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DAFTAR PUSTAKA

Abdulgani, N., Hidayati, D., Adinovitasary, R., Oliviatie, V., dan Sekartaji, A.D., 2020. MDA levels in the pancreas, testes, liver, and plasma of diabetic rats: The effect of snakehead (Channa striata) extract. *Nusantara Bioscience*, **12**: .

Abhari, M.B., Afshar, P.F., Alimoradzadeh, R., dan Mirmiranpour, H., 2019. Comparing the effect of including omega-3 to treatment regimen in elderly patients with ulcerative colitis with placebo: A randomized clinical tria. *Immunopathologia Persa*, **6**: e10–e10.

Ahmad, M.U (ed)., 2017. *Fatty Acids: Chemistry, Synthesis, and Applications*. Elsevier, United States, 529-531.

Alberti, K.G.M.M. dan Zimmet, P.Z., 1998. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus. Provisional report of a WHO Consultation. *Diabetic Medicine*, **15**: 539–553.

Albracht-Schulte, K., Kalupahana, N.S., Ramalingam, L., Wang, S., Rahman, S.M., Robert-McComb, J., dkk., 2018. Omega-3 fatty acids in obesity and metabolic syndrome: a mechanistic update. *The Journal of Nutritional Biochemistry*, **58**: 1–16.

Ali, F.F. dan Rifaai, R.A., 2019. Preventive effect of omega-3 fatty acids in a rat model of stress-induced liver injury. *Journal of Cellular Physiology*, **234**: 11960–11968.

UNIVERSITAS
GADJAH MADA
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Allan, M., McCafferty, K., Sheaff, M., dan Yaqoob, M.M., 2023. Identification and management of diabetic nephropathy. *Medicine*, **51**: 262–268.

AOAC, 2000. AOAC Official Method: Oils and Fats. Nutrition and Food Science. *Nutrition & Food Science*, **41**: 38–43.

AOAC, 2006. *Association of Offi Cial Analytical Chemist. Edition 18 2005.* Offi cial Methods of Analysis., Washington DC.

Apriasari, M.L., Syahadati, M.A., dan Carabelly, A.N., 2020. Clinical Analysis of Channa micropeltes for Treating Wound of Diabetes Mellitus. *Berkala Kedokteran*, **16**: 1–10.

Araújo, L.S., Silva, M.V. da, Silva, C.A. da, Monteiro, M.L.R., Pereira, L.H. de M., Rocha, L.P., dkk., 2016. Cytokines and T Helper Cells in Diabetic Nephropathy Pathogenesis. *Journal of Diabetes Mellitus*, **06**: 230.

Araújo, L.S., Torquato, B.G.S., da Silva, C.A., dos Reis Monteiro, M.L.G., dos Santos Martins, A.L.M., da Silva, M.V., dkk., 2020. Renal expression of cytokines and chemokines in diabetic nephropathy. *BMC Nephrology*, **21**: 308.

Arisky, Y.P., Supriyanto, S., dan Fakhry, M., 2021. The Effect of Using Bromelain and Papain Enzymes on the Quality of Pure Fish Oil from Milkfish Silage (Chanos chanos). *Jurnal Ilmiah Perikanan dan Kelautan*, **13**: 233–242.

Aryaie, M., Sharifi, H., Saber, A., Salehi, F., Etminan, M., Nazemipour, M., dkk., 2022. Longitudinal causal effect of modified creatinine index on all-cause

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

mortality in patients with end-stage renal disease: Accounting for time-varying confounders using G-estimation. *PLOS ONE*, **17**: e0272212.

Aryee, A.N.A. dan Simpson, B.K., 2009. Comparative studies on the yield and quality of solvent-extracted oil from salmon skin. *Journal of Food Engineering*, **92**: 353–358.

Association, A.D., 2007. Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care*, **30**: S42–S47.

Aziza, I.N., Maulana, I.T., dan Sadiyah, E.R., 2015. Perbandingan kandungan omega 3 dalam minyak ikan bandeng (*Chanos chanos* Forsskal) yang segar dengan ikan bandeng yang dikeringkan di pasar. *Prosiding Farmasi*, **0**: 539–544.

Baggio, B., Musacchio, E., dan Priante, G., 2005. Polyunsaturated fatty acids and renal fibrosis: pathophysiologic link and potential clinical implications. *Journal of nephrology*, **18**: 362–367.

Bako, T., Umogbai, V., dan Obetta, S., 2014. Extraction and characterization of Mackery (Scomber scombrus) oil for industrial use. *Researcher*, **6**: 80–85.

Barnett, K.N., Ogston, S.A., McMurdo, M.E.T., Morris, A.D., dan Evans, J.M.M., 2010. A 12-year follow-up study of all-cause and cardiovascular mortality among 10 532 people newly diagnosed with Type 2 diabetes in Tayside, Scotland. *Diabetic Medicine*, **27**: 1124–1129.

Bernardy, K., Farias, J.G., Pereira, A.S., Dorneles, A.O.S., Bernardy, D., Tabaldi, L.A., dkk., 2020. Plants' genetic variation approach applied to zinc

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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contamination: secondary metabolites and enzymes of the antioxidant system in Pfaffia glomerata accessions. *Chemosphere*, **253**: 126692.

Bohlouli, J., Namjoo, I., Borzoo-Isfahani, M., Hojjati Kermani, M.A., Balouch Zehi, Z., dan Moravejolahkami, A.R., 2021. Effect of probiotics on oxidative stress and inflammatory status in diabetic nephropathy: A systematic review and meta-analysis of clinical trials. *Heliyon*, **7**: e05925.

Bonilla-Méndez, J.R., Hoyos-Concha, J.L., Bonilla-Méndez, J.R., dan Hoyos-Concha, J.L., 2018. Methods of extraction refining and concentration of fish oil as a source of omega-3 fatty acids. *Ciencia y Tecnología Agropecuaria*, **19**: 645–668.

Bork, C.S., Baker, E.J., Lundbye-Christensen, S., Miles, E.A., dan Calder, P.C., 2019. Lowering the linoleic acid to alpha-linoleic acid ratio decreases the production of inflammatory mediators by cultured human endothelial cells. *Prostaglandins, Leukotrienes and Essential Fatty Acids*, **141**: 1–8.

BPOM RI, 2011. Persyaratan Penambahan Zat Gizi dan Non Gizi dalam Pangan Olahan.

Brosius, F.C., Alpers, C.E., Bottinger, E.P., Breyer, M.D., Coffman, T.M., Gurley, S.B., dkk., 2009. Mouse Models of Diabetic Nephropathy. *Journal of the American Society of Nephrology : JASN*, **20**: 2503–2512.

Brownlee, M., 2001. Biochemistry and molecular cell biology of diabetic complications. *Nature*, **414**: 813–820.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Brownlee, M., 2005. The Pathobiology of Diabetic Complications: A Unifying Mechanism. *Diabetes*, **54**: 1615–1625.

Carballo-Casla, A., García-Esquinas, E., Banegas, J.R., Rodríguez-Artalejo, F., dan Ortolá, R., 2022. Fish consumption, omega-3 fatty acid intake, and risk of pain: the Seniors-ENRICA-1 cohort. *Clinical Nutrition*, **41**: 2587–2595.

Chantachum, S., Benjakul, S., dan Sriwirat, N., 2000. Separation and quality of fish oil from precooked and non-precooked tuna heads. *Food Chemistry*, **69**: 289–294.

Chen, J. dan Liu, H., 2020. Nutritional Indices for Assessing Fatty Acids: A Mini-Review. *International Journal of Molecular Sciences*, **21**: 5695.

Chen, S., Bobe, G., Zimmerman, S., Hammond, E.G., Luhman, C.M., Boylston, T.D., dkk., 2004. Physical and Sensory Properties of Dairy Products from Cows with Various Milk Fatty Acid Compositions. *Journal of Agricultural and Food Chemistry*, **52**: 3422–3428.

Cicero, A.F.G., Ertek, S., dan Borghi, C., 2009. Omega-3 Polyunsaturated Fatty Acids: Their Potential Role in Blood Pressure Prevention and Management. *Current Vascular Pharmacology*, **7**: 330–337.

Cohen, J.B., Tewksbury, C.M., Torres Landa, S., Williams, N.N., dan Dumon, K.R., 2019. National Postoperative Bariatric Surgery Outcomes in Patients with Chronic Kidney Disease and End-Stage Kidney Disease. *Obesity Surgery*, **29**: 975–982.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Cordero-Pérez, P., Sánchez-Martínez, C., García-Hernández, P.A., dan Saucedo, A.L., 2020. Metabolomics of the diabetic nephropathy: behind the fingerprint of development and progression indicators. *Nefrología (English Edition)*, **40**: 585–596.

Cruz, P.L., Moraes-Silva, I.C., Ribeiro, A.A., Machi, J.F., de Melo, M.D.T., dos Santos, F., dkk., 2021. Nicotinamide attenuates streptozotocin-induced diabetes complications and increases survival rate in rats: role of autonomic nervous system. *BMC Endocrine Disorders*, **21**: 133.

da Silva, E.P., Nachbar, R.T., Levada-Pires, A.C., Hirabara, S.M., dan Lambertucci, R.H., 2016. Omega-3 fatty acids differentially modulate enzymatic anti-oxidant systems in skeletal muscle cells. *Cell Stress and Chaperones*, **21**: 87–95.

de Assis, A.M., Rech, A., Longoni, A., da Silva Morrone, M., de Bittencourt Pasquali, M.A., Perry, M.L., dkk., 2015. Dietary n-3 polyunsaturated fatty acids revert renal responses induced by a combination of 2 protocols that increase the amounts of advanced glycation end product in rats. *Nutrition Research*, **35**: 512–522.

DiPiro, J.T., Talbert, R.L., Yee, G.C., Matzke, G.R., Wells, B.G., dan Posey, L.M., 2008. *Pharmacotherapy: A Pathophysiologic Approach*. McGraw Hill Professional.

Domingueti, C.P., Dusse, L.M.S., Carvalho, M. das G., de Sousa, L.P., Gomes, K.B., dan Fernandes, A.P., 2016. Diabetes mellitus: The linkage between

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

oxidative stress, inflammation, hypercoagulability and vascular complications. *Journal of Diabetes and its Complications*, **30**: 738–745.

Dömling, A. dan Li, X., 2021. TNF-α: The shape of small molecules to come? *Drug Discovery Today*, .

Dotto, J., Espinoza-Quiñones, F.R., Milinsk, M.C., dan Alves, H.J., 2021. High performance on the moisture reduction in waste oils by a bentonite-based adsorption process. *Environmental Technology*, **42**: 3338–3347.

Eknoyan, G., Lameire, N., Eckardt, K., Kasiske, B., Wheeler, D., Levin, A., dkk., 2013. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney Int*, **3**: 5–14.

El-Boshy, M., Alsaegh, A., Qasem, A.H., Sindi, R.A., Abdelghany, A.H., Gadalla, H., dkk., 2021. Enhanced renoprotective actions of Paricalcitol and omega-3 fatty acids co-therapy against diabetic nephropathy in rat. *Journal of Advanced Research*, .

FAO, 2017. 'Standard For Fish Oils CXS 329-2017', . Codex Alimentarius Commission. Rome: FAO., Codex Alimentarius Commission. Rome: FAO.

Fathy, S.A., Mohamed, M.R., Ali, M.A.M., EL-Helaly, A.E., dan Alattar, A.T., 2019. Influence of IL-6, IL-10, IFN-γ and TNF-α genetic variants on susceptibility to diabetic kidney disease in type 2 diabetes mellitus patients. *Biomarkers*, **24**: 43–55.

Fatimah, R.N., 2015. Diabetes melitus tipe 2. *Jurnal Majority*, **4**: .

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Fitriani, H., Munandar, A., Surilayani, D., Haryati, S., Pratama, G., Meata, B.A., dkk., 2021. Preliminary study of fish oil from milkfish satay by product using dry rendering extraction. *Food ScienTech Journal*, **3**: 101–107.

Frier, B.C., Noble, E.G., dan Locke, M., 2008. Diabetes-induced atrophy is associated with a muscle-specific alteration in NF-κB activation and expression. *Cell Stress and Chaperones*, **13**: 287–296.

Georgiou, M. dan Prokopiou, E., 2023. Diabetic retinopathy and the role of Omega-3 PUFAs: A narrative review. *Experimental Eye Research*, **231**: 109494.

Ghasemi Fard, S., Wang, F., Sinclair, A.J., Elliott, G., dan Turchini, G.M., 2019. How does high DHA fish oil affect health? A systematic review of evidence. *Critical Reviews in Food Science and Nutrition*, **59**: 1684–1727.

Ghazizadeh, Z., Khaloo, P., Alemi, H., Rabizadeh, S., Mirmiranpour, H., Esteghamati, A., dkk., 2019. Definition of an oxidative stress status by combined assessment of Malondialdehyde and Oxidized-LDL: A study in patients with type2 diabetes and control. *Meta Gene*, **19**: 91–97.

Gholamalizadeh, M., Rastgoo, S., Doaei, S., Vahid, F., Malmir, H., Ashoori, N., dkk., 2021. Index of Nutritional Quality (INQ) and the Risk of Obesity in Male Adolescents: a Case-Control Study. *Biological Trace Element Research*, **199**: 1701–1706.

Grimstad, T., Bjørndal, B., Cacabelos, D., Aasprong, O.G., Janssen, E.A.M., Omdal, R., dkk., 2012. Dietary supplementation of krill oil attenuates

UNIVERSITAS
GADJAH MADA
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HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

inflammation and oxidative stress in experimental ulcerative colitis in rats. *Scandinavian Journal of Gastroenterology*, **47**: 49–58.

Guo, L., Jiang, B., Li, D., dan Xiao, X., 2021. Nephroprotective Effect of Adropinin Against Streptozotocin-Induced Diabetic Nephropathy in Rats: Inflammatory Mechanism and YAP/TAZ Factor. *Drug Design, Development and Therapy*, **15**: 589–600.

Han, E., Yun, Y., Kim, G., Lee, Y., Wang, H.J., Lee, B.-W., dkk., 2016. Effects of omega-3 fatty acid supplementation on diabetic nephropathy progression in patients with diabetes and hypertriglyceridemia. *PLoS One*, **11**: e0154683.

Haneda, M., Koya, D., Isono, M., dan Kikkawa, R., 2003. Overview of Glucose Signaling in Mesangial Cells in Diabetic Nephropathy. *Journal of the American Society of Nephrology*, **14**: 1374–1382.

Hasanuzzaman, M., Bhuyan, M.H.M.B., Zulfiqar, F., Raza, A., Mohsin, S.M., Mahmud, J.A., dkk., 2020. Reactive Oxygen Species and Antioxidant Defense in Plants under Abiotic Stress: Revisiting the Crucial Role of a Universal Defense Regulator. *Antioxidants*, **9**: 681.

Hastarini, E., Fardiaz, D., Irianto, H.E., dan Budhijanto, S., 2012. Karakteristik minyak ikan dari limbah pengolahan filet Ikan Patin Siam (Pangasius hypopthalmus) dan Patin Jambal (Pangasius djambal). *Agritech*, **32**: .

Heilig, C.W., Concepcion, L.A., Riser, B.L., Freytag, S.O., Zhu, M., dan Cortes, P., 1995. Overexpression of glucose transporters in rat mesangial cells

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

cultured in a normal glucose milieu mimics the diabetic phenotype. *The Journal of Clinical Investigation*, **96**: 1802–1814.

Heilig, C.W., Kreisberg, J.I., Freytag, S., Murakami, T., Ebina, Y., Guo, L., dkk., 2001. Antisense GLUT-1 protects mesangial cells from glucose induction of GLUT-1 and fibronectin expression. *American Journal of Physiology-Renal Physiology*, **280**: F657–F666.

Hernandez, E. dan Hosokawa, M., 2015. *Omega-3 Oils: Applications in Functional Foods*. Elsevier.

Hidayah, N., Rohman, A., Mustafidah, M., dan Irnawati, 2022. Physicochemical characterization and fatty acid profiles of fish oil from milkfish (Chanos chanos F.). *Food Research*, **6**: 265–270.

Hidayati, D., Faizah, A., Prasetyo, E.N., Jadid, N., dan Abdulgani, N., 2018. Antioxidant Capacity of Snakehead Fish Extract (Channa striata) at Different Shelf Life and Temperatures. *Journal of Physics: Conference Series*, **1028**: 012021.

Hidayaturrahmah, H., 2017. Hypoglycemic Test Of Catfish Oil Extracts (Pangasius hypophthalmus) In The Oral Glucose Tolerance Test And Histology Of The Pancreas Of Male Rats (Rattus norvegicus). *Hypoglycemic Test Of Catfish Oil Extracts (Pangasius hypophthalmus) In The Oral Glucose Tolerance Test And Histology Of The Pancreas Of Male Rats (Rattus norvegicus).*, **8**: .

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Hostetter, T.H., 2003. Hyperfiltration and glomerulosclerosis. *Seminars in Nephrology*, **23**: 194–199.

Hovind, P., Rossing, P., Tarnow, L., Smidt, U.M., dan Parving, H.-H., 2001. Progression of diabetic nephropathy. *Kidney International*, **59**: 702–709.

Hu, S., Wang, Jinhui, Wang, Jingfeng, Li, S., Jiang, W., dan Liu, Y., 2017. Renoprotective effect of fucoidan from Acaudina molpadioides in streptozotocin/high fat diet-induced type 2 diabetic mice. *Journal of Functional Foods*, **31**: 123–130.

Huang, C., Chiba, L.I., dan Bergen, W.G., 2020. Bioavailability and metabolism of omega-3 polyunsaturated fatty acids in pigs and omega-3 polyunsaturated fatty acid-enriched pork: A review. *Livestock Science*, 104370.

Huang, S., Tan, M., Guo, F., Dong, L., Liu, Z., Yuan, R., dkk., 2020. Nepeta angustifolia C. Y. Wu improves renal injury in HFD/STZ-induced diabetic nephropathy and inhibits oxidative stress-induced apoptosis of mesangial cells. *Journal of Ethnopharmacology*, **255**: 112771.

Husna, F., Suyatna, F., Arozal, W., dan Purwaningsih, E., 2019. Model Hewan Coba pada Penelitian Diabetes. *Pharmaceutical Sciences and Research*, **6**: .

Huynh, M.D. dan Kitts, D.D., 2009. Evaluating nutritional quality of pacific fish species from fatty acid signatures. *Food Chemistry*, **114**: 912–918.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Ibuki, F.K., Bergamaschi, C.T., da Silva Pedrosa, M., dan Nogueira, F.N., 2020. Effect of vitamin C and E on oxidative stress and antioxidant system in the salivary glands of STZ-induced diabetic rats. *Archives of Oral Biology*, **116**: 104765.

Indah, I., Rohman, A., dan Lestari, L.A., 2022. Physicochemical Characterization Patin Fish Oil (Pangasius micronema) Is Refined Using Bentonite and Activated Carbon. *Journal of Food and Pharmaceutical Sciences*, 626–633.

Iseki, K., Ikemiya, Y., dan Fukiyama, K., 1997. Risk factors of end-stage renal disease and serum creatinine in a community-based mass screening. *Kidney International*, **51**: 850–854.

Itsiopoulos, C., Marx, W., Mayr, H.L., Tatucu-Babet, O.A., Dash, S.R., George, E.S., dkk., 2018. The role of omega-3 polyunsaturated fatty acid supplementation in the management of type 2 diabetes mellitus: A narrative review. *Journal of Nutrition & Intermediary Metabolism*, **14**: 42–51.

Iwansyah, A.C., Luthfiyanti, R., Ardiansyah, R.C.E., Rahman, N., Andriana, Y., dan Hamid, H.A., 2021. Antidiabetic activity of Physalis angulata L. fruit juice on streptozotocin-induced diabetic rats. *South African Journal of Botany*, .

Jacobsen, C., Nielsen, N.S., Horn, A.F., dan Sørensen, A.-D.M., 2013. *Food Enrichment with Omega-3 Fatty Acids*. Elsevier.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
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Jamilian, M., Samimi, M., Mirhosseini, N., Afshar Ebrahimi, F., Aghadavod, E., Taghizadeh, M., dkk., 2018. A Randomized Double-Blinded, Placebo-Controlled Trial Investigating the Effect of Fish Oil Supplementation on Gene Expression Related to Insulin Action, Blood Lipids, and Inflammation in Gestational Diabetes Mellitus-Fish Oil Supplementation and Gestational Diabetes. *Nutrients*, **10**: 163.

Jangale, N.M., Devarshi, P.P., Bansode, S.B., Kulkarni, M.J., dan Harsulkar, A.M., 2016. Dietary flaxseed oil and fish oil ameliorates renal oxidative stress, protein glycation, and inflammation in streptozotocin–nicotinamide-induced diabetic rats. *Journal of physiology and biochemistry*, **72**: 327–336.

Jatavan, P., 2020. Chapter 8 - Oxidative stress in gestational diabetes mellitus, dalam: Preedy, V.R. (Editor), *Diabetes (Second Edition)*. Academic Press, hal. 79–85.

Kashani, K., Rosner, M.H., dan Ostermann, M., 2020. Creatinine: From physiology to clinical application. *European Journal of Internal Medicine*, **72**: 9–14.

Keapai, W., Apichai, S., Amornlerdpison, D., dan Lailerd, N., 2016. Evaluation of fish oil-rich in MUFAs for anti-diabetic and anti-inflammation potential in experimental type 2 diabetic rats. *The Korean journal of physiology & pharmacology: official journal of the Korean Physiological Society and the Korean Society of Pharmacology*, **20**: 581.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Khan, N.U., Lin, J., Liu, X., Li, H., Lu, W., Zhong, Z., dkk., 2020. Insights into predicting diabetic nephropathy using urinary biomarkers. *Biochimica et Biophysica Acta (BBA) - Proteins and Proteomics*, **1868**: 140475.

Khoury, C.C., Chen, S., dan Ziyadeh, F.N., 2020. Chapter 19 - Pathophysiology of Diabetic Nephropathy, dalam: Kimmel, P.L. dan Rosenberg, M.E. (Editor), *Chronic Renal Disease (Second Edition)*. Academic Press, hal. 279–296.

Kishore, L., Kaur, N., dan Singh, R., 2017. Nephroprotective effect of Paeonia emodi via inhibition of advanced glycation end products and oxidative stress in streptozotocin–nicotinamide induced diabetic nephropathy. *Journal of Food and Drug Analysis*, **25**: 576–588.

Ladeira, L.C.M., dos Santos, E.C., Santos, T.A., da Silva, J., Lima, G.D. de A., Machado-Neves, M., dkk., 2021. Green tea infusion prevents diabetic nephropathy aggravation in recent-onset type 1 diabetes regardless of glycemic control. *Journal of Ethnopharmacology*, **274**: 114032.

Lee, C.C. dan Adler, A.I., 2012. Recent findings on the effects of marine-derived n-3 polyunsaturated fatty acids on urinary albumin excretion and renal function. *Current atherosclerosis reports*, **14**: 535–541.

Lenzen, S., 2008. The mechanisms of alloxan- and streptozotocin-induced diabetes. *Diabetologia*, **51**: 216–226.

Lestari, D.U., Sumardianto, S., dan Purnamayati, L., 2020. The Characteristics of Striped Catfish Oil (Pangasius hypophthalmus) Extracted by Dry

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Rendering Method at Different Temperatures. *Caraka Tani: Journal of Sustainable Agriculture*, **35**: 66–77.

Liu, J.-D., Liu, W.-B., Zhang, D.-D., Xu, C.-Y., Zhang, C.-Y., Zheng, X.-C., dkk., 2020. Dietary reduced glutathione supplementation can improve growth, antioxidant capacity, and immunity on Chinese mitten crab, Eriocheir sinensis. *Fish & Shellfish Immunology*, **100**: 300–308.

Liu, S.-H., Chen, Y.-C., Tzeng, H.-P., dan Chiang, M.-T., 2021. Fish oil enriched ω-3 fatty acids ameliorates protein synthesis/degradation imbalance, inflammation, and wasting in muscles of diet-induced obese rats. *Journal of Functional Foods*, **87**: 104755.

Liu, W., Gao, M., Yang, S., Sun, C., Bi, Y., Li, Y., dkk., 2023. Effects of omega-3 supplementation on glucose and lipid metabolism in patients with gestational diabetes: A meta-analysis of randomized controlled trials. *Journal of Diabetes and its Complications*, **37**: 108451.

Marzuki, I., Paserangi, I., dan Ali, M.Y., 2020. Aplikasi Tepung Cacing Tanah (Lumbricus rubellus) Untuk Meningkatkan Kadar Omega-3 Dan Omega-6 Ikan Bandeng (Chanos chanos) Budidaya Tambak. *Al-Kimia*, **8**: 129–138.

Masiello, P., Broca, C., Gross, R., Roye, M., Manteghetti, M., Hillaire-Buys, D., dkk., 1998. Experimental NIDDM: Development of a New Model in Adult Rats Administered Streptozotocin and Nicotinamide. *Diabetes*, **47**: 224–229.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Mendes, O., Koetzner, L., dan Chen, J., 2018. Chapter 26 - Nutraceutical Impact on the Pathophysiology of Diabetes Mellitus, dalam: Bagchi, D. dan Nair, S. (Editor), *Nutritional and Therapeutic Interventions for Diabetes and Metabolic Syndrome (Second Edition)*. Academic Press, hal. 329–341.

Mihardja, L., Delima, D., Massie, R.G.A., Karyana, M., Nugroho, P., dan Yunir, E., 2018. Prevalence of kidney dysfunction in diabetes mellitus and associated risk factors among productive age Indonesian. *Journal of Diabetes & Metabolic Disorders*, **17**: 53–61.

Mima, A., 2013. Inflammation and Oxidative Stress in Diabetic Nephropathy: New Insights on Its Inhibition as New Therapeutic Targets. *Journal of Diabetes Research*, **2013**: e248563.

Mishra, R., Emancipator, S.N., Kern, T., dan Simonson, M.S., 2005. High glucose evokes an intrinsic proapoptotic signaling pathway in mesangial cells. *Kidney International*, **67**: 82–93.

MMAF, 2023. 'Total Produksi', *Pengolahan Data Produksi Kelautan dan Perikanan*. URL: https://statistik.kkp.go.id/home.php?m=total&i=2#panel-footer (diakses tanggal 05/07/2023).

Moresco, R.N., Sangoi, M.B., De Carvalho, J.A.M., Tatsch, E., dan Bochi, G.V., 2013. Diabetic nephropathy: Traditional to proteomic markers. *Clinica Chimica Acta*, **421**: 17–30.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Mozaffarian, D. dan Wu, J.H.Y., 2012. (n-3) Fatty Acids and Cardiovascular Health: Are Effects of EPA and DHA Shared or Complementary? *The Journal of Nutrition*, **142**: 614S-625S.

Nazir, N., Diana, A., dan Sayuti, K., 2017. Physicochemical and fatty acid profile of fish oil from head of tuna (Thunnus albacares) extracted from various extraction method. *International Journal on Advanced Science, Engineering and Information Technology*, **7**: 709–715.

Neha, K., Haider, M.R., Pathak, A., dan Yar, M.S., 2019. Medicinal prospects of antioxidants: A review. *European Journal of Medicinal Chemistry*, **178**: 687–704.

Ni, Z., Guo, L., Liu, F., Olatunji, O.J., dan Yin, M., 2019. Allium tuberosum alleviates diabetic nephropathy by supressing hyperglycemia-induced oxidative stress and inflammation in high fat diet/streptozotocin treated rats. *Biomedicine & Pharmacotherapy*, **112**: 108678.

Noei Razliqi, R., Ahangarpour, A., Mard, S.A., dan Khorsandi, L., 2023. Gentisic acid protects against diabetic nephropathy in Nicotinamide-Streptozotocin administered male mice by attenuating oxidative stress and inflammation: The role of miR-200a/Keap1/Nrf2 pathway, renin-angiotensin system (RAS) and NF-κB. *Chemico-Biological Interactions*, **380**: 110507.

Nugent, J., Aklilu, A., Yamamoto, Y., Simonov, M., Li, F., Biswas, A., dkk., 2021. Assessment of Acute Kidney Injury and Longitudinal Kidney

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Function After Hospital Discharge Among Patients With and Without COVID-19. *JAMA Network Open*, **4**: e211095.

Omoboyowa, D.A., Karigidi, K.O., dan Aribigbola, T.C., 2021. Nephro-protective efficacy of Blighia sapida stem bark ether fractions on experimentally induced diabetes nephropathy. *Comparative Clinical Pathology*, **30**: 25–33.

Ortiz, G.G., Pacheco Moisés, F.P., Mireles-Ramírez, M., Flores-Alvarado, L.J., González-Usigli, H., Sánchez-González, V.J., dkk., 2017. Chapter One - Oxidative Stress: Love and Hate History in Central Nervous System, dalam: Donev, R. (Editor), *Advances in Protein Chemistry and Structural Biology, Stress and Inflammation in Disorders*. Academic Press, hal. 1–31.

Ozougwu, J., Obimba, K., Belonwu, C., dan Unakalamba, C., 2013. The pathogenesis and pathophysiology of type 1 and type 2 diabetes mellitus. *Journal of physiology and pathophysiology*, **4**: 46–57.

Panagan, A.T., Yohandini, H., Yohandini, H., dan Gultom, J.U., 2011. Analisis Kualitatif dan Kuantitatif Asam Lemak Tak Jenuh Omega-3 dari Minyak Ikan Patin (Pangasius pangasius) dengan Metoda Kromatografi Gas. *Jurnal Penelitian Sains*, **14**: .

Pasaribu, Y.P., Buyang, Y., Suryaningsih, N.L.S., Dirpan, A., dan Djalal, M., 2020. Effect of steaming and pressurized boiling process to the nutrient profile of Papuan cork fish Channa striata as potential protein-rich food to prevent stunting. *Medicina Clinica Practica*, **3**: .

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Pasaribu, Yenni Pintauli, Buyang, Y., Suryaningsih, N.L.S., Dirpan, A., dan Djalal, M., 2020. Effect of steaming and pressurized boiling process to the nutrient profile of Papuan cork fish Channa striata as potential protein-rich food to prevent stunting. *Medicina Clínica Práctica*, , 1st International WOSQUAL-2019 Conference (selected medicine proceedings) **3**: 100120.

Persson, F. dan Rossing, P., 2018. Diagnosis of diabetic kidney disease: state of the art and future perspective. *Kidney International Supplements*, **8**: 2–7.

Pineda-Peña, E.A., Martínez-Pérez, Y., Galicia-Moreno, M., Navarrete, A., Segovia, J., Muriel, P., dkk., 2018. Participation of the anti-inflammatory and antioxidative activity of docosahexaenoic acid on indomethacin-induced gastric injury model. *European Journal of Pharmacology*, **818**: 585–592.

Pontoh, J. dan Tumiwa, D., 2018. Gas chromatographic analysis of fatty acid composition in the freshwater fishes in North Sulawesi.

Putri, A., Rohman, A., dan Setyaningsih, W., 2021. Classification and prediction of patin fish oil's antioxidant activities from different origins using FTIR spectroscopy and chemometrics. *International Journal of Pharmaceutical Research*, **13**: 990–998.

Putri, A.R., Rohman, A., dan Riyanto, S., 2019. Comparative study of fatty acid profiles in patin (*Pangasius micronemus*) and gabus (*Channa striata*) fish oil and its authentication using FTIR spectroscopy combined with chemometrics. *International Journal of Applied Pharmaceutics*, 55–60.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Putri, A.R., Rohman, A., Setyaningsih, W., dan Riyanto, S., 2020. Determination of acid, peroxide, and saponification value in patin fish oil by FTIR spectroscopy combined with chemometrics. *Journal of Food Science*, **4**: 1758–1766.

Qi, S.S., Shao, M.L., Ze, S., dan Zheng, H.X., 2021. Salidroside from Rhodiola rosea L. attenuates diabetic nephropathy in STZ induced diabetic rats via anti-oxidative stress, anti-inflammation, and inhibiting TGF-β1/Smad pathway. *Journal of Functional Foods*, **77**: 104329.

Rachmah, Q., Atmaka, D.R., Haryana, N.R., dan Daud, Z.A.M., 2023. Predictors of chronic kidney disease among Indonesian adult population: Results from the 2018 Indonesia Basic Health Research.

Rahman, N., Hashem, S., Akther, S., dan Jothi, J.S., 2023. Impact of various extraction methods on fatty acid profile, physicochemical properties, and nutritional quality index of Pangus fish oil. *Food Science & Nutrition*, .

Rai, A.K., Swapna, H.C., Bhaskar, N., Halami, P.M., dan Sachindra, N.M., 2010. Effect of fermentation ensilaging on recovery of oil from fresh water fish viscera. *Enzyme and Microbial Technology*, **46**: 9–13.

Refaat, B., Abdelghany, A.H., BaSalamah, M.A., El-Boshy, M., Ahmad, J., dan Idris, S., 2018. Acute and chronic iron overloading differentially modulates the expression of cellular iron-homeostatic molecules in normal rat kidney. *Journal of Histochemistry & Cytochemistry*, **66**: 825–839.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Remacle, J., Raes, M., Toussaint, O., Renard, P., dan Rao, G., 1995. Low levels of reactive oxygen species as modulators of cell function. *Mutation Research/DNAging*, **316**: 103–122.

Riccardi, G., Giacco, R., dan Rivellese, A.A., 2004. Dietary fat, insulin sensitivity and the metabolic syndrome. *Clinical nutrition*, **23**: 447–456.

Rosmalina, R.T., Kosasih, W., dan Priatni, S., 2021. The effects of adsorbent materials on the lipid quality of lemuru fish oil and the enrichment of omega-3 using lipase. *Jurnal Teknologi dan Industri Pangan*, **32**: 16–26.

Rossing, P., Hansen, B.V., Nielsen, F.S., Myrup, B., Hølmer, G., dan Parving, H.-H., 1996. Fish Oil in Diabetic Nephropathy. *Diabetes Care*, **19**: 1214–1219.

Saeedi, P., Petersohn, I., Salpea, P., Malanda, B., Karuranga, S., Unwin, N., dkk., 2019. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Research and Clinical Practice*, **157**: 107843.

Sagoo, M.K. dan Gnudi, L., 2018. Diabetic nephropathy: Is there a role for oxidative stress? *Free Radical Biology and Medicine*, **116**: 50–63.

Sahena, F., Zaidul, I.S.M., Jinap, S., Jahurul, M.H.A., Khatib, A., dan Norulaini, N.A.N., 2010. Extraction of fish oil from the skin of Indian mackerel using supercritical fluids. *Journal of Food Engineering*, **99**: 63–69.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Saini, R.K. dan Keum, Y.-S., 2018. Omega-3 and omega-6 polyunsaturated fatty acids: Dietary sources, metabolism, and significance — A review. *Life Sciences*, **203**: 255–267.

Salih, A.W., Najim, S.M., dan Al-Noor, J.M., 2021. Some physical, chemical and sensory properties of fish oil extracted from fish wastes by physical and chemical methods. *Biol. Appl. Env. Res*, **5**: 152–162.

Samsu, N., 2021. Diabetic Nephropathy: Challenges in Pathogenesis, Diagnosis, and Treatment. *BioMed Research International*, **2021**: e1497449.

Sandesh Suresh, K., Suresh, P.V., dan Kudre, T.G., 2019. 4 - Prospective ecofuel feedstocks for sustainable production, dalam: Azad, K. (Editor), *Advances in Eco-Fuels for a Sustainable Environment, Woodhead Publishing Series in Energy*. Woodhead Publishing, hal. 89–117.

Sangoi, M.B., Carvalho, J.A.M. de, Guarda, N.S., Duarte, T., Duarte, M.M.M.F., Premaor, M.O., dkk., 2019. Association between Urinary Levels of Interleukin-6, Interleukin-10 and Tumor Necrosis Factor-Alpha with Glomerular and Tubular Damage Indicators in Patients with Type 2 Diabetes. *Clinical Laboratory*, **65**: .

Sasongko, H., Efendi, N.R., dan Sugiyarto, 2018. The ethanolic extract of mountain papaya (*Vasconcellea pubescens* A.DC.) fruit against lipid peroxidation of rat liver tissues. *AIP Conference Proceedings*, **2019**: 050001.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Sasongko, H., Lestari, R., Yugatama, A., Farida, Y., Farida, Y., dan Farida, Y., 2020. Antidiabetic and Antioxidant Effect Combination Vasconcellea pubescens A.DC. and Momordica charantia L. Extract in Alloxan- Induced Diabetic Rats. *Pharmacognosy Journal*, **12**: 311–315.

Sasongko, H., Nurrochmad, A., Nugroho, A.E., dan Rohman, A., 2022. Indonesian freshwater fisheries' oil for health and nutrition applications: a narrative review. *Food Research*, **6**: 501–511.

Sasongko, H., Nurrochmad, A., Nugroho, A.E., dan Rohman, A., 2023. Fish oil supplementation in diabetic nephropathy prevents: inflammatory andoxidative stress target. *Food Research*, **7**: 307–315.

Sathibabu Uddandrao, V.V., Brahmanaidu, P., Ravindarnaik, R., Suresh, P., Vadivukkarasi, S., dan Saravanan, G., 2019. Restorative potentiality of S-allylcysteine against diabetic nephropathy through attenuation of oxidative stress and inflammation in streptozotocin–nicotinamide-induced diabetic rats. *European Journal of Nutrition*, **58**: 2425–2437.

Sathivel, S., Prinyawiwatkul, W., Negulescu, I.I., dan King, J.M., 2008. Determination of Melting Points, Specific Heat Capacity and Enthalpy of Catfish Visceral Oil During the Purification Process. *Journal of the American Oil Chemists' Society*, **85**: 291–296.

Sayed, A.A.R., 2012. Ferulsinaic Acid Modulates SOD, GSH, and Antioxidant Enzymes in Diabetic Kidney. *Evidence-Based Complementary and Alternative Medicine*, **2012**: e580104.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Schwartz, S.S., Epstein, S., Corkey, B.E., Grant, S.F.A., Gavin III, J.R., Aguilar, R.B., dkk., 2017. A Unified Pathophysiological Construct of Diabetes and its Complications. *Trends in Endocrinology & Metabolism*, **28**: 645–655.

Sembach, F.E., Østergaard, M.V., Vrang, N., Feldt-Rasmussen, B., Fosgerau, K., Jelsing, J., dkk., 2021. Rodent models of diabetic kidney disease: human translatability and preclinical validity. *Drug Discovery Today*, **26**: 200–217.

Sembiring, L., Ilza, M., dan Diharmi, A., 2018. Characteristics of Pure Oils from Belly Fat (Pangasius hypophthalmus) with Bentonite Purification. *Jurnal Pengolahan Hasil Perikanan Indonesia*, **21**: 549–555.

Shahidi, F. dan Ambigaipalan, P., 2018. Omega-3 Polyunsaturated Fatty Acids and Their Health Benefits. *Annual Review of Food Science and Technology*, **9**: 345–381.

Shang, T., Liu, L., Zhou, J., Zhang, M., Hu, Q., Fang, M., dkk., 2017. Protective effects of various ratios of DHA/EPA supplementation on high-fat diet-induced liver damage in mice. *Lipids in Health and Disease*, **16**: 65.

Shankar, K. dan Mehendale, H.M., 2014. Oxidative Stress, dalam: Wexler, P. (Editor), *Encyclopedia of Toxicology (Third Edition)*. Academic Press, Oxford, hal. 735–737.

Shapiro, H., Theilla, M., Attal-Singer, J., dan Singer, P., 2011. Effects of polyunsaturated fatty acid consumption in diabetic nephropathy. *Nature Reviews Nephrology*, **7**: 110–121.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Shatynska, O., Tokarskyy, O., Lykhatskyi, P., Yaremchuk, O., Bandas, I., dan Mashtalir, A., 2020. Dietary supplementation with magnesium citrate may improve pancreatic metabolic indices in an alloxan-induced diabetes rat model. *Potravinarstvo Slovak Journal of Food Sciences*, **14**: 836–846.

Simopoulos, A.P., 2002. The importance of the ratio of omega-6/omega-3 essential fatty acids. *Biomedicine & Pharmacotherapy*, **56**: 365–379.

Singh, Brahmjot, Kumar, A., Singh, H., Kaur, Sarabjit, Kaur, Satwinderjeet, Singh Buttar, H., dkk., 2020. Zingerone produces antidiabetic effects and attenuates diabetic nephropathy by reducing oxidative stress and overexpression of NF-κB, TNF-α, and COX-2 proteins in rats. *Journal of Functional Foods*, **74**: 104199.

Singla, K. dan Singh, R., 2020. Nephroprotective effect of Curculigo orchiodies in streptozotocin–nicotinamide induced diabetic nephropathy in wistar rats. *Journal of Ayurveda and Integrative Medicine*, **11**: 399–404.

Soleimani, A., Taghizadeh, M., Bahmani, F., Badroj, N., dan Asemi, Z., 2017. Metabolic response to omega-3 fatty acid supplementation in patients with diabetic nephropathy: A randomized, double-blind, placebo-controlled trial. *Clinical Nutrition*, **36**: 79–84.

Souza, D.R. de, Pieri, B.L. da S., Comim, V.H., Marques, S. de O., Luciano, T.F., Rodrigues, M.S., dkk., 2020. Fish oil reduces subclinical inflammation, insulin resistance, and atherogenic factors in overweight/obese type 2

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

diabetes mellitus patients: A pre-post pilot study. *Journal of Diabetes and its Complications*, **34**: 107553.

Stanton, R.C., 2021. Role of Glucose Metabolism and Mitochondrial Function in Diabetic Kidney Disease. *Current Diabetes Reports*, **21**: 6.

Sudirman, S., Herpandi, Lestari, S.D., dan Andayani, W., 2018. Effects of weight and body parts of siamese catfish (Pangasius hypophthalmus) on the nutritional content. *Food Research*, **2**: 307–313.

Suhartono, E., Triawanti, Yunanto, A., Firdaus, R.T., dan Iskandar, 2013. Chronic Cadmium Hepatooxidative in Rats: Treatment with Haruan Fish (Channa striata) Extract. *APCBEE Procedia*, , 4th International Conference on Environmental Science and Development- ICESD 2013 **5**: 441–445.

Sun, H., Saeedi, P., Karuranga, S., Pinkepank, M., Ogurtsova, K., Duncan, B.B., dkk., 2022. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Research and Clinical Practice*, **183**: 109119.

Suseno, S.H., Rizkon, A.K., Jacoeb, A.M., Nurjanah, N., dan Supinah, P., 2020. Ekstraksi dry rendering dan karakterisasi minyak ikan patin (Pangasius sp.) hasil samping industri filet di lampung. *Jurnal Pengolahan Hasil Perikanan Indonesia*, **23**: 38–46.

Syifa, F., Hidayah, N., Lukitaningsih, E., Irnawati, dan Rohman, A., 2022. Physicochemical properties, fatty acid composition and FTIR Spectra of Gabus (*Channa striata*) fish oil. *Food Research*, **6**: 219–224.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Szeto, H.H., 2006. Mitochondria-targeted peptide antioxidants: Novel neuroprotective agents. *The AAPS Journal*, **8**: 62.

Szkudelski, T., 2012. Streptozotocin–nicotinamide-induced diabetes in the rat. Characteristics of the experimental model. *Experimental Biology and Medicine*, **237**: 481–490.

Taati, M.M., Shabanpour, B., dan Ojagh, M., 2018. Investigation on fish oil extraction by enzyme extraction and wet reduction methods and quality analysis. *Aquaculture, Aquarium, Conservation & Legislation*, **11**: 83–90.

Taghizadeh, M., Mohammad Zadeh, A., Asemi, Z., Farrokhnezhad, A.H., Memarzadeh, M.R., Banikazemi, Z., dkk., 2022. Morus Alba leaf extract affects metabolic profiles, biomarkers inflammation and oxidative stress in patients with type 2 diabetes mellitus: A double-blind clinical trial. *Clinical Nutrition ESPEN*, **49**: 68–73.

Taneda, S., Honda, K., Tomidokoro, K., Uto, K., Nitta, K., dan Oda, H., 2010. Eicosapentaenoic acid restores diabetic tubular injury through regulating oxidative stress and mitochondrial apoptosis. *American Journal of Physiology-Renal Physiology*, **299**: F1451–F1461.

Tong, H., Snow, S.J., Chen, H., Schladweiler, M.C., Carswell, G., Chorley, B., dkk., 2020. Fish oil and olive oil-enriched diets alleviate acute ozone-induced cardiovascular effects in rats. *Toxicology and Applied Pharmacology*, **409**: 115296.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Tsai, H.-J., Kuo, F.-C., Wu, C.-F., Sun, C.-W., Hsieh, C.-J., Wang, S.-L., dkk., 2021. Association between two common environmental toxicants (phthalates and melamine) and urinary markers of renal injury in the third trimester of pregnant women: The Taiwan Maternal and Infant Cohort Study (TMICS). *Chemosphere*, **272**: 129925.

Usta, M., Ersoy, A., Ersoy, C., Ayar, Y., Goksel, G., dan Karagoz, I.S., 2020. Effect of omega-3 polyunsaturated fatty acid supplementation on glycemic control and renal function in type 2 diabetic patients with chronic kidney disease. *Acta Medica Mediterranea*, **36**: 821–828.

Vara-Messler, M., Mukdsi, J.H., Osieki, N.I., Benizio, E., Repossi, G.M., Ajayi, E.I., dkk., 2020. Eicosapentaenoic acid prevents salt sensitivity in diabetic rats and decreases oxidative stress. *Nutrition*, **72**: 110644.

Vinod, P.B., 2012. Pathophysiology of diabetic nephropathy. *Clinical Queries: Nephrology*, **1**: 121–126.

Vitlov Uljević, M., Starčević, K., Mašek, T., Bočina, I., Restović, I., Kević, N., dkk., 2019. Dietary DHA/EPA supplementation ameliorates diabetic nephropathy by protecting from distal tubular cell damage. *Cell and Tissue Research*, **378**: 301–317.

Wang, X., Li, C., Huan, Y., Cao, H., Sun, S., Lei, L., dkk., 2021. Diphenyl diselenide ameliorates diabetic nephropathy in streptozotocin-induced diabetic rats via suppressing oxidative stress and inflammation. *Chemico-Biological Interactions*, **338**: 109427.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
HERU SASONGKO, Prof. Dr. apt. Agung Endro Nugroho, M.Si; Prof. Dr. apt. Abdul Rohman, S.F., M.Si; Dr. apt. Arie
Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

Wei, P.Z., Fung, W.W.-S., Ng, J.K.-C., Lai, K.-B., Luk, C.C.-W., Chow, K.M., dkk., 2019. Metabolomic Changes of Human Proximal Tubular Cell Line in High Glucose Environment. *Scientific Reports*, **9**: 16617.

Wen, L., Zhang, Y., Sun-Waterhouse, D., You, L., dan Fu, X., 2017. Advantages of the polysaccharides from Gracilaria lemaneiformis over metformin in antidiabetic effects on streptozotocin-induced diabetic mice. *RSC Advances*, **7**: 9141–9151.

Wolf, G., Butzmann, U., dan Wenzel, U.O., 2003. The Renin-Angiotensin System and Progression of Renal Disease: From Hemodynamics to Cell Biology. *Nephron Physiology*, **93**: p3–p13.

Wong, C., Ho, A., Tong, P., Yeung, C., Kong, A., Lun, S., dkk., 2007. Aberrant activation profile of cytokines and mitogen-activated protein kinases in type 2 diabetic patients with nephropathy. *Clinical & Experimental Immunology*, **149**: 123–131.

Yan, L.-J., 2022. The Nicotinamide/Streptozotocin Rodent Model of Type 2 Diabetes: Renal Pathophysiology and Redox Imbalance Features. *Biomolecules*, **12**: 1225.

Yang, J., Fernández-Galilea, M., Martínez-Fernández, L., González-Muniesa, P., Pérez-Chávez, A., Martínez, J.A., dkk., 2019. Oxidative Stress and Non-Alcoholic Fatty Liver Disease: Effects of Omega-3 Fatty Acid Supplementation. *Nutrients*, **11**: 872.

UNIVERSITAS
GADJAH MADA
Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Yenni, Y., Nurhayati, T., dan Nurjanah, N., 2012. Pengaruh perebusan terhadap kandungan asam lemak dan kolesterol kerang pokea (Batissa violacea celebensis Marten 1897). *Jurnal Pengolahan Hasil Perikanan Indonesia*, **15**: 193–198.

Yoo, D., Jung, E., Noh, J., Hyun, H., Seon, S., Hong, S., dkk., 2019. Glutathione-Depleting Pro-Oxidant as a Selective Anticancer Therapeutic Agent. *ACS Omega*, **4**: 10070–10077.

Yu, H., Jing, Y., Zhang, X., Qayum, A., Gantumur, M.-A., Bilawal, A., dkk., 2020. Comparison of intracellular glutathione and related antioxidant enzymes: Impact of two glycosylated whey hydrolysates. *Process Biochemistry*, **97**: 80–86.

Yusoh, N.A.M., Man, R.C., Azman, N.A.M., Shaarani, S.M., Mudalip, S.K.A., Sulaiman, S.Z., dkk., 2022. Recovery of antioxidant from Decapterus Macarellus waste using wet rendering method. *Materials Today: Proceedings*, International Symposium of Reaction Engineering, Catalysis & Sustainable Energy (RECaSE 2021) **57**: 1382–1388.

Zahwa, I.M.E., 2018. Analisa omega-3 (*fatty acid*) dalam minyak ekstrak ikan bandeng (*Chanos chanos*) terhadap penurunan jumlah neutrofil jaringan granulasi pasca pencabutan gigi pada tikus galur wistar studi in vivo pada tikus putih, *Disertasi*, Fakultas Kedokteran Gigi UNISSULA.

Zhang, C., Chen, H., dan Bai, W., 2018. Characterization of Momordica charantia L. polysaccharide and its protective effect on pancreatic cells injury in

UNIVERSITAS
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Aktivitas Nefroprotektif Minyak Ikan Pada Model Tikus Diabetes Melitus
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Universitas Gadjah Mada, 2023 | Diunduh dari http://etd.repository.ugm.ac.id/

STZ-induced diabetic mice. *International Journal of Biological Macromolecules*, **115**: 45–52.

Zhang, J., Liu, J., dan Qin, X., 2018. Advances in early biomarkers of diabetic nephropathy. *Revista da Associação Médica Brasileira*, **64**: 85–92.

Zhang, Y., Fan, M., Zhang, W., Liu, W., Li, H., Ren, S., dkk., 2023. Schisandrin ameliorates diabetic nephropathy via regulating of PI3K/Akt/NF-κB-mediated inflammation and TGF-β1-induced fibrosis in HFD/STZ-induced C57BL/6J mice. *Journal of Functional Foods*, **100**: 105376.

Zuraini, A., Somchit, M.N., Solihah, M.H., Goh, Y.M., Arifah, A.K., Zakaria, M.S., dkk., 2006. Fatty acid and amino acid composition of three local Malaysian Channa spp. fish. *Food Chemistry*, **97**: 674–678.