



## DAFTAR PUSTAKA

- Abbas, A. K., Lichtman, A. H., and Pillai, S. 2022. Cellular and Molecular Immunology, Tenth Edition. *South Asia Edition-E-Book*. Elsevier Health Sciences.
- Abood, W.N. 2017. Immunomodulatory and Natural Immunomodulators. *Journal of Allergy and Inflammation*, 1(2).
- Afnuhazi, R., Sari, F.S., Hendrawati, S.D., and Poddar, R. 2022. The effect of Stewed Sungkai Leaves (*Peronema canescens* Jack) on the decrease in Inflammatory Symptoms of COVID-19 patients. *Research Journal of Pharmacy and Technology*, 15(12), 5464-5466.
- Ahda, M., Jaswir, I., Khatib, A., Ahmed, Q.U., Mahfudh, N., Ardini, Y.D., Syed Mohamad, S.N.A., Anwar, M., Hernawan, H., Miyashita, K., and Salamatullah, A.M. 2023. Phytochemical analysis, antioxidant,  $\alpha$ -glucosidase inhibitory activity, and toxicity evaluation of *Orthosiphon stamineus* leaf extract. *Scientific Reports*, 13(1), 1–11.
- Ahkam, A.H., Susilawati, Y., and Sumiwi, S.A. 2024. *Peronema canescens* as a Source of Immunomodulatory Agents: A New Opportunity and Perspective. *Biology*, 13(9),744.
- Ahmad, T., Eapen, M.S., Ishaq, M., Park, A.Y., Karpiniec, S.S., Stringer, D.N., Sohal, S.S., Fitton, J.H., Guven, N., Caruso, V., and Eri, R. 2021. Anti-inflammatory activity of fucoidan extracts *in vitro*. *Marine Drugs*, 19(12). <https://doi.org/10.3390/md19120702>
- Ait Chaouche, F.S., Mouhouche, F., and Hazzit, M. 2018. Antioxidant capacity and total phenol and flavonoid contents of *Teucrium polium* L. grown in Algeria. *Mediterranean Journal of Nutrition and Metabolism*, 11(2), 135–144.
- Alkausart, A., Asra, R., and Fauziah, F. 2022. Overview of phytochemicals and pharmacological activities of sungkai (*Peronema canescens* Jack): popular plants in Indonesia during the COVID-19 pandemic. *IOSR Journal Of Pharmacy And Biological Sciences*, 17(2).
- Ananda, M.D., Mierza, V., Khaerunisa, A., and Apriani, R.D. 2024. Pharmacological benefits extracts of putri malu (*Mimosa pudica* linn.) In herbal medicine: A review. *Jurnal Pijar Mipa*, 19(6), 1052–1057.
- Anjayani, N., Amalia, S.P., Sukmarini, L., Tamhid, H.A., Primahana, G., and Triastuti, A. 2025. Metabolomic and cytotoxicity profiles of ethanol extract of *Peronema canescens* Jack on human non-small lung cancer cell A549. *Jurnal Sains Farmasi & Klinis*, 12(1), 7–14.
- Ashaolu, T.J., Zarei, M., Agrawal, H., Kharazmi, M.S., and Jafari, S.M. 2024. A critical review on immunomodulatory peptides from plant sources; action mechanisms and recent advances. *Critical Reviews in Food Science and Nutrition* 64(20), 7220-7236.



- Bahuguna, A., Khan, I., Bajpai, V.K., and Kang, S.C. 2017. MTT assay to evaluate the cytotoxic potential of a drug. *Bangladesh Journal of Pharmacology*, 12(2).
- Banu, K. S., and Cathrine, L. 2015. General Techniques Involved in Phytochemical Analysis. *International Journal of Advanced Research in Chemical Science*, 2(4), 25-32.
- Bartekova, M., Radosinska, J., Jelemensky, M., & Dhalla, N. S. (2018). Role of cytokines and inflammation in heart function during health and disease. In *Heart Failure Reviews*, 23(5), 733-758.
- Benhssain, K., Aabdousse, J., Salim, N., Oussif, I., Ramchoun, M., Elhabty, M., Abbas, Y., and Berrougui, H. 2023. Effect of geographical origin on yield and secondary metabolite content of extracts of Moroccan *Juniperus thurifera*. *Australian Journal of Crop Science*, 17(7), 591–599.
- Biswas, S. K., and Mantovani, A. 2010. Macrophage plasticity and interaction with lymphocyte subsets: Cancer as a paradigm. *Nature Immunology*, 11(10), 889-896.
- Borghini, S.M., Mizokami, S.S., Pinho-Ribeiro, F.A., Fattori, V., Crespigio, J., Clemente-Napimoga, J.T., Napimoga, M.H., Pitol, D.L., Issa, J.P.M., Fukada, S.Y., Casagrande, R., and Verri, W.A. 2018. The flavonoid quercetin inhibits titanium dioxide (TiO<sub>2</sub>)-induced chronic arthritis in mice. *Journal of Nutritional Biochemistry*, 53, 81-95.
- Bourque, J., and Hawiger, D. 2018. Immunomodulatory bonds of the partnership between dendritic cells and T cells. *Critical Reviews in Immunology*, 38(5).
- Cárdeno, A., Aparicio-Soto, M., Montserrat-de la Paz, S., Bermudez, B., Muriana, F.J.G., and Alarcón-de-la-Lastra, C. 2015. Squalene targets pro- and anti-inflammatory mediators and pathways to modulate over-activation of neutrophils, monocytes and macrophages. *Journal of Functional Foods*, 14, 779-790.
- Chainet, F., Courtiade, M., Lienemann, C.P., Ponthus, J., and Donard, O.F.X. 2011. Silicon speciation by gas chromatography coupled to mass spectrometry in gasolines. *Journal of Chromatography A*, 1218(51), 9269-9278.
- Chang, C.C., Yang, M.H., Wen, H.M., and Chern, J.C. 2002. Estimation of total flavonoid content in propolis by two complementary colometric methods. *Journal of Food and Drug Analysis*, 10(3), 3.
- Chen, W., Zhang, W., Shen, W., and Wang, K. 2010. Effects of the acid polysaccharide fraction isolated from a cultivated *Cordyceps sinensis* on macrophages *in vitro*. *Cellular Immunology*, 262(1), 69-74.
- Chen, X., Nie, W., Yu, G., Li, Y., Hu, Y., Lu, J., and Jin, L. 2012. Antitumor and immunomodulatory activity of polysaccharides from *Sargassum fusiforme*. *Food and Chemical Toxicology*, 50(3–4).
- Chopra, A.S., Lordan, R., Horbańczuk, O.K., Atanasov, A.G., Chopra, I., Horbańczuk, J.O., Jóźwik, A., Huang, L., Pirgozliev, V., Banach, M., Battino, M., and Arkells, N. 2022. The current use and evolving landscape of nutraceuticals. *Pharmacological Research*, 175, 106001.



- Cinelli, M.A., Do, H.T., Miley, G.P., and Silverman, R.B. 2020. Inducible nitric oxide synthase: Regulation, structure, and inhibition. *Medicinal Research Reviews*, 40(1), 158-189.
- Cruvinel, W.D.M., Júnior, D.M., Araújo, J.A.P., Catelan, T.T.T., de Souza, A.W.S., da Silva, N.P., and Andrade, L.E.C. 2010. Immune system - part I fundamentals of innate immunity with emphasis on molecular and cellular mechanisms of inflammatory response. *Revista Brasileira de Reumatologia*, 50(4), 434-447.
- Dhandapani, S., Tjhang, J.G., and Jang, I.C. 2020. Production of multiple terpenes of different chain lengths by subcellular targeting of multi-substrate terpene synthase in plants. *Metabolic Engineering*, 61, 397-405.
- Dillasamola, D., Aldi, Y., Kurniawan, H., and Jalius, I.M. 2022. Immunomodulator effect test of sungkai leaves (*Peronema canescens* Jack.) ethanol extract using carbon clearance method. *Proceedings of the 2nd International Conference on Contemporary Science and Clinical Pharmacy 2021 (ICCSCP 2021)*. Atlantis Press. 40, 262-267.
- Dillasamola, D., Aldi, Y., Wahyuni, F.S., Rita, R.S., Dachriyanus, Umar, S., and Rivai, H. 2021. Study of sungkai (*Peronema canescens* Jack) leaf extract activity as an immunostimulators with *in vivo* and *in vitro* methods. *Pharmacognosy Journal*, 13(6), 1397-1407.
- Dillasamola, D., Rachmaini, F., Yultri, M., Larisa, H., Gustia, E., Diliarosta, S., and Oktomalioputri, B. 2021. Immunostimulant effect of *Peronema canescens* Jack leaves extract and propolis in male white mice. *2nd International Conference on Cotemporary Science and Clinical Pharmacy 2021 (ICCSCP 2021)*, 40(Iccscp), 62-67.
- Dillasamola, D., Wahyuni, F.S., Rita, R. S., Dachriyanus, Alen, Y., Umar, S., and Aldi, Y. 2022. Immunostimulating study of active agent fraction from Sungkai (*Peronema canescens* Jack.) leaf from SARS-COV-2 virus antigen exposure to NK and CD<sup>8+</sup>T Cells. *Pharmacognosy Journal*, 14(4).
- Ding, S., Jiang, H., and Fang, J. 2018. Regulation of immune function by polyphenols. *Journal of Immunology Research*, 2018(1), 1264074.
- Do, Q.D., Angkawijaya, A.E., Tran-Nguyen, P.L., Huynh, L.H., Soetaredjo, F.E., Ismadji, S., and Ju, Y.H. 2014. Effect of extraction solvent on total phenol content, total flavonoid content, and antioxidant activity of *Limnophila aromatica*. *Journal of Food and Drug Analysis*, 22(3), 296-302.
- Dong, Z., Zhang, M., Li, H., Zhan, Q., Lai, F., and Wu, H. 2020. Structural characterization and immunomodulatory activity of a novel polysaccharide from *Pueraria lobata* (Willd.) Ohwi root. *International Journal of Biological Macromolecules*, 154, 1556-1564.
- Duque, G.A., and Descoteaux, A. 2014. Macrophage cytokines: Involvement in immunity and infectious diseases. *Frontiers in Immunology* (5), 0491.



- Durga, M., Nathiya, S., and Devasena, T. 2014. Immunomodulatory and antioxidant actions of dietary flavonoids. *International Journal of Pharmacy and Pharmaceutical Sciences*, 6(2), 50-56.
- Cahya, N.R.D, Abdulkadir, W.S., and Hasan, H. 2023. Uji toksisitas ekstrak etanol kulit terong ungu (*Solanum melongena* L.) menggunakan metode brine shrimp lethality test (BSLT). *Journal Syifa Sciences and Clinical Research*, 4(1).
- Elufioye, T.O., Chinaka, C.G., and Oyedeji, A.O. 2019. Antioxidant and anticholinesterase activities of *Macrosphyra Longistyla* (DC) hiern relevant in the management of Alzheimer's disease. *Antioxidants*, 8(9), 400.
- Evizal, R., Setyaningrum, E., Ardian, Wibawa, A., and Apriliani, D. 2013. Keragaman tumbuhan dan ramuan etnomedisin Lampung Timur. *Semirata FMIPA UNILA*, 1(1).
- Fadlilaturrahmah, F., Khairunnisa, A., Putra, A.M, and Sinta, I. 2021. Uji aktivitas tabir surya dan antioksidan ekstrak etanol daun sungkai (*Peronema canescens* Jack). *Jurnal Ilmiah Ibnu Sina (JIIS): Ilmu Farmasi dan Kesehatan*, 6(2), 322–330.
- Faraone, I., Rai, D.K., Chiummiento, L., Fernandez, E., Choudhary, A., Prinzo, F., and Milella, L. 2018. Antioxidant activity and phytochemical characterization of *Senecio clivicolus* wedd. *Molecules*, 23(10), 1–17.
- Fard, M., Arulsevan, P., Karthivashan, G., Adam, S., and Fakurazi, S. 2015. Bioactive extract from *Moringa oleifera* inhibits the pro-inflammatory mediators in lipopolysaccharide stimulated macrophages. *Pharmacognosy Magazine*, 11(44), 556
- Fransisca, D., Kahanjak, D.N., and Frethernety, A. 2020. Uji aktivitas antibakteri ekstrak etanol daun sungkai (*Peronema canescens* Jack) terhadap pertumbuhan *Escherichia coli* dengan metode difusi cakram Kirby-Bauer. *Journal of Environmental Sustainability Management*, 4(1), 460–470.
- Gala, S., Sumarno, S., and Mahfud, M. 2018. Microwave-assisted extraction of natural dyes from *Coleus atropurpureus* leaves: The effect of solvent. *MATEC Web of Conferences*, 156, 06011.
- Gandhi, G.R., Neta, M.T.S.L., Sathiyabama, R.G., Quintans, J.D.S.S., de Oliveira e Silva, A.M., Araújo, A.A.D.S., Narain, N., Júnior, L.J.Q., and Gurgel, R.Q. 2018. Flavonoids as Th1/Th2 cytokines immunomodulators: A systematic review of studies on animal models. *Phytomedicine* 44, 74-84.
- Giardino, G., Gallo, V., Prencipe, R., Gaudino, G., Romano, R., De Cataldis, M., Lorello, P., Palamaro, L., Di Giacomo, C., Capalbo, D., Cirillo, E., D'Assante, R., and Pignata, C. 2016. Unbalanced immune system: Immunodeficiencies and autoimmunity. *Frontiers in Pediatrics*, 4, 107.
- Gough, P., and Myles, I.A. 2020. Tumor necrosis factor receptors: pleiotropic signaling complexes and their differential effects. *Frontiers in Immunology*, 11, 585880
- Grigore, A. 2017. Plant phenolic compounds as immunomodulatory agents. *Phenolic Compounds - Biological Activity*, 8, 75-98.



- Gupta, S.C., Tyagi, A.K., Deshmukh-Taskar, P., Hinojosa, M., Prasad, S., and Aggarwal, B.B. 2014. Downregulation of tumor necrosis factor and other proinflammatory biomarkers by polyphenols. *Archives of Biochemistry and Biophysics*, 559, 91-99.
- Hada, Y., Uchida, H.A., Mukai, T., Kojima, F., Yoshida, M., Takeuchi, H., Kakio, Y., Otaka, N., Morita, Y., and Wada, J. 2020. Inhibition of interleukin-6 signaling attenuates aortitis, left ventricular hypertrophy and arthritis in interleukin-1 receptor antagonist deficient mice. *Clinical Science*, 134(20), 2771-2787.
- Hakim, A.R., and Saputri, R. 2020. Narrative Review: Optimasi Etanol sebagai Pelarut Senyawa Flavonoid dan Fenolik. *Jurnal Surya Medika*, 6(1), 177-180.
- Hameed, I.H., Hussein, H.J., Kareem, M.A., and Hamad, N.S. 2015. Identification of five newly described bioactive chemical compounds in Methanolic extract of *Mentha viridis* by using gas chromatography – mass spectrometry (GC-MS). *Journal of Pharmacognosy and Phytotherapy*, 7(7), 107-125.
- Han, L., Fu, Q., Deng, C., Luo, L., Xiang, T., and Zhao, H. 2022. Immunomodulatory potential of flavonoids for the treatment of autoimmune diseases and tumour. *Scandinavian Journal of Immunology*, 95(1), e13106.
- Harun, N.H., Septama, A.W., Ahmad, W.A.N.W., and Suppian, R. 2020. Immunomodulatory effects and structure-activity relationship of botanical pentacyclic triterpenes: A review. *Chinese Herbal Medicines*, 12(2), 118-124.
- Harvanová, G., Duranková, S., and Bernasovská, J. 2023. The role of cytokines and chemokines in the inflammatory response. *Alergologia Polska - Polish Journal of Allergology*, 10(3), 210-219.
- Hikariastri, P., Winarno, H., Kusmardi, K., Laksmiawati, D.R., and Abdillah, S. 2019. Aktivitas antiinflamasi crude aextract fukoidan dari *Sargassum crassifolium* pada sel RAW 264.7 yang siinduksi LPS. *Jurnal Kefarmasian Indonesia*, 97-105.
- Hirano, T. 2021. IL-6 in inflammation, autoimmunity and cancer. *International immunology*, 33(3), 127-148.
- Hosseinzade, A., Sadeghi, O., Biregani, A.N., Soukhtehzari, S., Brandt, G.S., and Esmailzadeh, A. 2019. Immunomodulatory effects of flavonoids: Possible induction of T CD4<sup>+</sup> regulatory cells through suppression of mTOR pathway signaling activity. *Frontiers in Immunology*, 10, 51
- Husni, E., Dillasamola, D., and Jannah, M. 2023. Subacute toxicity test of ethanol extract of sungkai leaf (*Peronema canescens* Jack.) on SGOT and SGPT levels. *Tropical Journal of Natural Product Research*, 7(11).
- Ibrahim, A., and Kuncoro, H. 2012. Identifikasi metabolit sekunder dan aktivitas antibakteri ekstrak daun sungkai (*Peronema canescens* Jack.) terhadap beberapa bakteri patogen. *Journal of Tropical Pharmacy and Chemistry*, 2(1), 8–18.



- Iftitah, K., Saputra, E., and Pujiastuti, Y.D. 2025. Characteristics and shelf life of pedada fruit leather (*Sonneratia caseolaris*) with the addition of sorbitol and *Kappaphycus alvarezii*. *Journal of Marine and Coastal Science*, 14(1), 18–32.
- Indrianingsih, A.W., Apriyana, W., Nisa, K., Rosyida, V.T., Hayati, S.N., Darsih, C., and Kusumaningrum, A. 2019. Antiradical activity and physico-chemical analysis of crackers from *Cucurbita moschata* and modified cassava flour. *Food Research*, 3(5), 484-490.
- Indriati, G. 2016. Etnobotani tumbuhan obat yang digunakan suku anak dalam di Desa Tabun Kecamatan VII Koto Kabupaten Tebo Jambi. *Jurnal Sainstek*, 6(1), 52–56.
- Islam, H., Neudorf, H., Mui, A.L., and Little, J.P. 2021. Interpreting ‘anti-inflammatory’ cytokine responses to exercise: focus on interleukin-10. *Journal of Physiology*, 599(23), 5163-5177.
- ISO. 2009. International Standard ISO 10993-5 Biological evaluation of medical devices. *Iso*, 40(5), 984–989.
- Jantan, I., Ahmad, W., and Bukhari, S.N.A. 2015. Plant-derived immunomodulators: An insight on their preclinical evaluation and clinical trials. *Frontiers in Plant Science*, 6, 655.
- Jarrah, A. A., Schwarskopf, M., Wang, E. R., LaRocca, T., Dhume, A., Zhang, S., Hadri, L., Hajjar, R. J., Schechter, A. D., & Tarzami, S. T. (2018). SDF-1 induces TNF-mediated apoptosis in cardiac myocytes. *Apoptosis*, 23(1). <https://doi.org/10.1007/s10495-017-1438-3>
- Jiang, S., Shi, D., Bai, L., Niu, T., Kang, R., and Liu, Y. 2023. Inhibition of interleukin-6 trans-signaling improves survival and prevents cognitive impairment in a mouse model of sepsis. *International Immunopharmacology*, 119, 110169.
- Johari, M.A., and Khong, H.Y. 2019. Total phenolic content and antioxidant and antibacterial activities of *Pereskia bleo*. *Advances in Pharmacological Sciences*, 2019(1), 7428593.
- Jomova, K., Alomar, S.Y., Valko, R., Liska, J., Nepovimova, E., Kuca, K., and Valko, M. 2025. Flavonoids and their role in oxidative stress, inflammation, and human diseases. *Chemico-Biological Interactions*, 413, 111489.
- Joo, T., Sowndhararajan, K., Hong, S., Lee, J., Park, S. Y., Kim, S., and Jhoo, J. W. 2014. Inhibition of nitric oxide production in LPS-stimulated RAW 264.7 cells by stem bark of *Ulmus pumila* L. *Saudi Journal of Biological Sciences*, 21(5), 427-435.
- Juswardi, J., Amalia, I.D, and Sriwijaya, U. 2023. Metabolite profile of false elder leaves (*Peronema canescens* Jack.) based on development levels. *Int. J. of Life Sciences*, 11(2), 143–150.
- Kang, C., Zhang, Y., Zhang, M., Qi, J., Zhao, W., Gu, J., Guo, W., and Li, Y. 2022. Screening of specific quantitative peptides of beef by LC–MS/MS coupled with OPLS-DA. *Food Chemistry*, 387, 132932.



- Khairunnisa, A. 2022. Perbandingan aktivitas antioksidan pada ekstrak daun dan kulit batang sungkai (*Peronema canescens* Jack). Skripsi *Fakultas Farmasi Universitas Muhammadiyah Kalimantan Timur*.
- Kitagawa, I., Simanjuntak, P., Hori, K., Nagami, N., Mahmud, T., Kobayashi, M., and Shibuya, H. 1994. Indonesian medicinal plants. VII. Seven new clerodane-type diterpenoids, Peronemins A2, A3, B1, B2, B3, C1, and D1, from the leaves of *Peronema canescens* (Verbenaceae). *Chemical and Pharmaceutical Bulletin*, 42(5).
- Kiyama, R. 2017. Estrogenic terpenes and terpenoids: pathways, functions and applications. *European Journal of Pharmacology*, 815, 405-415.
- Kumar, A., and Sharma, C. 2022. Recent update of the various sources originating ghost peaks in gas chromatography: A review. *Journal of Chromatography A*, 1685, 463625.
- Kumar, S., Gupta, P., Sharma, S., and Kumar, D. 2011. A review on immunostimulatory plants. *Journal of Chinese Integrative Medicine*, 9(2), 117-128.
- Kusriani, R.H., Nawawi, A., and Turahman, T. 2015. Uji aktivitas antibakteri ekstrak dan fraksi kulit batang dan daun sungkai (*Peronema canescens* Jack) terhadap *Staphylococcus aureus* ATCC 25923 dan *Escherichia coli* ATCC 25922. *Jurnal Farmasi Galenika Volume*, 2(1), 8–14.
- Latief, M., Fisesa, A.T., Sari, P.M., and Tarigan, I.L. 2021. Anti-inflammatory activity of sungkai leaves (*Peronema canescens* Jack) ethanol extract in carrageenan-induced mice. *Jurnal Farmasi Sains dan Praktis*, 7(2), 144-153.
- Latief, M., Sari, P.M., Fatwa, L.T., Tarigan, I.L., and Rupasinghe, H.P.V. 2021. Antidiabetic activity of sungkai (*Peronema canescens* Jack) leaves ethanol extract on the male mice induced alloxan monohydrate. *Pharmacology and Clinical Pharmacy Research*, 6(2), 64-74.
- Latief, M., Sutrisno, Dasrinal, E., Safitri, W., and Tarigan, I.L. 2023. Immunomodulator activity of 5,7-dihydroxy isoflavones and  $\beta$ -Sitosterol from *Peronema canescens* Jack leaves methanol and ethyl acetate extract In *4th Green Development International Conference (GDIC 2022)*: 558-572. Atlantis Press.
- Lee, J., Kim, M., Son, H., Kim, S., Jo, S., Janchiv, A., Kim, S.Y., Lee, T., and Yoo, H.Y. 2024. Phytochemical characterization and bioactivity evaluation of extracts obtained via ultrasound-assisted extraction of medicinal plant *Phedimus aizoon*. *Plants*, 13(14), 1915.
- Lee, J., Kim, S., and Kang, C.H. 2022. Immunostimulatory activity of lactic acid bacteria cell-free supernatants through the activation of NF- $\kappa$ B and MAPK signaling pathways in RAW 264.7 cells. *Microorganisms*, 10(11), 2247.
- Leite, P.M., Amorim, J.M., and Castilho, R.O. 2022. Immunomodulatory role of terpenoids and phytosteroids. *Plants and Phytomolecules for Immunomodulation: Recent Trends and Advances* (321-360). Singapore: Springer Nature Singapore.



- Lestari, I.C. 2021. Potensi herbal sebagai immunomodulator. *Jurnal Kedokteran Ibnu Nafis*, 9(2), 33-44.
- Li, J., Xi, Y., Qiao, Y., Zhao, Z., Liu, J., and Li, F. 2024. Solvent effects on heterogeneous catalysis for the selective hydrogenation. *ChemCatChem*, 16(14), e202400120.
- Lin, M.S., Yu, Z.R., Wang, B.J., Wang, C.C., Weng, Y.M., and Koo, M. 2015. Bioactive constituent characterization and antioxidant activity of *Ganoderma lucidum* extract fractionated by supercritical carbon dioxide. *Sains Malaysiana*, 44(12), 1685–1691.
- Liu, C., Chu, D., Kalantar-Zadeh, K., George, J., Young, H.A., and Liu, G. 2021. Cytokines: from clinical significance to quantification. *Advanced Science*, 8(15), 2004433.
- Liu, Y., Li, Q.Z., Li, L.D.J., and Zhou, X.W. 2021. Immunostimulatory effects of the intracellular polysaccharides isolated from liquid culture of *Ophiocordyceps sinensis* (Ascomycetes) on RAW264.7 cells via the MAPK and PI3K/Akt signaling pathways. *Journal of Ethnopharmacology*, 275, 114130.
- Lv, S., Ma, L., and He, H. 2022. Research status of macrophage polarization and osteogenesis and vasculogenesis after polarization. *Frontiers in Medical Science Research*, 4(11).
- Ma, J., Li, K., Shi, S., Li, J., Tang, S., and Liu, L.H. 2022. The application of UHPLC-HRMS for quality control of traditional Chinese medicine. *Frontiers in Pharmacology*, 13, 922488.
- Mahima, Ingle, A.M., Verma, A.K., Tiwari, R., Karthik, K., Chakraborty, S., Deb, Q., Rajagunalan, S., Rathore, R., and Dhama, K. 2013. Immunomodulators in day to day life: A review. *Pakistan Journal of Biological Sciences*, 16(17).
- Maigoda, T., Judiono, J., Purkon, D.B., Haerussana, A.N.E.M., and Mulyo, G.P.E. 2022. Evaluation of *Peronema canescens* leaves extract: fourier transform infrared analysis, total phenolic and flavonoid content, antioxidant capacity, and radical scavenger activity. *Open Access Macedonian Journal of Medical Sciences*, 10(A), 117–124.
- Malček Šimunková, M., Štekláč, M., Raptová, R., Gajdoš, P., Čertík, M., and Malček, M. 2024. The effect of Cu(II) ion on antioxidant and DNA-binding mechanism of baicalein and scutellarein: Spectroscopic, theoretical, and molecular docking study. *Applied Organometallic Chemistry*, 38(4), e7390.
- Marciniak, M., Stachowicz-Suhs, M., and Wagner, M. 2025. The role of innate immune cells in modulating vascular dynamics in skin malignancies. *Biochimica et Biophysica Acta - Reviews on Cancer*, 1880 (3),18933.
- Markousis-Mavrogenis, G., Baumhove, L., Al-Mubarak, A.A., Aboumsallem, J.P., Bomer, N., Voors, A.A., and van der Meer, P. 2024. Immunomodulation and immunopharmacology in heart failure. *Nature Reviews Cardiology*, 21(2), 119-149.



- Marshall, J.S., Warrington, R., Watson, W., and Kim, H.L. 2018. An introduction to immunology and immunopathology. *Allergy, asthma and clinical immunology*, 14(Suppl 2), 49.
- Medzhitov, R. 2008. Origin and physiological roles of inflammation. *Nature*, 454(7203), 428-435.
- Muharni, M., Ferlinahayati, F., and Yohandini, H. 2021. Antioxidant, antibacterial, total phenolic and flavonoid contents of sungkai leaves (*Peronema canescens*). *Tropical Journal of Natural Product Research*, 5(3), 528–533.
- Muharni, M., Ferlinahayati, F., Yohandini, H., Riyanti, F., and Pakpahan, N.A.P. 2021. The anticholesterol activity of betulinic acid and stigmaterol isolated from the leaves of sungkai (*Peronema canescens* Jack). *International Journal of Applied Pharmaceutics*, 13(2), 198–203.
- Mukherjee, P.K., Nema, N.K., Bhadra, S., Mukherjee, D., Braga, F.C., and Matsabisa, M.G. 2014. Immunomodulatory leads from medicinal plants. *Indian Journal of Traditional Knowledge*, 13(2), 235-256.
- Mundim, F.M., and Pringle, E.G. 2018. Whole-plant metabolic allocation under water stress. *Frontiers in Plant Science*, 9, 852–863.
- Mushtaq, M.Y., Choi, Y.H., Verpoorte, R., and Wilson, E.G. 2014. Extraction for metabolomics: Access to the metabolome. *Phytochemical Analysis*, 25(4), 291-306.
- Najmi, A., Javed, S.A., Al Bratty, M., and Alhazmi, H.A. 2022. Modern approaches in the discovery and development of plant-based natural products and their analogues as potential therapeutic agents. *Molecules*, 27(2), 349.
- Ningsih, A., and Ibrahim, A. 2013. Aktifitas antimikroba ekstrak fraksi *n*-heksan daun sungkai (*Peronema canescens* Jack) terhadap beberapa bakteri dengan metode KLT-Bioautografi. *Journal of Tropical Pharmacy and Chemistry*, 2(2), 76–82.
- Ningsih, A., Subehan, and Djide, M.N. 2013. Potensi antimikroba dan analisis spektroskopi isolat aktif ekstrak *n*-heksan daun sungkai (*Peronema canescens* Jack) terhadap beberapa mikroba uji. [Tesis] *Pascasarjana Program Studi Farmasi, Fakultas Farmasi Universitas Hasanuddin. Makassar*.
- Noviana, E., Indrayanto, G., & Rohman, A. (2022). Advances in Fingerprint Analysis for Standardization and Quality Control of Herbal Medicines. In *Frontiers in Pharmacology* (Vol. 13). <https://doi.org/10.3389/fphar.2022.853023>
- Novita, R., Suhartanto, B., and Widayati, D.T. 2025. Determination of sungkai leaf (*Peronema canescens* Jack) as a natural antioxidant using different polarities solvents. *Proceedings of IOP Conference Series: Earth and Environmental Science, IOP Publishing*, 1482(1): 012038
- Nowak, A., Czyzowska, A., Efenberger, M., and Krala, L. 2016. Polyphenolic extracts of cherry (*Prunus cerasus* L.) and blackcurrant (*Ribes nigrum* L.) leaves as natural preservatives in meat products. *Food Microbiology*, 59, 142–149.



- Park, J.Y., Yoon, H.J., Lee, N.K., and Paik, H.D. 2025. Antioxidant and immunostimulatory effects of lactobacillus strains in RAW 264.7 macrophages via NF- $\kappa$ B and MAPK signaling pathways. *Probiotics and Antimicrobial Proteins*, 0123456789, 1–15.
- Patel, S.S., and Savjani, J.K. 2015. Systematic review of plant steroids as potential antiinflammatory agents: Current status and future perspectives. *The Journal of Phytopharmacology*, 4(2), 121-125.
- Pattanayak, S.P., and Mazumder, P.M. 2011. Immunomodulatory activities of *Dendrophthoe falcata* (L.f) ettingsh in experimental animals: *in vitro* and *in vivo* Investigations. *Journal of Scientific Research*, 3(3), 619-630.
- Paul, S., Pan, S., Mukherjee, A., and De, P. 2021. Nitric oxide releasing delivery platforms: design, detection, biomedical applications, and future possibilities. *Molecular Pharmaceutics* 18(9), 3181-3205.
- Pereira, D.M., Valentão, P., Pereira, J.A., and Andrade, P.B. 2009. Phenolics: From chemistry to biology. *Molecules*, 14(6), 2202-2211.
- Pindan, N.P., Daniel, S.C., and Magdaleni, A.R. 2021. Phytochemical test and antioxidant activity test of *n*-hexane fraction extract, ethyl acetate and remained ethanol from leaf of sungkai (*Peronema canescens* Jack.) using DPPH method. *Jurnal Atomik*, 06(1), 22–27.
- Placha, I., Bacova, K., Zitterl-Eglseer, K., Laukova, A., Chrastinova, L., Madarova, M., Zitnan, R., and Strkolcova, G. 2022. Thymol in fattening rabbit diet, its bioavailability and effects on intestinal morphology, microbiota from caecal content and immunity. *Journal of Animal Physiology and Animal Nutrition*, 106(2). 368-377.
- Prabu, S.L., Suriyaprakash, T.N.K., Kumar, C.D., Sureshkumar, S., and Ragavendran, T. 2012. *Nutraceuticals : A review*. 46, 8372–8377.
- Prasiwi, D., Sundaryono, A., and Handayani, D. 2018. Aktivitas fraksi etanol dari ekstrak daun *Peronema canescens* terhadap tingkat pertumbuhan *Plasmodium berghei*. *Alotrop*, 2(1), 25–32.
- Pratama, R.R., Sari, R.A., Sholikhah, I., Mansor, H., Chang, H.I., Sukardiman, and Widyowati, R. 2024. Inhibition of nitric oxide production in RAW 264.7 cells and cytokines IL-1 $\beta$  in osteoarthritis rat models of 70 % ethanol extract of *Arcangelisia flava* (L.) merr stems. *Heliyon*, 10(15), e35730.
- Priyanga, S., Velusamy, M., Ramasubramanian, R., and Mayilmurugan, R. 2024. Fe(III) complexes as the optical imaging probe for l-Arginine via the redox mechanism. *Crystal Growth & Design*, 25(2), 182-190.
- Puspita, F.S., and Prasetya, A.T. 2023. Phytochemical and antioxidant activity tests of ethanol extracts of the roots, stems and leaves of song of india (*Dracaena reflexa*) plant using the DPPH method. *Indonesian Journal of Chemical Science*, 12(1), 33-46.



- Qian, L., Du, M., Yang, X., Wang, Q., Huang, S., Ma, Y., and Sun, Y. 2023. Microanalysis characterization and immunomodulatory effect for selenium-enriched polysaccharide from *Morchella esculenta* (L.) Pers. *Molecules*, 28(7).
- Răducanu, A.E., Tihăuan, B.M., Marinaș, I.C., Ciupercă, O.T., Țebrencu, C.E., Ionescu, E., and Onisei, T. 2021. The biological effects of novel nutraceuticals with curcuminoids and other plant-derived immunomodulators and pre-probiotics. *Pharmaceutics*, 13(5), 666.
- Rahardhian, M.R.R., Susilawati, Y., Musfiroh, I., Febriyanti, R.M., Muchtaridi, and Sumiwi, S.A. 2022. In silico study of bioactive compounds from sungkai (*Peronema canescens*) as immunomodulator. *Int J App Pharm*, 14, 135-41.
- Rahardhian, M.R.R., Susilawati, Y., Sumiwi, A., Muktiwardoyo, M., and Muchtaridi. 2022. A review of sungkai (*Peronema canescens*): traditional usage, phytoconstituent, and pharmacological activities. *Int J App Pharm*, 14(5), 15-23.
- Rahma, C.S.A., Ardini, D., Isnenia, and Mulatasih, E.R. 2022. Profil metabolit sekunder daun sungkai (*Peronema canescens* Jack) dan aktivitas antioksidan ekstrak etanol daun sungkai (*Peronema canescens* Jack) dengan metode DPPH. *Jurnal Analis Farmasi*, 7(2), 192–210.
- Rahman, A., Rengganis, G.P., Prayuni, S., Novriyanti, I., Sari, T.N., Pratiwi, P.D., and Pratama, S. 2021. The effect of sungkai leaves (*Peronema canescens*) infusion on the number of leukocytes in mice. *Journal of Healthcare Technology and Medicine*, 7(2), 614–620.
- Ramadenti, F., Sundaryono, A., and Handayani, D. 2017. Uji fraksi etil asetat daun *Peronema canescens* terhadap *Plasmodium berghei* pada *Mus musculus*. *Alotrop Jurnal Pendidikan Dan Ilmu Kimia*, 2(1), 89–92.
- Rasyid, A., Putra, M.Y., and Yasman. 2023. Antibacterial and antioxidant activity of sea cucumber extracts collected from Lampung waters, Indonesia. *Kuwait Journal of Science*, 50(4), 615–621.
- Renda, G., Gökkaya, İ., and Şöhretoğlu, D. 2022. Immunomodulatory properties of triterpenes. *Phytochemistry Reviews*, 21(2), 537–563.
- Riastri, A., Putri, D.D.P., Sa'adah, M., Gani, A.P., and Murwanti, R. 2023. RAW 264.7 macrophage cell line: *in vitro* model for the evaluation of the immunomodulatory activity of Zingiberaceae. *Tropical Journal of Natural Product Research*, 7(2).
- Ridker, P.M., and Rane, M. 2021. Interleukin-6 signaling and anti-interleukin-6 therapeutics in cardiovascular disease. *Circulation Research*, 128(11), 1728-1746.
- Ryu, H.Y., Lee, H., Kong, H.J., and Kang, J.H. 2019. Anti-inflammatory effects of complex extract including *Eucommia ulmoides* in LPS-induced RAW 264.7 cells. *Journal of Acupuncture Research*, 36(4).



- Saada, M., Falleh, H., Catarino, M.D., Cardoso, S.M., and Ksouri, R. 2018. Plant growth modulates metabolites and biological activities in *Retama raetam* (Forssk.) Webb. *Molecules*, 23(2177), 1–17.
- Saghazadeh, A., Mahmoudi, M., and Rezaei, N. 2019. Introduction. *Nutrition and Immunity* (1–14). Springer.
- Santoni, A., Efdi, M., and Fadhilah, N. 2023. Profil fitokimia dan penentuan fenolik total, flavonoid total, dan uji aktivitas antioksidan ekstrak daun sungkai (*Peronema canescens* Jack) dari daerah Kota Padang. *Jurnal Kimia Unand*, 12(1), 1-6.
- Saraiva, M., Vieira, P., and O’Garra, A. 2020. Biology and therapeutic potential of interleukin-10. *Journal of Experimental Medicine*, 217(1), e20190418.
- Sari, N., Latief, M., and Elisma, E. 2022. Uji aktivitas ekstrak etanol daun Sungkai (*Peronema canescens* Jack) terhadap penyembuhan luka bakar pada kelinci jantan (*Oryctolagus cuniculus*). *Indonesian Journal of Pharma Science*, 4(1), 113-122.
- Sari, R.M., Wahono, S.K., Anwar, M., Rizal, W.A., Suryani, R., and Suwanto, A. 2023. Pyrolysis of coconut shells for liquid smoke production: effect of integrated water scrubber on reduction of tar. *Biomass Conversion and Biorefinery*, 14(20), 26105-26119.
- Sari, S.G., and Aulya, D. 2022. Morfologi batang dan daun sungkai (*Peronema canescens*) pada lingkungan tumbuh yang berbeda. *Seminar Nasional Hasil Penelitian dan Pengabdian Kepada Masyarakat 2022 LP2M UST Jogja*, 1, (1), 390-400.
- Shalihin, M.I., Khatib, A., Yusnaidar, Y., Lasmana, I., and Latief, M. 2024. An in - vogue plant, *Peronema canescens* Jack : traditional uses and scientific evidence of its bioactivities. *Discover Plants*, 1(58).
- Shreshtha, S., Sharma, P., Kumar, P., Sharma, R., and Singh, S.P. 2018. Nitric oxide: It’s role in immunity. *Journal of Clinical and Diagnostic Research*, 12(7).
- Silva, L.B., dos Santos Neto, A.P., Maia, S.M.A.S., dos Santos Guimarães, C., Quidute, I.L., Carvalho, A. de A.T., Júnior, S.A., and Leão, J.C. 2019. The role of TNF- $\alpha$  as a proinflammatory cytokine in pathological processes. *The Open Dentistry Journal*, 13(1), 332-338.
- Singh, A., and Kumar, V. 2023. Phytochemical and bioactive compounds of pumpkin seed oil as affected by different extraction methods. *Food Chemistry Advances*, 2(100211), 1–9.
- Singh, I.K., and Sharma, P. 2022. An interplay of cellular and molecular components of immunology. *An Interplay of Cellular and Molecular Components of Immunology*. CRC Press.
- Smith, J.A. 2018. Regulation of cytokine production by the unfolded protein response; Implications for infection and autoimmunity. *Frontiers in Immunology*, 9, 422.



- Somensi, N., Rabelo, T.K., Guimarães, A.G., Quintans-Junior, L.J., de Souza Araújo, A.A., Moreira, J.C.F., and Gelain, D.P. 2019. Carvacrol suppresses LPS-induced pro-inflammatory activation in RAW 264.7 macrophages through ERK1/2 and NF- $\kappa$ B pathway. *International Immunopharmacology*, 75, 105743.
- Stenvinkel, P., Ketteler, M., Johnson, R.J., Lindholm, B., Pecoits-Filho, R., Riella, M., Heimbürger, O., Cederholm, T., and Girndt, M. 2005. IL-10, IL-6, and TNF- $\alpha$ : Central factors in the altered cytokine network of uremia - The good, the bad, and the ugly. *Kidney International*, 67(4), 1216-1233.
- Sujono, T.A., Kusumowati, I.T.D., and Munawaroh, R. 2021. Aktivitas imunomodulator ekstrak metanol dan fraksi buah talok (*Muntingia calabura* L.) pada sel RAW 264.7. *Journal of Pharmaceutical Science and Clinical Research*, 6(2), 82–95.
- Suryani, A.E., Nisa, K., Hadayani, S., Darsih, C., Yanuartono, Y., and Wuryastuty, H. 2025. The UHPLC-HRMS profiling, *in vitro* -antioxidant and pancreatic lipase inhibitory activities of *Peronema canescens* leaves extract and fractions from Indonesia. *Journal of Applied Pharmaceutical Science*, 15(05), 75–89.
- Suwandi, J.F., Wijayanti, M.A., and Mustofa, M. 2018. *In vitro* antiplasmodial and cytotoxic activities of a Sungkai (*Peronema canescens*) leaf extract. *International Journal of Pharmacy and Pharmaceutical Sciences*, 10(10), 110–113.
- Szliszka, E., and Krol, W. 2011. The role of dietary polyphenols in tumor necrosis factor-related apoptosis inducing ligand (TRAIL)-induced apoptosis for cancer chemoprevention. *European Journal of Cancer Prevention*, 20(1), 63-69.
- Tao, Y., Wang, D., Hu, Y., Huang, Y., Yu, Y., and Wang, D. 2014. The immunological enhancement activity of propolis flavonoids liposome *in vitro* and *in vivo*. *Evidence-Based Complementary and Alternative Medicine*, 2014(1), 483513.
- Tarigan, I.L., Sutrisno, Rumaida, Aini I.P.S, and Latief M. 2022. Isolation of a flavone apigenin and a steroids squalene from *Peronema canescens* Jack leaves with anti inflammatory activities. *Pharmacogn J*, 14(6): 744-752.
- Teng, L., Fu, H., Wang, M., Deng, C., and Chen, J. 2015. Stimulation of RAW264.7 macrophages by sulfated *Escherichia coli* K5 capsular polysaccharide *in vitro*. *Molecular Medicine Reports*, 12(4), 5545-5553.
- Thiese, M.S., Ronna, B. and Ott, U. 2016. P value interpretations and considerations. *Journal of thoracic disease*, 8(9), E928.
- Tizard, I. 2018. Veterinary Immunology, 10th edition. *Elsevier*.
- To'bungan, N., Widhiastuti, S.S., Hida, F.N.L., and Mahardhika, I.W.S. 2024. Phytochemical properties, antioxidant, and cytotoxicity activity of knobweed (*Hyptis capitata*) from South Sulawesi, Indonesia. *Journal of Tropical Biodiversity and Biotechnology*, 9(3), 90976.



- Turner, M.D., Nedjai, B., Hurst, T., and Pennington, D.J. 2014. Cytokines and chemokines: At the crossroads of cell signalling and inflammatory disease. *Biochimica et Biophysica Acta-Molecular Cell Research*, 1843(11), 2563-2582.
- Ugrasena, P.Y., Puspitasari, D.R.A., and Rupayantini, D.A. 2022. Perbandingan uji sitotoksik fraksi *n*-heksana, fraksi etil asetat dan ekstrak purifikasi herba sambiloto (*Andrographis paniculata* (Burm. F.) Nees) dengan metode brine shrimp lethality test (BSLT). *Journal Pharmactive*, 1(1), 1-6.
- Vasu, S., Palaniyappan, V., and Badami, S. 2010. A novel microwave-assisted extraction for the isolation of andrographolide from *Andrographis paniculata* and its *in vitro* antioxidant activity. *Natural Product Research*, 24(16).
- Venkatachalam, D. 2019. Review on immunomodulatory nutraceuticals. *Asian Journal of Pharmaceutical Research and Development*, 7(3).
- Venkatalakshmi, P., Vadivel, V., and Brindha, P. 2016. Role of phytochemicals as immunomodulatory agents: A review. *International Journal of Green Pharmacy*, 10, (1).
- Versita, R., and Setiani, A.D. 2023. Effectiveness anti-inflammatory of sungkai leaf (*Peronema canescens* Jack.) ethanol extract on male rabbit (*Oryctolagus cuniculus*). *Medical Sains : Jurnal Ilmiah Kefarmasian*, 8(3), 1135-1140.
- Wang, J., Ma, L., Zhou, F., Wang, F., Chen, L., and Xiao, J. 2022. Pathway and genomics of immunomodulator natural products. *Plants and Phytomolecules for Immunomodulation: Recent Trends and Advances*, (83-114).
- Windarsih, A., Suratno, Warmiko, H.D., Indrianingsih, A.W., Rohman, A., and Ulumuddin, Y.I. 2022. Untargeted metabolomics and proteomics approach using liquid chromatography-Orbitrap high resolution mass spectrometry to detect pork adulteration in *Pangasius hypophthalmus* meat. *Food Chemistry*, 386, 132856.
- Wiyono, T., Frediansyah, A., Sholikhah, E.N., and Pratiwi, W.R. 2022. UHPLC-ESI-MS analysis of Javanese *Tamarindus indica* leaves from various tropical zones and their beneficial properties in relation to antiobesity. *Journal of Applied Pharmaceutical Science*, 12(8), 137-147.
- Woods, N., Niwasabutra, K., Acevedo, R., Igoli, J., Altwaijry, N.A., Tusiimire, J., Gray, A.I., Watson, D.G., and Ferro, V.A. 2017. Natural vaccine adjuvants and immunopotentiators derived from plants, fungi, marine organisms, and insects. *Immunopotentiators in Modern Vaccines: Second Edition*, (211-229). Academic Press.
- Yani, A.P., and Pratama, A.Y. 2015. Efek samping penggunaan daun sungkai (*Peronema canescens* Jack) sebagai obat tradisional suku lembak pada mencit (*Mus musculus*). *Prosiding Semirata 2015 Bidang MIPA BKS-PTN Barat*.
- Yani, A.P., Yenita, Y., Ansyori, I., and Irwanto, R. 2013. Uji potensi daun muda sungkai (*Peronema canescens*) untuk Kesehatan (Imunitas) pada mencit (*Mus mucus*). *Proceeding Biology Education Conference: Biology, Science, Enviromental, and Learning*, 11(1), 245-250.



- Zhang, L., Virgous, C., and Si, H. 2019. Synergistic anti-inflammatory effects and mechanisms of combined phytochemicals. *Journal of Nutritional Biochemistry*, 69, 19-30.
- Zhang, Q.W., Lin, L.G., and Ye, W.C. 2018. Techniques for extraction and isolation of natural products: A comprehensive review. *Chinese Medicine (United Kingdom)*, 13(1), 1–26.
- Zhao, F., Chen, Y.P., Salmaki, Y., Drew, B.T., Wilson, T.C., Scheen, A.C., Celep, F., Bräuchler, C., Bendiksby, M., Wang, Q., Min, D.Z., Peng, H., Olmstead, R.G., Li, B., and Xiang, C.L. 2021. An updated tribal classification of Lamiaceae based on plastome phylogenomics. *BMC Biology*, 19(1), 2.
- Zhou, Y., Wang, S., Feng, W., Zhang, Z., and Li, H. 2021. Structural characterization and immunomodulatory activities of two polysaccharides from *Rehmanniae Radix Praeparata*. *International Journal of Biological Macromolecules*, 186., 385-395.