

## DAFTAR PUSTAKA

- Abdel-Sattar, E., S.A. El-Maraghy, R.S. El-Dine, and S.M. Rizk. 2016. Russelioside B, a pregnane glycoside ameliorates hyperglycemia in streptozotocin induced diabetic rats by regulating key enzymes of glucose metabolism. *Chemico-Biological Interactions*. 252: 47-53.
- Almasdy, D., D.P. Sari, Suharti, D. Darwin, dan N. Kurniasih. 2015. Evaluasi penggunaan obat antidiabetik pada pasien diabetes melitus tipe 2 di suatu Rumah Sakit Pemerintah Kota Padang-Sumatera Barat. *Jurnal Sains Farmasi & Klinis*. 2(1):104-110.
- Alvarez, A., J. Lacalle, M.L. Canavate, D. Alonso-Alconada, I. Lara-Celador, F.J. Alvarez, and E. Hilario. 2010. Cell death. A comprehensive approximation. *Necrosis. Microscopy: Science, Technology, Applications and Education*. 1017-1024.
- American Diabetes Association (ADA). 2006. Standards of medical care in diabetes. *Diabetes Care*. 29: 4-42.
- \_\_\_\_\_. 2013. Standards of medical care in diabetes. *Diabetes Care*. 36: S11-S66.
- Anonim. 2005. Pharmaceutical care untuk penyakit diabetes melitus. Direktorat Bina Farmasi Komunitas dan Klinik Direktorat Jenderal Bina Kefarmasian dan Alat Kesehatan Departemen Kesehatan RI.
- Arunachalam, K. and T. Parimelazhagan. 2014. Antidiabetic and enzymatic antioxidant properties from methanol extract of *Ficus talboti* bark on diabetic rats induced by streptozotocin. *Asian Pacific Journal of Reproduction*. 3(2): 97-105.
- Arya, A., M.M.J. Al-Obaidi, N. Shahid, M.I.B. Noordin, C.Y. Looi, W.F. Won, S.L. Khaing, and M.R. Mustafa. 2014. Synergistic effect quercetin and quinic acid by alleviating structural degeneration in the liver, kidney, and pancreas tissue of STZ-induced diabetic rats: A mechanistic study. *Food and Chemical Toxicology*. 71: 183-196.
- Aslan, L. 1998. *Rumput Laut*. Kanisius, Yogyakarta.
- Ayesha, Hira, V. Sultana, J. Ara, and S. Ehteshamul-Haque. 2010. In vitro cytotoxicity of seaweeds from karachi coast on brine shrimp. *Pakistan Journal of Botany*. 42(5): 3555-3560.
- Balboa, E.M., E. Conde, A. Moure, E. Falque, and H. Dominguez. 2013. In vitro antioxidant properties of crude extracts and compounds from brown algae. *Food Chemistry*. 138: 1764-1785.
- Bastaki, S. 2005. Review: Diabetes mellitus and its treatment. *International Journal of Diabetes and Metabolism*. 13: 111-134.

- Bhadri, N. and R. Razdan. 2016. Benefical effect of phloroglucinol against adverse metabolic and electrophysiological alterations in streptozotocin induced diabetic rats: a possible target for the prevention of diabetic peripheral neuropathy. *Austin Endocrinal Diabetes Case Reports*. 1(1): 1-5.
- Burtis, C.A., E.R. Ashwood, and D.E. Bruns. 2005. *Tietz Textbook of Clinical Chemistry*. 4<sup>th</sup> ed. Saunders Company, USA.
- Carvalho, E.N., N.A.S. de Carvalho, and L.M. Ferreira. 2003. Experimental model of induction of diabetes mellitus in rats. *Acta Cir Bras*. 18: 60-64.
- Chatzigeorgiou, A., A. Halapas, K. Kalafatakis, and E. Kamper. 2009. The use of animal models in the study of diabetes mellitus. *In vivo*. 23: 245-258.
- Chew, K.K., M.Z. Khoo, S.Y. Ng, Y.Y. Thoo, W.M.W. Aida, and C.W. Ho. 2011. Effect of ethanol concentration, extraction time and extraction temperature on the recovery of phenolic compounds and antioxidant capacity of *Orthosiphon stamineus* extracts. *International Food Research Journal*. 18(4): 1427-1435.
- Colegate, S.M. and R.J. Molyneux. 2008. *Bioactive Natural Products: Detection, Isolation, and Structural*. CRC Press Taylor & Francis Group, USA.
- Cormack, D.H. 2001. *Essential Histology*. Lippincott Williams & Wilkins, Philadelphia.
- Cuong, D.X., V.N. Boi, T.T.T. Van, and L.N. Hau. 2016. Effect of storage time on phlorotannin content and antioxidant activity of six *Sargassum* species from Nhatrang Bay, Vietnam. *Journal of Applied Phycology*. 28: 567-572.
- Damron, W.S. 2003. *Introduction to Animal Science: Biological, Industry Perspective*. Prentice Hall, New Jersey.
- DiaSys Diagnostic Systems. 2009. Glucose GOD FS. DiaSys Diagnostic Systems GmbH, Germany.
- \_\_\_\_\_. 2012a. Cholesterol FS. DiaSys Diagnostic Systems GmbH, Germany.
- \_\_\_\_\_. 2012b. HDL Precipitant. DiaSys Diagnostic Systems GmbH, Germany.
- \_\_\_\_\_. 2012c. LDL Precipitant. DiaSys Diagnostic Systems GmbH, Germany.
- \_\_\_\_\_. 2012d. Triglycerides FS. DiaSys Diagnostic Systems GmbH, Germany.
- Direktorat Jenderal Pengawasan Obat dan Makanan. 2000. Parameter standar umum ekstrak tumbuhan obat. Departemen Kesehatan RI, Jakarta.

- Dogan, A., I. Celik, and M.S. Kaya. 2015. Antidiabetic properties of lyophilized extract of acorn (*Quercus brantii* Lindl.) on experimentally STZ-induced diabetic rats. *Journal of Ethnopharmacology*. 176: 243-251.
- Etuk, E.U. 2010. Animals models for studying diabetes mellitus. *Agriculture Biology Journal of North America*. 1(2): 130-134.
- Farvin, K.H.S. and C. Jacobsen. 2013. Phenolic compounds and antioxidant activities of selected species of seaweeds from Danish coast. *Food Chemistry*. 138: 1670-1681.
- Firdaus, M., S.S. Karyono, dan M. Astawan. 2009. Penapisan fitokimia dan identifikasi ekstrak rumput laut coklat (*Sargassum duplicatum*). *Jurnal Ilmu-ilmu Hayati (Life Science)*. 21: 1-14.
- Firdaus, M., M. Astawan, D. Mushtadi, T. Wresdiyati, S. Waspadji, dan S.S. Karyono. 2010. Pengaruh ekstrak rumput laut coklat terhadap fungsi sel endotelium aorta tikus diabetes melitus. *Majalah Farmasi Indonesia*. 21(3): 151-157.
- Firdaus, M. 2011. Aktivitas antioksidan ekstrak rumput laut coklat (*Sargassum echinocarpum*) sebagai pencegah disfungsi sel endothelium aorta tikus diabetes melitus. Institut Pertanian Bogor. Disertasi.
- Freile-Pelegrin, Y., D. Robledo, M.J. Chan-Bacab, and B.O. Ortega-Morales. 2008. Antileishmanial properties of tropical marine algae extracts. *Fitoterapia*. 79: 374-377.
- Fried, B. and J. Sherma. 1999. *Thin-Layer Chromatography, Revised and Expanded*. Marcel Dekker, Inc., New York.
- Friedman, M and H.S. Jurgens. 2000. Effect of pH on the stability of plant phenolic compound. *Journal of Agricultural and Food Chemistry*. 48(6): 2101-2110.
- Gamal, E.A.A. 2010. Biological importance of marine algae. *Saudi Pharmaceutical Journal*. 18: 1-25.
- Hamidi, M.R., B. Jovanova, and T.K. Panovska. 2014. Toxicological evaluation of the plant products using brine shrimp (*Artemia salina* L.) model. *Macedonian Pharmaceutical Bulletin*. 60(1): 9-18.
- Harborne, J.B. 1984. *Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis*. Chapman and Hall, New York.
- Hardoko, T. Siratantri, Eveline, M. Yogabuana, and S. Olivia. 2014. An in vitro study of antidiabetic activity of *Sargassum duplicatum* and *Turbinaria decurens* seaweed. *International Journal of Pharmaceutical Science Invention*. 3(2): 13-18.

- Harini, M. and O.P. Astirin. 2009. Blood cholesterol levels of hypercholesterolemic rat (*Rattus norvegicus*) after VCO treatment. *Nusantara Bioscience*. 1(2): 53-58.
- Harnita, A.N.I., I.E. Santosa, S. Martono, Sudarsono, S. Widayarni, and F.J.M. Harren. 2013. Inhibition of lipid peroxidation induced by ultraviolet radiation by crude phlorotannis isolated from brown algae *Sargassum hystrix* v. *Buxifolium* C. Agardh. *Indonesian Journal of Chemistry*. 13(1): 14-20.
- Hill, R.A., D.N. Kirk, H.L.J. Makin, and G.M. Murphy. 1991. *Dictionary of Steroids*. Chapman and Hall Ltd, UK.
- Husni, A., D. Purwanti, and Ustadi. 2016a. Blood glucose level and lipid profile of streptozotocin-induced diabetes rats treated with sodium alginate from *Sargassum crassifolium*. *Journal of Biological Science*. 16: 58-64.
- Husni, A., F.P. Anggara, A. Isnansetyo, and A.E. Nugroho. 2016b. Blood glucose level and lipid profile of streptozotocin-induced diabetes rats treated with *Sargassum polycystum* extract. *International Journal of Pharmaceutical and Clinical Research*. 8(5): 445-450.
- Husni, A., S. Pawestri, and A. Isnansetyo. 2016c. Blood glucose level and lipid profile of alloxan-induced diabetes rats treated with Na-alginate from seaweed *Turbinaria ornata* (Turner) J. Agardh. *Jurnal Teknologi (Science & Engineering)*. 78: 7-14.
- IDF. 2015. *Diabetes Atlas 7<sup>th</sup> Edition*. <<http://www.diabetesatlas.org/resources/2015-atlas.html>>. Diakses tanggal 31 Agustus 2016.
- Juniarti, D.O. dan Yuhernita. 2009. Kandungan senyawa kimia, uji toksisitas (*Brine Shrimp Lethality Test*) dan antioksidan (1,1-diphenyl-2-pikrilhidrazil) dari ekstrak daun saga (*Abrus precatorius* L.). *Makara Sains*. 13(1): 50-54.
- Kadi, A. dan W.S. Atmadja. 1988. Rumput laut (algae): Jenis, reproduksi, produksi, budidaya, dan pasca-panen. Pusat Penelitian dan Pengembangan Oseanologi Lembaga Ilmu Pengetahuan Indonesia, Jakarta.
- Kang, C., Y.B. Jin, H. Lee, M. Cha, E. Sohn, J. Moon, C. Park, S. Chun, E.S. Jung, J.S. Hong, S.B. Kim, J.S. Kim, and E. Kim. 2010. Brown algae *Ecklonia cava* attenuates type 1 diabetes activating AMPK and Akt signaling pathways. *Food and Chemical Toxicology: An International Journal British Industrial Biological Research Association*. 48(2): 509-516.
- Kang, M.C., W.A.J.P. Wijesinghe, S.H. Lee, S.M. K, S.C. Ko, X. Yang, N. Kang, B.T. Jeon, J. Kim, D.H. Lee, and Y.J. Jeon. 2013. Dieckol isolated from brown seaweed *Ecklonia cava* attenuates type II diabetes in db/db mouse model. *Food and Chemical Toxicology: An International Journal Published for the British Industrial Biological Research Association*. 53: 294-298.

- Kim, J.A., C.S. Kong, and S.K. Kim. 2010. Effect of *Sargassum thunbergii* on ROS mediated oxidative damage and identification of polyunsaturated fatty acid components. *Food and Chemical Toxicology*. 48: 1243-1249.
- Kim, M.J. and H.K. Kim. 2012. Insulinotrophic and hypolipidemic effect of *Ecklonia cava* in streptozotocin-induced diabetic mice. *Asian Pasific Journal of Tropical Medicine*. 374-379.
- KKI Phytomedica. 1993. Kelompok Kerja Ilmiah Phytomedica: Penapisan Farmakologi, Pengujian Fitokimia, dan Pengujian Klinik. Yayasan Pengembangan Obat Alam Phytomedica, Jakarta.
- Koivikko, R. 2008. Brown Algal Phorotannins: Improving and Applying Chemical Methods. Department of Chemistry. University of Turku, Finland.
- Kroemer, G., L. Galluzzi, P. Vandenabeele, J. Abrams, E.S. Alnemri, E.H. Baehrecke, M.V. Blagosklonny, W.S. El-Deiry, P. Golstein, D.R. Green, M. Hengartner, R.A. Knight, S. Kumar, S.A. Lipton, W. Malorni, G. Nunez, M.E. Peter, J. Tschopp, J. Yuan, M. Piacentini, B. Zhivotovsky, and G. Melino. Classification of cell death. *Cell Death Differ*. 16(1): 3-11.
- Kuda, T., M. Tsunekawa, H. Goto, and Y. Araki. 2005. Antioxidant properties of four edible algae harvested in the Noto Peninsula, Japan. *Journal of Food Composition and Analysis*. 18: 625-633.
- Kumar, K., A. Issac, E. Ninan, R. Kuttan, and B. Maliakel. 2014. Enhanced anti-diabetic activity of polyphenol-rich de-coumarinated extract of *Cinnamomum cassia*. *Journal of Fuctional Food*. 10: 54-64.
- Kurniatanty, I., M.I. Tan, T. Ruml, and S.H. Sumarsono. 2015. Potential cell proliferation inhibitor isolated from Indonesian brown algae (phaeophyta). *International Journal of Pharmacy and Pharmaceutical Sciences*. 7(11): 140-143.
- Lade, B.D., A.S. Patil, H.M. Paikrao, A.S. Kale, and K.K. Hire. 2014. A comprehensive working, principles and applications of thin layer chromatography. *Research Journal of Pharmaceutical, Biological, and Chemical Sciences*. 5(4): 486-503.
- Lee, C.W. and J.S. Han. 2012. Hypoglycemic effect of *Sargassum ringgoldianum* extract. *Nutrition Food Science*. 17: 8-13.
- Lee, S.H., M.H. Park, S.J. Heo, S.M. Kang, S.C. Ko, J.S. Han, and Y.J. Jeon. 2010. Dieckol isolated from *Ecklonia cava* inhibits  $\alpha$ -glucosidase and  $\alpha$ -amylase in vitro and alleviates postprandial hyperglycemia in streptozotocin-induced diabetic mice. *Food and Chemical Toxicology*. 48: 2633-2637.

- Lee, S.H. and Y.J. Jeon. 2013. Anti-diabetic effects of brown algae derived phlorotannins marine polyphenols through diverse mechanisms. *Fitoterapia*. 86: 129-136.
- Liu, L., M. Heinrich, S. Myers, and S.A. Dworjanyn. 2012. Towards a better understanding of medicinal uses of the brown seaweed *Sargassum* in traditional Chinese medicine: A phytochemical and pharmacological review. *Journal of Ethnopharmacology*. 142: 591-619.
- Magalhaes, L.M., F. Santos, M.A. Segundo, S. Reis, and J.L.F.C. Lima. Rapid microplate high-throughput methodology for assessment of Folin-Ciocalteu reducing capacity. *Talanta*. 83: 441-447.
- Malole, M.B.M. dan C.S.U Pramono. 1989. Penggunaan Hewan Percobaan di Laboratorium. Departemen Pendidikan dan Kebudayaan Direktorat Jendral Pendidikan Tinggi. Pusat Antar Universitas. Institut Pertanian Bogor, Bogor.
- Meyer, B.N., N.R. Ferrigni, J.E. Putnam, L.B. Jacobsen, D.E. Nichols, and J.L. McLaughlin. 1982. Brine shrimp: A convenient general bioassay for active plant constituents. *Journal of Medicinal Plant Research*. 45: 31-34.
- Mihardja, L. 2009. Faktor yang berhubungan dengan pengendalian gula darah pada penderita diabetes melitus di perkotaan Indonesia. *Majalah Kedokteran Indonesia*. 59(9): 418-424.
- Mohapatra, L., S.K. Bhattamishra, R. Panigrahy, S. Parida, and P. Pati. 2016. Antidiabetic effect of *Sargassum wightii* and *Ulva fasciata* in high fat diet and multi low dose streptozotocin induced type 2 diabetic mice. *United Kingdom Journal of Pharmaceutical and Biosciences*. 4(2): 13-23.
- Moree, S.S., G.B. Kavishankar, and J. Rajesha. 2013. Antidiabetic effect of secoisolariciresinol diglucoside in streptozotocin-induced diabetic rats. *Phytomedicine*. 20: 237– 245.
- Motshakeri, M., M. Ebrahimi, Y.M. Goh, P. Matanjun, and S. Mohamed. 2012. *Sargassum polycystum* reduces hyperglycaemia, dyslipidaemia and oxidative stress via increasing insulin sensitivity in a rat model of type 2 diabetes. *Journal of the Science of Food and Agriculture*. 93(7): 1772-1778.
- Motshakeri, M., M. Ebrahimi, Y.M. Goh, H.H. Othman, M. Hair-Bejo, and S. Mohamed. 2014. Effect of brown seaweed (*Sargassum polycystum*) extracts on kidney, liver, and pancreas of type 2 diabetic rat model. *Evidence-Based Complementary and Alternative Medicine*. 2014: 1-11.
- Nah, W.H., I.K. Koh, H.S. Ahn, M.J. Kim, H.G. Kang, J.H. Jun, and M.C. Gye. 2012. Effect of *Spirulina maxima* on spermatogenesis and steroidogenesis in streptozotocin-induced type I diabetic male rats. *Food Chemistry* 134: 173-179.

- National Center of Biotechnology Information (NCBI). 2016. Open chemistry database. <<https://pubchem.ncbi.nlm.nih.gov/>>. Diakses tanggal 5 Agustus 2016.
- Norra, I., A. Aminah, and R. Suri. 2016. Effect of drying methods, solvent extraction and particle size of Malaysian brown seaweed, *Sargassum* sp. on the total phenolic and free radical scavenging activity. *International Food of Research Journal*. 23(4): 1558-1563.
- Nwosu, F., J. Morris, V.A. Lund, D. Stewart, H.A. Ross, and G.J. McDougall. 2011. Anti-proliferative and potential anti-diabetic effects of phenolic-rich extracts from edible marine algae. *Food Chemistry*. 126: 1006-1012.
- Pejic, R.N and D.T. Lee. 2006. Hypertriglyceridemia. *Journal of the American Board of Family Medicine*. 19(3): 310-316.
- Peteros, N.P. and M.M. Uy. 2010. Antioxidant and cytotoxic activities and phytochemical screening of four Philippine medical plants. *Journal of Medicinal Plants Research*. 4(5): 407-414.
- Petti, S. and C. Scully. 2009. A Review: Polyphenols, oral health and disease. *Journal of Dentistry*. 37(6): 413-423.
- Pratiwi, T. 2013. Uji Aktivitas Ekstrak Metanolik *Sargassum hystrix* dan *Eucheuma denticulatum* dalam Menghambat  $\alpha$ -amilase dan  $\alpha$ -glukosidase. Fakultas Pertanian. Universitas Gadjah Mada. Skripsi.
- Ridwan, A., R.T. Astrian, dan A. Barlian. 2012. Pengukuran efek antidiabetes polifenol (*Polyphenon 60*) berdasarkan kadar glukosa darah dan histologi pankreas mencit (*Mus Musculus* L.) S.W. Jantan yang dikondisikan diabetes mellitus. *Jurnal Matematika dan Sains*. 17(2): 78-82.
- Ringwald, P. and L.K. Basco. 1999. Comparison of in vivo and in vitro tests of resistance in patients treated with chloroquine in Yaounde, Cameroon. *Buletin of The World Health Organization*. 77(1): 34-43.
- Ruenroengklin, N., J. Zhong, X. Duan, B. Yang, J. Li, and Y. Jiang. 2008. Effect of various temperatures and pH values on the extraction yield of phenolics from Litchi fruit pericar tissue and the antioxidant activity of the extracted anthocyanins. *International Journal Molecular Sciences*. 9: 1333-1341.
- Samudra, A. 2013. Aktivitas Inhibisi  $\alpha$ -Amilase dan  $\alpha$ -Glukosidase oleh Ekstrak Polisakarida dan Senyawa Polifenol dari *Eucheuma denticulatum* dan *Sargassum hystrix*. Program Pascasarjana Program Studi Ilmu Farmasi Fakultas Farmasi, Universitas Gadjah Mada. Tesis.
- Sanchez-Rangel, J.C., J. Benavides, J.B. Heredia, L. Cisneros-Zevallos, and D.A. Jacobo-Velazquez. 2013. The Folin-Ciocalteau assay revisited: improvement of

- its specificity for total phenolic content determination. *Analytical Methods*. 5: 5990-5999.
- Schrot, R.J. 2004. Targeting plasma glucose: preprandial versus postprandial. *Clinical Diabetes*. 22(4): 169-172.
- Thanigaivel, S., S.V. Hindu, S. Vijayakumar, A. Mukherjee, N. Chandrasekaran, and J. Thomas. 2015. Differential solvent extraction of two seaweed and their efficacy in controlling *Aeromonas salmonicida* infection on *Oreochromis mossambicus*: A novel therapeutic approach. *Aquaculture*. 443: 56-64.
- Tjokroprawiro, A. 1996. *Diabetes Mellitus: Klasifikasi, Diagnosis, dan Terapi*. Gramedia Pustaka Utama, Jakarta.
- USDA. 2016. Dr. Duke Phytochemical and Ethnobotanical Databases. <<https://phytochem.nal.usda.gov/>>. Diakses tanggal 5 Agustus 2016.
- Vermerris, W. and R. Nicholson. 2006. *Phenolic Compound Biochemistry*. Springer, Netherlands.
- WHO. 1993. *Research guidelines for evaluating the safety and efficiency of herbal medicine*. Manila: Region all office for the Western Pasific. 31-41.
- WHO. 1999. *Definition, Diagnosis, and Classification of Diabetes Mellitus and its Complications*. Food and Agricultural Organization of The United Nations, Geneva.
- WHO. 2016. *Global report on diabetes*. <[http://http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257\\_eng.pdf?ua=1](http://http://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf?ua=1)>. Diakses tanggal 31 Agustus 2016.
- Winarno, F.G. 1996. *Teknologi Pengolahan Rumput Laut*. Pustaka Sinar Harapan, Jakarta.
- You, T. and S.M. Barnett. 2004. Effect of light quality on production of extracellular polysaccharides and growth rate of *Porphyridium cruentum*. *Biochemical Engineering Journal*. 19: 251-258.
- Yu, Q.L., Z.C. Tang, J.G. Li, G.L. Wang, P.J. Wang, and Z.B. Pan. 2015. Anticancer and anti-angiogenesis effect of the leaf extract of *Sargassum wightii* against osteosarcoma cancer cells. *A Journal of Bangladesh Pharmacological Society*. 10(2): 351-357.
- Zhang, J., C. Tiller, J. Shen., C. Wang, G.S. Girouard, D. Dennis, C.J. Barrow, M. Miao, and H.S. Ewart. 2007. Antidiabetic properties of polysaccharide- and polyphenolic-enriched fractions from the brown seaweed *Ascophyllum nodosum*. *Canadian Journal of Physiology and Pharmacology*. 85: 1116-1123.



UNIVERSITAS  
GADJAH MADA

**PENGARUH PEMBERIAN EKSTRAK *Sargassum hystrix* SEBAGAI ANTIDIABETES PADA TIKUS WISTAR**

THEODORA LINGGARYATI, Dr. Amir Husni, S.Pi., M.P. ; Prof. Dr. Ir. Ustadhi, M.P.

Universitas Gadjah Mada, 2016 | Diunduh dari <http://etd.repository.ugm.ac.id/>

Zubia, M., D. Robledo, Y. Freile-Pelegrin. 2007. Antioxidant activities in tropical marine macroalgae from Yucatan Peninsula, Mexico. *Journal of Applied Phycology*. 19(5): 449-458.