

**SUSU FERMENTASI KOMBINASI STARTER *Lactobacillus plantarum*  
Dad 13 *Lactococcus lactis* DAN YEAST SEBAGAI  
MAKANAN FUNGSIONAL ANTIDIABETES**

**INTISARI**

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Penelitian ini bertujuan mengevaluasi karakteristik mikrobiologis, kimia, organoleptik dan aktivitas antioksidan susu yang difermentasi oleh *Lactobacillus plantarum* Dad 13, *Lactococcus lactis* 0086, *Saccharomyces cerevisiae* 3012 dan *Kluyveromyces marxianus* 3011 serta pengaruhnya terhadap kadar glukosa darah, resistensi insulin, kadar MDA plasma serta ekspresi GLUT 4 pada tikus diabetes melitus (DM) tipe 2. Susu fermentasi terdiri dari 9 kombinasi starter yaitu: K1 = *L. plantarum* Dad 13; K2 = *L. plantarum* Dad 13 dan *Lc. lactis*; K3 = *L. plantarum* Dad 13 dan *Saccharomyces cerevisiae*; K4 = *L. plantarum* Dad 13 dan *Kluyveromyces Marxianus*; K5 = *L. plantarum* Dad 13, *Lc. lactis*, dan *Saccharomyces cerevisiae*; K6 = *L. plantarum* Dad 13, *Lc. lactis*, dan *Kluyveromyces Marxianus*; K7 = *Lc. lactis*; K8 = *Lc. lactis*, dan *Saccharomyces cerevisiae*; dan K9 = *Lc. lactis*, dan *Kluyveromyces Marxianus*. Semua perlakuan diinkubasi pada suhu 37°C selama 18 jam. Susu fermentasi yang memiliki aktivitas antioksidan tertinggi selanjutnya diujikan pada tikus DM. Tikus dibagi 5 kelompok perlakuan yaitu: P1 = Tikus normal; P2 = Tikus DM; P3 = Tikus DM diberi susu fermentasi 1 ml/200 g bb/hari; P4 = Tikus DM diberi susu fermentasi 2 ml/200 g bb/hari; P5 = Tikus DM diberi susu fermentasi 3 ml/200 g bb/hari. Hasil penelitian menunjukkan kombinasi starter berpengaruh terhadap karakteristik mikrobiologis, kimia, organoleptik dan aktivitas antioksidan susu fermentasi. Susu fermentasi memiliki total bakteri asam laktat yakni 8,15-8,46 log cfu/ ml, pH 3,62-4,56, keasaman 0,50-1,18%, kadar laktosa 3,58-4,18%, alkohol 0,04-0,10%, beta karoten 0,05-0,08% serta aktivitas antioksidan 43,04-48,10%. Susu fermentasi dengan kombinasi starter *L. plantarum* Dad 13, *Lc. lactis*, dan *Saccharomyces cerevisiae* memiliki aktivitas antioksidan tertinggi dan selanjutnya digunakan untuk diuji cobakan pada tikus DM. Pemberian susu fermentasi selama 28 hari pada tikus DM mampu menurunkan kadar glukosa darah dari 341,11 menjadi 116,98 mg/dl, resistensi insulin dari 12,16 menjadi 2,81, kadar MDA plasma dari 4,20 menjadi 2,16 dan meningkatkan ekspresi GLUT 4 jaringan otot skelet. Jumlah sel yang mengekspresikan GLUT 4 sebesar 86,66%. Tidak ada perbedaan pada kadar insulin sebelum dan sesudah perlakuan. Kesimpulan yang diperoleh adalah perbedaan kombinasi starter dapat mempengaruhi karakteristik mikrobiologis, kimia, organoleptik dan aktivitas antioksidan susu fermentasi. Suplementasi susu fermentasi dengan kombinasi *L. plantarum* Dad 13, *Lc. lactis*, dan *Saccharomyces cerevisiae* 1 ml/200g bb/hr dapat berperan sebagai makanan fungsional antidiabetes melalui mekanisme penurunan kadar glukosa darah, resistensi insulin, kadar MDA serta peningkatan ekspresi GLUT 4 otot skelet tikus DM tipe 2.

**Kata kunci:** Antidiabetes, Bakteri asam laktat, Susu fermentasi, Yeast.

**MILK FERMENTED USING STARTER COMBINATION *Lactobacillus plantarum* Dad 13  
*Lactococcus lactis* AND YEAST AS  
ANTIDIABETES FUNCTIONAL FOOD**

**ABSTRACT**

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The aims of this study was to evaluate the microbiological, chemical, organoleptic characteristics, and antioxidant activity of milk fermented by *Lactobacillus plantarum* Dad 13, *Lactococcus lactis* 0086, *Saccharomyces cerevisiae* 3012 and *Kluyveromyces marxianus* 3011, and their effects on blood glucose level, insulin resistance, level of MDA plasma and expression of GLUT 4 in type 2 diabetes mellitus rats (DM). Fermented milk consisted of 9 combination of starter i.e. K1 = *L. plantarum* Dad 13; K2 = *L. plantarum* Dad 13 and *Lc. lactis*; K3 = *L. plantarum* Dad 13 and *Saccharomyces cerevisiae*; K4 = *L. plantarum* Dad 13 and *K. Marxianus*; K5 = *L. plantarum* Dad 13, *Lc. lactis*, and *Saccharomyces cerevisiae*; K6 = *L. plantarum* Dad 13, *Lc. lactis*, and *Kluyveromyces Marxianus*; K7 = *Lc. lactis*; K8 = *Lc. lactis* and *Saccharomyces cerevisiae*; and K9 = *Lc. lactis*, and *Kluyveromyces Marxianus*. The treatments were done at 37°C during 18 hours. Fermented milk with the highest of antioxidant activity was subsequently tested on DM rats that were divided into 5 groups, namely: K1 = normal rats; K2 = DM rats; K3 = DM rats treated with 1 ml/200 g bw/day fermented milk; K4 = DM rats treated with 2 ml/200 g bw/day fermented milk; and K5 = DM rats treated with 3 ml/200 g bw/day fermented milk. The results showed that different combinations of starter affect the microbiological, chemical and organoleptic characteristics also antioxidant activity of fermented milk. Total LAB content 8,15 to 8,46 (in log cfu/ml), pH 3,62 to 4,56, acidity 0,05 to 0,08%, and antioxidant activity 43,04 to 48,10% found within fermented milk. Fermented milk with the highest antioxidant activity from starter combination of *L. plantarum* Dad 13, *Lc. lactis*, and *Saccharomyces cerevisiae* was supplemented on DM rats. Treatment with fermented milk for 28 days to DM rats was capable in lowering blood glucose level from 341,11 to 116,98 mg/dl, the value of insulin resistance from 12,16 to 2,81, and level of MDA plasma from 4,20 to 2,16 and increased the expression of GLUT 4 of skeletal muscle tissue. Total cells that expressed GLUT 4 found to be 86,66%. There was no different in insulin level before and after treatment. It was concluded that the difference combination of starter could improve the microbiological, chemical, and organoleptic characteristics and also enhanced the antioxidant activity of fermented milk. Supplementation of fermented milk from starter combination *L. plantarum* Dad 13, *Lc. lactis*, dan *Saccharomyces cerevisiae* 1 ml/200g bw/day could play a role as antidiabetic functional food through mechanisms of lowering blood glucose level, insulin resistance, MDA level, and also increase in GLUT 4 expression of skeletal muscle from type 2 DM rats.

**Keywords:** Antidiabetic, Fermented milk, Lactic acid bacteria, Yeast.