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EFFECT OF PRE-PROCESSING ON THE COOKING CHARACTERISTICS OF RAKTHASHALI RICE—A TRADITIONAL RICE VARIETY

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Rakthashali rice is a red rice variety which is widely used in the northern parts of Kerala. As it contains high amount of iron and fiber it is used as medicinal rice. Rice was pulverized and blended with texture stabilizers and five value added products were developed from the rice as ready to cook and ready to eat snacks. The cooking property of the rice and the products were studied and compared. RVA, proximate analysis and color analysis were done to find out the quality and five point hedonic scale was used to find out the acceptability of products. The results of cooking quality shows that the developed products need less time when compared to the raw rice and the products shows good water absorption capability. The proximate and the color values of the products have slight difference from that of raw rice. Sensory results show good acceptability for all the five products.

Keywords: Rakthashali rice, Texture stabilizers, Cooking quality, Water absorption

INTRODUCTION

Rice is known as the grain of life and cannot be avoided from the Asian food menu. Compared to white rice colored rice are more nutritious. Among colored rice, red rice is available as unhulled or partially hulled and it has a nutty flavor and is with high nutritional quality. Red rice are of different kinds include red cargo rice, rakthashali rice, Bhutanese red rice, camargece red rice, matta rice. Shali rices are the ones which mature in winter and are refrigerant, tasty and have so many medicinal properties. Among shali rices rakthashali rice is the best one; it has the capacity to quench thirst and can balance the humors (the three body humors vata, kafa, and pita). Rakthashali rice is good for better health, good skin, improves eyesight, diuretic, voice improving and semen enhancer and it is good for the treatment of ulcers and fever (Nene, 2005).

Rakthashali rice is rare variety rice with high nutritional as well as medicinal value. It has been used in Ayurveda to treat different kinds of diseases. Rakthashali rice was available from ancient times and was used as medicinal rice. The unique properties of rice make it desirable to produce value added products. Rice starch is not as widely used as starches derived from other sources due to the high value of milled rice as food.

Both whole rice grain and rice flour are widely used as a component for many products. Rice imparts not only its special flavor but also texture modifying properties in formulation and processing. The starch content in rice flour gives a particular property to the rice products. Mostly rice grain is consumed as cooked whole grain. Rice flour is widely used as an important ingredient for many food items like ready to eat breakfast cereals, baby foods and snacks (Hsich

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et al., 1990). The main reason for using rice flour as an ingredient because it is gluten free and it has a bland taste, white color, high digestibility and hypo allergic property (Rosell and Marco, 2008). Hogan in 1977 reviewed the literature on the use of rice cereals in which rice alone or in combination with other cereal grain products is precooked, dried, flaked or formed into dough then expanded or puffed and toasted.

Macaroni, vermicelli, noodles are commonly called pasta (Kent and Evers, 1994). Now a day's extruded rice products have great importance because everyone can consume them including the people who has allergy to gluten, the wheat protein.

MATERIALS AND METHODS

Development of RTE Snack

Ready to eat foods means that are edible as such and do not need any additional cooking. They include cakes, biscuits, extruded snacks etc. These are known as tertiary processed foods.

Ready to Cook products are secondary processed foods. It can be consumed after the addition of hot water or

Figure 1: Flowchart of Extruded Snack

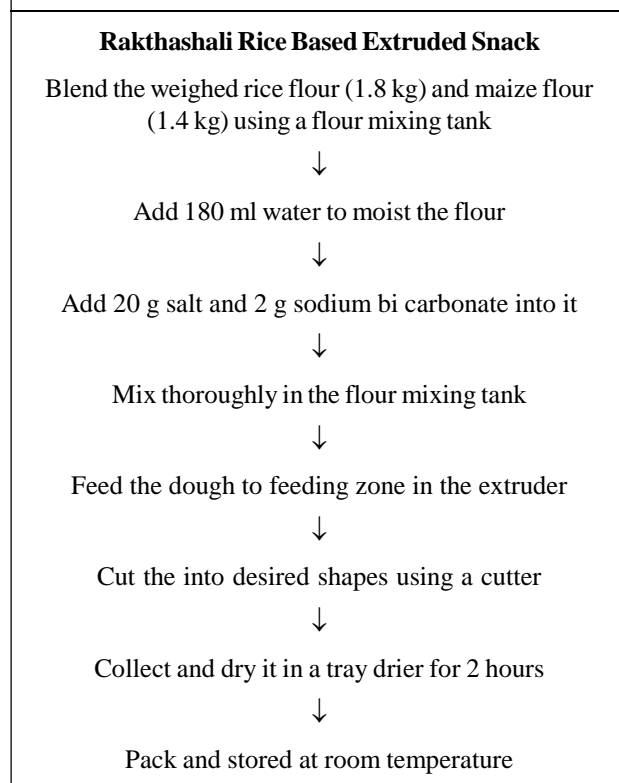


Figure 2: Flowchart of Rakthashali Rice Flakes Development of RTC Products

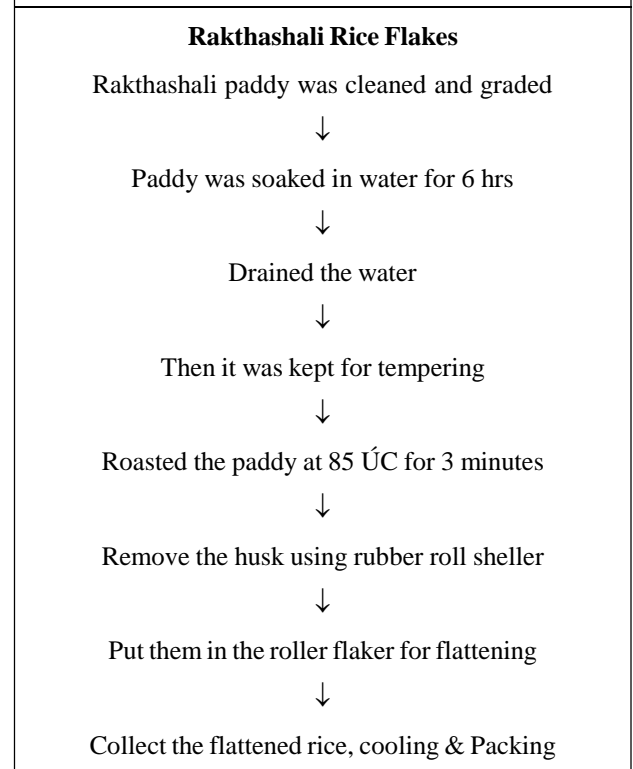
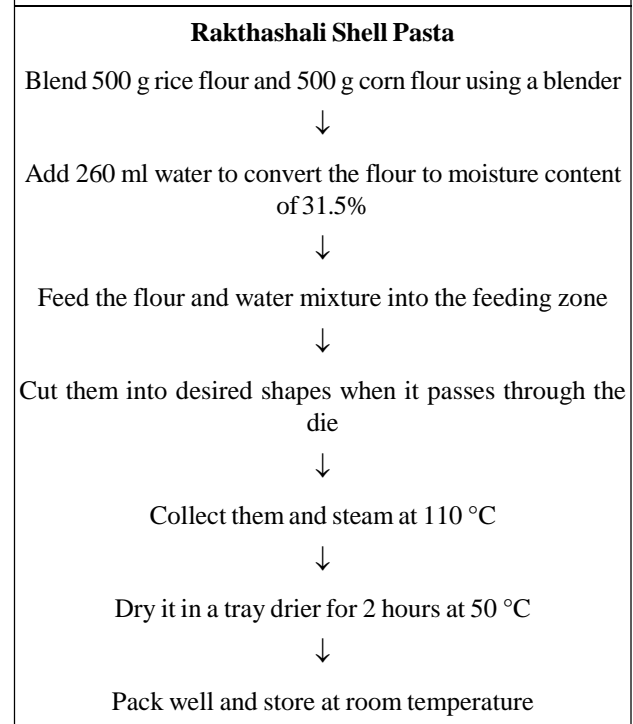
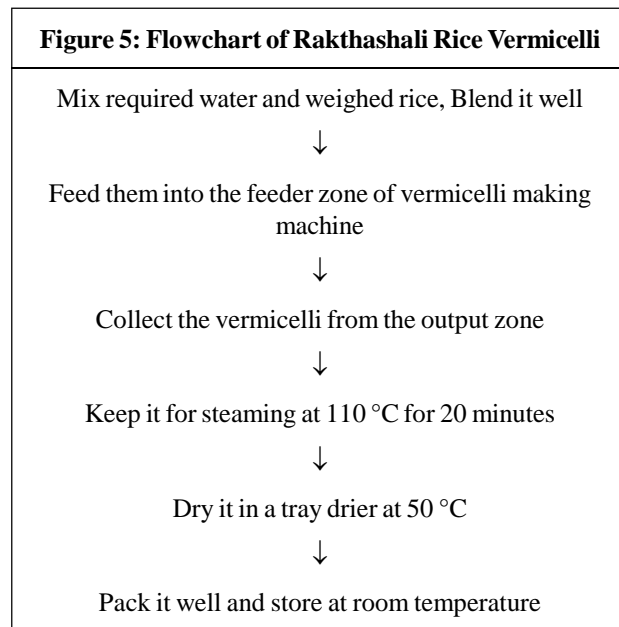
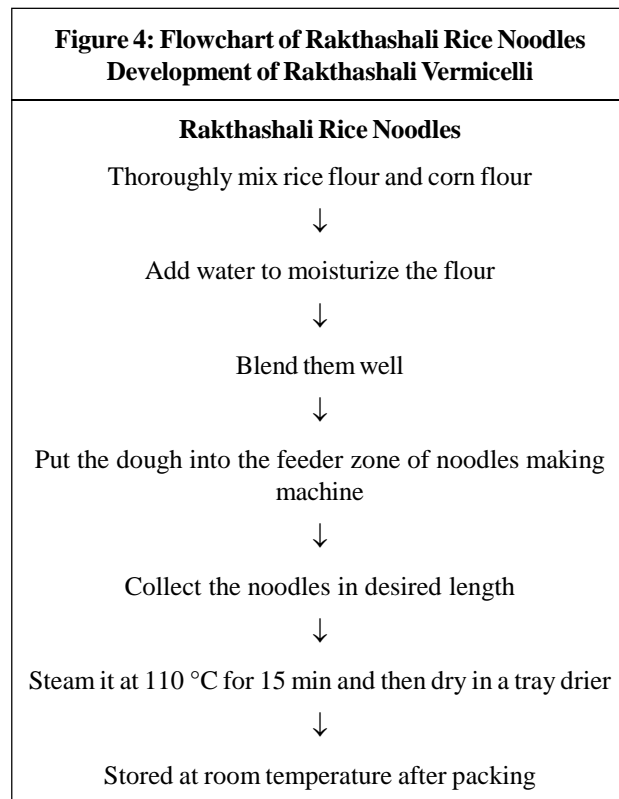


Figure 3: Flowchart of Rakthashali Rice Shell Pasta



seasonings. It consume less time for preparation. It is otherwise called as convenience foods.



Analysis of the Developed Products

Cooking Quality

Analyzing the cooking quality plays an important role to

study the characteristics of the rice. For this Rakthashali rice of good appearance was selected and weighed and cooked.

Cooking Time

5 samples of same weight were used to find out the cooking time. Among these one sample was cooked without soaking and the four other samples were soaked in water of same temperature and different time. Then the samples were cooked at a temperature of 98 °C using an induction cooker. In the case of noodles, pasta and vermicelli the cooking time can be find out by pressing the vermicelli/noodles/pasta between two glass plates, the absence of white color indicate it is cooked well.

Water Uptake Ratio

Water uptake ratio was studied using slightly modified method of Larsen (2000). Rakthashali rice sample of weight 10 g was cooked in 100 ml water using an induction cooker, the sample was weighed after attaining the cooking time to calculate the water uptake ratio.

$$\text{Water uptake ratio} = (\text{Weight of cooked rice})/(\text{Weight of rawrice})$$

Solid Loss

Solid loss of the sample was found out 10 g of rice was cooked in 100 ml water using an induction cooker. Whole rice water sample was placed in a pre weighed petriplate and air dried in a hot air oven at 130 °C until the water completely evaporates. Then the weight of the petriplate was taken to calculate the solid loss.

RVA

The gelling properties, pasting properties can be found out using RVA (AACC, 1995).

CHEMICAL ANALYSIS

The Moisture was determined based on AOAC Method 934.01: Air Oven Method (AOAC, 1990), Fat analysis was conducted based on AOAC Method 963.15: Soxhlet Extraction Method utilizing petroleum ether as solvent (AOAC, 2000), Crude proteins determined based on AOAC Method 960.52: Micro-Kjeldahl Method (AOAC, 2000), Carbohydrate content was estimated by difference and caloric value was measured by calculation. Energy was calculated by the Atwater method (Protein x 4; Fat x 9; Carbohydrate x 4) the samples were determined on triplicate samples.

Color Analysis

Colour differences including visual brightness (L), redness to greenness (a), yellowness to blueness (b) of Rice Products were measured by Colour Hunter Lab. L* value is a measure of the lightness–darkness fraction (L* = 0 yields black and L* = 100 indicates white) (Mamat *et al.*, 2010).

Sensory Evaluation

Five point Hedonic rating scale was used for sensory evaluation. The samples were given to ten membered panelists for analysis. Extruded rice snack was provided as whole without adding any coating and the ready to cook items placed for sensory evaluation as cooked without adding salt or any seasonings. Parameters used were appearance, texture, stickiness, chewiness and total acceptability.

Yield

The yield of the product will depend on the processing, whether there is any problem with processing yield will be less and vice versa. Rice flakes were passed through 2 mm mesh to avoid the broken flakes. The good ones were selected and the yield was calculated. Yield can be calculated using the following formula.

$$\%Yield = \frac{\text{Weight of good riceflakes}}{\text{Weight of paddy taken for flaking}} * 100$$

RESULTS AND DISCUSSION

Cooking Quality - Cooking Time, Water Absorption Capacity, Solid Loss

Table 1 contains the cooking property evaluation of rice. According to Ejlali *et al.* (1978) varietal characteristics and the water rice ratio are important factors influencing the texture of cooked rice. Amount of water in the cooking water is independent of grain type (Matz and Beachell, 1969).

The whole rice need 30 ± 0.81 for cooking and the products need less than 4 min for cooking. Rice vermicelli which was made with only Rakthashali rice need more cooking time compared to other ready to cook items. It seems

that rice noodles made using rice and corn flour need only 2.1 min for cooking, and shell pasta which was also made with the same ratio of rice and corn flour need about 3.1 min.

This shows that the character of corn flour, shape of the product decided the cooking time. The whole rice was unpolished hence it took that much time. All the products were steamed before packing so the pre cooking also helped to decrease the cooking time. Dawson *et al.* studied the cooking behavior of rice in 1960, and proved that there is a negative correlation was reported to exist between the water uptake ratios.

Water absorption indicates how much water can be absorbed by the starch content in a product or rice during cooking time. Water absorption capacity is higher for rice noodles made with rice and corn flour but is low for rice pasta made with the same mix hence it shows that here the shape of the product had an important role because rice vermicelli which was made with only rice has more water absorption ratio than rice pasta. As per the studies conducted by Bhattacharya *et al.* (1999) cooking loss and swelling are the most important factors influencing the cooking quality of noodles.

Solid loss during cooking indicates the strength of the product. It shows the leaching out of starch during cooking; it was less for whole rice since it has a protective covering of bran. Solid loss is higher for vermicelli made with only rice and very low for rice pasta hence it indicates that the shape, size, and the mix also plays an important role in solid loss, when more starch leach out from the product the breakage of product is high during cooking. So the corn flour mix product has less solid loss, it acts as a binder for rice starch. Several studies were carried out on rice noodles and its cooking characteristics. Studies conducted showed that the moisture level, temperature of cooking influences the solid loss and cooking time.

RVA

While running the instrument the flour was first attains the temperature of 65 °C slowly it was increased. First the break

Table 1: Cooking Properties of Rice

| Parameters | Whole Rice | Rice Vermicelli | Rice Noodles | Rice Pasta |
|----------------------|------------------|-------------------|------------------|-------------------|
| Cooking time (min) | 30.00 ± 0.81 | 3.23 ± 0.200 | 2.10 ± 0.080 | 3.10 ± 0.081 |
| Water absorption (g) | 20.55 ± 0.33 | 22.89 ± 0.174 | 25.18 ± 0.66 | 19.53 ± 0.486 |
| Solid loss (g) | $0.895 \pm .020$ | 4.438 ± 0.083 | 2.29 ± 0.008 | 1.28 ± 0.015 |

down takes place at 65, i.e., degradation of starch and after the final viscosity obtained. The set back means retrogradation of starch. The starch molecule which was broken down was again combined together at 184 (Figure 6).

Proximate Composition

For vermicelli, noodles and pasta moisture is high because water was added to made them into dough during production. The ash content indicates the mineral content the whole rice has higher ash content of 2.43 ± 0.04 compared to the products and a slight variation for the vermicelli made with only rice.

Protein content is higher for rice than the products because the degradation of protein occurred during higher temperature treatments. Same as that of protein and fat is higher in whole rice grain and is low in products made by

mixing with corn flour. Crude fiber is higher in both whole rice and in rice vermicelli and low in rice noodles and rice pasta. Carbohydrate is higher in both rice noodles and in pasta because of corn flour, carbohydrate content (Table 2).

Color Analysis

Figure 7 shows the color analysis result of rice and rice products. The addition of maize flour influenced the color of extruded snack hence it has more lighter *a* value than others.

Sensory Evaluation

According to Bhattacharya *et al.* (1999) texture of cooked noodles is one of the major characters in determining the consumer acceptability and the best method for the assessment of texture is sensory evaluation which gives an

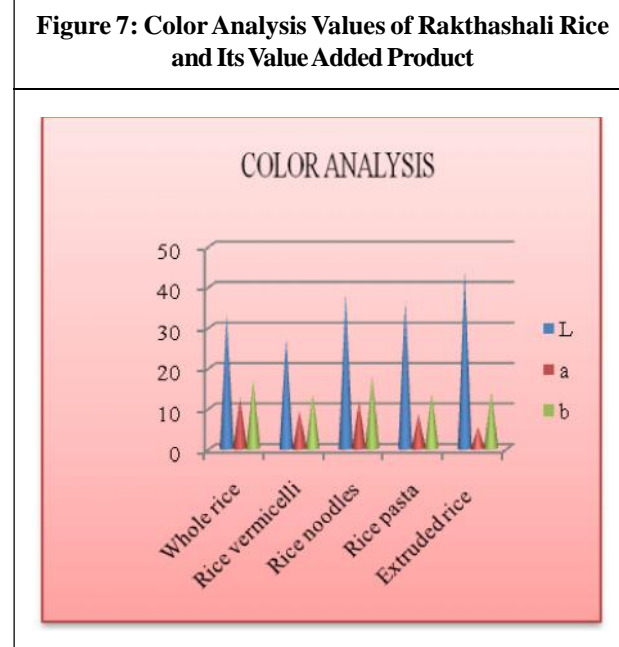
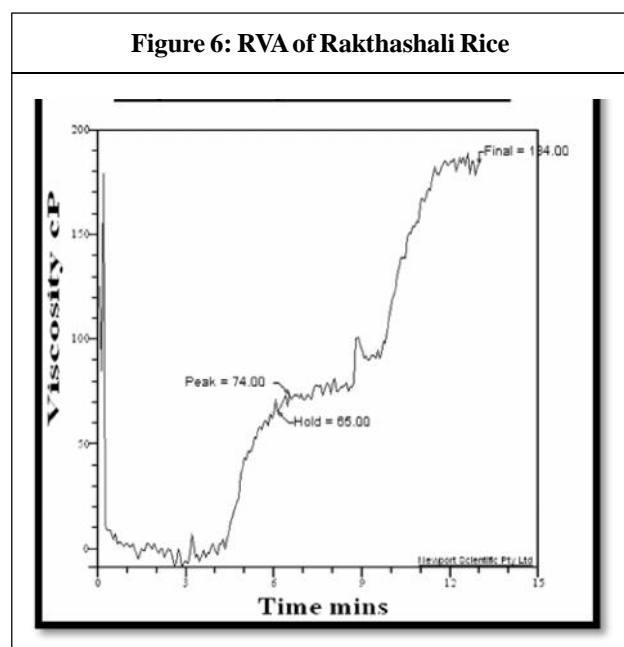
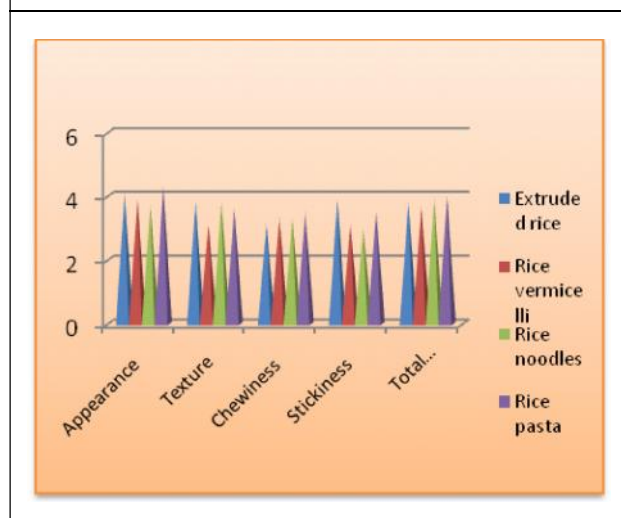


Table 2: Proximate Composition of Rakthashali Rice and Value Added Products

| Proximate Composition | Rice Flour | Rice Vermicelli | Rice Noodles | Rice Pasta |
|-----------------------|-------------------|-------------------|-------------------|-------------------|
| Moisture | 8.18 ± 0.012 | 10.49 ± 0.420 | 11.27 ± 0.220 | 11.39 ± 0.029 |
| Ash | 2.43 ± 0.040 | 2.36 ± 0.047 | 1.85 ± 0.044 | 1.83 ± 0.044 |
| Protein | 1.51 ± 0.004 | 1.34 ± 0.036 | 0.73 ± 0.018 | 0.72 ± 0.012 |
| Fat | 4.20 ± 0.0047 | 3.90 ± 0.008 | 2.26 ± 0.070 | 2.20 ± 0.024 |
| Crude fiber | 8.23 ± 0.035 | 8.23 ± 0.054 | 7.63 ± 0.120 | 7.50 ± 0.120 |
| Carbohydrate | 75.43 ± 0.098 | 73.65 ± 0.440 | 76.24 ± 0.055 | 76.30 ± 0.040 |

Figure 8: Sensory Evaluation Result of Ready to Eat Snack and Ready to Cook Products



idea about consumer preference. Extruded snack was good in appearance and was less sticky and has good acceptability also been good in texture. Rice vermicelli had good appearance but was poor in texture and was sticky. When go through the rice noodles and pasta had good appearance, but texture was good for noodles but was less sticky and good chewing effect than noodles hence it became a product with good total acceptability. Among rice vermicelli, rice noodles and rice pasta most of the people like rice pasta which had a good appearance, and texture and less sticky compared to other ones (Figure 8).

CONCLUSION

Based on new combinations and ratios five value added products from Rakthashali rice were developed, they include rice flakes, extruded snack, rice noodles, rice vermicelli and rice pasta and the nutritional as well as the quality parameters were analyzed. The sensory result shows greater acceptability of the products. Development of value added products from Rakthashali rice will help in increasing the consumption of the rice. The process of value addition has also reduced the cooking time and will add variety to the diet through different developed products. The rice with high nutritional and therapeutic value can be commercialized to be included in the routine diet.

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