in formulating the diabetic diet.

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