Motilitas *Colon* dan Ekspresi Penanda Penuaan pada Tikus *Sprague Dawley* Jantan yang Diinduksi D-galaktosa

Abstrak

Latar belakang: Penuaan merupakan proses kompleks yang ditandai oleh penghentian siklus sel, perubahan struktur *nucleus*, dan peningkatan *Senescence-Associated Secretory Phenotype* (SASP). Induksi D-galaktosa (D-gal) banyak digunakan sebagai model penuaan eksperimental, namun karakteristik perubahan penuaan pada *colon* masih belum sepenuhnya dipahami. Penelitian ini bertujuan mengevaluasi penuaan *colon* secara komprehensif melalui pendekatan fisiologis, histologis, dan molekuler pada model tikus yang diinduksi D-galaktosa.
Metode: Tikus jantan *Sprague Dawley*, 12 minggu (n=12) dibagi menjadi kelompok kontrol dan D-gal (100 mg/kgBB/hari selama 6 minggu). Parameter fisiologis meliputi waktu transit *colon* dan jumlah feses. Analisis struktur dilakukan dengan pewarnaan hematoksilin-eosin dan imunohistokimia terhadap $p^{16INK4a}$, LMNB1, dan IL-1β. Analisis molekuler dilakukan menggunakan RT-qPCR untuk gen *p53, Cdkn1a, Il-6, Il-1β,* dan *Lmnb1*.
Hasil: Pada kelompok D-gal didapatkan pemendekan waktu transit *colon* (p<0,05) disertai skor kerusakan *epitheliocytus*, *myocytus levis*, dan infiltrasi *leucocytus* yang lebih tinggi secara signifikan (p<0,01). Analisis secara molekuler menunjukkan peningkatan ekspresi *Il-1β* (p<0,01) disertai peningkatan skor $p^{16INK4a}$ pada imunohistokimia (p<0,05).
Simpulan: Induksi D-galaktosa 100 mg/ kgBB/ hari selama 6 minggu memicu penuaan awal pada *colon* yang ditandai oleh perubahan fungsional, struktural, dan molekuler, serta peningkatan aktivitas inflamasi.

Kata Kunci: *colon*, D-galaktosa, penuaan tahap awal, struktur, molekuler

Colonic Motility and Expression of Aging Markers in Male Sprague Dawley Rats Induced by D-galactose

Abstract

Background: *Aging is a complex process characterized by cell cycle arrest, alterations in nuclear structure, and increased Senescence-Associated Secretory Phenotype (SASP). D-galactose (D-gal) induction is widely used as an experimental aging model; however, the characteristics of aging-related changes in the colon remain incompletely understood. This study aimed to comprehensively evaluate colonic aging through physiological, histological, and molecular approaches in a D-galactose-induced rat model.*
Methods: *Twelve-week-old male Sprague Dawley rats (n=12) were divided into control and D-gal groups receiving D-galactose (100 mg/kgBW/day for 6 weeks). Physiological parameters included colonic transit time and fecal output. Structural analysis was performed using hematoxylin-eosin staining and immunohistochemistry for* $p16^{INK4a}$, LMNB1, *and* IL-1β. *Molecular analysis was conducted using RT-qPCR for p53, Cdkn1a, Il-6, Il-1β, and Lmnb1 genes.*
Results: *The D-gal group showed shortened colonic transit time ($p<0.05$), accompanied by significantly higher scores for epithelial damage, smooth muscle damage, and leucocyte infiltration ($p<0.01$). Molecular analysis revealed increased Il-1β expression ($p<0.01$), along with higher score of* $p16^{INK4a}$ *expression detected by immunohistochemistry ($p<0.05$).*
Conclusion: *D-galactose induction at 100 mg/kgBW/day for 6 weeks induced early colonic aging characterized by functional, structural, and molecular alterations, as well as increased inflammatory activity.*

Keywords : colon, D-galactose, early aging, structure, molecular