

DAFTAR PUSTAKA

- Aluwong, T., K. P. Ishaku, and A. Abdullahi. 2010. Volatile fatty acid production in ruminants and the role of monocarboxylate transporters: a review. *African Journal of Biotechnology* 9(38): 6229-6232.
- AlZahal, F. L., L. L. Guan, N. D. Walker, dan B. W. McBride. 2016. Factors influencing ruminal bacterial community diversity and composition and microbial fibrolytic enzyme abundance in lactating dairy cows with a focus on the role of activity dry yeast. *Journal Dairy Science* 100(6): 1-17.
- Anam, M. S., 2019. Pengaruh Suplementasi Kombinasi Minyak Jagung Terproteksi dan Non Terproteksi Terhadap Karakteristik Fermentasi, Produksi Gas Metan, Dan Kecernaan Nutrien Secara *In Vitro*. Magister Fakultas Peternakan. Universitas Gadjah Mada. Yogyakarta.
- Angreni, B., B. Liunokas, dan F. K. Karwur. 2020. Isolasi dan identifikasi komponen kimia minyak atsiri daging buah dan fuli berdasarkan umur buah pala (*Myristica Fragrans* Houtt). *Jurnal Biologi Tropis* 20(1): 69-77.
- AOAC. 2005. Official Methods of Analysis of AOAC Internatinal. 18th Ed. Assoc. Off. Anal. Chem. Arlington.
- Arora, S. P. 1996. Pencernaan Mikroba pada Ruminansia. Penerjemah Retno Muwarni Gadjah Mada University Press. Yogyakarta
- Astuti, M. 2007. Pengantar Ilmu Statistik untuk Peternakan dan Kesehatan Hewan. Binasti Publisier. Bogor.
- Atmaja, T. H. W., Mudatsir, dan Saminga. 2017. Pengaruh konsentrasi ekstrak etanol buah pala (*Myristica fragrans*) terhadap daya hambat *Staphylococcus aureus*. *Jurnal EduBio Tropika* 5(1): 1-53.
- Baso, A. 2018. Karakteristik Manajemen Pakan dan Daya Dukung Pakan Dalam Pengembangan Ternak Kerbau di Kecamatan Seko Kabupaten Luwu Utara. Skripsi. Sarjana Fakultas Peternakan. Universitas Hasanuddin. Makassar.
- Bath, C., M. Morrison, E. M. Ross, B. J. Hayes, and B. G. Cocks. 2013. The symbiotic rumen microbiome and cattle performance: a brief review. *Animal Production Science* 53: 876-881.

- Benedeti, P. D. B., L. G. Silva, E. M. de Paula, T. Shenkoru, M. I. Marcondes, H. F. Monteiro, B. Amorati, Y. Yen, S. R. Poulson, and A. P. Faciola. 2015. Effects of partial replacement of corn with glycerin on ruminal fermentation in dual-flow continuous culture system. *Journal Plos One* 10(11): 1-13.
- Bhatta, R., M. Saravanan, L. Baruah, and K. T. Sampath. 2012. Nutrient content, *in vitro* ruminal fermentation characteristics and methane reduction potential of tropical tannin-containing levels. *Journal Science Food Agricultures* 93: 2929-2935.
- Bi, Y., S. Zeng, R. Zhang, Q. Diao, and Y. Tu. 2018. Effects of dietary energy levels on rumen bacterial community composition in holstein heifers under the same forage to concentrate ratio condition. *BMC Microbiology* 18(69): 1-11.
- Castillo-Gonzalez, A. R., M. E. Burrola-Barraza, J. Domiguez-Viveros, and A. Chavez-Martinez. 2014. Rumen microorganism and fermentation. *Archivos de Medicina Veterinaria* 46: 349-361.
- Choudhury, P. K., A. Z. M. Salem, R. Jena, S. Kumar, R. Singh, and A. K. Puniya. 2015. Rumen Microbiology: An Overview. In: A. K. Puniya, R. Singh, and D. N. Kamra, editors. *Rumen Microbiology: From Evolution to Revolution*. Springer India. pp. 3-16.
- Dewata, D., M. Azhar, and B. Oktavia. 2016. Identifikasi molekuler gen 16S rRNA isolat bakteri pendegradasi inulin dari rizosfer umbi dahlia. *Chemistry Journal of State University of Padang*. 5(2): 16-21.
- Dias, A. M., L. C. V. Itavo, J. C. Damasceno, G. T. Santos, E. Nogueira, and C. C. B. F. Itavo. 2012. Ruminal parameters of bovines fed diets based on sugar cane with doses of calcium hydroxide. *Revista Brasileira de Zootecnia*. 41(4): 963-969.
- Ehtisham, M., F. Wani, I. Wani, P. Kaur, and S. Nissar. 2016. Polymerase chain reaction (PCR): back to basics. *Indian Journal of Contemporary Dentistry* 4(2): 30-35.
- El-Waziry, A., S. Basmakil, A. Al-Owaimer, H. Metwally, M. Ali, and M. Al-Harbi. 2018. Influence of alfalfa hay replacement with acacia foliage on the digestibility, rumen fermentation and growth performance of ardi goats. *Asian Journal of Animal and Veterinary Advances* 13(3): 269-275.
- Fajri, A. I., Hartutik, dan A. Irsyammawati. 2018. Pengaruh penambahan pollard dan bekatul dalam pembuatan silase rumput odot

- (*Pennisetum purpureum* Cv. Mott) terhadap pencernaan dan produksi gas secara *in vitro*. *Jurnal Nutrisi Ternak Tropis* 1(1): 9-17.
- Filípek, J. and R. Dvořák. 2009. Determination of the volatile fatty acid content in the rumen liquid: Comparison of gas chromatography and capillary isotachopheresis. *Acta Vet. Brno* 78(4):627-633.
- France, J. and J. Dijkstra. 2005. Volatile Fatty Acid Production. In: Dijkstra, J., J. M. Forbes, and J. France. *Quantitative Aspects of Ruminants Digestion and Metabolism*. CABI Publishing. Wallingford.
- Freitas L. S., I. L. Brondani, L. R. Segabinaszz, J. Restle, D. C. A. Filho, L. A. D. Pizzuti, V. S. Silva, and L. S. Rodrigues. 2013. Performance of finishing steers fed different sources of carbohydrates. *Revista Brasileira de Zootecnia* 42(5): 354-362.
- Friedt, A. D., T. A. McAllister, M. L. He, G. B. Panner, and J. J. McKinnon. 2014. Effects of replacing barley grain with graded levels of wheat bran on rumen fermentation, voluntary intake and nutrient digestion in beef cattle. *Journal Animal Sciences* 94: 129-137.
- Fulnecek, J., and A. Kovarik. 2014. How to interpret methylation sensitive amplified polymorphism (MSAP) profiles. *BMC Genetics*. 15(2): 1-9.
- Hadianto, I. 2019. *Kajian Penggunaan Sinamaldehyd Kulit Kayu Mani (*Cinnamomum burmanni* Ness ex. Bl.) untuk Proteksi Protein Pakan Secara *In Vitro**. Tesis. Fakultas Peternakan Universitas Gadjah Mada. Yogyakarta.
- Handoyo, D. dan Rudiretna. 2000. Prinsip umum dan pelaksanaan polymerase chain reaction (PCR). *Universitas Surabaya* 9(1): 17-29.
- Hartadi, H., S. Reksohadiprodjo, dan A. D. Tillman. 2005. *Tabel Komposisi Pakan untuk Indonesia*. Gadjah Mada University Press. Yogyakarta.
- Hartanto, E. S. dan R. F. Silitonga. 2018. Ekstraksi asam miristat asal biji pala (*Myristica Fragrans Houtt*) dan limbah industri olahannya. *Journal of Agro-based Industry* 35(1): 38-45.
- Harun, A. Y. and K. Sali. 2019. Factor affecting rumen microbial protein synthesis: a review. *Journal Veterinary Medicine Open* 4(1): 27-35.
- Hatew, B., S. C. Podesta, H. Van Laar, J. L. Ellis, J. Dijkstra, and A. Bannink. 2015. Effects of dietary starch content and rate of

- fermentation on methane production in lactating dairy cows. *Journal Dairy Science* 98: 486-499.
- Henderson, G., F. Cox, S. Ganesh, A. Jonker, W. Young, and P. H. Janssen. 2015. Rumen microbial community composition varies with diet and host, but a core microbiome is found across a wide geographical range. *Science Report* 5:14567..
- Hook, S. E., A. G. Wright, and B. W. McBride. 2010. Methanogens: methane producer of the rumen and mitigation strategies. *Arcahe* 2010: 1-12.
- Ibáñez, C., M. C. López, P. Criscioni, and C. Fernández. 2014. Effect of replacing dietary corn with beet pulp on energy partitioning, substrate oxidation and methane production in lactating dairy goats. *Animal Production Science* 55: 56-63.
- Jasim, U. M., K. Z. Haque, and K. M. M. Hasan. 2015. Dynamics of microbial protein synthesis in the rumen. *Annals of Veterinary and Animal Science*. 2(5): 116-131.
- Junior, A. C. H., B. F. Nocera, L. F. Faleiros, M. T. C. Almeida, J. R. Paschoaloto, H. L. Perez, A. P. D'Auera, and J. M. B. Ezequiel. 2019. Patia replacement of corn by soybean hulls in high grain diets for feedlot sheep. *Peaquisa Agropecuaria Brasileira* 29: 1-7.
- Kamal, M. 1997. *Kontrol Kualitas Pakan*. Fakultas Peternakan Universitas Gadjah Mada. Yogyakarta.
- Karlsson, J., M. Ramin, M. Kass, M. Lindberg, and K. Holtenius. 2019. Effects of replacing wheat starch with glycerol on methane emissions, milk production, and feed efficiency in dairy cows fed grass silage-based diets. *Journal Dairy Science* 102: 7927-7935.
- Khaing, K. T., T. C. Loh, S. Ghizan, M. F. Jahroni, R. A. Halim, and A. A. Samsudin. 2016. Profiling of rumen fermentation and microbial population changes in goats fed with napier grass supplemented with whole corn plant silage. *Asian Journal of Animal Sciences* 10: 3923.
- Kim, S., L. L. Mamuad, C. Jeong, Y. Choi, S. S. Lee, J. Ko, and S. Lee. 2013. *In vitro* evaluation of different feeds for their potential to generate methane and change methanogen diversity. *Journal Animal Science* 26(12): 1698-1707.

- Lee, H. J., S. C. Lee, J. D. Kim, Y. G. Oh, B. K. Kim, C. W. Kim, and K. J. Kim. 2013. Methane production potential of feed ingredients as measured by *in vitro* gas test. *Asian-Australian Journal Animal Science* 16(8): 1143-1150.
- Lwin, K. O., and H. Matsui. 2014. Comparative analysis of the methanogen diversity in horse and pony using *mcrA* gene and archaeal 16S rRNA gene clone libraries. *Archaea*. 2014: 1-10.
- Maesya, A. dan S. Rusdiana. 2018. Prospek pengembangan usaha ternak kambing dan memacu peningkatan ekonomi peternak. *Agriekonomika* 7(2): 135-148.
- Martin, C., D. P. Morgavi, and M. Doreau. 2010. Methane mitigation in ruminants: from microbe to the farm scale. *Animal* 4(3): 351-365.
- Maurya, G. K. 2019. Restriction Enzyme. Pages 1-4 in *Encyclopedia Animal of Animal Cognition and Behavior*. J. Vonk, and T. K. Shackelford, ed. Springer, Switzerland.
- McDonald, P., R. A. Edwards, J. F. D. Greenhalgh, C. A. Morgan, L. A. Sinclair, dan R. G. Wilkinson. 2011. *Animal Nutrition*. 7th ed. Pearson, UK. pp. 171-189.
- Melati, P. Y., I. G. L. O. Cakra, and B. G. Pratama. 2019. Pengaruh penggantian *pollard* dengan dedak padi yang disuplementasi multivitamin-mineral dalam konsentrat terhadap penampilan sapi Bali jantan. *Majalah Ilmiah Peternakan* 22(1): 5-9.
- Membrive, C. M. B. 2016. Rumenology: Anatomy and Physiology of the Rumen. Pages 1-38 *Rumenology*. D. D. Millen, M. D. B. Arrigoni, R. D. L. Pacheco, ed. Springer, Switzerland.
- Menke, K. K. dan H. Steinngas. 1988. Estimation of energetic feed value obtained from chemical analysis and *in vitro* gas production using rumen fluid. *Animal Research Development* 28(2):7-55.
- Mihaela, G., A. Criste, D. Cocan, R. Constantinescu, C. Raducu, and V. Miresan. 2014. Methane producing in the rumen and its influence on global warming. *ProEnvironment* 7: 64-70.
- Muchlas, M., Kusmartono, dan Marjuki. 2014. Pengaruh penambahan dan pohon terhadap kadar VFA dan pencernaan secara *in vitro* ransum berbasis ketela pohon. *Jurnal Ilmu-Ilmu Peternakan* 24(2): 8-19.
- Nagaraja, T. G., C. J. Newbold, C. J. van Nevel, and D. I. Demeyer. 1997. Manipulation of ruminal fermentation. In: S. C. S. (eds) Hobson P.N., editor. *The Rumen Microbial Ecosystem*. Springer, Dordrecht. pp. 523–632.

- NRC. 2006. Nutrient Requirements of Small Ruminants: Sheep, Goats, Cervids, and New World Camelids.
- Nurdjannah, N. 2007. Teknologi Pengolahan Pala. Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian. Bogor.
- Nolan, J. V. and R. C. Dobos. 2005. Nitrogen transactions in ruminants. Pages 177-206 in Quantitative Aspects of Ruminant Digestion and Metabolism. 2nd ed. J. Dijkstra, J. M. Forbes, and J. France, Wageningen University, Netherlands.
- Owens, F. N., and M. Basalan. 2016. Ruminal Fermentation. Pages 63-102 in Rumenology. Millen, D., D. Beni, M. Arrigoni, Lauritano, R. Pacheco, Springer, Cham.
- Polii, F. F. 2016. Penelitian penyulingan minyak pala "SIAUW" metode uap bertekanan dan karakteristik mutu minyak pala. Jurnal Penelitian Teknologi Industri. 89(1): 23-34.
- Permana, H., S. Chuzaemi, Marjuki, dan Mariyono. 2017. Pengaruh pakan dengan dengan level serat kasar berbeda terhadap konsumsi, pencernaan dan karakteristik VFA pada sapi Peranakan Ongole. Journal Indonesia Tropical Animal 33(4): 282-289.
- Qiao, J., Z. Tan, and N. Wang. 2014. Potential and existing mechanism of enteric methane producing in ruminants. Scientia Agricola 71(5): 345-355.
- Qin, W. Z., C. Y. Li, Jj. K. Kim, J. G. Ju, and M. K. Song. 2012. Effects of defaunation on fermentation characteristics and methane production by rumen microbes *in vitro* when incubated with strachy feed sources. Asian-Australian Journal Animal Science 25: 1381-1388.
- Quy, D. D., A. E. Angkawijaya, P. L. Tran-Nguyen, L. H. Huynh, F. E. Soetaredjo, and S. Ismadji. 2014. Effect of extraction solvent on total phenol content, total flavonoid content, and antioxidant activity of *Limnophila aromatica*. Journal Food and Drug Analysis 22: 296-302.
- Patra, A. K. 2012. Enteric methane mitigation technologies for ruminant livestock: a synthesis of current reseach and future directios. EMA. 184: 1929-1952.
- Plummer, D. T. 1987. An Introduction to Practical Biochemistry. 3rd Edition. Mc. Graw-Hill Book Company Publ. New Delhi.
- Popova, M., C. Martin, M. Eugene, M. M. Mialon, M. Doreau, and D. P. Morgavi. 2011. Effect of fibre and strach rich finishing diets on methanogenic *archae* diversity and acivity in the umen of feedlot bulls. Animal Feed Science and Technology 166(167): 113-121.

- Restitrisnani, V., T. A. Nugroho, E. Rianto, and A. Purnomoadi. 2016. Methane emission factor at different total digestible nutrients and feeding level in ram. *Proc. Intsem. LPVT*. 352-356.
- Ridwan, R., M. Rusmana, Y. Widyastuti, K. G. Wiryawan, B. Prasetya, M. Sukamoto, and M. Ohkuma. 2019. Bacteria and methanogen community in the rumen fed different levels of grass-legume silage. *Biodiversitas* 20(4): 1055-1062.
- Rinanda, T. 2011. Analisis sekuensing 16S rRNA di bidang mikrobiologi. *Jurnal Kedokteran Syiah Kuala* 11(3): 172-177.
- Rita, H. 2017. Pendugaan Umur Simpan Bubuk Daging Buah Pala (*Myristicifera fructus*) Menggunakan Metode Arrhenius. Skripsi. Fakultas Peternakan Universitas Lampung. Bandar Lampung.
- Sanjay, K., A. K. Puniya, M. Puniya, S. S. Dagar, S. K. Sirohi, K. Singh, and G. W. Griffith. 2009. Factor affecting rumen methanogens and methane mitigation strategies. *World Journal Microbiol Biotechnol.* 1-8.
- Sari, N. F. 2017. Mengenal keragaman mikroba rumen pada perut sapi secara molekuler. *BioTrends* 8(1): 5-9.
- Sekretariat Jenderal Kementerian Pertanian. 2019. Outlook Pala Komoditas Pertanian Subsektor Perkebunan. Pusat Data dan Sistem Informasi Pertanian Sekretariat Jenderal Kementerian Pertanian. Jakarta.
- Schwab, C. G. 1995. Protected Proteins and Amino Acids for Ruminants. In: Wallace, R.J., and A. Chesson. *Biotechnology in Animal Feed and Animal Feeding*. VCH.
- Shibata, M. and F. Terada. 2010. Factor affecting methane production and mitigation in ruminants. *Animal Science Journal* 81: 2-10.
- Suryani, N. N., L. W. Suarna, Mahardika, L. G., and N. P. Sarini. 2020. Rumen fermentation and microbial protein synthesis of Bali cattle heifers (*Bos sondaicus*) fed ration containing different energy protein level. *Jurnal Sain Peternakan Indonesia* 15(2): 187-194.
- Tefa, S. M., W. A. Lay, dan T. Dodu. 2017. Pengaruh substitusi pakan komplet dengan pollard terhadap pertumbuhan ternak babi betina peranakan landrace fase pertumbuhan. 2017. *Jurnal Nukleus Peternakan* 4(2): 138-146.
- Turner, K. E., D. P. Belesky, R. W. Zobel, and A. M. Fortuna. 2020. Initial effects of supplemental forages and feedstuffs on bovine rumen

- ecology *in vitro* as determined by DNA-based molecular procedure. *Journal of Applied Animal Research* 48(1): 268-280.
- Utomo, R. 2012. *Evaluasi Pakan dengan Metode Noninvasif*. PT. Citra Aji Parama. Yogyakarta.
- Vanwonterghem, I., P. N Evans, D. H. Parks, P. D. Jensen, B. J. Woodcroft, P. Hugenholtz, and G. W. Tyson. 2016. Methylophilic methanogenesis discovered in the archaeal phylum Verstraetearchaeota. *Nature Microbiology* 1: 170.
- Verma, K., J. Dalal, and S. Sharma. 2014. Scientific concepts of polymerase chain restriction (PCR). *International Journal of Pharmaceutical Sciences and Research* 5(8): 3086-3095.
- Wanapat, M., R. Pilajun, S. Kang, K. Setyaningsih, and A. R. Setyawan. 2012. Effect of ground cob replacement for cassava chip on feed intake, rumen fermentation and urinary derivatives in swamp buffaloes. *Journal Animal Science* 25(8): 1124-1131.
- Wang, L. Z., M. L. Zhou, J. W. Wang, and T. Yan. 2016. The effect of dietary replacement of ordinary rice with red yeast rice on nutrient utilization, enteric methane emission and rumen archaeal diversity in goats. *Journal Plos One* 10: 1-14.
- Wardani, P. K. 2014. *Pemberian Beberapa Dosis Enzim Pada Pakan Komersil Terhadap Kandungan Serat Kasa, Bahan Organik dan BETN*. Skripsi. Fakultas Perikanan dan Kelautan Universitas Airlangga. Surabaya.
- Weatherburn, M. W. 1967. Phenol-hypochlorite reaction for determination of ammonia. *Anal. Chem.* 39: 971.
- Wijayanti, N. P. P., I. G. L.O. Cakra, and I G Mahardika. 2015. Effect of feeding difference levels of concentrate on NH₃, VFA and *in vitro* digestibility. *Journal of Animal Science Udayana University* 4(1): 1-7.
- Wulandari, A. 2015. *Pemetaan Karakteristik Kimia, Fisik, Sensori dan Fungsional Beberapa Jenis Pala (*Myristica* spp.)*. Skripsi. Fakultas Teknologi Pertanian. Institut Pertanian Bogor. Bogor.
- Yu, J., L. Cai, J. Zhang, A. Yang, Y. Wang, L. Zhang, L. L. Guan, and D. Qi. 2020. Effects of thymol supplementation on goat rumen fermentation and rumen microbiota *in vitro*. *Microorganism* 8:1160.
- Yuangklang, C., K. Vasupen, S. Wongsuthavas, S. Bureenok, P. Panyakaew, A. Alhaidary, H. E. Mohame, and A. C. Beynen. 2010. Effect of replacement of soybean meal by dried tomato pomace on rumen fermentation and nitrogen metabolism in beef cattle. *American Journal of Agricultural and Biological Sciences* 5(3): 256-260.

- Zhang, X., H. Zhang, Z. Wang, X. Zhang, H. Zou, C. Tan, and Q. Peng. 2015. Effects of dietary carbohydrate composition on rumen fermentation characteristics and microbial population *in vitro*. *Italian Journal of Animal Science* 14: 3366.
- Zhou, M., E. Hernandez-Sanabria, and L. L. Guan. 2010. Characterization of variation in rumen methanogenic communities under different dietary and host feed efficiency conditions, as determined by PCR-denaturing gradient gel electrophoresis analysis. *Applied and Environmental Microbiology* 76(12): 3776-3786.