

Efek Ekstrak Etanol Daun Moringa Oleifera Asal Ntt Terhadap Perubahan Spasial Memori, Profil Biokimia Darah Dan Mikrobiota Usus Pada Anakan Tikus Dari Induk Defisiensi Protein = The Effects of Moringa oleifera Leaves Ethanolic Extract From NTT on Spatial Memory Changes, Blood Biochemical Profiles, and Intestine Microbiota in Rat Offspring From Protein Deficiency Rat

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Abstrak

Latar Belakang :

Malnutrisi selama kehamilan dan 1.000 hari pertama kehidupan dapat mempengaruhi pertumbuhan fisik, fungsi otak dan perkembangan hipokampus. Moringa oleifera (MO), telah digunakan sebagai suplemen makanan pada malnutrisi. Penelitian ini bertujuan untuk menguji efektifitas kandungan protein dari ekstrak etanol daun MO (EEMO) dalam mengatasi defisiensi protein pada anakan tikus dari induk defisiensi protein.

Metode :

Daun MO asal kabupaten Kupang, propinsi NTT diekstraksi dengan metode UAE dalam etanol dan dikarakterisasi (EEMO). Anakan tikus Sprague dawley usia 3 minggu dari induk yang mendapat diet protein rendah (9% protein) diberikan terapi EEMO 400 atau 800 mg/kg BB atau protein normal (KP) selama 5 minggu. Kelompok pembanding adalah anakan dari induk yang diberikan diet protein normal (18% protein) yang tidak diberikan terapi atau diberikan EEMO 800 mg/kg BB selama 5 minggu. Pada akhir pengujian, dilakukan pemeriksaan antropometri, fungsi spasial memori (Y-test), profil biokimia darah dan asam amino darah, analisis histopatologi pada jaringan hati dan hipokampus, serta mikrobiota usus pada feces kolon.

Hasil:

EEMO yang dihasilkan pada penelitian ini mengandung protein sebesar 45,5% dan senyawa fitokimia utamanya adalah golongan kaempferol. Pemberian EEMO tidak memberikan perbaikan pada profil antropometrik dibandingkan dengan kelompok KP. Pemberian EEMO 400, 800 mg/kg BB dan KP dapat menormalkan spasial memori, yang diikuti dengan penurunan rasio sel pada daerah CA1-4 hipokampus. Hasil analisis histopatologi jaringan hati menunjukkan bahwa EEMO 800 mg/kg BB memperbaiki perlemakan hati lebih baik vs. EEMO 400 mg/kg BB dan KP. EEMO meningkatkan kadar albumin, Hb, BUN dan menurunkan kadar glukosa mendekati kelompok normal, namun belum dapat menetralkan bilirubin, SGPT, SGOT dan kreatinin. Terdapat tendensi perbaikan pada total asam amino esensial dan BCAA pada plasma darah setelah pemberian EEMO dan KP. Selain itu, EEMO dapat memperbaiki relative abundance mikrobiota di usus. Perbaikan pada spasial memori berkorelasi negatif dengan total asam amino non esensial, asam amino alifatik sederhana, asam amino hidroksi alifatik dan berkorelasi negatif dengan kelimpahan famili Peptostreptococcaceae, Erysipelotrichacea dan Staphylococcaceae.

Kesimpulan:

Penelitian ini menunjukkan bahwa induk dengan diet rendah protein selama kehamilan akan melahirkan keturunan dengan karakteristik defisiensi protein (DP), termasuk berat badan lahir rendah (BBLR), BMI di bawah 0,45 g/cm², kenaikan berat badan yang lambat, anemia, hypoalbuminemia, rendahnya kadar BUN, penurunan asam amino darah dan gangguan enzim hati. Hasil penelitian kami menunjukkan bahwa pemberian EEMO pada anak tikus sampai dengan usia 8 minggu tidak memperbaiki antropometri anak, namun dapat menormalkan spasial memori, memperbaiki kerusakan sel hipokampus dan meminimalkan perlemakan hati anak tikus DP. Perbaikan tersebut diikuti dengan perbaikan kelimpahan mikrobiota usus di tingkat filum.

.....Background:

Malnutrition during pregnancy and the first 1,000 days of life can affect physical growth, brain function, and hippocampal development. *Moringa oleifera* (MO) has been used as a food supplement in malnutrition. This study aims to evaluate the effectiveness of the protein content of an ethanolic extract of MO leaves (EEMO) in overcoming protein deficiency in rat offspring of protein-deficient rats.

Methods:

Moringa oleifera leaves from the Kupang district, Nusa Tenggara Timur province were extracted using the UAE method in ethanol and then characterized. Offspring of Sprague Dawley rats, aged 3 weeks from mothers on a low protein diet (9% protein) were given 400 or 800 mg/kg BW EEMO or normal protein (KP) for 5 weeks. The comparison groups were offspring from rats given a normal protein diet (18% protein) without therapy or given 800 mg/kg BW EEMO for 5 weeks. At the end of the study, various assessments were conducted, including anthropometric examinations, spatial memory function using the Y-maze test, analysis of blood biochemical and blood amino acid profiles, histopathological analysis of liver and hippocampal tissue, and assessment of intestinal microbiota in colonic faeces.

Results:

In this research, the EEMO contained 45.5% protein, with the main phytochemical compound being the kaempferol group. The administration of EEMO did not improve anthropometric profiles compared to the KP group. However, the administration of 400 and 800 mg/kg BW EEMO, as well as KP, normalized spatial memory and decreased the damaged cell ratio in the CA1-4 area of the hippocampus.

Histopathological analysis of liver tissue revealed that EEMO 800 mg/kg BW was more effective in improving fatty liver than EEMO 400 mg/kg BW and KP. In addition, EEMO increased albumin Hb and BUN levels and reduced glucose levels, bringing them close to the normal group. However, it could not neutralize bilirubin, SGPT, SGOT, and creatinine levels. There was a tendency for improvement in total essential amino acids and BCAA's in blood plasma after the administration of EEMO and KP. Furthermore, EEMO improved the relative abundance of microbiota in the intestine. Notably, improvements in spatial memory were negatively correlated with total non-essential amino acids, simple aliphatic amino acids, aliphatic-hydroxy amino acids, and the abundance of the Peptostreptococcaceae, Erysipelotrichaceae, and Staphylococcaceae families.

Conclusions:

This research showed that rats with a low protein diet during pregnancy gave birth to offspring with characteristics of protein deficiency (PD), including low birth weight (LBW), BMI below 0.45 g/cm², slow weight gain, anaemia, hypoalbuminemia, low BUN levels, decreased blood amino acids and liver enzyme disorders. The results also showed that administering EEMO to rats' offspring up to 8 weeks of age did not improve the anthropometric measurement but did normalize spatial memory, repair hippocampal cell damage, and minimize fatty liver in PD rats offspring. Additionally, a positive impact of EEMO was observed in the abundance of gut microbiota at the phylum level.