



## DAFTAR PUSTAKA

- Acharya, A., Das, I., Chandhok, D., Saha, T., 2010. Redox regulation in cancer: a double-edged sword with therapeutic potential. *Oxid. Med. Cell. Longev.* doi: 10.4161/oxim.3.1.10095.
- Al-Ishaq, R. K., Abotaleb, M., Kubatka, P., Kajo, K., & Büsselberg, D., 2019. Flavonoids and Their Anti-Diabetic Effects: Cellular Mechanisms and Effects to Improve Blood Sugar Levels. *Biomolecules*. <https://doi.org/10.3390/biom9090430>
- Al-Olayan, E.M., El-Khadragy, M.F., Aref, A.M., Othman, M.S., Kassab, R.B., Abdel Moneim, A.E., 2014. The potential protective effect of *Physalis peruviana* L. against carbon tetrachloride-induced hepatotoxicity in rats is mediated by suppression of oxidative stress and downregulation of MMP-9 expression. *Oxid. Med. Cell. Longev.* doi: 10.1155/2014/381413.
- Alves, M.G., Martins, A.D., Cavaco, J.E., Socorro, S., Oliveira, P.F., 2013. Diabetes, insulin-mediated glucose metabolism and Sertoli/blood-testis barrier function. *Tissue Barriers*. doi: 10.4161/tisb.23992.
- Aziz, A.M., Permatasari, N., Soeharto, S., Nugrahenny, D., 2021. Effect of *Physalis Angulata* L. Leaf Water Extract on Malondialdehyde (MDA) Testis, Calcium Intracellular Sperm and Total Motile Sperm of Male Wistar Rats (*Rattus Novergicus*) Model of Hypertension. *Medico-legal Update*. <https://doi.org/10.37506/mlu.v21i2.2648>
- Ballester, J., Muñoz, M. C., Domínguez, J., Rigau, T., Guinovart, J. J., & Rodríguez-Gil, J. E., 2004. Insulin-dependent diabetes affects testicular function by FSH- and LH-linked mechanisms. *J. Androl.* <https://doi.org/10.1002/j.1939-4640.2004.tb02845.x>
- Batlajery, Y., Hiariej, A., Dece, E.S., 2022. Kajian Etnobotani Tumbuhan Obat Pada Masyarakat Desa Watmuri Kecamatan Nirunmas Kabupaten Kepulauan Tanimbar. *BIOSEL (Biology Sci Educ J Penelit Sci dan Pendidik)*
- Bhattacharya, S. M., Ghosh, M., & Nandi, N., 2014. Diabetes mellitus and abnormalities in semen analysis. *J. Obstet. Gynecol.* <https://doi.org/10.1111/jog.12149>
- Boyer, F., Vidot, J.B., Dubourg, A.G., Rondeau, P., Essop, M.F., Bourdon, E., 2015. Oxidative stress and adipocyte biology: focus on the role of AGEs. *Oxid. Med. Cell. Longev.* doi: 10.1155/2015/534873.



Brondum, E., Nilsson, H., Aalkjaer, C., 2005. Functional abnormalities in isolated arteries from Goto-Kakizaki and streptozotocin-treated diabetic rat models. *Horm. Metab. Res.* doi: 10.1055/s-2005-861370.

Cannarella, R., Arato, I., Condorelli, R. A., Mongioi, L. M., Lilli, C., Bellucci, C., et al., 2019. Effects of Insulin on Porcine Neonatal Sertoli Cell Responsiveness to FSH In Vitro. *J.Clin.Med.* <https://doi.org/10.3390/jcm8060809>

Chen, M., Wang, X., Wang, Y., Zhang, L., Xu, B., Lv, L., 2014. Wt1 is involved in Leydig cell steroid hormone biosynthesis by regulating paracrine factor expression in mice. *Biol. Reprod.* doi: 10.1095/biolreprod.113.114702.

Cheng, J., Watkins, S. C., & Walker, W. H., 2007. Testosterone activates mitogen-activated protein kinase via Src kinase and the epidermal growth factor receptor in sertoli cells. *Endocrinology*. <https://doi.org/10.1210/en.2006-1465>

Cui, Y., Niu, A., Pestell, R., Kumar, R., Curran, E. M., Liu, Y., et al., 2006. Metastasis-associated protein 2 is a repressor of estrogen receptor alpha whose overexpression leads to estrogen-independent growth of human breast cancer cells. *Mol. Endocrinol.* <https://doi.org/10.1210/me.2005-0063>

Condorelli, R. A., La Vignera, S., Mongioi, L. M., Alamo, A., & Calogero, A. E., 2018. Diabetes Mellitus and Infertility: Different Pathophysiological Effects in Type 1 and Type 2 on Sperm Function. *Front. Endocrinol.* <https://doi.org/10.3389/fendo.2018.00268>

Fadhli, H., Ruska, S.L., Furi, M., Suhery, W.N., Susanti, E., Nasution, M.R., 2023. Ciplukan (*Physalis angulata* L.) : Review Tanaman Liar yang Berpotensi sebagai Tanaman Obat. *Jurnal Farmasi Indonesia*. <https://doi.org/10.35617/jfionline.v15i2.144>

Faure, A. K., Pivot-Pajot, C., Kerjean, A., Hazzouri, M., Pelletier, R., Pe'oc'h, M., et al., 2003. Misregulation of histone acetylation in Sertoli cell-only syndrome and testicular cancer. *Mol. Hum. Reprod.*

El-Nikhely, N., Karger, A., Sarode, P., Singh, I., Weigert, A., Wietelmann, A., et al., 2020. Metastasis-Associated Protein 2 Represses NF- $\kappa$ B to Reduce Lung Tumor Growth and Inflammation. *Cancer Res.* <https://doi.org/10.1158/0008-5472.CAN-20-1158>

Federer, W.Y., 1963. Experimental Design, Theory and Application. New York: MacMillan;544.



Fietz, D., Bergmann, M., 2017. Functional anatomy and histology of the testis. In : Simoni, M., Huhtaniemi, I. (Ed.) : *Endocrinology of the testis and male reproduction*. Springer, Cham.

França, L.R., Hess, R.A., Dufour, J.M., Hofmann, M.C. and Griswold, M.D. 2016. The Sertoli cell: one hundred fifty years of beauty and plasticity. *Andrology*. <https://doi.org/10.1111/andr.12165>

George, J. W., Dille, E. A., & Heckert, L. L., 2011. Current concepts of follicle-stimulating hormone receptor gene regulation. *Biol. Reprod.* <https://doi.org/10.1095/biolreprod.110.085043>

Gerber, J., Heinrich, J., Brehm, R., 2016. Blood-testis barrier and Sertoli cell function: lessons from SCCx43KO mice. *Reproduction*. <https://doi.org/10.1530/REP-15-0366>

Giacco, F., Brownlee, M., 2010. Oxidative stress and diabetic complications. *Circ. Res.* doi: 10.1161/CIRCRESAHA.110.223545.

Hazra, R., Jimenez, M., Desai, R., Handelsman, D.J., Allan, C.M., 2013. Sertoli cell androgen receptor expression regulates temporal fetal and adult Leydig cell differentiation, function, and population size. *Endocrinology*. doi: 10.1210/en.2012-2273.

He, Z., Yin, G., Li, Q.Q., Zeng, Q., Duan, J., 2021. Diabetes Mellitus Causes Male Reproductive Dysfunction: A Review of the Evidence and Mechanisms. *In Vivo*. doi: 10.21873/invivo.12531.

Hedger, M. P., 2015. The Immunophysiology of Male Reproduction. *Knobil and Neill's Physiology of Reproduction*. <https://doi.org/10.1016/B978-0-12-397175-3.00019-3>

Hou, S., Yuan, Q., Yu, N., Liu, B., Huang, G., & Yuan, X., 2019. Cardamonin attenuates chronic inflammation and tumorigenesis in colon. *Cell Cycle*. <https://doi.org/10.1080/15384101.2019.1673620>

Hou, W., Dong, Y., Zhang, J., Yin, Z., Wen, H., Xiong, L., et al., 2012. Hypoxia-induced deacetylation is required for tetraploid differentiation in response to testicular ischemia-reperfusion (IR) injury. *J.Androl.* <https://doi.org/10.2164/jandrol.112.016584>

Ighodaro, O.M., 2018. Molecular pathways associated with oxidative stress in diabetes mellitus. *Biomed. Pharmacother.* doi: 10.1016/j.biopharm.2018.09.058.



International Diabetes Federation. 2021. *IDF Diabetes Atlas*, 10th edn. Brussels, Belgium. Available at: <https://www.diabetesatlas.org>

Iwansyah, A. C., Luthfiyanti, R., Ardiansyah, R. C. E., Rahman, N., Andriana, Y., & Abd Hamid, H., 2022. Antidiabetic activity of *Physalis angulata* L. fruit juice on streptozotocin-induced diabetic rats. *S. Afr. J. Bot.*

Kaur, G., Thompson, L. A., Babcock, R. L., Mueller, K., & Dufour, J. M., 2018. Sertoli Cells Engineered to Express Insulin to Lower Blood Glucose in Diabetic Mice. *DNA Cell Biol.* <https://doi.org/10.1089/dna.2017.3937>

Kianifard, D., Sadrkhanlou, R. A., & Hasanzadeh, S. (2012). The ultrastructural changes of the sertoli and leydig cells following streptozotocin induced diabetes. *Iran J. Basic Med. Sci.*

Krausz, C., & Farnetani, G., 2023. Clinical Interpretation of Semen Analysis. In: Bettocchi, C., Busetto, G.M., Carrieri, G., Cormio, L. (eds) Practical Clinical Andrology. Springer, Cham. [https://doi.org/10.1007/978-3-031-11701-5\\_13](https://doi.org/10.1007/978-3-031-11701-5_13)

Kubatka, P., Mazurakova, A., Samec, M., Koklesova, L., Zhai, K., Al-Ishaq, R., et al., 2021. Flavonoids against non-physiologic inflammation attributed to cancer initiation, development, and progression-3PM pathways. *EPMA J.* <https://doi.org/10.1007/s13167-021-00257-y>

Kumar, A., Raut, S., Balasinor, N.H., 2018. Endocrine regulation of sperm release. *Reprod. Fertil. Dev.* doi: 10.1071/RD18057

Lazo-de-la-Vega-Monroy, M. L., Fernandez-Mej, C., 2013. Oxidative Stress in Diabetes Mellitus and the Role Of Vitamins with Antioxidant Actions. In : José A. Morales-González, J.A (Ed.) : *Oxidative Stress and Chronic Degenerative Diseases - A Role for Antioxidants*. Intech. doi:10.5772/51788

Liu, B., Zhang, X., Qin, M., Song, A., Cui, T., Wang, C., 2016. Malfunction of Sertoli cell secretion leads to testicular damage in diabetic rats. *Int. J. Clin. Exp. Med.*

Lotti, F., & Maggi, M., 2023. Effects of diabetes mellitus on sperm quality and fertility outcomes: Clinical evidence. *Andrology. Andrology.* <https://doi.org/10.1111/andr.13342>

Ma, P., Yu, F., Zhong, Y., Xu, L., & Xiao, P. 2023. Protective effects of flavonoids in *Coreopsis tinctoria* Nutt. in a mouse model of type 2 diabetes. *J. Ethnopharmacol.* <https://doi.org/10.1016/j.jep.2023.116214>



Mäkelä, J.A., Koskenniemi, J.J., Virtanen, H.E., Toppari, J., 2019. Testis Development. *Endocr. Rev.* doi: 10.1210/er.2018-00140. PMID: 30590466

Makkar, R., Behl, T., Arora, S., 2020 Role of HDAC Inhibitors in Diabetes Mellitus. *Curr. Res. Trans. Med.* doi: 10.1016/j.retram.2019.08.001

Malini, D. M., Ratningsih, N., Fitriani, N., Rahmi, D., 2020. Potensi regenerasi sel Sertoli dan sel Leydig tikus (*Rattus norvegicus*) model diabetes pasca pemberian ekstrak etanol kulit buah jengkol (*Archidendron pauciflorum*). *Jurnal Pro-Life*. doi: 10.33541/jpvol6Iss2pp102.

Maliangkay, H. P., Rumondor, R., & Kantohe, M., 2019. Skrining Fitokimia dan Potensi Antidiabetes Ekstrak Etanol Herba Ciplukan (*Physalis Angulata L*) pada Tikus Putih (*Rattus Novergicus*) yang Diinduksi Aloksan. *Bio-Edu: Jurnal Pendidikan Biologi*.

Mallidis, C., Agbaje, I., McClure, N., Kliesch, S., 2011. The influence of diabetes mellitus on male reproductive function: a poorly investigated aspect of male infertility. *Urologe A*. doi: 10.1007/s00120-010-2440-3.

Meng, J., Greenlee, A.R., Taub, C.J., Braun, RE., 2011. Sertoli cell-specific deletion of the androgen receptor compromises testicular immune privilege in mice. *Biol. Reprod.* doi: 10.1095/biolreprod.110.090621.

Meroni, S. B., Galardo, M. N., Rindone, G., Gorga, A., Riera, M. F., et al., 2019. Molecular Mechanisms and Signaling Pathways Involved in Sertoli Cell Proliferation. *Front. Endocrinol.* <https://doi.org/10.3389/fendo.2019.00224>

Mescher, A., 2018. The male reproductive system. In: *Junqueira's Basic Histology. 15th edition*. McGraw Hill Education, New York.

Nna, Victor., Bakar, A., Ainul., Mohamed., Mahaneem., 2017. Diabetes mellitus-induced male reproductive impairment: The role of natural products: A review. *J. Appl. Pharm. Sci.* 10.7324/JAPS.2017.70932.

Oatley, M.J., Racicot, K.E., Oatley, J.M., 2011. Sertoli cells dictate spermatogonial stem cell niches in the mouse testis. *Biol. Reprod.* doi: 10.1095/biolreprod.110.087320.

O'Donnell, L., Stanton, P., de Kretser, D.M., 2017. Endocrinology of the Male Reproductive System and Spermatogenesis. In: Feingold, K.R, Anawalt, B., Blackman, M.R., et al (Ed.) : *Endotext*. South Dartmouth (MA). Available from: <https://www.ncbi.nlm.nih.gov/books/NBK279031/>

O'Donnell, L., Smith, L.B., Reboucet, D., 2022. Sertoli cells as key drivers of testis function. *Semin. Cell. Dev. Biol.* doi: 10.1016/j.semcdb.2021.06.016.



- Oduwole, O.O., Peltoketo, H., Huhtaniemi, I.T., 2018. Role of Follicle-Stimulating Hormone in Spermatogenesis. *Front Endocrinol.* doi: 10.3389/fendo.2018.00763.
- Ojo, O. O., & Olorunsogo, O. O., 2021. Quercetin and vitamin E attenuate diabetes-induced testicular anomaly in Wistar rats via the mitochondrial-mediated apoptotic pathway. *Andrologia.* <https://doi.org/10.1111/and.14185>
- Oliveira, A.M., Malunga, L.N., Perusello, C.A., Beta, T., Ribani, R.H., 2020. Phenolic acids from fruits of *Physalis angulata* L. in two stages of maturation. *S. Afr. J. Bot.*
- Pranaka, R.N., Yusro, F., Budiastutik, I., 2020. Pemanfaatan Tanaman Obat Oleh Masyarakat Suku Melayu Di Kabupaten Sambas. *J Tumbuh Obat Indones.*
- Ramakrishna Pillai, J., Wali, A.F., Menezes, G.A., Rehman, M.U., Wani, T.A., Arafah, A., Zargar, S., et al., 2022. Chemical Composition Analysis, Cytotoxic, Antimicrobial and Antioxidant Activities of *Physalis angulata* L.: A Comparative Study of Leaves and Fruit. *Molecules.* doi: 10.3390/molecules27051480
- Rebourcet, D., Darbey, A., Monteiro, A., Soffientini, U., Tsai, Y.T., Handel, I., 2017. Sertoli Cell Number Defines and Predicts Germ and Leydig Cell Population Sizes in the Adult Mouse Testis. *Endocrinology.* doi: 10.1210/en.2017-00196.
- Sadler, T.W., 2012. Gametogenesis : Conversion of Germ Cells into Male and Female Gametes. In: *Langman's Medical Embryology*, 12th Edition. Wolters Kluwer, Philadelphia.
- Sahu, S. K., Cockrem, J. F., Parkinson, T. J., & Laven, R. A, 2017. Effects of GnRH, a progesterone-releasing device, and energy balance on an oestrus synchronisation program in anoestrous dairy cows. *Aust. Vet. J.* <https://doi.org/10.1111/avj.12611>
- Schmittgen, T. D., & Livak, K. J., 2008. Analyzing real-time PCR data by the comparative C(T) method. *Nature protocols.* <https://doi.org/10.1038/nprot.2008.73>
- Shah, W., Khan, R., Shah, B., Khan, A., Dil, S., Liu, W., Wen, J., & Jiang, X., 2021. The Molecular Mechanism of Sex Hormones on Sertoli Cell Development and Proliferation. *Front Endocrinol.* <https://doi.org/10.3389/fendo.2021.648141>



Shima, Y., Miyabayashi, K., Haraguchi, S., Arakawa, T., Otake, H., Baba, T., 2013. Contribution of Leydig and Sertoli cells to testosterone production in mouse fetal testes. *Mol. Endocrinol.* doi: 10.1210/me.2012-1256.

Sholichin, M., 2020. Studi Etnobotani Tumbuhan Obat Oleh Etnis Bali dan Jawa di Desa Simpang Bayat Kecamatan Bayung Lencir Provinsi Sumatera Selatan. UIN Sulthan Thaha Saifuddin. Jambi

Si, W., Liu, X., Wei, R., Zhang, Y., Zhao, Y., Cui, L., et al., 2019. MTA2-mediated inhibition of PTEN leads to pancreatic ductal adenocarcinoma carcinogenicity. *Cell Death Dis.* <https://doi.org/10.1038/s41419-019-1424-5>

Song, K., Yang, X., An, G., Xia, X., Zhao, J., Xu, X., et al., 2022. Targeting APLN/APJ restores blood-testis barrier and improves spermatogenesis in murine and human diabetic models. *Nat. Commun.* <https://doi.org/10.1038/s41467-022-34990-3>

Stanton, P.G., 2016. Regulation of the blood-testis barrier. *Semin. Cell. Dev. Biol.* doi: 10.1016/j.semcdb.2016.06.018.

Styskal, J., Van Remmen, H., Richardson, A., Salmon, A.B., 2012. Oxidative stress and diabetes: what can we learn about insulin resistance from antioxidant mutant mouse models? *Free. Radic. Biol. Med.* doi: 10.1016/j.freeradbiomed.2011.10.441.

Sulistyowati, Y., Soedjono, S.K., Mustofa, Mulyono, B., 2014. The Difference Between Physalin Standardized Extract from Physalis Angulata . L and Control on Pancreatic Function of Sprague Dawley Rat Induced by Streptozotocin-Nicotinamide. *Sch. J. Appl. Med. Sci.*

Sun, L., Liu, J., Liu, P., Yu, Y., Ma, L., Hu, L., 2011. Immunosuppression effect of Withanolide A from Physalis angulata via heme oxygenase 1-dependent pathways. *Process Biochem.*

Tung, K.S., Harakal, J., Qiao, H., Rival, C., Li, J.C., Paul, A.G., Wheeler, K., 2017. Egress of sperm autoantigen from seminiferous tubules maintains systemic tolerance. *J. Clin. Invest.* doi: 10.1172/JCI89927.

Ukwubile, C.A., Bingari, M.S., Angyu, A.E., Garba, L.C., 2018. Physalis angulata Linn. (Solanaceae) Leaf Extract Boosts Fertility, Sperm Production and Haematological Parameters in Swiss Male Albino Rats. *Int. J. Med. Plants Nat. Prod.*

Ulloa-Aguirre, A., Reiter, E., & Crépieux, P., 2018. FSH Receptor Signaling: Complexity of Interactions and Signal Diversity. *Endocrinology.* <https://doi.org/10.1210/en.2018-00452>



Vandesompele, J., De Preter, K., Pattyn, F., 2002. Accurate normalization of real-time quantitative RT-PCR data by geometric averaging of multiple internal control genes. *Genome Biol.* <https://doi.org/10.1186/gb-2002-3-7-research0034>

Vessal, M., Hemmati, M., & Vasei, M., 2003. Antidiabetic effects of quercetin in streptozocin-induced diabetic rats. *Comp. Biochem. Physiol. C. Toxicol. Pharmacol.* [https://doi.org/10.1016/s1532-0456\(03\)00140-6](https://doi.org/10.1016/s1532-0456(03)00140-6)

Wahyuningsih, M., Wiwekananda, K., Putri, A., Nugrahaningsih, D., Yuniyanti, M. 2023. Bioassay Guided Fractionation of Ciplukan (*Physalis angulata* L.) Monitored by Glucose Consumption Assay and Thin Layer Chromatography on Myoblast Cells. *Majalah Obat Tradisional.* doi:<https://doi.org/10.22146/mot.79783>

Wang, JM., Li, ZF., Yang, WX., 2022. Follicle-stimulating hormone signaling in Sertoli cells: a licence to the early stages of spermatogenesis. *Reprod. Biol. Endocrinol.* <https://doi.org/10.1186/s12958-022-00971-w>

Wang, N., Yi, W. J., Tan, L., Zhang, J. H., Xu, J., Chen, Y., et al., 2017. Apigenin attenuates streptozotocin-induced pancreatic  $\beta$  cell damage by its protective effects on cellular antioxidant defense. *In Vitro Cell. Dev. Biol. Anim.* <https://doi.org/10.1007/s11626-017-0135-4>

Weng, X., Ma, X., Wang, Q., Xu, K., Hu, X., Liu, W., Zhang, C., 2019. Effect of hypothyroidism on CYP51 and FSHR expression in rat ovary. *Theriogenology.* doi: 10.1016/j.theriogenology.2019.07.012.

World Health Organization. 2016. *Global report on diabetes*. Geneva : World Health Organization. [https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257\\_eng.pdf](https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf)

Xu, R., Wang, F., Zhang, Z., Zhang, Y., Tang, Y., Bi, J., 2023. Diabetes-Induced Autophagy Dysregulation Engenders Testicular Impairment via Oxidative Stress. *Oxid. Med. Cell. Longev.* doi: 10.1155/2023/4365895.

Yao, D., Brownlee, M., 2010. Hyperglycemia-induced reactive oxygen species increase expression of the receptor for advanced glycation end products (RAGE) and RAGE ligands. *Diabetes.* doi: 10.2337/db09-0801.

Ye, R. J., Yang, J. M., Hai, D. M., Liu, N., Ma, L., Lan, X. B., 2020. Interplay between male reproductive system dysfunction and the therapeutic effect of flavonoids. *Fitoterapia.* <https://doi.org/10.1016/j.fitote.2020.104756>



Zhang, S., Li, W., Zhu, C., Wang, X., Li, Z., Zhang, J., et al., 2012. Sertoli cell-specific expression of metastasis-associated protein 2 (MTA2) is required for transcriptional regulation of the follicle-stimulating hormone receptor (FSHR) gene during spermatogenesis. *J. Biol. Chem.* doi: 10.1074/jbc.M112.383802.

Zhang, X., Tang, Y., Lu, G., & Gu, J., 2023. Pharmacological Activity of Flavonoid Quercetin and Its Therapeutic Potential in Testicular Injury. *Nutrients*. <https://doi.org/10.3390/nu15092231>

Zhao, L., Gu, Q., Xiang, L., Dong, X., Li, H., Ni, J., et al., 2017. Curcumin inhibits apoptosis by modulating Bax/Bcl-2 expression and alleviates oxidative stress in testes of streptozotocin-induced diabetic rats. *Ther. Clin. Risk. Manag.* <https://doi.org/10.2147/TCRM.S141738>

Zhao, L., Yao, C., Xing, X., Jing, T., Li, P., Zhu, Z., et al., 2020.. Single-cell analysis of developing and azoospermia human testicles reveals central role of Sertoli cells. *Nat. Commun.* doi: 10.1038/s41467-020-19414-4.