

## REFERENCES

- Akbarzadeh, A., Norouzian, D., Mehrabi, M.R., Jamshidi, Sh., Farhangi, A., Verdi, A.A., Mofidian, S.M.A. and Rad, B.L. (2007). Induction of diabetes by Streptozotocin in rats. *Indian Journal of Clinical Biochemistry*, 22(2), pp.60–64.
- Alarcón, G. (2012). Functional anatomy and physiology of the hippocampus. *Introduction to Epilepsy*, pp.37–39.
- Arfian, N., Emoto, N., Vignon-Zellweger, N., Nakayama, K., Yagi, K. and Hirata, K. (2012). ET-1 deletion from endothelial cells protects the kidney during the extension phase of ischemia/reperfusion injury. *Biochemical and Biophysical Research Communications*, 425(2), pp.443–449.
- Bagdas, D., Etoz, B.C., Gul, Z., Ziyank, S., Inan, S., Turacozen, O., Gul, N.Y., Topal, A., Cinkilic, N., Tas, S., Ozyigit, M.O. and Gurun, M.S. (2015). In vivo systemic chlorogenic acid therapy under diabetic conditions: Wound healing effects and cytotoxicity/genotoxicity profile. *Food and Chemical Toxicology*, 81, pp.54–61.
- Bourque, S.L., Davidge, S.T. and Adams, M.A. (2011). The interaction between endothelin-1 and nitric oxide in the vasculature: new perspectives. *American Journal of Physiology-Regulatory, Integrative and Comparative Physiology*, 300(6), pp.R1288–R1295.
- Cau, S.B.A., Evora, P.R.B. and Tostes, R.C. (2018). Vasoconstrictor Substances Produced by the Endothelium. *Endothelium and Cardiovascular Diseases*, pp.115–125.
- Chou, J.C., Rollins, S.D., Ye, M., Batlle, D. and Fawzi, A.A. (2014). Endothelin Receptor-A Antagonist Attenuates Retinal Vascular and Neuroretinal Pathology in Diabetic Mice. *Investigative Ophthalmology & Visual Science*, 55(4), pp.2516–2525.

- Coucha, M., Abdelsaid, M., Ward, R., Abdul, Y. and Ergul, A. (2018). Impact of Metabolic Diseases on Cerebral Circulation: Structural and Functional Consequences. *Comprehensive Physiology*, pp.773–79
- Damasceno, D.C., Netto, A.O., Iessi, I.L., Gallego, F.Q., Corvino, S.B., Dallaqua, B., Sinzato, Y.K., Bueno, A., Calderon, I.M.P. and Rudge, M.V.C. (2014). Streptozotocin-Induced Diabetes Models: Pathophysiological Mechanisms and Fetal Outcomes. *Biomed Research International*.
- Demir, R., Cadirci, E., Akpinar, E., Cayir, Y., Atmaca, H.T., Un, H., Kunak, C.S., Yayla, M., Bayraktutan, Z. and Demir, I. (2014). Does Bosentan Protect Diabetic Brain Alterations in Rats? The Role of Endothelin-1 in the Diabetic Brain. *Basic & Clinical Pharmacology & Toxicology*, 116(3), pp.236–243.
- Dhikav, V. and Anand, K. (2012). Hippocampus in health and disease: An overview. *Annals of Indian Academy of Neurology*, [online] 15(4), pp.239.
- Diwakar, L., Gowaikar, R., Chithanathan, K., Gnanabharathi, B., Tomar, D.S. and Ravindranath, V. (2021). Endothelin-1 mediated vasoconstriction leads to memory impairment and synaptic dysfunction. *Scientific Reports*, 11(1).
- Ergul, A. (2011). Endothelin-1 and diabetic complications: Focus on the vasculature. *Pharmacological Research*, 63(6), pp.477–482.
- Farhaty, N. and Muchtaridi, M. (2016). Tinjauan Kimia dan Aspek Farmakologi Senyawa Asam Klorogenat Pada Biji Kopi : Review. *Farmaka*, 14(1), pp.214–227.
- Freeman, B.D., Machado, F.S., Tanowitz, H.B. and Desruisseaux, M.S. (2014). Endothelin-1 and its role in the pathogenesis of infectious diseases. *Life Sciences*, pp.110–119.
- Förstermann U. and Münzel T. (2006). Endothelial Nitric Oxide Synthase in Vascular Disease. *Circulation*, 113(13), pp.1708–1714.

- Frommer, K.W. and Muller-Ladner, U. (2008). Expression and function of ETA and ETB receptors in SSc. *Rheumatology*, 47(Supplement 5), pp.v27–v28.
- Galicia-Garcia, U., Benito-Vicente, A., Jebari, S., Larrea-Sebal, A., Siddiqi, H., Uribe, K.B., Ostolaza, H. and Martín, C. (2020). Pathophysiology of Type 2 Diabetes Mellitus. *International Journal of Molecular Sciences*, [online] 21(17), pp.6275.
- Gosmanov, A.R., Gosmanova, E.O. and Kitabchi, A.E. (2018). *Hyperglycemic Crises: Diabetic Ketoacidosis (DKA), And Hyperglycemic Hyperosmolar State (HHS)*.
- Graham, M.L., Janecek, J.L., Kittredge, J.A., Hering, B.J. and Schuurman, H.-J. (2011). The Streptozotocin-Induced Diabetic Nude Mouse Model: Differences between Animals from Different Sources. *Comparative Medicine*, 61(4), pp.356–360.
- Hermawati, E., Arfian, N., Mustofa, M. and Partadiredja, G. (2019). Chlorogenic acid ameliorates memory loss and hippocampal cell death after transient global ischemia. *European Journal of Neuroscience*, 51(2), pp.651–669.
- Ho, N., Sommers, M.S. and Lucki, I. (2013). Effects of diabetes on hippocampal neurogenesis: Links to cognition and depression. *Neuroscience & Biobehavioral Reviews*, 37(8), pp.1346–1362.
- Idris-Khodja, N., Ouerd, S., Mian, M.O.R., Gornitsky, J., Barhoumi, T., Paradis, P. and Schiffrin, E.L. (2016). Endothelin-1 Overexpression Exaggerates Diabetes-Induced Endothelial Dysfunction by Altering Oxidative Stress. *American Journal of Hypertension*, 29(11), pp.1245–1251.
- Islam, S.M.S., Purnat, T.D., Phuong, N.T.A., Mwingira, U., Schacht, K. and Fröschl, G. (2014). Non-Communicable Diseases (NCDs) in developing countries: a symposium report. *Globalization and Health*, 10(1).

- Jaminon, A., Reesink, K., Kroon, A. and Schurgers, L. (2019). The Role of Vascular Smooth Muscle Cells in Arterial Remodeling: Focus on Calcification-Related Processes. *International Journal of Molecular Sciences*, 20(22), pp.5694.
- Jones-Muhammad and Warrington (2019). Cerebral Blood Flow Regulation in Pregnancy, Hypertension, and Hypertensive Disorders of Pregnancy. *Brain Sciences*, 9(9), pp.224.
- Kartha, C.C., Surya Ramachandran and Pillai, R.M. (2017). Mechanisms of Vascular Defects in Diabetes Mellitus. Cham Springer International Publishing.
- Kolluru, G.K., Bir, S.C. and Kevil, C.G. (2012). Endothelial Dysfunction and Diabetes: Effects on Angiogenesis, Vascular Remodeling, and Wound Healing. *International Journal of Vascular Medicine*, 2012, pp.1–30.
- Kostov, K. (2021). The Causal Relationship between Endothelin-1 and Hypertension: Focusing on Endothelial Dysfunction, Arterial Stiffness, Vascular Remodeling, and Blood Pressure Regulation. *Life*, 11(9), pp.986.
- Li, W., Abdul, Y., Ward, R. and Ergul, A. (2018). Endothelin and Diabetic Complications: a Brain-Centric View. *Physiological Research*, pp.S83–S94.
- Liu, Z.-J. . and Velazquez, O.C. (2010). Angiogenesis in Wound Healing. *Encyclopedia of the Eye*, pp.99–105.
- Lukitasari, M., Saifur Rohman, M., Nugroho, D.A., Widodo, N. and Nugrahini, N.I.P. (2020). Cardiovascular protection effect of chlorogenic acid: focus on the molecular mechanism. *F1000Research*, 9, pp.1462.
- L. Taylor, S., Trudeau, D., Arnold, B., Wang, J., Gerrow, K., Summerfeldt, K., Holmes, A., Zamani, A., S. Brocardo, P. and E. Brown, C. (2015). VEGF can protect against blood

brain barrier dysfunction, dendritic spine loss and spatial memory impairment in an experimental model of diabetes. *Neurobiology of Disease*, 78, pp.1–11.

Liu, X., Deng, F., Yu, Z., Xie, Y., Hu, C. and Chen, L. (2014). Inhibition of endothelin A receptor protects brain microvascular endothelial cells against hypoxia-induced injury. *International Journal of Molecular Medicine*, 34(1), pp.313–320.

Manuel Serrano Ríos and Al, E. (2005). *The metabolic syndrome at the beginning of the 21st Century : a genetic and molecular approach*. Madrid: Elsevier.

Murray, M., Stanley, M., Lugar, H.M. and Hershey, T. (2010). Hippocampal Volume in Type 1 Diabetes. *European Endocrinology*, 10(1), pp.14.

Massey, J.L. (2016). *Coffee : production, consumption and health benefits*. New York: Nova Publishers.

Olthof, M.R., Hollman, P.C. and Katan, M.B. (2001). Chlorogenic acid and caffeic acid are absorbed in humans. *The Journal of Nutrition*, 131(1), pp.66–71.

Sapra, A. and Bhandari, P. (2020). Diabetes Mellitus. PMID: 33760470

Spinetti, G., Kraenkel, N., Emanuelli, C. and Madeddu, P. (2008). Diabetes and vessel wall remodeling: from mechanistic insights to regenerative therapies. *Cardiovascular Research*, 78(2), pp.265–273.

Susilowati, A., Sari, D.C.R. and Arfian, N. (2021). Pengaruh Asam Klorogenat (Chlorogenic Acid) Terhadap Perbaikan Disfungsi Memori, Ekspresi mRNA p53, Bax, dan Bcl-2 Pada Tikus Model Diabetes Mellitus.

Tajik, N., Tajik, M., Mack, I. and Enck, P. (2017). The potential effects of chlorogenic acid, the main phenolic components in coffee, on health: a comprehensive review of the literature. *European Journal of Nutrition*, 56(7), pp.2215–2244.

Tang, S.T., Su, H., Zhang, Q., Tang, H.Q., Wang, C.J., Zhou, Q., Wei, W., Zhu, H.Q. and Wang, Y. (2016). Sitagliptin inhibits endothelin-1 expression in the aortic endothelium of rats with streptozotocin-induced diabetes by suppressing the nuclear factor- $\kappa$ B/I $\kappa$ B $\alpha$  system through the activation of AMP-activated protein kinase. *International Journal of Molecular Medicine*, 37(6), pp.1558–1566.

Tortora, G.J. and Derrickson, B. (2009). *Principles of anatomy and physiology*. Hoboken, NJ: Wiley.

Wang, D., Hou, J., Wan, J., Yang, Y., Liu, S., Li, X., Li, W., Dai, X., Zhou, P., Liu, W. and Wang, P. (2021). Dietary chlorogenic acid ameliorates oxidative stress and improves endothelial function in diabetic mice via Nrf2 activation. *Journal of International Medical Research*, 49(1), p.030006052098536.

Wang, F., Cao, Y., Ma, L., Pei, H., Rausch, W.D. and Li, H. (2018). Dysfunction of Cerebrovascular Endothelial Cells: Prelude to Vascular Dementia. *Frontiers in Aging Neuroscience*, 10.

Ward, R., Li, W., Abdul, Y., Jackson, L., Dong, G., Jamil, S., Filosa, J., Fagan, S.C. and Ergul, A. (2019). NLRP3 inflammasome inhibition with MCC950 improves diabetes-mediated cognitive impairment and vasoneuronal remodeling after ischemia. *Pharmacological Research*, 142, pp.237–250.

[www.idf.org](http://www.idf.org). (2020). *IDF Diabetes Atlas 9<sup>th</sup> edition*. ISBN: 978-2-930229-87-4

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

- Yu, J., Zhang, Y., Zhang, X., Rudic, R.D., Bauer, P.M., Altieri, D.C. and Sessa, W.C. (2012). Endothelium Derived Nitric Oxide Synthase Negatively Regulates the PDGF-Survivin Pathway during Flow-Dependent Vascular Remodeling. *PLoS ONE*, 7(2), pp.e31495.
- Zhu, J., Song, W., Li, L. and Fan, X. (2016). Endothelial nitric oxide synthase: a potential therapeutic target for cerebrovascular diseases. *Molecular Brain*, 9(1).
- Zhang, L., Xue, S., Hou, J., Chen, G. and Xu, Z.-G. (2020). Endothelin receptor antagonists for the treatment of diabetic nephropathy: A meta-analysis and systematic review. *World Journal of Diabetes*, 11(11), pp.553–566.



UNIVERSITAS  
GADJAH MADA

**THE EFFECT OF CHLOROGENIC ACID (CGA) ON THE mRNA EXPRESSION OF ppET-1, ENDOTHELIN A RECEPTOR (ETAR), AND eNOS IN RAT'S HIPPOCAMPUS OF TYPE 1 DIABETES MELLITUS**

MARCELO, dr. Junaedy Yunus, M.Sc, Ph.D ; Dr. dr. Dwi Cahyani Ratna Sari, M.Kes, PA(K)

Universitas Gadjah Mada, 2022 | Diunduh dari <http://etd.repository.ugm.ac.id/>