

DAFTAR PUSTAKA

- Ahmad, I., Budu, B., Hatta, M., Ihsan, A., Rahmatiah, S., Nasrullah, N., Laudo, S., Djalil, N., Basri, M., & Muin, I. (2020). The analysis of mrna expression of peroxisome proliferatoractivated receptor gamma coactivator 1-alpha (PGC-1 α) gene and the physical fitness levels (VO₂max) in the candidates for indonesian hajj health officers. *Malaysian Journal of Biochemistry and Molecular Biology*, 23(2), 78–85.
- Ahmad Khan, M., Sarwar, A. H. M. G., Rahat, R., Ahmed, R. S., & Umar, S. (2020a). Stigmasterol protects rats from collagen induced arthritis by inhibiting proinflammatory cytokines. *International Immunopharmacology*, 85(January), 106642. <https://doi.org/10.1016/j.intimp.2020.106642>
- Ahmad Khan, M., Sarwar, A. H. M. G., Rahat, R., Ahmed, R. S., & Umar, S. (2020b). Stigmasterol protects rats from collagen induced arthritis by inhibiting proinflammatory cytokines. *International Immunopharmacology*, 85(May), 106642. <https://doi.org/10.1016/j.intimp.2020.106642>
- Alemanly, L., Laparra, J. M., Barbera, R., & Alegria, A. (2012). Evaluation of the cytotoxic effect of 7keto-stigmasterol and 7keto-cholesterol in human intestinal (Caco-2) cells. *Food and Chemical Toxicology*, 50(5), 3106–3113.
- Amanat, M., Gautam, S., Chalotra, R., Lal, K., Gupta, T., Agrawal, R., Mojwar, S., & Singh, R. (2023). Zingiber roseum Roscoe. (Zingiberaceae): Current and future perspective. *Pharmacological Research - Modern Chinese Medicine*, 7(May), 100258. <https://doi.org/10.1016/j.prmcm.2023.100258>
- Anne Stetler, R., Leak, R. K., Gao, Y., & Chen, J. (2013). The dynamics of the mitochondrial organelle as a potential therapeutic target. *Journal of Cerebral Blood Flow and Metabolism*, 33(1), 22–32. <https://doi.org/10.1038/jcbfm.2012.158>
- Antwi, A. O., Obiri, D. D., Osafo, N., Essel, L. B., Forkuo, A. D., & Atobiga, C. (2018). Stigmasterol Alleviates Cutaneous Allergic Responses in Rodents. *BioMed Research International*, 2018. <https://doi.org/10.1155/2018/3984068>
- Antwi, A. O., Obiri, D. D., Osafo, N., Forkuo, A. D., & Essel, L. B. (2017). Stigmasterol inhibits lipopolysaccharide-induced innate immune responses in murine models. *International Immunopharmacology*, 53(July), 105–113. <https://doi.org/10.1016/j.intimp.2017.10.018>
- Aroor, A. R., Sowers, J. R., Bender, S. B., Nistala, R., Garro, M., Mugerfeld, I., Hayden, M. R., Johnson, M. S., Salam, M., Whaley-Connell, A., &

- DeMarco, V. G. (2013). Dipeptidylpeptidase inhibition is associated with improvement in blood pressure and diastolic function in insulin-resistant male zucker obese rats. *Endocrinology*, *154*(7), 2501–2513. <https://doi.org/10.1210/en.2013-1096>
- Asthary, A. A., Yuharmen, & Hilwan, Y. T. (2014). *ISOLASI DAN UJI TOKSISITAS SENYAWA METABOLIT SEKUNDER DARI EKSTRAK n-HEKSANA DAUN TUMBUHAN Polyalthia rumphii (B) Merr. (ANNONACEAE)* (Vol. 5, Issue Maret). <https://repository.unri.ac.id/handle/123456789/5904>
- Bae, H., Song, G., & Lim, W. (2020). Stigmasterol causes ovarian cancer cell apoptosis by inducing endoplasmic reticulum and mitochondrial dysfunction. *Pharmaceutics*, *12*(6). <https://doi.org/10.3390/pharmaceutics12060488>
- Banjarnahor, P. R. S., Rahardjo, S. P., Savitri, E., Hatta, M., Suhadi, F. X. B., & Bukhari, A. (2021). The correlation between tnm and YY1 and P53 mRNA expression in nasopharyngeal cancer. *Biomedical and Pharmacology Journal*, *14*(1), 105–111. <https://doi.org/10.13005/bpj/2104>
- Bloomgarden, Z. T. (2000). American Diabetes Association Annual Meeting, 1999: Nephropathy and neuropathy. *Diabetes Care*, *23*(4), 549–556. <https://doi.org/10.2337/diacare.23.4.549>
- Cabianca, A., Müller, L., Pawlowski, K., & Dahlin, P. (2021). Changes in the plant β -sitosterol/stigmasterol ratio caused by the plant parasitic nematode *meloidogyne incognita*. *Plants*, *10*(2), 1–15. <https://doi.org/10.3390/plants10020292>
- Calles-Escandon, J., & Cipolla, M. (2001). *Diabetes and Endothelial Dysfunction: A Clinical Perspective*.
- Catley, M. C., Chivers, J. E., Holden, N. S., Barnes, P. J., & Newton, R. (2005). Validation of IKK β as therapeutic target in airway inflammatory disease by adenoviral-mediated delivery of dominant-negative IKK β to pulmonary epithelial cells. *British Journal of Pharmacology*, *145*(1), 114–122. <https://doi.org/10.1038/sj.bjp.0706170>
- Choi, K., & Kim, Y. B. (2010). Molecular mechanism of insulin resistance in obesity and type 2 diabetes. *Korean Journal of Internal Medicine*, *25*(2), 119–129. <https://doi.org/10.3904/kjim.2010.25.2.119>
- Csikós, E., Horváth, A., Ács, K., Papp, N., Balázs, V. L., Dolenc, M. S., Kenda, M., Glavač, N. K., Nagy, M., Protti, M., Mercolini, L., Horváth, G., & Farkas, Á. (2021). Treatment of benign prostatic hyperplasia by natural drugs. *Molecules*, *26*(23), 1–33. <https://doi.org/10.3390/molecules26237141>

- Darwati, I., & Roostika, I. (2016). Status Penelitian Purwoceng (*Pimpinella alpina* Molk.) di Indonesia. *Buletin Plasma Nutfah*, *12*(1), 9.
<https://doi.org/10.21082/blpn.v12n1.2006.p9-15>
- Dash, D. K., Choudhury, A. K., Singh, M., Mangaraj, S., Mohanty, B. K., & Baliarsinha, A. K. (2018). Effect of parental history of diabetes on markers of inflammation, insulin resistance and atherosclerosis in first degree relatives of patients with type 2 diabetes mellitus. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, *12*(3), 285–289.
<https://doi.org/10.1016/j.dsx.2017.12.004>
- De La Garza-Rodea, A. S., Knaän-Shanzer, S., Den Hartigh, J. D., Verhaegen, A. P. L., & Van Bekkum, D. W. (2010). Anomer-equilibrated streptozotocin solution for the induction of experimental diabetes in mice (*Mus musculus*). *Journal of the American Association for Laboratory Animal Science*, *49*(1), 40–44.
- DeFronzo, R. A., Simonson, D., & Ferrannini, E. (1982). Hepatic and peripheral insulin resistance: A common feature of Type 2 (non-insulin-dependent) and Type 1 (insulin-dependent) diabetes mellitus. *Diabetologia*, *23*(4), 313–319.
<https://doi.org/10.1007/BF00253736>
- Demirel, M. A., Ilhan, M., Suntar, I., Keles, H., & Kupeli Akkol, E. (2016). Activity of *Corylus avellana* seed oil in letrozole-induced polycystic ovary syndrome model in rats. *Revista Brasileira de Farmacognosia*, *26*(1), 83–88.
<https://doi.org/10.1016/j.bjp.2015.09.009>
- Di, W., Lv, J., & Jiang, S. (2018). *PGC-1 : The Energetic Regulator in Cardiac Metabolism*. 29–46.
- Dira, M. (2015). Oleh I Made Dira Swantara. In *Sterol Ganggang Laut* (1st ed.). OLEH I MADE DIRA SWANTARA PROGRAM STUDI MAGISTER KIMIA TERAPAN PROGRAM PASCASARJANA UNIVERSITAS UDAYANA.
- Dwivedi, P. S. R., Rasal, V. P., Kotharkar, E., Nare, S., & Khanal, P. (2021). *Gene set enrichment analysis of PPAR- γ regulators from *Murraya odorata* Blanco*. 369–375.
- Dwiyanti, R., Hatta, M., Natzir, R., Pratiwi, S., Sabir, M., Yasir, Y., Noviyanthi, R. A., Junita, A. R., Tandirogang, N., Amir, M., Fias, M., Saning, J., & Bahar, B. (2017). Association of typhoid fever severity with polymorphisms NOD2, VDR and NRAMP1 Genes in endemic area, Indonesia. *Journal of Medical Sciences (Faisalabad)*, *17*(3), 133–139.
<https://doi.org/10.3923/jms.2017.133.139>

- Fachri, M., Hatta, M., Massi, M. N., Santoso, A., Wikanningtyas, T. A., Dwiyanti, R., Junita, A. R., Primaguna, M. R., & Sabir, M. (2021). The strong correlation between ADAM33 expression and airway inflammation in chronic obstructive pulmonary disease and candidate for biomarker and treatment of COPD. *Scientific Reports*, *11*(1), 1–13.
<https://doi.org/10.1038/s41598-021-02615-2>
- Farsida, Hatta, M., Patellongi, I., Prihantono, Shabariyah, R., Larasati (Laras), R. A., Islam, A. A., Natzir, R., Massi, M. N., Hamid, F., & Bahagia, A. D. (2020). The correlation of Foxp3 + gene and regulatory T cells with scar BCG formation among children with Tuberculosis. *Journal of Clinical Tuberculosis and Other Mycobacterial Diseases*, *21*, 100202.
<https://doi.org/10.1016/j.jctube.2020.100202>
- Farsida, Shabariah, R., Hatta, M., Patellongi, I., Prihantono, Nasrum Massi, M., Asadul Islam, A., Natzir, R., Dwi Bahagia Febriani, A., Hamid, F., Fatimah, Akaputra, R., & Aprilia Savitri, P. (2021). Relationship between expression mRNA gene Treg, Treg, CD4+, and CD8+ protein levels with TST in tuberculosis children: A nested case-control. *Annals of Medicine and Surgery*, *61*(December 2020), 44–47.
<https://doi.org/10.1016/j.amsu.2020.12.011>
- Feng, S., Dai, Z., Liu, A. B., Huang, J., Narsipur, N., Guo, G., Kong, B., Reuhl, K., Lu, W., Luo, Z., & Yang, C. S. (2018). Intake of stigmasterol and β -sitosterol alters lipid metabolism and alleviates NAFLD in mice fed a high-fat western-style diet. *Biochimica et Biophysica Acta - Molecular and Cell Biology of Lipids*, *1863*(10), 1274–1284.
<https://doi.org/10.1016/j.bbalip.2018.08.004>
- Goswami, M., Priya, Jaswal, S., Gupta, G. Das, & Verma, S. K. (2023). A comprehensive update on phytochemistry, analytical aspects, medicinal attributes, specifications and stability of stigmasterol. *Steroids*, *196*(January), 109244. <https://doi.org/10.1016/j.steroids.2023.109244>
- Governa, P., Giachetti, D., Biagi, M., Manetti, F., & De Vico, L. (2016). Hypothesis on *Serenoa repens* (Bartram) small extract inhibition of prostatic 5 α -reductase through an in silico approach on 5 β -reductase x-ray structure. *PeerJ*, *2016*(11). <https://doi.org/10.7717/peerj.2698>
- Gupta, R., Sharma, A. K., Dobhal, M. P., Sharma, M. C., & Gupta, R. S. (2011). Antidiabetic and antioxidant potential of β -sitosterol in streptozotocin-induced experimental hyperglycemia. *Journal of Diabetes*, *3*(1), 29–37.
<https://doi.org/10.1111/j.1753-0407.2010.00107.x>
- Hall, J. E., & Guyton, A. C. (2014). *Textbook of Medical physiology* (12th ed.). Elsevier.

- Hatta, M., Surachmanto, E. E., Islam, A. A., & Wahid, S. (2017). Expression of mRNA IL-17F and sIL-17F in atopic asthma patients. *BMC Research Notes*, *10*(1), 1–5. <https://doi.org/10.1186/s13104-017-2517-9>
- Herawati, I. E., & Saptarini, N. M. (2020). ANALISIS KADAR TOTAL FITOSTEROL PADA EKSTRAK DAUN SELADA (*Lactuca sativa* L.) DENGAN METODE KOLORIMETRI. *Jurnal Sabdariffarma*, *9*(1), 7–10. <https://doi.org/10.53675/jsfar.v2i1.25>
- Hsueh, W. A., Jackson, S., & Law, R. E. (2001). Control of Vascular Cell Proliferation and Migration by PPAR-Gamma. *Diabetes Care*, *24*(2), 391–397.
- Hurrle, S., & Hsu, W. H. (2017). The etiology of oxidative stress in insulin resistance. *Biomedical Journal*, *40*(5), 257–262. <https://doi.org/10.1016/j.bj.2017.06.007>
- Indradevi, S., Ilavenil, S., Kaleeswaran, B., Srigopalram, S., & Ravikumar, S. (2012). Ethanolic extract of *Crinum asiaticum* attenuates hyperglycemia-mediated oxidative stress and protects hepatocytes in alloxan induced experimental diabetic rats. *Journal of King Saud University - Science*, *24*(2), 171–177. <https://doi.org/10.1016/j.jksus.2010.12.007>
- Jan, K. (2012). *Decreased mRNA Expression of PGC-1 [alpha] and PGC-1 [alpha] -Regulated ...*
- Jati, B. N., Yunilawati, R., Nuraeni, C., Oktarina, E., Aviandharie, S. A., & Rahmi, D. (2019). Ekstraksi dan Identifikasi Fitosterol pada Mikroalga *Nannochloropsis oculata*. *Jurnal Kimia Dan Kemasan*, *41*(1), 31. <https://doi.org/10.24817/jkk.v41i1.4969>
- Jayaraman, S., Devarajan, N., Rajagopal, P., & Babu, S. (2021). Insulin Resistance by down-Regulating IKK β / NF- κ B and JNK Signaling Pathway in Adipocytes of Type 2 Diabetic Rats. *Molecules*, *26*(2101), 1–21.
- Jie, F., Yang, X., Yang, B., Liu, Y., Wu, L., & Lu, B. (2022). Stigmasterol attenuates inflammatory response of microglia via NF- κ B and NLRP3 signaling by AMPK activation. *Biomedicine and Pharmacotherapy*, *153*(May). <https://doi.org/10.1016/j.biopha.2022.113317>
- Jin, S., Mutvei, A. P., Chivukula, I. V., Andersson, E. R., Ramsköld, D., Sandberg, R., Lee, K. L., Kronqvist, P., Mamaeva, V., Östling, P., Mpindi, J. P., Kallioniemi, O., Screpanti, I., Poellinger, L., Sahlgren, C., & Lendahl, U. (2013). Non-canonical Notch signaling activates IL-6/JAK/STAT signaling in breast tumor cells and is controlled by p53 and IKK α /IKK β . *Oncogene*, *32*(41), 4892–4902. <https://doi.org/10.1038/onc.2012.517>

- Kallergi, E., Kalef-Ezra, E., Karagouni-Dalakoura, K., & Tokatlidis, K. (2014). Common players in mitochondria biogenesis and neuronal protection against stress-induced apoptosis. *Neurochemical Research*, *39*(3), 546–555. <https://doi.org/10.1007/s11064-013-1109-x>
- Kandeel, F. R., Koussa, V. K. T., & Swerdloff, R. S. (2001). *Male Sexual Function and Its Disorders: Physiology, Pathophysiology, Clinical Investigation, and Treatment*.
- Karnina, R., Arif, S. K., Hatta, M., Bukhari, A., Natzir, R., Hisbullah, Patellongi, I., & Kaelan, C. (2021). Systemic lidocaine administration influences NF- κ B gene expression, NF- κ B and TNF- α protein levels on BALB/c mice with musculoskeletal injury. *Annals of Medicine and Surgery*, *69*(August), 102660. <https://doi.org/10.1016/j.amsu.2021.102660>
- Kumar, M., Prasad, S. K., Krishnamurthy, S., & Hemalatha, S. (2014). Antihyperglycemic activity of *Houttuynia cordata* Thunb. in streptozotocin-induced diabetic rats. *Advances in Pharmacological Sciences*, *2014*. <https://doi.org/10.1155/2014/809438>
- Kurniawan, R. A. (2017). *FORMULASI DAN KARAKTERISASI SOLID SELF-NANOEMULSIFYING DRUG DELIVERY SYSTEM (S-SNEDDS) EKSTRAK AKAR PURWOCENG GUNUNG (Artemisia lactiflora Wall. Ex D.C.) SERTA UJI DISOLUSI SECARA IN-VITRO* [Thesis]. Gadjah Mada University.
- Lee, J. Y., Lee, D. C., Im, J. A., & Lee, J. W. (2014). Mitochondrial DNA copy number in peripheral blood is independently associated with visceral fat accumulation in healthy young adults. *International Journal of Endocrinology*, *2014*. <https://doi.org/10.1155/2014/586017>
- Li, L., Chen, X., Su, C., Wang, Q., Li, R., Jiao, W., Luo, H., Tian, Y., Tang, J., Li, X., Liu, B., Wang, W., Zhang, D., & Guo, S. (2020). Si-Miao-Yong-An decoction preserves cardiac function and regulates GLC/AMPK/NF- κ B and GLC/PPAR α /PGC-1 α pathways in diabetic mice. *Biomedicine and Pharmacotherapy*, *132*(September), 110817. <https://doi.org/10.1016/j.biopha.2020.110817>
- Lifsey, H. C., Kaur, R., Thompson, B. H., Bennett, L., Temel, R. E., Graf, G. A., & Diabetes, B. (2021). *HHS Public Access*. 1–17. <https://doi.org/10.1016/j.jnutbio.2019.108263>. Stigmasterol
- Liu, X., Ye, J., Wang, L., Li, Z., Zhang, Y., Sun, J., Du, C., Wang, C., & Xu, S. (2017). Protective Effects of PGC-1 α Against Lead-Induced Oxidative Stress and Energy Metabolism Dysfunction in Testis Sertoli Cells. *Biological Trace*

Element Research, 175(2), 440–448. <https://doi.org/10.1007/s12011-016-0799-8>

- Ma, H., Mahdi Zangeneh, M., Zangeneh, A., Veisi, H., Hemmati, S., Pirhayati, M., & Karmakar, B. (2023). Green decorated gold nanoparticles on magnetic nanoparticles mediated by Calendula extract for the study of preventive effects in streptozotocin-induced gestational diabetes mellitus rats. *Inorganic Chemistry Communications*, 151(December 2022), 110633. <https://doi.org/10.1016/j.inoche.2023.110633>
- Marlina, R., Hatta, M., Sridiana, E., Djaharuddin, I., Patellongi, I., & Murtiani, F. (2021). The effect of miana (coleus scutellariodes [L]) on vascular endothelial growth factor expression in Balb/C mice infected with mycobacterium tuberculosis. *Biomedical and Pharmacology Journal*, 14(2), 525–532. <https://doi.org/10.13005/bpj/2154>
- Mas Rusyati, L. M., Hatta, M., Widiiana, I. G. R., Adiguna, M. S., Wardana, M., Dwiyantri, R., Noviyanti, R. A., Sabir, M., Yasir, Y., Paramita, S., Junita, A. R., & Primaguna, M. R. (2020). Higher Treg FoxP3 and TGF- β mRNA Expression in Type 2 Reaction ENL (Erythema Nodosum Leprosum) Patients in Mycobacterium leprae Infection. *The Open Microbiology Journal*, 14(1), 304–309. <https://doi.org/10.2174/1874434602014010304>
- McArdle, F., Knight, L., & Stratigos, T. (2013). Imagining social justice. *Contemporary Issues in Early Childhood*, 14(4), 357–369. <https://doi.org/10.2304/ciec.2013.14.4.357>
- Miranda-Osorio, P. H., Castell-Rodríguez, A. E., Vargas-Mancilla, J., Tovilla-Zárate, C. A., Ble-Castillo, J. L., Aguilar-Domínguez, D. E., Juárez-Rojop, I. E., & Díaz-Zagoya, J. C. (2016). Protective action of Carica papaya on β -cells in streptozotocin-induced diabetic rats. *International Journal of Environmental Research and Public Health*, 13(5). <https://doi.org/10.3390/ijerph13050446>
- Mishra, A. P., Yedella, K., Lakshmi, J. B., & Siva, A. B. (2018). Wdr13 and streptozotocin-induced diabetes. *Nutrition and Diabetes*, 8(1), 6–11. <https://doi.org/10.1038/s41387-018-0065-6>
- Mongkolpobsin, K., Sillapachaiyaporn, C., Nilkhet, S., Tencomnao, T., & Baek, S. J. (2023). Stigmasterol isolated from Azadirachta indica flowers attenuated glutamate-induced neurotoxicity via downregulation of the Cdk5/p35/p25 signaling pathway in the HT-22 cells. *Phytomedicine*, 113, 154728. <https://doi.org/10.1016/J.PHYMED.2023.154728>
- Mouri, Mi., & Badireddy, M. (2021). *Hyperglycemia*.

- Mulyadi, R., Hatta, M., Islam, A. A., Murtala, B., Tammase, J., Firdaus, M., Susanto, E., & Prihartono, J. (2021). Intratumoral and Peritumoral Apparent Diffusion Coefficient and MGMT mRNA Expression in Different Meningioma Histopathological Grade. *Indonesian Biomedical Journal*, *13*(1), 97–105. <https://doi.org/10.18585/inabj.v13i1.1338>
- Mulyawan, E., Ahmad, M. R., Islam, A. A., Massi, Muh. N., Hatta, M., & Arif, S. K. (2020). Analysis of GABRB3 Protein Level After Administration of Valerian Extract (*Valeriana officinalis*) in BALB/c mice. *Pharmacognosy Journal*, *12*(4), 821–827. <https://doi.org/10.5530/pj.2020.12.118>
- Nagarajan, S., Choo, H., Cho, Y. S., Shin, K. J., Oh, K. S., Lee, B. H., & Pae, A. N. (2010). IKK β inhibitor identification: A multi-filter driven novel scaffold. *BMC Bioinformatics*, *11*(SUPPL. 7). <https://doi.org/10.1186/1471-2105-11-S7-S15>
- Nahdi, A. M. T. A., John, A., & Raza, H. (2017). Elucidation of Molecular Mechanisms of Streptozotocin-Induced Oxidative Stress, Apoptosis, and Mitochondrial Dysfunction in Rin-5F Pancreatic β -Cells. *Oxidative Medicine and Cellular Longevity*, 2017. <https://doi.org/10.1155/2017/7054272>
- Nasiri, K., Akbari, A., Nimrouzi, M., Ruyvaran, M., & Mohamadian, A. (2021). Safflower seed oil improves steroidogenesis and spermatogenesis in rats with type II diabetes mellitus by modulating the genes expression involved in steroidogenesis, inflammation and oxidative stress. *Journal of Ethnopharmacology*, *275*(April), 114139. <https://doi.org/10.1016/j.jep.2021.114139>
- Neto, F. T. L., Bach, P. V., Najari, B. B., Li, P. S., & Goldstein, M. (2016). Spermatogenesis in humans and its affecting factors. *Seminars in Cell and Developmental Biology*, *59*, 10–26. <https://doi.org/10.1016/j.semcdb.2016.04.009>
- Novrial, D. (2018). Kerusakan Sel β Pankreas Akibat Induksi Streptozotocin : Tinjauan Patologi. *Mandala of Health*, *3*(March), 48.
- Occhiuto, C., Santoro, G., Tranchida, P. Q., Bono, G., & Occhiuto, F. (2023). Pharmacological Effects of the Lipidosterolic Extract from *Kigelia africana* Fruits in Experimental Benign Prostatic Hyperplasia Induced by Testosterone in Sprague Dawley Rats. *Journal of Experimental Pharmacology*, *15*(January), 41–50. <https://doi.org/10.2147/JEP.S383699>
- Oley, M. H., Oley, M. C., Noersasongko, A. D., Hatta, M., Philips, G. G., Agustine, Faruk, M., Kalangi, J. A., Rumampuk, I. M. A., & Tulong, M. T. (2021). Effects of hyperbaric oxygen therapy on vascular endothelial growth

factor protein and mRNA in crush injury patients: A randomized controlled trial study. *International Journal of Surgery Open*, 29(January), 33–39.
<https://doi.org/10.1016/j.ijso.2021.01.003>

- Oyelere, S. F., Ajayi, O. H., Ayoade, T. E., Santana Pereira, G. B., Dayo Owoyemi, B. C., Ilesanmi, A. O., & Akinyemi, O. A. (2022). A detailed review on the phytochemical profiles and anti-diabetic mechanisms of *Momordica charantia*. *Heliyon*, 8(4), e09253.
<https://doi.org/10.1016/j.heliyon.2022.e09253>
- Panggabean Efta; Yunita, Ema Pristi, F. K. T. (2014). Uji Aktivitas Peningkatan Sensitivitas Insulin Ekstrak Biji Jintan Hitam (*Nigella sativa*) melalui Pengukuran Konsentrasi Tirosin Terfosforilasi Insulin Reseptor Substrat-1 (terhadap Tikus Wistar Model Diabetes Mellitus Tipe 2). *Majalah Kesehatan FKUB*, 1(Vol 1, No 1 (2014)), pp.53-59.
- Papachristoforou, E., Lambadiari, V., Maratou, E., & Makrilakis, K. (2020). Association of Glycemic Indices (Hyperglycemia, Glucose Variability, and Hypoglycemia) with Oxidative Stress and Diabetic Complications. *Journal of Diabetes Research*, 2020. <https://doi.org/10.1155/2020/7489795>
- Park, S. J., Kim, D. H., Jung, J. M., Kim, J. M., Cai, M., Liu, X., Hong, J. G., Lee, C. H., Lee, K. R., & Ryu, J. H. (2012). The ameliorating effects of stigmasterol on scopolamine-induced memory impairments in mice. *European Journal of Pharmacology*, 676(1–3), 64–70.
<https://doi.org/10.1016/j.ejphar.2011.11.050>
- Pelzer, K., Stebbins, J. F., Prinz, F. B., Borisov, A. S., Hazendonk, P., Hayes, P. G., Abele, M., Nmr, S., York, N., Santibáñez-Mendieta, A. B., Didier, C., Inglis, K. K., Corkett, A. J., Pitcher, M. J., Zanella, M., Shin, J. F., Daniels, L. M., Rakhmatullin, A., Li, M. M., ... Society, C. (2017). No 主観的健康感を中心とした在宅高齢者における健康関連指標に関する共分散構造分析Title. *Solid State Ionics*, 2(1), 1–10.
- Pitteloud, N., Hardin, M., Dwyer, A. A., Valassi, E., Yialamas, M., Elahi, D., & Hayes, F. J. (2005). Increasing insulin resistance is associated with a decrease in Leydig cell testosterone secretion in men. *Journal of Clinical Endocrinology and Metabolism*, 90(5), 2636–2641.
<https://doi.org/10.1210/jc.2004-2190>
- Poulose, N., Sajayan, A., Ravindran, A., Chandran, A., Priyadharshini, G. B., Selvin, J., & Kiran, G. S. (2021). Anti-diabetic Potential of a Stigmasterol From the Seaweed *Gelidium spinosum* and Its Application in the Formulation of Nanoemulsion Conjugate for the Development of Functional Biscuits. *Frontiers in Nutrition*, 8(September), 1–10.
<https://doi.org/10.3389/fnut.2021.694362>

- Pratiwi, R., Nantasenamat, C., Ruankham, W., Suwanjang, W., Prachayasittikul, V., Prachayasittikul, S., & Phopin, K. (2021). Mechanisms and Neuroprotective Activities of Stigmasterol Against Oxidative Stress-Induced Neuronal Cell Death via Sirtuin Family. *Frontiers in Nutrition*, 8(May), 1–12. <https://doi.org/10.3389/fnut.2021.648995>
- Purnamanita, Budu, Hatta, M., Massi, M. N., Natzir, R., Ichsan, A. M., & Sujuti, H. (2020). The effectiveness of triamcinolone injection on risk of postoperative operations with the conjunctiva autograft technique and its association with change of VEGF mRNA Expression. *Biomedical and Pharmacology Journal*, 13(2), 543–549. <https://doi.org/10.13005/bpj/1916>
- Rachmadi, A. (2008). Kadar Gula Darah dan Kadar Hormon Testosteron Pada Pria Penderita Diabetes Melitus dan Hubungannya dengan Disfungsi Seksual. *Universitas Diponegoro*, 1, 1–90.
- Rashid, U., & Khan, M. R. (2021). Phytochemicals of *Periploca aphylla* Dcne. ameliorated streptozotocin-induced diabetes in rat. *Environmental Health and Preventive Medicine*, 26(1), 1–15. <https://doi.org/10.1186/s12199-021-00962-0>
- Reza, M. S., Shuvo, M. S. R., Hassan, M. M., Basher, M. A., Islam, M. A., Naznin, N. E., Jafrin, S., Ahmed, K. S., Hossain, H., & Daula, A. F. M. S. U. (2020). Antidiabetic and hepatoprotective potential of whole plant extract and isolated compounds of *Aeginetia indica*. *Biomedicine and Pharmacotherapy*, 132, 110942. <https://doi.org/10.1016/j.biopha.2020.110942>
- Ridwan, R., Natzir, R., Rasyid, H., Patellongi, I., Hatta, M., Linggi, E. B., Bukhari, A., & Bahrin, U. (2019). Decreased renal function induced by high-fat diet in Wistar rat: The role of plasma angiotensin converting enzyme 2 (ACE2). *Biomedical and Pharmacology Journal*, 12(3), 1279–1287. <https://doi.org/10.13005/bpj/1756>
- Rivera-Mancía, S., Trujillo, J., & Chaverri, J. P. (2018). Utility of curcumin for the treatment of diabetes mellitus: Evidence from preclinical and clinical studies. *Journal of Nutrition and Intermediary Metabolism*, 14, 29–41. <https://doi.org/10.1016/j.jnim.2018.05.001>
- Rohimatun, & Darwati, I. (2011). Pertumbuhan Akar Rambut Purwoceng Pada Beberapa Komposisi Media Dan Sumber Karbon. *Buletin Litrtro*, 22(2), 166–176.
- Ropelle, E. R., Flores, M. B., Cintra, D. E., Rocha, G. Z., Pauli, J. R., Morari, J., de Souza, C. T., Moraes, J. C., Prada, P. O., Guadagnini, D., Marin, R. M., Oliveira, A. G., Augusto, T. M., Carvalho, H. F., Velloso, L. A., Saad, M. J.

- A., & Carvalheira, J. B. C. (2010). IL-6 and IL-10 anti-inflammatory activity links exercise to hypothalamic insulin and leptin sensitivity through IKK β and ER stress inhibition. *PLoS Biology*, 8(8), 31–32.
<https://doi.org/10.1371/journal.pbio.1000465>
- Ruqaiyah, Abdullah, N., Hatta, M., Mappeware, N. A., Harun, A., Amir, F., & Baharuddin, A. (2020). The effects of prenatal yoga for primagravida with gen expression mRNA FKBP5 (FK506-binding protein 51). *Indian Journal of Forensic Medicine and Toxicology*, 14(4), 3468–3473.
<https://doi.org/10.37506/ijfmt.v14i4.12162>
- Sachan, R., Kundu, A., Dey, P., Son, J. Y., Kim, K. S., Lee, D. E., Kim, H. R., Park, J. H., Lee, S. H., Kim, J. H., Cao, S., Lee, B. M., Kwak, J. H., & Kim, H. S. (2020). Dendropanax morbifera protects against renal fibrosis in streptozotocin-induced diabetic rats. *Antioxidants*, 9(1).
<https://doi.org/10.3390/antiox9010084>
- Saliu, T. P., Kumrungsee, T., Miyata, K., Tominaga, H., Yazawa, N., Hashimoto, K., Kamesawa, M., & Yanaka, N. (2022). Comparative study on molecular mechanism of diabetic myopathy in two different types of streptozotocin-induced diabetic models. *Life Sciences*, 288(September 2021), 120183.
<https://doi.org/10.1016/j.lfs.2021.120183>
- Sangeetha, K. N., Sujatha, S., Muthusamy, V. S., Anand, S., Shilpa, K., kumari, P. J., Sarathkumar, B., Thiyagarajan, G., & Lakshmi, B. S. (2017). Current trends in small molecule discovery targeting key cellular signaling events towards the combined management of diabetes and obesity. *Bioinformatics*, 13(12), 394–399. <https://doi.org/10.6026/97320630013394>
- Schneider, M. R., Zettler, S., Rathkolb, B., & Dahlhoff, M. (2023). TXNIP overexpression in mice enhances streptozotocin-induced diabetes severity. *Molecular and Cellular Endocrinology*, 565(January), 111885.
<https://doi.org/10.1016/j.mce.2023.111885>
- Semenkovich, C. F. (2006). Insulin resistance and atherosclerosis. *Journal of Clinical Investigation*, 116(7), 1813–1822. <https://doi.org/10.1172/JCI29024>
- Setyawati, T. (2014a). Peroxisome Proliferator Activated Receptor- γ (Ppar- γ) coactivator 1- α (PGC-1 α) Pada Diabetes Melitus Tipe 2 (DMT2) dan Perannya dalam fungsi mitokondria. *Jurnal Ilmiah Kedokteran Medika Tadulako*, 1(1), 54–62.
- Setyawati, T. (2014b). Tri Setyawati, Peningkatan HDL Plasma pada Diabetes Mellitus... *Jurnal Ilmiah Kedokteran*, 1(3), 22–34.

- Shaw, J. E., Sicree, R. A., & Zimmet, P. Z. (2010). Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Research and Clinical Practice*, 87(1), 4–14. <https://doi.org/10.1016/j.diabres.2009.10.007>
- Sirait, R. H., Hatta, M., Arief, S. K., Simanjuntak, T. P., & Suprayogi, B. (2018). Profile of HMGB1 mRNA expression and TLR4 protein in BALB/c mice model sterile injury after systemic lidocaine administration. *Pharmacognosy Journal*, 10(3), 586–589. <https://doi.org/10.5530/pj.2018.3.96>
- Sirait, R., Hatta, M., Ramli, M., Islam, A., & Arief, S. (2018). Systemic lidocaine inhibits high-mobility group box 1 messenger ribonucleic acid expression and protein in BALB/c mice after closed fracture musculoskeletal injury. *Saudi Journal of Anaesthesia*, 12(3), 395–398. https://doi.org/10.4103/sja.SJA_685_17
- Sitepu, R. K., Natzir, R., Warsinggih, Hatta, M., Rudiman, R., Labeda, I., Lusikooy, R. E., Bukhari, A., Miskad, U. A., & Bahar, B. (2022). Relation between expression of hMLH1 and p53 mRNA genes, in the feces of patients with colorectal carcinoma. Cross-sectional study. *Annals of Medicine and Surgery*, 73(October 2021), 103237. <https://doi.org/10.1016/j.amsu.2021.103237>
- Skuratovskaia, D., Komar, A., Vulf, M., & Litvinova, L. (2020). Mitochondrial destiny in type 2 diabetes: The effects of oxidative stress on the dynamics and biogenesis of mitochondria. *PeerJ*, 8. <https://doi.org/10.7717/peerj.9741>
- Smaill, M. M. A., Qureshi, M. A., Shmygol, A., Oz, M., Singh, J., Sydorenko, V., Arabi, A., Howarth, F. C., & Al Kury, L. (2016). Regional effects of streptozotocin-induced diabetes on shortening and calcium transport in epicardial and endocardial myocytes from rat left ventricle. *Physiological Reports*, 4(22), 1–11. <https://doi.org/10.14814/phy2.13034>
- Somsak, N., Peerawit, P., & Chusri, T. (2015). Hypoglycemic activity in diabetic rats of stigmasterol and sitosterol-3-O--D-glucopyranoside isolated from *Pseuderanthemum palatiferum* (Nees) Radlk. leaf extract. *Journal of Medicinal Plants Research*, 9(20), 629–635. <https://doi.org/10.5897/jmpr2014.5722>
- Steven, E. (2005). *IKK [beta] but Not IKK [alpha] Activates NF- [kappa] B and Cytokine ... 2005.*
- Sumantri, S., Hatta, M., Natzir, R., Rasyid, H., Rengganis, I., Nasrum Massi, M., Islam, A. A., Lawrence, G., Patellongi, I., Fachruddin Benyamin, A., Ye, S., & Taylor, E. (2021). *Metformin improves FOXP3 mRNA expression through suppression of interferon gamma levels in pristane-induced murine models of*

lupus [version 2; peer review: 3 approved].
<https://doi.org/10.12688/f1000research.23471.1>

- Surachmanto, E. E., Hatta, M., Islam, A. A., & Wahid, S. (2018). Association between asthma control and Interleukin-17F expression levels in adult patients with atopic asthma. *Saudi Medical Journal*, *39*(7), 662–667. <https://doi.org/10.15537/smj.2018.7.22055>
- Suzery, M., Cahyono, B., & Taufiqurahman. (2005). *Produksi senyawa afrodisiak.pdf*. <https://doi.org/>
- Syawal, P., Budu, B., Hatta, M., Massi, M. N., Ichsan, A. M., & Minhajat, R. (2022). Comparison between the triamcinolone and bevacizumab subconjunctivals and changes in Interleukin-1 mRNA expression in pterygium. *Journal of Taibah University Medical Sciences*, *17*(1), 67–71. <https://doi.org/10.1016/j.jtumed.2021.07.009>
- Tao, C., Shkumatov, A. A., Alexander, S. T., Ason, B. L., & Zhou, M. (2019). Stigmasterol accumulation causes cardiac injury and promotes mortality. *Communications Biology*, *2*(1). <https://doi.org/10.1038/s42003-018-0245-x>
- Tommy, T., Islam, A. A., Hatta, M., Bukhari, A., Nasrullah, Adhimarta, W., Aminuddin, & Zainuddin, A. A. (2021). Effect of folic acid on serum homocysteine, TNF α , IL-10, and HMGB1 gene expression in head injury model. *Annals of Medicine and Surgery*, *65*(March), 102273. <https://doi.org/10.1016/j.amsu.2021.102273>
- Tsuchiya, K., & Ogawa, Y. (2017). Forkhead box class O family member proteins: The biology and pathophysiological roles in diabetes. *Journal of Diabetes Investigation*, *8*(6), 726–734. <https://doi.org/10.1111/jdi.12651>
- Untereiner, A. A., Dhar, A., Liu, J., & Wu, L. (2011). Increased renal methylglyoxal formation with down-regulation of PGC-1 α -FBPase pathway in cystathionine γ -Lyase knockout mice. *PLoS ONE*, *6*(12). <https://doi.org/10.1371/JOURNAL.PONE.0029592>
- Usmiati, S., & Yuliani, S. (2010). *EFEK ANDROGENIK DAN ANABOLIK EKSTRAK AKAR Pimpinella alpina MOLK (PURWOCENG) PADA ANAK AYAM JANTAN [Androgenic and Anabolic Effect of Purwoceng (Pimpinella alpina Molk) Root on Male Chicken]*. *i*, 744–755. <https://doi.org/>
- Vincent, A. M., Edwards, J. L., McLean, L. L., Hong, Y., Cerri, F., Lopez, I., Quattrini, A., & Feldman, E. L. (2010). Mitochondrial biogenesis and fission in axons in cell culture and animal models of diabetic neuropathy. *Acta Neuropathologica*, *120*(4), 477–489. <https://doi.org/10.1007/s00401-010-0697-7>

- Wahyuni, T. D., Hatta, M., Bukhari, A., Santoso, A., & Massi, M. N. (2021). Increasing Natural Resistance Associated Macrophage Protein 1 serum level after Miana treatment in BALB/c induced *Klebsiella pneumoniae* experimental research. *Annals of Medicine and Surgery*, 65(March), 102262. <https://doi.org/10.1016/j.amsu.2021.102262>
- Wang, J., Huang, M., Yang, J., Ma, X., Zheng, S., Deng, S., Huang, Y., Yang, X., & Zhao, P. (2017). Anti-diabetic activity of stigmaterol from soybean oil by targeting the GLUT4 glucose transporter. *Food and Nutrition Research*, 61(1). <https://doi.org/10.1080/16546628.2017.1364117>
- Wang, X., Wang, W., Li, L., Perry, G., Lee, H. gon, Zhu, X., Sormin, I. P., Lukito, W., Wijaya, A., & As'ad, S. (2014). Negative impact of inflammation and insulin resistance on the biogenesis of HDL-c in indonesian men with metabolic syndrome. *Biochimica et Biophysica Acta - Molecular Basis of Disease*, 19(1), 1240–1247. <https://doi.org/10.13181/mji.v19i1.381>
- Ward, M. G., Li, G., Barbosa-Lorenzi, V. C., & Hao, M. (2017). Stigmaterol prevents glucolipotoxicity induced defects in glucose-stimulated insulin secretion. *Scientific Reports*, 7(1), 1–14. <https://doi.org/10.1038/s41598-017-10209-0>
- Watt, C., Sanchez-Rangel, E., & Hwang, J. J. (2020). Glycemic variability and cns inflammation: Reviewing the connection. *Nutrients*, 12(12), 1–14. <https://doi.org/10.3390/nu12123906>
- Wen, S., He, L., Zhong, Z., Zhao, R., & Weng, S. (2021). *Stigmaterol Restores the Balance of Treg / Th17 Cells by Activating the Butyrate-PPAR α Axis in Colitis*. 12(October), 1–17. <https://doi.org/10.3389/fimmu.2021.741934>
- Wibisono, J. J., Rauf, S., Hatta, M., Natsir, R., Massi, M. N., Husni Cangara, M., Masadah, R., Pattelongi, I. J., & Salim, J. (2020). Yin Yang 1 (YY1) and P53 Gene Expression Analysis in Cervical Cancer and Its Relationship with Cancer Staging. *Biomedical and Pharmacology Journal*, 13(3), 1095–1101. <https://doi.org/10.13005/bpj/1977>
- Wilcox, G. (2005). Insulin and insulin resistance. *Clin Biochem Rev*, 26(2), 19–39. <https://doi.org/10.1111/j.1365-2036.2005.02599.x>
- Ye, Q., Huang, W., Li, D., Si, E., Wang, J., Wang, Y., Chen, C., & Chen, X. (2016). Overexpression of PGC-1 α Influences Mitochondrial Signal Transduction of Dopaminergic Neurons. *Molecular Neurobiology*, 53(6), 3756–3770. <https://doi.org/10.1007/s12035-015-9299-7>
- Zhang, G. M., Deng, M. T., Zhang, Y. L., Fan, Y. X., Wan, Y. J., Nie, H. T., Wang, Z. Y., Wang, F., & Lei, Z. H. (2016). Effect of PGC-1 α

overexpression or silencing on mitochondrial apoptosis of goat luteinized granulosa cells. *Journal of Bioenergetics and Biomembranes*, 48(5), 493–507. <https://doi.org/10.1007/s10863-016-9684-6>

Zhao, R., Li, N., Liu, W., Liu, Q., Zhang, L., Peng, X., Zhao, R., & Hu, H. (2023). Low glycemic index potato biscuits alleviate physio-histological damage and gut dysbiosis in rats with type-2 diabetes mellitus induced by high-sugar and high-fat diet and streptozotocin. *The Journal of Nutritional Biochemistry*, 109401. <https://doi.org/10.1016/j.jnutbio.2023.109401>

Zhou, M., Zhu, L., Cui, X., Feng, L., Xuefeng, Z., He, S., Ping, F., Li, W., & Li, Y. (2016). Physical Exercise as therapy for type II diabetes. *Diabetes/Metabolism Research and Reviews*, 32(30), 768–774. <https://doi.org/10.1002/dmrr>

Lampiran 1. Hasil identifikasi akar Purwoceng Gunung



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SURAT KETERANGAN

No. **9.5.10/UN1/FFA.2/S1/PT/2022**

Yth. Rauhul Akbar Kurniawan
 Nomor Pokok : C013181017
 Program Studi Doktor Ilmu Kedokteran
 Fakultas Kedokteran UNHAS

5 Oktober 2022

Dalam rangka menindaklanjuti permohonan identifikasi sampel yang disampaikan ke Departemen Biologi Farmasi Fakultas Farmasi UGM, maka berikut kami sampaikan keterangan atas hasil identifikasi yang telah dilakukan oleh tenaga ahli kami:

No.Pendaftaran	Jenis	Suku
88	<i>Artemisia lactiflora</i> Wall. ex DC.	Asteraceae

Demikian surat ini dibuat untuk dapat digunakan sebagaimana mestinya.

Mengetahui,

Dekan



Prof. Dr. apt. Satibi, M.Si.

NIP. 197402181999031002

Ketua Departemen Biologi Farmasi

Prof. Dr. apt. Erna Prawita S., M.Si.

NIP. 196804151997022001

Lampiran 2. Rendemen ekstraksi

Bobot awal simplisia akar Purwoceng Gunung	= 1 Kg
Serbuk yang diperoleh	= 735 g
Hasil maserasi pertama dengan ethanol 96% pa	= 100,2967 g
Rendemen 1	= 13,65 %
Hasil maserasi kedua dengan n-hexane:kloroform	= 14,1131 g
Rendemen 2	= 14,07 %

$$\text{Rendemen ekstraksi} = \frac{14,1131 \text{ gram}}{735 \text{ gram}} \times 100\% = 1,920\%$$

Lampiran 3. Perhitungan dosis

1. Dosis kontrol positif

Dosis standar stigmasterol adalah 10 mg/Kg BB

Sehingga dosis untuk mencit = 0,2 mg/20g BB

$$= 0,01 \text{ mg/g BB}$$

2. Ekstrak dosis 1

Konsentrasi stigmasterol dalam ekstrak berdasarkan (Kurniawan, 2017) adalah $11,96 \pm 0,93$ %b/b.

Jadi 0,01 mg stigmasterol terdapat dalam 0,0836 mg ekstrak

Sehingga dosis menjadi 0,0836 mg/g BB

3. Ekstrak dosis 2

Ekstrak dosis 2 = 2x dosis 1

$$= 0,1672 \text{ mg/g BB}$$

Lampiran 4 Data penelitian

No	KLP	SAMPSEL														
		1				2				3						
		L6		Serum		L6		Serum		L6		Serum				
No	mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)	No	mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)	No	mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)					
1	I. POSTIF KONTROL	LA01	14,234	SA01	162	624,77	LB01	5,498	SB01	335	484,06	LC01	13,879	SC01	155	591,79
2		LA02	14,171	SA02	123	659,67	LB02	5,103	SB02	309	498,41	LC02	14,159	SC02	148	647,4
3	K1. Stigmesterol 0,01mg/gram BB	LA03	13,902	SA03	130	640,02	LB03	5,280	SB03	318	481,01	LC03	13,650	SC03	147	608,37
4		LA04	13,132	SA04	126	633,19	LB04	5,948	SB04	302	469,07	LC04	13,436	SC04	153	620,73
5		LA05	13,296	SA05	151	616,37	LB05	5,671	SB05	324	475,64	LC05	12,942	SC05	168	587,9
6		LA06	14,799	SA06	135	626,26	LB06	6,173	SB06	332	506,04	LC06	12,275	SC06	146	588,96
7		LA07	13,773	SA07	143	640,71	LB07	7,113	SB07	336	469,33	LC07	13,414	SC07	150	628,93
8		IL EKSTRAK 1	LA08	13,804	SA08	114	648,33	LB08	6,396	SB08	339	507,44	LC08	10,787	SC08	265
9	K2 Ekstrak 0,0836 mg/gram BB selama 20 hari	LA09	14,902	SA09	153	650,2	LB09	5,251	SB09	352	492,1	LC09	10,019	SC09	236	553,15
10		LA10	14,110	SA10	138	645,54	LB10	7,144	SB10	327	477,39	LC10	10,972	SC10	241	553,89
11		LA11	14,750	SA11	161	618,11	LB11	6,881	SB11	307	487,27	LC11	10,439	SC11	263	549,4
12		LA12	15,015	SA12	150	655,46	LB12	5,925	SB12	311	482,33	LC12	10,298	SC12	240	568,18
13		LA13	13,799	SA13	164	641,63	LB13	5,186	SB13	292	507,35	LC13	10,526	SC13	245	574,64
14		LA14	13,135	SA14	111	610,59	LB14	6,615	SB14	305	468,74	LC14	11,181	SC14	243	579,35
15	ILEKSTRAK 2	LA15	13,519	SA15	116	623,89	LB15	6,620	SB15	342	501,61	LC15	12,661	SC15	152	605,84
16	K3. Ekstrak 0,1672 mg/gram BB selama 20 hari	LA16	15,120	SA16	118	656,38	LB16	5,620	SB16	304	488,37	LC16	13,074	SC16	155	610,07
17		LA17	13,585	SA17	127	622,14	LB17	6,479	SB17	348	479,8	LC17	12,310	SC17	166	593,42
18		LA18	15,181	SA18	174	670,97	LB18	5,209	SB18	312	470,25	LC18	12,563	SC18	161	622,49
19		LA19	13,156	SA19	165	640,48	LB19	6,674	SB19	317	472,04	LC19	12,751	SC19	164	617,24
20		LA20	14,522	SA20	121	623,61	LB20	6,994	SB20	331	490,66	LC20	13,129	SC20	167	593,85
21		LA21	14,591	SA21	142	688,54	LB21	6,832	SB21	315	489,41	LC21	12,471	SC21	163	593,03

Lampiran 5 Analisis data kadar testosteron

a. Kadar testosteron pre STZ vs post STZ

Uji Normalitas dan homogenitas

Kadar testosteron	Nilai signifikansi		
	<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Levene test</i>
Kontrol positif pre STZ	0,200	0,756	- Berdasarkan Mean :
Kontrol positif post STZ	0,200	0,355	0,842
Ekstrak Dosis 1 pre STZ	0,089	0,101	- Berdasarkan median :
Ekstrak Dosis 1 post STZ	0,200	0,589	0,972
Ekstrak Dosis 2 pre STZ	0,200	0,184	
Ekstrak Dosis 2 post STZ	0,200	0,629	
Kontrol Negatif pre STZ	0,200	0,080	
Kontrol Negatif post STZ	0,200	0,476	

Uji *Bonferroni*

Pasangan data kadar testosteron	Signifikansi
Kontrol positif pre STZ - Kontrol positif post STZ	< 0,001
Ekstrak dosis 1 pre STZ – Ekstrak dosis 1 post STZ	< 0,001
Ekstrak dosis 2 pre STZ – Ekstrak dosis 2 post STZ	< 0,001
Kontrol negatif pre STZ – Kontrol negatif post STZ	< 0,001
Kontrol Positif pre STZ – Ekstrak dosis 1 pre STZ	1,000
Kontrol Positif pre STZ - Ekstrak dosis 2 pre STZ	1,000
Kontrol Positif pre STZ - Kontrol negatif pre STZ	1,000
Ekstrak dosis 1 pre STZ – Ekstrak dosis 2 pre STZ	0,788
Ekstrak dosis 1 pre STZ – Kontrol negatif pre STZ	1,000
Ekstrak dosis 2 pre STZ – Kontrol negatif post STZ	1,000
Kontrol positif post STZ - Ekstrak dosis 1 post STZ	1,000
Kontrol positif post STZ - Ekstrak dosis 2 post STZ	1,000

Kontrol positif post STZ - Kontrol negatif post STZ	1,000
Ekstrak dosis 1 post STZ - Ekstrak dosis 2 post STZ	1,000
Ekstrak dosis 1 post STZ - Kontrol negatif post STZ	1,000
Ekstrak dosis 2 post STZ - Kontrol negatif post STZ	1,000

b. Kadar testosteron pre perlakuan vs post perlakuan

Uji Normalitas dan homogenitas

Kadar testosteron			Nilai signifikansi		
			<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Levene test</i>
Kontrol positif	pre	Perlakuan	0,200	0,355	- Berdasarkan Mean : 0,118
Kontrol positif	post	Perlakuan	0,200	0,363	- Berdasarkan median : 0,263
Ekstrak Dosis 1	pre	Perlakuan	0,200	0,589	
Ekstrak Dosis 1	post	Perlakuan	0,094	0,201	
Ekstrak Dosis 2	pre	Perlakuan	0,200	0,629	
Ekstrak Dosis 2	post	Perlakuan	0,199	0,220	
Kontrol Negatif	pre	Perlakuan	0,200	0,476	
Kontrol Negatif	post	Perlakuan	0,150	0,130	

ANOVA

Kadar testosteron

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	164043.235	7	23434.748	113.103	<,001
Within Groups	9945.475	48	207.197		
Total	173988.709	55			

Uji Bonferroni

Pasangan data kadar testosteron	Signifikansi
Kontrol positif pre Perlakuan - Kontrol positif post Perlakuan	< 0,001
Ekstrak dosis 1 pre Perlakuan – Ekstrak dosis 1 post Perlakuan	< 0,001
Ekstrak dosis 2 pre Perlakuan – Ekstrak dosis 2 post Perlakuan	< 0,001
Kontrol negatif pre Perlakuan – Kontrol negatif post Perlakuan	1,000
Kontrol Positif pre Perlakuan – Ekstrak dosis 1 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Ekstrak dosis 2 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Kontrol negatif pre Perlakuan	1,000
Ekstrak dosis 1 pre Perlakuan – Ekstrak dosis 2 pre Perlakuan	1,000
Ekstrak dosis 1 pre Perlakuan – Kontrol negatif pre Perlakuan	1,000
Ekstrak dosis 2 pre Perlakuan – Kontrol negatif post Perlakuan	1,000
Kontrol positif post Perlakuan - Ekstrak dosis 1 post Perlakuan	< 0,001
Kontrol positif post Perlakuan - Ekstrak dosis 2 post Perlakuan	1,000
Kontrol positif post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Ekstrak dosis 2 post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 2 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001

5.3 Uji data selisih atau delta kadar testosteron

Kelompok perlakuan	Signifikansi
Kontrol positif vs Ekstrak Dosis 1	<0,001
Kontrol positif vs Ekstrak Dosis 2	1,000
Kontrol positif vs Kontrol negatif	<0,001
Ekstrak Dosis 1 vs Ekstrak Dosis 2	0,003
Ekstrak Dosis 1 vs Kontrol negatif	<0,001
Ekstrak Dosis 2 vs Kontrol negatif	<0,001

Lampiran 6 Analisis data ekspresi mRNA gen PGC 1- α

- a. Data sebelum vs sesudah STZ
Uji Normalitas dan homogenitas

Ekspresi mRNA gen PGC 1- α	Nilai signifikansi		
	<i>Kolmogorov- Smirnov</i>	<i>Shapiro- Wilk</i>	<i>Levene test</i>
Kontrol positif pre STZ	0,200	0,887	- Berdasarkan Mean :
Kontrol positif post STZ	0,200	0,449	0,870
Ekstrak Dosis 1 pre STZ	0,200	0,477	- Berdasarkan median :
Ekstrak Dosis 1 post STZ	0,200	0,462	0,972
Ekstrak Dosis 2 pre STZ	0,200	0,302	
Ekstrak Dosis 2 post STZ	0,071	0,119	
Kontrol Negatif pre STZ	0,200	0,933	
Kontrol Negatif post STZ	0,200	0,795	

ANOVAKadar mRNA PGC 1 α

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	878.860	7	125.551	260.152	<,001
Within Groups	23.165	48	.483		

Uji Bonferroni

Pasangan data Ekspresi mRNA gen PGC 1- α	Signifikansi
Kontrol positif pre STZ - Kontrol positif post STZ	< 0,001
Ekstrak dosis 1 pre STZ – Ekstrak dosis 1 post STZ	< 0,001
Ekstrak dosis 2 pre STZ – Ekstrak dosis 2 post STZ	< 0,001
Kontrol negatif pre STZ – Kontrol negatif post STZ	< 0,001
Kontrol Positif pre STZ – Ekstrak dosis 1 pre STZ	1,000
Kontrol Positif pre STZ - Ekstrak dosis 2 pre STZ	1,000
Kontrol Positif pre STZ - Kontrol negatif pre STZ	1,000
Ekstrak dosis 1 pre STZ – Ekstrak dosis 2 pre STZ	1,000
Ekstrak dosis 1 pre STZ – Kontrol negatif pre STZ	1,000
Ekstrak dosis 2 pre STZ – Kontrol negatif post STZ	1,000
Kontrol positif post STZ - Ekstrak dosis 1 post STZ	0,971
Kontrol positif post STZ - Ekstrak dosis 2 post STZ	0,852
Kontrol positif post STZ - Kontrol negatif post STZ	0,903
Ekstrak dosis 1 post STZ - Ekstrak dosis 2 post STZ	1,000
Ekstrak dosis 1 post STZ - Kontrol negatif post STZ	1,000
Ekstrak dosis 2 post STZ - Kontrol negatif post STZ	1,000

6.2. Data mRNA gen PGC 1 α Post stz dan post perlakuan

Uji Normalitas dan homogenitas

Ekspresi mRNA gen PGC			Nilai signifikansi		
1- α			<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Levene test</i>
Kontrol Perlakuan	positif	pre	0,200	0,449	- Berdasarkan Mean : 0,387
Kontrol Perlakuan	positif	post	0,200	0,715	- Berdasarkan median : 0,715
Ekstrak Perlakuan	Dosis 1	pre	0,200	0,462	
Ekstrak Perlakuan	Dosis 1	post	0,200	0,976	
Ekstrak Perlakuan	Dosis 2	pre	0,071	0,119	
Ekstrak Perlakuan	Dosis 2	post	0,200	0,639	
Kontrol Perlakuan	Negatif	pre	0,200	0,795	
Kontrol Perlakuan	Negatif	post	0,200	0,831	

ANOVA

Kadar mRNA PGC 1 α

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	516.087	7	73.727	206.780	<,001
Within Groups	17.114	48	.357		
Total	533.201	55			

Tabel 13. Uji *Bonferroni*

Pasangan data ekspresi mRNA gen PGC 1- α	Signifikansi
Kontrol positif pre Perlakuan - Kontrol positif post Perlakuan	< 0,001
Ekstrak dosis 1 pre Perlakuan – Ekstrak dosis 1 post Perlakuan	< 0,001
Ekstrak dosis 2 pre Perlakuan – Ekstrak dosis 2 post Perlakuan	< 0,001
Kontrol negatif pre Perlakuan – Kontrol negatif post Perlakuan	1,000
Kontrol Positif pre Perlakuan – Ekstrak dosis 1 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Ekstrak dosis 2 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Kontrol negatif pre Perlakuan	1,000

Ekstrak dosis 1 pre Perlakuan – Ekstrak dosis 2 pre Perlakuan	1,000
Ekstrak dosis 1 pre Perlakuan – Kontrol negatif pre Perlakuan	1,000
Ekstrak dosis 2 pre Perlakuan – Kontrol negatif post Perlakuan	1,000
Kontrol positif post Perlakuan - Ekstrak dosis 1 post Perlakuan	< 0,001
Kontrol positif post Perlakuan - Ekstrak dosis 2 post Perlakuan	1,000
Kontrol positif post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Ekstrak dosis 2 post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 2 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001

6.3 Uji data selisih atau delta ekspresi mRNA PGC 1 α

Kelompok perlakuan	Nilai signifikansi
Kontrol positif vs Ekstrak Dosis 1	0,002
Kontrol positif vs Ekstrak Dosis 2	0,482
Kontrol positif vs Kontrol negatif	0,002
Ekstrak Dosis 1 vs Ekstrak Dosis 2	0,002
Ekstrak Dosis 1 vs Kontrol negatif	0,002

Lampiran 7 Analisa data kadar glukosa

a. Data kadar glukosa pre STZ vs post STZ

Tabel 16. Uji Normalitas dan homogenitas

Kadar glukosa	Nilai signifikansi		
	<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Levene test</i>
Kontrol positif pre STZ	0,200	0,634	- Berdasarkan Mean :
Kontrol positif post STZ	0,200	0,429	0,449
Ekstrak Dosis 1 pre STZ	0,200	0,202	- Berdasarkan median :
Ekstrak Dosis 1 post STZ	0,200	0,729	0,918
Ekstrak Dosis 2 pre STZ	0,200	0,133	
Ekstrak Dosis 2 post STZ	0,200	0,517	
Kontrol Negatif pre STZ	0,200	0,974	
Kontrol Negatif post STZ	0,200	0,958	

ANOVA

Kadar glukosa (mg/dL)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	457430.857	7	65347.265	197.787	<,001
Within Groups	15858.857	48	330.393		
Total	473289.714	55			

Tabel 17. Uji *Bonferroni*

Pasangan data Kadar glukosa	Signifikansi
Kontrol positif pre STZ - Kontrol positif post STZ	< 0,001
Ekstrak dosis 1 pre STZ – Ekstrak dosis 1 post STZ	< 0,001
Ekstrak dosis 2 pre STZ – Ekstrak dosis 2 post STZ	< 0,001
Kontrol negatif pre STZ – Kontrol negatif post STZ	< 0,001
Kontrol Positif pre STZ – Ekstrak dosis 1 pre STZ	1,000
Kontrol Positif pre STZ - Ekstrak dosis 2 pre STZ	1,000
Kontrol Positif pre STZ - Kontrol negatif pre STZ	1,000
Ekstrak dosis 1 pre STZ – Ekstrak dosis 2 pre STZ	1,000
Ekstrak dosis 1 pre STZ – Kontrol negatif pre STZ	1,000
Ekstrak dosis 2 pre STZ – Kontrol negatif post STZ	1,000

Kontrol positif post STZ - Ekstrak dosis 1 post STZ	1,000
Kontrol positif post STZ - Ekstrak dosis 2 post STZ	1,000
Kontrol positif post STZ - Kontrol negatif post STZ	1,000
Ekstrak dosis 1 post STZ - Ekstrak dosis 2 post STZ	1,000
Ekstrak dosis 1 post STZ - Kontrol negatif post STZ	1,000
Ekstrak dosis 2 post STZ - Kontrol negatif post STZ	1,000

b. Data kadar glukosa post STZ vs post perlakuan

Uji Normalitas dan homogenitas

Kadar glukosa			Nilai signifikansi		
			<i>Kolmogorov-Smirnov</i>	<i>Shapiro-Wilk</i>	<i>Levene test</i>
Kontrol Perlakuan	positif	pre	0,200	0,429	- Berdasarkan Mean : 0,003
Kontrol Perlakuan	positif	post	0,200	0,064	- Berdasarkan median : 0,119
Ekstrak Perlakuan	Dosis 1	pre	0,200	0,729	
Ekstrak Perlakuan	Dosis 1	post	0,053	0,058	
Ekstrak Perlakuan	Dosis 2	pre	0,200	0,517	
Ekstrak Perlakuan	Dosis 2	post	0,200	0,329	
Kontrol Perlakuan	Negatif	pre	0,200	0,958	
Kontrol Perlakuan	Negatif	post	0,200	0,490	

Uji *Games-Howell*

Pasangan data kadar glukosa	Signifikansi
Kontrol positif pre Perlakuan - Kontrol positif post Perlakuan	< 0,001
Ekstrak dosis 1 pre Perlakuan - Ekstrak dosis 1 post Perlakuan	< 0,001
Ekstrak dosis 2 pre Perlakuan - Ekstrak dosis 2 post Perlakuan	< 0,001
Kontrol negatif pre Perlakuan - Kontrol negatif post Perlakuan	0,132
Kontrol Positif pre Perlakuan - Ekstrak dosis 1 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Ekstrak dosis 2 pre Perlakuan	1,000
Kontrol Positif pre Perlakuan - Kontrol negatif pre Perlakuan	0,997
Ekstrak dosis 1 pre Perlakuan - Ekstrak dosis 2 pre Perlakuan	0,999
Ekstrak dosis 1 pre Perlakuan - Kontrol negatif pre Perlakuan	0,988
Ekstrak dosis 2 pre Perlakuan - Kontrol negatif post Perlakuan	1,000
Kontrol positif post Perlakuan - Ekstrak dosis 1 post Perlakuan	< 0,001

Kontrol positif post Perlakuan - Ekstrak dosis 2 post Perlakuan	0,310
Kontrol positif post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Ekstrak dosis 2 post Perlakuan	< 0,001
Ekstrak dosis 1 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001
Ekstrak dosis 2 post Perlakuan - Kontrol negatif post Perlakuan	< 0,001

7.3 Uji data selisih atau delta kadar glukosa darah

Kelompok perlakuan	Signifikansi
Kontrol positif vs Ekstrak Dosis 1	<0,001
Kontrol positif vs Ekstrak Dosis 2	1,000
Kontrol positif vs Kontrol negatif	<0,001
Ekstrak Dosis 1 vs Ekstrak Dosis 2	<0,001
Ekstrak Dosis 1 vs Kontrol negatif	<0,001
Ekstrak Dosis 2 vs Kontrol negatif	<0,001

Lampiran 8 Data Selisih kadar testosteron, mRNA PGC-1 α , dan kadar glukosa darah

No	Kelompok	Selisih		
		mRNA PGC 1 α (Fold Change)	TESTOSTERON (pg/ml)	GLUKOSA (mg/dL)
1	Kontrol +	8.381	107.73	180
2		9.056	148.99	161
3		8.370	127.36	171
4		7.488	151.66	149
5		7.271	112.26	156
6		6.101	82.92	186
7		6.301	159.6	186
1	Ekstrak dosis 1	4.392	47.92	74
2		4.769	61.05	116
3		3.828	76.5	86
4		3.559	62.13	44
5		4.373	85.85	71
6		5.340	67.29	47
7		4.566	110.61	62
1	Ekstrak dosis 2	6.041	104.23	190
2		7.453	121.7	149
3		5.831	113.62	182
4		7.354	152.24	151
5		6.076	145.2	153
6		6.135	103.19	164
7		5.639	103.62	152
1	Kontrol -	-0.053	-38.17	-14
2		-0.337	-10.29	-53
3		0.090	2.51	-2
4		-0.526	10.8	-32
5		0.046	3.63	-15
6		-0.275	-3.76	-8
7		-0.365	6.54	-24

No	Kelompok	Pre STZ			Post stz			Post perlakuan		
		mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)	mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)	mRNA PGC 1 α (Fold Change)	GLUKOSA (mg/dL)	TESTOSTERON (pg/ml)
1	Kontrol +	14,234	162	624,77	5,498	335	484,06	13,879	155	591,79
2		14,171	123	659,67	5,103	309	498,41	14,159	148	647,4
3		13,902	130	640,02	5,280	318	481,01	13,650	147	608,37
4		13,132	126	633,19	5,948	302	469,07	13,436	153	620,73
5		13,296	151	616,37	5,671	324	475,64	12,942	168	587,9
6		14,799	135	626,26	6,173	332	506,04	12,275	146	588,96
7		13,773	143	640,71	7,113	336	469,33	13,414	150	628,93
1	Ekstrak dosis 1	13,804	114	648,33	6,396	339	507,44	10,787	265	555,36
2		14,902	153	650,2	5,251	352	492,1	10,019	236	553,15
3		14,110	138	645,54	7,144	327	477,39	10,972	241	553,89
4		14,750	161	618,11	6,881	307	487,27	10,439	263	549,4
5		15,015	150	655,46	5,925	311	482,33	10,298	240	568,18
6		13,799	164	641,63	5,186	292	507,35	10,526	245	574,64
7		13,135	111	610,59	6,615	305	468,74	11,181	243	579,35
1	Ekstrak dosis 2	13,519	116	623,89	6,620	342	501,61	12,661	152	605,84
2		15,120	118	636,38	5,620	304	488,37	13,074	155	610,07
3		13,585	127	622,14	6,479	348	479,8	12,310	166	593,42
4		15,181	174	670,97	5,209	312	470,25	12,563	161	622,49
5		13,156	165	640,48	6,674	317	472,04	12,751	164	617,24
6		14,522	121	623,61	6,994	331	490,66	13,129	167	593,85
7		14,591	142	658,54	6,832	315	489,41	12,471	163	593,03
1	Kontrol -	13,903	159	635,48	7,049	334	511,37	6,997	348	473,2
2		13,014	141	671,32	6,728	301	485,28	6,391	354	474,99
3		13,430	168	643,7	6,016	349	491,48	6,106	351	493,99
4		14,051	128	646,04	6,262	313	468,47	5,736	345	479,27
5		15,135	155	671,96	5,331	340	474,43	5,377	355	478,06
6		14,640	175	667,26	6,820	329	491,92	6,545	337	488,16
7		13,672	145	636,14	5,900	325	467,56	5,535	349	474,1

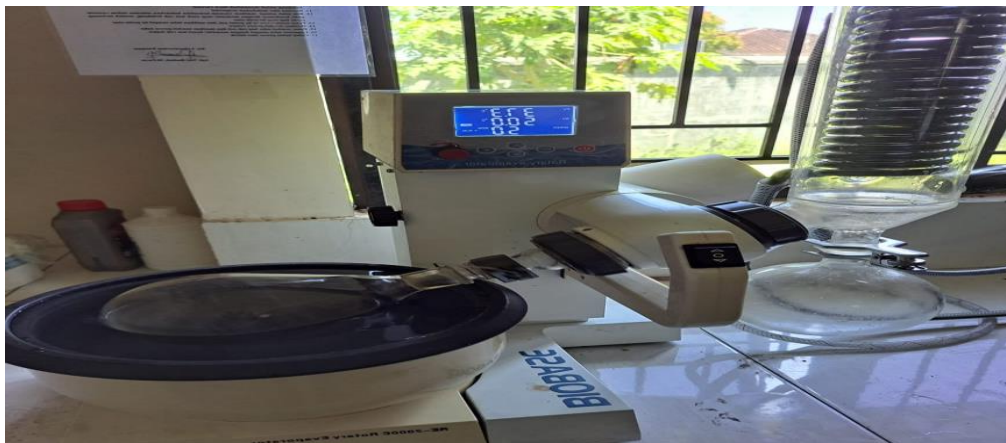
Lampiran 9 Dokumentasi Penelitian



Simplisia akar Purwoceng Gunung



Simplisia yang diserbuk

Proses ekstraksi pada *rotary evaporator*

Ekstrak akar Purwoceng Gunung



Larutan stok



Pengelompokan hewan uji