

**PENGARUH *NANOSTRUCTURED LIPID CARRIERS* EKSTRAK
ETANOL SAMBILOTO (*Andrographis paniculata*) TERHADAP KADAR
ALT, AST, DAN BILIRUBIN MENCIT BALB/C YANG DIINDUKSI CCl₄**

ABSTRAK

Latar Belakang: Penyakit hati merupakan masalah kesehatan global yang dapat dipicu oleh paparan zat hepatotoksik, salah satunya karbon tetraklorida (CCl₄), yang diketahui menimbulkan stres oksidatif dan meningkatkan kadar ALT, AST, bilirubin. *Andrographis paniculata* (sambiloto) mengandung *andrographolide* dan flavonoid dengan aktivitas antioksidan yang berpotensi menekan stres oksidatif pada jaringan hati, meskipun pemanfaatannya masih terbatas akibat rendahnya bioavailabilitas. Pengembangan sistem penghantaran berbasis *Nanostructured Lipid Carriers* (NLC) diharapkan mampu meningkatkan stabilitas dan efektivitas senyawa aktif sambiloto.

Tujuan: Penelitian ini bertujuan untuk mengetahui pengaruh NLC ekstrak etanol sambiloto terhadap kadar ALT, AST, dan bilirubin mencit BALB/c yang diinduksi CCl₄.

Metodologi: Penelitian ini merupakan studi eksperimental dengan desain *post-test only with control group*. Sebanyak 30 mencit BALB/c dibagi ke dalam lima kelompok, yaitu kontrol sehat, kontrol sakit yang diinduksi CCl₄, serta tiga kelompok perlakuan yang diinduksi CCl₄ dan diberikan NLC ekstrak etanol sambiloto, ekstrak etanol sambiloto, dan NLC kosong. Perlakuan diberikan pada hari ke-3 dan ke-5. Kadar ALT, AST, dan bilirubin total dianalisis menggunakan uji One-Way ANOVA dan Kruskal-Wallis dengan *software* statistik *GraphPad Prism* versi 10.

Hasil: Kelompok yang menerima NLC ekstrak etanol sambiloto memiliki median kadar ALT sebesar 94 IU/L, serta rerata kadar AST dan bilirubin total masing-masing sebesar 122,2 IU/L dan 0,2275 mg/dL, yang lebih rendah dibandingkan dengan kelompok kontrol sakit. Secara statistik tidak ditemukan perbedaan bermakna kadar ALT ($p = 0,2465$), AST ($p = 0,4829$), dan bilirubin total ($p = 0,1335$) antar kelompok.

Kesimpulan: Pemberian NLC ekstrak etanol sambiloto belum menunjukkan pengaruh yang signifikan terhadap parameter fungsi hati pada mencit yang diinduksi CCl₄.

Kata Kunci: ALT, AST, bilirubin, CCl₄, *Nanostructured Lipid Carrier* (NLC), Sambiloto (*Andrographis paniculata*).

**THE EFFECT OF NANOSTRUCTURED LIPID CARRIER-BASED
ETHANOLIC EXTRACT OF SAMBILOTO (*Andrographis paniculata*) ON
ALT, AST, AND BILIRUBIN LEVELS IN CCL₄-INDUCED BALB/C MICE**

ABSTRACT

Background: Liver disease is a global health problem that can be triggered by exposure to hepatotoxic agents, one of which is carbon tetrachloride (CCl₄) known to induce oxidative stress and increase ALT, AST, and bilirubin levels. *Andrographis paniculata* (sambiloto) contains andrographolide and flavonoids with antioxidant activity that have the potential to suppress oxidative stress in hepatic tissue; however, its utilization remains limited due to low bioavailability. The development of a drug delivery system based on Nanostructured Lipid Carriers (NLC) is expected to enhance the stability and effectiveness of sambiloto's active compounds.

Objective: This study aimed to determine the effect of NLC containing ethanolic extract of sambiloto on ALT, AST, and bilirubin levels in CCl₄-induced BALB/c mice.

Methodology: This study was conducted as an experimental study using a post-test only with control group design. A total of 30 BALB/c mice were divided into five groups: a healthy control group, a disease control group induced with CCl₄, and three treatment groups induced with CCl₄ and administered NLC-loaded ethanol extract of sambiloto, ethanol extract of sambiloto, and empty NLC, respectively. Treatments were administered on days 3 and 5. ALT, AST, and total bilirubin levels were analyzed using Kruskal-Wallis tests and One-Way ANOVA with GraphPad Prism version 10.

Results: The group receiving NLC of ethanol extract of *Andrographis paniculata* had a median ALT level of 94 IU/L, as well as mean AST and total bilirubin levels of 122,2 IU/L and 0,2275 mg/dL, respectively, which were lower than those of the disease control group. However, no statistically significant differences are observed in ALT ($p = 0,2465$), AST ($p = 0,4829$), or total bilirubin levels ($p = 0,1335$) among the groups.

Conclusion: Administration of NLC-loaded ethanol extract of sambiloto does not show a significant effect on liver function parameters in CCl₄-induced mice.

Keywords: ALT, AST, bilirubin, CCl₄, Nanostructured Lipid Carrier (NLC), Sambiloto (*Andrographis paniculata*).