International Journal of Home Science 2018; 4(1): 169-171

International Journal of Home Science

ISSN: 2395-7476
IJHS 2018; 4(1): 169-171

www.homesciencejournal.com
Received: 27-11-2017
Accepted: 28-12-2017

Neethu Ravikumar
Research Scholar, Department of Home Science, St Teresas College, Ernakulam, Affiliated to M G University, Kottayam, Kerala, India

Anooja Thomas K
Associate Professor, Department of Home Science, C M S College. Affiliated to M G University, Kottayam, Kerala, India

Correspondence
Neethu Ravikumar
Research Scholar, Department of Home Science, St Teresas College, Ernakulam, Affiliated to M G University, Kottayam, Kerala, India

Comparative study on the proximate composition and morphological aspects of rice varieties

Neethu Ravikumar and Anooja Thomas K

Abstract
Rice undergoes different post-harvest operations and among them, parboiling is very common method. Parboiling brings about a spectrum of qualitative changes in rice. Among three important steps of parboiling, soaking is the most crucial step as it changes the composition and distribution of nutrients within grains [6, 7, 9]. Soaking is a hydration process in which water diffuses into rice grains, essential for the complete gelatinization of starch. Soaking causes the leaching of rice constituents in the soaking water [3, 7, 9]. The present study was undertaken to do a comparative study on the proximate composition and morphological aspects of rice varieties and for comparison two varieties were selected namely "Jaya and Sulekha". Both of them were subjected to cold soaking (12 hours), hot soaking (70 °C for 2 hours) followed by steaming and drying in sun. Amylose Content of the samples was determined spectrophotometrically and proximate composition by Pearson Composition Method. The morphological properties of the rice samples were studied using Scanning Electron Microscopy (SEM). Data collected were tabulated and consolidated. It was found the rice samples selected for the present study belongs to low amylose (Sulekha) and intermediate amylose (Jaya) varieties. The SEM micrographs of cold soaked samples were completely coagulated and hot soaked were partially distorted when a comparison is made with raw rice varieties. While looking onto the proximate composition it was observed that the both the carbohydrate and protein content decreased during parboiling, fat and moisture content showed a slight increase and ash content showed only a slight variations.

Keywords: Rice, parboiling, soaking, amylose content, SEM, proximate composition

1. Introduction

Rice (*Oryza sativa* L.) is a staple food for more than half of the world's population [11] and provides carbohydrates, proteins, fats, fibres, minerals, vitamins etc [4]. Rice is considered as one of the major sources of nutrients due to its daily consumption [2]. Parboiling is a process developed for improving rice quality and consists of three main steps namely soaking, steaming and drying of rough rice. Parboiling is applied with an objective to induce the milling, nutritional and organoleptic improvements in rice. It affects the physical properties, nutritional composition, starch characteristics, cooking qualities etc [1, 2, 5-8]. Among three important steps of parboiling, soaking is the most critical step as it changes the gross composition and distribution of nutrients within grains [6, 7, 9]. Soaking is a hydration process in which water diffuses into rice grains, essential for the complete gelatinization of starch. Soaking results in leaching of rice constituents into the soaking water [3, 7, 9]. Starch is the primary component of rice which plays a crucial role in determining the rice quality. When subjected to hot soaking, it undergoes gelatinization which alters its physical, chemical, nutritional, rheological and viscosity properties [6, 9]. Starch content of rice decreases due to leaching of starch granules [9] and thereby reducing rice quality. Starch crystallinity, an indicator of quality, also changes with severity of soaking as amylose, the major crystalline component, tends to degrade when rice is heat-treated [5]. Apart from amylose, cooking quality of rice can also be influenced by components such as proteins, fats or amylopectin [10]. Proteins and fats are susceptible to hot soaking and their contents decrease [7]. Similarly, soaking changes fibre, ash and mineral compositions in rice. Minerals in paddy migrate with the soaking water, thereby changing their distribution in rice grains [2, 3]. Soaking also brings diffusion of color pigments, fat globules etc. from husk and bran layers into starchy endosperm [1, 7]. The study was aimed to compare the proximate composition and morphological properties of six samples selected (Raw Jaya and Sulekha, Hot Soaked Jaya and Sulekha and Cold Soaked Jaya and Sulekha).

2. Materials and Methods

Two rice varieties – "Jaya and Sulekha" were procured from Rice Research Station, Monkompu, Kerala. The paddy collected were cleaned manually for removing any dirt and debris. They were then subsequently cold soaked for 12 hours, hot soaked at 70 °C for 3 hours, steamed and dried in sun. Grain samples were milled for 30 seconds to remove the husk. Amylose Content of the selected samples were determined spectrophotometrically and proximate composition by Pearson Composition Method. The morphological properties of the rice varieties were studied using SEM.

3. Results and Discussion

3.1 Assessment of Total Amylose content

Table 1: Assessment of Total amylose

Samples	Total Amylose (%)	Total Amylopectin (%)	Amylose – Amylopectin ratio
Raw Jaya	25.5	74.5	0.34
Hot Soaked Jaya	22.79	77.21	0.29
Cold Soaked Jaya	21.6	78.4	0.27
Raw Sulekha	19.9	80.1	0.24
Hot Soaked Sulekha	19.04	80.96	0.23
Cold Soaked Sulekha	18.8	81.2	0.23

Rice varieties are grouped on the basis of their milled rice-amylose contents into waxy (0-2% amylose), very low amylose (2-9%), low amylose (9-20%), intermediate amylose (20-25%) and high amylose (25% and above) (IRRI,1972). In the present study among the rice varieties analyzed for their amylose content, the maximum total amylose content of Raw Jaya was observed as 25.5%, followed by Hot Soaked Jaya (22.79%) and Cold Soaked Jaya (19.04%). Similarly the total amylose content of Raw Sulekha was 19.9%, followed by Hot Soaked Sulekha (19.04%) and Cold Soaked Sulekha (18.8%). The above data shows that the rice sample Jaya belongs to intermediate amylose and Sulekha belongs to low amylose varieties. The ratio of amylose-amylopectin is an important parameter which determines the rice quality during processing and cooking. Rice samples with high amylose – amylopectin ratio absorb more water during cooking and become fluffy with separate grains. In the study the amylose- amylopectin ratio of raw, hot soaked and cold soaked rice samples were found to be in the range of 0.23-0.34.

3.2 Estimation of Proximate composition of rice samples

Table 2: Estimation of Proximate composition

Samples	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Carbohydrate (%)
Raw Jaya	11.68	1.69	8.36	1.45	76.82
Hot Soaked Jaya	11.95	1.86	8.28	1.53	76.38
Cold Soaked Jaya	11.9	1.72	8.23	1.5	76.65
Raw Sulekha	11.94	1.58	7.93	1.43	77.12
Hot Soaked Sulekha	12.32	1.65	7.86	1.6	76.57
Cold Soaked Sulekha	12.37	1.64	7.78	1.53	76.68

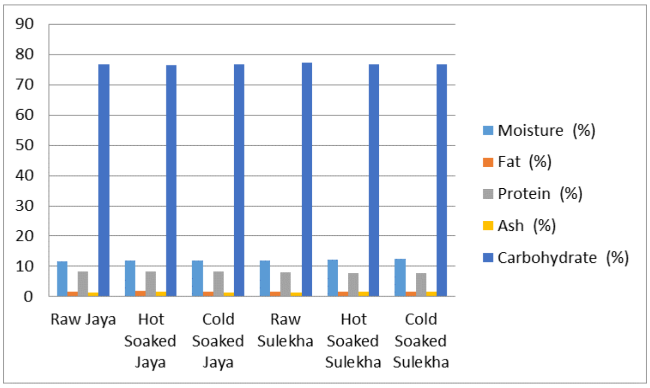

Fig 1: Estimation of Proximate Composition of Rice Samples

The parboiled paddy samples were dried at room temperature and assesses for their moisture content. The moisture of paddy ranged from 11.68 to 11.95 in Jaya variety and 11.94 to 12.37 in Sulekha variety. Paddy after parboiling resulted in reduction of carbohydrate content. It was observed that the carbohydrate was reduced from 76.82 % to 76.38 in case of Jaya varieties and 77.12% to 76.57% in Sulekha varieties. The reason for reduction may be due to the leaching of soluble starchy materials during the process of hot soaking, cold soaking, steaming and drying. While comparing the protein content between raw, hot soaked and cold soaked varieties a slight reduction in protein content was observed and this is due to the susceptibility of protein to hot soaking and leaching of soluble proteins [3]. In the present study it was observed that there is an increase in oil content from 1.69 to 1.86 in Jaya variety and 1.58 to 1.65 in Sulekha variety respectively. This slight increase in oil content is because of the exudation of oil to the bran layer which may be due to soaking and subsequent steaming. Among the samples analyzed for ash content, the data revealed that ash percentage showed subsequent increase when compared with the control samples.

3.3 Determination of Rice structure by SEM

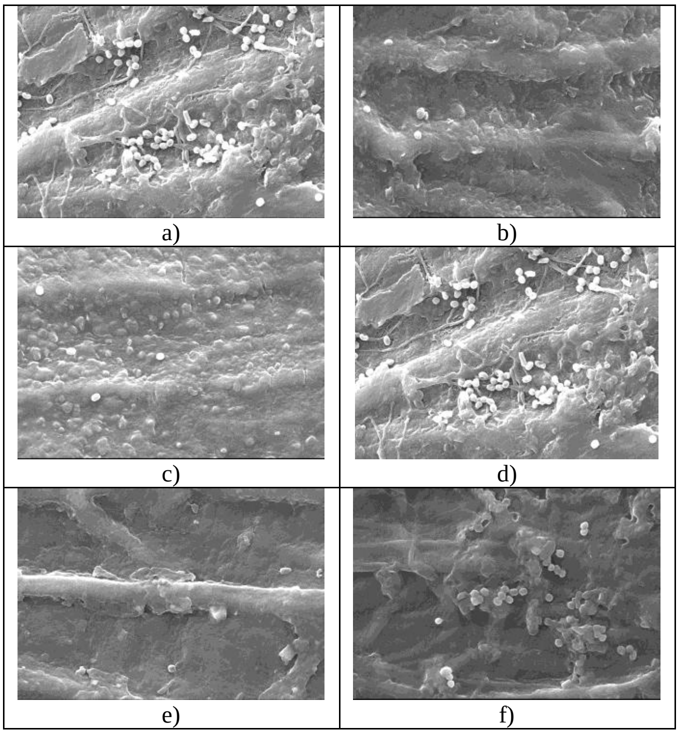

Fig 1: SEM Micrographs of Rice Structure a) Raw Jaya b) Hot Soaked Jaya c) Cold Soaked Jaya d) Raw Sulekha e) Hot Soaked Sulekha f) Cold soaked Sulekha.

The morphology of rice grains was evaluated using scanning electron microscopy. The SEM Micrograph of each sample was taken on 5µm scale. The SEM micrographs of cold soaked samples were completely coagulated and hot soaked were partially distorted when a comparison is made with raw rice varieties. The coagulation was due to water absorption and distorted as a result of steaming.

4. Conclusion

Soaking in hot water increases the rate of diffusion of water into grains by capillary action, molecular absorption and hydration. The hydrodynamic volume of starch increases because of irreversible swelling (gelatinization) during hot water soaking and subsequent steaming, which causes splitting of the husks. During soaking water penetrates into the void spaces and seals the internal fissures of the rice grain. The hot soaking method accelerates this healing process. During hydrothermal treatment of paddy varieties especially by soaking and steaming method, more amount of oil expels to the grain surface and subsequently grain becomes hardened on parboiling and only a small amount of bran can be removed from parboiled rice during milling. This minor removal of bran also leads to a slight increase in the mineral content of parboiled rice. The SEM micrographs revealed that the granular structure of starch was distorted partially or completely due to prolonged water absorption and subsequent heat treatment.

5. References

1. Dutta H, Mahanta CL. Effect of hydrothermal treatment varying in time and pressure on the properties of the parboiled rices with different amylose content. Food Res Int. 2012; 49:655-663.
2. Heinemann RJB, Fagundes PL, Pinto EA, Penteado MVC, Lanfer-Marquez UM. Comparative study of nutrient composition of commercial brown, parboiled and milled rice from Brazil. J Food Comp Anal. 2005; 18:287-296.
3. Ibukun EO. Effect of prolonged parboiling duration on proximate composition of rice. Sci Res Essay. 2008; 3(7):323-325.
4. Juliano BO. Rice in Human Nutrition. Rome, Italy: Food and Agriculture Organization, 1993, 162.
5. Manful JT, Grimm CC, Gayin J, Coker RD. Effect of variable parboiling on crystallinity of rice samples. Cereal Chem. 2008; 85(l):92-95.
6. Mir SA, Bosco SJD. Effect of soaking temperature on physical and functional properties of parboiled rice cultivars grown in temperate region of India. Food Nutr Sci. 2013; 4:282-288.
7. Otegbayo BO, Osamuel F, Fashakin JB. Effect of parboiling on physico-chemical qualities of two local rice varieties in Nigeria. J Food Technol Afr. 2001; 6(4):130-132.
8. Patindol J, Newton J, Wang YJ. Functional properties as affected by laboratory-scale parboiling of rough rice and brown rice. J Food Sci. 2008; 73(8):370-377.
9. Sareepuang K, Siriamornpun S, Wiset L, Meeso N. Effect of soaking temperature on physical, chemical and cooking properties of parboiled fragrant rice. World J Agric Sci. 2008; 4(4):409-415.
10. Thomas R, Wan-Nadiah WA, Bhat R. Physicochemical properties, proximate composition, and cooking qualities of locally grown and imported rice varieties marketed in Penang, Malaysia. Int Food Res J. 2013; 20(3):1345-1351.
11. Xiang C, Ren J, Zhao XQ, Ding ZS, Zhang J, Wang C *et al*. Genetic dissection of low phosphorus tolerance related traits using selected introgression lines in rice. Rice Sci. 2015; 22(6):264-274.