

Synergistic Potential of Cisplatin and *Eclipta alba* Extract Against HeLa Cervical Cancer Cells: An *In Vitro* Study

Potensi Sinergis Kombinasi Cisplatin dan Ekstrak *Eclipta alba* terhadap Sel Kanker Serviks HeLa: Studi *In Vitro*

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Abstract

Cervical cancer remains a major cause of cancer-related mortality among women worldwide, particularly in developing countries. In Indonesia, it ranks fourth in incidence. Cisplatin is a first-line chemotherapeutic agent; however, its use is limited by resistance and dose-dependent toxicity. This study evaluated the cytotoxic and synergistic effects of cisplatin in combination with *Eclipta alba* extract on HeLa cervical cancer cells. The extract was prepared by maceration and characterized using TLC and LC-MS, which confirmed the presence of coumarins, flavonoids, triterpenoid saponins, wedelolactone, luteolin, and eclalbasaponin. Cytotoxicity was assessed using the MTT assay. The IC₅₀ values were 1.15 ± 0.16 µg/mL for cisplatin, 598.29 ± 42.89 µg/mL for the extract, and 64.55 µg/mL for the combination. All tested combination ratios yielded CI values < 1, indicating synergistic interactions. These findings suggest that *E. alba* extract has potential as a chemotherapeutic adjuvant to enhance cisplatin efficacy while reducing toxicity.

Keywords: cervical cancer, cisplatin, *Eclipta alba*, HeLa cells, synergistic effect

Abstrak

Kanker serviks masih menjadi penyebab utama kematian terkait kanker pada perempuan di seluruh dunia, terutama di negara berkembang. Di Indonesia, kanker serviks menempati peringkat keempat berdasarkan angka kejadian. Cisplatin merupakan agen kemoterapi lini pertama namun, penggunaannya sering dibatasi oleh resistensi dan toksisitas yang bergantung pada dosis. Penelitian ini bertujuan untuk mengevaluasi efek sitotoksik dan

sinergis kombinasi cisplatin dengan ekstrak *Eclipta alba* pada sel kanker serviks HeLa. Ekstrak disiapkan melalui metode maserasi dan dikarakterisasi menggunakan KLT dan LC-MS, yang mengonfirmasi keberadaan kumarin, flavonoid, saponin triterpenoid, wedelolakton, luteolin, dan eclalbasaponin. Uji sitotoksitas dilakukan menggunakan metode MTT. Nilai IC_{50} masing-masing adalah $1,15 \pm 0,16 \mu\text{g/mL}$ cisplatin, $598,29 \pm 42,89 \mu\text{g/mL}$ ekstrak, dan $64,55 \mu\text{g/mL}$ kombinasi. Seluruh rasio kombinasi yang diuji menghasilkan nilai indeks kombinasi (CI) < 1 , yang menunjukkan adanya interaksi sinergis. Temuan ini menunjukkan bahwa ekstrak *E. alba* berpotensi digunakan sebagai adjuvan kemoterapi untuk meningkatkan efektivitas cisplatin sekaligus mengurangi toksisitasnya.

Kata Kunci: kanker serviks, cisplatin, *Eclipta alba*, sel HeLa, efek sinergis.

Introduction

According to the World Health Organization (WHO), cancer remains one of the leading causes of global mortality, accounting for nearly 10 million deaths in 2020. Cervical cancer is among the malignancies that significantly contribute to this number. Approximately 99.7% of cervical cancer cases are attributed to persistent infections with high-risk human papillomavirus (HPV), particularly types 16 and 18, which infect the squamous epithelium of the cervical transformation zone and promote the development of precancerous lesions (Nabi et al., 2025). Globally, cervical cancer ranks as the fourth most common cancer affecting women. In 2022, approximately 660,000 new cases and 350,000 deaths were reported, with around 94% of these occurring in low- and middle-income countries (WHO, 2024). In Indonesia, cervical cancer is the fourth leading cause of cancer-related mortality, with 36,964 new cases and 20,708 deaths reported in 2022 (GLOBOCAN, 2022). These figures are largely attributed to low rates of early detection, limited access to healthcare technologies, and inadequate public awareness.

The primary therapeutic modalities for cancer include surgery, radiotherapy, and chemotherapy (Ismail et al., 2021). In Indonesia, chemotherapy remains the most widely used treatment, with a prevalence of 24.9% (Kemenkes RI, 2018). Cisplatin is the standard first-line chemotherapeutic agent for various malignancies, including cervical cancer (Ranasinghe et al., 2022). However, its clinical utility is limited by severe adverse effects, including nephrotoxicity (20–35% of patients), neurotoxicity, and the emergence of drug resistance (Fang et al., 2021; Elmorsy et al., 2024). Therefore, novel therapeutic strategies are urgently needed to enhance treatment efficacy while minimizing toxicity. Several studies have