DAFTAR PUSTAKA

Afriyanti, M. (2008). *Fermentabilitas dan kecernaan in vitro ransum yang diberi kursin bungkil biji jarak pagar (Jatropha curcas L.) pada ternak sapi dan kerbau.*InstitutPertanian Bogor.

Agrawal M, Khan DSK, Siddique S, Ajazuddina, Sarafe S, Sarafe SH, Alexandera A. (2020). Extraction *of catechins from green tea using supercritical carbon dioxide*. Green Sustainable Process for Chemical and Environmental Engineering and Science. 3: 41-46. https://doi.org/10.1016/B978-0-12-817388-6.00003-9

Alfaafa, J., , S., Sofyan, A., Sukria, H., &Istiqomah, L. (2019). *Effect of tannin supplementation from Uncariagambir extract on rumen fermentation, microbial protein and in vitro gas production*. *IOP Conference Series: Earth and Environmental Science*, 387. https://doi.org/10.1088/1755-1315/387/1/012039.

Anggorodi, R. (1994). *Ilmu Pakan Ternak Umum*. Penerbit PT Gramedia Pustaka Utama. Jakarta.

Am, M., Anggraeny, Y., &Wina, E. (2021). *The Role of Catechin Compounds and Its Derivates to Mitigate Methane Gas Production in the Rumen Fermentation*. *Wartazoa*,31,13-22. https://doi.org/10.14334/WARTAZOA.V31I1.2548.

Ampapon, T., Phesatcha, K., &Wanapat, M. (2019). *Effects of Phytonutrients on Ruminal Fermentation, Digestibility, and Microorganisms in Swamp Buffaloes*. *Animals : an Open Access Journal from MDPI*, 9. https://doi.org/10.3390/ani9090671.

Antonius. 2023. *Ekstrak daun gambir sebagai pakan aditif: Pengaruhnya terhadap fermentasi rumen, performa dan kualitas daging kambing.* Institut Pertanian Bogor.

Antonius A, Pazla R, Putri EM, Alma'i MI, Laconi EB, Diapari D, Jayanegara A, Ardani LR, Marlina L, Purba RD, Gopar RA, Negara W, Asmaraicen S, and Negoro PS. (2024). *Effects of herbal plant supplementation on rumen fermentation profiles and protozoan population in vitro*. *Veterinary World*. 17(5): 1139–1148.

Antonius A, Pazla R, Putri EM, Negara W, Laia N, Ridla M, Suharti S, Jayanegara A, Asmairicen S, Marlina L, and Marta Y. (2023). *Effectiveness*

of herbal plants on rumen fermentation, methane gas emissions, in vitro nutrient digestibility, and population of protozoa. Veterinary World. 16(7): 1477–1488.

AOAC International, (2016). *Appendix F: Guidelines for Standard Method Performance Requirements*. AOAC Official Method of Analysis. AOAC International 1-18.

Becker PM, Wikselaar PG, Franssen MCR, de Vos RCH, Hall RD, Beekwilder J. (2014). *Evidence for a hydrogen-sink mechanism of (+)catechin-mediated emission reduction of the ruminant greenhouse gas methane. Metabolomics.* 10 (2): 179-189. https://doi.org/10.1007/s11306-013-0554-5.

Bhattacharya, D., Ghosh, D., Bhattacharya, S., Sarkar, S., Karmakar, P., Koley, H., & Gachhui, R. (2018). *Antibacterial activity of polyphenolic fraction of Kombucha against Vibrio cholerae: targeting cell membrane*. *Letters in Applied Microbiology*, 66. https://doi.org/10.1111/lam.12829.

Billman, E., Dillard, S., Roca-Fernández, A., & Soder, K. (2022). *Supplementation of Oilseeds to an Herbage Diet High in Condensed Tannins Affects Methane Production with Minimal Impact on Ruminal Fermentation in Continuous Culture*. *Fermentation*. https://doi.org/10.3390/fermentation8030109.

Bossche, T., Goossens, K., Haesaert, G., Wambacq, E., Vandaele, L., & Boever, J. (2023). *Autumn grass treated with a hydrolysable tannin extract versus lactic acid bacteria inoculant: Effects on silage fermentation characteristics and nutritional value and on performance of lactating dairy cows*. *Journal of animal physiology and animal nutrition*. https://doi.org/10.1111/jpn.13871.

Carvalho, I., Doelman, J., & Martín-Tereso, J. (2019). *Post-ruminal non-protein nitrogen supplementation as a strategy to improve fibre digestion and N efficiency in the ruminant*. *Journal of animal physiology and animal nutrition*. https://doi.org/10.1111/jpn.13233.

Castillo-Castillo, Y., Gonzalez-Mora, B., Anderson, R., Salinas-Chavira, J., Angulo-Montoya, C., Romero-Vilorio, L., Ruiz-Barrera, O., & Copado-Garcia, R. (2023). *PSXI-27 Live Yeasts Enhance Ruminal Fermentation of Fibrous Feedstuffs*. *Journal of Animal Science*. https://doi.org/10.1093/jas/skad281.740.

Chang, M., Ma, F., Wei, J., Liu, J., Nan, X., & Sun, P. (2021). *Live Bacillus subtilis natto Promotes Rumen Fermentation by Modulating Rumen Microbiota In Vitro*. *Animals : an Open Access Journal from MDPI*, 11. https://doi.org/10.3390/ani11061519.

Chen, Xinyu, Shifeng Pan, Fei Li, Xinyu Xu, and Hua Xing. (2022).*Plant-Derived Bioactive Compounds and Potential Health Benefits:Involvement of the Gut Microbiota and Its Metabolic Activity.Review.Biomolecules* 12 (12). https://doi.org/10.3390/biom12121871.

Chen, W., Zhu, X., Lu, Q., Zhang, L., Wang, X., & Liu, R. (2020). *C-ring cleavage metabolites of catechin and epicatechin enhanced antioxidant activities through intestinal microbiota*. *Food research international*, 135, 109271 .https://doi.org/10.1016/j.foodres.2020.109271.

Cherdthong A, Wanapat M. (2013). *Manipulation of in vitro ruminal fermentation and digestibility by dried rumen digesta*. Livest. Sci. 153: 94-100.

Chuzaemi, S., Mashudi, M., Ndaru, P., Huda, A., &Siswoyo, E. (2022). *Effect of Condensed Tannin and Myristic Acid in Corn Straw-Based Complete Feeds on NH3 Concentration and Microbial Protein Synthesis*. *Advances in Biological Sciences Research*. https://doi.org/10.2991/absr.k.220401.007.

Conway, E. J. dan E. O'Malley. (1942). *Microdiffusion methods: ammonia and urea using buffered absorbents (revised methods for ranges greater than 10 µgN).Biochemistry Journal*. 36: 655-66.

Dehority, B.A. (2004). *Rumen Microbiology*. Nottingham University Press, Nottingham.

Dhalimi, A. (2006). *Permasalahan Gambir (Uncaria gambir, L) di Sumatera Barat dan Alternatif Pemecahannya*. Perspektif. 5(4): 46-59.

Dijkstra, J. A. Bannink, A.M. van Vaouren, J.W. Spek, J. W. van Groenigen, and O. Oenema. (2013). *Diet effects on urine composition of cattle and N2O emissions*. *Animal*. 7(2): 292–302. doi: 10.1017/ S1751731113000578.

Djanun, L.N. C. (1998). *Peluang ekspor gambir di pasar Internasional*. BPEN. Depperindak Jakarta.

Elihasridas ., Pazla R., Jamarun N., Yanti G., Asmairicen S., Marlina L., Hadiatry M.C., Arief R.W., Bansi H.,Khan S.U., Khan F.A., Putri E.M., Antonius A., Ikhlas Z., Ikhsan Z., Ardani L.R., Siva A.T., Yendrita H., Zelinea F. (2024). *Effect of tanin degradation of mangrove fruit (Sonneratia alba) on nutrient degradation, protozoa population and methanegas production*. Czech J. Anim. Sci., 69: 292–301.

Elihasridas, Zain M, Pazla R, Sowmen S, Aini Q (2023). In-vitro digestibility of ammoniated aromatic supplemented lemongrass waste. Adv. Anim.Vet. Sci.

11(8): 1368-1376.https://doi.org/10.17582/journal.aavs/2023/11.8.1368.1376

Fardiaz, S. (1989). *Fisiologi Fermentasi*. PAU Pangan Gizi, Institut Pertanian Bogor, Bogor.

Fidriyanto, Ridwan FR, Rohmatussolihat, Astuti WD, Sari NF, Adi EBM, Mulyaningsih ES, Widyastuti Y. (2019). *In vitro rumen fermentability kinetics of parboiled rice bran*. J. of the Indones. Trop. Anim. Agric. 44(1): 96-105

Fieves, V., O. J. Babayemi., and D. Deyemi. (2005). *Estimation of direct and indirect gas production in syringes: A tool to estimate short chain fatty acid production that requires minimal laboratory facilities. Animal Feed Science and Technology*. Hal 197-210.

Franzolin, R., Rosales, F. P., & Soares, W. V. B. (2010).*Effects of dietary energy and nitrogen supplements on rumen fermentation and protozoa population in buffalo and zebu cattle*. RevistaBrasileria de Zootecnia. 39(3):549-555.

García-Lomillo J, Gonzalez-SanJose ML, Delpino-García V, Ortega-Heras M, Muñiz Rodríguez P. (2017). *Antioxidant effect of seasonings derived from wine pomace on lipid oxidation in refrigerated and frozen beef patties*. LWTFood Sci. Technol. 77: 85-91. https://doi.org/10.1016/j.lwt.2016.11.038.

García-Morales, S., Corzo-Jiménez, I. J., Silva-Córdova, N. F., Soto-Cordero, A. M., Rodríguez-Mejía, D. I., Pardo-Núñez, J., & León-Morales, J. M. (2022). *Comparative study of steroidal sapogenins content in leaves of five Agave species.Journal of the Science of Food and Agriculture*. https://doi.org/10.1002/jsfa.11912

General Laboratory Prosedure. 1996. Departement of Dairy Science. University of Wisconsin.

Gosselink, J.M.J., Poncet, C., Dulphy, J.P. and Cone, J.W. (2003). *Estimation of the duodenal flow of microbial nitrogen in ruminants based on the chemical composition of forages*. Anim. Res. 52: 229-243.INRA, IDP Sciences.

Griswold, K. E., G. A. Apgar., J. Bouton and J. I. Firkins. (2003). *Effects of urea infusion and ruminal degradable protein concentration on microbial growth digestibility and feratiton in continous culture*. J. Anim. Sci. Vol (81(1):329-336.

Guerreiro, O., Alves, S., Costa, M., Duarte, M., Jerónimo, E., & Bessa, R. (2021). *Effects of Increasing Doses of Condensed Tannins Extract from Cistus ladanifer L. on In Vitro Ruminal Fermentation and Biohydrogenation*. *Animals : an Open Access Journal from MDPI*, 11. https://doi.org/10.3390/ani11030761.

Gumbira-sa'id. E., K. Syamsu., A. Herryandie., E. Mardliyati dan N.A. Evalia. (2010). *Kajian perbaikanmutu pada agroindustry skalamikro dan kecilgambir Indonesia*. Jurnalilmupertanian Indonesia. Vol 15 (2):130-136

Hackmann, T., & Firkins, J. (2015). *Maximizing efficiency of rumen microbial protein production*. *Frontiers in Microbiology*, 6. https://doi.org/10.3389/fmicb.2015.00465.

Hapsari, N.S., Harjanti, D.W., dan Muk-tiani, A. (2018). *Fermentabilitas pakan dengan imbuhanekstrakdaunba-badotan(Ageratum conyzoides)dan jahe (Zingiber officinale)pada sapi perah secara in vitro*. Agripet,18(1),1-9.

Haryanto, S. (2009). *EnsiklopediaTanaman Obat Indonesia*. Yogyakarta: Palmall. 562 hal.

Hassanat, F., &Benchaar, C. (2013). *Assessment of the effect of condensed (acacia and quebracho) and hydrolysable (chestnut and valonea) tannins on rumen fermentation and methane production in vitro*. *Journal of the science of food and agriculture*, 93 2, 332-9 .https://doi.org/10.1002/jsfa.5763.

Huang, R., Wang, X., Ma, C., & Zhang, F. (2022). *Effects of intrinsic tannins on proteolysis dynamics, protease activity, and metabolome during sainfoin ensiling*. *Frontiers in Microbiology*, 13. https://doi.org/10.3389/fmicb.2022.976118

Isnawati. A., M. Raini., O. D. Sampurno., D. Mutiatikum., L. Widowati., dan R. Gitawati. (2012). *Karakteristik tiga jenis ekstrak Gambir (Uncaria gambir Roxb) dari Sumatera Barat*. Buletin Peneliti Kesehatan. Vol 40(4):201-208.

Jadhav, R., Kannan, A., Bhar, R., Sharma, O., Gulati, A., Rajkumar, K., Mal, G., Singh, B., & Verma, M. (2018). *Effect of tea (Camellia sinensis) seed saponins on in vitro rumen fermentation, methane production and true digestibility at different forage to concentrate ratios*. *Journal of Applied Animal Research*, 46, 118 - 124. https://doi.org/10.1080/09712119.2016.1270823.

Jamarun, N., Elihasridas, R. Pazla and Fitriyani. (2017). *In-vitro nutrients digestibility of the combination titonia (Tithonia diversifolia) and Napier grass (Pennisetum purpureum).Proceedings of the 7th International Seminar on Tropical Animal Production*. September 12- 14, 2017, Yogyakarta, Indonesia.

Jamarun N, Zain M, Arief, Pazla R. (2017). *Populations of rumen microbes and the in vitro digestibility of fermented oil palm founds in combination with tithonia (Tithonia diversifolia) and elephant grass (Pennisetum purpureum).* Pak. J. of Nutr. 17(1): 39-45.

Jamarun, N dan Y.S, Nur. (1999). *Pengaruh jumlah inokulum Aspergillus Niger dan lama fermentasi terhadap kadar air, protein kasar dan serat kasar kulit pisang*. J. Akademika 2 (3): 35 – 37

Jayanegara A, Sofyan A. (2008). *Penentuan aktivitas biologis tanin beberapa hijauan secara in vitro menggunakan "Hohenheim gas test" dengan polietilen glikol sebagai determinan*. Med. Pet. 3(1): 44-52.

Jayanegara A, Wina E, Takahashi J. (2014). *Meta-analysis on methane mitigating properties of saponin-rich sources in the rumen: Influence of addition levels and plant sources. Asian-Australasian Journal of Animal Sciences*: 27(10): 1426-1435. https://doi.org/10.5713/ajas.2014.14086

Jayanegara, A., Yogianto, Y., Wina, E., Sudarman, A., Kondo, M., Obitsu, T., & Kreuzer, M. (2020). Combination Effects of Plant Extracts Rich in Tannins and Saponins as Feed Additives for Mitigating in Vitro Ruminal Methane and Ammonia Formation. *Animals : an Open Access Journal from MDPI*, 10. https://doi.org/10.3390/ani10091531.

Jayanegara, A. (2008). *Reducing methane emissions from livestock: nutritional approaches. Proceedings of Indonesian Students Scientific Meeting (ISSM),*

Institute for Science and Technology Studies (ISTECS) European Chapter, 13-15 May 2008, Delft, the Netherlands: 18-21.

Junior, F., Nogueira, R., Carvalho, R., Cassiano, E., & Rodrigues, P. (2022). *Use of tannin extract as a strategy to reduce methane in Nellore and Holstein cattle and its effect on intake, digestibility, microbial efficiency and ruminal fermentation*. *Journal of animal physiology and animal nutrition*. https://doi.org/10.1111/jpn.13702.

Kand, D., Raharjo, I., Castro-Montoya, J., &Dickhoefer, U. (2018). *The effects of rumen nitrogen balance on in vitro rumen fermentation and microbial protein synthesis vary with dietary carbohydrate and nitrogen sources*. *Animal Feed Science and Technology*. https://doi.org/10.1016/J.ANIFEEDSCI.2018.05.005.

Kasim, Anwar., Asben, A., Mutiar, S. (2015). *Kajian Kualitas Gambir dan Hubungannya dengan Karakteristik Kulit Tersamak*. MajalahKulit, Karet dan Plastik. 31 (1): 55-64.

Kholif, A. (2023). *A Review of Effect of Saponins on Ruminal Fermentation, Health and Performance of Ruminants*. *Veterinary Sciences*, 10. https://doi.org/10.3390/vetsci10070450.

Kim, H., Kim, B., Yoo, D., Moon, J., Kwon, I., Lee, Y., & Seo, J. (2023). *In vitro evaluation of Aloe saponaria as a potential feed additive to modulate ruminal fermentation and microbial diversity*. *Journal of Applied Animal Research*, 51, 115 - 122. https://doi.org/10.1080/09712119.2023.2165086.

Koli P, Singh S, Bhadoria BK, Agarwal M, Lata S, Ren Y. (2022). *Sequential Extraction of Proanthocyanidin Fractions from Ficus Species and Their Effects on Rumen Enzyme Activities In Vitro*. Molecules. 27: 5153. https://doi.org/10.3390/molecules27165153.

Kurniawati, A. 2004. Pertumbuhan mikroba rumen dan efisiensi pemanfaatan nitrogen pada silase Red Clover (Trifolium pratense cv. Sabatron). Pusat Penelitian dan Pengembangan Teknologi Isotop dan Radiasi. BATAN, Jakarta (Risalah Seminar Ilmiah Penelitian dan Pengembangan Aplikasi Isotop dan Radiasi).

Kusumaningrum, C. E., Sugoro. I., dan Aditiawati. P. (2018). *Pengaruh Silase Sinambung Jerami Jagung Terhadap Fermentasi Dalam Cairan Rumen Secara In Vitro*. Jurnal Ilmu Ternak. Vol 18(1):26-33.

Kuryaningtyas IB, Pandansari PR, Astuti I, Widyawati SD, Suprayogi WPS. (2012). *Pengaruh macam akselerator terhadap kualitas fisik, kimiawi dan biologis silase rumput kolonjono*. Trop. Anim. Husb. 1(1): 7-14.

Ku-Vera, J., Jiménez-Ocampo, R., Valencia-Salazar, S., Montoya-Flores, M., Molina-Botero, I., Arango, J., Gómez-Bravo, C., Aguilar-Pérez, C., & Solorio-Sánchez, F. (2020). *Role of Secondary Plant Metabolites on Enteric Methane Mitigation in Ruminants*. *Frontiers in Veterinary Science*, 7. https://doi.org/10.3389/fvets.2020.00584

Layda, K. (2014). *Pengaruh pemakaian berbagai bahan sumber karbohidrat dalam pembuatan silase pucuk tebu (Saccharum officinarum, Linn) terhadap kecernaan BK, BO dan PK secara in-vitro*. Fakultas Peternakan Unand. Padang.

Li, M., White, R., Guan, L., Harthan, L., & Hanigan, M. (2021). *Metatranscriptomic analyses reveal ruminal pH regulates fiber degradation and fermentation by shifting the microbial community and gene expression of carbohydrate-active enzymes*. *Animal Microbiome*, 3. https://doi.org/10.1186/s42523-021-00092-6.

Li P, Liu A, Xiong W, Lin H, Xiao W, Huang J, Zhang S, Liu Z. (2019). *Catechins enhance skeletal muscle performance. Food Science and Nutrition*. 60 (3): 515- 528. https://doi.org/10.1080/10408398.2018.1549534.

Li, P., Mehmood, I., & Chen, W. (2022). *Effects of Polymeric Media-Coated Gynosaponin on Microbial Abundance, Rumen Fermentation Properties and Methanogenesis in Xinjiang Goats*. *Animals : an Open Access Journal from MDPI*, 12. https://doi.org/10.3390/ani12162035.

Liu, Y., Ying, D., Sanguansri, L., Cai, Y., & Le, X. (2018). *Adsorption of catechin onto cellulose and its mechanism study: Kinetic models, characterization and molecular simulation. Food research international*, 112, 225-232 .https://doi.org/10.1016/j.foodres.2018.06.044.

Lopes, A., Oliveira, J., Santos, E., Medeiros, A., Givisiez, P., Lemos, M., Santos, F., Silva, N., Azevedo, P., Sousa, L., Pereira, D., & Oliveira, C. (2020). *Goats fed with non-protein nitrogen: ruminal bacterial community and ruminal fermentation, intake, digestibility and nitrogen balance*. *The Journal of Agricultural Science*, 158, 781 - 790. https://doi.org/10.1017/S0021859621000162.

Lowry, O. H., N. J. Roserbrough, A. L. Farr, and R. J. Randall. (1951). *Protein measurement with the Folin reagent*. J. Biol. Chem. 193:265.

Makmur M, Zain M, Sholikin MM, Suharlina, Jayanegara A. (2022). *Modulatory effects of dietary tannins on polyunsaturated fatty acid biohydrogenation in the rumen: A meta-analysis*. Heliyon. 8: e09828. https://doi.org/10.1016/j.heliyon.2022.e09828.

Mani S, Aiyegoro OA, Adeleke MA. (2021). *Characterization of rumen microbiota of two sheep breeds suplemmented with direct-fed lactic acid bacteria*. Front. Vet. Sci. 7: 570074. McDonald P, Edwards RA, Greenh.

Martin, C., Doreau, M., &Morgavi. D. P. 2008. Methane Mitigation in Ruminants: From Rumen Microbes To The Animal. Inra, Ur 1213. Herbivores Research Unit Research Centre of Clermont-Ferrand-Theix, F63122. France: St Genes Champanell

McDonald P, Edwards RA, Greenhalgh JDF, Morgan CA, Sinclair LA, Wilkinson RG. (2011). *Animal Nutrition*. 7Th Editio. Harlow (UK) : Prentice Hall.

Muck KE, Filya I, Contreras-Govea FE. (2007). *Inoculant effects on alfalfa silage: in vitro gas and volatile fatty acid production*. J. of Dairy Sci. 90: 5115- 5125.

Murtidjo, B. A. (1990). *Sapipotong*. Kanisius, Yogyakarta

Musdja, M., Hapsari, M., & Agusta, A. (2018). *Comparison of Activity and Inhibitory Mechanism between (+)-Catechin and Water Extract of Gambier (Uncaria Gambir Roxb.) Against Some Bacteria*. *Scientific Journal of PPI - UKM*, 4, 55-60.

Navarrete, S., Kemp, P., Pain, S., & Back, P. (2016). *Bioactive compounds, aucubin and acteoside, in plantain (Plantago lanceolata L.) and their effect on in vitro rumen fermentation*. *Animal Feed Science and Technology*, 222, 158-167. https://doi.org/10.1016/J.ANIFEEDSCI.2016.10.008.

Northa MK, Zotte AD, Hoffmana LC. (2019). *The use of dietary flavonoids in meat production: A review. Animal Feed Science and Technology*. 257: 1-15. https://doi.org/10.1016/j.anifeedsci.2019.114291.

NRC. (2001). *Nutrient Requirements of Beef Cattle: Seventh Revised Edition: Update 2000. Subcommitte on Beef Cattle Nutrition. Committee on Animal Nutrition. National Research Council*.

Nurdin, E. and Fitrimiwati. (2018). *The effect of the gambir (Uncariagambir (hunt.) roxb.) leaves waste and white turmeric (Curcuma zedoaria) for the productivity, antioxidant content and mastitis condition of the fries holland dairy cows. IOP Conference Series: Earth and Environmental Science*. 119: 012041. https://doi.org/10.1088/1755-1315/119/1/012041.

Ogimoto, K. & S. Imai. (1981). *Atlas of rumen microbiology*. JSSP: Scientific Societes Press. Tokyo.

Olchowik-Grabarek, E., Sekowski, S., Kwiatek, A., Płaczkiewicz, J., Abdulladjanova, N., Shlyonsky, V., Święcicka, I., &Zamaraeva, M. (2022). *The Structural Changes in the Membranes of Staphylococcus aureus Caused by Hydrolysable Tannins Witness Their Antibacterial Activity*. *Membranes*, 12. https://doi.org/10.3390/membranes12111124.

Oliveira, L., Pereira, M., Oliveira, C., Oliveira, C., Silva, R., Pereira, R., DeVries, T., & Pereira, M. (2023). *Effect of low dietary concentrations of Acacia mearnsii tannin extract on chewing, ruminal fermentation, digestibility, nitrogen partition, and performance of dairy cows. Journal of dairy science*. https://doi.org/10.3168/jds.2022-22521.

Orzuna-Orzuna, J., Dorantes-Iturbide, G., Lara-Bueno, A., Mendoza-Martínez, G., Miranda-Romero, L., & Hernández-García, P. (2021). *Effects of Dietary Tannins' Supplementation on Growth Performance, Rumen Fermentation, and Enteric Methane Emissions in Beef Cattle: A Meta-Analysis*. *Sustainability*. https://doi.org/10.3390/SU13137410.

Parakkasi, A. (1995). *Ilmu Makanan Ternak Ruminansia*. Penerbit Universitas Indonesia. Jakarta.

Pathak, A. K. (2008). *Various factors affecting microbial protein synthesis in the rumen*. Vet. World. 1 (6) : 186 - 189.

Patra, A. K.and J. Saxena. (2010). *A new perspective on the use of plant secondary metabolites to inhibit methanogenesis in the rumen*. J. Phytochemistry. 71: 1198– 1222.

Patra, A., & Yu, Z. (2014). Combinations of nitrate, saponin, and sulfate additively reduce methane production by rumen cultures in vitro while not adversely affecting feed digestion, fermentation or microbial communities.. *Bioresource technology*, 155, 129-35 .https://doi.org/10.1016/j.biortech.2013.12.099.

Pazla R, Elihasridas, Jamarun N, Yanti G, Antonius, Putri EM, Ikhlas Z, Khan SU, Khan FA, Asmairicen S, Surachman M, Darmawan IWA, Akhadiarto S and Efendi Z. (2024). *Optimizing nutrient digestibility through fermentation of mangrove (Sonneratia alba) fruit with Aspergillus niger: implications for livestock feed quality improvement. International Journal of Veterinary Science* 13(6): 862-869. https://doi.org/10.47278/journal.ijvs/2024.182

Pazla R, Jamarun N, Agustin F, Zain M and Cahyani NO. (2021). In vitro nutrient digestibility, volatile fatty acids, and gas production of fermented palm fronds combined with tithonia (Tithonia diversifolia) and elephant grass (Pennisetum purpureum). IOP Conference Series: Earth and Environmental Science 888(1): 012067. https://doi.org/ 10.1088/1755-1315/888/1/012067

Pazla R, Jamarun N, Zain M and Arief. (2018). *Microbial protein synthesis and in vitro fermentability of fermented oil palm fronds by Phanerochaetechrysosporiumin combination with tithonia (Tithonia diversifolia) and elephant grass (Pennisetum purpureum). Pakistan Journal of Nutrition* 17(10): 462-470. https://doi.org/10.3923/pjn.2018.462.470

Puastuti, W. (2009*). Manipulasi Bioproses dalam Rumen untuk Meningkatkan Penggunaan Pakan Berserat*. Wartazoa, 19(4), 180-190.

Puniya AK, Singh R, Kamra DN. (2015). *Rumen Microbiology: from evolution to revolution*. Springer. India. eBook.

Putra, S. (2006). *Pengaruh Suplementasi Agensia Defaunasi Segar dan Waktu Inkubasi Terhadap Degradasi Bahan Kering, Bahan Organik, dan Produk Fermentasi Secra In Vitro*. Jurnal Protein.13(2). 141-148

Rahmadi, D., A. Muktiani, E. Pangestu, J. Achmadi, M. Christiyanto, Sunarso, Surono dan Surahmanto. (2010). *Ruminologi Dasar*. Jurusan Nutrisi dan Makanan Ternak Fakultas Peternakan Universitas Diponegoro. Sekawan, Semarang.

Rahmadi. (2003). *Parameter metabolisme rumen in-vitro limbah kubis terinsilase pada lama pemeraman berbeda*. Fakultas Peternakan Universitas Diponegoro. Semarang.

Ramadhan R, Permana IG, Jayanegara A, Rofiq MN, Wahyuni DS. (2019). *Supplementation effectivity of cassava and indigoferazollingeriana leaves extraction on rumen fermentation system of in vitro*. AIP Conf. Pro

Ramaiyulis, R., Metri, Y., Irda, I., Kurnia, D., & Syukriani, D. (2022). *Effects of Tannin-containing Supplement on Enteric Methane Emissions, Total Digestible Nutrient, and Average Daily Gain of Local Indonesian Beef Cattle*. *World's Veterinary Journal*. https://doi.org/10.54203/scil.2022.wvj45.

Ramaiyulis, R. (2021). *Rumen un-degraded dietary protein and TCA soluble protein with gambier leave residue supplementation as a source of tannins in cattle feed supplement*. *IOP Conference Series: Earth and Environmental Science*, 759. https://doi.org/10.1088/1755-1315/759/1/012045.

Ramos-Morales, E., Fuente, G., Duval, S., Wehrli, C., Bouillon, M., Lahmann, M., Preskett, D., Bragança, R., & Newbold, C. (2017). *Antiprotozoal Effect of Saponins in the Rumen Can Be Enhanced by Chemical Modifications in Their Structure*. *Frontiers in Microbiology*, 8. https://doi.org/10.3389/fmicb.2017.00399.

Ranjhan, S. K. (1977). *Animal Nutrition and Feeding Practices in India*. Vikas Publishing House PVT. Ltd. New Delhi, Bombay, Bangalore Calcutta Kampar. p. 68-87.

Rangkuti, J. H. (2011). *Produksi dan Kualitas Susu Kambing Peranakan Etawah (PE) pada Kondisi Tatalaksana yang Berbeda.Departemen Ilmu Produksi dan Teknologi Peternakan*. Fakultas Peternakan. Institut Pertanian Bogor.

Rela, S., Sribudiani. E. dan Darlis. V. V. (2023). *Kaitan prduksi tanaman gambir (Uncaria gambir Rovb.) berdasarkan ketinggian tempat tumbuh di Kabupaten Lima Puluh Kota*. Jurnal Ilmu-ilmu Kehutanan. Vol 7(1).

Riswandi, R., Priyanto, L., Imsya, A., & Nopiyanti, M. (2017). *Kecernaan in vitro ransum berbasis Rumput Kumpai (Hymenachne acutigluma) fermentasi disuplementasi legum berbeda (In vitro digestibility of fermented hymenacne acutigluma-based rations supplemented with different legumes).* Jurnal Veteriner, 18(2), 303–311. https://doi.org/10.19087/ jveteriner.2017.18.2.303

Rosmalia, A., Dewi, N., Permana, I., & , D. (2022). *Reformulation of Dairy Cattle Concentrate Based on Rumen Degradable Protein to Undegradable Protein*

Ratio at Different Energy Levels: In Vitro Study. *IOP Conference Series: Earth and Environmental Science*, 1020. https://doi.org/10.1088/1755-1315/1020/1/012008.

Rosmalia, A., Permana, I., &Despal, D. (2022). *Synchronization of rumen degradable protein with non-fiber carbohydrate on microbial protein synthesis and dairy ration digestibility*. *Veterinary World*, 15, 252 - 261. https://doi.org/10.14202/vetworld.2022.252-261.

Russell, J.B., Muck, R.E., and Weimer, P.J. (2009). *Quantitative analysis of cellulose degradation and growth of cellulolytic bacteria in the rumen. FEMS MicrobiolEcol* 67:183-197.

Salami, S., Valenti, B., Bella, M., O'Grady, M., Luciano, G., Kerry, J., Jones, E., Priolo, A., & Newbold, C. (2018). *Characterisation of the ruminal fermentation and microbiome in lambs supplemented with hydrolysable and condensed tannins*. *FEMS microbiology ecology*, 94 5. https://doi.org/10.1093/femsec/fiy061.

Sari NF, Ridwan R, Rohmatussolihat, Fidriyanto R, Astuti WD, Widyastuti Y. (2018). *Characteristic of different level of fermented concentrate in the rumen metabolism based on in vitro*. J. of the Indones. Trop. Anim. Agric. 43(3). 296-305.

Schneider, B.H. and W.P. Flatt. (1975). *The Evaluation of Feeds Through Digestibility Experiment*. The University of Georgia Press, New York. 23-15.

Sebayang, L. (2013). *Budidaya dan Pengolahan Gambir*. Badan Penelitian dan Pengembangan Pertanian. Sumatera Utara.

Sejati G, Prasetyo BWHE, Surono. (2012). *Pengaruh ekstraksi dan proteksi dengan tanin pada tepung kedelai terhadap produksi gas total dan metan secara in vitro*. Anim. Agric. J. 1(1): 241- 256.

Setiawan, W., Yusiati, L., Hanim, C., &Muhlisin, M. (2022). *The Effect of Mixed Leaves Tannin Sources (Acacia mangium Willd, Swietenia mahagoni, and Artocarpus heterophyllus) in Pellets on In Vitro Methane Production*. *Advances in Biological Sciences Research*. https://doi.org/10.2991/absr.k.220401.055.

Singh, R., Dey, A., & Singh, M. (2023). Modulating Natural Methane Release from Rumen Fermentation through the Use of Ficus glomerata Leaf Tannins in Murrah Buffalo (Bubalus bubalis). *Methane*. https://doi.org/10.3390/methane2030021.

Sinz, S., Marquardt, S., Soliva, C., Braun, U., Liesegang, A., & Kreuzer, M. (2019). *Phenolic plant extracts are additive in their effects against in vitro ruminal methane and ammonia formation*. *Asian-Australasian Journal of Animal Sciences*, 32, 966 - 976. https://doi.org/10.5713/ajas.18.0665.

Suharti S, A. Kurniawan, D.A. Astuti, E. Wina. (2010). *Microbial population and fermentation characteristic in response to sapindusrarak mineral block supplementation*. Media Peternakan 33(3); 150-154.

Sutardi, T. (1980). *Ikhtisar Ruminologi. Bahan Penataran Kursus Peternakan Sapi Perah di Kayu Ambon, Lembang*. BPPLP-Dit, Jend. Peternakan – FAO.

Syamsiyah, D., Suharti, S., & Jayanegara, A. (2023). *Fermentation Characteristics, Digestibility, and Estimation of Ruminant Methane from Saponin: A Quantitative Study*. *Jurnal Sain Peternakan Indonesia*. https://doi.org/10.31186/jspi.id.18.2.76-82.

Thanh, L., Kha, P., Loor, J., & Hằng, T. (2022). *Grape seed tannin extract and polyunsaturated fatty acids affect in vitro ruminal fermentation and methane production*. *Journal of animal science*. https://doi.org/10.1093/jas/skac039.

Tilley, JMA, and RA Terry. (1963). *A two stage technique for in vitro digestin of forage crops*. J. Brit. Grass.Soc. 18.108-111.

Tillman, A.D., H. Hartadi, S. Reksohadiprodjo, S. Prawirokusumo, dan S. Lebdosukojo. (1998). *Ilmu Makanan Ternak Dasar*. Cetakan ke-4. Gadjah Mada University Press, Yogyakarta.

Towne, G., T.G. Nagaraja, J. Brandt, R.T. and K.E. Kemp. (1990). *Dynamics of ruminal ciliated protozoa in feedlot cattle*. Appl. Environ. Microbiol. 56:3174-3178.

Tulung, Y.L.R. dan A. F. Pendong., B. T. (2020). *Evaluasi Nilai Biologis Pakan LengkapBerbasis Tebon Jagung dan RumputCampuranTerhadap Kinerja ProduksiSapi Peranakan Ongole (PO).*Zootec, 40(1): 2612–8698.

Uddin, J.M., K.Z Haque., K.M Jasimuddin,. and K.M.M Hasan,. (2015) *Dynamics of microbial protein synthesis in the rumen a review. Ann. Vet. Anim. Sci.,*

2(5): 2312- 9123Unnawong, N., Cherdthong, A., & So, S. (2021). Crude saponin extract from Sesbania grandiflora (L.) Pers pod meal could modulate ruminal fermentation, and protein utilization, as well as mitigate methane production. *Tropical Animal Health and Production*, 53. https://doi.org/10.1007/s11250-021-02644-z.

Wahyuni IMDA, Muktiani A, Christianto M. (2014). *Penentuan dosis tanin dan saponin untuk defaunasi dan peningkatan fermentabilitas pakan.* JITP3(3):133-140.

Wanapat M, Cherdtong A, Pakdee P, Wanapat S. (2014). *Manipulation of rumen ecology by dietary lemongrass powder supplementation*. J. Anim Sci. 86(3): 3497-3503

Wang JK, Ye JA, Liu JX. (2012). *Effects of tea saponins on rumen microbiota, rumen fermentation, methane production and growth performance: a review. Tropical animal health and production*. 44(4): 697-706.

Widyarini, S., Nagari, F., Hanim, C., Bachruddin, Z., Muhlisin, M., &Yusiati, L. (2021). *Effect of Nigella sativa L. as Saponin Sources on In vitro Rumen Fermentation, Enzyme Activity and Nutrients Digestibility*. *Advances in Animal and Veterinary Sciences*. https://doi.org/10.17582/journal.aavs/2021/9.12.2247.2257.

Wina, E., & Muetzel, S. (2020). *Effect of lerak (Sapindus rarak) extract in high roughage diet on rumen microbial protein microbial protein synthesis and performance of. Indonesian Journal of Agricultural Science*. https://doi.org/10.21082/ijas.v21n2.2020.p89-97.

Yang, C., Bing-Wen, S., Qi-Yu, D., Hai, J., Shu-Qin, Z. and Yan, T. (2016). *Rumen fermentation and bacterial communities in weaned Chahaer lambs on diets with different protein levels*. J. Integr. Agric., 15(7): 1564-1574.

Yang CS, Wang X, Lu G, Picinich SC. (2009). *Cancer prevention by tea: animal studies, molecular mechanisms and human relevance*. *Nature Reviews Cancer*. 9 (6): 429-439. https://doi.org/10.1038/nrc2641

Yanza, Y., Jayanegara, A., Fitri, A., & Hidayat, C. (2023). *Tea saponin modulates in vitro rumen fermentation profile and reduces methane production ; a meta-analysis*. Biotropia. https://doi.org/10.11598/btb.2023.30.1.1805.

Yeni G, Syamsu K, Suparno O, Mardliyati E, Muchtar E. (2014). *Repeated extraction process of raw gambiers (Uncaria gambier Roxb.) for the catechin production as an antioxidant*. IJAER. 9: 24565-24578.

Yokohama, M.T. and K.A. Johnson. (1988). *Microbiology of the rumen and intestine in The Ruminant Animal Digestive Physiology and Nutrition. Church, D.C ed. Prentice Hall. New Yersey.*

Yuliarti, I. (2022). *Mitigasi gas etanaasaljeramipadimelaluipemanfaatannyasebagaipakanternakruminansia*. Universitas Jambi.

Yunus, M. (2002). *Kajian Usaha Tani Gambir di Lahan Miring dan Upaya Konservasi Tanah dan Air (Studi Kasus Sub DAS Mahat Kabupaten 50 Kota, Propinsi Sumatera Barat)*. Institut Teknologi Bandung. Bandung.

Yusondra. (2018). *Pengaruh pemberian ransum pelepah sawit fermentasi, titonia (tithonia diversifolia) dan rumput gajah (pennisetum pupureum) terhadap konsumsi PK, kecernaan PK, dan kecernaan NDF pada kambing etawa (PE) laktasi*.Fakultas Peternakan Universitas Andalas Padang.

Zain, M., Tanuwiria UH., Syamsu JA., Yunilas Y., Pazla R., Putri EM., Makmur M., Amanah U., Shafura PO., and Bagaskara B. (2024). *Nutrient digestibility, characteristics of rumen fermentation, and microbial protein synthesis from Pesisir cattle diet containing non-fiber carbohydrate to rumen degradable protein ratio and sulfur supplement*. *Veterinary World*, 17(3): 672–681.

Zain, M., N. Jamarun dan A.S Tjakradidjaja. (2010). *Phosphorus supplementation of ammoniated rice straw on rumen fermentability, syntesised microbial protein 62 and degradability in vitro. International Journal of Nutrition and Food Engineering*. 4(5): 357-359.

Zhang, Z., Niu, X., Li, F., Li, F., & Guo, L. (2020). *Ruminal cellulolytic bacteria abundance leads to the variation in fatty acids in the rumen digesta and meat of fattening lambs. Journal of animal science*. https://doi.org/10.1093/jas/skaa228.