

AKTIVITAS ANTIDIABETES EKSTRAK CAMPURAN DAUN GAHARU (*Aquilaria malaccensis* Lamk.), TEH (*Camellia sinensis* (L.) Kuntze) HITAM, DAN JAHE MERAH (*Zingiber officinale* var. *rubrum* Theilade) SECARA IN VITRO DAN IN SILICO

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INTISARI

Diabetes mellitus (DM) merupakan gangguan metabolisme kronis ditandai dengan peningkatan glukosa dalam darah yang melebihi batas normal. Penggunaan obat sintetik untuk DM memberikan efek samping sehingga masyarakat mulai menggunakan bahan herbal karena lebih aman dan terjangkau. Daun gaharu (*Aquilaria malaccensis*) berkhasiat sebagai antidiabetes, antihiperglikemia, antioksidan, antibakteri, dan sebagainya. Teh (*Camellia sinensis*) hitam dan jahe merah (*Zingiber officinale* var. *rubrum*) dipilih untuk mengoptimalkan fungsinya sebagai teh herbal dan mendukung bioaktivitas antidiabetes. Riset sebelumnya melaporkan kombinasi gaharu dan kayu manis memiliki efek inhibisi enzim α -amilase yang lebih baik dibandingkan bahan tunggalnya. Namun, belum ada penelitian mengenai kombinasi dari daun gaharu, teh hitam, dan jahe merah untuk dijadikan teh herbal antidiabetes. Penelitian ini bertujuan untuk mengetahui aktivitas antidiabetes, rasio kombinasi terbaik, profil metabolit sekunder serta bioaktivitas teh herbal campuran daun gaharu, teh hitam, dan jahe merah. Metode penelitian yang dilakukan adalah ekstraksi dengan metode maserasi, uji aktivitas inhibisi enzim α -amilase, analisis profil metabolit sekunder dengan GC-MS, dan skrining PASS Online. Ekstrak campuran dibuat dengan perbandingan gaharu, teh hitam, dan jahe merah secara berturut-turut sebagai M1 (1:0,75:0,75), M2 (1:0,75:0,50), dan M3 (1:0,75:0,25). Aktivitas inhibisi α -amilase ekstrak campuran M1 ($IC_{50} = 1,385 \pm 0,087 \mu\text{g/mL}$) lebih tinggi dibandingkan ekstrak tunggalnya yaitu *A. malaccensis* ($IC_{50} = 8,232 \pm 0,222 \mu\text{g/mL}$), *Z. officinale* var. *rubrum* ($IC_{50} = 59,946 \pm 0,130 \mu\text{g/mL}$), dan *C. sinensis* ($IC_{50} = 111,163 \pm 0,532 \mu\text{g/mL}$). Profil metabolit sekunder ekstrak tunggal dan campuran *A. malaccensis*, *C. sinensis*, dan *Z. officinale* var. *rubrum* mengandung berbagai jenis terpenoid, asam lemak, fenolik, alkaloid, alkana, aldehyd, keton, ester, steroid, sterol, dan alkohol. Berdasarkan skrining PASS Online, senyawa-senyawa pada ekstrak M1 dengan persen area tertinggi meliputi *zingerone*, *caffeine*, *cis-6-shogaol*, *squalene*, dan *n-hexadecanoic acid* menunjukkan bioaktivitasnya sebagai antidiabetes, antioksidan, antiobesitas, antimikrobia, neuromodulator, immunomodulator, dan lain-lain. Oleh karena itu, ekstrak campuran gaharu, teh hitam, dan jahe merah bersifat sinergis dan berpotensi sebagai agen antidiabetes.

Kata kunci : antidiabetes, *Aquilaria malaccensis*, *Camellia sinensis*, inhibisi α -amilase, metabolit sekunder, *Zingiber officinale* var. *rubrum*

ANTIDIABETIC ACTIVITY OF MIXED EXTRACT OF AGARWOOD (*Aquilaria malaccensis* Lamk.) LEAVES, BLACK TEA (*Camellia sinensis* (L.) Kuntze), AND RED GINGER (*Zingiber officinale* var. *rubrum* Theilade) IN VITRO AND IN SILICO

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ABSTRACT

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by an increase in blood glucose that exceeds normal limits. The use of synthetic drugs for DM gives side effects so that people start using herbal ingredients because they are safer and more affordable. Agarwood leaves (*Aquilaria malaccensis*) are efficacious as antidiabetic, antihyperglycemia, antioxidant, antibacterial, and so on. Black tea (*Camellia sinensis*) and red ginger (*Zingiber officinale* var. *rubrum*) were selected to optimize their function as herbal tea and support antidiabetic bioactivity. Previous research reported that the combination of agarwood and cinnamon has a better α -amylase enzyme inhibition effect than the single ingredients. However, there is no research on the suitable combination of agarwood leaves, black tea, and red ginger to be used as antidiabetic herbal tea. This study aims to determine the antidiabetic activity, the best combination ratio, the secondary metabolite profile, and the bioactivity of herbal tea mixed with agarwood leaves, black tea, and red ginger. The research methods were extraction by maceration method, α -amylase enzyme inhibition activity test, secondary metabolite profile analysis by GC-MS, and PASS Online screening. Mixed extracts were made with the ratio of agarwood, black tea, and red ginger as M1 (1:0.75:0.75), M2 (1:0.75:0.50), and M3 (1:0.75:0.25), respectively. The α -amylase inhibitory activity of the mixed extract M1 ($IC_{50} = 1.385 \pm 0.087 \mu\text{g/mL}$) was higher than the single extract of *A. malaccensis* ($IC_{50} = 8.232 \pm 0.222 \mu\text{g/mL}$), *Z. officinale* var. *rubrum* ($IC_{50} = 59.946 \pm 0.130 \mu\text{g/mL}$), and *C. sinensis* ($IC_{50} = 111.163 \pm 0.532 \mu\text{g/mL}$). Secondary metabolite profiles of single and mixed extracts of *A. malaccensis*, *C. sinensis*, and *Z. officinale* var. *rubrum* contain various types of terpenoids, fatty acids, phenolics, alkaloids, alkanes, aldehydes, ketones, esters, steroids, sterols, and alcohols. Based on PASS Online screening, the compounds in M1 extract with the highest percent area include zingerone, caffeine, cis-6-shogaol, squalene, and n-hexadecanoic acid showing their bioactivity as antidiabetic, antioxidant, antiobesity, antimicrobial, neuromodulator, immunomodulator, and others. Therefore, mixed extract of agarwood, black tea, and red ginger is synergistic and has potential as an antidiabetic agent.

Keywords : α -amylase inhibition, antidiabetic, *Aquilaria malaccensis*, *Camellia sinensis*, secondary metabolite, *Zingiber officinale* var. *rubrum*