

**PHYTATES IN SOME SRI LANKAN RICE VARIETIES  
AND  
EFFECT OF FERMENTATION**

By

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“We certify that the above statement made by the candidate is true and that the thesis is suitable for submission to the University for the purpose of evaluation.

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## DECLARATION

“The work of this thesis was carried out by me at the Food Technology Division, at Industrial Technology Institute, under the supervision of Mrs. D. Rajapaksha and Dr. K.K.D.S. Ranaweera and report on this has not been submitted in whole or in part to any University or Institution for another Degree/ Diploma.

A handwritten signature in blue ink, appearing to read 'S Alagiyawanna', is written above a horizontal dotted line.

Alagiyawannage Sachintha Maduri Alagiyawanna

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**ABSTRACT**

Rice is the staple and the main nutritional source of people in many countries of the world including Sri Lanka. Phytate is a common constituent found mainly in the bran layers of cereal grains including rice and it is considered as an anti-nutritional factor. Numerous studies have indicated that phytates reduce the bioavailability of nutrients specially minerals. Phytate content in cereals can be reduced by different cooking and processing methods. Among them fermentation is one of the most effective methods that reduces phytates in cereals.

There are only a few studies carried out on phytate contents of some commonly consumed rice varieties in Sri Lanka. Also there is no sufficient literature on phytates in traditional rice varieties. Traditional rice varieties are becoming popular among today's consumers. It is found that the traditional varieties contain higher amounts of vitamins and minerals compared to commonly consumed popular varieties.

This study was carried out to determine phytate content of ten Sri Lankan rice varieties. Phytates were extracted to 2.4% HCl and separated using an anion exchange column followed by colourimetric procedure (AOAC method). During the study, the effect of fermentation on the reduction of phytate in rice flour was studied. In

addition, the effect of fermentation on HCl extractability of minerals like iron and phosphorus in rice flour were studied.

Phytate contents of these varieties were found to be between 0.1% and 0.5%.

According to the results fermentation has reduced the phytate content of rice flour and has increased HCl extractability of minerals (iron and phosphorous).



## CHAPTER 1

### INTRODUCTION

Phytates widely occur in plant seeds and grains, roots and tubers, fruits and vegetables, nuts pollen of various plant species and organic soils. Phytates are the primary storage form of both inositol and phosphate in all seeds and grains. Both phytic acid and its salts usually occur simultaneously in many seeds and they are collectively referred to as “Phytates”. The currently accepted name of phytic acid is *myo-inositol 1,2,3,4,5,6 hexakis dihydrogen phosphate* or myo-inositol hexakisphosphate (Reddy and Sathe, 2002).

Phytates are considered as anti-nutrient factors because of several reasons. It has strong ability to chelate mineral ions, especially divalent cations and is recognized as a potential concern in animal and human mineral nutrition. Some *in vivo* and *in vitro* studies in humans and animals have indicated that phytates decrease the mineral bio-availability by forming complexes with these minerals (Cheryan, 1980; Maga, 1982). Many of these phytate-mineral complexes are insoluble and therefore, they may become unavailable for absorption under normal physiological conditions. Also phytates affect the digestion of protein and solubility of starch. Phytates are ionic in nature and can react with charged groups of proteins. Sometimes mineral ions such as  $\text{Ca}^{2+}$  mediate this reaction. The resultant phytate-protein and phytate-mineral-protein complexes may adversely influence the protein digestion and bioavailability. Phytates can also bind with starch through phosphate groups or can bind indirectly through proteins which may result in a decrease in starch solubility and digestibility (Reddy and

Sathe, 2002). Because of these reasons some nutrients, especially minerals, in cereals and grains may not be available to humans who consume it.

The negative effect of phytates in food on human health are likely to be most pronounced in people on marginal subsistence diets that consist mainly of seeds, grains or fruits. The humans live in developing countries largely have micronutrient deficiencies. Rice is the staple food of many countries in the world including Sri Lanka. It is the main nutritional source of people who consume it. According to the literature rice contains about 0.9% of phytates (Juliano, 2003). Although rice takes a major part of Sri Lankan diet only a few studies have been carried out to find phytate contents of rice cultivated in Sri Lanka (Hapuarachchy, *et al.* 2003). Also literature on phytate contents in Sri Lankan traditional rice varieties is not reported.

In the past traditional rice varieties were grown in Sri Lanka which had a good taste, odour and also said to be rich in nutrients. During past few decades they were rarely found and they were not cultivated abundantly. These traditional varieties are now gradually becoming popular. Therefore it is important to know the nutritional contents as well as the anti-nutritional factors of Sri Lankan varieties. In this study phytate contents of some selected traditional rice varieties were analysed.

Phytates are somewhat heat stable and has the ability to withstand harsh field conditions, seed/ grain transportation and storage environment. Number of food processing methods like soaking, cooking, germinating, seed irradiation, extruding, milling, frying, fermenting, roasting, microwaving and several combinations of these methods may decrease phytates to a degree depending upon the food to be processed