

**STUDIES ON FORMULATION AND THE EFFECT OF
FERMENTATION ON MILLET BASED COMPOSITE
FLOUR RUSK**



By

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DECLARATION

“The work of this thesis was carried out by me at the laboratory of the Department of Food science and Technology of University of Sri Jayawardenapura under the supervision of

Mrs. D. Rajapaksha, Senior Research Officer, Food Technology Division of the Industrial Technology Institute, Colombo and a report on this has not been submitted in whole or in part to any University or Institution for another degree or diploma”

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I certify that the above statement made by the candidate is true and that this thesis is suitable for submission to the university for the purpose of evaluation

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STUDIES ON FORMULATION AND THE EFFECT OF FERMENTATION ON A MILLET BASED COMPOSITE FLOUR RUSK

ABSTRACT

The major millet types grown in Sri Lanka are Kurakkan (*Eleusine coracana*), Meneri (*Panicum miliaceum* L) and Thanahal (*Setaria italica*). The millets are known as minor cereals as they are small grain crops which are less common and cultivated in a smaller region of the country. These varieties are recommended to be grown in Sri Lanka by the Field Crop Research Development Institute at Mahalluppallama, as a source of energy and protein.

This study was undertaken to develop a ready to eat food item (rusks) using a blend of wheat flour and Meneri flour. The effect of fermentation on the nutrient composition and the polyphenol content was also studied. Meneri (AC254) used for the study was obtained from Field Crop Research Development Institute at Mahalluppallama and also from Plant Genetic Resources Centre, Gannoruwa, Peradeniya.

Proximate analysis of both fermented Meneri flour and unprocessed Meneri flour was carried out using AOAC official methods. Fermented Meneri contained moisture $10.40 \pm 0.12\%$, Carbohydrate 72.39%, Protein $13.25 \pm 0.07\%$, Fat $1.09 \pm 0.03\%$, Crude fibre $1.70 \pm 0.02\%$, Ash $1.17 \pm 0.03\%$ (on dry basis). Proximate analysis of unprocessed Meneri flour gave the following results. Moisture $7.80 \pm 0.03\%$, Carbohydrate 75.40%, Protein $11.9 \pm 0.13\%$, Fat $1.47 \pm 0.01\%$, Crude fibre $1.47 \pm 0.01\%$, Ash $1.27 \pm 0.01\%$ (on dry basis). Fermentation (48 hours) was observed to increase the Moisture and protein contents significantly ($P \leq 0.05$), and decreased the fat and crude fibre contents significantly.

($P \leq 0.05$). There was no significant change in the ash content on fermentation.

The minerals iron and calcium were determined by Atomic absorption spectroscopy. The amount of iron in fermented Meneri flour was 7.32 ± 0.04 mg / 100g and unprocessed

Meneri flour had 5.22 ± 0.13 mg / 100g . The levels of iron in the two samples of Meneri flour were not significantly different ($P \geq 0.05$). There was a significant difference between the amounts of calcium in the two samples ($P \leq 0.05$) . The fermented Meneri flour and unprocessed Meneri flour had calcium levels of 7.32 ± 0.04 mg /100g and 8.10 ± 0.80 g / 100g respectively.

The total polyphenol content was determined spectrophotometrically using Folin – Ciocalteu reagent. The total polyphenol content in unprocessed Meneri flour was 150.3 ± 1.6 mg tannic acid equivalents/ 100g). Fermented meneri flour had a total polyphenol content of 115.5 ± 0.85 mg tannic acid equivalents/ 100g). There is a significant difference ($P \leq 0.05$) between the total polyphenol contents of the two samples.

A flour formulation for the preparation of rusks was selected after carrying out several baking studies using different composite mixtures of Meneri flour and Wheat flour. The most accepted flour formulation (40% Meneri flour and 60 % Wheat flour) was selected by sensory evaluation and by analysis of chemical composition. Both fermented Meneri flour and unprocessed Meneri flour were used for the preparation of the rusks.

The final product was selected after carrying out sensory evaluations on colour , crispness, mouth feel and aftertaste .The sensory attributes were evaluated using a five point hedonic scale. The rusks prepared with fermented Meneri flour was superior with respect to mouth feel and aftertaste. There was no significant difference observed for crispness and colour ($P \geq 0.05$) between the two types of rusks.

The chemical composition and keeping quality of the selected final product (40 % fermented Meneri flour and 60 % Wheat flour) was analyzed according to the AOAC official methods . The rusks contained Moisture 2.80% , Carbohydrate 76.37%, Protein 13.9 % , fat 3.80% Crude fibre 1.57 % , Ash 1.56 % (on dry basis) , iron 3.8mg/ 100g and calcium 11.4mg /100g. The polyphenol content was 64mg tannic acid eq/ 100g .The energy value of the rusks was 395.28 kCal /100g.

CHAPTER 1

INTRODUCTION

Milletts are one of the oldest foods known to humans and one of the first cereal grains to be used for domestic cculinary purposes. Milletts were first domesticated in Africa about five thousand years ago. There is evidence that this grain reached India three thousand years ago.

The use of milletts in Sri Lanka goes back to many years. Kurakkan (*Elucine coracana*) and Meneri (*Panicum milaceum* L.) being the staple food of the Veddha community .Kurakkan and Meneri have been grown in Chena cultivations in the dry zone in Sri Lanka. These grains are drought resistant and can be stored without deterioration for many years .All food preparations made from rice flour can be made using Meneri flour .

The nutritional value of milletts is comparable with other cereals . Both proso millet and foxtail millet are somewhat higher in protein than common varieties of rice , corn and oats . It is rich in vitamins and minerals .

However in Sri Lanka milletts have limited utilization and are less popular . Meals and other preparations of milletts have a strong flavor which is not generally appreciated by persons having access to blander grains such as wheat , rice and oats. The main reason for the poor sensory properties is due to the presence of significant amounts of antinutritional factors such as Phytates, Tannins and Polyphenols. Tannins and Polyphenols influence the colour and flavor . Phytates have long been recognized as a strong chelating agent of important minerals such as calcium, magnesium , iron and zinc. Traditional processing treatments such as soaking , dehulling , germination and fermentation are used to reduce the antinutritional factors , and thereby improving the nutritive value of these minor cereals .

The use of blends of wheat and millet flours in the manufacture of various food products is popular in African countries and in India. . Baby food ,snack foods beverages , breads, dietary foods and extruded products have been developed using composite flour mixtures of wheat and milletts by simple processing techniques. The International Crops Research for Semi –Arid Tropics (ICRISAT) is working on popularizing the millet based low cost, high protein and energy rich products .