

PENGARUH PEMBERIAN MONOSODIUM GLUTAMAT TERHADAP JUMLAH SEL PYRAMIDAL HIPPOCAMPUS REGIO CA1 DAN MEMORI SPASIAL TIKUS WISTAR (*Rattus norvegicus*) JANTAN REMAJA

INTISARI

Latar belakang: Monosodium glutamat (MSG) adalah salah satu senyawa kimia yang terbukti dapat menyebabkan kerusakan beberapa jaringan tubuh termasuk hippocampus. Monosodium glutamat merupakan zat tambahan makanan yang berupa garam dari asam glutamat. Berlebihnya kadar glutamat dalam jangka waktu yang lama dapat menyebabkan neurotoksik. Neurotoksisitas akibat paparan MSG terjadi akibat aktivasi asam amino eksitatorik. Hippocampus regio CA1 merupakan salah satu bagian otak yang peka terhadap peningkatan kadar glutamat. Sel pyramidal merupakan neuron utama di hippocampus regio CA1. Kerusakan sel pyramidal hippocampus regio CA1 dapat mengakibatkan gangguan pada memori spasial.

Tujuan: Mengkaji seberapa besar penurunan jumlah sel pyramidal hippocampus regio CA1 dan memori spasial setelah pemberian monosodium glutamat dengan kadar 2,5;3,0 dan 3,5 mg/g berat badan tikus Wistar jantan remaja.

Metode: Dua puluh empat ekor tikus Wistar (*Rattus norvegicus*) jantan remaja berumur 4-5 minggu, berat 100-150 g dibagi menjadi 4 kelompok. Kelompok kontrol (C) mendapat 2 ml NaCl. Kelompok T_{2,5} mendapat MSG 2,5 mg/kg BB yang dilarutkan dalam 2 ml NaCl. Kelompok T_{3,0} mendapat MSG 3 mg/kg BB yang dilarutkan dalam 2 ml NaCl. Kelompok T_{3,5} mendapat MSG 3,5 mg/kg BB yang dilarutkan dalam 2 ml NaCl. Hewan coba diadaptasi selama 7 hari dan ditempatkan dalam kandang pemeliharaan dengan intensitas cahaya 12 jam terang dan 12 jam gelap. Pakan dan air minum diberikan secara *ad libitum* dikontrol setiap hari untuk memastikan kebersihan dan kecukupan pakannya. Pemberian MSG melalui injeksi intraperitoneal dilakukan selama 10 hari. Sehari setelah perlakuan berakhir, dilakukan uji memori spasial uji penyelamatan diri dengan menggunakan *Morris water maze* selama 3 hari berturut-turut. Pada hari ke-10 dan 17 setelah perlakuan berakhir, dilakukan uji persistensi memori *Morris water maze*. Pada hari ke-37 dilakukan perfusi transkardial dan pengambilan hippocampus. Penghitungan jumlah sel pyramidal hippocampus regio CA1 menggunakan metode $N_v \times V(\text{ref})$. Data dianalisis dengan uji parametrik *one-way* ANOVA SPSS. Perbedaan dinilai bermakna apabila nilai $p < 0,05$. Prosedur penelitian telah disetujui komisi etik Fakultas Kedokteran Universitas Gadjah Mada Yogyakarta (Nomor KE/FK/81/EC).

Hasil: Ada perbedaan bermakna dalam penurunan jumlah sel pyramidal hippocampus regio CA1 antara kelompok C, T_{2,5}, T_{3,0}, dan T_{3,5} dengan nilai $p = 0,048$. Tidak ada perbedaan bermakna penurunan memori spasial antara kelompok C, T_{2,5}, T_{3,0}, dan T_{3,5} dengan nilai $p > 0,05$.

Kesimpulan: Monosodium glutamat menyebabkan penurunan jumlah sel pyramidal hippocampus regio CA1 pada dosis 3,0 dan 3,5 mg/g BB namun tidak menurunkan memori spasial tikus Wistar (*Rattus norvegicus*) jantan remaja

Kata kunci : Monosodium glutamat, sel pyramidal, hippocampus regio CA1, stereologi, memori spasial

EFFECT OF MONOSODIUM GLUTAMATE ON THE NUMBER OF PYRAMIDAL CELLS CA1 REGION OF HIPPOCAMPUS AND SPATIAL MEMORY IN ADOLESCENT MALE RATS

ABSTRACT

Backgrounds: Monosodium glutamate (MSG) is one of chemical compound that is proven to be the causal factor of damage of body tissue including hippocampus. Monosodium glutamate is additive food which is in the form of salt from glutamic acid. Excessive intake of MSG for a long time can cause neurotoxicity. Neurotoxicity effect of MSG occurs due to the activation excitatory amino acid. CA1 region of hippocampus represents one region of brain that is glutamate sensitive. Pyramidal cell is the special neuron in CA1 region of hippocampus. The damage of the pyramidal cell CA1 region of hippocampus could cause spatial memory disorders.

Objectives: The present study aimed at investigating the number of pyramidal cells of CA1 region of hippocampus and the spatial memory of adolescent male Wistar rats exposed 2,5; 3,0 and 3,5 mg/g body weight of MSG.

Methods: Twenty four adolescent male Wistar rat (*Rattus norvegicus*) of 4-5 weeks of age, and 100-150 gr of body weight were assigned into 4 groups. Control group (C) was given 2 ml of NaCl. T_{2,5} group was given 2.5 mg/g bw of MSG. T_{3,0} group was given 3.0 mg/g bw of MSG. T_{3,5} group was given 3.5 mg/kg bw of MSG. The experimental animals were adapted for 7 days and put in maintenance cages with light intensities of 12 hours light and 12 hours dark. Fodder and drinking water were given ad libitum and controlled daily to ensure cleanliness and sufficiency. The monosodium glutamate solution was made everyday before the intraperitoneal injection for 10 days. Escape acquisition of spatial memory test was carried for three consecutive days after the last treatment using Morris water maze procedure. Memory persistence test was carried out at day 10 and 17. Transcardial perfusion and hippocampus removal were conducted after the last Morris water maze procedure. The number of the pyramidal cells of CA1 region of hippocampus was calculated using Nv x V(ref) methods. Data was analyzed using one-way ANOVA. The statistical significance was set at $p < 0.05$. The procedure of the study was approved by the Ethic Committee of the Faculty of Medicine of Gadjah Mada University Yogyakarta (number KE/FK/81/EC).

Results: There was significant decrease in the number of the hippocampal pyramidal cells among of the treatment groups of T_{3,0} ($p=0,037$) and T_{3,5} ($p=0,008$). There was not significant decrease in the spatial memory groups in the treatment groups of T_{2,5}; T_{3,0}, and T_{3,5} at $p > 0.05$

Conclusion: Monosodium glutamate caused a decrease in the number of pyramidal cells of CA1 region of hippocampus at doses T_{3,0}, and T_{3,5} but a decrease did not cause decrease spatial memory of Wistar rats (*Rattus norvegicus*) adolescent between T_{2,5}; T_{3,0}, and T_{3,5} groups.

Keywords : monosodium glutamate, pyramidal cell, CA1 region of hippocampus, stereology, spatial memory