

References

- Agbangba, C. E., Sacla Aide, E., Honfo, H., & Glèlè Kakai, R. (2024). On the use of post-hoc tests in environmental and biological sciences: A critical review. *Heliyon*, 10(3), e25131. <https://doi.org/10.1016/j.heliyon.2024.e25131>
- Alp, D., & Bulantekin, Ö. (2021). The microbiological quality of various foods dried by applying different drying methods: a review. *European food research and technology = Zeitschrift für Lebensmittel-Untersuchung und -Forschung. A*, 247(6), 1333–1343. <https://doi.org/10.1007/s00217-021-03731-z>
- Altyar, A. E., Kensara, O. A., Sayed, A. A., Aleya, L., Almutairi, M. H., Zaazouee, M. S., Elshanbary, A. A., El-Demerdash, F. M., & Abdel-Daim, M. M. (2023). Acute aflatoxin B1-induced hepatic and cardiac oxidative damage in rats: Ameliorative effects of morin. *Heliyon*, 9(11), e21837. <https://doi.org/10.1016/j.heliyon.2023.e21837>
- Andrade, P. D., & Caldas, E. D. (2015). Aflatoxins in cereals: Worldwide occurrence and dietary risk assessment. *World Mycotoxin Journal*, 8(4), 415–432. <https://doi.org/10.3920/wmj2014.1847>
- Ashokkumar, K., Simal-Gandara, J., Murugan, M., Dhanya, M. K., & Pandian, A. (2022). Nutmeg (*Myristica fragrans* Houtt.) essential oil: A review on its composition, biological, and pharmacological activities. *Phytotherapy research : PTR*, 36(7), 2839–2851. <https://doi.org/10.1002/ptr.7491>
- Audrey, L. J., Herman, R. E. H. A. T. T. A., Riadh, U. M., & Asri, M. S. (2017). Productivity of Nutmeg (*Myristica* spp.) in Agroforestry System (Dusung) in Ambon Island. *Future Collaboration on Island Studies between Pattimura University and Kagoshima University*, 69.
- Ayanda, I. O., Ekhatior, U. I., & Bello, O. A. (2019). Determination of selected heavy metal and analysis of proximate composition in some fish species from Ogun River, Southwestern Nigeria. *Heliyon*, 5(10).

- Ayeni, J. A., Magami, I. M., Ahmed, J. M., & Muhammad, M. T. (2025). Effects of Drying Methods on Nutrient Contents of *Laptadenia hastata* (PERS.) Decne Leaves. *Sahel Journal of Life Sciences FUDMA*, 3(1), 397-406.
- BPOM. (2018). Salinan_perbpom_8_tahun_20.18 PERATURAN BADAN PENGAWAS OBAT DAN MAKANAN NOMOR 8 TAHUN 2018 TENTANG BATAS MAKSIMUM CEMARAN KIMIA DALAM PANGAN OLAHAN.
https://standarpangan.pom.go.id/dokumen/peraturan/2018/Salinan_PerBPOM_8_Tahun_2018_tentang_Cemaran_Kimia_Pangan_Join.pdf
- Calín-Sánchez, Á., Lipan, L., Cano-Lamadrid, M., Kharaghani, A., Masztalerz, K., Carbonell-Barrachina, Á. A., & Figiel, A. (2020). Comparison of Traditional and Novel Drying Techniques and Its Effect on Quality of Fruits, Vegetables and Aromatic Herbs. *Foods* (Basel, Switzerland), 9(9), 1261.
<https://doi.org/10.3390/foods9091261>
- Chanal, D., Yousfi Steiner, N., Petrone, R., Chamagne, D., & Péra, M.-C. (2022). Online diagnosis of PEM fuel cell by fuzzy c-means clustering. *Encyclopedia of Energy Storage*, 359–393.
<https://doi.org/10.1016/b978-0-12-819723-3.00099-8>
- Denissa, L. (2022). Pala dan Cengkeh Di antara Jejak Sejarah, Batik dan Identitas. *Humanitas (Jurnal Psikologi)*, 6(1), 63-80.
- Dhakal, A., Hashmi, M. F., & Sbar, E. (2023). Aflatoxin Toxicity. In *StatPearls*. StatPearls Publishing.
- Dharmaputra, O. S., Ambarwati, S., Retnowati, I., & Nurfadila, N. (2022). Postharvest quality improvement of nutmeg (*Myristica fragrans*). *BIOTROPIA*, 29(3), 185-192.
- European Food Safety Authority and World Health Organization. (2016). Review of the Threshold of Toxicological Concern (TTC) approach and development of new TTC decision tree. *EFSA Supporting Publications*, 13(3), 1006E.
- European Food Safety Authority (EFSA), Bellisai, G., Bernasconi, G., Brancato, A., Carrasco Cabrera, L., Ferreira, L., Giner, G., Greco, L., Jarrah, S., Kazocina, A., Leuschner, R., Magrans, J. O., Miron, I., Nave, S., Pedersen, R., Reich, H., Ruocco, S., Santos, M., Scarlato, A. P., Theobald, A., ...

- Verani, A. (2021). Focussed assessment of certain existing maximum residues levels of concern for abamectin. *EFSA journal*. European Food Safety Authority, 19(10), e06842. <https://doi.org/10.2903/j.efsa.2021.6842>
- FAOSTAT, (2023). Nutmeg market size: Mordor Intelligence. Nutmeg Market - Size, Share & Industry Analysis. <https://www.mordorintelligence.com/industry-reports/nutmeg-market>
- Food and Drug Administration. (2014). Water activity (aw) in foods. Inspection Technical Guides, Dept. of Health, Education, and Welfare Public Health Service.
- Francis, S., Kortei, N. K., Sackey, M., & Richard, S. A. (2024). Aflatoxin B1 induces infertility, fetal deformities, and potential therapies. *Open medicine (Warsaw, Poland)*, 19(1), 20240907. <https://doi.org/10.1515/med-2024-0907>
- Gagiu, V., Mateescu, E., Armeanu, I., Dobre, A. A., Smeu, I., Cucu, M. E., Oprea, O. A., Iorga, E., & Belc, N. (2018). Post-Harvest Contamination with Mycotoxins in the Context of the Geographic and Agroclimatic Conditions in Romania. *Toxins*, 10(12), 533. <https://doi.org/10.3390/toxins10120533>
- Garces-Vega, F. J., Ryser, E. T., & Marks, B. P. (2019). Relationships of water activity and moisture content to the thermal inactivation kinetics of Salmonella in low-moisture foods. *Journal of Food Protection*, 82(6), 963-970.
- Gizachew, D., Chang, C. H., Szonyi, B., De La Torre, S., & Ting, W. E. (2019). Aflatoxin B1 (AFB1) production by *Aspergillus flavus* and *Aspergillus parasiticus* on ground Nyjer seeds: The effect of water activity and temperature. *International journal of food microbiology*, 296, 8–13. <https://doi.org/10.1016/j.ijfoodmicro.2019.02.017>
- Georggiatt, O. C., Muiño, J. C., Montrull, H., Brizuela, N., Avalos, S., & Gómez, R. M. (2000). Estudio de la relación entre aflatoxina B 1 y cáncer de pulmón [Relationship between lung cancer and aflatoxin B1]. *Revista de la Facultad de Ciencias Medicas (Cordoba, Argentina)*, 57(1), 95–107.

- Gutiérrez-Silva, G., Vásquez-Lara, F., Heredia-Sandoval, N. G., & Islas-Rubio, A. R. (2023). Effect of High-Protein and High-Fiber Breadcrumbs on Oil Absorption and Quality Attributes in Chicken Nuggets. *Foods* (Basel, Switzerland), 12(24), 4463. <https://doi.org/10.3390/foods12244463>
- Gomez, E. J., Delgado, J. A., & Gonzalez, J. M. (2021). Influence of water availability and temperature on estimates of microbial extracellular enzyme activity. *PeerJ*, 9, e10994. <https://doi.org/10.7717/peerj.10994>
- Hamid, A. S., Tesfamariam, I. G., Zhang, Y., & Zhang, Z. G. (2013). Aflatoxin B1-induced hepatocellular carcinoma in developing countries: Geographical distribution, mechanism of action and prevention. *Oncology letters*, 5(4), 1087–1092. <https://doi.org/10.3892/ol.2013.1169>
- Harrison, D. M., Chang, W. C., & Lin, H. T. (2024). Dietary exposure and health risk assessment of polycyclic aromatic hydrocarbons in black tea consumed in Taiwan. *Toxics*, 12(2), 134.
- Hassane, A. M. A., El-Shanawany, A. A., Abo-Dahab, N. F., Abdel-Hadi, A. M., Abdul-Raouf, U. M., & Mwanza, M. (2017). Influence of different moisture contents and temperature on growth and production of aflatoxin B1 by a toxigenic *Aspergillus flavus* isolate in wheat flour. *Journal of ecology of health & environment*, 5(3), 77-83.
- He, X. Y., Tang, L., Wang, S. L., Cai, Q. S., Wang, J. S., & Hong, J. Y. (2006). Efficient activation of aflatoxin B1 by cytochrome P450 2A13, an enzyme predominantly expressed in human respiratory tract. *International journal of cancer*, 118(11), 2665–2671. <https://doi.org/10.1002/ijc.21665>
- Iizumi, T., & Ramankutty, N. (2015). How do weather and climate influence cropping area and intensity?. *Global food security*, 4, 46-50.
- Iqbal, J., Asghar, M. A., Ahmed, A., Khan, M. A., & Jamil, K. (2014). Aflatoxins contamination in Pakistani brown rice: a comparison of TLC, HPLC, LC-MS/MS and ELISA techniques. *Toxicology mechanisms and methods*, 24(8), 544–551. <https://doi.org/10.3109/15376516.2014.948247>
- Ismail, B. P. (2024). Ash content determination. In *Nielsen's Food Analysis Laboratory Manual* (pp. 129-131). Cham: Springer International Publishing.

- Jaiyeoba, K. F., Ogunlade, C. A., Kwanaki, O. S., & Fadele, O. K. (2020). Moisture dependent physical properties of nutmeg (*Myristica fragrans*) relevant for design of processing machines. *Current Journal of Applied Science and Technology*, 39(12), 74-85.
- Jallow, A., Xie, H., Tang, X., Qi, Z., & Li, P. (2021). Worldwide aflatoxin contamination of agricultural products and foods: From occurrence to control. *Comprehensive reviews in food science and food safety*, 20(3), 2332-2381.
- Jannah, A., Anggarawati, S., Sunardi, S., & Turuy, I. (2022, January). Performance of nutmeg (*Myristica fragrans*) post harvest and marketing in East Halmahera Regency. In *International Conference on Tropical Agrifood, Feed and Fuel (ICTAFF 2021)* (pp. 74-78). Atlantis Press.
- Joseph, B. B., & George, S. (2020). The road to radiation safety and ALARA: A review. *Int. J. Maxillofac Imaging*, 6(4), 89-92.
- Joseph, G. S., Mandey, L. C., & Djarkasi, G. S. (2023). The Impact of Postharvest Handling on the Nutmeg Seed (*Myristica fragrans* Houtt) Quality. *Jurnal Agroekoteknologi Terapan*, 4(2), 421-427.
- Jubeen, F., Zahra, N., Nazli, Z. I. H., Saleemi, M. K., Aslam, F., Naz, I., ... & Iqbal, M. (2022). Risk assessment of hepatocellular carcinoma with aflatoxin B1 exposure in edible oils. *Toxins*, 14(8), 547.
- Kakailatu, J. S. H., Masrikat, J. A., & Tubalawony, S. (2024). ENSO (EL NIÑO-SOUTHERN OSCILLATION) INFLUENCE ON WIND AND WAVE VARIABILITY IN MALUKU WATERS. *Jurnal Perikanan Unram*, 14(2), 887-897.
- Kementan. (2023). P A L A - satu data pertanian. OUTLOOK KOMODITAS PERKEBUNAN PALA. https://satudata.pertanian.go.id/assets/docs/publikasi/Outlook_Pala_2022.pdf
- Khazaeli, P., Mehrabani, M., Heidari, M. R., Asadikaram, G., & Lari Najafi, M. (2017). Prevalence of Aflatoxin Contamination in Herbs and Spices in Different Regions of Iran. *Iranian journal of public health*, 46(11), 1540–1545.
- Kipkoech, G., Jepkorir, M., Kamau, S., Wanyoko, A., Kibunja, S., Amosi Jeremiah, R., Masese, J., Ntui-Njock, V., Mutai, C., & Mwitari, P. (2025). Immunomodulatory effects of aflatoxin B1 (AFB1)

- and the use of natural products to ameliorate its immunotoxic effects: A review. *Open research Africa*, 6, 22. <https://doi.org/10.12688/openresafrica.14406.2>
- Kumar, A., Pathak, H., Bhadauria, S., & Sudan, J. (2021). Aflatoxin contamination in food crops: causes, detection, and management: a review. *Food Production, Processing and Nutrition*, 3, 1-9.
- Kwak S. (2023). Are Only p-Values Less Than 0.05 Significant? A p-Value Greater Than 0.05 Is Also Significant!. *Journal of lipid and atherosclerosis*, 12(2), 89–95. <https://doi.org/10.12997/jla.2023.12.2.89>
- Lahouar, A., Marin, S., Crespo-Sempere, A., Saïd, S., & Sanchis, V. (2016). Effects of temperature, water activity and incubation time on fungal growth and aflatoxin B1 production by toxinogenic *Aspergillus flavus* isolates on sorghum seeds. *Revista Argentina de microbiologia*, 48(1), 78-85.
- Liu, K. (2019). Effects of sample size, dry ashing temperature and duration on determination of ash content in algae and other biomass. *Algal Research*, 40, 101486.
- Liu, Y., & Wu, F. (2010). Global burden of aflatoxin-induced hepatocellular carcinoma: a risk assessment. *Environmental health perspectives*, 118(6), 818–824. <https://doi.org/10.1289/ehp.0901388>
- Magnoli, A. P., Pereyra, M. L. G., Monge, M. P., Cavaglieri, L. R., & Chiacchiera, S. M. (2018). Validation of a liquid chromatography/tandem mass spectrometry method for the detection of aflatoxin B1 residues in broiler liver. *Revista Argentina de microbiologia*, 50(2), 157-164.
- Marchese, S., Polo, A., Ariano, A., Velotto, S., Costantini, S., & Severino, L. (2018). Aflatoxin B1 and M1: Biological Properties and Their Involvement in Cancer Development. *Toxins*, 10(6), 214. <https://doi.org/10.3390/toxins10060214>
- Mareta, L., Agiel, H. M., & Hadiningrum, T. (2024). Historical and projected rainfall climatology in Sumatra based on the CMIP6. In *IOP Conference Series: Earth and Environmental Science* (Vol. 1359, No. 1, p. 012089). IOP Publishing.

- Mihai, R. A., Espinoza-Caiza, I. A., Melo-Heras, E. J., Cubi-Insuaste, N. S., Pinto-Valdiviezo, E. A., & Catana, R. D. (2023). Does the mineral composition of volcanic ashes have a beneficial or detrimental impact on the soils and cultivated crops of Ecuador?. *Toxics*, 11(10), 846.
- Mohsenzadeh, M. S., Hedayati, N., Riahi-Zanjani, B., & Karimi, G. (2016). Immunosuppression following dietary aflatoxin B1 exposure: a review of the existing evidence. *Toxin Reviews*, 35(3-4), 121-127.
- Moussa, L., Hassan, H. F., Savvaidis, I. N., & Karam, L. (2024). Impact of source, packaging and presence of food safety management system on heavy metals levels in spices and herbs. *PloS one*, 19(8), e0307884. <https://doi.org/10.1371/journal.pone.0307884>
- Moore, S. (2020). Why is moisture content analysis of food important. *News Medical Life Science*.
- Mutuli, G. P., Mbugue, D. O., & Gitau, A. N. (2022). Effect of humidity on aflatoxin contamination for selected African leafy vegetables. *Journal of food science and technology*, 59(7), 2724–2730. <https://doi.org/10.1007/s13197-021-05293-0>
- National Center for Biotechnology Information (2025). PubChem Taxonomy Summary for Taxonomy 51089, *Myristica fragrans* (nutmeg). Retrieved March 1, 2025 from <https://pubchem.ncbi.nlm.nih.gov/taxonomy/Myristica-fragrans>.
- National Center for Biotechnology Information (2025). PubChem Compound Summary for CID 186907, Aflatoxin B1. Retrieved March 3, 2025 from <https://pubchem.ncbi.nlm.nih.gov/compound/Aflatoxin-B1>.
- Naz, F., Verpoort, F., Iqbal, S. Z., Naheed, N., & Asi, M. R. (2022). Seasonal Variation of Aflatoxin Levels in Selected Spices Available in Retail Markets: Estimation of Exposure and Risk Assessment. *Toxins*, 14(9), 597. <https://doi.org/10.3390/toxins14090597>
- Ouakhsase, A., Chahid, A., Choubbane, H., Aitmazirt, A., & Addi, E. A. (2019). Optimization and validation of a liquid chromatography/tandem mass spectrometry (LC-MS/MS) method for the

- determination of aflatoxins in maize. *Heliyon*, 5(5), e01565.
<https://doi.org/10.1016/j.heliyon.2019.e01565>
- Peraturan Kepala Badan Pengawas Obat Dan Makanan. (2016).
https://standarpangan.pom.go.id/dokumen/peraturan/2016/PerKa_BPOM_No_21_Tahun_2016_tentang_Kategori_Pangan.pdf
- Pereira, F. B., Renagi, O., Panakal, J. J., & Anduwan, G. (2019). A study of climate variability in Papua New Guinea. *Journal of Geoscience and Environment Protection*, 7(5), 45-52.
- Purba, H. J., Yusufi, E. S., & Hestina, J. (2021). Performane and competitiveness of indoznesian nutmeg in the export market. In *E3S Web of Conferences* (Vol. 232, p. 02018). EDP Sciences.
- Quintanilla-Villanueva, G. E., Luna-Moreno, D., Núñez-Salas, R. E., Rodríguez-Delgado, M. M., & Villarreal-Chiu, J. F. (2024). Inactivation of *Aspergillus* Species and Degradation of Aflatoxins in Water Using Photocatalysis and Titanium Dioxide. *Processes*, 12(12), 2673.
- Rehatta, H., Leatemala, J. A., & Laimeheriwa, S. (2021). The impact of climate variables on nutmeg (*Mirystica fragrans* HOUTT) production in Saparua Island, Central Maluku Regency. In *IOP Conference Series: Earth and Environmental Science* (Vol. 797, No. 1, p. 012025). IOP Publishing.
- Ruth, S. M., Silvis, I. C., Alewijn, M., Liu, N., Jansen, M., & Luning, P. A. (2019). No more nutmegging with nutmeg: Analytical fingerprints for distinction of quality from low-grade nutmeg products. *Food Control*, 98, 439-448.
- Sangadji, S. S., Kariadi, M. T., & Rachman, S. (2020). The effectivity of nutmeg processing and packaging reformulation activity in increasing the public welfare in jaya village of tidore islands. *Agro Bali: Agricultural Journal*, 3(2), 118-126.
- Sembiring, B. (2020). Reducing aflatoxin contamination of nutmeg using drying methods. In *IOP Conference Series: Earth and Environmental Science* (Vol. 418, No. 1, p. 012030). IOP Publishing.

- Shabeer, S., Asad, S., Jamal, A., & Ali, A. (2022). Aflatoxin contamination, its impact and management strategies: an updated review. *Toxins*, 14(5), 307.
- Soleimany, F., Jinap, S., & Abas, F. J. F. C. (2012). Determination of mycotoxins in cereals by liquid chromatography tandem mass spectrometry. *Food chemistry*, 130(4), 1055-1060.
- Sulaeman, Y., Maftuáh, E., Noor, M., Hairani, A., Nurzakiah, S., Mukhlis, M., ... & Ningsih, R. D. (2024). Coastal acid-sulfate soils of Kalimantan, Indonesia, for food security: Characteristics, management, and future directions. *Resources*, 13(3), 36.
- Susanto, J., Zheng, X., Liu, Y., & Wang, C. (2020). The impacts of climate variables and climate-related extreme events on island country's tourism: Evidence from Indonesia. *Journal of Cleaner Production*, 276, 124204.
- Tanveer, H., Glesener, H., Su, B., Bolsinger, B., Krajmalnik-Brown, R., & Voth-Gaeddert, L. E. (2025). Evaluating Methods for Aflatoxin B1 Monitoring in Selected Food Crops Within Decentralized Agricultural Systems. *Toxins*, 17(1), 37.
- Teo, P. S., Van Dam, R. M., Whitton, C., Tan, L. W. L., & Forde, C. G. (2021). Consumption of foods with higher energy intake rates is associated with greater energy intake, adiposity, and cardiovascular risk factors in adults. *The Journal of Nutrition*, 151(2), 370-378.
- Triwinarto, A., Utami, N., & Hermina, H. (2016). Gambaran median tinggi badan dan berat badan menurut kelompok umur pada penduduk Indonesia yang sehat berdasarkan hasil riskesdas 2013. *Penelitian Gizi Dan Makanan (The Journal of Nutrition and Food Research)*, 39(2), 137-144.
- Umar, A., Bhatti, H. S., & Honey, S. F. (2023). A call for aflatoxin control in Asia. *CABI Agriculture and Bioscience*, 4(1), 27.
- Vakili, F., Roosta, Z., Safari, R., Raeisi, M., Hossain, M. S., Guerreiro, I., Akbarzadeh, A., & Hoseinifar, S. H. (2023). Effects of dietary nutmeg (*Myristica fragrans*) seed meals on growth, non-specific immune indices, antioxidant status, gene expression analysis, and cold stress tolerance in

- zebrafish (Danio rerio). *Frontiers in nutrition*, 9, 1038748.
<https://doi.org/10.3389/fnut.2022.1038748>
- Van der Hoeven-Hangoor, E., Rademaker, C. J., Paton, N. D., Verstegen, M. W. A., & Hendriks, W. H. (2014). Evaluation of free water and water activity measurements as functional alternatives to total moisture content in broiler excreta and litter samples. *Poultry Science*, 93(7), 1782-1792.
- Wagacha, J. M., & Muthomi, J. W. (2008). Mycotoxin problem in Africa: Current status, implications to food safety and health and possible management strategies. *International Journal of Food Microbiology*, 124(1), 1–12. <https://doi.org/10.1016/j.ijfoodmicro.2008.01.008>
- Wahidin, D., & Purnhagen, K. (2018). Improving the level of food safety and market access in developing countries. *Heliyon*, 4(7). <https://doi.org/10.1016/j.heliyon.2018.e00683>
- Wahyuni, S., Susilowati, M., Bakri, A., & Bermawie, N. (2022). Fruit and seed variation of wild nutmeg (*Myristica schefferi* Warb.) in South Aceh, Indonesia. In *IOP Conference Series: Earth and Environmental Science* (Vol. 974, No. 1, p. 012067). IOP Publishing.
- Wijaya, C. H., & Astuti, J. (2012). Utilization of ripe nutmeg husk (*Myristica* sp.) as the main ingredient on spice blend powder.
- Word, C. S., McLaughlin, D. L., Strahm, B. D., Stewart, R. D., Varner, J. M., Wurster, F. C., ... & Link, N. T. (2022). Peatland drainage alters soil structure and water retention properties: Implications for ecosystem function and management. *Hydrological Processes*, 36(3), e14533.
- Worldometer. (2024). Indonesia population (live). <https://www.worldometers.info/world-population/indonesia-population/>
- Yang, R., Guan, J., Sun, S., Sablani, S. S., & Tang, J. (2020). Understanding water activity change in oil with temperature. *Current research in food science*, 3, 158–165.
<https://doi.org/10.1016/j.crfs.2020.04.001>