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The novel fraction of rice bran as functional food ingredients

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A life style-related disease has become prevalent worldwide including in Indonesia as a result of changes in lifestyle and eating habits. Intake of western diet with low dietary fiber and less exercise activity are causes of this diseases and major risk factors of death in recent years. These diseases associated with a number of serious medical complications, such as coronary heart disease, hypertension, type 2 diabetes, nonalcoholic fatty liver, and certain cancers. Currently, there is increasing linked science and knowledge between functional food, diet intake, and health. Consumption of various functional food and nutraceutical derived from edible plants, vegetables, fruits, cereals, and fermented food has been regarded as a preventive factor against these diseases. Therefore, any active compounds from food having the ability to reduce life style-related diseases are a potential candidate for functional food. Hypertension is one manifestation of life style-related diseases and continues to be a top major cause of death beside stroke in Indonesia (Pusdatin, 2015). The control and management of hypertension through food intake has been a focus of public health strategies in the recent years. A 5-mm Hg decrease in hypertension has been equated with a 16% decrease in this disease (FitzGerald et al., 2004).

Presently, much effort is being invested in detecting bioactive components in foods that can contribute to a decreased risk of life style-related diseases. Among these compounds, rice bran is a by-product of the rice milling process which is produced during the process of brown rice into polished rice (Figure 1) (see supplementary file); its abundantly contains phytochemicals and various antioxidants that impart beneficial effects on rodent and human studies. In the rice milling process, approximately 8-10% bran of rice are produced. It is well known that major rice bran contains highly unsaponifiable components such as tocotrienol, ϒ-oryzanol, and β-sitosterol; all these compounds may have capacity to the lowering plasma lipid levels. Rice bran also contains a high level of dietary fibers (β-glucan, pectin, and gum). In addition, it also contains 4-hydroxy-3-methoxycinnamic acid (ferulic acid), which may also be a component of the structure of non-lignified cell walls (Figure 2) (see supplementary file)

In our studies, we used two types of rice bran fraction that were derived from the outer layer of rice after ethanol extraction or enzymatic treatment with Driselase (mixture of cell wall-degrading enzymes originated from Basidiomycetes sp.) as a dietary component in the prevention or treatment of hypertension in SHRSP, a species animal that has a hereditary spontaneous hypertensive conditions and related disorders similar to human essential hypertension, hyperlipidemia, multisystem end-organ damage with prominent involvement of the kidney (proteinuria), insulin resistance syndrome, and higher oxidative stress in the brain.

Our studies have successfully developed a new extraction method of rice bran using ethanol or enzymatic treatment to produce new fractions (ethanol fraction; EF and Driselase fraction; DF) of rice bran. With the new method of extraction, we found many surprising results not covered by other studies before (Ardiansyah et al., 2006). We have made the first report that our fraction of rice bran has the potential to decrease hypertension in the rat model of hypertension. We have found that our fraction have improved the parameter related to the hypertension, such as kidney function, angiotensin-1 converting enzyme inhibitory activity, lipid and glucose metabolisms. The new findings of our study are that DF as the filtrate of rice bran treated with plant cell wall-degrading enzyme mixture has a beneficial effect on hypertension and improving lipid profiles, and these effects were observed as same as with EF as lipid soluble fraction of rice bran that contains highly unsaponifiable compounds. The synergistic effect of bioactive components contained in the DF and EF is responsible for the improved hypertension, lipid profile, and glucose metabolism in SHRSP.

The continuation of our studies were then we developed a fractionation method for the identification of active components contained in the DF of rice bran with silica gel column and HPLC by using ODS column. By NMR analyses regarding an active fraction; we found that adenosine and L-tryptophan were as the active components. Hypertension, plasma lipid, nitric oxide (NO), insulin, leptin, adiponectin, and glucose metabolism were significantly improved in the adenosine group. The mRNA expression levels of genes involved in fatty acid and glucose metabolism were altered in the adenosine group. Single oral administration of adenosine improved hypertension, plasma triglyceride, glucose, and NO levels 2 h after administration (Ardiansyah et al., 2009). Furthermore, chronic administration of L-tryptophan showed increased plasma NO levels in plasma corresponded well with the hypotensive effect observed in SHRSP. Plasma glucose and insulin levels were also significantly decreased in the L-tryptophan group after 2 and 3 week of the administration (Ardiansyah et al., 2011).

In summary, we described that dietary supplementation of diets with the DF-treated fraction of rice bran have resulted numerous protective effects against hypertension, hyperglycemia, and hyperlipidemia in animal model of life style-related diseases. Moreover, the DF-treated of rice bran could be an excellent functional food derived from waste of rice milling process and can be used for the purpose of dietary functional food ingredient in the absence of therapeutic agents. REFERENCES (see supplementary file)