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PHYSICOCHEMICAL CHARACTERIZATION ON SELECTED MALAYSIAN RICE VARIETIES AS AFFECTED BY DIFFERENT GRINDING METHODS AND ITS APPLICATION IN DRY LAKSA NOODLE

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ABSTRACT

In the food industry, flour or fine powder is considered as both end products and intermediate products between unit operations. Many food processes specifically involving whole rice grains frequently require size reduction, which is accomplished by dry or wet grinding methods. However, both methods have some drawbacks in term of the flour characteristics and environmental-wise which called for an alternative method. Thus, this study was carried out with the aim to determine the appropriate soaking and grinding times by using dry, semi-wet and wet grinding methods; as well as to evaluate flours' characteristics and further develop into food product formulation. The Rice (*Oryza sativa* L.) used in this study consist of two newly released Malaysian hybrids, namely MR 253 and MR 263; and two other hybrids, MR 211 and MR 220. Characterisation focused on the effects of grinding methods and rice varieties on the physicochemical, morphological, functional and thermal properties of rice flours. First stage was the preliminary study on the soaking and grinding processes of whole rice grains, which were done at different time frames of 4, 6, 8 hours and 4, 6, 8, 10 minutes; respectively. The second and third stages involved the preparation of the Malaysian rice flours and their evaluation through physicochemical and functional analyses and morphological observation as well as on the flours' thermal and pasting profiles and its rheological behaviour. In the final stage; based on the resulted hydration properties, selected samples of rice flours of semi-wet of variety MR 253, wet of variety MR 220 and wet of variety MR 253 were further incorporated in the application phase which involved the formulation and production of Malaysian dry rice noodle (laksa).The study revealed that the 8 hours soaking and 8 minutes grinding was an appropriate combination procedure in order to obtain rice flour with low percentage of damaged starch content and fine average particle size of starch granules for all three methods. Soaking and grinding times were significantly ($p<0.05$) strongly correlated with percentage of damaged starch content (r=-0.87); while intermediate correlation was found between grinding times and the average particle size (r=-0.59). Overall, the method of grinding employed has significantly greater impact on the physicochemical and functional characteristics of the rice flours than the differences in rice varieties. Correlation analyses emphasised that percentage of damaged granules plays a significant role in governing the rice flours' physicochemical properties while average particle size of granules possessed crucial role in determining its functional properties. Scanning electron micrograph images revealed characteristic morphological changes in the granules of rice flour samples, without inducing legion changes in the relative crystallinity, though increase in severity of processing resulted in reduced of peak intensity. Gelatinisation and pasting profiles were affected primarily by the grinding methods. All Malaysian rice flour samples exhibit elastic moduli (G') higher than viscous moduli (G") in both oscillatory temperature and frequency sweeps. Dry laksa noodles evaluated through the three point bending test showed that experimental noodle from semi-wet ground flour of variety MR 253 showed significant in strength as reflected through the breaking force data; and as well possessed higher tensile strength and extensibility in its cooked (wet) form which indicates the ability of the noodle strands to hold together during cooking and resist breakdown. Overall acceptability scores revealed that all experimental noodles made from Malaysian ground rice flours were more preferable than the commercial noodle.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Cereals are an important component of human diet throughout the world, as it constitutes the major source of carbohydrates, and also protein, vitamins and minerals. Cereals are eatable seeds or grains of the monocotyledonous family called *Gramineae*. Rice (*Oryza sativa* L.) is regarded as a major food in the world, being a staple food with more than half of the world's population; especially Asian countries depend on rice as their primary caloric source. Rice is originally grown to be consumed as milled grains, but lately, there has been a significant increase in rice flour production (FAOSTAT, 2012) for novel foods, such as gluten-free foodstuffs. In Asian countries, most rice products are being made from the rice flour (Chou et al., 2014). It also has been used in variety of food products such as noodles and infant foods (Vongsawasdi et al., 2009; Wu et al., 2010; Zhu et al., 2010; Ahmed et al., 2016; Wang et al., 2016). There are thousands of different rice varieties; some have been in the diet for centuries such as Basmati and Jasmine rice, while others are new hybrids promoted for qualities such as high yield and drought as well as disease resistance. The first attempts to cultivate rice occurred around 10,000 years ago (FAO, 2000). Since that time farmers and more recently rice breeders, have manipulated the crop for desired characteristics. Through these attempts several high yielding rice varieties were established. The influence of modern agricultural practices and focus on high yield crop varieties has been another contributing factor (IRRI, 1996).

The chemical and physical properties of starch samples are influenced by genotype and environmental conditions during plant growth. Different rice varieties, Amaroo and Illabong (Australian); Doongara, Langi and Kyeema (Australian); Yang-fu-nuo, Su-yu-nuo and Guang-ling-xiang-nuo (China); IGR, EAR, ILR and N2R (Nigerian); Bg 300, Bg 352, Bg 403, Bg 94-1, Ld 356, Bw 272-6b, At 405 and At 306 (Sri Lankan); IGR, EAR, ILR and N2R (Nigerian); Cypress, Drew and Wells (Arkansas) had different pasting profiles on the rapid visco analyser (Lisle et al., 2000; Patindol & Wang, 2002; Fitzgerald et al., 2003; Dang & Copeland, 2004; Zhu et al., 2010; Fari et al., 2011; Ashogbon & Akintayo, 2012a). Franklin, K2, GIB-C9,