

DAFTAR PUSTAKA

- Adams, B. K., Cai, J., Armstrong, J., Herold, M., Lu, Y. J., Sun, A., Snyder, J. P., Liotta, D. C., Jones, D. P., & Shoji, M. (2005). EF24, a novel synthetic curcumin analog, induces apoptosis in cancer cells via a redox-dependent mechanism: *Anti-Cancer Drugs*, 16(3), 263–275.
- Aggarwal, B. B., Surh, Y.-J., & Shishodia, S. (Eds.). (2007). *The Molecular Targets and Therapeutic Uses of Curcumin in Health and Disease* (Vol. 595). Springer US.
- Anand, P., Sundaram, C., Jhurani, S., Kunnumakkara, A. B., & Aggarwal, B. B. (2008). Curcumin and Cancer: An “Old-age” Disease With an “Age-old” Solution. *Cancer Letters*, 267(1), 133–164.
- Anisuzzaman, A. S., Haque, A., Rahman, M. A., Wang, D., Fuchs, J. R., Hurwitz, S., Liu, Y., Sica, G., Khuri, F. R., & Shin, D. M. (2015). Preclinical In Vitro, In Vivo, and Pharmacokinetic Evaluations of FLLL12 for the Prevention and Treatment of Head and Neck Cancers. *Cancer Prevention Research*, 12.
- Bangphumi, K. (2015). Pharmacokinetics of Curcumin Diethyl Disuccinate, a Prodrug of Curcumin, in Wistar Rats. *Eur J Drug Metab Pharmacokinet*, 10.
- Bansal, M., Singh, N., Pal, S., Dev, I., & Ansari, K. M. (2018). Chemopreventive Role of Dietary Phytochemicals in Colorectal Cancer. In *Advances in Molecular Toxicology* (Vol. 12, pp. 69–121). Elsevier.
- Cen, L., Hutzen, B., Ball, S., DeAngelis, S., Chen, C.-L., Fuchs, J. R., Li, C., Li, P.-K., & Lin, J. (2009). New structural analogues of curcumin exhibit potent growth suppressive activity in human colorectal carcinoma cells. *BMC Cancer*, 9(1), 99.
- Chen, M., Zhou, B., Zhong, P., Rajamanickam, V., Dai, X., Karvannan, K., Zhou, H., Zhang, X., & Liang, G. (2016). Increased Intracellular Reactive Oxygen Species Mediates the Anti-Cancer Effects of WZ35 via Activating Mitochondrial Apoptosis Pathway in Prostate Cancer Cells: Targeting ROS Induces Cancer Cell Death. *The Prostate*, 77(5), 489–504.
- Cheng, Y., Yang, Y., Wu, Y., Wang, W., Xiao, L., Zhang, Y., Tang, J., Huang, Y.-D., Zhang, S., & Xiang, Q. (2020). The Curcumin Derivative, H10, Suppresses Hormone-Dependent Prostate Cancer by Inhibiting 17β-

Hydroxysteroid Dehydrogenase Type 3. *Frontiers in Pharmacology*, 11, 637.

Chikara, S., Nagaprashantha, L. D., Singhal, J., Horne, D., Awasthi, S., & Singhal, S. S. (2018). Oxidative stress and dietary phytochemicals: Role in cancer chemoprevention and treatment. *Cancer Letters*, 413, 122–134. <https://doi.org/10.1016/j.canlet.2017.11.002>

Chisholm-Burns, M. A., Schwinghammer, T. L., Wells, B. G., Malone, P. M., Kolesar, J. M., & DiPiro, J. T. (2016). *Pharmacotherapy: Principles & Practice* (4th ed). McGraw Hill Education.

Cho, W. C. S. (Ed.). (2012). *Materia Medica for Various Cancers* (Vol. 2). Springer Netherlands.

Ciolino, H. P., Daschner, P. J., Wang, T. T. Y., & Yeh, G. C. (1998). Effect of Curcumin on the Aryl Hydrocarbon Receptor and Cytochrome P450 1A1 in MCF-7 Human Breast Carcinoma Cells. *Biochemical Pharmacology*, 56(2), 197–206. [https://doi.org/10.1016/S0006-2952\(98\)00143-9](https://doi.org/10.1016/S0006-2952(98)00143-9)

Dalvie, D., Kang, P., Loi, C.-M., Goulet, L., & Nair, S. (2010). Chapter 7. Influence of Heteroaromatic Rings on ADME Properties of Drugs. In D. A. Smith (Ed.), *Drug Discovery* (pp. 328–369). Royal Society of Chemistry. <https://doi.org/10.1039/9781849731102-00328>

Dei Cas, M., & Ghidoni, R. (2019). Dietary Curcumin: Correlation between Bioavailability and Health Potential. *Nutrients*, 11(9), 2147. <https://doi.org/10.3390/nu11092147>

Dinkova-Kostova, A. T., & Talalay, P. (1999). Relation of structure of curcumin analogs to their potencies as inducers of Phase 2 detoxification enzymes. *Carcinogenesis*, 20(5), 911–914. <https://doi.org/10.1093/carcin/20.5.911>

Duvoix, A., Blasius, R., Delhalle, S., Schnekenburger, M., Morceau, F., Henry, E., Dicato, M., & Diederich, M. (2005). Chemopreventive and therapeutic effects of curcumin. *Cancer Letters*, 223(2), 181–190.

Friedman, L., Lin, L., Ball, S., Bekaii-Saab, T., Fuchs, J., Li, P.-K., Li, C., & Lin, J. (2009). Curcumin analogues exhibit enhanced growth suppressive activity in human pancreatic cancer cells. *Anti-Cancer Drugs*, 20(6), 444–449.

Gibaldi, M. (1977). *Biopharmaceutics and Clinical Pharmacokinetics* (2nd ed.). Lea and Febiger.

- Gupta, N. K., & Dixit, V. K. (2011). Bioavailability Enhancement of Curcumin by Complexation with Phosphatidyl Choline. *Journal of Pharmaceutical Sciences*, 100(5), 1987–1995.
- Haque, A., Rahman, M. A., Fuchs, J. R., Chen, Z. G., Khuri, F. R., Shin, D. M., & Amin, A. R. M. R. (2015). FLLL12 induces apoptosis in lung cancer cells through a p53/p73-independent but death receptor 5-dependent pathway. *Cancer Letters*, 363(2), 166–175.
- Hatcher, H., Planalp, R., Cho, J., Torti, F. M., & Torti, S. V. (2008). Curcumin: From Ancient Medicine to Current Clinical Trials. *Cellular and Molecular Life Sciences*, 65(11), 1631–1652.
- He, G., Feng, C., Vinothkumar, R., Chen, W., Dai, X., Chen, X., Ye, Q., Qiu, C., Zhou, H., Wang, Y., Liang, G., Xie, Y., & Wu, W. (2016). Curcumin analog EF24 induces apoptosis via ROS-dependent mitochondrial dysfunction in human colorectal cancer cells. *Cancer Chemotherapy and Pharmacology*, 78(6), 1151–1161.
- Horie, S. (2012). Chemoprevention of Prostate Cancer: Soy Isoflavones and Curcumin. *Korean Journal of Urology*, 53(10), 665.
- Judah, F. (1995). Clinical Applications of Research on Angiogenesis. *The New England Journal of Medicine*, 333(26), 7.
- Kasinski, A. L., Du, Y., Thomas, S. L., Zhao, J., Sun, S.-Y., Khuri, F. R., Wang, C.-Y., Shoji, M., Sun, A., Snyder, J. P., Liotta, D., & Fu, H. (2008). Inhibition of I κ B Kinase-Nuclear Factor- κ B Signaling Pathway by 3,5-Bis(2-fluorobenzylidene)piperidin-4-one (EF24), a Novel Monoketone Analog of Curcumin. *Molecular Pharmacology*, 74(3), 654–661.
- Kemenkes RI. (2015). *Infodatin: Situasi Penyakit Kanker*. Kementerian Kesehatan RI. <https://www.kemkes.go.id/resources/download/pusdatin/infodatin/infodatin-kanker.pdf>
- Kemenkes RI. (2020, January). *Jenis Kanker Ini Rentan Menyerang Manusia*. Kementerian Kesehatan Republik Indonesia. <https://www.kemkes.go.id/article/view/20011400002/jenis-kanker-ini-rentan-meny Serang-manusia.html>
- Kotha, R. R., & Luthria, D. L. (2019). Curcumin: Biological, Pharmaceutical, Nutraceutical, and Analytical Aspects. *Molecules*, 24(16), 2930.

- Lestari, M. L. A. D., & Indrayanto, G. (2014). Curcumin. In *Profiles of Drug Substances, Excipients and Related Methodology* (Vol. 39, pp. 113–204). Elsevier.
- Liang, G., Shao, L., Wang, Y., Zhao, C., Chu, Y., Xiao, J., Zhao, Y., Li, X., & Yang, S. (2009). Exploration and synthesis of curcumin analogues with improved structural stability both in vitro and in vivo as cytotoxic agents. *Bioorganic & Medicinal Chemistry*, 17(6), 2623–2631.
- Liang, Y., Yin, D., Hou, L., Zheng, T., Wang, J., Meng, X., Lu, Z., Song, X., Pan, S., Jiang, H., & Liu, L. (2011). Diphenyl Difluoroketone: A Potent Chemotherapy Candidate for Human Hepatocellular Carcinoma. *PLoS ONE*, 6(8), e23908.
- Lin, L., Hutzen, B., Ball, S., Foust, E., Sobo, M., Deangelis, S., Pandit, B., Friedman, L., Li, C., Li, P.-K., Fuchs, J., & Lin, J. (2009). New curcumin analogues exhibit enhanced growth-suppressive activity and inhibit AKT and signal transducer and activator of transcription 3 phosphorylation in breast and prostate cancer cells. *Cancer Science*, 100(9), 1719–1727.
- Liu, H., Liang, Y., Wang, L., Tian, L., Song, R., Han, T., Pan, S., & Liu, L. (2012). In Vivo and In Vitro Suppression of Hepatocellular Carcinoma by EF24, a Curcumin Analog. *PLoS ONE*, 7(10), e48075.
- López-Lázaro, M. (2008). Anticancer and Carcinogenic Properties of Curcumin: Considerations For Its Clinical Development as a Cancer Chemopreventive and Chemotherapeutic Agent. *Molecular Nutrition & Food Research*.
- Mahran, R. I., Hagra, M. M., Sun, D., & Brenner, D. E. (2017). Bringing Curcumin to the Clinic in Cancer Prevention: A Review of Strategies to Enhance Bioavailability and Efficacy. *The AAPS Journal*, 19(1), 54–81.
- Maiti, K., Mukherjee, K., Gantait, A., Saha, B. P., & Mukherjee, P. K. (2007). Curcumin–phospholipid complex: Preparation, therapeutic evaluation and pharmacokinetic study in rats. *International Journal of Pharmaceutics*, 9.
- Marczylo, T. H., Verschoyle, R. D., Cooke, D. N., Morazzoni, P., Steward, W. P., & Gescher, A. J. (2007). Comparison of systemic availability of curcumin with that of curcumin formulated with phosphatidylcholine. *Cancer Chemotherapy and Pharmacology*, 60(2), 171–177.
- Muthenna, P., Suryanarayana, P., Gunda, S. K., Petrash, J. M., & Reddy, G. B. (2009). Inhibition of aldose reductase by dietary antioxidant curcumin:

Mechanism of inhibition, specificity and significance. *FEBS Letters*, 583(22), 3637–3642.

Nagaraju, G. P., Zhu, S., Ko, J. E., Ashritha, N., Kandimalla, R., Snyder, J. P., Shoji, M., & El-Rayes, B. F. (2015). Antiangiogenic effects of a novel synthetic curcumin analogue in pancreatic cancer. *Cancer Letters*, 357(2), 557–565.

Nagaraju, G. P., Zhu, S., Wen, J., Farris, A. B., Adsay, V. N., Diaz, R., Snyder, J. P., Mamoru, S., & El-Rayes, B. F. (2013). Novel synthetic curcumin analogues EF31 and UBS109 are potent DNA hypomethylating agents in pancreatic cancer. *Cancer Letters*, 341(2), 195–203.

Noureddin, S. A., El-Shishtawy, R. M., & Al-Footy, K. O. (2019). Curcumin Analogues and Their Hybrid Molecules as Multifunctional Drugs. *European Journal of Medicinal Chemistry*, 182, 111631.

Nurrochmad, A. (2004). Review: The New Paradigm of Curcumin and Its Anticancer Activity. *Biofarmasi Journal of Natural Product Biochemistry*, 2(2), 75–80.

Olivera, A., Moore, T. W., Hu, F., Brown, A. P., Sun, A., Liotta, D. C., Snyder, J. P., Yoon, Y., Shim, H., Marcus, A. I., Miller, A. H., & Pace, T. W. W. (2012). Inhibition of the NF- κ B signaling pathway by the curcumin analog, 3,5-Bis(2-pyridinylmethylidene)-4-piperidone (EF31): Anti-inflammatory and anti-cancer properties. *International Immunopharmacology*, 12(2), 368–377.

Padhye, S., Banerjee, S., Chavan, D., Pandye, S., Swamy, K. V., Ali, S., Li, J., Dou, Q. P., & Sarkar, F. H. (2009). *Fluorocurcumins as Cyclooxygenase-2 Inhibitor: Molecular Docking, Pharmacokinetics and Tissue Distribution in Mice*. 8.

Rajitha, B., Belalcazar, A., Nagaraju, G. P., Shaib, W. L., Snyder, J. P., Shoji, M., Pattnaik, S., Alam, A., & El-Rayes, B. F. (2016). Inhibition of NF- κ B translocation by curcumin analogs induces G0/G1 arrest and downregulates thymidylate synthase in colorectal cancer. *Cancer Letters*, 373(2), 227–233.

Rajitha, B., Nagaraju, G. P., Shaib, W. L., Alese, O. B., Snyder, J. P., Shoji, M., Pattnaik, S., Alam, A., & El-Rayes, B. F. (2017). Novel synthetic curcumin analogs as potent antiangiogenic agents in colorectal cancer: ANTIANGIOGENIC EFFECTS OF CURCUMIN AND ITS ANALOGS. *Molecular Carcinogenesis*, 56(1), 288–299.

- Reid, J. M., Buhrow, S. A., Gilbert, J. A., Jia, L., Shoji, M., Snyder, J. P., & Ames, M. M. (2014). Mouse pharmacokinetics and metabolism of the curcumin analog, 4-piperidinone,3,5-bis[(2-fluorophenyl)methylene]-acetate(3E,5E) (EF-24; NSC 716993). *Cancer Chemother Pharmacol*, 10.
- Rodrigues, F. C., Anil Kumar, N. V., & Thakur, G. (2019). Developments in The Anticancer Activity of Structurally Modified Curcumin: An Up-To-Date Review. *European Journal of Medicinal Chemistry*, 177, 76–104.
- Ruddon, R. W. (2007). *Cancer Biology* (4th ed). Oxford University Press.
- Satoh, H., Moriguchi, T., Taguchi, K., Takai, J., Maher, J. M., Suzuki, T., Winnard, P. T., Raman, V., Ebina, M., Nukiwa, T., & Yamamoto, M. (2010). Nrf2-deficiency creates a responsive microenvironment for metastasis to the lung. *Carcinogenesis*, 31(10), 1833–1843. <https://doi.org/10.1093/carcin/bgq105>
- Shargel, L., Wu-Pong, S., & Yu, A. (2005). *Applied Biopharmaceutics and Pharmacokinetics* (5th ed.). McGraw-Hill Medical Publishing.
- Sharma, R. A., Gescher, A. J., & Steward, W. P. (2005). Curcumin: The Story So Far. *European Journal of Cancer*, 41(13), 1955–1968.
- Shen, H., Shen, J., Pan, H., Xu, L., Sheng, H., Liu, B., & Yao, M. (2021). Curcumin analog B14 has high bioavailability and enhances the effect of anti-breast cancer cells in vitro and in vivo. *Cancer Science*, 112(2), 815–827.
- Siviero, A., Gallo, E., Maggini, V., Gori, L., Mugelli, A., Firenzuoli, F., & Vannacci, A. (2015). Curcumin, A Golden Spice With a Low Bioavailability. *Journal of Herbal Medicine*, 5(2), 57–70.
- Subramaniam, D., May, R., Sureban, S. M., Lee, K. B., George, R., Kuppusamy, P., Ramanujam, R. P., Hideg, K., Dieckgraefe, B. K., Houchen, C. W., & Anant, S. (2008). Diphenyl Difluoroketone: A Curcumin Derivative with Potent *In vivo* Anticancer Activity. *Cancer Research*, 68(6), 1962–1969.
- Surh, Y.-J., & Chun, K.-S. (2007). Cancer Chemopreventive Effects of Curcumin. In B. B. Aggarwal, Y.-J. Surh, & S. Shishodia (Eds.), *The Molecular Targets and Therapeutic Uses of Curcumin in Health and Disease* (Vol. 595, pp. 149–172). Springer US.

- Teiten, M.-H., Gaascht, F., Eifes, S., Dicato, M., & Diederich, M. (2010). Chemopreventive Potential of Curcumin in Prostate Cancer. *Genes & Nutrition*, 5(1), 61–74.
- Tomeh, M., Hadianamrei, R., & Zhao, X. (2019). A Review of Curcumin and Its Derivatives as Anticancer Agents. *International Journal of Molecular Sciences*, 20(5), 1033.
- Toutain, P. L., & Bousquet-Melou, A. (2004). Bioavailability and its assessment. *Journal of Veterinary Pharmacology and Therapeutics*, 27(6), 455–466.
- Ullah, M. F., Bhat, S. H., Husain, E., Abu-Duhier, F., Hadi, S. M., Sarkar, F. H., & Ahmad, A. (2014). Cancer chemopreventive pharmacology of phytochemicals derived from plants of dietary and non-dietary origin: Implication for alternative and complementary approaches. *Phytochem Rev*, 13, 811–833.
- Vijaya Saradhi, U. V. R., Ling, Y., Wang, J., Chiu, M., Schwartz, E. B., Fuchs, J. R., Chan, K. K., & Liu, Z. (2010). A liquid chromatography–tandem mass spectrometric method for quantification of curcuminoids in cell medium and mouse plasma. *Journal of Chromatography B*, 878(30), 3045–3051.
- Wang, G., Li, Y., Sun, W., Wang, Z., Chen, D., Shu, S., Jin, J., Mahoo, J., Pan, L., Hu, G., Liu, Z., & Zhang, X. (2019). *Cytochrome P450-Mediated Metabolic Characterization of a Mono-Carbonyl Curcumin Analog WZ35*. 11.
- Wang, L., Wang, C., Tao, Z., Zhao, L., Zhu, Z., Wu, W., He, Y., Chen, H., Zheng, B., Huang, X., Yu, Y., Yang, L., Liang, G., Cui, R., & Chen, T. (2019). Curcumin derivative WZ35 inhibits tumor cell growth via ROS-YAP-JNK signaling pathway in breast cancer. *Journal of Experimental & Clinical Cancer Research*, 38(1), 460.
- Wang, R., Chen, C., Zhang, X., Zhang, C., Zhong, Q., Chen, G., Zhang, Q., Zheng, S., Wang, G., & Chen, Q.-H. (2015). Structure–Activity Relationship and Pharmacokinetic Studies of 1,5-Diheteroaryl-penta-1,4-dien-3-ones: A Class of Promising Curcumin-Based Anticancer Agents. *Journal of Medicinal Chemistry*, 58(11), 4713–4726.
- Wang, Y.-J., Pan, M.-H., Cheng, A.-L., Lin, L.-I., Ho, Y.-S., Hsieh, C.-Y., & Lin, J.-K. (1997). Stability of curcumin in buffer solutions and characterization of its degradation products. *Journal of Pharmaceutical and Biomedical Analysis*, 15(12), 1867–1876. [https://doi.org/10.1016/S0731-7085\(96\)02024-9](https://doi.org/10.1016/S0731-7085(96)02024-9)

- WHO. (2020a). *Cancer Today*. International Agency for Research on Cancer. World Health Organization. <http://gco.iarc.fr/>
- WHO. (2020b). *Global: Cancer Profile 2020*. https://www.paho.org/hq/index.php?option=com_docman&view=download&category_slug=4-cancer-country-profiles-2020&alias=51561-global-cancer-profile-2020&Itemid=270&lang=fr
- WHO. (2020c). *Indonesia: Cancer Country Profile 2020*. https://www.who.int/cancer/country-profiles/IDN_2020.pdf?ua=1
- Xiao, L., Bei, Y., Li, J., Chen, M., Zhang, Y., & Xiang, Q. (2021). Preclinical Pharmacokinetics, Tissue Distribution and Primary Safety Evaluation of a Novel Curcumin Analogue H10 Suspension, a Potential 17 β Hydroxysteroid Dehydrogenase Type 3 Inhibitor. *Chem. Pharm. Bull.*, 69(1), 7.
- Xin Tan, Sidell, N., Mancini, A., Huang, R.-P., Shenming Wang, Horowitz, I. R., Liotta, D. C., Taylor, R. N., & Wieser, F. (2010). Multiple Anticancer Activities of EF24, a Novel Curcumin Analog, on Human Ovarian Carcinoma Cells. *Reproductive Sciences*, 17(10), 931–940.
- Yang, K.-Y., Lin, L.-C., Tseng, T.-Y., Wang, S.-C., & Tsai, T.-H. (2007). Oral bioavailability of curcumin in rat and the herbal analysis from *Curcuma longa* by LC–MS/MS. *J. Chromatogr. B*, 7.
- Zhang, J., Feng, Z., Wang, C., Zhou, H., Liu, W., Kanchana, K., Dai, X., Zou, P., Gu, J., Cai, L., & Liang, G. (2017). Curcumin derivative WZ35 efficiently suppresses colon cancer progression through inducing ROS production and ER stress-dependent apoptosis. *American Journal of Cancer Research*, 7(2), 275–288.
- Zhang, X. (2017). Asymmetric 1,5-diaryl-penta-1,4-dien-3-ones: Antiproliferative activity in prostate epithelial cell models and pharmacokinetic studies. *European Journal of Medicinal Chemistry*, 17.
- Zhang, X., Chen, M., Zou, P., Kanchana, K., Weng, Q., Chen, W., Zhong, P., Ji, J., Zhou, H., He, L., & Liang, G. (2015). Curcumin analog WZ35 induced cell death via ROS-dependent ER stress and G2/M cell cycle arrest in human prostate cancer cells. *BMC Cancer*, 15(1), 866.
- Zhang, X., Guo, S., Chen, C., Perez, G. R., Zhang, C., Patanapongpibul, M., Subrahmanyam, N., Wang, R., Keith, J., Chen, G., Dong, Y., Zhang, Q., Zhong, Q., Zheng, S., Wang, G., & Chen, Q.-H. (2017). Asymmetric 1,5-

diaryl-penta-1,4-dien-3-one: Antiproliferative activity in prostate epithelial cell models and pharmacokinetic studies. *European Journal of Medicinal Chemistry*, 137, 263–279.

Zhao, C., Liu, Z., & Liang, G. (2013). Promising curcumin-based drug design: Mono-carbonyl analogues of curcumin (MACs). *Current Pharmaceutical Design*, 19(11), 2114–2135.

Zhu, S., Moore, T. W., Lin, X., Morii, N., Mancini, A., Culver, D., Arrendale, R. F., Reddy, P., Evers, T. J., Zhang, H., Sica, G., Chen, Z. G., Sun, A., Fu, H., Shin, D. M., Snyder, J. P., & Shoji, M. (2013). Synthetic curcumin analog EF31 inhibits the growth of head and neck squamous cell carcinoma xenografts. *Integr Biol*, 17.

Zhu, S., Moore, T. W., Lin, X., Morii, N., Mancini, A., Howard, R. B., Culver, D., Arrendale, R. F., Reddy, P., Evers, T. J., Zhang, H., Sica, G., Chen, Z. G., Sun, A., Fu, H., Khuri, F. R., Shin, D. M., Snyder, J. P., & Shoji, M. (2012). Synthetic curcumin analog EF31 inhibits the growth of head and neck squamous cell carcinoma xenografts. *Integrative Biology*, 4(6), 633–640.

Zou, P., Xia, Y., Chen, W., Chen, X., Ying, S., Feng, Z., Chen, T., Ye, Q., Wang, Z., Qiu, C., Yang, S., & Liang, G. (2016). EF24 induces ROS-mediated apoptosis via targeting *thioredoxin reductase 1* in gastric cancer cells. *Oncotarget*, 7(14), 18050–18064.

Zou, P., Zhang, J., Xia, Y., Kanchana, K., Guo, G., Chen, W., Huang, Y., Wang, Z., Yang, S., & Liang, G. (2015). ROS generation mediates the anti-cancer effects of WZ35 via activating JNK and ER stress apoptotic pathways in gastric cancer. *Oncotarget*, 6(8), 5860–5876.