

INTISARI

Bekatul bebas lemak (*Defatted Rice Bran*, DRB) diketahui mengandung asam-asam fenolat yang sangat berguna untuk pengembangan makanan/minuman fungsional bagi penderita Diabetes Mellitus (DM). Penelitian ini bertujuan untuk mengevaluasi potensi fraksi kaya asam fenolat (FKAF)-DRB sebagai antioksidan dan antidiabetik. Tahapan penelitian yang dilakukan meliputi (1) skrining varietas padi untuk memperoleh ekstrak hidrofilik bekatul berdasarkan *total phenolik content* (TPC) dan aktivitas antioksidan tinggi, (2) pemilihan cara penghilangan lemak (*defatting*) berdasarkan kadar lemak DRB (<4%) serta pemilihan cara stabilisasi bekatul berdasarkan peningkatan asam lemak bebas (ALB) dan aktivitas antioksidan ekstrak hidrofilik DRB, (3) identifikasi komposisi asamf enolat dan pengujian sifat antioksidatif dalam system biologi (*in vitro*)FKAF-DRB, (4) pengujian sifat antidiabetik FKAF-DRB secara *in vitro*dengan pengukuran kemampuan penghambatan enzim -glukosidase serta pengujian secara *in vivo* dengan parameter kadar Malondialdehid (MDA) plasma, kadar glukosa, kadar insulin, *homeostasis model of assesment-* (HOMA-) dan perbaikan sekresi insulin dengan uji *bioassay*.Rancangan percobaan yang digunakan pada setiap tahap penelitian adalah rancangan acak lengkap (RAL). Data dianalisis dengan analisis varian (ANOVA) menggunakan *software* SPSS. Hasil penelitian menunjukkan bahwa ekstrak hidrofilik bekatul dengan TPC dan aktivitas antioksidan tertinggi diperoleh dari varietas Menthikwangi, masing-masing sebesar $2794,28 \pm 181,83 \mu\text{g EAG/g}$ bekatul dan $41,28 \pm 0,60 \%$ RSA DPPH. DRB tanpa proses stabilisasi bekatul yang dilanjutkan *defatting* (perlakuan re-ekstraksi rasio bahan:hexana=1: 4) mengalami peningkatan ALB paling rendah serta menghasilkan ekstrak hidrofilik dengan sifat antioksidan tertinggi dibanding DRB yang diproses dengan stabilisasi bekatul menggunakan oven dan *microwave*.Tiga fraksi yang diekstraksi dari DRB dua diantaranya yaitu E.RES (ekstrak yang diperoleh dari mengekstraksi DRB residu hasil ekstraksi methanol) dan E.TEM (ekstrak dari mengekstraksi DRB) tidak terdapat perbedaan signifikan kadar asam ferulat dan asam -kumarat, sedangkan pada fraksi E.MET (ekstrak DRB dengan methanol) tidak terdeteksi kedua senyawa tersebut. Kandungan asam ferulat dan -kumarat E.RES dan E.TEM berturut-turut adalah $4,31 \pm 0,09$; $3,80 \pm 0,09$ dan $4,91 \pm 0,15$; $4,17 \pm 0,10$ (g/100g ekstrak DRB).Terdapat perbedaan signifikan ketiga FKAF dalam penghambatan oksidasi LDL *human plasma*. Nilai IC-50 asam ferulat, E.TEM, asam kumarat, E.RES dan E.MET berturut-turut adalah 8,83; 25,75; 25,83; 29,72 $\mu\text{g/ml}$ dan 177,06 $\mu\text{g/ml}$.Kedua FKAF-DRB (E.TEM dan E.RES)memiliki aktivitas antidiabetik dalam penghambatan enzim -glukosidase yang hampir sama dengan acarbose (kontrol) tetapi lebih rendah dari pada asam ferulat. Nilai IC-50 penghambatan enzim -glukosidase, asam ferulat<acarbose=E.RES=E.TEM<E.MET. Uji *bioassay* terhadap E.TEM selama

4 minggu menunjukkan fraksi tersebut memiliki sifat menurunkan kadar MDA, menekan kadar glukosa darah tikus (3,71%), memperbaiki sekresi insulin, menunjukkan HOMA- yang lebih tinggi dan menekan kerusakan sel-sel pankreas. E.TEM mempunyai potensi sebagai antioksidan dan antidiabetes.

Kata kunci : bekatul, *defatted Rice Bran*, asam fenolat, asam ferulat, antioksidan, diabetes mellitus

ABSTRACT

Defatted Rice Bran (DRB) was known to contain phenolic acids, which are of valuable materials for the formulation of functional food/drink for the therapy of people with diabetic mellitus (DM). This study was aimed to evaluate the potentiality of phenolic-acid rich defatted fraction of the rice bran as antioxidant and antidiabetic agents, in both *in vitro* and *in vivo* analytical procedures. The research was conducted involving the following steps: (1) screening of local rice varieties for highest total phenolic content (TPC) and antioxidant activity (DPPH radical scavenging), (2) Selection rice bran defatting method based on DRB fat levels (<4%) and rice bran stabilization method based on increased free fatty acid (FFA) as well as DRB hydrophilic extract antioxidant activity), (3) identification of phenolic acid composition and testing of antioxidative characteristic in biological system (*in vitro* assay on oxidation of LDL isolate), and (4) *in vitro* testing of antidiabetic characteristic by measuring the ability of the hydrophylic extract of DRB to inhibit α -glucosidase enzyme, as well as *in vivo* test on levels of plasma Malondialdehyd (MDA), glucose, insulin, homeostasis by HOMA- α assesment, and improvement of insulin secretion using rat bioassay test. Completely Randomize Design were utilized at any stage of this research layout. Data were analyzed by the analysis of variance, ANOVA, using SPSS software. The result showed that hydrophilic rice bran extract with TPC and the highest antioxidant activity were retrieved from Menthikwangi varieties, respectively $2794,28 \pm 181,83$ μg EAG/g of rice bran and $41,28 \pm 0,60$ % RSA DPPH. DRB without rice bran stabilization that continued by defatting (re-extraction with material hexana ratio = 1:4) have the lowest increased ALB and produce hydrophilic extract with highest antioxidant properties compared to DRB were processed by rice bran stabilization using oven and microwave. Three fractions that extracted from DRB, two of them are E.RES (extract were obtained from extracting DRB that results of methanol extraction residue) and E.TEM (extract from extracting DRB) that was no significant difference in ferulic acid levels and α -cumaric levels, meanwhile E.MET fraction (DRB extract with ethanol) ferulic acid levels and α -cumaric levels were not detected. Ferulic acid and α -cumaric E.RES and E.TEM contain consecutively $4,31 \pm 0,09$; $3,80 \pm 0,09$ and $4,91 \pm 0,15$; $4,17 \pm 0,10$ (g/100g of DRB extract). There were significantly different among the three of FKAF on the capability to inhibit oxidation of human plasma LDL. The values of IC-50 of ferulic acid, E.TEM, cumaric acid, E.RES, and E.MET, consecutively, were 8,83; 25,75; 25,83; 29,72 $\mu\text{g}/\text{ml}$ and 177,06 $\mu\text{g}/\text{ml}$. Both FKAF-DRB (E.TEM and E.RES) have antidiabetic activity in term of α -glucosidase enzyme inhibition, which was similar to acarbose (control), but lower than ferulic acid. Comparison of values of IC-50 α -glucosidase enzyme inhibition were: ferulic acid < acarbose = E.RES = E.TEM < E.MET. Bioassay test against E.TEM, the highest potential, for 4 weeks showed that fraction has properties to lowering MDA levels, pressing the blood glucose levels of mice (3,71%), improvement of insulin secretion, showed

higher HOMA- and suppress damaged of the pancreatic cells. E.TEM, in the DRB, possess high potential to be used as antioxidant and antidiabetic agent.

Keyword: rice bran, *defatted Rice Bran*, phenolic acid, ferulic acid, antioxidant, diabetes mellitus