

Study on developing micronutrients enriched spread using fermented cooked rice

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Abstract— Most of the people in the world today suffer from micronutrient deficiencies caused largely by a dietary deficiency of vitamins and minerals. The objective of the present study was to develop the micronutrient enriched spread using fermented cooked rice, using the raw materials available in Sri Lanka named by Red rice, Tomato, Chick pea, Spices, Corn flour, Salt, Sugar, Coconut oil and Bee's honey. The cooked rice was fermented overnight and dried at 65-66 °C for 24 hours (without deterioration of Vitamin B₁₂). The powdered dried rice mixed with tomato pulp, powdered spices (Garlic, Cardamom, Cloves, Mustard, Chili, Black pepper), corn flour, Chickpea flour, sugar, salt, coconut oil and Bee's honey in different formulations. Four formulations were prepared to select the best spicy blend and other four formulations were prepared with the selected spicy blend to obtain best formulae for the final product. Sensory analysis was carried out using 30 untrained panelists and the results were analyzed using Kruskal-Wallis test in MINITAB software and the formula 244 selected as the best formula with respect to all sensory properties. The *Lactobacillus* group was isolated and identified from fermented cooked rice after 12 hours fermentation period (According to ISO 15214, 1998). The proximate composition of product number 244 was contained 43± 0.002% moisture, 5.7±0.6% crude protein, 5.2±0.08% Total fat, 4.1± 0.057% Ash, 3.3± 0.011% Crude fiber and 39.6% carbohydrate. Micronutrient content of 100 g of final product was 2.3 µg of Vitamin B₁₂, 40 mg of ascorbic acid, and 820.78mg of Na, 826.09mg of K, 64.25mg of Fe, 9.74 mg of Zn, 167.79 mg of Mg and 184.94 mg of Ca. The fatty acid profile of the final sample was 4.451% of capric acid, 47.50% of lauric acid, 17.49% of palmitic acid, 9.74% of linoleic acid, 16.31% of oleic acid, 0.14% of stearic acid and 4.24% of erucic acid. The shelf life analysis for the final product was carried out and the sensory attributes and microbiological counts were in the acceptable levels within 30 days under the refrigerated condition.

Index Terms— Fermented cooked rice, Micronutrients, *Lactobacillus*, Vitamin B₁₂

I. INTRODUCTION

Rice (*Oryza sativa* L., family Gramineae) is the most widely consumed basic foodstuff in the world (Khush, 1997). Most people in Asian countries consume cooked rice as their main meal. The remaining quantity of cooked rice is soaked in water in a covered container and kept overnight for fermentation process and converted to fermented cooked rice. Fermented cooked rice is a

traditional food widely-consumed in Asian countries is referred to as *Diyabath* in Sri Lanka and *Poita bhat* in Assam, *Panta bhath* in Bengal and *Pokhalo* in Orissa. This nutritious food is rich in Vitamins and can be considered as micro nutrients supplement food. This is a food rich in energy with all natural nutritional supplements which comes from the fermenting bacteria in it. The advantage of this food is trillions of bacteria that produce copious amount of Vitamin B complex such as vitamin B₁₂ (a good source for vegetarians). The lactic acid bacteria having the potential of removing anti-nutritional factors in cooked rice during the fermentation period.

The main objective of this study was to develop a spread rich in micronutrients using fermented cooked rice. The specific objectives were, identification of Lactic acid bacteria group available in fermented cooked rice (after 12 hours incubation period), finding a method to extend the shelf life of fermented cooked rice without deteriorates of vitamin B₁₂, determination of the best combination of ingredients to develop the micronutrient enriched spread, determination of the nutritional profile and determination of the microbial safety in relation to the shelf life of the final product were carried out.

II. METHODOLOGY

The raw materials for the preparation of micronutrients enriched spread, were Sri Lankan red rice (raw), Tomato, Chick pea, Corn flour, Garlic, Cardamom, Cloves, Mustard, Black pepper, Chili powder, Corn flour, Salt, Sugar, Coconut oil and Bee honey. The cooked rice was fermented by soaked in water in a closed container, kept for 12 hours in a steady condition. The fermented rice was dried at 65-66 °C for 24 hours in a drying oven. Then the dried rice was converted into powder through grinding and sieving. The tomato pulp was prepared through hot break process. All the spices were converted into powder forms and corn flour, sugar, salt, coconut oil and bee honey taken from the local market. The ingredients were mixed in different formulation to obtain selected four samples and the two sensory analysis were carried out using 30 untrained panelists to select the best spicy blend formulation and the best recipe for the final product. The results of the sensory analysis were analyzed using Kruskal-Wallis test in MINITAB software (14).

Isolation of *Lactobacillus* bacteria group in fermented cooked rice was carried out using De man Ragosa Sharpe agar medium (pH 5.7 at 10 °C-30 °C) according to ISO method (ISO 15214, 1998). For identification and confirmation of *Lactobacillus* bacteria group, Gram staining, Catalase test, Oxidase test and Motility tests were carried out. Moisture, Ash, Crude protein, Total Fat,