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Iron fortification of four rice cultivars in Northern Province through the parboiling process

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Iron deficiency is a widespread micronutrient deficiency in humans. Usage of iron supplementation tablets and iron fortified foods are not common in developing countries. The study was to focus on the alternative and cost-effective way to fortify four rice cultivars, which are often consumed by the people in the low income category in the Northern Province, with iron, through parboiling to increase Fe concentration and bioavailability of Fe in rice based diets. Four paddy cultivars were parboiled in deionized water containing Fe-EDTA (250mg Fe kg^{-1} paddy rice) made by mixing ferrous sulfate ($FeSO_4$) with ethylenediaminetetraacetic acid disodium salt (Na_2EDTA) in acidic pH of 5.50 – 5.70. Addition of Fe during the parboiling process resulted in increased concentration of Fe (40 – 80mg Fe kg^{-1}) in grain compared to unfortified rice cultivars (30 – 35mg Fe kg^{-1}) ($p < 0.05$) depending on the physiochemical properties among different rice cultivars. Fe concentration in fortified grains are negatively correlated with increasing concentration of Fe in unfortified grains ($r = -0.812$, $p < 0.01$). Fe retention test was conducted by rinsing the grain thoroughly three times using deionized water followed by oven drying at 70^{o}C for 72h. The bioaccessibility and bioavailability of Fe in rice cultivars (unfortified and fortified) were evaluated by *invitro* digestion, which showed that bioavailability of Fe in fortified rice was significantly increased compared to unfortified rice ($p < 0.05$),independent of rice cultivars ($p > 0.05$). There was no correlation between bioavailability of Fe and concentration of Fe in fortified and unfortified rice cultivars ($p > 0.01$). In conclusion, the parboiling process is an effective way to fortify rice grain with Fe, and Fe fortified rice is a vehicle for improving Fe status in rice based diets consumed by low income people.

Keywords: Rice, parboiling, iron fortification, bioavailability

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