Changes of Anthocyanins in Black Rice Flours Prepared by Cooking and Pregelatinization

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ABSTRACT

Black rice is considered healthier than white rice as it contains anthocyanins which have been claimed to have multiple health benefits. The wide application of black rice is limited due to the limiting properties of native rice flour. The Thai black rice cultivar, Niew Dam (ND; glutinous type) and Hom Nil (HN; non-glutinous type), were pregelatinized through conventional cooking (C) followed by drum-drying (D). The effects of the heat treatments on physical and chemical properties, anthocyanin content, and antioxidant activity were determined. Rice flour with no heat treatment (native: N) showed lower hydration values compared to those of cooked and drum dried samples. Total anthocyanin contents (TAC) of ND-N, ND-C, and ND-D (4,099, 452, and 358 mg/100 g dw, respectively) were significantly higher than those of HN-N, HN-C, HN-D (305, 95, and 23 mg/100 g dw, respectively). After cooking and drum-drying processes, the retention percentage of TAC in ND-D and HN-D were 9 % and 8%, respectively. Specific anthocyanin compounds, namely cyanidin-3-glucoside and peonidin-3-glucoside, were significantly decreased in both rice cultivars after cooking and the drum-drying processes. The LC-ESI-QTOF was able to identify cyanidin-3-sambubioside for the first time

in black rice. Compared to untreated grains, the antioxidant activity of the drum dried samples was decreased by approximately 20% indicating reasonable preservation of the antioxidant benefits. The improvement of physical properties and the remaining anthocyanin content of the pre-gelatinized black rice flour indicates that it has a potential application as an ingredient in healthier food products.

Keywords: Anthocyanin, Black rice, Drum-drying, Pregelatinization

INTRODUCTION

Rice is a staple food for people in many countries in Asia and consumption is increasing in other areas around the world. Different rice varieties are commercially available in the market. In Thailand, both glutinous and non-glutinous rice cultivars are mostly consumed as cooked rice or as an ingredient in sweet dishes. Recently, pigmented rice, including black, red, or purple types, has received more attention due to claimed health benefiting from specific compounds in the bran layers. Black rice *(Oryza sativa* L. *indica)*, grains, which have a dark purple (so-called black color) appearance, contain anthocyanins which have been shown to have multiple health benefits, including prevention of cardiovascular diseases and some cancers (He and Giusti, 2010). The major anthocyanin compounds in black rice are cyanidin-3-glucoside and peonidin-3-glucoside (Pereira-Caro et al., 2013). Although it has been recognized that pigmented rice selections provide higher health benefits than white rice, the consumption of black rice remain very low.

In addition to direct consumption of rice as cooked grains, rice is also processed to flour for a number of broader applications. Although black rice flour is currently commercially available, its applications are still limited due to inherent characteristics such as the presence of starch granules, low water solubility, and an undesirable amylose/amylopectin ratio (Miles et al., 1985). One approach that can be used to modify the starch in rice grains is a pregelatinization process, which involves the use of heat from a drum dryer, a spray dryer, or an extruder (Lai, 2001). The pregelatinization process could possibly alter rice flour so that it has better properties such as improved water absorption, solubility, pasting property, storage stability, and reduced starch retrogradation (Juliano, 1984; Miles et al., 1985). With improved properties, the pregelatinized starch would be suitable for various food applications and create healthier food products, such as porridges, soups, and beverages (Juliano, 1984).