Leaf-based Protein from Biofortified Rice: A Game Changer

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ABSTRACT:

Increasing the incidence of non-communicable diseases (NCDs) among the senior and elderly populations in the developing world has now become a significant public health concern. Consuming low-nutrient-dense, reduced protein intake and high glycemic index foods combined with a sedentary lifestyle are the leading cause of obesity and type-2-diabetes. In particular, low-protein diets have been a leading cause of muscle loss and weakness among older adults. Nonetheless, plant-based proteins developed from legumes, beans and seed nuts are rich in protein and antinutritive factors such as trypsin inhibitors and phytate that block nutrient bioavailability and set plant-based protein quality lower than animal proteins. Economic sustainability relies on the availability and price of raw materials with high protein content. Among the top five rice exporters with 10 million hectares of paddy, Thailand should consider utilising high-protein rice as a reliable source of plant-based protein. Although rice grains have approximately 6-8% protein content, their low in Lysine, Methionine, and Cysteine make rice quality lower than soybean. However, plant-based protein from antioxidant-rich pigmented rice varieties may confer higher therapeutic potential against chronic diseases than non-pigmented rice.

We first isolated protein hydrolysate from raw rice bran and germinated Riceberry, a cultivated nutrient-rich pigmented rice. The enzymatic protein hydrolysates from Riceberry bran (RBPH) contained 19% highly absorbable protein showing highly anti-inflammatory, antidiabetics, and antioxidants. RBPH also showed potently suppressed the survival of specific cancer cell lines derived from the liver, breast, and bile duct and protection against Lipopolysaccharide (LPS)-induced inflammation. Nonetheless, RBPH is still costly for those in need. Here, we found rice leaf lacks caloric starch, rich in dietary fibre, protein, and micronutrients, similar to rice bran but economical for large-scale production. We have focused on Rainbow Rice, producing innovative highly-pigmented leaves, as the first model. Fresh Rainbow Rice leaves showed powerful antioxidants, high protein content (14-20%), rich in micronutrients (Fe, Mg, Mn) and minimum antinutritive factors (Phytate). In particular, some Rainbow Rice whole grains contain exceptionally high protein (14%). Therefore, both leaves and entire grains have strong potential to develop functional ingredients for various therapeutic products and functional plant-based proteins against chronic diseases. We will broaden research into the nutritional benefits of green-leaf rice grown in pesticide-free farming. Farmers can gain significantly more income from producing high-quality leaves instead of burnout and causing air pollution. Therefore, rice leaves and whole-grain can become a significant supply chain for plant-based protein industries.