

Hepatoprotective effect of polyphenols of marine brown algae *Sargassum graminifolium* through modulation of Nrf2/HO-1

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Received 21 November 2025; revised 12 January 2026

Bioactive compounds from the marine brown algae *Sargassum graminifolium* protect against toxin-induced liver injury. In this study, we assessed the hepatoprotective effects of *Sargassum graminifolium* against CCl₄ toxicity in rats via the activation of the Nrf2/HO-1 pathway. Marine polyphenols were fractionated and quantified using the DMBA assay and characterized using LC-MS and FT-IR. The experimental groups were as follows: Group I (normal saline), Group II (CCl₄ 1mL/kg in olive oil), Group III (silymarin 50 mg/kg+ CCl₄), and Groups IV and V (polyphenol extract of *Sargassum graminifolium* 200 and 400 mg/kg+CCl₄). LC-MS analysis identified 7-hydroxyeckol (*m/z* 387.2921) and hydroxytrifluhalol A (*m/z* 405.3619), along with other unknown biologically active compounds exhibiting antioxidant activity. The extract significantly (*p* ≤ 0.05) reduced liver biomarkers, lipid profiles, and inflammatory cytokines (IL-1β, IL-6, TNF-α, and NF-κB), while enhancing tissue antioxidants and reducing MDA levels to restore CCl₄ toxicity. Furthermore, the probable mechanism of action for the hepatoprotective effect of *Sargassum graminifolium* was observed through upregulation of the Nrf2/HO-1 signaling pathway and rebuilding of liver histopathological alterations. In conclusion, the present study demonstrated that the polyphenol fraction of *S. graminifolium* prevents CCl₄-induced liver injury by upregulating the Nrf2/HO-1 pathway and exhibits potential antioxidant and anti-inflammatory effects.

Keywords: Liver toxicity, Polyphenols, Anti-inflammation, Antioxidant