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DAFTAR PUSTAKA

Abreu, R. V., Silva-Oliveira, E. M., Moraes, M. F., Pereira, G. S. & Moraes-Santos, T. (2011) Chronic coffee and caffeine ingestion effects on the cognitive function and antioxidant system of rat brains. *Pharmacol Biochem Behav,* 99: 659-64.

Ahn, E. H., Kim, D. W., Shin, M. J., Kwon, S. W., Kim, Y. N., Kim, D. S., Lim, S. S., Kim, J., Park, J., Eum, W. S., Hwang, H. S. & Choi, S. Y. (2011) Chlorogenic Acid Improves Neuroprotective Effect of PEP-1-Ribosomal Protein S3 Against Ischemic Insult. *Exp Neurobiol,* 20: 169-75.

Ainge, J. A. & Langston, R. F. (2012) Ontogeny of neural circuits underlying spatial memory in the rat. *Front Neural Circuits,* 6: 1-10.

Ali, N., Rashid, S., Nafees, S., Hasan, S. K., Shahid, A., Majed, F. & Sultana, S. (2017) Protective effect of Chlorogenic acid against methotrexate induced oxidative stress, inflammation and apoptosis in rat liver: An experimental approach. *Chem Biol Interact,* 272: 80-91.

Andersen, P., Morris, R., Amaral, D., Bliss, T. & O'Keefe, J. (eds.) (2007) *The Hippocampus Book,* New York: Oxford University Press.

Appeldoorn, M. M., Venema, D. P., Peters, T. H., Koenen, M. E., Arts, I. C., Vincken, J. P., Gruppen, H., Keijer, J. & Hollman, P. C. (2009) Some phenolic compounds increase the nitric oxide level in endothelial cells in vitro. *J Agric Food Chem,* 57: 7693-9.

Arai, K., Jin, G., Navaratna, D. & Lo, E. H. (2009) Brain angiogenesis in developmental and pathological processes: neurovascular injury and angiogenic recovery after stroke. *Febs j,* 276: 4644-52.

Arfian, N., Emoto, N., Vignon-Zellweger, N., Nakayama, K., Yagi, K. & Hirata, K. (2012) ET-1 deletion from endothelial cells protects the kidney during the extension phase of ischemia/reperfusion injury. *Biochem Biophys Res Commun,* 425: 443-9.

Auer, R. N., Jensen, M. L. & Whishaw, I. Q. (1989) Neurobehavioral deficit due to ischemic brain damage limited to half of the CA1 sector of the hippocampus. *J Neurosci,* 9: 1641-7.

Bagdas, D., Cam Etoz, B., Inan Ozturkoglu, S., Cinkilic, N., Ozyigit, M. O., Gul, Z., Isbil Buyukcoskun, N., Ozluk, K. & Gurun, M. S. (2014) Effects of systemic chlorogenic acid on random-pattern dorsal skin flap survival in diabetic rats. *Biol Pharm Bull,* 37: 361-70.

Banasiak, K. J., Xia, Y. & Haddad, G. G. (2000) Mechanisms underlying hypoxia-induced neuronal apoptosis. *Prog Neurobiol,* 62: 215-49.

Baumann, O. & Mattingley, J. B. (2014) Dissociable roles of the hippocampus and parietal cortex in processing of coordinate and categorical spatial information. *Front Hum Neurosci,* 8: 1-6.

Bear, M., Connors, B. & Paradiso, M. (2007) *Neuroscience Exploring The Brain,* Philadelphia:Lippincott Williams & Wilkins.

Bendel, O., Bueters, T., von Euler, M., Ove Ogren, S., Sandin, J. & von Euler, G. (2005) Reappearance of hippocampal CA1 neurons after ischemia is

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

associated with recovery of learning and memory. *J Cereb Blood Flow Metab,* 25: 1586-95.

Bernaudin, M., Nouvelot, A., MacKenzie, E. T. & Petit, E. (1998) Selective neuronal vulnerability and specific glial reactions in hippocampal and neocortical organotypic cultures submitted to ischemia. *Exp Neurol,* 150: 30-9.

Berti, R., Williams, A. J., Moffett, J. R., Hale, S. L., Velarde, L. C., Elliott, P. J., Yao, C., Dave, J. R. & Tortella, F. C. (2002) Quantitative real-time RT-PCR analysis of inflammatory gene expression associated with ischemia-reperfusion brain injury. *J Cereb Blood Flow Metab,* 22: 1068-79.

Bezaire, M. J. & Soltesz, I. (2013) Quantitative assessment of CA1 local circuits: knowledge base for interneuron-pyramidal cell connectivity. *Hippocampus,* 23: 751-85.

Bieganska-Hensoldt, S. & Rosolowska-Huszcz, D. (2017) Polyphenols in preventing endothelial dysfunction. *Postepy Hig Med Dosw (Online),* 71: 227-35.

Boccara, C. N., Sargolini, F., Thoresen, V. H., Solstad, T., Witter, M. P., Moser, E. I. & Moser, M. B. (2010) Grid cells in pre- and parasubiculum. *Nat Neurosci,* 13: 987-94.

Bonita, J. S., Mandarano, M., Shuta, D. & Vinson, J. (2007) Coffee and cardiovascular disease: in vitro, cellular, animal, and human studies. *Pharmacol Res,* 55: 187-98.

Bouet, V., Freret, T., Ankri, S., Bezault, M., Renolleau, S., Boulouard, M., Jacotot, E., Chauvier, D. & Schumann-Bard, P. (2010) Predicting sensorimotor and memory deficits after neonatal ischemic stroke with reperfusion in the rat. *Behav Brain Res,* 212: 56-63.

Boyce, R. W., Dorph-Petersen, K. A., Lyck, L. & Gundersen, H. J. (2010) Design-based stereology: introduction to basic concepts and practical approaches for estimation of cell number. *Toxicol Pathol,* 38: 1011-25.

Buch, P., Patel, V., Ranpariya, V., Sheth, N. & Parmar, S. (2012) Neuroprotective activity of Cymbopogon martinii against cerebral ischemia/reperfusion-induced oxidative stress in rats. *J Ethnopharmacol,* 142: 35-40.

Burger, D. & Touyz, R. M. (2012) Cellular biomarkers of endothelial health: microparticles, endothelial progenitor cells, and circulating endothelial cells. *J Am Soc Hypertens,* 6: 85-99.

Butler, T. R., Self, R. L., Smith, K. J., Sharrett-Field, L. J., Berry, J. N., Littleton, J. M., Pauly, J. R., Mulholland, P. J. & Prendergast, M. A. (2010) Selective vulnerability of hippocampal cornu ammonis 1 pyramidal cells to excitotoxic insult is associated with the expression of polyamine-sensitive N-methyl-D-asparate-type glutamate receptors. *Neuroscience,* 165: 525-34.

Camfield, D. A., Silber, B. Y., Scholey, A. B., Nolidin, K., Goh, A. & Stough, C. (2013) A randomised placebo-controlled trial to differentiate the acute cognitive and mood effects of chlorogenic acid from decaffeinated coffee. *PLoS One,* 8: 1-14.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Cano-Marquina, A., Tarin, J. J. & Cano, A. (2013) The impact of coffee on health. *Maturitas,* 75: 7-21.

Carman, A. J., Dacks, P. A., Lane, R. F., Shineman, D. W. & Fillit, H. M. (2014) Current evidence for the use of coffee and caffeine to prevent age-related cognitive decline and Alzheimer's disease. *J Nutr Health Aging,* 18: 383-92.

Chan, P. H. (1996) Role of oxidants in ischemic brain damage. *Stroke,* 27: 1124-9.

Chen, H., Yoshioka, H., Kim, G. S., Jung, J. E., Okami, N., Sakata, H., Maier, C. M., Narasimhan, P., Goeders, C. E. & Chan, P. H. (2011) Oxidative stress in ischemic brain damage: mechanisms of cell death and potential molecular targets for neuroprotection. *Antioxid Redox Signal,* 14: 1505-17.

Chen, J., Nagayama, T., Jin, K., Stetler, R. A., Zhu, R. L., Graham, S. H. & Simon, R. P. (1998) Induction of caspase-3-like protease may mediate delayed neuronal death in the hippocampus after transient cerebral ischemia. *J Neurosci,* 18: 4914-28.

Cho, E. S., Jang, Y. J., Hwang, M. K., Kang, N. J., Lee, K. W. & Lee, H. J. (2009) Attenuation of oxidative neuronal cell death by coffee phenolic phytochemicals. *Mutat Res,* 661: 18-24.

Chu, Y. F., Brown, P. H., Lyle, B. J., Chen, Y., Black, R. M., Williams, C. E., Lin, Y. C., Hsu, C. W. & Cheng, I. H. (2009) Roasted coffees high in lipophilic antioxidants and chlorogenic acid lactones are more neuroprotective than green coffees. *J Agric Food Chem,* 57: 9801-8.

Corder, R., Douthwaite, J. A., Lees, D. M., Khan, N. Q., Viseu Dos Santos, A. C., Wood, E. G. & Carrier, M. J. (2001) Endothelin-1 synthesis reduced by red wine. *Nature,* 414: 863-4.

Cui, X., Chopp, M., Zacharek, A., Zhang, C., Roberts, C. & Chen, J. (2009) Role of endothelial nitric oxide synthetase in arteriogenesis after stroke in mice. *Neuroscience,* 159: 744-50.

Culmsee, C., Zhu, C., Landshamer, S., Becattini, B., Wagner, E., Pellecchia, M., Blomgren, K. & Plesnila, N. (2005) Apoptosis-inducing factor triggered by poly(ADP-ribose) polymerase and Bid mediates neuronal cell death after oxygen-glucose deprivation and focal cerebral ischemia. *J Neurosci,* 25: 10262-72.

Daglia, M., Papetti, A., Gregotti, C., Berte, F. & Gazzani, G. (2000) In vitro antioxidant and ex vivo protective activities of green and roasted coffee. *J Agric Food Chem,* 48: 1449-54.

Dahlan, M. (2009) *Statistik untuk kedokteran dan kesehatan,* Jakarta:Salemba Medika.

del Zoppo, G. J. (2009) Inflammation and the neurovascular unit in the setting of focal cerebral ischemia. *Neuroscience,* 158: 972-82.

Dent, E. W. (2017) Of microtubules and memory: implications for microtubule dynamics in dendrites and spines. *Mol Biol Cell,* 28: 1-8.

Dietrich, W. D., Ginsberg, M. D., Busto, R., Watson, B. D. & Yoshida, S. (1986) Vascular aspects and hemodynamic consequences of central nervous system injury. *Cent Nerv Syst Trauma,* 3: 265-80.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Dimaio, T. A., Wang, S., Huang, Q., Scheef, E. A., Sorenson, C. M. & Sheibani, N. (2008) Attenuation of retinal vascular development and neovascularization in PECAM-1-deficient mice. *Dev Biol,* 315: 72-88.

Eichenbaum, H. (2002) *The Cognitive Neuroscience of Memory an Introduction.,* New York:Oxford University Press.

Eichenbaum, H. (2013) Memory on time. *Trends Cogn Sci,* 17: 81-8.

Eltzschig, H. K. & Collard, C. D. (2004) Vascular ischaemia and reperfusion injury. *Brit Med Bull,* 70: 71-86.

Eltzschig, H. K. & Eckle, T. (2011) Ischemia and reperfusion--from mechanism to translation. *Nat Med,* 17: 1391-401.

Esquivel, P. & Jiménez, V. M. (2012) Functional properties of coffee and coffee by-products. *Food Res Int,* 46: 488-95.

Fagan, S. C., Hess, D. C., Hohnadel, E. J., Pollock, D. M. & Ergul, A. (2004) Targets for vascular protection after acute ischemic stroke. *Stroke,* 35: 2220-5.

Fang, S. Q., Wang, Y. T., Wei, J. X., Shu, Y. H., Xiao, L. & Lu, X. M. (2016) Beneficial effects of chlorogenic acid on alcohol-induced damage in PC12 cells. *Biomed Pharmacother,* 79: 254-62.

Foster, T. C., Defazio, R. A. & Bizon, J. L. (2012) Characterizing cognitive aging of spatial and contextual memory in animal models. *Front Aging Neurosci,* 4: 1-18.

Frost-Meyer, N. J. & Logomarsino, J. V. (2012) Impact of coffee components on inflammatory markers: A review. *J Funct Foods,* 4: 819-30.

Gee, C. E., Benquet, P., Raineteau, O., Rietschin, L., Kirbach, S. W. & Gerber, U. (2006) NMDA receptors and the differential ischemic vulnerability of hippocampal neurons. *Eur J Neurosci,* 23: 2595-603.

Gibbons, G. H. & Dzau, V. J. (1994) The emerging concept of vascular remodeling. *N Engl J Med,* 330: 1431-8.

Gilbert, P. E. & Brushfield, A. M. (2009) The role of the CA3 hippocampal subregion in spatial memory: a process oriented behavioral assessment. *Prog Neuropsychopharmacol Biol Psychiatry,* 33: 774-81.

Gill, P. R., Mizumori, S. J. & Smith, D. M. (2011) Hippocampal episode fields develop with learning. *Hippocampus,* 21: 1240-9.

Gill, R., Tsung, A. & Billiar, T. (2010) Linking oxidative stress to inflammation: Toll-like receptors. *Free Radic Biol Med,* 48: 1121-32.

Girbovan, C., Kent, P., Merali, Z. & Plamondon, H. (2016) Dose-related effects of chronic resveratrol administration on neurogenesis, angiogenesis, and corticosterone secretion are associated with improved spatial memory retention following global cerebral ischemia. *Nutr Neurosci,* 19: 352-68.

Girn, H. R., Ahilathirunayagam, S., Mavor, A. I. & Homer-Vanniasinkam, S. (2007) Reperfusion syndrome: cellular mechanisms of microvascular dysfunction and potential therapeutic strategies. *Vasc Endovascular Surg,* 41: 277-93.

Goulart, B. K., de Lima, M. N., de Farias, C. B., Reolon, G. K., Almeida, V. R., Quevedo, J., Kapczinski, F., Schroder, N. & Roesler, R. (2010) Ketamine impairs recognition memory consolidation and prevents learning-induced

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

increase in hippocampal brain-derived neurotrophic factor levels. *Neuroscience,* 167: 969-73.

Greenberg, D. A. & Jin, K. (2013) Vascular endothelial growth factors (VEGFs) and stroke. *Cell Mol Life Sci,* 70: 1753-61.

Gu, Z., Kaul, M., Yan, B., Kridel, S. J., Cui, J., Strongin, A., Smith, J. W., Liddington, R. C. & Lipton, S. A. (2002) S-nitrosylation of matrix metalloproteinases: signaling pathway to neuronal cell death. *Science,* 297: 1186-90.

Guyton, A. C. & Hall, J. E. (2006) *Textbook of Medical Physiology 11th Edition,* Pennsylvania:Elsevier Inc.

Han, J., Miyamae, Y., Shigemori, H. & Isoda, H. (2010) Neuroprotective effect of 3,5-di-O-caffeoylquinic acid on SH-SY5Y cells and senescence-accelerated-prone mice 8 through the up-regulation of phosphoglycerate kinase-1. *Neuroscience,* 169: 1039-45.

Han, X., Shen, T. & Lou, H. (2007) Dietary Polyphenols and Their Biological Significance. *Int. J. Mol. Sci.,* 8:950-88.

Harry, G. J. & Lefebvre d'Hellencourt, C. (2003) Dentate gyrus: alterations that occur with hippocampal injury. *Neurotoxicology,* 24: 343-56.

Hartley, T., Lever, C., Burgess, N. & O'Keefe, J. (2014) Space in the brain: how the hippocampal formation supports spatial cognition. *Philos Trans R Soc Lond B Biol Sci,* 369: 1-18.

Hartman, R. E., Lee, J. M., Zipfel, G. J. & Wozniak, D. F. (2005) Characterizing learning deficits and hippocampal neuron loss following transient global cerebral ischemia in rats. *Brain Res,* 1043: 48-56.

Hayashi, H., Dikkes, P. & Soriano, S. G. (2002) Repeated administration of ketamine may lead to neuronal degeneration in the developing rat brain. *Paediatr Anaesth,* 12: 770-4.

Hayashi, T. & Abe, K. (2004) Ischemic neuronal cell death and organellae damage. *Neurol Res,* 26: 827-34.

Hermann, D. M. & Zechariah, A. (2009) Implications of vascular endothelial growth factor for postischemic neurovascular remodeling. *J Cereb Blood Flow Metab,* 29: 1620-43.

Hermawati, E., Arfian, N., Mustofa & Partadiredja, G. (2018) Spatial Memory Disturbance Following Transient Brain Ischemia is Associated with Vascular Remodeling in Hippocampus. Unpublished.

Howard, C. & Reed, M. (2005) *Unbiased stereology three-dimensional measurement in microscopy,* New York:BIOS Scientific Publishers.

Hua, F., Ma, J., Ha, T., Xia, Y., Kelley, J., Williams, D. L., Kao, R. L., Browder, I. W., Schweitzer, J. B., Kalbfleisch, J. H. & Li, C. (2007) Activation of Toll-like receptor 4 signaling contributes to hippocampal neuronal death following global cerebral ischemia/reperfusion. *J Neuroimmunol,* 190: 101-11.

Huang, L., Liu, Y., Jin, W., Ji, X. & Dong, Z. (2012) Ketamine potentiates hippocampal neurodegeneration and persistent learning and memory impairment through the PKCgamma-ERK signaling pathway in the developing brain. *Brain Res,* 1476: 164-71.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Hugel, H. M., Jackson, N., May, B., Zhang, A. L. & Xue, C. C. (2016) Polyphenol protection and treatment of hypertension. *Phytomedicine,* 23: 220-31.

Hung, V. K., Yeung, P. K., Lai, A. K., Ho, M. C., Lo, A. C., Chan, K. C., Wu, E. X., Chung, S. S., Cheung, C. W. & Chung, S. K. (2015) Selective astrocytic endothelin-1 overexpression contributes to dementia associated with ischemic stroke by exaggerating astrocyte-derived amyloid secretion. *J Cereb Blood Flow Metab,* 35: 1687-96.

Hwang, I. K., Kim, D. W., Yoo, K. Y., Jung, B. K., Song, J. H., Jung, J. Y., Choi, S. Y., Kang, T. C., Lee, J. Y., Kwon, Y. G. & Won, M. H. (2005) Ischemia-induced changes of platelet endothelial cell adhesion molecule-1 in the hippocampal CA1 region in gerbils. *Brain Res,* 1048: 251-7.

Inagaki, T. & Etgen, A. M. (2013) Neuroprotective action of acute estrogens: animal models of brain ischemia and clinical implications. *Steroids,* 78: 597-606.

Ito, H., Sun, X. L., Watanabe, M., Okamoto, M. & Hatano, T. (2008) Chlorogenic acid and its metabolite m-coumaric acid evoke neurite outgrowth in hippocampal neuronal cells. *Biosci Biotechnol Biochem,* 72: 885-8.

Ji, L., Jiang, P., Lu, B., Sheng, Y., Wang, X. & Wang, Z. (2013) Chlorogenic acid, a dietary polyphenol, protects acetaminophen-induced liver injury and its mechanism. *J Nutr Biochem,* 24: 1911-9.

Jiang, R., Hodgson, J. M., Mas, E., Croft, K. D. & Ward, N. C. (2016) Chlorogenic acid improves ex vivo vessel function and protects endothelial cells against HOCl-induced oxidative damage, via increased production of nitric oxide and induction of Hmox-1. *J Nutr Biochem,* 27: 53-60.

Jin, R., Yang, G. & Li, G. (2010) Inflammatory mechanisms in ischemic stroke: role of inflammatory cells. *J Leukoc Biol,* 87: 779-89.

Jung, J. E., Kim, G. S., Chen, H., Maier, C. M., Narasimhan, P., Song, Y. S., Niizuma, K., Katsu, M., Okami, N., Yoshioka, H., Sakata, H., Goeders, C. E. & Chan, P. H. (2010) Reperfusion and neurovascular dysfunction in stroke: from basic mechanisms to potential strategies for neuroprotection. *Mol Neurobiol,* 41: 172-9.

Kalinowska, A. & Losy, J. (2006) PECAM-1, a key player in neuroinflammation. *Eur J Neurol,* 13: 1284-90.

Kalogeris, T., Bao, Y. & Korthuis, R. J. (2014) Mitochondrial reactive oxygen species: a double edged sword in ischemia/reperfusion vs preconditioning. *Redox Biol,* 2: 702-14.

Kandel, E., Schwartz, J. & Jessel, T. (2000) *Principles of Neural Science,* New York:McGraw-Hill.

Karthikesan, K., Pari, L. & Menon, V. P. (2010) Protective effect of tetrahydrocurcumin and chlorogenic acid against streptozotocin–nicotinamide generated oxidative stress induced diabetes. *J. Funct. Foods,* 2: 134-42.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Kayali, F., Montie, H. L., Rafols, J. A. & DeGracia, D. J. (2005) Prolonged translation arrest in reperfused hippocampal cornu Ammonis 1 is mediated by stress granules. *Neuroscience,* 134: 1223-45.

Kebets, V., Gregoire, S. M., Charidimou, A., Barnes, J., Rantell, K., Brown, M. M., Jager, H. R., Cipolotti, L. & Werring, D. J. (2015) Prevalence and cognitive impact of medial temporal atrophy in a hospital stroke service: retrospective cohort study. *Int J Stroke,* 10: 861-7.

Kesner, R. P. (2007) Behavioral functions of the CA3 subregion of the hippocampus. *Learn Mem,* 14: 771-81.

Khalaf, O. & Graff, J. (2016) Structural, Synaptic, and Epigenetic Dynamics of Enduring Memories. *Neural Plast,* 2016: 3425908.

Kim, J., Lee, S., Shim, J., Kim, H. W., Kim, J., Jang, Y. J., Yang, H., Park, J., Choi, S. H., Yoon, J. H., Lee, K. W. & Lee, H. J. (2012) Caffeinated coffee, decaffeinated coffee, and the phenolic phytochemical chlorogenic acid up-regulate NQO1 expression and prevent H(2)O(2)-induced apoptosis in primary cortical neurons. *Neurochem Int,* 60: 466-74.

Kim, J. H., Auger, C., Kurita, I., Anselm, E., Rivoarilala, L. O., Lee, H. J., Lee, K. W. & Schini-Kerth, V. B. (2013) Aronia melanocarpa juice, a rich source of polyphenols, induces endothelium-dependent relaxations in porcine coronary arteries via the redox-sensitive activation of endothelial nitric oxide synthase. *Nitric Oxide,* 35: 54-64.

Konkel, A. & Cohen, N. J. (2009) Relational memory and the hippocampus: representations and methods. *Front Neurosci,* 3: 166-74.

Kovalenko, T., Osadchenko, I., Nikonenko, A., Lushnikova, I., Voronin, K., Nikonenko, I., Muller, D. & Skibo, G. (2006) Ischemia-induced modifications in hippocampal CA1 stratum radiatum excitatory synapses. *Hippocampus,* 16: 814-25.

Kraus, B. J., Robinson, R. J., 2nd, White, J. A., Eichenbaum, H. & Hasselmo, M. E. (2013) Hippocampal "time cells": time versus path integration. *Neuron,* 78: 1090-101.

Kulik, T., Kusano, Y., Aronhime, S., Sandler, A. L. & Winn, H. R. (2008) Regulation of cerebral vasculature in normal and ischemic brain. *Neuropharmacology,* 55: 281-8.

Kwon, S. H., Lee, H. K., Kim, J. A., Hong, S. I., Kim, H. C., Jo, T. H., Park, Y. I., Lee, C. K., Kim, Y. B., Lee, S. Y. & Jang, C. G. (2010) Neuroprotective effects of chlorogenic acid on scopolamine-induced amnesia via anti-acetylcholinesterase and anti-oxidative activities in mice. *Eur J Pharmacol,* 649: 210-7.

Lafay, S., Morand, C., Manach, C., Besson, C. & Scalbert, A. (2006) Absorption and metabolism of caffeic acid and chlorogenic acid in the small intestine of rats. *Br J Nutr,* 96: 39-46.

Lakhan, S. E., Kirchgessner, A. & Hofer, M. (2009) Inflammatory mechanisms in ischemic stroke: therapeutic approaches. *J Transl Med,* 7: 1-11.

Langston, R. F., Stevenson, C. H., Wilson, C. L., Saunders, I. & Wood, E. R. (2010) The role of hippocampal subregions in memory for stimulus associations. *Behav Brain Res,* 215: 275-91.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Lapchak, P. A. (2007) The phenylpropanoid micronutrient chlorogenic acid improves clinical rating scores in rabbits following multiple infarct ischemic strokes: synergism with tissue plasminogen activator. *Exp Neurol,* 205: 407-13.

Lee, A. C., Yeung, L. K. & Barense, M. D. (2012a) The hippocampus and visual perception. *Front Hum Neurosci,* 6: 1-17.

Lee, K., Lee, J. S., Jang, H. J., Kim, S. M., Chang, M. S., Park, S. H., Kim, K. S., Bae, J., Park, J. W., Lee, B., Choi, H. Y., Jeong, C. H. & Bu, Y. (2012b) Chlorogenic acid ameliorates brain damage and edema by inhibiting matrix metalloproteinase-2 and 9 in a rat model of focal cerebral ischemia. *Eur J Pharmacol,* 689: 89-95.

Lee, S. R., Tsuji, K., Lee, S. R. & Lo, E. H. (2004) Role of matrix metalloproteinases in delayed neuronal damage after transient global cerebral ischemia. *J Neurosci,* 24: 671-8.

Leopoldini, M., Russo, N. & Toscano, M. (2011) The molecular basis of working mechanism of natural polyphenolic antioxidants. *Food Chemistry,* 125: 288-306.

Leung, J. W., Ho, M. C., Lo, A. C., Chung, S. S. & Chung, S. K. (2004) Endothelial cell-specific over-expression of endothelin-1 leads to more severe cerebral damage following transient middle cerebral artery occlusion. *J Cardiovasc Pharmacol,* 44 Suppl 1: S293-300.

Li, H., Colbourne, F., Sun, P., Zhao, Z., Buchan, A. M. & Iadecola, C. (2000) Caspase inhibitors reduce neuronal injury after focal but not global cerebral ischemia in rats. *Stroke,* 31: 176-82.

Li, K., Yu, W., Cao, R., Zhu, Z. & Zhao, G. (2017) Microglia-mediated BAFF-BAFFR ligation promotes neuronal survival in brain ischemia injury. *Neuroscience,* 363: 87-96.

Li, S., Bian, H., Liu, Z., Wang, Y., Dai, J., He, W., Liao, X., Liu, R. & Luo, J. (2012) Chlorogenic acid protects MSCs against oxidative stress by altering FOXO family genes and activating intrinsic pathway. *Eur J Pharmacol,* 674: 65-72.

Li, Y., Shi, W., Li, Y., Zhou, Y., Hu, X., Song, C., Ma, H., Wang, C. & Li, Y. (2008) Neuroprotective effects of chlorogenic acid against apoptosis of PC12 cells induced by methylmercury. *Environ Toxicol Pharmacol,* 26: 13-21.

Liu, J., Wang, Y., Akamatsu, Y., Lee, C. C., Stetler, R. A., Lawton, M. T. & Yang, G. Y. (2014) Vascular remodeling after ischemic stroke: mechanisms and therapeutic potentials. *Prog Neurobiol,* 115: 138-56.

Livak, K. J. & Schmittgen, T. D. (2001) Analysis of relative gene expression data using real-time quantitative PCR and the 2(-Delta Delta C(T)) Method. *Methods,* 25: 402-8.

Ludwig, I. A., Clifford, M. N., Lean, M. E. J., Ashihara, H. & Crozier, A. (2014) Coffee: biochemistry and potential impact on health. *Food & Function,* 5: 1695-717.

Lynch, M. A. (2004) Long-term potentiation and memory. *Physiol Rev,* 84: 87-136.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

MacDonald, C. J., Lepage, K. Q., Eden, U. T. & Eichenbaum, H. (2011) Hippocampal "time cells" bridge the gap in memory for discontiguous events. *Neuron,* 71: 737-49.

Manach, C., Scalbert, A., Morand, C., Remesy, C. & Jimenez, L. (2004) Polyphenols: food sources and bioavailability. *Am J Clin Nutr,* 79: 727-47.

Marinova, E. M., Toneva, A. & Yanishlieva, N. (2009) Comparison of the antioxidative properties of caffeic and chlorogenic acids. *Food Chemistry,* 114: 1498-502.

Marti, H. J., Bernaudin, M., Bellail, A., Schoch, H., Euler, M., Petit, E. & Risau, W. (2000) Hypoxia-induced vascular endothelial growth factor expression precedes neovascularization after cerebral ischemia. *Am J Pathol,* 156: 965-76.

Martin, L. J., Al-Abdulla, N. A., Brambrink, A. M., Kirsch, J. R., Sieber, F. E. & Portera-Cailliau, C. (1998) Neurodegeneration in excitotoxicity, global cerebral ischemia, and target deprivation: A perspective on the contributions of apoptosis and necrosis. *Brain Res Bull,* 46: 281-309.

Mehta, S. L., Manhas, N. & Raghubir, R. (2007) Molecular targets in cerebral ischemia for developing novel therapeutics. *Brain Res Rev,* 54: 34-66.

Miao, M., Cao, L., Li, R., Fang, X. & Miao, Y. (2017) Protective effect of chlorogenic acid on the focal cerebral ischemia reperfusion rat models. *Saudi Pharm J,* 25: 556-63.

Mikami, Y., Kakizawa, S. & Yamazawa, T. (2016) Essential Roles of Natural Products and Gaseous Mediators on Neuronal Cell Death or Survival. *Int J Mol Sci,* 17.

Mikami, Y. & Yamazawa, T. (2015) Chlorogenic acid, a polyphenol in coffee, protects neurons against glutamate neurotoxicity. *Life Sci,* 139: 69-74.

Miki, T., Satriotomo, I., Li, H., Matsumoto, Y., Gu, H., Yokoyama, T., Lee, K., Bedi, K. & Takeuchi, Y. (2005) Application of the physical disector to the central nervous system: Estimation of the total number of neurons in subdivisions of the rat hippocampus. *Anat Sci Int,* 80: 153-62.

Mizumori, S. J. (2013) Context prediction analysis and episodic memory. *Front Behav Neurosci,* 7: 132.

Mizuno, K. & Giese, K. P. (2005) Hippocampus-dependent memory formation: do memory type-specific mechanisms exist? *J Pharmacol Sci,* 98: 191-7.

Moser, E. I. & Moser, M. B. (2013) Grid cells and neural coding in high-end cortices. *Neuron,* 80: 765-74.

Movassaghi, S., Nadia Sharifi, Z., Soleimani, M., Joghataii, M. T., Hashemi, M., Shafaroodi, H. & Mehdizadeh, M. (2012) Effect of Pentoxifylline on Ischemia- induced Brain Damage and Spatial Memory Impairment in Rat. *Iran J Basic Med Sci,* 15: 1083-90.

Muller, G. J., Stadelmann, C., Bastholm, L., Elling, F., Lassmann, H. & Johansen, F. F. (2004) Ischemia leads to apoptosis--and necrosis-like neuron death in the ischemic rat hippocampus. *Brain Pathol,* 14: 415-24.

Muzzio, I. A., Kentros, C. & Kandel, E. (2009) What is remembered? Role of attention on the encoding and retrieval of hippocampal representations. *J Physiol,* 587: 2837-54.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Naganuma, Y. (1990) Changes of the cerebral microvascular structure and endothelium during the course of permanent ischemia. *Keio J Med,* 39: 26-31.

Nakajima, H., Unoda, K., Ito, T., Kitaoka, H., Kimura, F. & Hanafusa, T. (2012) The Relation of Urinary 8-OHdG, A Marker of Oxidative Stress to DNA, and Clinical Outcomes for Ischemic Stroke. *Open Neurol J,* 6: 51-7.

Nicholson, S. K., Tucker, G. A. & Brameld, J. M. (2008) Effects of dietary polyphenols on gene expression in human vascular endothelial cells. *Proc Nutr Soc,* 67: 42-7.

Nicholson, S. K., Tucker, G. A. & Brameld, J. M. (2010) Physiological concentrations of dietary polyphenols regulate vascular endothelial cell expression of genes important in cardiovascular health. *Br J Nutr,* 103: 1398-403.

Nikonenko, A. G., Radenovic, L., Andjus, P. R. & Skibo, G. G. (2009) Structural features of ischemic damage in the hippocampus. *Anat Rec (Hoboken),* 292: 1914-21.

Nyengaard, J. R. (1999) Stereologic methods and their application in kidney research. *J Am Soc Nephrol,* 10: 1100-23.

Olthof, M. R., Hollman, P. C. & Katan, M. B. (2001) Chlorogenic acid and caffeic acid are absorbed in humans. *J Nutr,* 131: 66-71.

Ostwald, K., Hagberg, H., Andine, P. & Karlsson, J. O. (1993) Upregulation of calpain activity in neonatal rat brain after hypoxic-ischemia. *Brain Res,* 630: 289-94.

Panickar, K. S. & Anderson, R. A. (2011) Effect of polyphenols on oxidative stress and mitochondrial dysfunction in neuronal death and brain edema in cerebral ischemia. *Int J Mol Sci,* 12: 8181-207.

Park, J. J., Hwang, S. J., Park, J. H. & Lee, H. J. (2015) Chlorogenic acid inhibits hypoxia-induced angiogenesis via down-regulation of the HIF-1alpha/AKT pathway. *Cell Oncol (Dordr),* 38: 111-8.

Parker, A., Wilding, E. & Bussey, T. (2002) *The Cognitive Neuroscience of Memory Encoding and Retrieval,* New York:Psychology Press.

Partadiredja, G. & Bedi, K. (2010) Undernutrition during gestation and suckling periods does not cause any loss of pyramidal neurons in the CA2-CA3 region of the rat hippocampus. *Nutr Neurosci,* 13: 1-7.

Pastalkova, E., Itskov, V., Amarasingham, A. & Buzsaki, G. (2008) Internally generated cell assembly sequences in the rat hippocampus. *Science,* 321: 1322-7.

Privratsky, J. R. & Newman, P. J. (2014) PECAM-1: regulator of endothelial junctional integrity. *Cell Tissue Res,* 355: 607-19.

Pulungan, Z. S., Sofro, Z. M. & Partadiredja, G. (2016) Sodium fluoride does not affect the working memory and number of pyramidal cells in rat medial prefrontal cortex.

Pulungan, Z. S. A., Sofro, Z. M. & Partadiredja, G. (2018) Sodium fluoride does not affect the working memory and number of pyramidal cells in rat medial prefrontal cortex. 93: 128-38.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Purves, D., Augustine, G., Fitzpatrick, D., Hall, W., LaMantia, A., McNamara, J. & Williams, S. (eds.) (2004) *Neuroscience,* Sunderland: Sinauer Associates,Inc.

Puyal, J., Ginet, V. & Clarke, P. G. (2013) Multiple interacting cell death mechanisms in the mediation of excitotoxicity and ischemic brain damage: a challenge for neuroprotection. *Prog Neurobiol,* 105: 24-48.

Quintard, H., Borsotto, M., Veyssiere, J., Gandin, C., Labbal, F., Widmann, C., Lazdunski, M. & Heurteaux, C. (2011) MLC901, a traditional Chinese medicine protects the brain against global ischemia. *Neuropharmacology,* 61: 622-31.

Rami, A., Bechmann, I. & Stehle, J. H. (2008) Exploiting endogenous anti-apoptotic proteins for novel therapeutic strategies in cerebral ischemia. *Prog Neurobiol,* 85: 273-96.

Rami, A. & Kogel, D. (2008) Apoptosis meets autophagy-like cell death in the ischemic penumbra: Two sides of the same coin? *Autophagy,* 4: 422-6.

Rewell, S. S., Churilov, L., Sidon, T. K., Aleksoska, E., Cox, S. F., Macleod, M. R. & Howells, D. W. (2017) Evolution of ischemic damage and behavioural deficit over 6 months after MCAo in the rat: Selecting the optimal outcomes and statistical power for multi-centre preclinical trials. *PLoS One,* 12: e0171688.

Rolls, E. T. (2017) The storage and recall of memories in the hippocampo-cortical system. *Cell Tissue Res*.

Ruifeng, G., Yunhe, F., Zhengkai, W., Ershun, Z., Yimeng, L., Minjun, Y., Xiaojing, S., Zhengtao, Y. & Naisheng, Z. (2014) Chlorogenic acid attenuates lipopolysaccharide-induced mice mastitis by suppressing TLR4-mediated NF-kappaB signaling pathway. *Eur J Pharmacol,* 729: 54-8.

Ruszkiewicz, J. & Albrecht, J. (2015) Changes in the mitochondrial antioxidant systems in neurodegenerative diseases and acute brain disorders. *Neurochem Int,* 88: 66-72.

Sanderson, T. H., Reynolds, C. A., Kumar, R., Przyklenk, K. & Huttemann, M. (2013) Molecular mechanisms of ischemia-reperfusion injury in brain: pivotal role of the mitochondrial membrane potential in reactive oxygen species generation. *Mol Neurobiol,* 47: 9-23.

Sasi, N., Hwang, M., Jaboin, J., Csiki, I. & Lu, B. (2009) Regulated cell death pathways: new twists in modulation of BCL2 family function. *Mol Cancer Ther,* 8: 1421-9.

Savelli, F., Yoganarasimha, D. & Knierim, J. J. (2008) Influence of boundary removal on the spatial representations of the medial entorhinal cortex. *Hippocampus,* 18: 1270-82.

Sawada, N. & Liao, J. K. (2009) Targeting eNOS and beyond: emerging heterogeneity of the role of endothelial Rho proteins in stroke protection. *Expert Rev Neurother,* 9: 1171-86.

Schaller, B. J. (2006) The role of endothelin in stroke: experimental data and underlying pathophysiology. *Arch. Med. Sci.,* 2: 146-58.

Segal, M. (2017) Dendritic spines: Morphological building blocks of memory. *Neurobiol Learn Mem,* 138: 3-9.

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Selakovic, V., Korenic, A. & Radenovic, L. (2011) Spatial and temporal patterns of oxidative stress in the brain of gerbils submitted to different duration of global cerebral ischemia. *Int J Dev Neurosci,* 29: 645-54.

Shan, J., Fu, J., Zhao, Z., Kong, X., Huang, H., Luo, L. & Yin, Z. (2009) Chlorogenic acid inhibits lipopolysaccharide-induced cyclooxygenase-2 expression in RAW264.7 cells through suppressing NF-kappaB and JNK/AP-1 activation. *Int Immunopharmacol,* 9: 1042-8.

Sharma, V., Ling, T. W., Rewell, S. S., Hare, D. L., Howells, D. W., Kourakis, A. & Wookey, P. J. (2012) A novel population of alpha-smooth muscle actin-positive cells activated in a rat model of stroke: an analysis of the spatio-temporal distribution in response to ischemia. *J Cereb Blood Flow Metab,* 32: 2055-65.

Shen, J., Zhu, Y., Yu, H., Fan, Z. X., Xiao, F., Wu, P., Zhang, Q. H., Xiong, X. X., Pan, J. W. & Zhan, R. Y. (2014) Buyang Huanwu decoction increases angiopoietin-1 expression and promotes angiogenesis and functional outcome after focal cerebral ischemia. *J Zhejiang Univ Sci B,* 15: 272-80.

Shen, W. H., Zhang, C. Y. & Zhang, G. Y. (2003) Antioxidants attenuate reperfusion injury after global brain ischemia through inhibiting nuclear factor-kappa B activity in rats. *Acta Pharmacol Sin,* 24: 1125-30.

Sheng, T., Zhang, X., Wang, S., Zhang, J., Lu, W. & Dai, Y. (2015) Endothelin-1-induced mini-stroke in the dorsal hippocampus or lateral amygdala results in deficits in learning and memory. *J Biomed Res,* 29: 362-9.

Shi, H., Dong, L., Bai, Y., Zhao, J., Zhang, Y. & Zhang, L. (2009) Chlorogenic acid against carbon tetrachloride-induced liver fibrosis in rats. *Eur J Pharmacol,* 623: 119-24.

Shi, H., Dong, L., Jiang, J., Zhao, J., Zhao, G., Dang, X., Lu, X. & Jia, M. (2013) Chlorogenic acid reduces liver inflammation and fibrosis through inhibition of toll-like receptor 4 signaling pathway. *Toxicology,* 303: 107-14.

Shichita, T., Sakaguchi, R., Suzuki, M. & Yoshimura, A. (2012) Post-ischemic inflammation in the brain. *Front Immunol,* 3: 132.

Soares, L. M., Schiavon, A. P., Milani, H. & de Oliveira, R. M. (2013) Cognitive impairment and persistent anxiety-related responses following bilateral common carotid artery occlusion in mice. *Behav Brain Res,* 249: 28-37.

Solenski, N. J., diPierro, C. G., Trimmer, P. A., Kwan, A. L. & Helm, G. A. (2002) Ultrastructural changes of neuronal mitochondria after transient and permanent cerebral ischemia. *Stroke,* 33: 816-24.

Solstad, T., Boccara, C. N., Kropff, E., Moser, M. B. & Moser, E. I. (2008) Representation of geometric borders in the entorhinal cortex. *Science,* 322: 1865-8.

Stanika, R. I., Winters, C. A., Pivovarova, N. B. & Andrews, S. B. (2010) Differential NMDA receptor-dependent calcium loading and mitochondrial dysfunction in CA1 vs. CA3 hippocampal neurons. *Neurobiol Dis,* 37: 403-11.

Tam, N. N., Gao, Y., Leung, Y. K. & Ho, S. M. (2003) Androgenic regulation of oxidative stress in the rat prostate: involvement of NAD(P)H oxidases and

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

antioxidant defense machinery during prostatic involution and regrowth. *Am J Pathol,* 163: 2513-22.

Tang, S. C., Arumugam, T. V., Xu, X., Cheng, A., Mughal, M. R., Jo, D. G., Lathia, J. D., Siler, D. A., Chigurupati, S., Ouyang, X., Magnus, T., Camandola, S. & Mattson, M. P. (2007) Pivotal role for neuronal Toll-like receptors in ischemic brain injury and functional deficits. *Proc Natl Acad Sci U S A,* 104: 13798-803.

Tang, S. H., Yu, J. G., Li, J. J. & Sun, J. Y. (2015) Neuroprotective effect of ketamine on acute spinal cord injury in rats. *Genet Mol Res,* 14: 3551-6.

Tewari, A., Mahendru, V., Sinha, A. & Bilotta, F. (2014) Antioxidants: The new frontier for translational research in cerebroprotection. *J Anaesthesiol Clin Pharmacol,* 30: 160-71.

Vanhoutte, P. M., Shimokawa, H., Feletou, M. & Tang, E. H. (2017) Endothelial dysfunction and vascular disease - a 30th anniversary update. *Acta Physiol (Oxf),* 219: 22-96.

Vardi, N., Parlakpinar, H. & Ates, B. (2012a) Beneficial effects of chlorogenic acid on methotrexate-induced cerebellar Purkinje cell damage in rats. *Journal of Chemical Neuroanatomy,* 43: 43-7.

Vardi, N., Parlakpinar, H. & Ates, B. (2012b) Beneficial effects of chlorogenic acid on methotrexate-induced cerebellar Purkinje cell damage in rats. *J Chem Neuroanat,* 43: 43-7.

Vauzour, D. (2012) Dietary polyphenols as modulators of brain functions: biological actions and molecular mechanisms underpinning their beneficial effects. *Oxid Med Cell Longev,* 2012: 1-16.

Vilahur, G., Padro, T., Casani, L., Mendieta, G., Lopez, J. A., Streitenberger, S. & Badimon, L. (2015) Polyphenol-enriched diet prevents coronary endothelial dysfunction by activating the Akt/eNOS pathway. *Rev Esp Cardiol (Engl Ed),* 68: 216-25.

Wagatsuma, H. & Yamaguchi, Y. (2007) Neural dynamics of the cognitive map in the hippocampus. *Cogn Neurodyn,* 1: 119-41.

Wallez, Y. & Huber, P. (2008) Endothelial adherens and tight junctions in vascular homeostasis, inflammation and angiogenesis. *Biochim Biophys Acta,* 1778: 794-809.

Wang, L., Jia, J. & Wu, L. (2013a) The relationship between cognitive impairment and cerebral blood flow changes after transient ischaemic attack. *Neurol Res,* 35: 580-5.

Wang, X., Fan, X., Yuan, S., Jiao, W., Liu, B., Cao, J. & Jiang, W. (2017) Chlorogenic acid protects against aluminium-induced cytotoxicity through chelation and antioxidant actions in primary hippocampal neuronal cells. 8: 2924-34.

Wang, X. & Michaelis, E. K. (2010) Selective neuronal vulnerability to oxidative stress in the brain. *Front Aging Neurosci,* 2: 12.

Wang, Y., Ge, P. & Zhu, Y. (2013b) TLR2 and TLR4 in the brain injury caused by cerebral ischemia and reperfusion. *Mediators Inflamm,* 2013: 1-8.

Wang, Y., Kilic, E., Kilic, U., Weber, B., Bassetti, C. L., Marti, H. H. & Hermann, D. M. (2005) VEGF overexpression induces post-ischaemic

UNIVERSITAS GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

neuroprotection, but facilitates haemodynamic steal phenomena. *Brain,* 128: 52-63.

Warner, D. S., Sheng, H. & Batinic-Haberle, I. (2004) Oxidants, antioxidants and the ischemic brain. *J Exp Biol,* 207: 3221-31.

Watson, C., Kirkcaldie, M. & Paxinos, G. (2010) *The Brain an Introduction to Functional Neuroanatomy,* San Diego:Elsevier Inc.

West, M. J. (2012a) Estimating volume in biological structures. *Cold Spring Harb Protoc,* 2012: 1129-39.

West, M. J. (2012b) The precision of estimates in stereological analyses. *Cold Spring Harb Protoc,* 2012: 937-49.

West, M. J. (2013) Tissue shrinkage and stereological studies. *Cold Spring Harb Protoc,* 2013.

Winters, L., Winters, T., Gorup, D., Mitrecic, D., Curlin, M., Kriz, J. & Gajovic, S. (2013) Expression analysis of genes involved in TLR2-related signaling pathway: Inflammation and apoptosis after ischemic brain injury. *Neuroscience,* 238: 87-96.

Wolbers, T. & Wiener, J. M. (2014) Challenges for identifying the neural mechanisms that support spatial navigation: the impact of spatial scale. *Front Hum Neurosci,* 8: 1-12.

Xu, Y., Chen, J., Yu, X., Tao, W., Jiang, F., Yin, Z. & Liu, C. (2010) Protective effects of chlorogenic acid on acute hepatotoxicity induced by lipopolysaccharide in mice. *Inflamm Res,* 59: 871-7.

Yan, J. & Jiang, H. (2014) Dual effects of ketamine: neurotoxicity versus neuroprotection in anesthesia for the developing brain. *J Neurosurg Anesthesiol,* 26: 155-60.

Ye, H. Y., Jin, J., Jin, L. W., Chen, Y., Zhou, Z. H. & Li, Z. Y. (2017) Chlorogenic Acid Attenuates Lipopolysaccharide-Induced Acute Kidney Injury by Inhibiting TLR4/NF-kappaB Signal Pathway. *Inflammation,* 40: 523-9.

Yeung, P. K., Shen, J., Chung, S. S. & Chung, S. K. (2013) Targeted over-expression of endothelin-1 in astrocytes leads to more severe brain damage and vasospasm after subarachnoid hemorrhage. *BMC Neurosci,* 14: 131-45.

Yokota, M., Saido, T. C., Kamitani, H., Tabuchi, S., Satokata, I. & Watanabe, T. (2003) Calpain induces proteolysis of neuronal cytoskeleton in ischemic gerbil forebrain. *Brain Res,* 984: 122-32.

Yuan, Y., Gong, X., Zhang, L., Jiang, R., Yang, J., Wang, B. & Wan, J. (2017) Chlorogenic acid ameliorated concanavalin A-induced hepatitis by suppression of Toll-like receptor 4 signaling in mice. *Int Immunopharmacol,* 44: 97-104.

Yun, N., Kang, J. W. & Lee, S. M. (2012) Protective effects of chlorogenic acid against ischemia/reperfusion injury in rat liver: molecular evidence of its antioxidant and anti-inflammatory properties. *J Nutr Biochem,* 23: 1249-55.

Zhao, B. Q., Tejima, E. & Lo, E. H. (2007) Neurovascular proteases in brain injury, hemorrhage and remodeling after stroke. *Stroke,* 38: 748-52.

UNIVERSITAS
GADJAH MADA
PENGARUH ASAM KLOROGENAT TERHADAP STRUKTUR DAN FUNGSI HIPPOCAMPUS PADA TIKUS MODEL ISKEMIA GLOBAL TRANSIEN (Kajian terhadap Fungsi Memori Spasial, Jumlah Sel Piramidal dan Respon Vaskuler)
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Universitas Gadjah Mada, 2018 | Diunduh dari http://etd.repository.ugm.ac.id/

Zhou, L., Zhang, T., Lu, B., Yu, Z., Mei, X., Abulizi, P. & Ji, L. (2016) Lonicerae Japonicae Flos attenuates diabetic retinopathy by inhibiting retinal angiogenesis. *J Ethnopharmacol,* 189: 117-25.

Zhu, C., Qiu, L., Wang, X., Hallin, U., Cande, C., Kroemer, G., Hagberg, H. & Blomgren, K. (2003) Involvement of apoptosis-inducing factor in neuronal death after hypoxia-ischemia in the neonatal rat brain. *J Neurochem,* 86: 306-17.

Zhu, C., Xu, F., Wang, X., Shibata, M., Uchiyama, Y., Blomgren, K. & Hagberg, H. (2006) Different apoptotic mechanisms are activated in male and female brains after neonatal hypoxia-ischaemia. *J Neurochem,* 96: 1016-27.

Ziegler, G., Harhausen, D., Schepers, C., Hoffmann, O., Rohr, C., Prinz, V., Konig, J., Lehrach, H., Nietfeld, W. & Trendelenburg, G. (2007) TLR2 has a detrimental role in mouse transient focal cerebral ischemia. *Biochem Biophys Res Commun,* 359: 574-9.