BAB VII

SIMPULAN DAN SARAN

7.1 Simpulan

Dari hasil penelitian yang telah dilakukan dapat diambil kesimpulan sebagai berikut :

1. Terdapat hubungan antara gambaran mikroskopik nekrosis sel hepatosit organ hati *Rattus norvegicus strain wistar* setelah pemberian *intake* mikroplastik *low density polyethylene* per oral selama 90 hari.
2. Tidak terdapat hubungan antara gambaran mikroskopik sel degenerasi lemak hepatosit organ hati *Rattus norvegicus strain wistar* setelah pemberian *intake* mikroplastik *low density polyethylene* per oral selama 90 hari.

7.2 Saran

Dari hasil penelitian, peneliti memberi beberapa saran yang dapat dilakukan untuk penelitian selanjutnya :

1. Menganjurkan pemeriksaan darah untuk mengetahui kadar SGOT dan SGPT yang bertujuan untuk mengetahui pengaruh pemberian mikroplastik terhadap fungsi fisiologis hati.
2. Menganjurkan untuk memastikan makanan dan minuman tikus hewan coba bersih dari kontaminasi mikroplastik agar tidak mempengaruhi hasil penelitian pada kelompok kontrol.

DAFTAR PUSTAKA

1. Geyer R, Jambeck JR, Law KL. Production, use, and fate of all plastics ever made [Producción, uso y destino de todos los plásticos jamás fabricados]. Sci Adv. 2017;3(7):e1700782.
2. World Bank 2021. Plastic Waste Discharges from Rivers and Coastlines in Indonesia. Plastic Waste Discharges from Rivers and Coastlines in Indonesia. 2021;
3. Green Peace. Throwing Away the Future : Throwing Away The Future: How Companies Still Have It Wrong on Plastic Pollution "Solutions'''." 2019;32.
4. Revel M, Châtel A, Mouneyrac C. Micro(nano)plastics: A threat to human health? Environmental Science and Health. 2018;1:17–23.
5. Wright SL, Kelly FJ. Plastic and Human Health: A Micro Issue? Environ Sci Technol. 2017;51(12):6634–47.
6. Maulina M. Zat-Zat yang Mempengaruhi Histopatologi Hepar. Unimal Press. 2018;49:1.
7. Deng Y, Zhang Y, Lemos B, Ren H. Tissue accumulation of microplastics in mice and biomarker responses suggest widespread health risks of exposure. Sci Rep. 2017;7(March):1–10.
8. Banerjee A, Shelver WL. Micro- and nanoplastic induced cellular toxicity in mammals: A review. Science of the Total Environment. 2021;755.
9. Zheng T, Yuan D, Liu C. Molecular toxicity of nanoplastics involving in oxidative stress and desoxyribonucleic acid damage. Journal of Molecular Recognition. 2019 Nov 1;32(11).
10. Chang X, Xue Y, Li J, Zou L, Tang M. Potential health impact of environmental micro- and nanoplastics pollution. Journal of Applied Toxicology. 2020;40(1):4–15.
11. Yong CQY, Valiyaveettil S, Tang BL. Toxicity of microplastics and nanoplastics in Mammalian systems. Int J Environ Res Public Health. 2020;17(5):1–24.
12. Bîrca A, Gherasim O, Grumezescu V, Grumezescu AM. Introduction in thermoplastic and thermosetting polymers. Materials for Biomedical Engineering: Thermoset and Thermoplastic Polymers. 2019;1–28.
13. Sarkar, Supta & Aparna K. Food Packaging and Storage. Research Trends in Home Science and Extension. 2020;3:27–51.

14. Lusher A, Hollman P, Mandoza-Hill J. Microplastics in fisheries and aquaculture. Vol. 615, FAO Fisheries and Aquaculture Technical Paper. 2017. 127 p.

15. Sarmah R, Dutta R, Baishya S, Borah S. Microplastic pollution: An emerging environmental issue. J Entomol Zool Stud. 2018;6(6):340–4.

16. Efimova I, Bagaeva M, Bagaev A, Kileso A, Chubarenko IP. Secondary microplastics generation in the sea swash zone with coarse bottom sediments: Laboratory experiments. Front Mar Sci. 2018;5(SEP).

17. Hale RC, Seeley ME, La Guardia MJ, Mai L, Zeng EY. A Global Perspective on Microplastics. J Geophys Res Oceans. 2020;125(1):1–40.

18. Drake RL, Vogl W, Mitchell AWM, Richardson P. Gray's Basic Anatomy. Elsevier; 2017. (Student consult).

19. Mescher AL. Basic Histology Junqueira. 2016. 580 p.

20. Vernon H, Wehrle CJ KA. Anatomy, Abdomen and Pelvis, Liver. Treasure Island (FL): StatPearls Publishing. 2021.

21. Mescher AL. Junqueira's Basic histology book & atlas 12th. McGraw-Hill Medical. 2010. 5–452 p.

22. Gartner , LP. Textbook of histology. 2017.

23. Sherwood L. Human physiology : from cells to systems. Eighth edition. Belmont, CA : Brooks/Cole, Cengage Learning, [2013] ©2013;

24. Kalra A, Yetiskul E, Wehrle CJ et al. Physiology, Liver. Treasure Island (FL): StatPearls Publishing;

25. Kubes P, Jenne C, Snyder J. Annual review of immunology immune responses in the liver. Annu Rev Immunol. 2018;36(9):1–31.

26. Kumar, V., Abbas, A. K., & Aster JC. Robbins Basic Pathology (10th ed.). 10th ed. Elsevier - Health Sciences Division; 2017.

27. Miller MA, Zachary JF. Mechanisms and Morphology of Cellular Injury, Adaptation, and Death. Zachary JF, editor. Pathologic Basis of Veterinary Disease. 2017/02/17. 2017;2-43.e19.

28. Sari LM. Apoptosis: Mekanisme Molekuler Kematian Sel. Cakradonya Dental Journal. 2018;10(2):65–70.

29. Cavalcante GC, Schaan AP, Cabral GF, Santana-da-Silva MN, Pinto P, Vidal AF, et al. A Cell's Fate: An Overview of the Molecular Biology and Genetics of Apoptosis. Vol. 20, International Journal of Molecular Sciences . 2019.

30. Monson EA, Trenerry AM, Laws JL, MacKenzie JM, Helbig KJ. Lipid droplets and lipid mediators in viral infection and immunity. FEMS Microbiol Rev. 2021;45(4):1–20.

31. Preuss C, Jelenik T, Bódis K, Müssig K, Burkart V, Szendroedi J, et al. A New Targeted Lipidomics Approach Reveals Lipid Droplets in Liver, Muscle and Heart as a Repository for Diacylglycerol and Ceramide Species in Non-Alcoholic Fatty Liver. Cells. 2019 Mar 22;8:277.

32. Zhang W, Xu L, Zhu L, Liu Y, Yang S, Zhao M. Lipid Droplets, the Central Hub Integrating Cell Metabolism and the Immune System . Vol. 12, Frontiers in Physiology . 2021.

33. Nguyen TB, Olzmann JA. Lipid droplets and lipotoxicity during autophagy. Autophagy. 2017;13(11):2002–3.

34. Jarc E, Petan T. A twist of FATe: Lipid droplets and inflammatory lipid mediators. Biochimie. 2020;169:69–87.

35. Dutta A, Banerjee S, Sinha D. Lipid Droplet metabolism dependent microbial defense in pre-immune zebrafish embryos. 2018.

36. Dayem AA, Hossain MK, Lee S Bin, Kim K, Saha SK, Yang GM, et al. The role of reactive oxygen species (ROS) in the biological activities of metallic nanoparticles. Int J Mol Sci. 2017;18(1):1–21.

37. Shields HJ, Traa A, Van Raamsdonk JM. Beneficial and Detrimental Effects of Reactive Oxygen Species on Lifespan: A Comprehensive Review of Comparative and Experimental Studies . Vol. 9, Frontiers in Cell and Developmental Biology . 2021.

38. Arjunan KP, Sharma V, Ptasinska S. Effects of Atmospheric Pressure Plasmas on Isolated and Cellular DNA—A Review. Int J Mol Sci. 2015 Feb 1;16:2971–3016.

39. Chen Z, Tian R, She Z, Cai J, Li H. Role of oxidative stress in the pathogenesis of nonalcoholic fatty liver disease. Free Radic Biol Med. 2020;152:116–41.

40. Travasso RDM, Sampaio dos Aidos F, Bayani A, Abranches P, Salvador A. Localized redox relays as a privileged mode of cytoplasmic hydrogen peroxide signaling. Redox Biol. 2017;12:233–45.

41. Di Marzo N, Chisci E, Giovannoni R. The Role of Hydrogen Peroxide in Redox-Dependent Signaling: Homeostatic and Pathological Responses in Mammalian Cells. Vol. 7, Cells . 2018.

42. Wagner H, Cheng JW, Ko EY. Role of reactive oxygen species in male infertility: An updated review of literature. Arab J Urol. 2018;16(1):35–43.

43. Susilawati IDA. Sumber Reactive Oxygen Species (ROS) Vaskular. STOMATOGNATIC - Jurnal Kedokteran Gigi. 2021;18(1):1.

44. Ridwan E. Etika Pemanfaatan Hewan Percobaan dalam Penelitian Kesehatan Ethical Use of Animals in Medical Research. J Indon Med Assoc. 2013;63(3):112–6.

45. Delwatta SL, Gunatilake M, Baumans V, Seneviratne MD, Dissanayaka MLB, Batagoda SS, et al. Reference values for selected hematological, biochemical and physiological parameters of Sprague-Dawley rats at the Animal House, Faculty of Medicine, University of Colombo, Sri Lanka. Animal Model Exp Med. 2018;1(4):250–4.

46. Liu , Fan, Jianglin,, E. Fundamentals of laboratory animal science. 2018.

47. Ali A, Shaker AL, Abd Y, Ahmed EG, Mohammed A, Ghallab A. AYA THESIS. 2019.

48. Dheaa S, Zageer, Sundus F, Hantoosh S, Mayyahi M, Almayyahy. THE LIVER GENIUS FUNCTIONS and DISORDERS PART ONE. 2021.

49. Kruepunga N, Hakvoort TBM, Hikspoors JPJM, Köhler SE, Lamers WH. Anatomy of rodent and human livers: What are the differences? Biochimica et Biophysica Acta (BBA) - Molecular Basis of Disease. 2019;1865(5):869–78.

50. Myers, P., R. Espinosa, C. S. Parr, T. Jones, G. S. Hammond and TAD. Rattus norvegicus brown rat (Also: Norway rat) [Internet]. The Animal Diversity Web (online). 2022. Available from: https://animaldiversity.org

51. Al-Hajj DN, Algabr M, Sharif H, Aboshora W, Wang H. In Vitro and in Vivo Evaluation of Antidiabetic Activity of Leaf Essential Oil of Pulicaria inuloides-Asteraceae. Journal of food and nutrition research. 2016 Aug 6;4:461–70.

52. Qiao R, Sheng C, Lu Y, Zhang Y, Ren H, Lemos B. Microplastics induce intestinal inflammation, oxidative stress, and disorders of metabolome and microbiome in zebrafish. Science of The Total Environment. 2019;662:246–53.

53. Li L, Xu M, He C, Wang H, Hu Q. Polystyrene nanoplastics potentiate the development of hepatic fibrosis in high fat diet fed mice. Environ Toxicol. 2022;37(2):362–72.

54. Pangalela AA, Weta IW, Maker II. ASTAXANTHIN MENGHAMBAT PERLEMAKAN HATI DAN PENINGKATAN KADAR SERUM GAMMA-GLUTAMYLTRANSFERASE PADA TIKUS WISTAR JANTAN YANG DIBERI MINYAK JELANTAH Abstrak 46 | Indonesian Journal of Clinical Nutrition Physician . Hal 46-55 p -ISSN : 2597-4297 Volume 3 No . 2020;3(1):46–55.

55. Wang YL, Lee YH, Hsu YH, Chiu IJ, Huang CC, Chia ZC, et al. The Kidney-Related Effects of Polystyrene Microplastics on Human Kidney Proximal Tubular Epithelial Cells HK-2 and Male C57BL/6 Mice. Environ Health Perspect. 2021 May 6;5.

56. Li L, Xu M, He C, Wang H, Hu Q. Polystyrene nanoplastics potentiate the development of hepatic fibrosis in high fat diet fed mice. Environ Toxicol. 2022 Feb 1;37(2):362–72.

57. Noreen A, Bukhari DA, Rehman A. Reactive oxygen species: Synthesis and their relationship with cancer-A review. Vol. 50, Pakistan Journal of Zoology. University of Punjab (new Campus); 2018. p. 1951–63.