

DAFTAR PUSTAKA

- Akbarzadeh, A., Norouzian, D., Mehrabi, M., Jamshidi, S., Farhangi, A., Verdi, A., *et al*, 2007. Induction of diabetes by streptozotocin in rats. *Indian Journal of Clinical Biochemistry* 22: 60–64.
- Andersen, H., Gjerstad, M.D., Jakobsen, J., 2004. Atrophy of Foot Muscles A measure of diabetic neuropathy.
- Avin, K.G., Coen, P.M., Huang, W., Stolz, D.B., Sowa, G.A., Dubé, J.J., *et al.*, 2014. Skeletal muscle as a regulator of the longevity protein, Klotho. *Front Physiol* 5 JUN. doi:10.3389/fphys.2014.00189
- Bamisi, O.D., Alese, M.O., 2020. Effects of various fixatives and temperature on the quality of glycogen demonstration in the brain and liver tissues. *Ann Diagn Pathol* 48. doi:10.1016/j.anndiagpath.2020.151604
- Bassil, M.S., Gougeon, R., 2013. Muscle protein anabolism in type 2 diabetes. *Curr Opin Clin Nutr Metab Care*. doi:10.1097/MCO.0b013e32835a88ee
- Bhatti, J.S., Sehrawat, A., Mishra, J., Sidhu, I.S., Navik, U., Khullar, N., *et al.*, 2022. Oxidative stress in the pathophysiology of type 2 diabetes and related complications: Current therapeutics strategies and future perspectives. *Free Radic Biol Med* 184: 114–134. doi:10.1016/j.freeradbiomed.2022.03.019
- Boyce, R.W., Dorph-Petersen, K.A., Lyck, L., Gundersen, H.J.G., 2010. Design-based stereology: introduction to basic concepts and practical approaches for estimation of cell number. *Toxicol Pathol*. doi:10.1177/0192623310385140
- Buendía, P., Ramírez, R., Aljama, P., Carracedo, J., 2016. Klotho Prevents Translocation of NFκB, in: Vitamins and Hormones. Academic Press Inc., pp. 119–150. doi:10.1016/bs.vh.2016.02.005
- Charan, J., Kantharia, N., 2013. How to calculate sample size in animal studies? *J Pharmacol Pharmacother* 4: 303–306. doi:10.4103/0976-500X.119726
- Chazaud, B., Mounier, R., 2021. Diabetes-induced skeletal muscle fibrosis: Fibro-adipogenic precursors at work. *Cell Metab* 33: 2095–2096. doi:10.1016/j.cmet.2021.10.009
- Cheng, J.T., Cheng, M.F., Chen, L.J., 2010. Decrease of Klotho in the kidney of streptozotocin-induced diabetic rats. *J Biomed Biotechnol* 2010. doi:10.1155/2010/513853
- Choi, J.H., Kim, H.R., Song, K.H., 2022. Musculoskeletal complications in patients with diabetes mellitus. *Korean Journal of Internal Medicine*. doi:10.3904/kjim.2022.168
- Cruz, P.L., Moraes-Silva, I.C., Ribeiro, A.A., Machi, J.F., de Melo, M.D.T., dos Santos, F., *et al.*, 2021. Nicotinamide attenuates streptozotocin-induced diabetes complications and increases survival rate in rats: role of autonomic nervous system. *BMC Endocr Disord* 21. doi:10.1186/s12902-021-00795-6
- Cruz-Jentoft, A.J., Baeyens, J.P., Bauer, J.M., Boirie, Y., Cederholm, T., Landi, F., *et al.*, 2010. Sarcopenia: European consensus on definition and diagnosis. *Age Ageing* 39: 412–423. doi:10.1093/ageing/afq034
- Dinas Kesehatan Provinsi Yogyakarta, 2021. Profil DIY 2021.

- Dokumacioglu, E., Iskender, H., 2022. Klotho Protein and Diabetes Mellitus. *Journal of Apitherapy and Nature*. doi:10.35206/jan.1087260
- Eleazu, C.O., Eleazu, K.C., Chukwuma, S., Essien, U.N., 2013. Review of the mechanism of cell death resulting from streptozotocin challenge in experimental animals, its practical use and potential risk to humans. *Journal of Diabetes & Metabolic Disorders* 12: 1–7. doi:<https://doi.org/10.1186/2251-6581-12-60>
- Feldman, E.L., Callaghan, B.C., Pop-Busui, R., Zochodne, D.W., Wright, D.E., Bennett, D.L., *et al.*, 2019. Diabetic neuropathy. *Nat Rev Dis Primers*. doi:10.1038/s41572-019-0092-1
- Furukawa, S., Fujita, T., Shimabukuro, M., Iwaki, M., Yamada, Y., Nakajima, Y., *et al.*, 2004. Increased oxidative stress in obesity and its impact on metabolic syndrome. *Journal of Clinical Investigation* 114: 1752–1761. doi:10.1172/JCI21625
- Glass, D.J., 2003. Signalling pathways that mediate skeletal muscle hypertrophy and atrophy, *Nature Cell Biology*.
- Gregg, E.W., Li, Y., Wang, J., Rios Burrows, N., Ali, M.K., Rolka, D., *et al.*, 2014. Changes in Diabetes-Related Complications in the United States, 1990–2010. *New England Journal of Medicine* 370: 1514–1523. doi:10.1056/nejmoa1310799
- Guo, S., Chen, Q., Sun, Y., Chen, J., 2019. Nicotinamide protects against skeletal muscle atrophy in streptozotocin-induced diabetic mice. *Arch Physiol Biochem* 125: 470–477. doi:10.1080/13813455.2019.1638414
- Guo, Y., Zhuang, X., Huang, Z., Zou, J., Yang, D., Hu, X., *et al.*, 2018. Klotho protects the heart from hyperglycemia-induced injury by inactivating ROS and NF- κ B-mediated inflammation both in vitro and in vivo. *Biochim Biophys Acta Mol Basis Dis* 1864: 238–251. doi:10.1016/j.bbadis.2017.09.029
- Gusarov, I., Nudler, E., 2018. Glycogen at the Crossroad of Stress Resistance, Energy Maintenance, and Pathophysiology of Aging. *BioEssays* 40: 1–6. doi:10.1002/bies.201800033
- Hołda, M.K., Klimek-Piotrowska, W., Koziej, M., Piątek, K., Hołda, J., 2016. Influence of different fixation protocols on the preservation and dimensions of cardiac tissue. *J Anat* 229: 334–340. doi:10.1111/joa.12469
- Houstis, N., Rosen, E.D., Lander, E.S., 2006. Reactive oxygen species have a causal role in multiple forms of insulin resistance. *Nature* 440: 944–948. doi:10.1038/nature04634
- Huang, S., Xiang, C., Song, Y., 2022. Identification of the shared gene signatures and pathways between sarcopenia and type 2 diabetes mellitus. *PLoS One* 17. doi:10.1371/journal.pone.0265221
- Hurrle, S., Hsu, W.H., 2017. The etiology of oxidative stress in insulin resistance. *Biomed J*. doi:10.1016/j.bj.2017.06.007
- Husna, F., Suyatna, F.D., Arozal, W., Purwaningsih, E.H., 2019. Model Hewan Coba pada Penelitian Diabetes Animal Model in Diabetes Research. *Mini Review Article Pharmaceutical Sciences and Research (PSR)* 6: 131–141.
- International Diabetes Federation, 2021. IDF Diabetes Atlas 2021 [WWW Document]. www.diabetesatlas.org. doi:10.1016/j.diabres.2013.10.013

- Ishida, T., Iizuka, M., Ou, Y., Morisawa, S., Hirata, A., Yagi, Y., *et al.*, 2019. Juzentaihoto Suppresses Muscle Atrophy in Streptozotocin-Induced Diabetic Mice. *Biol. Pharm. Bull* 42: 1128–1133.
- Ji, N., Luan, J., Hu, F., Zhao, Y., Lv, B., Wang, W., *et al.*, 2018. Aerobic exercise-stimulated klotho upregulation extends life span by attenuating the excess production of reactive oxygen species in the brain and kidney. *Exp Ther Med* 16: 3511–3517. doi:10.3892/etm.2018.6597
- Jiang, W., Xiao, T., Han, W., Xiong, J., He, T., Liu, Y., Huang, Yinghui, Yang, K., Bi, X., Xu, X., Yu, Y., Li, Y., Gu, J., Zhang, J., Huang, Yunjian, Zhang, B., Zhao, J., 2019. Klotho inhibits PKC α /p66SHC-mediated podocyte injury in diabetic nephropathy. *Mol Cell Endocrinol* 494. doi:10.1016/j.mce.2019.110490
- Joost, H.-G., Al-hasani, H., Schurmann, A., 2012. Animal Models in Diabetes Research, Walker, John M. ed. Humana Press, New York. doi:https://doi.org/10.1007/978-1-62703-068-7
- Kang, J.S., Son, S.S., Lee, J.H., Lee, S.W., Jeong, A.R., Lee, E.S., Cha, S.K., Chung, C.H., Lee, E.Y., 2021. Protective effects of klotho on palmitate-induced podocyte injury in diabetic nephropathy. *PLoS One* 16. doi:10.1371/journal.pone.0250666
- Khamseh, M.E., Malek, M., Aghili, R., Emami, Z., 2011. Sarcopenia and diabetes: Pathogenesis and consequences. *British Journal of Diabetes and Vascular Disease* 11: 230–234. doi:10.1177/1474651411413644
- Kuro-O*, M., Matsumura, Y., Aizawa, H., Kawaguchi, H., Suga, T., Utsugi, T., *et al.*, 1997. Mutation of the mouse klotho gene leads to a syndrome resembling ageing, NATURE.
- Langer, H.T., Afzal, S., Kempa, S., Spuler, S., 2020. Nerve damage induced skeletal muscle atrophy is associated with increased accumulation of intramuscular glucose and polyol pathway intermediates. *Sci Rep* 10. doi:10.1038/s41598-020-58213-1
- Lee, E.Y., Kim, S.S., Lee, J.S., Kim, I.J., Song, S.H., Cha, S.K. *et al.*, 2014. Soluble α -klotho as a novel biomarker in the early stage of nephropathy in patients with type 2 diabetes. *PLoS One* 9. doi:10.1371/journal.pone.0102984
- Licini, A., Malmstrom, T.K., 2016. Frailty and Sarcopenia as Predictors of Adverse Health Outcomes in Persons With Diabetes Mellitus. *J Am Med Dir Assoc* 17: 846–851. doi:10.1016/j.jamda.2016.07.007
- Liu, C.-T., Hsu, T.-W., Chen, K.-M., Tan, Y.-P., Lii, C.-K., Sheen, L.-Y., 2012. The Antidiabetic Effect of Garlic Oil is Associated with Ameliorated Oxidative Stress but Not Ameliorated Level of Pro-inflammatory Cytokines in Skeletal Muscle of Streptozotocin-induced Diabetic Rats, *Journal of Traditional and Complementary Medicine*.
- Liu, X., Cheng, C., Deng, B., Liu, M., 2022. Ellagic Acid Attenuates Muscle Atrophy in STZ-Induced Diabetic Mice. *Physiol Res* 71: 631–641. doi:10.33549/physiolres.934918
- Ma, Z., Zhu, L., Liu, Y., Wang, Z., Yang, Y., Chen, L., *et al.*, 2017. Lovastatin alleviates endothelial-to-mesenchymal transition in glomeruli via suppression

- of oxidative stress and TGF- β 1 signaling. *Front Pharmacol* 8. doi:10.3389/fphar.2017.00473
- Morley, J.E., Malmstrom, T.K., Rodriguez-Mañas, L., Sinclair, A.J., 2014. Frailty, Sarcopenia and Diabetes. *J Am Med Dir Assoc*. doi:10.1016/j.jamda.2014.10.001
- Naddaf, E., Barohn, R.J., Dimachkie, M.M., 2018. Inclusion Body Myositis: Update on Pathogenesis and Treatment. *Neurotherapeutics*. doi:10.1007/s13311-018-0658-8
- Narasimhulu, C.A., Singla, D.K., 2023. BMP-7 Attenuates Sarcopenia and Adverse Muscle Remodeling in Diabetic Mice via Alleviation of Lipids, Inflammation, HMGB1, and Pyroptosis. *Antioxidants* 12. doi:10.3390/antiox12020331
- Narasimhulu, C.A., Singla, D.K., 2021. Amelioration of diabetes-induced inflammation mediated pyroptosis, sarcopenia, and adverse muscle remodelling by bone morphogenetic protein-7. *J Cachexia Sarcopenia Muscle* 12: 403–420. doi:10.1002/jcsm.12662
- Nishikawa, H., Fukunishi, S., Asai, A., Yokohama, K., Ohama, H., Nishiguchi, S., *et al.*, 2021. Sarcopenia, frailty and type 2 diabetes mellitus (Review). *Mol Med Rep* 24: 854. doi:10.3892/mmr.2021.12494
- Ono, T., Takada, S., Kinugawa, S., Tsutsui, H., 2015. Curcumin ameliorates skeletal muscle atrophy in type 1 diabetic mice by inhibiting protein ubiquitination. *Exp Physiol* 100: 1052–1063. doi:10.1113/EP085049
- Ostler, J.E., Maurya, S.K., Dials, J., Roof, S.R., Devor, S.T., Ziolo, M.T., *et al.*, 2014. Effects of insulin resistance on skeletal muscle growth and exercise capacity in type 2 diabetic mouse models. *Am J Physiol Endocrinol Metab* 306: 592–605. doi:10.1152/ajpendo.00277.2013.-Type
- Pant, I., Chaturvedi, S., Bala, K., Kushwaha, S., 2015. Muscle histopathology in today's era of molecular genetics: Role and limitations. *Ann Indian Acad Neurol* 18: 398–402. doi:10.4103/0972-2327.165455
- Patsouris, D., Cao, J.J., Vial, G., Bravard, A., Lefai, E., Durand, A., *et al.*, 2014. Insulin resistance is associated with MCP1-mediated macrophage accumulation in skeletal muscle in mice and humans. *PLoS One* 9. doi:10.1371/journal.pone.0110653
- Pedersen, A.J.T., Hingst, J.R., Friedrichsen, M., Kristensen, J.M., Højlund, K., Wojtaszewski, J.F.P., 2015. Dysregulation of muscle glycogen synthase in recovery from exercise in type 2 diabetes. *Diabetologia* 58: 1569–1578. doi:10.1007/s00125-015-3582-z
- Pedersen, M., Bruunsgaard, H., Weis, N., Hendel, H.W., Andreassen, B.U., Eldrup, E., *et al.*, 2003. Circulating levels of TNF-alpha and IL-6-relation to truncal fat mass and muscle mass in healthy elderly individuals and in patients with type-2 diabetes, in: Mechanisms of Ageing and Development. Elsevier Ireland Ltd, pp. 495–502. doi:10.1016/S0047-6374(03)00027-7
- PERKENI, 2021. Pedoman Pengelolaan dan Pencegahan Diabetes Melitus Tipe 2 Dewasa di Indonesia 2021. Jakarta.
- Perry, B.D., Caldow, M.K., Brennan-Speranza, T.C., Sbaraglia, M., Jerums, G., Garnham, A., *et al.*, 2016. Muscle atrophy in patients with Type 2 Diabetes

- Mellitus: roles of inflammatory pathways, physical activity and exercise, *Exerc Immunol Rev*.
- Purnamasari, D., Tetraswi, E.N., Kartiko, G.J., Astrella, C., Husam, K., Laksmi, P.W., 2022. Sarcopenia and Chronic Complications of Type 2 Diabetes Mellitus. *Review of Diabetic Studies* 18: 157–165. doi:10.1900/RDS.2022.18.157
- Rieusset, J., Bouzakri, K., Chevillotte, E., Ge Ricard, N., Jacquet, D., Bastard, J.-P., *et al.*, 2004. Suppressor of Cytokine Signaling 3 Expression and Insulin Resistance in Skeletal Muscle of Obese and Type 2 Diabetic Patients.
- Roman, W., Gomes, E.R., 2018. Nuclear positioning in skeletal muscle. *Semin Cell Dev Biol*. doi:10.1016/j.semcdb.2017.11.005
- Sandri, M., 2013. Protein breakdown in muscle wasting: Role of autophagy-lysosome and ubiquitin-proteasome. *International Journal of Biochemistry and Cell Biology*. doi:10.1016/j.biocel.2013.04.023
- Sozen, T., Calik Basaran, N., Tinazli, M., Ozisik, L., 2018. Musculoskeletal problems in diabetes mellitus. *Eur J Rheumatol* 5: 258–265. doi:10.5152/eurjrheum.2018.18044
- Srinivasan, K., Viswanad, B., Asrat, L., Kaul, C.L., Ramarao, P., 2005. Combination of high-fat diet-fed and low-dose streptozotocin-treated rat: A model for type 2 diabetes and pharmacological screening. *Pharmacol Res* 52: 313–320. doi:10.1016/j.phrs.2005.05.004
- Sriwijitkamol, A., Christ-Roberts, C., Berria, R., Eagan, P., Pratipanawatr, T., Defronzo, R.A., *et al.*, 2006. Reduced Skeletal Muscle Inhibitor of B Content Is Associated With Insulin Resistance in Subjects With Type 2 Diabetes Reversal by Exercise Training.
- Stephens, F.B., Chee, C., Wall, B.T., Murton, A.J., Shannon, C.E., Van Loon, L.J.C., *et al.*, 2015. Lipid-induced insulin resistance is associated with an impaired skeletal muscle protein synthetic response to amino acid ingestion in healthy young men. *Diabetes* 64: 1615–1620. doi:10.2337/db14-0961
- Sumiwi, Y.A.A., Paramita, D.K., 2023. Textus Muscularis (Jaringan Otot), in: Sumiwi, Y.A.A., Susilowati, R. (Eds.), *Buku Ajar Histologi*. Gadjah Mada University Press, Yogyakarta, pp. 89–92.
- Suyoto, P.S.T., Aulia, B., 2019. Low muscle mass and inflammation among patients with type 2 diabetes mellitus in Indonesia. *Diabetol Int* 10: 219–224. doi:10.1007/s13340-018-0384-9
- Szkudelski, T., 2012. Streptozotocin-nicotinamide-induced diabetes in the rat. Characteristics of the experimental model. *Exp Biol Med*. doi:10.1258/ebm.2012.011372
- Teng, S., Huang, P., 2019. The effect of type 2 diabetes mellitus and obesity on muscle progenitor cell function. *Stem Cell Res Ther*. doi:10.1186/s13287-019-1186-0
- Trierweiler, H., Kisielewicz, G., Jonasson, T.H., Petterle, R.R., Moreira, C.A., Borba, V.Z.C., 2018. Sarcopenia: A chronic complication of type 2 diabetes mellitus. *Diabetol Metab Syndr* 10. doi:10.1186/s13098-018-0326-5
- Wang, X., Hu, Z., Hu, J., Du, J., Mitch, W.E., 2006. Insulin resistance accelerates muscle protein degradation: Activation of the ubiquitin-proteasome pathway

- by defects in muscle cell signaling. *Endocrinology* 147: 4160–4168. doi:10.1210/en.2006-0251
- Watson, K., Baar, K., 2014. MTOR and the health benefits of exercise. *Semin Cell Dev Biol.* doi:10.1016/j.semcdb.2014.08.013
- Wilkinson, D.J., Piasecki, M., Atherton, P.J., 2018. The age-related loss of skeletal muscle mass and function: Measurement and physiology of muscle fibre atrophy and muscle fibre loss in humans. *Ageing Res Rev.* doi:10.1016/j.arr.2018.07.005
- Xianchu, L., Ming, L., Changhao, C., Beiwang, D., Jingtao, X., 2021. Sinaptic acid attenuates muscle atrophy in streptozotocin-induced diabetic mice. *Iran J Basic Med Sci* 24: 1695–1701. doi:10.22038/IJBMS.2021.60324.13370
- Yadav, A., Singh, A., Phogat, J., Dahuja, A., Dabur, R., 2021. Magnoflorine prevent the skeletal muscle atrophy via Akt/mTOR/FoxO signal pathway and increase slow-MyHC production in streptozotocin-induced diabetic rats. *J Ethnopharmacol* 267. doi:10.1016/j.jep.2020.113510
- Yan, L.J., 2014. Pathogenesis of chronic hyperglycemia: From reductive stress to oxidative stress. *J Diabetes Res.* doi:10.1155/2014/137919
- Yang, J.J., Yu, D., Wen, W., Saito, E., Rahman, S., Shu, X.O., *et al.*, 2019. Association of Diabetes with All-Cause and Cause-Specific Mortality in Asia: A Pooled Analysis of More Than 1 Million Participants. *JAMA Netw Open* 2. doi:10.1001/jamanetworkopen.2019.2696
- Yeganeh-Hajahmadi, M., Najafipour, H., Rostamzadeh, F., Naghibzadeh-Tahami, A., 2021. Klotho and SIRT1 changes from pre-diabetes to diabetes and pre-hypertension to hypertension. *Diabetol Metab Syndr* 13. doi:10.1186/s13098-021-00736-2
- Zhang, H., Yu, L., Yun, G., 2023. Reduced Serum Levels of Klotho are Associated with Mild Cognitive Impairment in Patients with Type 2 Diabetes Mellitus. *Diabetes, Metabolic Syndrome and Obesity* 16: 129–137. doi:10.2147/DMSO.S394099
- Zhang, X., Zhao, Y., Chen, S., Shao, H., 2021. Anti-diabetic drugs and sarcopenia: emerging links, mechanistic insights, and clinical implications. *J Cachexia Sarcopenia Muscle.* doi:10.1002/jcsm.12838
- Zoungas, S., Arima, H., Gerstein, H.C., Holman, R.R., Woodward, M., Reaven, P., *et al.*, 2017. Effects of intensive glucose control on microvascular outcomes in patients with type 2 diabetes: a meta-analysis of individual participant data from randomised controlled trials. *Lancet Diabetes Endocrinol* 5: 431–437. doi:10.1016/S2213-8587(17)30104-3
- Zubkiewicz-Kucharska, A., Wikiera, B., Noczyńska, A., 2021. Soluble Klotho Is Decreased in Children With Type 1 Diabetes and Correlated With Metabolic Control. *Front Endocrinol (Lausanne)* 12. doi:10.3389/fendo.2021.709564