

Guyana Rice Development Board



Opportunities for the Development of Guyana's Rice Value Chain



RICE RESEARCH STATION

POST-HARVEST / VALUE-ADDED DEPARTMENT

VALUE ADDITION OF RICE IN GUYANA

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- **Why rice?**
- **Rice & Rice-based food products**
- **Experiment-Composite rice-wheat flour bread & roti**
- **Future Prospects**

Introduction

- Rice is the largest agricultural commodity exported.
- In 2018, Guyana produced 627,327 metric tons of rice and exported 74%.
- The utilization of rice has always been low.



Why Value-Added?

- Increase local product diversification
- Allow for the possibility for nutritional fortification
- Add value for farmers and millers
- Enhanced marketability
- Allow for the conversion of by-products into value added processed products
- Create employment
- Source of income
- Import substitution



Why Rice?

- **Rice is one of the most popular cereals worldwide**
- **Excellent source of carbohydrates (accounts for 22% of persons living in many developing countries)**
- **Good source of vitamins**
- **Unique taste which allows for easy combination with other foods**
- **Excellent food vehicle for the fortification of micronutrients**



Rice & Rice-Based Food Products

- Quick-cooking rice
- Ready-to-eat convenience foods
- Rice flours
- Rice starch
- Cakes
- Puddings
- Baked breads and crackers



Rice & Rice-Based Food Products

- **Breakfast cereals and expanded rice products**
- **Extrusion-cooked and puffed rice snacks**
- **Noodles**
- **Baby/weaning foods**
- **Fermented foods and beverages**
- **Pet foods**
- **Bran products**

Rice & Rice-Based Food Products

Rice flour, starch and protein can be used as:

- Processing aid
- Ingredients in health food
- Coating agents in confectionary
- Water binders in small goods
- Expanding agents in extrusion food
- Flavor carriers
- Emulsifiers and fat replacers in dairy products
- Paper coating agents

Gluten-free

- **Gluten-free diets have become the trend in developed countries and emerging economies.**
- **Persons suffering from celiac disease, a systemic autoimmune syndrome, must follow a strict gluten-free diet, which includes the elimination of the use of foods originating from wheat, rye, and barley.**
- **1 in every 100 person are severely affected by gluten and 6 in 100 have sensitivity or intolerance.**

Value-Added Products - Rice Flour

Rice flours can be produced from:

- Long, medium and short grains
- Whole or broken rice
- Cargo, white or parboiled rice



Flours prepared from polished or parboiled rice are popular in: baby foods, breakfast cereals, snack foods, unbaked biscuits, dusting powders, bread mixes and formulations of pancakes and waffles

Benefits of Rice Flour

- **Ease of digestion**
- **Bland taste and no odour**
- **Sparkling white colour**
- **Hypoallergenic properties**
- **Rice flour is low in fat**
- **No gluten**
- **Cost effective**
- **Has low sodium and calorie value than wheat flour**
- **Rice flour has high value lysine than similar cereal flours**

Rice Flour Bread

Bread is considered one of the most versatile and convenient foods and is popular as a breakfast food among Guyanese.

There are three types of bread produced from rice flour:

- Wheat/rice composite flour bread (made from a combination rice flour and wheat flour)
- Gluten-free rice flour bread (made from previously gelatinized rice flour with thickening additives)
- Rice flour bread containing gluten (made from rice flour and gluten)

Composite Rice-Wheat Flour Bread & Roti

The Guyana Rice Development Board undertook physical and sensory analyses using various ratios of rice and wheat flour to determine the best blend for consumption.

Composite Rice-Wheat Flour Bread & Roti

Title

- The physical and sensory evaluation of local food products made from rice-wheat composite flour mixture in Guyana.

Objectives

- To produce roti and bread from blends of varying proportion of rice-wheat composite flour.
- To determine the physical and sensory properties and preference of roti and bread samples produced from different proportions of wheat and rice flour.

Composite Rice-Wheat Flour Bread & Roti

Methodology

Source of Raw Materials

- All ingredients were purchased from local supermarket/s.
- Polished rice (GRDB 10) was ground by a Burr mill to produce the rice flour and passed through a sieve of particle size <250 micrometers.

Preparation of the Composite Flour

- Composite flour was prepared by mixing various proportions of the composite flours.
- Blends of the flours were pure (wheat flour only) and binary (mixture of wheat and rice flour)

Composite Rice-Wheat Flour Bread & Roti

Methodology

Treatments

Treatments	Ratios
T 1	100% Wheat flour (Control)
T 2	80% Wheat flour + 20% Rice flour
T 3	60% Wheat flour + 40% Rice flour
T 4	40% Wheat flour + 60% Rice flour
T 5	20% Wheat flour + 80% Rice flour

No. of Replications : 3

Composite Rice-Wheat Flour Bread

Methodology

Preparation of Bread

- The five samples of Bread were coded according to treatment and replicate. Treatment 1 contained wheat flour only and Treatments 2 to 5 consisted of rice/wheat flours.

Table 1: Recipe formulation for bread production. Source: Bibiana *et al* 2014.

Ingredients	Treatments				
	T1	T2	T3	T4	T5
Wheat flour (g)	100	80	60	40	20
Rice Flour (g)	0	20	40	60	80
Salt (g)	2.5	2.5	2.5	2.5	2.5
Sugar (g)	2.5	2.5	2.5	2.5	2.5
Yeast	2.5	2.5	2.5	2.5	2.5
Shortening (g)	2.0	2.0	2.0	2.0	2.0
Water (ml)	65.0	65.0	65.0	65.0	65.0

Composite Rice-Wheat Flour Roti Methodology

Preparation of Roti

- The five samples of roti were coded according to treatment and replicate. Treatment 1 contained wheat flour only and Treatments 2 to 5 consisted of rice/wheat flours.

Table 2: Recipe formulation for roti production.

Ingredients	Treatments				
	T1	T2	T3	T4	T5
Wheat flour (g)	100	80	60	40	20
Rice Flour (g)	0	20	40	60	80
Baking Powder (g)	1 tsp	1 tsp	1 tsp	1 tsp	1 tsp
Water (ml)	65.0	65.0	65.0	65.0	65.0
Oil	2 tbsp.	2 tbsp.	2 tbsp.	2 tbsp.	2 tbsp.

Composite Rice-Wheat Flour Bread Methodology

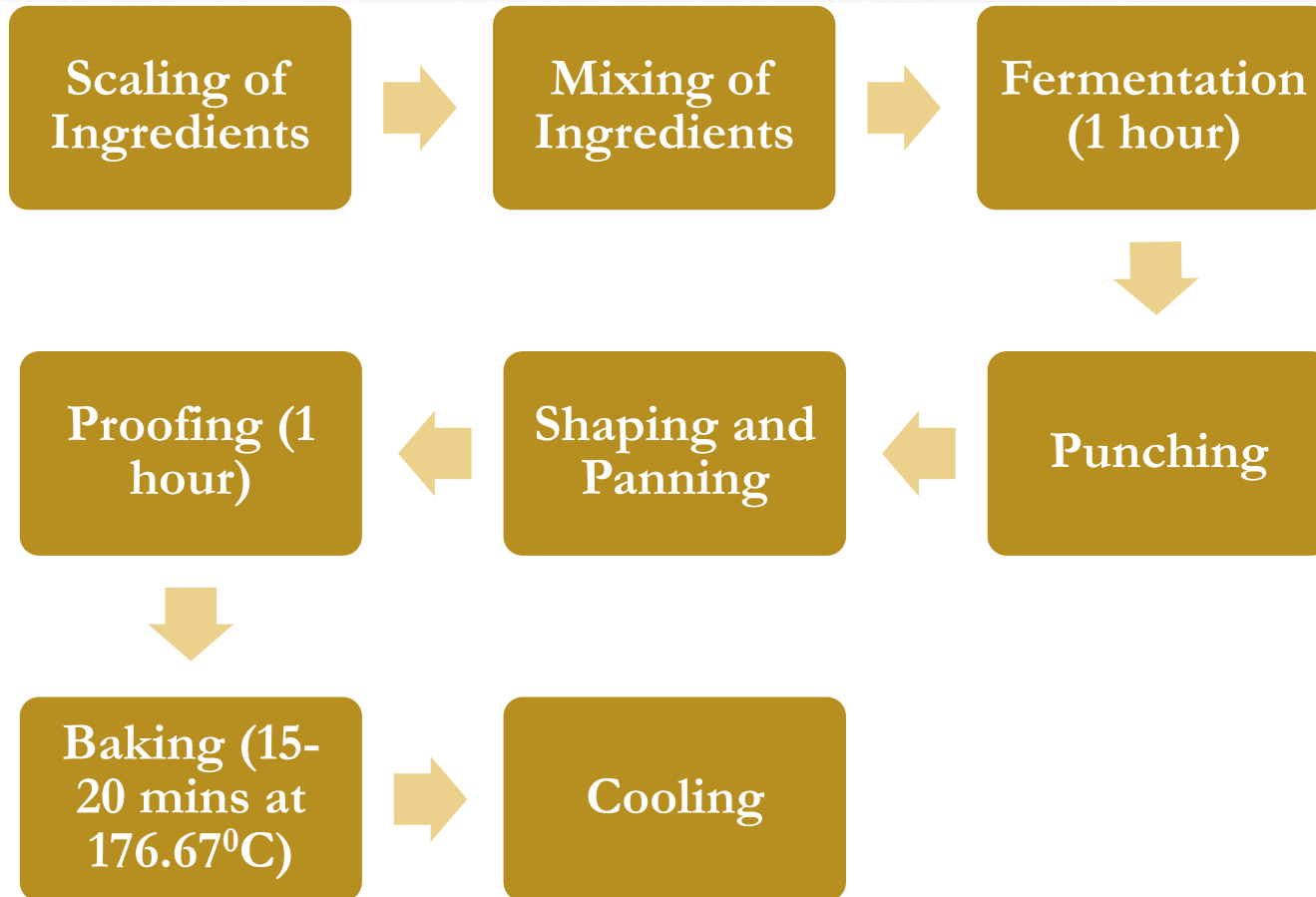


Figure 1: Baking Process

Composite Rice-Wheat Flour Bread

Methodology

Physical Evaluation of Bread

- **Length**
- **Width**
- **Thickness**
- **Weight**
- **Volume (Seed displacement method)**

Composite Rice-Wheat Flour Bread & Roti

Methodology

Sensory Evaluation of Bread and Roti

- Samples of the bread and roti were served to 40 semi-trained panelists who are familiar with the major sensory attributes of good quality bread and roti.
- Respondents were spread across a wide range of age, education and income groups.



Composite Rice-Wheat Flour Bread & Roti

Methodology

Sensory Evaluation of Bread and Roti

- Bread and roti were evaluated for aroma, taste, texture (mouth feel), colour of crust and crumb and overall acceptability.
- Samples were placed in identical containers and coded with random numbers then served simultaneously.



100% wheat

20% Rice + 80% wheat

60% Rice + 40% wheat

Composite Rice-Wheat Flour Bread & Roti

Methodology

Sensory Evaluation of Bread and Roti

- A 9-point hedonic scale was used to measure the degree of preference of the samples where 9 indicates “like extremely” to 1 indicates “dislike extremely”.
- A score of 5 or below was considered a limit of acceptability for all sensory attributes tested

9 - Like Extremely

8 - Like Very Much

7 - Like Moderately

6 - Like Slightly

5 - Neither Like nor Dislike

4 - Dislike Slightly

3 - Dislike moderately

2 - Dislike very much

1 - Dislike Extremely

Composite Rice-Wheat Flour Bread & Roti

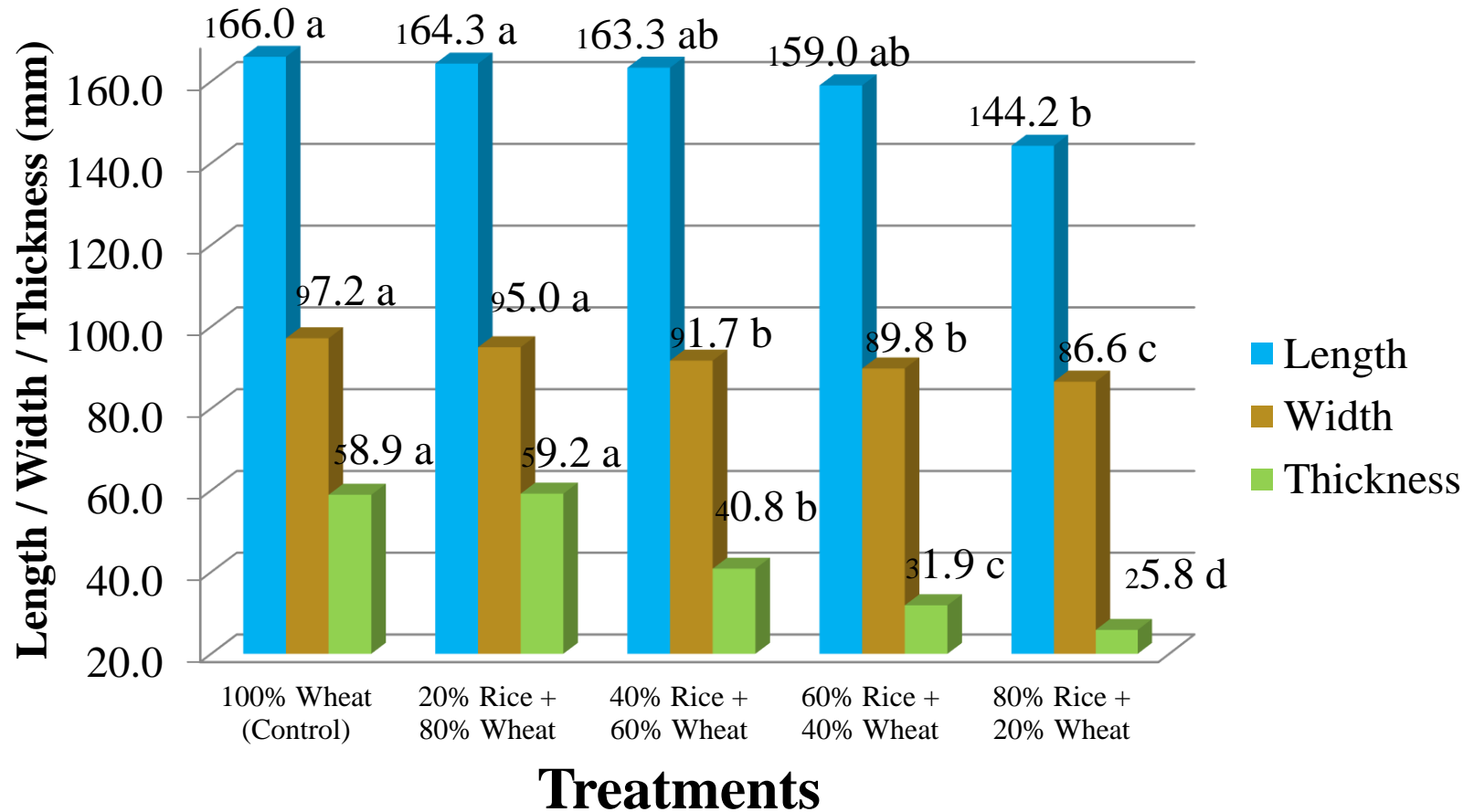
Methodology

Statistical Analysis

Results were subjected to analysis of variance (ANOVA) using a pre-packaged computer statistical software (SPSS 16.0). The means that the results were compared using Turkey's test and the statistical significance was defined as $P \leq 0.05$.

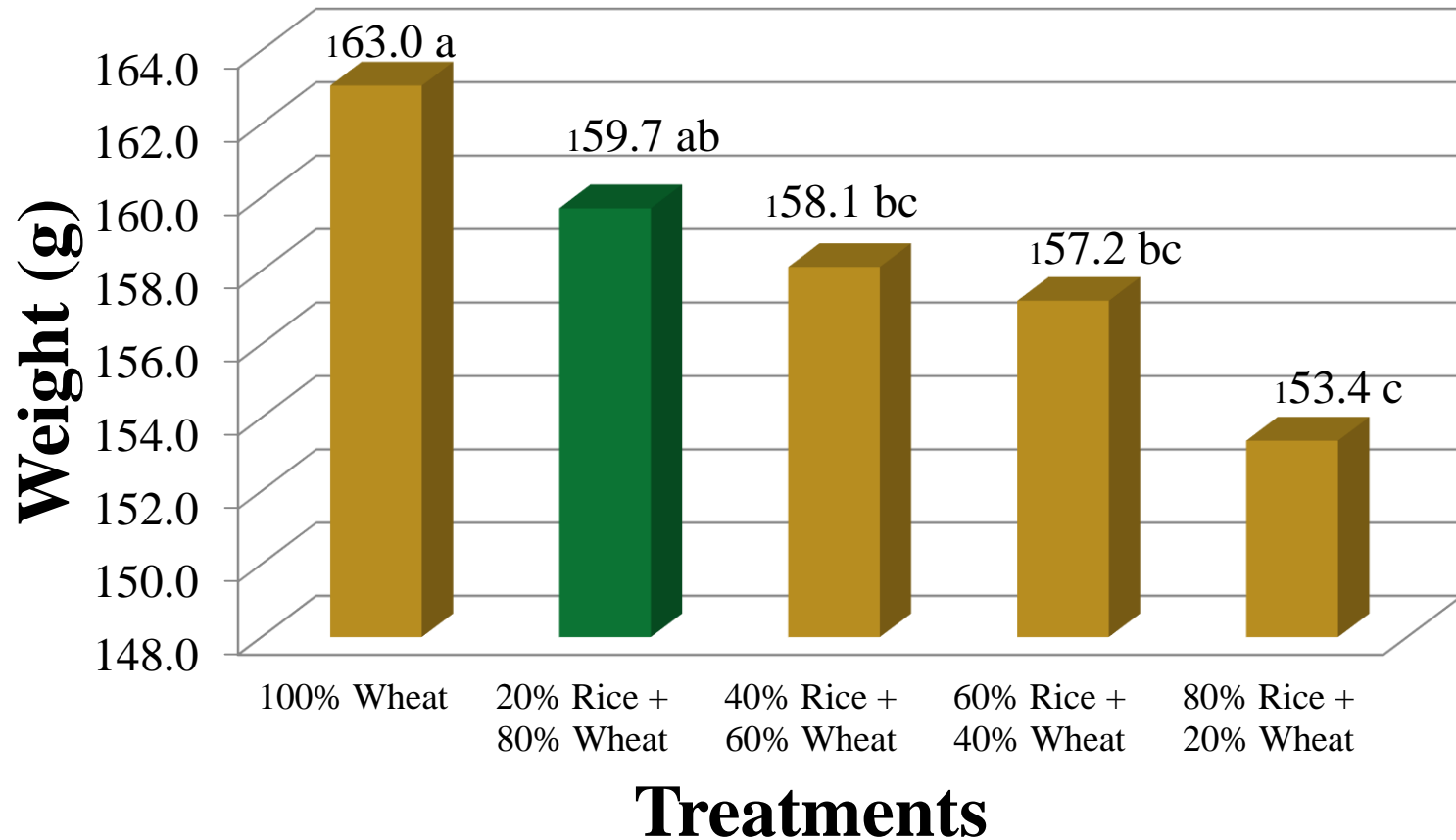
Composite Rice-Wheat Flour Bread

Physical Evaluation – Length, Width and Thickness



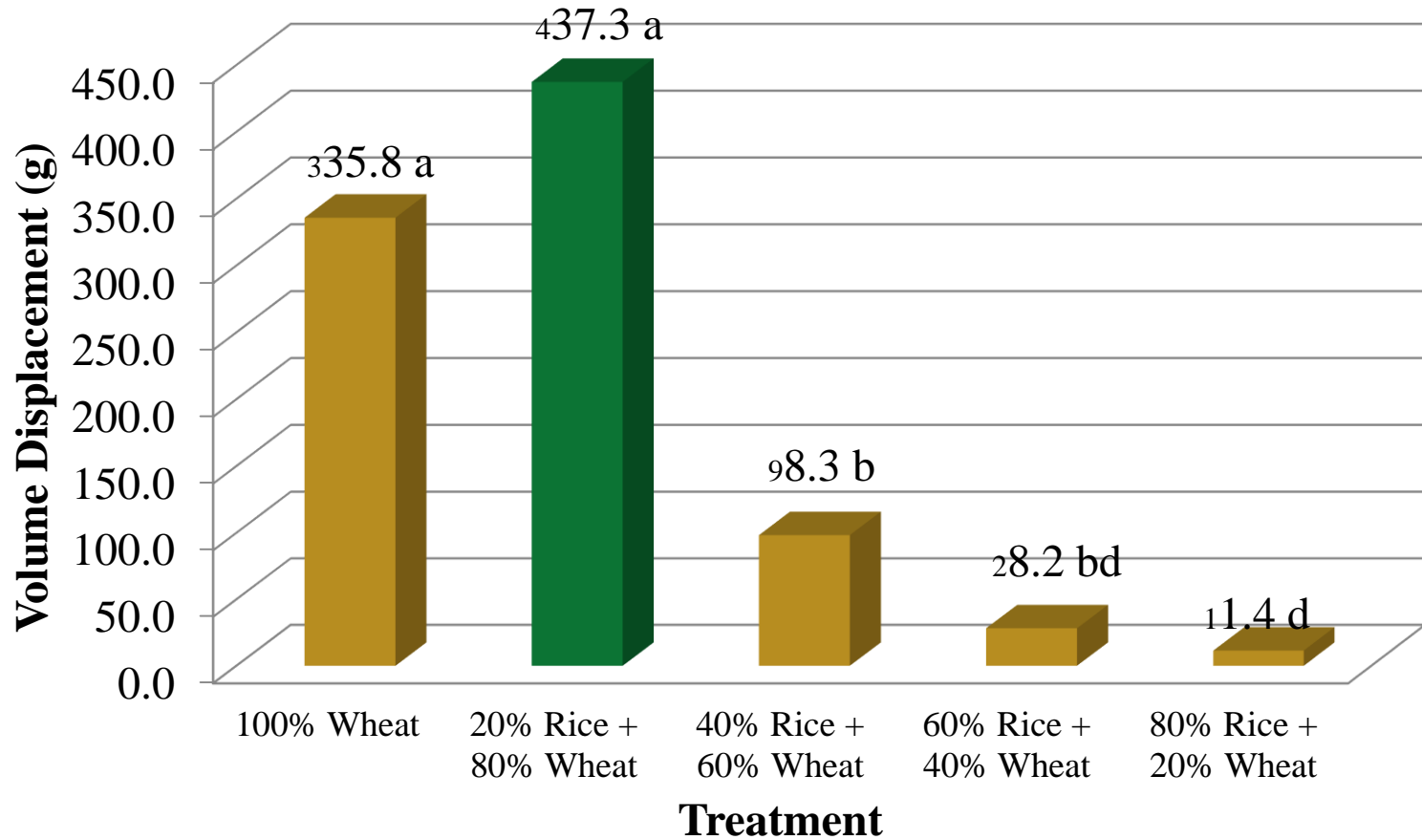
Composite Rice-Wheat Flour Bread

Physical Evaluation – Weight (g)



Composite Rice-Wheat Flour Bread

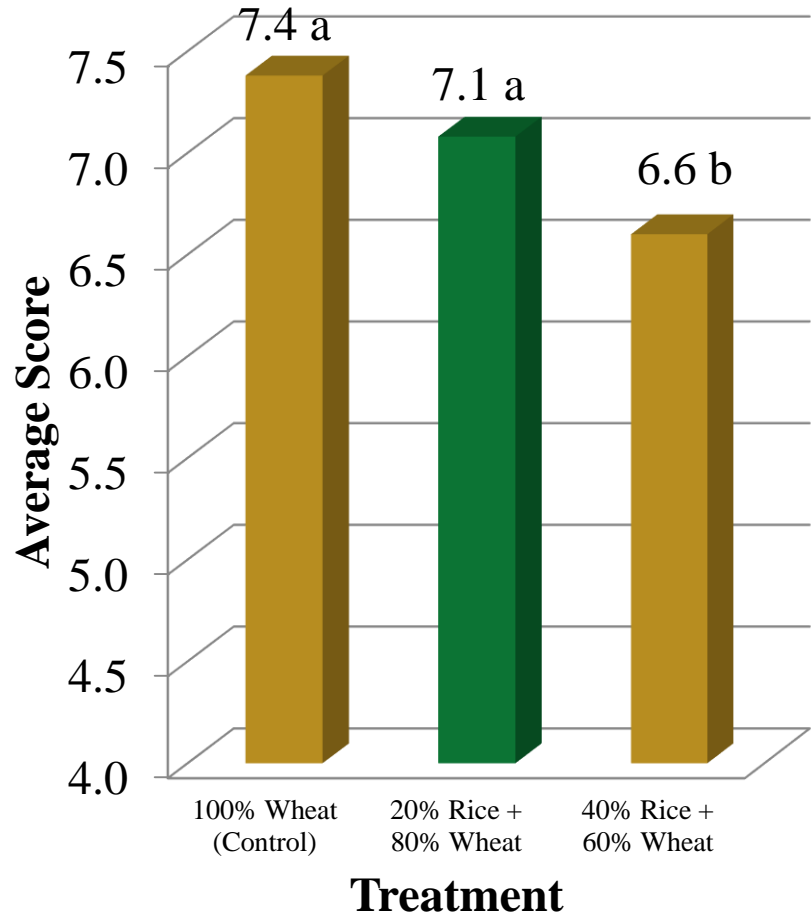
Physical Evaluation – Volume (g)



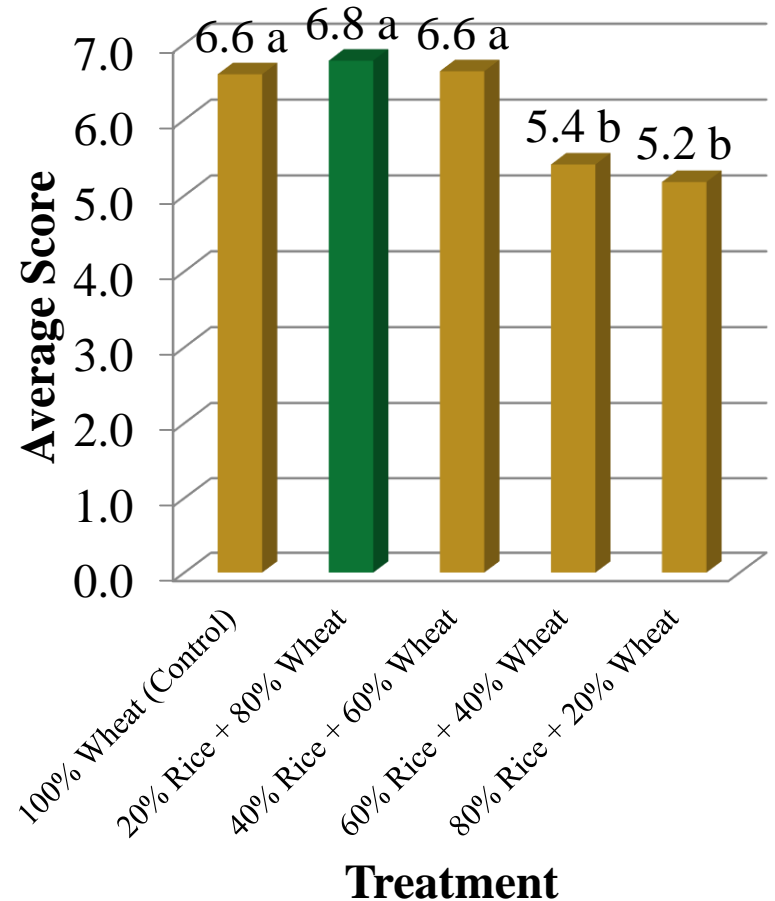
Composite Rice-Wheat Flour Bread & Roti

Sensory Evaluation

Aroma



Bread

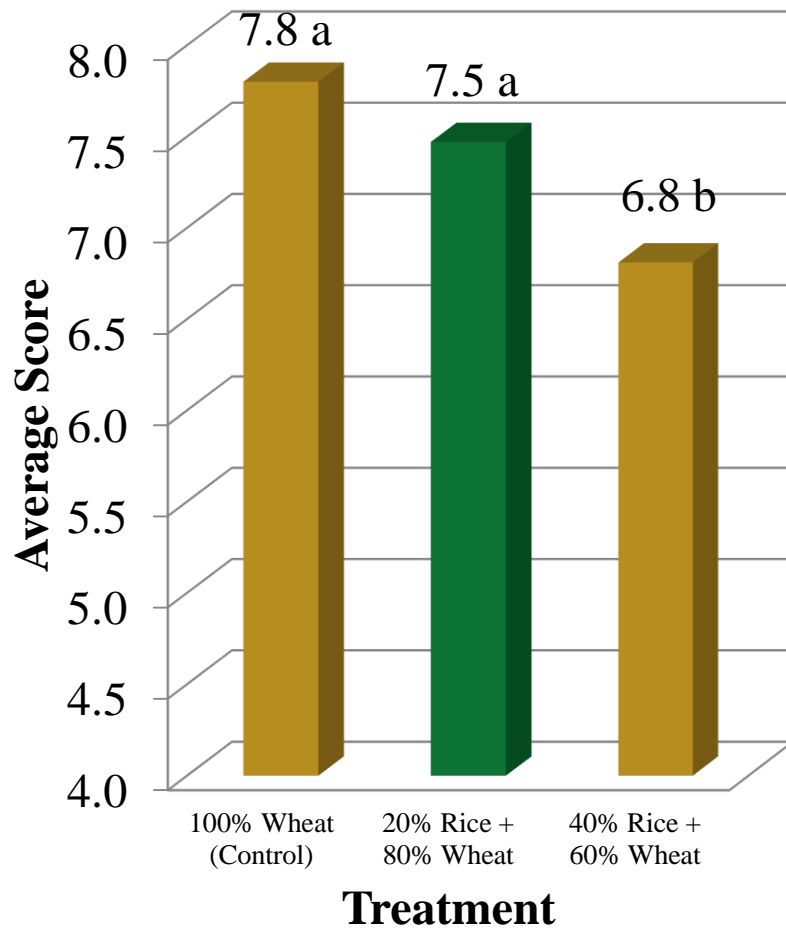


Roti

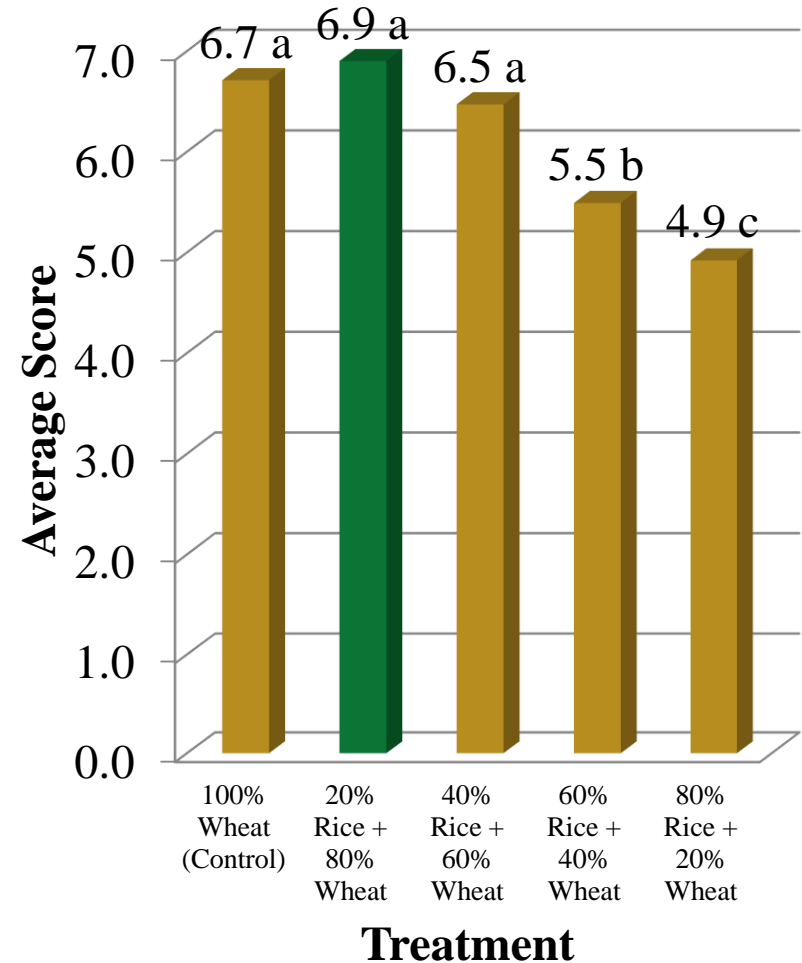
Composite Rice-Wheat Flour Bread & Roti

Sensory Evaluation

Colour



Bread

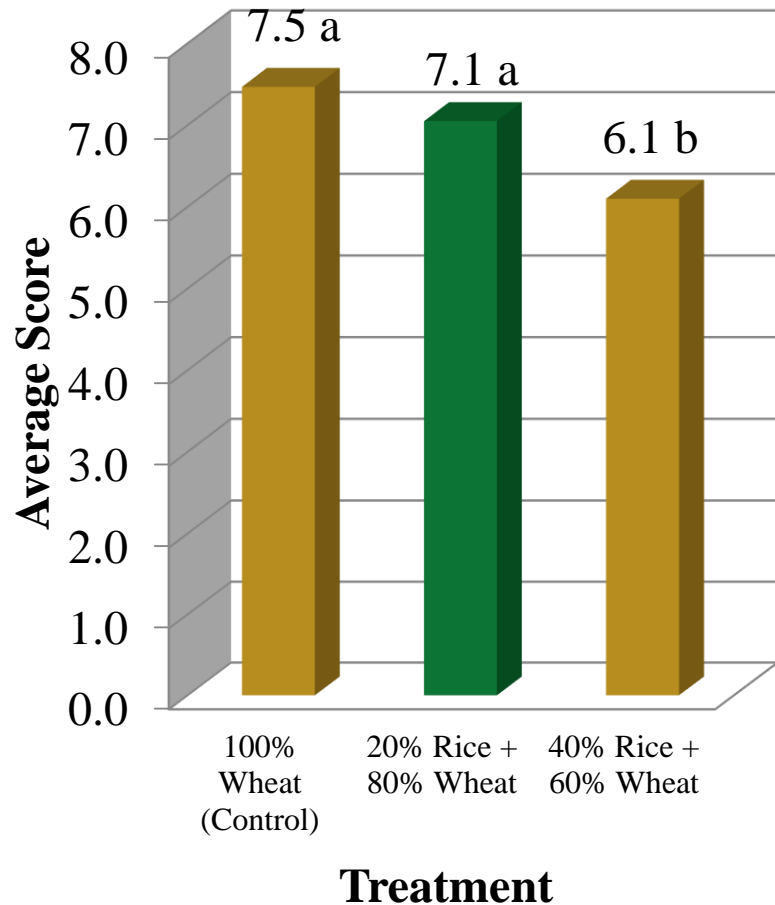


Roti

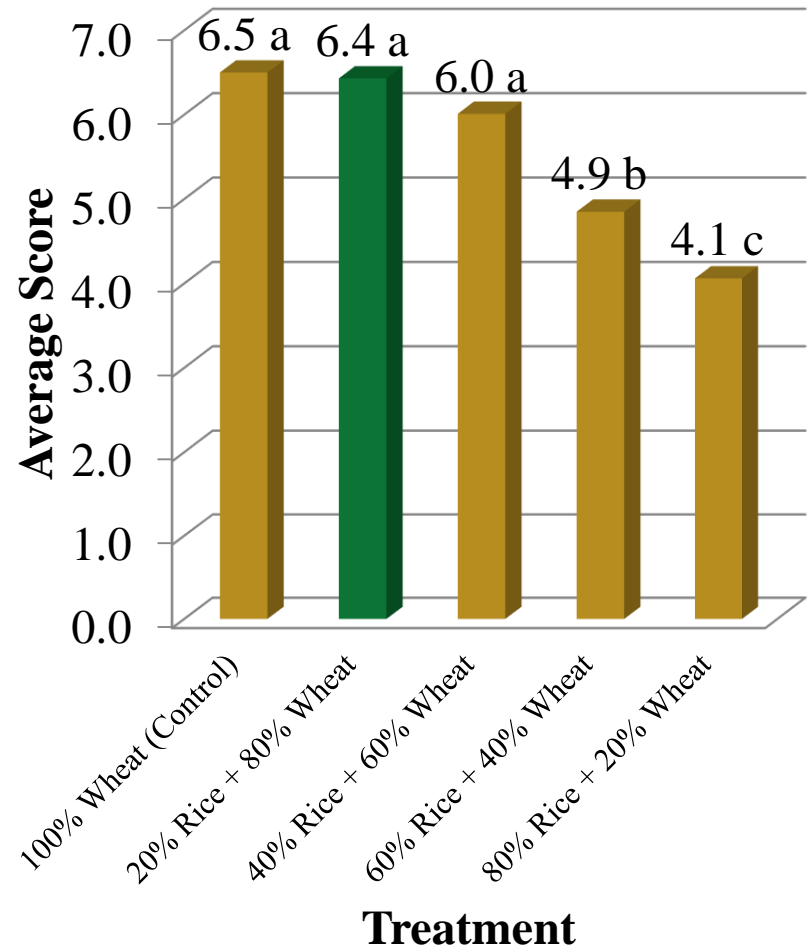
Composite Rice-Wheat Flour Bread & Roti

Sensory Evaluation

Texture



Bread

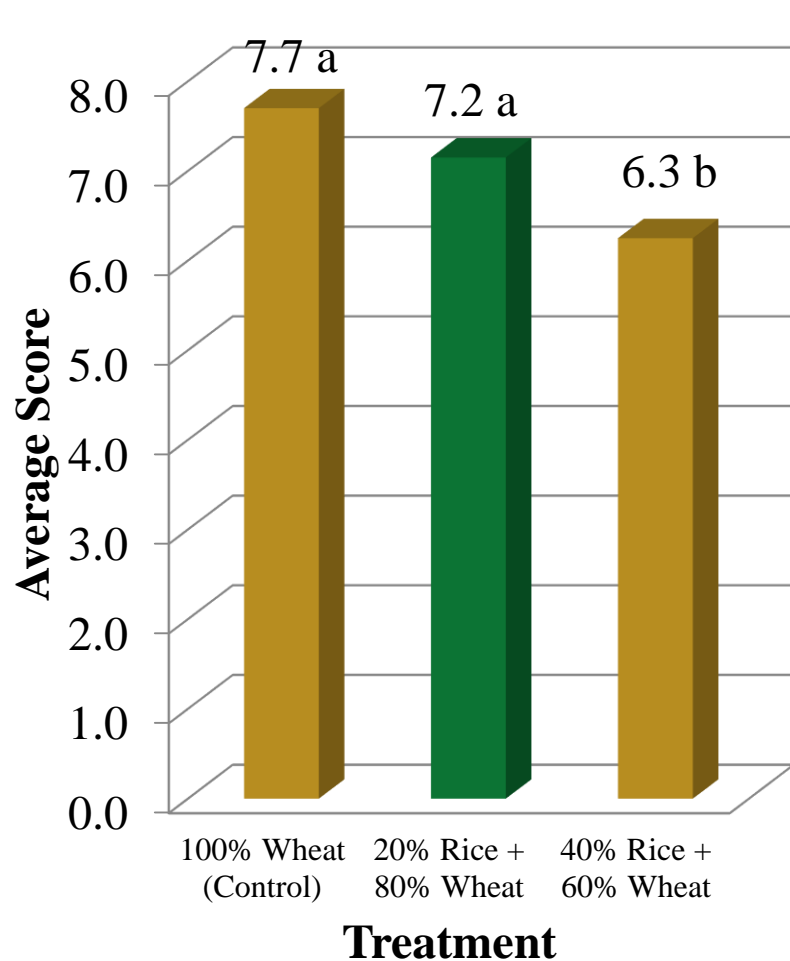


Roti

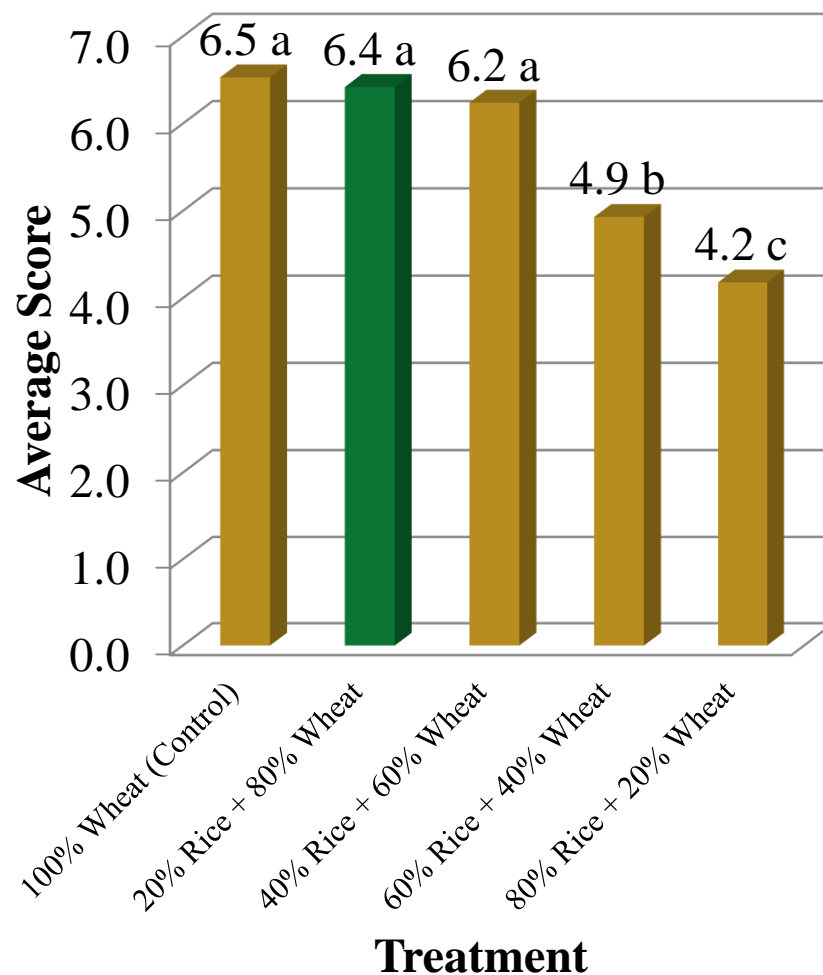
Composite Rice-Wheat Flour Bread & Roti

Sensory Evaluation

Taste



Bread

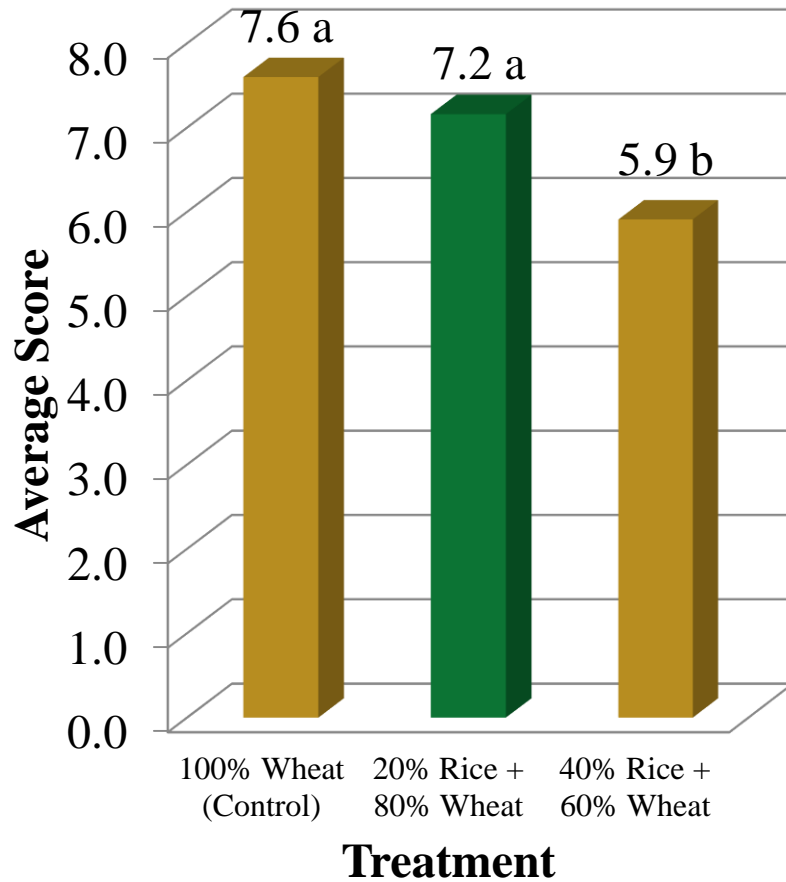


Roti

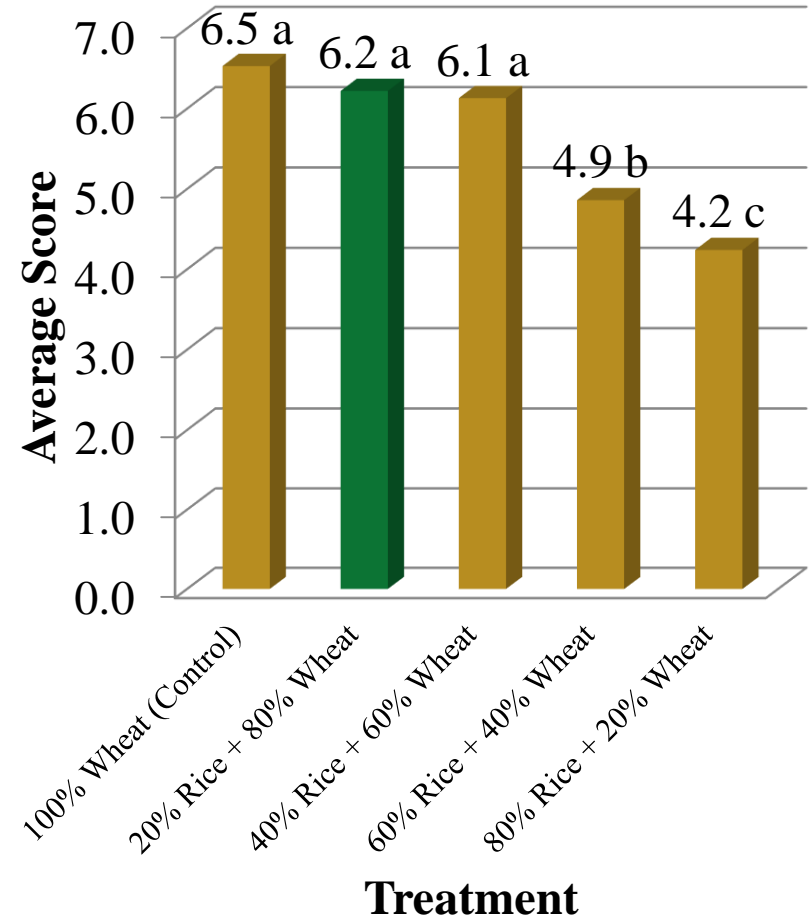
Composite Rice-Wheat Flour Bread & Roti

Sensory Evaluation

Overall Acceptance



Bread



Roti

Future Prospects

- Rice Snacks
- Pre-cooked / Quick-Cooking / Instant Rice
- Noodles / Pasta
- Baby Food
- Rice Beverages



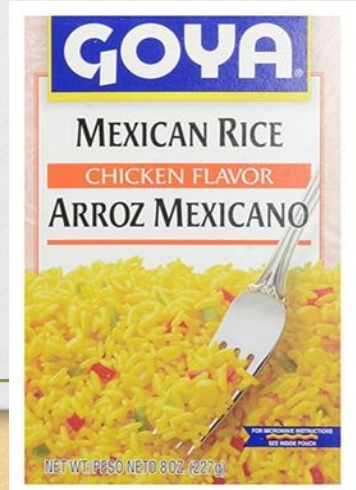
Pre-cooked, Quick-cooking & Instant Rice

- Rice requires 20 to 60 minutes to be cooked properly.
- Efforts are directed to the development of quick-cooking or pre-cooked rice to reduce the cooking time.



Pre-cooked, Quick-cooking & Instant Rice

For pre-cooked rice, the non-rice ingredients are packed separately and mixed only during heating. Pre-cooked rice are usually sealed in laminated plastic or aluminum-laminated plastic pouches (IRRI 1993).



Pre-cooked, Quick-cooking & Instant Rice

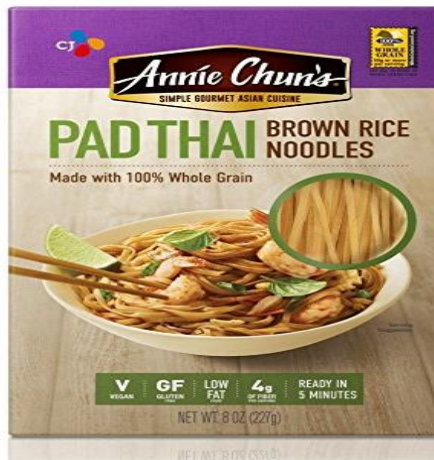
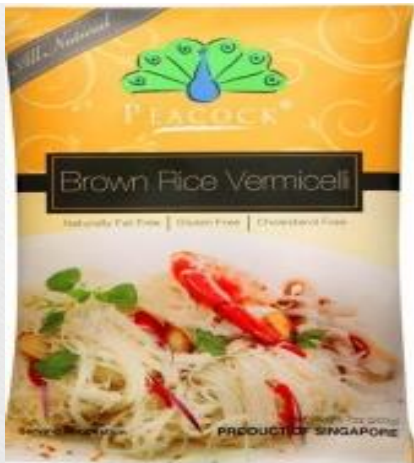
- Quick-cooking rice are those that require significantly less cooking time than raw milled rice.
- The rice should be cooked within 5 minutes and the cooking method should be simple.
- After cooking, the product should match the characteristic flavor, taste and texture of conventionally cooked rice and must have good keeping quality .



Rice Noodles / Pasta

- Pasta is consumed throughout the world
- The global consumption is second only to bread (Chandrajith et al 2014, 5).
- Rice noodles are broadly consumed in South-East Asia and are becoming increasingly popular in the western markets.
- Rice Noodles have a very smooth texture, soft mouth feel and are white in colour.
- Recently, gluten-free pasta is prepared using brown rice flour or a mixture of corn flour and brown rice flour (Padalino et al 2016).

Rice Noodles / Pasta



Rice Noodles / Pasta

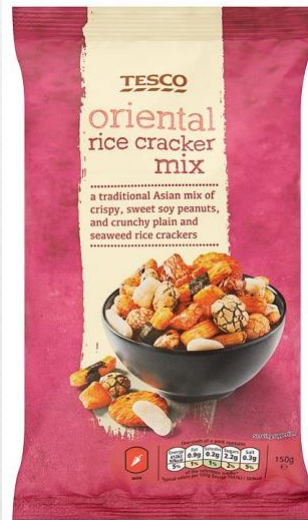


Rice Snacks / Cereals

- The global market for snack foods is about 50 billion dollars
- The extruded snacks market is projected to reach about \$31 billion by 2019.



Rice Snacks / Cereals



Rice Snacks - Bite Size



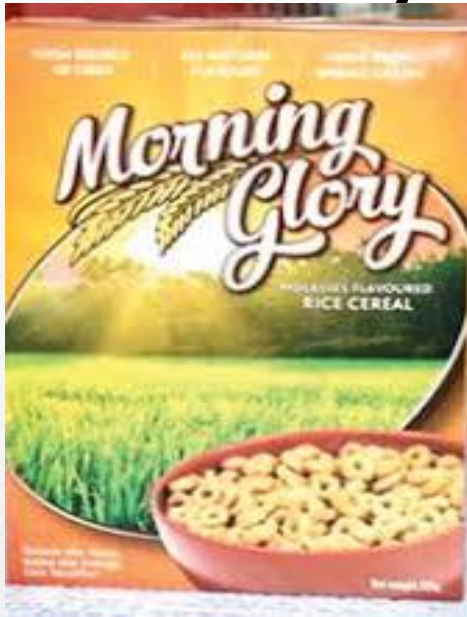
Rice Snacks - Rice Cakes



Rice Snacks - Chips



Rice Cereals



Baby Foods



Beverages



Beverages - Alcoholic



Conclusion

