

BAB VII

KESIMPULAN DAN SARAN

7.1 Kesimpulan

Berdasarkan hasil penelitian yang telah dilakukan, dapat disimpulkan bahwa :

1. Terdapat pengaruh pada pemberian ekstrak etanol daun Afrika dengan dosis 100mg/kgbb, 200mg/kgbb, dan 400mg/kgbb selama 14 hari pada jumlah sel spermatogenik tikus hiperglikemia.
2. Pemberian ekstrak etanol daun Afrika dosis 100mg/kgbb/hari menyebabkan perbaikan jumlah sel spermatogenik paling baik pada tikus hiperglikemia.
3. Daun Afrika dapat dipertimbangkan untuk pengobatan masalah fertilitas pada pria penderita diabetes mellitus.

7.2 Saran

Berdasarkan hasil penelitian, peneliti memberikan saran yang dapat dilakukan untuk penelitian berikutnya :

1. Melakukan penelitian pemberian ekstrak daun Afrika dengan waktu yang lebih lama agar dapat mengetahui efek pemberian jangka panjang
2. Melakukan isolasi senyawa yang terdapat dalam ekstrak daun Afrika agar dapat diketahui senyawa yang paling berperan dalam perbaikan jumlah spermatogenik.
3. Melakukan penelitian yang menggunakan metode induksi hiperglikemia dengan cara diet tinggi glukosa dan lemak seperti pada diabetes mellitus tipe 2

DAFTAR PUSTAKA

1. International Diabetes Federation. IDF Diabetes Atlas Ninth. Dunia : IDF. 2019. 168 p.
2. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. *Diabetes Res Clin Pract* [Internet]. 2019;157:107843. Diakses dari : <https://doi.org/10.1016/j.diabres.2019.107843>
3. Riskesdas. HASIL UTAMA RISKESDAS 2018, Kementerian Kesehatan. Riset Kesehatan Dasar. 2018;
4. Soelistijo S, Novida H, Rudijanto A, Soewondo P, Suastika K, Manaf A, et al. Konsensus Pengelolaan Dan Pencegahan Diabetes Melitus Tipe2 Di Indonesia 2015 [Internet]. Perkeni. 2015. 82 p. Diakses dari: <https://www.google.com/url?sa=t&source=web&rct=j&url=https://pbperkeni.or.id/wp-content/uploads/2019/01/4.-Konsensus-Pengelolaan-dan-Pencegahan-Diabetes-melitus-tipe-2-di-Indonesia-PERKENI-2015.pdf&ved=2ahUKEwjy8KOs8cfoAhXCb30KHQB1Ck0QFjADegQIBhAB&usg=AOv>
5. Ding GL, Liu Y, Liu ME, Pan JX, Guo MX, Sheng JZ, et al. The effects of diabetes on male fertility and epigenetic regulation during spermatogenesis. *Asian J Androl*. 2015;17(6):948–53. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/25814158>
6. Glazer CH, Bonde JP, Giwercman A, Vassard D, Pinborg A, Schmidt L, et al. Risk of diabetes according to male factor infertility : a register-based cohort study. 2017;32(7):1474–81. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5850522/> DOI : [10.1093/humrep/dex097](https://doi.org/10.1093/humrep/dex097)
7. Ballester J, Muñoz MC, Domínguez J, Rigau T, Guinovart JJ, Rodríguez-Gil JE. Insulin-dependent diabetes affects testicular function by FSH- and LH-linked mechanisms. *J Androl*. 2004;25(5):706–19. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/15292100>
8. Rhee SY, Kim YS. The role of advanced glycation end products in diabetic vascular complications. *Diabetes Metab J*. 2018;42(3):188–95. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6015964/> DOI : [10.4093/dmj.2017.0105](https://doi.org/10.4093/dmj.2017.0105)
9. Ko EY, Sabanegh ES, Agarwal A. Male infertility testing: Reactive oxygen species and antioxidant capacity. *Fertil Steril* [Internet]. 2014;102(6):1518–27. Diakses dari : <http://dx.doi.org/10.1016/j.fertnstert.2014.10.020>

10. Usunobun U, Ngozi O. Phytochemical analysis and proximate composition of *Vernonia amygdalina*. *Int J Sci World*. 2016;4(1):11. Diakses dari : <https://www.sciencepubco.com/index.php/IJSW/article/view/5845> DOI : [10.14419/ijsw.v4i1.5845](https://doi.org/10.14419/ijsw.v4i1.5845)
11. Alara OR, Nour A, Olalere OA. PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF *Vernonia amygdalina* : A REVIEW PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF *Vernonia amygdalina* : A REVIEW. 2017;(September). Diakses dari : <https://core.ac.uk/download/pdf/159193914.pdf> DOI : <https://doi.org/10.15282/JCEIB-V2-07.29/9/2017/2.2>
12. Audu SA, Taiwo AE, Ojuolape AR. A Study Review of Documented Phytochemistry of *Vernonia amygdalina* (Family Asteraceae) as the Basis for Pharmacologic Activity of Plant Extract. *J Nat Sci Res*. 2012;2(7):1–8. Diakses dari : <https://www.iiste.org/Journals/index.php/JNSR/article/view/2759>
13. Usunobun U, Okolie NP. PHYTOCHEMICAL, TRACE AND MINERAL COMPOSITION OF *VERNONIA AMYGDALINA* LEAVES. *International Journal of Biological & Pharmaceutical Research*. 2015. Diakses dari : https://www.academia.edu/35199503/PHYTOCHEMICAL_TRACE_A_ND_MINERAL_COMPOSITION_OF_VERNONIA_AMYGDALINA_LEAVES
14. Ijeh II, Ejike CECC. Current perspectives on the medicinal potentials of *Vernonia amygdalina* Del. *J Med Plants Res*. 2011;5(7):1051–61. Diakses dari: https://academicjournals.org/article/article1380529017_Ijeh%20and%20Ejike.pdf
15. Okoduwa SIR, Umar IA, Inuwa HM. Validation of the antidiabetic effects of *Vernonia amygdalina* delile leaf fractions in fortified diet-fed streptozotocin-treated rat model of type-2 diabetes. 2017;8(3):74-85. Diakses dari : https://www.researchgate.net/publication/322134969_Validation_of_the_antidiabetic_effects_of_Vernonia_amygdalina_delile_leaf_fractions_in_fortified_diet-fed_streptozotocin-treated_rat_model_of_type-2_diabetes DOI : [10.4103/jod.jod_19_17](https://doi.org/10.4103/jod.jod_19_17)
16. Asante DB, Effah-Yeboah E, Barnes P, Abban HA, Ameyaw EO, Boampong JN, et al. Antidiabetic Effect of Young and Old Ethanolic Leaf Extracts of *Vernonia amygdalina*: A Comparative Study. *J Diabetes Res*. 2016;. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4884890/> DOI :

- 10.1155/2016/8252741
17. Saalu LC, Akunna GG, Ajayi JO. Modulating role of bitter leaf on spermatogenic and steroidogenesis functions of the rat testis. *Am J Biochem Mol Biol.* 2013;3(3):314–21. Diakses dari : https://www.researchgate.net/publication/277009396_Modulating_Role_of_Bitter_Leaf_on_Spermatogenic_and_Steroidogenesis_Functions_of_the_Rat_Testis DOI : 10.3923/ajbmb.2013.314.321
 18. Ekenjoku JA, Airaodion AI, Okoroukwu VN, Ogbuagu EO, Ogbuagu U. Oral Administration of Ethanolic Leaf Extract of *Vernonia amygdalina* May Impact Negatively on Fertility in Male Wistar Rats. 2019;2(3):1–8. Diakses dari : <http://journalajmcp.com/index.php/AJMPCP/article/view/30101>
 19. Alwi I. Buku ajar ilmu penyakit dalam. Jilid I. Edisi VI. 2014 / FKUI [Internet]. Vol. 1, Jakarta Interna Publishing. 2014. 594–610 p.
 20. Tjokroprawiro A, Setiawan PB, Effendi C, Santoso D, Soegiarto G. Buku ajar ilmu penyakit dalam. Ed.2. Jakarta: Pusat Penerbitan Departemen Ilmu Penyakit Dalam Fakultas Kedokteran Universitas Indonesia
 21. Ivers NM, Jiang M, Alloo J, Singer A, Ngui D, Casey CG, et al. Diabetes Canada 2018 clinical practice guidelines. *Can Fam Physician.* 2019;65(1):14–24. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6347316/>
 22. Care D, Suppl SS. Classification and diagnosis of diabetes: Standards of medical care in diabetes-2019. *Diabetes Care.* 2019;42(January):S13–28. Diakses dari : https://care.diabetesjournals.org/content/42/Supplement_1/S13 DOI : <https://doi.org/10.2337/dc19-S002>
 23. Mathew P., Thoppil D. Hypoglycemia [Internet]. Statspearl Publishing; 2019. 25p . Available from: <https://www.ncbi.nlm.nih.gov/books/NBK534841/>
 24. Beckman JA, Creager MA. Vascular complications of diabetes. *Circ Res.* 2016;118(11):1771–85.
 25. Katzung B, Masters S, Trevor A. *Farmakologi Dasar dan Klinik* Edisi 12. 12th ed. Mc Graw Hill Education. 2013. 849-862 p.
 26. Gartner L, Hiatt J. *Color Atlas and Text of Histology.* *JAMA: The Journal of the American Medical.* 2012. 489-503 p.
 27. Mescher AL. *Junqueira 's Basic Histology Text & Atlas (14th ed .).* Mc Graw Hill. 2016. 362 – 374 p.
 28. Semihardjo H. *Buku Panduan Praktikum Histologi.* Sandra F, editor. Jakarta: EGC; 2013. 98 p.
 29. Oduwole OO, Peltoketo H, Huhtaniemi IT. Role of Follicle-Stimulating Hormone in Spermatogenesis. *Front Endocrinol (Lausanne).* 2018;9(December):1–11. Diakses dari:

- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6302021/>
doi: [10.3389/fendo.2018.00763](https://doi.org/10.3389/fendo.2018.00763)
30. Fishman SL, Sonmez H, Basman C, Singh V, Poretsky L. The role of advanced glycation end-products in the development of coronary artery disease in patients with and without diabetes mellitus: A review. *Mol Med.* 2018;24(1):1–12. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/30470170> DOI : 10.1186/s10020-018-0060-3.
 31. Omolaoye Temidayo S, Du Plessis Stefan S. Diabetes mellitus and male infertility. *Asian Pacific J Reprod.* 2018;7(1):6–14. Diakses dari : <http://www.apjr.net/article.asp?issn=23050500;year=2018;volume=7;issue=1;spage=6;epage=14;aulast=Temidayo> DOI : 10.4103/2305-0500.220978
 32. Panche AN, Diwan AD, Chandra SR. Flavonoid: an Overview. 2016;5:e47 Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5465813/> doi: [10.1017/jns.2016.41](https://doi.org/10.1017/jns.2016.41)
 33. Neto FTL, Bach PV, Najari BB, Li PS, Goldstein M. Spermatogenesis in humans and its affecting factors. *Semin Cell Dev Biol* [Internet]. 2016;59:10–26. Diakses dari: <http://dx.doi.org/10.1016/j.semcd.2016.04.009> DOI : doi: 10.1016/j.semcd.2016.04.009
 34. Shaikh H, Shrivastava VK, Amir M. Diabetes Mellitus and Impairment of Male Reproductive Function: Role of Hypothalamus Pituitary Testicular Axis and Reactive Oxygen Species. 2016;8(1):41–50. Diakses dari : <http://ijdo.ssu.ac.ir/article-1-284-en.pdf>
 35. Maresch CC, Stute DC, Alves MG, Oliveira PF, de Kretser DM, Linn T. Diabetes-induced hyperglycemia impairs male reproductive function: A systematic review. *Hum Reprod Update.* 2018;24(1):86–105. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/29136166> doi: 10.1093/humupd/dmx033.
 36. Yeap SK, Ho WY, Beh BK, Liang WS, Ky H, Yousr AHN, et al. *Vernonia amygdalina*, an ethnoveterinary and ethnomedical used green vegetable with multiple bioactivities. *J Med Plants Res.* 2010;4(25):2787–812. Diakses dari : https://www.researchgate.net/publication/285877471_Vernonia_amygdalina_an_ethnoveterinary_and_ethnomedical_used_green_vegetable_with_multiple_bioactivities
 37. Oyeyemi IT, Akinlabi AA, Adewumi A, Aleshinloye AO, Oyeyemi OT. *Vernonia amygdalina* : A folkloric herb with anthelmintic properties. *Beni-Suef Univ J Basic Appl Sci* [Internet]. 2018;7(1):43–9. Diakses dari : <https://doi.org/10.1016/j.bjbas.2017.07.007>

38. Kadiri O, Olawoye B. Vernonia amygdalina: An Underutilized Vegetable with Nutraceutical Potentials – A Review Turkish Journal of Agriculture - Food Science and Technology Vernonia amygdalina: An Underutilized Vegetable with Nutraceutical Potentials – A Review. 2016 Sep; 4(9):763-768. Diakses dari : <http://www.agrifoodscience.com/index.php/TURJAF/article/view/570>
DOI: 10.24925/turjaf.v4i9.763-768.570
39. Omede A, Ms S, Fo A, Momoh S, Et F, Vd S, et al. Evaluation of antioxidant and cytotoxic properties of Vernonia amygdalina. 2018;4(4):10–5. Diakses dari : <https://symbiosisonlinepublishing.com/plant-studies/plant-studies01.php>
40. Adesanoye OA, Farombi EO. In Vitro Antioxidant Properties of Methanolic Leaf Extract of Vernonia Amygdalina Del. 2014;29(December):91–101. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/26196573>
41. Asuquo OR, Mesembe OE. Ethanolic Extracts Of Vernonia Amygdalina And Ocimum Gratissimum Enhance Testicular Improvement In Diabetic Wistar Rats. Internet J Altern Med. 2012;8(2). Diakses dari : [https://www.researchgate.net/publication/231337496 Ethanolic Extracts Of Vernonia Amygdalina And Ocimum Gratissimum Enhance Testicular Improvement In Diabetic Wistar Rats](https://www.researchgate.net/publication/231337496_Ethanolic_Extracts_Of_Vernonia_Amygdalina_And_Ocimum_Gratissimum_Enhance_Testicular_Improvement_In_Diabetic_Wistar_Rats)
42. Udochukwu U, Omeje FI, Uloma IS, Oseiwe FD. PHYTOCHEMICAL ANALYSIS OF Vernonia amygdalina AND Ocimum gratissimum EXTRACTS AND THEIR ANTIBACTERIAL ACTIVITY ON SOME DRUG RESISTANT BACTERIA. Am J Res Commun. 2015;3(5):225–35. Diakses dari : http://www.usa-journals.com/wp-content/uploads/2015/04/Udochukwu_Vol35.pdf
43. Erasto P, Afolayan AJ. Antioxidant Constituents in Vernonia amygdalina . Leaves Antioxidant Constituents in Vernonia amygdalina . Leaves. 2008; 45(3):195-199. Diakses dari : <https://doi.org/10.1080/13880200701213070>
DOI: 10.1080/13880200701213070
44. Oyeyemi, M., Oluwatoyin, O., Ajala Leigh, O.O. THE SPERMIOGRAM OF MALE WISTAR RATS TREATED WITH AQUEOUS LEAF EXTRACT OF VERNONIA AMYGDALINA. 2008 Jan; 52(2):98–101. Diakses dari : [https://www.researchgate.net/publication/306322545 THE SPERMIOGRAM OF MALE WISTAR RATS TREATED WITH AQUEOUS LEAF EXTRACT OF Venrcnia antygdalina](https://www.researchgate.net/publication/306322545_THE_SPERMIOGRAM_OF_MALE_WISTAR_RATS_TREATED_WITH_AQUEOUS_LEAF_EXTRACT_OF_Venrcnia_antygdalina)
45. Vinerean, HV. Rats – Biology & Husbandry. Florida Int Univ. 2013:1-46. Diakses dari : <http://research.fiu.edu/documents/facilities/acf/documents/rats-biology->

[husbandry.pdf](#)

46. Liu E, Fan J. *Fundamentals of Laboratory Animal Science*. CRC Press. 2018. 352 p.
47. Hidayaturrahmah, Budi Santoso H, Aulia Rahmi R, Kartikasari D. Blood glucose level of white rats (*Rattus norvegicus*) after giving catfish biscuit (*Pangasius hypophthalmus*). *BIO Web Conf.* 2020;20:4. Diakses dari : https://www.bioconferences.org/articles/bioconf/full_html/2020/04/bioconf_icweb2019_04005/bioconf_icweb2019_04005.html#:~:text=3.1%20Blood%20Glucose%20Level%20of%20White%20Rats&text=The%20blood%20glucose%20normal%20level,50%2D135%20mg%2FdL. DOI : <https://doi.org/10.1051/bioconf/20202004005>
48. Sengupta P. The laboratory rat: Relating its age with human's. *Int J Prev Med.* 2013;4(6):624–30. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3733029/>
49. Krinke GJ. *The Laboratory Rat (Handbook of Experimental Animals)*. Academic Press. 2000. 150-152 p.
50. Unitly AJA, Kusumorini N, Agungpriyono S, Satyaningtijas AS. PERUBAHAN KUALITAS SPERMATOZOA DAN JUMLAH SEL-SEL SPERMATOGENIK TIKUS YANG TERPAPAR ASAP ROKOK Changes in Sperm Quality and Amount Cells of Spermatogenic Rat that Exposed to Cigarette Smoke. *J Kedokt Hewan.* 2014;8(2):8–11. Diakses dari : <http://www.jurnal.unsyiah.ac.id/JKH/article/view/2629>
51. Macdonald O, Mohammed A. ScienceDirect Alloxan-induced diabetes , a common model for evaluating the glycemic-control potential of therapeutic compounds and plants extracts in experimental studies. *Medicina (B Aires)* [Internet]. 2018;53(6):365–74. Diakses dari: <https://doi.org/10.1016/j.medic.2018.02.001>
52. King A, Austin A. *Animal Models for Cardiovascular Research Chapter 10: Animal Models of Type 1 and Type 2 Diabetes Mellitus* [Internet]. Second Edi. *Animal Models for the Study of Human Disease*. Elsevier Inc.; 2016; 245-265. Diakses dari: <https://doi.org/10.1016/B978-0-12-809468-6.00010-3>
53. Umairoh S, Sutyarso, Kanedi M, Busman H. Boosting Sperm Count Using Red Ginger in Mice Induced by. 2019;6(2):1–7.
54. Hasan IC, Subroto H, Puspasari G. Bitter Leaves Ethanol Extract (*Vernonia amygdalina*) Decreases Total Cholesterol Serum Level of Hypercholesterolemic Male Wistar Rats. *J Med Heal.* 2018;2(2):764–71. Diakses dari : https://www.researchgate.net/publication/327357419_Bitter_Leaves_Ethanol_Extract_Vernonia_amygdalina_Decreases_Total_Cholesterol_Serum_Level_of_Hypercholesterolemic_Male_Wistar_Rats

DOI: [10.28932/jmh.v2i2.1017](https://doi.org/10.28932/jmh.v2i2.1017)

55. Yurista SR, Ferdian RA, Sargowo D. Principles of the 3Rs and ARRIVE Guidelines in Animal Research. *Indones J Cardiol*. 2017;37(3):156–63. Diakses dari : <http://www.ijconline.id/index.php/ijc/article/view/579> DOI : <https://doi.org/10.30701/ijc.v37i3.579>
56. Celino FT, Yamaguchi S, Miura C, Ohta T, Tozawa Y, Iwai T, et al. Tolerance of spermatogonia to oxidative stress is due to high levels of Zn and Cu/Zn superoxide dismutase. *PLoS One*. 2011;6(2):1–11. Diakses dari : <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3041797/> DOI : [10.1371/journal.pone.0016938](https://doi.org/10.1371/journal.pone.0016938)
57. Adesanoye OA, Farombi EO. In Vitro Antioxidant Properties of Methanolic Leaf Extract of *Vernonia Amygdalina* Del. 2014;29(December):91–101. Diakses dari : <https://www.ncbi.nlm.nih.gov/pubmed/26196573>
58. Atangwho IJ, Ebong PE, Egbung GE, Obi AU. Extract of *Vernonia amygdalina* Del. (African bitter leaf) can reverse pancreatic cellular lesion after alloxan damage in the rat. *Aust J Basic Appl Sci*. 2010;4(5):711–6. Diakses dari : https://www.researchgate.net/publication/286968087_Extract_of_Vernonia_Amygdalina_Del_African_Bitter_Leaf_Can_Reverse_Pancreatic_Cellular_Lesion_after_Alloxan_Damage_in_the_Rat
59. Akpaso MI, Orié NN, Ebong PE. Administration of Combined Methanolic Leaf Extracts of *Vernonia amygdalina* and *Gongronema latifolium* Enhanced Glut 2 Expression in the Pancreas and Downregulates Serum Caspase 3 Activity of Streptozotocin-Induced Diabetic Wistar Rats. *J Adv Med Med Res*. 2019;30(9):1–10. Diakses dari : <https://www.journaljammr.com/index.php/JAMMR/article/view/30230>
60. Saalu LC, Kpela T, Benebo AS, Oyewopo AO, Anifowo EO, Oguntola JA. The dose-dependent testiculoprotective and testiculotoxic potentials of *Telfairia occidentalis* Hook f. leaves extract in rat. *Int J Appl Res Nat Prod*. 2010;3(3):27–38. Diakses dari : https://www.researchgate.net/publication/45258236_The_Dose-Dependent_Testiculoprotective_and_Testiculotoxic_Potentials_of_Telfairia_occidentalis_Hook_f_Leaves_Extract_in_Rat
61. Huang Y, Li L. DNA Crosslink Damage and Cancer - A Tale of Friend and Foe. *Transl Cancer Res*. 2013;2(3):144–54. Diakses dari: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3624763/pdf/nihms412728.pdf> DOI : [10.3978/j.issn.2218-676X.2013.03.01](https://doi.org/10.3978/j.issn.2218-676X.2013.03.01)
62. Soriton H, Yamlean PVY, Lolo WA. Uji Efektivitas Ekstrak Etanol Daun Tapak Dara (*Catharantus roseus* (L.) G.Don) Terhadap Penurunan Kadar Gula Darah Tikus Putih Jantan Galur Wistar (*Rattus norvegicus* L.) yang

Diinduksi Sukrosa. *J Ilm Farm* [Internet]. 2014;3(3):162–9. Diakses dari: <https://ejournal.unsrat.ac.id/index.php/pharmacon/article/view/5322/4835>

63. Wulandari AK. Pengaruh Kombinasi Ekstrak Etanol Sambiloto (*Andrographis Paniculata* (Burm.f.) Nees) dan Daun Salam (*Syzygium Polyanthum* (Wight.) Walp.) Terhadap Penurunan Kadar Glukosa Darah Mencit Jantan Galur Balb/C Yang Diinduksi Aloksan. Undergraduate Thesis. Univ Kristen Maranatha. 2008. Diakses dari : <http://repository.maranatha.edu/1542/>