

DAFTAR PUSTAKA

- (1) Alam, A.; Quamri, S.; Fatima, S.; Roqaiya, M.; Ahmad, Z. Efficacy of Spirulina (Tahlab) in Patients of Type 2 Diabetes Mellitus (Ziabetus Shakri) - A Randomized Controlled Trial. *J. Diabetes Metab.* **2016**, *7* (10). <https://doi.org/10.4172/2155-6156.1000710>.
- (2) Singh, P.; Singh, V. K.; Singh, A. K. Molecular Docking Analysis of Candidate Compounds Derived from Medicinal Plants with Type 2 Diabetes Mellitus Targets. *Bioinformation* **2019**, *15* (3), 179–188. <https://doi.org/10.6026/97320630015179>.
- (3) Siti Halimatul Munawaroh, H.; Gumilar, G. G.; Nurjanah, F.; Yuliani, G.; Aisyah, S.; Kurnia, D.; Wulandari, A. P.; Kurniawan, I.; Ningrum, A.; Koyande, A. K.; Show, P. L. In-Vitro Molecular Docking Analysis of Microalgae Extracted Phycocyanin as an Anti-Diabetic Candidate. *Biochem. Eng. J.* **2020**, *161* (April), 107666. <https://doi.org/10.1016/j.bej.2020.107666>.
- (4) Laoufi, H.; Benariba, N.; Adjdir, S.; Djaziri, R. In Vitro α -Amylase and α -Glucosidase Inhibitory Activity of Ononis Angustissima Extracts. *J. Appl. Pharm. Sci.* **2017**, *7* (2), 191–198. <https://doi.org/10.7324/JAPS.2017.70227>.
- (5) Gheda, S. F.; Abo-Shady, A. M.; Abdel-Karim, O. H.; Ismail, G. A. Antioxidant and Antihyperglycemic Activity of Arthrospira Platensis (Spirulina Platensis) Methanolic Extract: In Vitro and in Vivo Study. *Egypt. J. Bot.* **2021**, *61* (1), 71–93. <https://doi.org/10.21608/ejbo.2020.27436.1482>.
- (6) Kalita, D.; Holm, D. G.; Labarbera, D. V.; Petrash, J. M.; Jayanty, S. Aldose Reductase By Potato Polyphenolic Compounds. *PLoS One* **2018**, *13* (1), 1–21.
- (7) Salmaso, V.; Moro, S. Bridging Molecular Docking to Molecular Dynamics in Exploring Ligand-Protein Recognition Process: An Overview. *Front. Pharmacol.* **2018**, *9* (AUG), 1–16. <https://doi.org/10.3389/fphar.2018.00923>.
- (8) Ndisang, J. F.; Vannacci, A.; Rastogi, S. Insulin Resistance, Type 1 and Type 2 Diabetes, and Related Complications 2017. *J. Diabetes Res.* **2017**, *2017*, 10–13. <https://doi.org/10.1155/2017/1478294>.
- (9) Pandey, J. P.; Tiwari, A.; Mishra, G.; Mishra, R. M. Role of Spirulina Maxima in the Control of Blood Glucose Levels and Body Weight in Streptozotocin Induced Diabetic Male Wistar Rats. **2011**, *2* (4), 35–37.
- (10) Ripa, S. A.; Aziz, F. B.; Islam, R.; Hasan, M. M.; Misrat, M.; Parvez, M.; Jubayar, T. L.; Roy, M. Antidiabetic Effect of Spirulina (Spirulina Platensis) in an Alloxan-Induced Rabbit Model. *Int. J. Nat. Soc. Sci.* **2018**, *5* (4), 48–53.
- (11) Hussaini, S.; Hossain, M.; Islam, M.; Rafiq, K. Effects of Spirulina Platensis on Alloxan Induced Diabetic Rats. *Progress. Agric.* **2018**, *29* (2), 139–146. <https://doi.org/10.3329/pa.v29i2.38300>.
- (12) Chester, K.; Zahiruddin, S.; Ahmad, A.; Khan, W.; Paliwal, S.; Ahmad, S. Bioautography-Based Identification of Antioxidant Metabolites of Solanum Nigrum L. and Exploration Its Hepatoprotective Potential AgChester, K. et Al. (2017) 'Bioautography-Based Identification of Antioxidant Metabolites of Solanum Nigrum L. and Explorati. *Pharmacogn. Mag.* **2017**, *13* (Suppl (62)), 179–188. <https://doi.org/10.4103/pm.pm>.
- (13) Farouk, K. E.; Hanan, F. A.; El-Sayed, A. B.; Amal, A. M. Role of Spirulina Platensis in the Control of Glycemia in DM2 Rats. *Int. J. Sci. Eng. Res.* **2013**, *4* (12), 1731–1740.
- (14) Scaglioni, P. T.; Quadros, L.; de Paula, M.; Furlong, V. B.; Abreu, P. C.; Badiale-Furlong, E. Inhibition of Enzymatic and Oxidative Processes by Phenolic Extracts from Spirulina Sp. and Nannochloropsis Sp. *Food Technol. Biotechnol.*

- 2018**, 56 (3), 344–353. <https://doi.org/10.17113/ftb.56.03.18.5495>.
- (15) Gabr, G. A.; El-Sayed, S. M.; Hikal, M. S. Antioxidant Activities of Phycocyanin: A Bioactive Compound from *Spirulina Platensis*. *J. Pharm. Res. Int.* **2020**, No. May, 73–85. <https://doi.org/10.9734/jpri/2020/v32i230407>.
 - (16) Guldaz, M.; Ziyank-Demirtas, S.; Sahan, Y.; Yildiz, E.; Gurbuz, O. Antioxidant and Anti-Diabetic Properties of *Spirulina Platensis* Produced in Turkey. *Food Sci. Technol.* **2021**, 41 (3), 615–625. <https://doi.org/10.1590/fst.23920>.
 - (17) Datta, N.; Pal, M.; Roy, U.; Mitra, R.; Pradhan, A. World Journal of Pharmaceutical Research. *Infection* **2014**, 13 (January 2018), 15. <https://doi.org/10.20959/wjpr20181-10638>.
 - (18) Koyande, A. K.; Chew, K. W.; Rambabu, K.; Tao, Y.; Chu, D. T.; Show, P. L. Microalgae: A Potential Alternative to Health Supplementation for Humans. *Food Sci. Hum. Wellness* **2019**, 8 (1), 16–24. <https://doi.org/10.1016/j.fshw.2019.03.001>.
 - (19) Gumbo, J. R.; Nesamvuni, C. N. A Review: *Spirulina* a Source of Bioactive Compounds and Nutrition. *J. Chem. Pharm. Sci.* **2017**, 10 (3), 1317–1325.
 - (20) Saeed, A. M.; Abotaleb, S. I.; Alam, N. G.; Elmehalawy, A. A.; Gheda, S. F. In Vitro Assessment of Antimicrobial, Antioxidant and Anticancer Activities of Some Marine Macroalgae. *Egypt. J. Bot.* **2020**, 60 (1), 81–96. <https://doi.org/10.21608/ejbo.2019.11363.1303>.
 - (21) Metwally, M. A.; Ali, S. S.; Khatab, I. A.; El-Sayed, M. K. Antibacterial Potential of Some Seaweeds Species to Combat Biofilm-Producing Multi-Drug Resistant *Staphylococcus Aureus* of Nile Tilapia. *Egypt. J. Bot.* **2020**, 60 (1), 9–24. <https://doi.org/10.21608/ejbo.2019.6829.1275>.
 - (22) Nasirian, F.; Dadkhah, M.; Moradi-Kor, N.; Obeidavi, Z. Effects of *Spirulina Platensis* Microalgae on Antioxidant and Anti-Inflammatory Factors in Diabetic Rats. *Diabetes, Metab. Syndr. Obes. Targets Ther.* **2018**, 11, 375–380. <https://doi.org/10.2147/DMSO.S172104>.
 - (23) Hu, S.; Fan, X.; Qi, P.; Zhang, X. Identification of Anti-Diabetes Peptides from *Spirulina Platensis*. *J. Funct. Foods* **2019**, 56 (January), 333–341. <https://doi.org/10.1016/j.jff.2019.03.024>.
 - (24) Yousif, N.; Cole, J.; Rothwell, J. C.; Diedrichsen, J.; Zelik, K. E.; Winstein, C. J.; Kay, D. B.; Wijesinghe, R.; Protti, D. A.; Camp, A. J.; Quinlan, E.; Jacobs, J. V.; Henry, S. M.; Horak, F. B.; Jacobs, J. V.; Fraser, L. E.; Mansfield, A.; Harris, L. R.; Merino, D. M.; Knorr, S.; Campos, J. L.; Sciences, A. M.; Dakin, C. J.; *J. Phys. Ther. Sci.* **2018**, 9 (1), 1–11.
 - (25) Asghari, A.; Fazilati, M.; Latifi, A. M.; Salavati, H.; Choopani, A. A Review on Antioxidant Properties of *Spirulina*. *J. Appl. Biotechnol. Reports* **2016**, 3 (1), 345–351.
 - (26) Dvm, S. E.; Olfati, A.; Emami, S. Effects of Dietary Supplementing of *Spirulina Platensis* and *Chlorella Vulgaris* Microalgae on Hematologic Parameters in Streptozotocin-Induced Diabetic Rats. *Orig. Artic. Iran J Ped Hematol Oncol* **2017**, 7 (3), 163–170.
 - (27) Francenia Santos-Sánchez, N.; Salas-Coronado, R.; Villanueva-Cañongo, C.; Hernández-Carlos, B. Antioxidant Compounds and Their Antioxidant Mechanism. *Antioxidants* **2019**, 1–28. <https://doi.org/10.5772/intechopen.85270>.
 - (28) Septiana, E.; Bustanussalam, B.; Simanjuntak, P. Aktivitas Penghambatan α -Glukosidase Dan Peredaman Radikal Bebas Ekstrak Kapang Endofit Yang Diisolasi Dari Rimpang Kunyit. *Media Penelit. dan Pengemb. Kesehat.* **2019**, 29 (3), 189–196. <https://doi.org/10.22435/mpk.v29i3.1293>.
 - (29) Sadek, K. M.; Lebda, M. A.; Nasr, S. M.; Shoukry, M. *Spirulina Platensis*

- Prevents Hyperglycemia in Rats by Modulating Gluconeogenesis and Apoptosis via Modification of Oxidative Stress and MAPK-Pathways. *Biomed. Pharmacother.* **2017**, *92*, 1085–1094. <https://doi.org/10.1016/j.biopha.2017.06.023>.
- (30) Mane, R. S. Phytochemical Screening of Spirulina Platensis Extracts from Rankala Lake. **2019**, No. March.
- (31) Nursid, M.; Wikanta, T.; Susilowati, R. Aktivitas Antioksidan, Sitotoksisitas Dan Kandungan Fukosantin Ekstrak Rumpun Laut Coklat Dari Pantai Binuangun, Banten. *J. Pascapanen dan Bioteknologi Kelaut. dan Perikanan*. **2014**, *8* (1), 73. <https://doi.org/10.15578/jpbkp.v8i1.55>.
- (32) Hou, Y. N.; Ding, W. L.; Hu, J. L.; Jiang, X. X.; Tan, Z. Z.; Zhao, K. H. Very Bright Phycoerythrin Chromophore for Fluorescence Biolabeling. *ChemBioChem* **2019**, *20* (21), 2777–2783. <https://doi.org/10.1002/cbic.201900273>.
- (33) Kane, S. N.; Mishra, A.; Dutta, A. K. Preface: International Conference on Recent Trends in Physics (ICRTP 2016). *J. Phys. Conf. Ser.* **2016**, *755* (1). <https://doi.org/10.1088/1742-6596/755/1/011001>.
- (34) Dandekar, P. D.; Kotmale, A. S.; Chavan, S. R.; Kadlag, P. P.; Sawant, S. V.; Dhavale, D. D.; Ravikumar, A. Insights into the Inhibition Mechanism of Human Pancreatic α -Amylase, a Type 2 Diabetes Target, by Dehydrodieugenol B Isolated from *Ocimum tenuiflorum*. *ACS Omega* **2021**, *6* (3), 1780–1786. <https://doi.org/10.1021/acsomega.0c00617>.
- (35) Ak, M. D.; Abrar, M. 1. α -Amylase and α -Glucosidase Inhibitors from Plant Extracts. *J. Med. Vet.* **2019**, *13* (2), 151–158. <https://doi.org/10.21157/j.med.vet..v13i2.13819>.
- (36) Dennedy, M. C.; Rizza, R. A.; Dinneen, S. F. Classification and Diagnosis of Diabetes Mellitus. *Endocrinol. Adult Pediatr.* **2015**, 1–2 (January), 662–671.e2. <https://doi.org/10.1016/B978-0-323-18907-1.00038-X>.
- (37) Xu, L.; Li, Y.; Dai, Y.; Peng, J. Natural Products for the Treatment of Type 2 Diabetes Mellitus: Pharmacology and Mechanisms. *Pharmacol. Res.* **2018**, *130*, 451–465. <https://doi.org/10.1016/j.phrs.2018.01.015>.
- (38) Vahidi, O.; Kwok, K. E.; Gopaluni, R. B.; Knop, F. K. A Comprehensive Compartmental Model of Blood Glucose Regulation for Healthy and Type 2 Diabetic Subjects. *Med. Biol. Eng. Comput.* **2016**, *54* (9), 1383–1398. <https://doi.org/10.1007/s11517-015-1406-4>.
- (39) Suresh, P. S.; Singh, P. P.; Padwad, Y. S.; Sharma, U. Steroidal Saponins from *Trillium Govanianum* as α -Amylase, α -Glucosidase, and Dipeptidyl Peptidase IV Inhibitory Agents. *J. Pharm. Pharmacol.* **2021**, *73* (4), 487–495. <https://doi.org/10.1093/jpp/rgaa038>.
- (40) Oyedemi, S. O.; Oyedemi, B. O.; Ijeh, I. I.; Ohanyerem, P. E.; Cooposamy, R. M.; Aiyegoro, O. A. Alpha-Amylase Inhibition and Antioxidative Capacity of Some Antidiabetic Plants Used by the Traditional Healers in Southeastern Nigeria. *Sci. World J.* **2017**, 2017. <https://doi.org/10.1155/2017/3592491>.
- (41) Mohammadi-Khanaposhtani, M.; Rezaei, S.; Khalifeh, R.; Imanparast, S.; Faramarzi, M. A.; Bahadorikhalili, S.; Safavi, M.; Bandarian, F.; Nasli Esfahani, E.; Mahdavi, M.; Larijani, B. Design, Synthesis, Docking Study, α -Glucosidase Inhibition, and Cytotoxic Activities of Acridine Linked to Thioacetamides as Novel Agents in Treatment of Type 2 Diabetes. *Bioorg. Chem.* **2018**, *80* (June), 288–295. <https://doi.org/10.1016/j.bioorg.2018.06.035>.
- (42) González-Montoya, M.; Hernández-Ledesma, B.; Mora-Escobedo, R.; Martínez-Villaluenga, C. Bioactive Peptides from Germinated Soybean with Anti-Diabetic Potential by Inhibition of Dipeptidyl Peptidase-IV, α -Amylase, and α -Glucosidase

- Enzymes. *Int. J. Mol. Sci.* **2018**, *19* (10). <https://doi.org/10.3390/ijms19102883>.
- (43) Ahmed, F.; Chandra, J.; Timmaiah, N. An In Vitro Study on the Inhibitory Activities of Eugenia Jambolana Seeds against Carbohydrate Hydrolyzing Enzymes. *J. Young Pharm.* **2009**, *1* (4), 317. <https://doi.org/10.4103/0975-1483.59320>.
- (44) Ozougwu, V. E. O.; Akuba, B. O. In Vitro Inhibition of Carbohydrate Metabolizing Enzymes and in Vivo Anti-Hyperglycaemic Potential of Methanol Extract of Desmodium Velutinum Leaves. *Res. J. Med. Plants* **2018**, *12* (1), 48–56. <https://doi.org/10.3923/rjmp.2018.48.56>.
- (45) Tay, Y. N.; Bakar, M. H. A.; Azmi, M. N.; Saad, N. A.; Awang, K.; Litaudon, M.; Kassim, M. A. Inhibition of Carbohydrate Hydrolysing Enzymes, Antioxidant Activity and Polyphenolic Content of Beilschmiedia Species Extracts. *IOP Conf. Ser. Mater. Sci. Eng.* **2020**, *716* (1). <https://doi.org/10.1088/1757-899X/716/1/012007>.
- (46) Tadera, K.; Minami, Y.; Takamatsu, K.; Matsuoka, T. Inhibition of α -Glucosidase and α -Amylase by Flavonoids. *J. Nutr. Sci. Vitaminol. (Tokyo)*. **2006**, *52* (2), 149–153. <https://doi.org/10.3177/jnsv.52.149>.
- (47) Zhang, L.; Chen, Q.; Li, L.; Kwong, J.S.W.; Jia, P.; Zhao, P.; Wang, W.; Zhou, X.; Zhang, M.; Sun, X. -Glucosidase Inhibitors and Hepatotoxicity in Type 2 Diabetes: A Systematic Review and Meta-Analysis. *Sci Rep* **2016**, *6*.
- (48) PDB, R. Protein Data Bank [rcsb.org](https://www.rcsb.org).
- (49) Brayer, G. D.; Luo, Y.; Withers, S. G. The Structure of Human Pancreatic α -amylase at 1.8 Å Resolution and Comparisons with Related Enzymes. *Protein Sci.* **1995**, *4* (9), 1730–1742. <https://doi.org/10.1002/pro.5560040908>.
- (50) UniProt. UniProtKB-P04746 <https://www.uniprot.org/uniprot/P04746>.
- (51) Ren, L.; Qin, X.; Cao, X.; Wang, L.; Bai, F.; Bai, G.; Shen, Y. Structural Insight into Substrate Specificity of Human Intestinal Maltase-Glucoamylase. *Protein Cell* **2011**, *2* (10), 827–836. <https://doi.org/10.1007/s13238-011-1105-3>.
- (52) UniProt. UniProtKB-O05242 <https://www.uniprot.org/uniprot/O05242>.
- (53) PubChem, N. L. of. PubChem pubchem.ncbi.nlm.nih.gov.
- (54) Meng, X. Y., Zhang, H. X., Mezei, M., & Cui, M. (2011). \ , 7(2), 146-157. Molecular Docking: A Powerful Approach for Structure-Based Drug Discovery. *Current Computer-Aided Drug Design. Curr. Comput. Aided Drug Des.* **2011**, *7* (2), 146–157.
- (55) Selvaraj, C, Krishnasamy, G, Jagtap, S.S, Patel, S.K.S, Dhiman, S.S, Kim, S, Singh S.K, L. J. . Structural Insights into the Binding Mode of Sorbitol Dehydrogenase Using QM-Polarized Ligand Docking and Molecular Dynamics Simulations. *Biochem* **2016**, *114*, 244–256.
- (56) Taylor, J. B.; Trigg, D. J. *Comprehensive Medicinal Chemistry II*; 2006; Vol. 1. <https://doi.org/10.1002/qsar.19910100410>.
- (57) Wang, G.; Zhu, W. Molecular Docking for Drug Discovery and Development: A Widely Used Approach but Far from Perfect. *Future Med. Chem.* **2016**, *8* (14). <https://doi.org/10.4155/fmc-2016-0143>.
- (58) Berry, M.; Fielding, B.; Gamielien, J. *Practical Considerations in Virtual Screening and Molecular Docking*; Elsevier Inc., 2015. <https://doi.org/10.1016/B978-0-12-802508-6.00027-2>.
- (59) Kumalo, H. M.; Bhakat, S.; Soliman, M. E. S. Theory and Applications of Covalent Docking in Drug Discovery: Merits and Pitfalls. *Molecules* **2015**, *20* (2), 1984–2000. <https://doi.org/10.3390/molecules20021984>.
- (60) Singh, J.; Petter, R. C.; Baillie, T. A.; Whitty, A. The Resurgence of Covalent Drugs. *Nat. Rev. Drug Discov.* **2011**, *10* (4), 307–317. <https://doi.org/10.1038/nrd3410>.

- (61) Istyastono, E. P. Docking Studies of Curcumin As a Potential Lead Compound To Develop Novel Dipeptidyl Peptidase-4 Inhibitors. *Indones. J. Chem.* **2010**, *9* (1), 132–136. <https://doi.org/10.22146/ijc.21574>.
- (62) Vilar, S.; Cozza, G.; Moro, S. Medicinal Chemistry and the Molecular Operating Environment (MOE): Application of QSAR and Molecular Docking to Drug Discovery. *Curr. Top. Med. Chem.* **2008**, *8* (18), 1555–1572. <https://doi.org/10.2174/156802608786786624>.
- (63) (MOE), M. O. E. Molecular Operating Environment (MOE). Chemical Computing Group Inc: Canada 2015.
- (64) Listyani, T. A.; Herowati, R. Analisis Docking Molekuler Senyawa Derivat Phthalimide Sebagai Inhibitor Non-Nukleosida HIV-1 Reverse Transcriptase. *J. Farm. Indones.* **2018**, *15* (2), 123–134. <https://doi.org/10.31001/jfi.v15i2.445>.
- (65) Sapundzhi, F. I.; Dzimbova, T. A. Computer Modelling of the CB1 Receptor by Molecular Operating Environment. *Bulg. Chem. Commun.* **2018**, *50* (Special Issue B), 15–19.
- (66) Supriya, T.; Shankar, M.; Kavya Lalitha, S.; Dastgiri, J.; Niranjana Babu, M. American Journal of Biological and Pharmaceutical Research a Over View on Molecular Docking. *Am. J. Biol. Pharm. Res.* **2016**, *3* (2), 83–89.
- (67) Saputri, K. E.; Fakhmi, N.; Kusumaningtyas, E.; Priyatama, D.; Santoso, B. Docking Molekuler Potensi Anti Diabetes Melitus Tipe 2 Turunan Zerumbon Sebagai Inhibitor Aldosa Reduktase Dengan Autodock-Vina. *Chim. Nat. Acta* **2016**, *4* (1), 16. <https://doi.org/10.24198/cna.v4.n1.10443>.
- (68) Syarifuddin, N. *Ikatan Kimia*; UGM Press: Yogyakarta, 1994.

