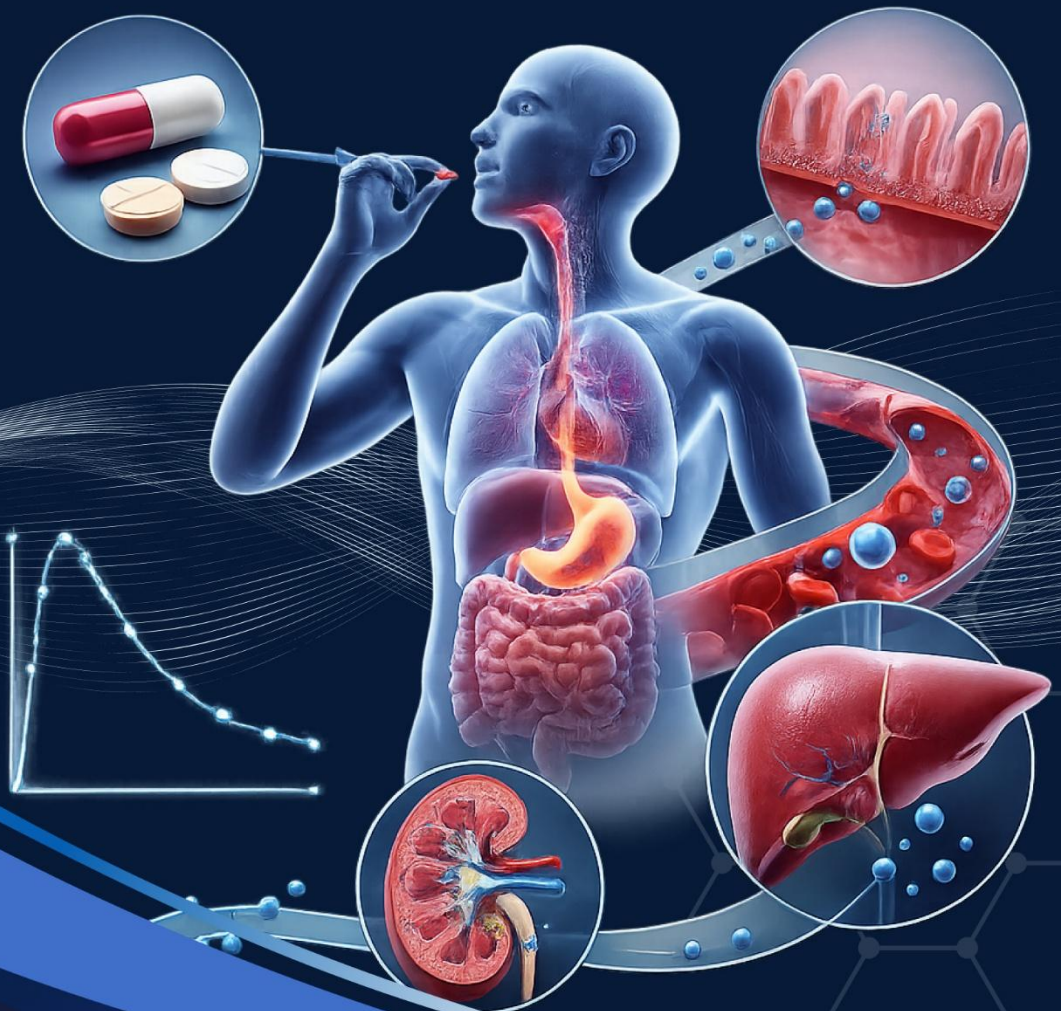


FARMAKOKINETIKA



Farmakokinetika

apt. Yahdian Rasyadi, M.Farm.

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KATA PENGANTAR

Puji syukur ke hadirat Tuhan Yang Maha Esa atas rahmat dan karunia-Nya, sehingga buku berjudul *Farmakokinetika* dapat hadir di tengah pembaca. Buku ini disusun untuk memberikan pemahaman mengenai bagaimana obat masuk, bergerak, berubah, dan dikeluarkan dari tubuh.

Farmakokinetika memiliki peran penting dalam penggunaan obat sehari-hari, terutama dalam menentukan dosis, waktu pemberian, serta keamanan penggunaan obat. Dengan memahami dasar-dasarnya, pembaca dapat lebih menghargai pentingnya mengikuti aturan pakai obat dan tidak mengubah dosis tanpa arahan tenaga kesehatan.

Semoga buku ini dapat menjadi bacaan yang bermanfaat bagi masyarakat umum dan semua pihak yang ingin menambah wawasan tentang penggunaan obat secara aman, efektif, dan rasional.

Jakarta, Juni 2026

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- Alqahtani, M. S., Kazi, M., Alsenaidy, M. A., & Ahmad, M. Z. (2021). Advances in oral drug delivery. *Frontiers in Pharmacology*, 12, 618411.
- Bakker, J., Vermeulen, M., & Hart, D. (2020). *Impact of renal function on drug absorption and pharmacokinetics: A review*. *Journal of Clinical Pharmacology*, 60(4), 245-252.
- Bansal, N., Momin, S., Bansal, R., Gurram Venkata, S. K. R., Ruser, L., & Yusuf, K. (2024). Pharmacokinetics of drugs: Newborn perspective. *Pediatric Medicine*, 7.
- Bennett, C. L., & Langer, R. (2020). *The impact of methotrexate on liver and kidney function: A review of the evidence*. *Journal of Clinical Oncology*, 38(2), 145-156.
- Bowers, N. (2023). Pharmacokinetics. *StatPearls Publishing*.
- Brunton, L. L., Hilal-Dandan, R., & Knollmann, B. C. (2023). *Goodman & Gilman's the pharmacological basis of therapeutics* (14th ed.). McGraw Hill.
- Buxton, I. O. (2023). Pharmacokinetics: The dynamics of drug absorption, distribution, metabolism, and elimination. In L. L. Brunton & B. C. Knollmann (Eds.), *Goodman & Gilman's: The pharmacological basis of therapeutics* (14th ed.). McGraw Hill.
- Chen, B. (2021). Compartmental models with application to pharmacokinetics. *Procedia Computer Science*, 187, 85–90.

- Chen, B. (2021). Compartmental models with application to pharmacokinetics. *Procedia Computer Science*, 195, 631–638.
- Chen, W. (2020). Pharmacokinetics in the elderly. *Journal of Clinical Pharmacology*, 60(1), 12-20.
- Cheng, L., Wong, H., & Chow, E. C. Y. (2020). Food effects on oral drug absorption: Application of physiologically-based pharmacokinetic modeling as a predictive tool. *Pharmaceutics*, 12(7), 672.
- Chrysafides, L., Smith, R., & Anderson, K. (2020). Pharmacokinetics of antibiotics in special populations. *Clinical Therapeutics*, 42(5), 900-913.
- Cohen, R., & Vancomper, S. (2020). *Pharmacokinetics in chronic kidney disease: An update on the impact of renal failure on drug disposition*. *Kidney Disease and Therapy*, 14(3), 98-102.
- Currie, G. M. (2018). Pharmacology, part 2: Introduction to pharmacokinetics. *Journal of Nuclear Medicine Technology*, 46(3), 221–230.
- Daali, Y., Samer, C. F., & Desmeules, J. A. (2022). Personalized medicine: Pharmacokinetics. *Pharmaceutics*, 15(10), 1208.
- Fang, Z., Zhang, H., Guo, J., & Guo, J. (2024). Overview of therapeutic drug monitoring and clinical practice. *Talanta*, 266, 124996.
- Fang, Z., Zhang, J., Luo, L., & Li, J. (2024). Overview of therapeutic drug monitoring and clinical practice. *TrAC Trends in Analytical Chemistry*, 174, 117686.
- Food and Drug Administration. (2022). *Bioequivalence studies with pharmacokinetic endpoints for drugs submitted under an*

ANDA: Guidance for industry. Food and Drug Administration.

- Furlong, D., O'Keeffe, J., & Sheridan, B. (2020). The role of therapeutic drug monitoring in the management of high-risk drugs. *European Journal of Clinical Pharmacology*, 76(10), 1325-1334.
- Gambus, P. L., & Shafer, S. L. (2023). Pharmacokinetics. *StatPearls Publishing*.
- Gandia, P., Llopis-Salvia, P., & Jullien, V. (2023). Plasma protein binding: From discovery to development. *Clinical Pharmacokinetics*, 62(9), 1231–1248.
- Garza, A. Z., Park, S. B., & Kocz, R. (2023). Drug elimination. *StatPearls Publishing*.
- Gomaa, A., Riad, A., & Farag, S. (2021). Pharmacokinetics and therapeutic considerations in pregnancy. *Journal of Clinical Pharmacology*, 61(4), 451-463.
- Gong, C., Narjoz, C., Durmus, S., & Pariente, A. (2023). A literature review of changes in phase II drug-metabolizing enzymes and drug transporters during pregnancy. *Pharmaceutics*, 15(11), 2574.
- Grogan, S., & Preuss, C. V. (2023). Pharmacokinetics. Dalam *StatPearls*. StatPearls Publishing.
- Haidar, M. A., & Benet, L. Z. (2021). Developmental pharmacokinetics: From neonate to adult. *The AAPS Journal*, 23(4), 901-912.
- Herman, T. F., Santos, C., & Bazil, M. K. (2023). *Pharmacokinetics*. StatPearls Publishing.
- Hernandez-Díaz, S., Van Marter, L., & Bar-Oz, B. (2020). Teratogenicity of drugs in pregnancy: A comprehensive

- review. *American Journal of Obstetrics and Gynecology*, 223(3), 472-478.
- Holbrook, A., Schulman, S., & Wittkowsky, A. (2021). *Warfarin dosing and monitoring*. The New England Journal of Medicine, 378(3), 211-221.
- Horde, G. W., Gupta, V., & Venkatesan, P. (2023). *Drug clearance*. StatPearls Publishing.
- Huang, Z., & Della, A. (2020). *Pharmacokinetics of drugs with narrow therapeutic indexes: A review and management strategies*. Clinical Therapeutics, 42(6), 1034-1042.
- Iacopetta, D., Ceramella, J., Catalano, A., Saturnino, C., Bonomo, M. G., Franchini, C., & Sinicropi, M. S. (2023). Impact of cytochrome P450 enzymes on the phase I metabolism of drugs. *Applied Sciences*, 13(10), 6045.
- Ibarra, M., Vázquez, M., Fagiolino, P., & Derendorf, H. (2021). Enteric reabsorption processes and their impact on drug pharmacokinetics. *British Journal of Clinical Pharmacology*, 87(4), 1422–1434.
- Idasiak-Piechocka, I., Kurnatowska, I., & Nowicki, M. (2025). Effect of hypoalbuminemia on drug pharmacokinetics. *Frontiers in Pharmacology*, 16, 1546465.
- Jancova, P., Anzenbacher, P., & Anzenbacherova, E. (2010). Phase II drug metabolizing enzymes. *Biomedical Papers*, 154(2), 103–116.
- Johnson, R. L., Adams, D. P., & Cummings, E. A. (2020). *Pharmacokinetics of drugs in patients with liver and renal dysfunction*. Journal of Clinical Pharmacology, 60(2), 123-135.
- Jones, M. R., & Brown, S. L. (2020). *The importance of therapeutic drug monitoring in clinical practice*. Journal of Clinical Pharmacology, 58(7), 890-901.

- Karalis, V. D. (2023). An in silico approach toward the appropriate absorption rate metric in bioequivalence studies. *Pharmaceuticals*, 16(5), 725.
- Karvaly, G. B. (2024). Modeling pharmacokinetics in individual patients using artificial quasi-models. *Pharmaceutics*, 16(3), 401.
- Kasius, J. M., Huisman, M., & Meijboom, L. (2021). *Ciclosporin: Therapeutic drug monitoring in solid organ transplantation*. Transplantation Proceedings, 53(7), 2205-2209.
- Katzung, B. G. (2021). *Basic and clinical pharmacology* (15th ed.). McGraw-Hill.
- Kusumastuti, K., Hakim, L., & Pinzon, R. T. (2023). An analysis of the Michaelis-Menten pharmacokinetics of phenytoin in epileptic Indonesian adults. *Pharmacy Education*, 23(4), 311–315.
- Łapczuk-Romańska, J., Drożdżik, M., & Oswald, S. (2023). Kidney drug transporters in pharmacotherapy. *International Journal of Molecular Sciences*, 24(3), 2856.
- Lee, D., & Patel, K. (2021). *Pharmacokinetics in liver disease: Alterations and clinical management*. Hepatology Research, 45(2), 112-120.
- Lee, Y.-J., Kang, G., Zang, D.-Y., & Lee, D.-H. (2025). Development of a population pharmacokinetic model of levofloxacin in healthy adults and identification of optimal dosing regimens. *Pharmaceuticals*, 18(5), 621.
- Li, S., Zhang, H., & Yu, J. (2021). Drug metabolism and pharmacokinetics during pregnancy: A clinical perspective. *Pharmacology Research & Perspectives*, 9(2), e00745.
- Liang, W. S., Chen, X., Yang, Y., & Li, X. (2024). Emerging therapeutic drug monitoring technologies. *Frontiers in Pharmacology*, 15, 1348112.

- Madadi, P., Rojas, L., & Cochrane, S. (2020). *Toxicology of paracetamol and acetaminophen in clinical practice*. *Drug Safety*, 43(5), 543-555.
- Mangas-Sanjuán, V., González-Álvarez, I., González-Álvarez, M., & Bermejo, M. (2023). Alternative pharmacokinetic metrics in single-dose bioequivalence studies: A simulation study. *Pharmaceutics*, 15(2), 409.
- Manikandan, P., & Nagini, S. (2018). Cytochrome P450 structure, function and clinical significance: A review. *Current Drug Targets*, 19(1), 38–54.
- Mansoor, A., & Mahabadi, N. (2025). *Volume of distribution*. StatPearls Publishing.
- Mariñas-Collado, I., Martin-Martin, R., Rivas-Lopez, M. J., & Rodriguez-Torreblanca, C. (2023). Optimal designs for a non-linear model for the pharmacokinetic process of ethanol in the human body. *Chemometrics and Intelligent Laboratory Systems*, 241, 104941.
- McKenna, M., Clarke, C., & Weaver, M. (2020). Pharmacokinetic and pharmacodynamic considerations in antibiotic therapy. *American Journal of Therapeutics*, 27(6), e558-e567.
- McMurray, J. J., Dargie, H. J., & Glaeske, G. (2021). *Amiodarone-induced toxicity: Management strategies*. *Lancet*, 397(10270), 1452-1460.
- Meier, W. M. (2021). *Monitoring and interpretation of drug levels in clinical practice*. *Therapeutic Drug Monitoring*, 43(1), 12-28.
- Metro North Health. (2023). *Antimicrobial therapeutic drug monitoring: Guideline*. Metro North Health.
- Migliorati, J. M., Amory, J. K., & Isoherranen, N. (2022). Absorption, distribution, metabolism, and excretion of US Food and Drug Administration-approved therapeutic

- peptides and proteins. *Drug Metabolism and Disposition*, 50(4), 437–450.
- Migliorati, J. M., Dykstra, K., Welling, P. G., & Reddy, M. B. (2022). Absorption, distribution, metabolism, and excretion of US Food and Drug Administration-approved antisense oligonucleotide drugs. *Drug Metabolism and Disposition*, 50(6), 888–897.
- MSD Manual. (2024). Drug excretion. *MSD Manual Professional Edition*.
- Müller, F., Schmidt, S., & Weber, E. (2021). The importance of *therapeutic drug monitoring* in clinical practice. *Clinical Pharmacology & Therapeutics*, 109(2), 254-262.
- NAFDAC. (2024). *Guidelines on the investigation of bioavailability and bioequivalence of drugs*. National Agency for Food and Drug Administration and Control.
- Nguyen, A. S., Kim, D. S., & Lee, B. H. (2020). *Factors affecting drug absorption and distribution in the human body*. *International Journal of Pharmacology*, 56(3), 202-210.
- Onetto, A. J., & Sharif, S. (2023). *Drug distribution*. StatPearls Publishing.
- Patel, P., Le, J., & Surapaneni, S. (2025). *Elimination half-life of drugs*. StatPearls Publishing.
- Paxman, R., Lund, J., & Truelove, M. (2021). Pharmacokinetics and optimal dosing strategies for antibiotics. *Infectious Disease Reports*, 13(3), 208-215.
- Pryor, A., Johnson, S., & Anderson, P. (2021). Drug transfer into breast milk: Implications for breastfeeding. *Clinical Drug Investigation*, 41(7), 689-700.

- Roth, S., & Roberts, D. (2020). *Challenges in pharmacokinetics and drug metabolism in clinical practice*. *Journal of Clinical Pharmacology*, 45(4), 678-688.
- Rowland, M., Tozer, T. N., & Peck, C. C. (2020). *Clinical pharmacokinetics and pharmacodynamics: Concepts and applications* (5th ed.). Wolters Kluwer.
- Sabeen, S., Holubar, M., & Elango, K. (2025). *Elimination half-life of drugs*. StatPearls Publishing.
- Sanchez, E. F., Smith, J. P., & Hughes, T. G. (2021). *Pharmacogenetics in personalized medicine: New insights and applications*. *Pharmacogenomics*, 22(2), 131-145.
- Sharma, H., & Saha, R. (2020). Pediatric pharmacokinetics: Considerations for drug dosing in children. *Indian Journal of Pharmacology*, 52(1), 14-21.
- Smith, J., & Jones, P. (2021). Aging and pharmacokinetics: Implications for drug therapy in the elderly. *Pharmacology & Therapeutics*, 110(3), 102-110.
- Stielow, M., Witczyńska, A., Kubryń, N., Fijałkowski, Ł., Nowaczyk, J., & Nowaczyk, A. (2023). The bioavailability of drugs—The current state of knowledge. *Molecules*, 28(24), 8038.
- Sun, L., Chen, Y., Li, H., & Wang, X. (2023). Pharmacokinetic and pharmacodynamic drug–drug interactions. *Pharmaceutics*, 15(8), 2121.
- Tanaka, R. (2025). Pharmacokinetic variability and significance of therapeutic drug monitoring for broad-spectrum antimicrobials in critically ill patients. *Journal of Pharmaceutical Health Care and Sciences*, 11, 21.
- Tracy, M., Smith, R., & King, J. (2020). Pharmacokinetics of drugs in pregnant women. *Therapeutic Advances in Drug Safety*, 11, 2042098619898691.

- U.S. Food and Drug Administration. (2022). *Bioavailability studies submitted in NDAs or INDs — General considerations: Guidance for industry*. U.S. Food and Drug Administration.
- U.S. Food and Drug Administration. (2024). *Pharmacokinetics in patients with impaired renal function: Study design, data analysis, and impact on dosing*. U.S. Food and Drug Administration.
- Vanderah, T. W. (Ed.). (2024). *Katzung's basic & clinical pharmacology* (16th ed.). McGraw Hill.
- Vermeulen, M. (2021). *Pharmacokinetics in renal failure: A review of drugs and dosing in chronic kidney disease*. International Journal of Nephrology, 27(2), 87-95.
- Wadhwa, R. R., & Cascella, M. (2023). *Steady state concentration*. StatPearls Publishing.
- Wang, Z., & Li, J. (2021). *Monitoring drug concentrations in patients with chronic conditions: A review of current practices*. Therapeutic Advances in Drug Safety, 12(1), 1-10.
- Williams, P. D., Roberts, C. E., & O'Neill, M. K. (2022). Metabolic pathways and drug interactions in children. *Clinical Pharmacokinetics*, 61(6), 803-811.
- Yan, D., Wu, X., Li, J., & Tang, S. (2023). Statistical analysis of two-compartment pharmacokinetic models with drug non-adherence. *Bulletin of Mathematical Biology*, 85, 72.
- Yousef, M., & Davies, N. M. (2024). Upholding or breaking the law of superposition in pharmacokinetics. *Biomedicines*, 12(8), 1843.
- Zhang, L., Wang, Y., Liu, X., Yang, Y., & Li, J. (2023). Modeling the protein binding non-linearity in population pharmacokinetic models of valproic acid in children with epilepsy. *Frontiers in Pharmacology*, 14, 1228641.

- Zhang, Y. B., Yang, Y., Liao, Z., Zhang, H., Liang, J., & Yao, H. (2022). A review of non-invasive drug delivery through respiratory and mucosal routes. *Pharmaceutics*, 14(9), 1974.
- Zhao, M., Ma, J., Li, M., Zhang, Y., Jiang, B., Zhao, X., Huai, C., Shen, L., Zhang, N., He, L., Qin, S., & Huang, J. (2021). Cytochrome P450 enzymes and drug metabolism in humans. *International Journal of Molecular Sciences*, 22(23), 12808.
- Zhao, Y., & Sun, L. (2021). *Advances in imaging techniques for pharmacokinetics studies*. Journal of Pharmaceutical Sciences, 110(3), 891-903.
- Zhou, S. (2021). *Management of narrow therapeutic index drugs: Clinical insights and challenges*. International Journal of Clinical Pharmacology, 45(2), 78-85.
- Zhou, S. F., Li, C. G., & Lee, S. H. (2020). *Drug interactions and pharmacokinetic-based dose adjustment*. Clinical Pharmacology, 12(2), 85-99.
- Zhu, S. X. (2025). Human absorption, distribution, metabolism, and excretion studies: Conventional or microtracer? *Drug Metabolism and Disposition*, 53(5), 100067.
- Zimmerman, M., Johnson, B., & Bennett, A. (2020). Renal function in pediatric patients: Implications for drug elimination. *Pediatric Nephrology*, 35(7), 1355-1365.

Farmakokinetika membahas perjalanan obat di dalam tubuh, mulai dari proses penyerapan, penyebaran, perubahan, hingga pengeluaran obat. Buku ini membantu pembaca memahami bagaimana obat bekerja setelah digunakan dan mengapa aturan pakai obat perlu diperhatikan dengan baik.

Dengan bahasa yang sederhana, buku ini menjelaskan faktor-faktor yang dapat memengaruhi kerja obat, seperti usia, kondisi tubuh, fungsi hati dan ginjal, dosis, serta waktu penggunaan obat. Pemahaman ini penting agar masyarakat tidak menggunakan obat secara sembarangan dan lebih bijak dalam mengikuti anjuran tenaga kesehatan.

Buku ini ditujukan bagi masyarakat umum, tenaga kesehatan, serta siapa saja yang ingin memahami penggunaan obat secara lebih tepat, aman, dan bertanggung jawab. Melalui buku ini, pembaca diharapkan semakin sadar bahwa keberhasilan pengobatan tidak hanya bergantung pada jenis obat, tetapi juga pada cara tubuh memproses obat tersebut.