

# Efek Kombinasi Environmental Enrichment Kontinu dan Latihan Aerobik terhadap ekspresi pTrkB dan pNMDAR Hipokampus serta Fungsi Memori Spasial Jangka Pendek Tikus = Effect of combination of continuous environmental enrichment and aerobic exercise on hippocampus pTrkB and pNMDAR expression and short-term spatial memory function in Rats.

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## Abstrak

Latar belakang: EE dan/atau latihan fisik dapat meningkatkan memori spasial dan menginduksi peningkatan ekspresi Brain-derived neurotrophic factor (BDNF) pada hipokampus tikus Wistar jantan usia 7 bulan. BDNF berikatan dengan reseptor tropomyosin receptor kinase B (TrkB) menyebabkan TrkB terfosforilasi, menghasilkan perekrutan protein yang mengaktifkan tiga kaskade transduksi sinyal. BDNF dapat meningkatkan kadar dan aktivitas reseptor NMDA sehingga terjadi perubahan jangka panjang pada aktivitas sinaps. Belum diketahui bagaimana pengaruh pemberian kombinasi EE dan latihan aerobik terhadap ekspresi pTrkB dan pNMDAR.

Tujuan: Menganalisis ekspresi reseptor pTrkB dan ekspresi pNMDAR yang dipicu oleh persinyalan BDNF pada hipokampus tikus yang diberikan model EE dan/atau latihan fisik aerobik.

Metode: Penelitian eksperimental menggunakan 24 tikus Wistar jantan usia 7 bulan, berat badan 250–350 gr, dibagi menjadi 4 kelompok: Kontrol (K), Aerobik (A) diberi latihan fisik 5x/minggu treadmill kecepatan 20 m/menit 30 menit/hari, EE, dan kombinasi latihan fisik EE (AEE). Perlakuan diberikan selama 8 minggu dan dilakukan pengukuran ekspresi pTrkB dan pNMDAR dengan western blot, memori spasial diukur dengan forced alteration Y-maze.

Hasil: Fosforilasi TrkB pada situs Tyr705 dan fosforilasi NMDA pada situs Tyr 1336 kelompok kombinasi lebih baik dari kontrol namun peningkatan tidak bermakna secara statistik. Fungsi memori spasial jangka pendek kelompok EE lebih baik daripada kelompok kontrol.

Kesimpulan: EE kontinu dapat meningkatkan fungsi memori spasial jangka pendek tikus, kombinasi EE dan latihan aerobik cenderung meningkatkan pTrkB dan pNMDAR namun tidak bermakna secara statistik.

.....Background: EE and/or aerobic exercise can improve spatial memory and induce increased expression of Brain-derived neurotrophic factor (BDNF) in the hippocampus of male Wistar rats aged 7 months. BDNF binds to the tropomyosin receptor kinase B (TrkB) induce phosphorylating of TrkB, resulting the recruitment of a protein that activates three signal transduction cascades. BDNF can increase the levels and activity of the NMDA receptors, resulting in long-term changes in synaptic activity. The effect of combination of continuous EE and aerobic exercise on hippocampus pTrkB and pNMDAR expression is not yet known.

Objective: To analyze pTrkB receptor expression and pNMDAR expression induced by BDNF signaling in the hippocampus of mice given EE models and / or aerobic exercise.

Methods: Experimental study using 24 male Wistar rats aged 7 months, weight 250–350 gr, divided into 4 groups: Control (K), Aerobics (A) given 5x physical exercise/week with treadmill speed 20 m/min 30 minutes/day, EE, combination of physical exercise and EE (AEE). Treatment was administered for 8 weeks

and the phosphorylation of TrkB and NMDA receptors measured with Western blot, spatial memory measured by forced alteration of Y-maze.

Result: The combination group of TrkB phosphorylation at Tyr705 site and NMDA phosphorylation at the Tyr 1336 site were better than the control group but the increase was not statistically significant. The EE group's short-term spatial memory function was better than the control group.

Conclusion: Continuous EE can improve mouse short-term spatial memory function, combination of EE and aerobic exercise tends to increase pTrkB and pNMDAR but not statistically significant.