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Protective effect of Moringa oleifera Lam. leaf extract against oxidative

stress, inflammation, depression, and apoptosis in a mouse model

## of hepatic encephalopathy

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The present study aimed to assess the antioxidative, anti-inflammatory, antiapoptotic, and anti-depression impacts of *Moringa oleifera* Lam. leaf ethanolic extract (MOLE) in the hippocampus and cerebral cortex of  $CCl_4$ -induced hepatic encephalopathy mouse model. High-performance liquid chromatography was used to detect marker compounds: rutin and  $\beta$  sitosterol.

Animals were divided into four groups: vehicle group,  $CCl_4$ -treated group, MOLE-treated group, and ( $CCl_4 + MOLE$ ) group treated with MOLE for 14 days before  $CCl_4$ -induced neurotoxicity. MOLE decreased alanine aminotransferase, aspartate aminotransferase, corticosterone, and ammonia levels in serum and improved the antioxidant status of  $CCl_4$ -treated mice in the hippocampus and cerebral cortex. It reduced the expression of toll-like receptor 4 (TLR4), TLR2, myeloid differentiation primary response 88 (MYD88), and nuclear factor-kappa B (NF- $\kappa$ B) genes and the protein levels of the pro-inflammatory cytokines. MOLE also attenuated apoptosis, as revealed by the reduced expression of caspase3, and prevented histological deterioration. Furthermore, MOLE attenuated CCl<sub>4</sub>- induced anxiety and depression-

like behavioral changes. Collectively, MOLE modulates neuroinflammation, oxidative stress, TLR4/2-MyD88/NF- $\kappa$ B signaling, and apoptosis in the hippocampus and cerebral cortex of the hepatic encephalopathy experimental model.