

ANTI-INFLAMMATORY EFFECTS OF RICE BRAN-FORTIFIED READY-TO-USE THERAPEUTIC FOOD DIGESTATES IN A CACO-2/HT29-MTX/THP-1 TRICULTURE MODEL

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**FOOD TECHNOLOGY STUDY PROGRAM
FACULTY OF ENGINEERING AND TECHNOLOGY
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ABSTRACT

ALIKA DIANASMARA PRAWIRADILAGA. Anti-Inflammatory Effect of Rice Bran-Fortified Ready-to-Use Therapeutic Food Digestates in Caco-2/HT29-MTX/THP-1 Triculture Model. Supervised by **PUSPO EDI GIRIWONO** and **VIRGINIE VIVES**.

Severe Acute Malnutrition is frequently associated with Environmental Enteric Dysfunction, necessitating therapeutic foods that provide both high nutritional density and immunomodulatory benefits. Ready-to-Use Therapeutic Food contain ingredients such as skim milk powder, wheat flour, and the addition of 5% Rice Bran that are hoping to give additional benefits. This study aimed to evaluate anti-inflammatory effects of RUTF + 5% Rice Bran formulation by comparing them to standard RUTF samples supplied by the SEAFast Center IPB. The experiment focused on monitoring cellular immune responses *in vitro*, where the production of pro-inflammatory cytokine human Interleukin-8 (IL-8) and Tumor Necrosis Factor-alpha (TNF α) was challenged using Lipopolysaccharide (LPS) and Interferon-gamma (IFN- γ) stimulation. The Neutral Red cell viability assay test revealed that *In Vitro* Digestion (IVD) product formulations were non-toxic and preserved lysosomal integrity at a 1/5 dilution. In the Phenol Red permeability test, the addition of RUTF + 5% Rice Bran digestate has shown to maintain tight junction integrity and low diffusion coefficients despite exposure to the inflammatory environment. Furthermore, ELISA test results revealed that pre-treatment with RUTF + 5% Rice Bran digestate has shown to have higher levels of pro-inflammatory cytokine biomarkers secretion of IL-8 but lower TNF α secretion than Inflammatory digestate, the difference in results begs the need for more comprehensive experiments.

Keywords: Anti-Inflammatory, Environmental Enteric Dysfunction, *In Vitro* Digestion Model, Rice Bran, RUTF.



ABSTRAK

ALIKA DIANASMARA PRAWIRADILAGA. Efek Anti-Inflamasi Digestat *Ready-to-Use Therapeutic Food* (RUTF) yang Difortifikasi *Rice bran* pada Model Trikultur *Caco-2/HT29-MTX/THP-1*. Dibimbing oleh **PUSPO EDI GIRIWONO** dan **VIRGINIE VIVES**.

Severe Acute Malnutrition sering berkaitan erat dengan *Environmental Enteric Dysfunction*, sehingga membutuhkan pangan terapi yang tidak hanya berkepadatan gizi tinggi tetapi juga memberikan manfaat *immunomodulatory*. *Ready-to-Use Therapeutic Food* / RUTF memanfaatkan bahan-bahan seperti susu bubuk skim, tepung terigu, serta penambahan 5% *rice bran* yang diharapkan mampu memberikan manfaat ekstra. Penelitian ini bertujuan untuk mengevaluasi efek anti-inflamasi dari formulasi RUTF + 5% *rice bran* dengan membandingkannya terhadap sampel RUTF standar buatan SEAFast Center IPB. Pengujian berfokus pada pemantauan respon imun seluler secara *in vitro*, di mana produksi sitokin pro-inflamasi *human Interleukin-8* (IL-8) dan *Tumor Necrosis Factor-alpha* (TNF α) dipicu menggunakan stimulasi *Lipopolysaccharide* (LPS) dan *Interferon-gamma* (IFN- γ). Uji viabilitas sel *Neutral Red* menunjukkan bahwa hasil cerna *In Vitro Digestion* (IVD) dari formulasi ini bersifat tidak toksik serta mampu menjaga integritas lisosom pada pengenceran 1/5. Pada uji permeabilitas *Phenol Red*, penambahan hasil cerna RUTF + 5% *rice bran* terbukti dapat mempertahankan integritas *tight junction* dan menjaga koefisien difusi tetap rendah meskipun dipaparkan pada kondisi inflamasi. Lebih lanjut, hasil uji ELISA mengungkapkan bahwa pra-perlakuan dengan hasil cerna RUTF + 5% *rice bran* menghasilkan sekresi biomarker sitokin pro-inflamasi IL-8 yang lebih tinggi, namun sekresi TNF α yang lebih rendah dibandingkan dengan kontrol inflamasi. Perbedaan hasil ini mengindikasikan perlunya penelitian yang lebih komprehensif ke depannya.

Kata Kunci: Anti-inflamasi, *Environmental Enteric Dysfunction*, Model *In Vitro Digestion*, Rice Bran, RUTF.

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ALIKA DIANASMARA PRAWIRADILAGA

Undergraduate Thesis

As one of the requirements to obtain a Bachelor's degree in the
Food Technology Study Program

**FOOD TECHNOLOGY STUDY PROGRAM
FACULTY OF ENGINEERING AND TECHNOLOGY
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PREFACE

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