

# PENGARUH SUPLEMENTASI EPIGALLOCATECHIN-3 GALLAT TERHADAP EKSPRESI NUCLEAR FACTOR ERYTHROID 2 DAN MATRIX METALLOPROTEINASE-9 SEL GANGLION RETINA

(Studi Eksperimental Pada Tikus Wistar Model Glaukoma dengan induksi N-Methyl-D-Aspartate)

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## ABSTRAK

**Latar Belakang :** Glaukoma merupakan penyakit neurodegeneratif progresif yang ditandai dengan kerusakan sel ganglion retina (Retinal Ganglion Cell/RGC) dan menjadi salah satu penyebab utama kebutaan irreversibel di dunia. Selain peningkatan tekanan intraokular, stres oksidatif dan proses inflamasi juga berperan penting dalam patogenesis glaukoma. Epigallocatechin gallate (EGCG), polifenol utama pada teh hijau, diketahui memiliki efek antioksidan dan antiinflamasi yang berpotensi memberikan efek neuroprotektif.

**Tujuan :** Penelitian ini bertujuan menganalisis pengaruh pemberian suplementasi epigallocatechin gallate (EGCG) secara oral terhadap ekspresi nuclear factor erythroid 2-related factor 2 (NRF2) dan matrix metalloproteinase-9 (MMP-9) pada sel ganglion retina tikus Wistar model glaukoma.

**Metode :** Penelitian eksperimental dengan desain post-test only randomized controlled group ini menggunakan 14 ekor tikus Wistar yang diinduksi glaukoma melalui injeksi intravitreal N-methyl-D-aspartate (NMDA). Subjek dibagi menjadi kelompok perlakuan yang menerima EGCG oral dosis 50 mg/kgBB/hari dan kelompok kontrol yang menerima phosphate buffered saline (PBS) selama dua minggu. Setelah perlakuan dilakukan enukleasi bulbi, pengambilan jaringan retina, serta pemeriksaan ekspresi NRF2 dan MMP-9 menggunakan metode RT-PCR. Data dianalisis dengan uji Independent t-test dan korelasi Pearson.

**Hasil :** Ekspresi NRF2 pada kelompok perlakuan ( $23,51 \pm 0,54$ ) lebih tinggi dibandingkan kelompok kontrol ( $20,83 \pm 0,39$ ) dengan perbedaan signifikan ( $p < 0,001$ ). Sebaliknya, ekspresi MMP-9 pada kelompok perlakuan ( $21,67 \pm 0,46$ ) lebih rendah dibandingkan kelompok kontrol ( $23,26 \pm 0,45$ ) ( $p < 0,001$ ). Analisis korelasi Pearson menunjukkan tidak terdapat korelasi bermakna antara ekspresi NRF2 dan MMP-9 ( $p = 0,744$ ).

**Simpulan :** Pemberian EGCG oral meningkatkan ekspresi NRF2 dan menurunkan ekspresi MMP-9 pada sel ganglion retina tikus Wistar model glaukoma. Temuan ini menunjukkan potensi efek neuroprotektif EGCG melalui aktivasi jalur antioksidan NRF2/ARE dan penekanan jalur inflamasi NF- $\kappa$ B.

**Kata Kunci :** Glaukoma, EGCG, NRF2, MMP-9, sel ganglion retina

# Effect of Epigallocatechin-3-Gallate Supplementation on the Expression of Nuclear Factor Erythroid 2 and Matrix Metalloproteinase-9 in Retinal Ganglion Cells: An Experimental Study in N-Methyl-D-Aspartate-Induced Glaucoma Model of Wistar Rats

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## ABSTRACT

**Background** : Glaucoma is a progressive neurodegenerative disease characterized by damage to retinal ganglion cells (RGCs) and is one of the leading causes of irreversible blindness worldwide. In addition to elevated intraocular pressure, oxidative stress and inflammatory processes play important roles in the pathogenesis of glaucoma. Epigallocatechin gallate (EGCG), the major polyphenol found in green tea, is known to possess strong antioxidant and anti-inflammatory properties and has potential neuroprotective effects.

**Objective** : This study aimed to analyze the effect of oral epigallocatechin gallate (EGCG) supplementation on the expression of nuclear factor erythroid 2-related factor 2 (NRF2) and matrix metalloproteinase-9 (MMP-9) in retinal ganglion cells of Wistar rats with a glaucoma model.

**Method** : This experimental study used a post-test only randomized controlled group design involving 14 Wistar rats induced with glaucoma through intravitreal injection of N-methyl-D-aspartate (NMDA). The subjects were divided into a treatment group receiving oral EGCG at a dose of 50 mg/kg body weight/day and a control group receiving phosphate buffered saline (PBS) for two weeks. After the treatment period, enucleation of the eyeball was performed, followed by retinal tissue collection and analysis of NRF2 and MMP-9 gene expression using RT-PCR. Data were analyzed using the Independent t-test and Pearson correlation test.

**Results** : NRF2 expression in the treatment group ( $23.51 \pm 0.54$ ) was significantly higher than in the control group ( $20.83 \pm 0.39$ ) ( $p < 0.001$ ). In contrast, MMP-9 expression in the treatment group ( $21.67 \pm 0.46$ ) was significantly lower than in the control group ( $23.26 \pm 0.45$ ) ( $p < 0.001$ ). Pearson correlation analysis showed no significant correlation between NRF2 and MMP-9 expression ( $p = 0.744$ ).

**Conclusion** : Oral administration of EGCG increased NRF2 expression and decreased MMP-9 expression in retinal ganglion cells of Wistar rats with a glaucoma model. These findings suggest the potential neuroprotective effect of EGCG through activation of the NRF2/ARE antioxidant pathway and suppression of the NF- $\kappa$ B inflammatory pathway.

**Keywords** : Glaucoma, EGCG, NRF2, MMP-9, retinal ganglion cells