

PENGARUH PEMBERIAN EKSTRAK BUAH KELOR (*MORINGA OLEIFERA*) TERHADAP PROFIL LIPID, KADAR MALONDIALDEHID (MDA) DAN HISTOPATOLOGI NEUROINFLAMASI SEL GLIA PADA TIKUS MODEL OBESITAS

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ABSTRAK

Latar Belakang: Obesitas memicu metaflammation dan stres oksidatif sistemik yang berdampak pada kerusakan integritas sawar darah otak serta neuroinflamasi kronis, khususnya pada medial Prefrontal Cortex (mPFC). Potensi neuroprotektif buah *Moringa oleifera* yang kaya fitokimia lipofilik masih jarang dieksplorasi dibandingkan bagian daunnya. **Tujuan:** Menganalisis pengaruh pemberian ekstrak buah *Moringa oleifera* terhadap profil lipid, kadar Malondialdehid (MDA), dan histopatologi neuroinflamasi mPFC pada tikus model obesitas. **Metode:** Penelitian eksperimental menggunakan 24 ekor tikus Wistar jantan yang dibagi menjadi empat kelompok: Kontrol Normal, Kontrol Negatif (diet HFHS), serta kelompok perlakuan dosis 500 mg/kgBB (KP3) dan 1000 mg/kgBB (KP4). Induksi obesitas dilakukan selama 8 minggu, dilanjutkan perlakuan selama 4 minggu. Parameter meliputi profil lipid, kadar MDA mPFC, Indeks Organ Otak, serta densitas sel glia. Analisis data menggunakan uji ANOVA/Welch dan Tukey ($p < 0,05$). **Hasil:** Induksi diet HFHS berhasil membentuk model obesitas (Indeks Lee $> 0,3$) dengan dislipidemia dan peningkatan kadar MDA mPFC tertinggi (12,91 nmol/ml). Pemberian ekstrak buah kelor dosis 1000 mg/kgBB (KP4) terbukti paling efektif memperbaiki profil lipid, mereduksi kadar MDA hingga level normal (7,35 nmol/ml), serta memulihkan Indeks Organ Otak (0,592). Secara histopatologis, KP4 signifikan memitigasi jumlah dark neurons dan vakuolisasi, serta menjaga densitas sel glia tetap terkendali. **Kesimpulan:** Ekstrak buah *Moringa oleifera* menunjukkan efektivitas neuroprotektif kuat secara dose-dependent, dengan dosis optimal 1000 mg/kgBB. Mekanisme ini dimediasi melalui perbaikan metabolisme lipid dan redaman kaskade stres oksidatif-neuroinflamasi mPFC.

Kata Kunci: *Moringa oleifera*, Obesitas, mPFC, Malondialdehid, Neuroinflamasi, Indeks Organ Otak.

THE EFFECT OF MORINGA OLEIFERA FRUIT EXTRACT ON LIPID PROFILE, MALONDIALDEHYDE (MDA) LEVELS, AND GLIAL CELL NEUROINFLAMMATION HISTOPATHOLOGY IN OBESITY-INDUCED RAT MODELS

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ABSTRACT

Background: Obesity triggers systemic metaflammation and oxidative stress, leading to blood-brain barrier disruption and chronic neuroinflammation, particularly in the medial Prefrontal Cortex (mPFC). The neuroprotective potential of *Moringa oleifera* fruit, which is rich in lipophilic phytochemicals, remains under-explored compared to its leaves. Objective: This study aimed to analyze the effects of *Moringa oleifera* fruit extract on the lipid profile, malondialdehyde (MDA) levels, and mPFC neuroinflammatory histopathology in obese rat models. Methods: This experimental study utilized 24 male Wistar rats divided into four groups: Normal Control (NC), Negative Control (HFHS diet), and two treatment groups receiving *Moringa oleifera* fruit extract at doses of 500 mg/kgBW (KP3) and 1000 mg/kgBW (KP4). Obesity was induced for 8 weeks, followed by a 4-week treatment period. Parameters included lipid profile, mPFC MDA levels, Brain Weight Index, and glial cell density. Data were analyzed using ANOVA/Welch and Tukey's post-hoc tests ($p < 0.05$). Results: The HFHS diet effectively established an obesity model (Lee Index > 0.3) characterized by dyslipidemia and significantly elevated mPFC MDA levels (12.91 nmol/ml). The administration of the extract at 1000 mg/kgBW (KP4) was the most effective in improving the lipid profile, reducing MDA levels to near-normal levels (7.35 nmol/ml), and restoring the Brain Weight Index (0.592). Histopathological observation revealed that KP4 significantly mitigated the number of dark neurons and vacuolization while maintaining controlled glial cell density compared to the negative control. Conclusion: *Moringa oleifera* fruit extract demonstrates potent dose-dependent neuroprotective effects, with 1000 mg/kgBW as the optimal dose. This protective mechanism is mediated through the improvement of systemic lipid metabolism and attenuation of the oxidative stress-neuroinflammation cascade in the mPFC.

Keywords: *Moringa oleifera*, Obesity, mPFC, Malondialdehyde, Neuroinflammation, Brain Weight Index.