

Development of Gluten-free Round Bread Made from Rice Flour

Background

Although Japan's food and wheat self-sufficiency rates are very low, rice self-sufficiency is almost 100%. This trend is the opposite of Japan's demand for rice consumption due to the changing diet trend. Similar to what happens in Europe and the USA, the number of patients with gluten-related diseases is increasing in Japan. This is indicated by the number of Japanese people with allergies, which has increased in recent years. Gluten-related diseases are also expected to increase. In addition, more and more people are becoming health-conscious, especially about diseases related to food allergies. As a consequence, the gluten-free market in Japan is expanding. In order to increase food self-sufficiency and provide a gluten-free source of energy in Japan, it is considered effective to expand the way people consume rice. Rice flour bread has been getting attention these days. However, making rice flour bread is tricky because it tends to lose its shape and does not expand easily. Thus, many recipes for rice-flour bread require the use of molds or psyllium husks to keep the bread in shape. Psyllium husk is fiber from the plantain plant (plant fiber) and is not healthy if eaten in excess. Also, some people are allergic to it.

Objective

This study aims to develop a recipe for rice flour bread that can be made using only readily available ingredients with minimal allergy or health impact, based on the following four conditions:

- The main ingredient is *Mizuho Chikara* for rice flour bread.
- No molds are used.
- Free from gluten, plantain and 28 allergens.
- Explore measures to maintain the moisture in the baked bread.

Survey

Method

- Survey I : Find out the characteristics of rice flour in general.
 Survey II : Consider ingredients that are allergy-free and could be used for rice flour bread.
 Survey III : Find existing recipes for fluffy, delicious rice flour breads and breads with high water retention.
 →Try to bake breads.

Result

- To keep bread's form and moisture:
- As soon as the surface temperature drops, wrap in plastic film and seal in a bag.
 - Add starch syrup (sugar) and oil (rice oil).
 - Use rice flour which has high amylose content
→*Mizuho Chikara* for rice flour bread
 - Use β (beta) rice.

Experiment

Method

- (1) Develop new recipes based on the survey.
- (2) Make bread and reflect on the recipe.
- (3) Repeat the procedure above to develop a recipe for a fluffy and delicious rice-flour loaf.

1. Make dough from the ingredients below and ferment on different conditions at 40°C for 30 minutes.

Basic ingredients:

rice flour, salt, sugar, dried yeast, water and, rice oil.

2. Prepare dough using the ingredients above, ferment it and bake it with different temperatures and baking-times.
3. Make dough of 30 different combinations of the ingredients listed in Table 1, and bake them. Taste the bread right after baking and 24 hours later.

Ingredients:

| Fixed ingredients | Rice flour (Mizuho Chikara) 100g | |
|-------------------|----------------------------------|----|
| | Salt | 1g |
| Rice oil | 6g | |
| Dried yeast | 3g | |
| Variables | Baking powder | |
| | Lemon juice | |
| | Sugar | |
| | Starch syrup | |
| | Rice flour paste | |
| | Corn starch | |
| Amazake | | |

Treatment to dough:

With or without fermentation and timing of fermentation.
 Baking temperature and time.
 Whether or not to cover with aluminum foil.

Whether or not to use steam.

Result

To maintain the moisture and its shape:

- Use rice flour paste, syrup, baking powder, and (*amazake/sweet sake*).
- Ferment at 40°C until doubled in size (30 to 60 minutes).
- Coat the surface with rice oil before baking.
- Baking: 230°C for 6 minutes

Table 1 Timing of Fermentation and degree:

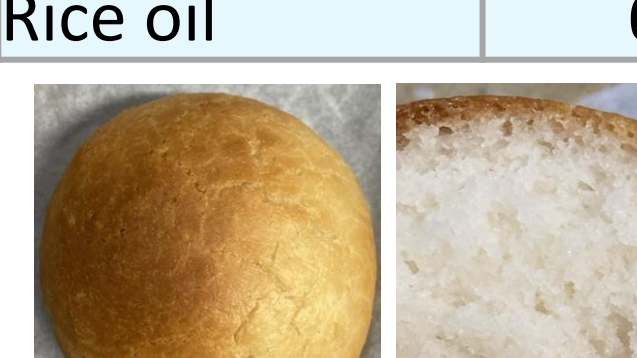
| | Before molding | After molding | Degree of fermentation |
|---|----------------|---------------|------------------------|
| A | × | × | Lowest |
| B | ○ | × | Low |
| C | × | ○ | Highest |
| D | ○ | ○ | High |

Table 2 Baking temperature and time:

| | 180°C | 230°C |
|--------|--------------------------|-----------------------------|
| 6 min | | ◎Crust is soft |
| 10 min | Half-roasted | Surface is dry. |
| 13 min | ○Crust is thick and dry. | Surface and inside are dry. |
| 15 min | Surface is dry. | |

Best Recipes

| i | | ii | | iii | |
|------------------|-----|------------------|-----|-------------|------|
| Rice flour | 90g | Rice flour | 90g | Rice flour | 100g |
| Starch syrup | 40g | Sugar | 6g | Sugar | 6g |
| Salt | 1g | Salt | 1g | Salt | 1g |
| Dried yeast | 3g | Dried yeast | 3g | Dried yeast | 3g |
| Rice flour paste | 40g | Baking powder | 4g | Amazake | 42g |
| Rice oil | 6g | Rice flour paste | 50g | Rice oil | 6g |
| | | Water | 14g | | |
| | | Rice oil | 6g | | |



Condition of dough



Fig.1 Dough with basic ingredients



Fig.2 Dough with rice flour paste added



Fig.3 Dough with starch syrup added

Consideration

Making round bread from rice flour without gluten, psyllium husk, or allergens is difficult. However, with various innovations, it is possible to make round rice flour bread, although it is not as good as wheat flour bread. Adding rice paste, baking powder, and sweet sake, fermenting after shaping, and oiling the surface before baking proved effective. If the recipe for rice-flour bread that retains a good texture for 24 hours after baking is further improved, it will become easier to make rice-flour bread at home and increase the bread variety available. The more interest in making homemade rice flour bread, the higher the demand for rice bread and rice flour. It may also improve Japan's food self-sufficiency rate and contribute to the sustainability of rice farmers in Japan. It would also allow people with gluten allergies to enjoy bread with peace of mind.

Future Work

We would like to further improve the recipe for rice-flour bread that was confirmed in the experiment, so that the texture can be maintained for a longer period of time. We would also like to experiment with this recipe on other varieties of rice so that it can be adopted in other rice-growing regions overseas. Thus, it may also contribute to the improvement of food self-sufficiency in those regions.