ABSTRAK

Pengaruh Nanopartikel PLGA Ekstrak Etanol Sambiloto (*Andrographis paniculata*) terhadap Ekspresi mRNA dan Kadar Protein IL-1β dan TNF-α pada Sel RAW 264.7 yang Diinduksi Lipopolisakarida

Latar Belakang: IL-1β dan TNF-α merupakan sitokin proinflamasi utama. Ekstrak etanol *Andrographis paniculata* (sambiloto) berpotensi sebagai antiinflamasi, namun keterbatasan bioavailabilitas dapat mengurangi efektivitasnya. Formulasi ekstrak dalam nanopartikel PLGA diharapkan meningkatkan penghantaran dan aktivitas biologisnya. **Metode:** Studi *in vitro* pada sel RAW 264.7 yang diinduksi lipopolisakarida. Perlakuan dibagi menjadi 9 kelompok meliputi kontrol sehat (A), kontrol sakit (B), nanopartikel PLGA ekstrak etanol sambiloto 200–600 ppm (C–G), ekstrak etanol sambiloto 500 ppm (H), dan nanopartikel PLGA kosong (I). Ekspresi mRNA IL-1β dan TNF-α dianalisis dengan RT-qPCR (metode 2^−ΔΔCq), sedangkan kadar protein diukur dengan ELISA. Analisis statistik menggunakan *ANOVA* dan *Welch ANOVA* dilanjutkan dengan *post hoc Tukey's* dan *Dunnett's T3*. **Hasil:** Nanopartikel PLGA ekstrak etanol sambiloto menurunkan mRNA dan protein IL-1β serta TNF-α secara signifikan dibanding kontrol LPS (p<0,05). Penurunan protein terbesar terjadi pada 400 ppm, sedangkan mRNA terendah pada 600 ppm. Korelasi mRNA–protein kuat pada IL-1β (r=0,91; p<0,05) dan TNF-α (r=0,795; p<0,05). **Kesimpulan:** Nanopartikel PLGA ekstrak etanol sambiloto dapat menurunkan IL-1β dan TNF-α pada model inflamasi RAW 264.7 terinduksi LPS.

Kata kunci: *Andrographis paniculata*; sambiloto; PLGA nanopartikel; IL-1β; TNF-α; RAW 264.7

ABSTRACT

Effect of PLGA–Ethanolic Extract of *Andrographis paniculata* Nanoparticles on IL-1β and TNF-α mRNA Expression and Protein Levels in Lipopolysaccharide-Stimulated RAW 264.7 Cells

Background: IL-1β and TNF-α are major pro-inflammatory cytokines. The ethanolic extract of *Andrographis paniculata* (sambiloto) has anti-inflammatory potential; however, limited bioavailability may reduce its effectiveness. Encapsulation of the extract in PLGA nanoparticles is expected to enhance delivery and biological activity. **Methods:** This in vitro study used RAW 264.7 cells induced with lipopolysaccharide (LPS). Treatments were divided into nine groups: healthy control (A), LPS-stimulated control (B), PLGA nanoparticles loaded with ethanolic *A. paniculata* extract at 200–600 ppm (C–G), ethanolic extract 500 ppm (H), and blank PLGA nanoparticles (I). IL-1β and TNF-α mRNA expression was analyzed by RT-qPCR (2^−ΔΔCq method), while protein levels were measured by ELISA. Statistical analysis employed *ANOVA* and *Welch ANOVA* followed by *Tukey's* and *Dunnett's T3* post hoc tests. **Results:** PLGA nanoparticles loaded with ethanolic *A. paniculata* extract significantly reduced IL-1β and TNF-α mRNA expression and protein levels compared with the LPS control ($p<0.05$). The greatest protein reduction occurred at 400 ppm, whereas the lowest mRNA expression was observed at 600 ppm. Strong mRNA–protein correlations were observed for IL-1β ($r=0.91$; $p<0.05$) and TNF-α ($r=0.795$; $p<0.05$). **Conclusion:** PLGA nanoparticles containing ethanolic *A. paniculata* extract reduced IL-1β and TNF-α in an LPS-induced RAW 264.7 inflammation model.

Keywords: *Andrographis paniculata*; PLGA nanoparticles; IL-1β; TNF-α; RAW 264.7