

Title Effect of milling on colour and nutritional properties of rice
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Abstract

Brown rice (long-grain variety Puntal) was abrasively milled (0–100 s) to various degrees of milling (DOM, 0–25%). The non-linear relationship between milling time and DOM indicated a variability in hardness within the different rice fractions. The hardness of the bran layers increased from outer to inner bran layers, while the different endosperm fractions were of comparable hardness. The colour parameters L^* , a^* and b^* and extinction measurements of water-saturated butanol extracts of flour, from rice with different DOM, indicated that bran contained much more yellow and red pigment than endosperm. The levels of yellow and red pigment decreased from the surface of the brown rice to the middle endosperm (DOM = 15%). Once bran (DOM = 9%) and outer endosperm (additional DOM = 6%) were removed, the yellowness and redness of the middle endosperm of the raw rice remained constant, indicating that the pigments were uniformly distributed in the middle endosperm. Cooking of rice containing residual bran layers (DOM < 9%) increased rice brightness (L^*) and decreased its redness (a^*) and yellowness (b^*), as expected from a dilution effect resulting from the uptake of water, as well as from leaching of pigments in the cooking water and diffusion of bran pigments to the endosperm. Cooking of rices with DOM > 9% resulted in products of constant brightness and redness but with yellowness which decreased as a function of DOM. Proteins, minerals and starch were not uniformly distributed in the brown rice kernel. The endosperm (DOM > 9%), contained most of the rice kernel proteins (84.2%), and proteins were mostly concentrated in the outer endosperm (9% < DOM < 15%). Bran (0% < DOM < 9%) contained most of the minerals (61.0%), and starch (84.6%) was concentrated in the core endosperm fraction (DOM 25%).