UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

DAFTAR PUSTAKA

Abbeddou, S., Rischkowsky, B., Richter, E.K., Hess, H.D and Kreuzer, M. 2011. Modification of milk fatty acid composition by feeding forages and agro-industrial byproducts from dry areas to Awassi sheep. J. Dairy Sci. 94:4657–4668.

Abuelfatah, K., Zakaria, M., Bakar, Z. A., Meng, G. Y and Sazili, A. Q. 2014. Changes in fatty acid composition and distribution of N-3 fatty acids in goat tissues fed different levels of whole linseed. J. Sci World. 934154.

Abuelfatah, K., Zuki, A., Goh, Y and Sazili, A. 2016. Effects of enriching goat meat with n-3 polyunsaturated fatty acids on meat quality and stability. Small Ruminan Research. 136:36-42

Agarwal, N., D. N. Kamra, and L. C. Chaudhary. 2015. Rumen microbial ecosystem of domesticated ruminants.Pages 17–30 in Rumen Microbiology: From Evolution to Revolution. Springer.

Agarwal, N., Shekhar, C., Kumar, R., Chaudhary, L. C and Kamra, D. N. 2009. Effect of peppermint (Mentha piperita) oil on in vitro methanogenesis and fermentation of feed with buffalo rumen liquor. J. Anim. Feed Sci and Tech. 148(2-4):321-327.

Alexander, G., Singh, B., Sahoo, A., Bhat, T., 2008. In vitro screening of plant extracts to enhance the efficiency of utilization of energy and nitrogen in ruminant diets. Anim. Feed Sci. Technol. 145, 229–244.

Animut, G., Goetsch, A.L., Puchala, R., Patra, A.K., Sahlu, T., Varel, V.H and Wells, J. 2008. Methane emission by goats consuming different sources of condensed tannins. J. Anim. Feed Sci. Technol. 144:228–241.

Animut, G., Goetsch, A.L., Puchala, R., Patra, A.K., Sahlu, T., Varel, V.H and Wells, J. 2008. Methane emission by goats consuming diets with different levels of condensed tannins from lespedeza. J. Anim. Feed Sci Technol. 144:212–227.

AOAC International. 2005. Official Methods of Analysis of The Association of Analytical Chemists International.

Bae, H. D., McAllister, T. A., Yanke, J., Cheng, K. J and Muir, A. D. 1993. Effects of condensed tannins on endoglucanase activity and filter paper digestion by Fibrobacter succinogenes S85. J. Appl Environ Microbiol. 59(7):2132-2138.

Baldwin, R. L and Allison, M. J. 1983. Rumen metabolism. J. Anim. Sci. 57:461-477.

Barret, A and T. Ndou. 2013. Inhibition of amylase and glucoamylase by tannis extracted from cocoa, pomegranates, cranberries, and grapes. J. Agrc. Food Chem. 61(7):1477- 1486.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Beauchemin, K.A and McGinn, S. 2006. Methane emissions from beef cattle: effects of fumaric acid, essential oil, and canola oil. J. Anim. Sci. 84:1489

Beauchemin, K.A., McGinn, S.M., Martinez, T.F and McAllister, T.A. 2007. Use of condensed tannin extract from quebracho trees to reduce methane emissions from cattle. J. Anim. Sci. 85:1990–1996.

Behan, A.A., T.C. Loh, S. Fakurazi, U. Kaka, A. Kaka and A.A. Samsudin. 2019. Effects of Supplementation of Rumen Protected Fats on Rumen Ecology and 2129 Digestibility of Nutrients in Sheep. Animals. 9:1-18.

Benchaar C, Chouinard PY. 2009. Assessment of the potential of cinnamaldehyde, condensed tannins, and saponins to modify milk fatty acid composition of dairy cows. J Dairy Sci. 92:3392-3396.

Benchaar, C., Calsamiglia, S., Chaves, A.V., Fraser, G.R., Colombatto, D., Mcallister, T.A and Beauchemin, K.A. 2008. A review of plant-derived essential oils in ruminant nutrition and production. J. Anim. Feed Sci Technol. 145:209-228.

Berthelot, V., Bas, P., Pottier, E and Normand, J. 2012. The effect of maternal linseed supplementation and/or lamb linseed supplementation on muscle and subcutaneous adipose tissue fatty acid composition of indoor lambs. J. Meat Sci. *90*(3):548-557.

Bhatta, R., Uyeno, Y., Tajima, K., Takenaka, A., Yabumoto, Y., Nonaka, I., Enishi, O and Kurihara, M. 2009. Difference in the nature of tannins on in vitro ruminal methane and volatile fatty acid production and on methanogenic archaea and protozoal populations. J. Dairy Sci. 92:5512–5522.

Bodas, R., Prieto, N., García-González, R., Andrés, S., Giráldez, F. J and López, S. 2012. Manipulation of rumen fermentation and methane production with plant secondary metabolites. J. Anim. Feed Sci and Tech. 176(1-4):78-93.

Bokulich, N. A., Subramanian, S., Faith, J. J., Gevers, D., Gordon, I., Knight, R and Caporaso, J. G. 2013. HHS Public Access. 10(1):57–59.

BPS [Badan Pusat Statistik]. 2014. Statistik Perdagangan Luar Negeri Indonesia : Ekspor Jilid II. BPS. Jakarta.

Buccioni, A., Decandian, M., Minieri, S., Molle, G and Cabiddu, A. 2012. Lipid metabolism in the rumen: New insights on lipolysis and biohydrogenation with an emphasis on the role of endogenous plant factors. J. Anim. Feed Sci and Tech. 174:1-25.

Busquet, M., Calsamiglia, S and Ferret, A. 2005. Effects of cinnamaldehyde and garlic oil on rumen microbial fermentation in a dual flow continuous culture. J. Dairy Sci. 88:2508–2516.

Busquet, M., S. Calsamiglia, A. Ferret and C. Kamel. 2006. Plant extract affects in vitro rumen microbial fermentation. J. Dairy Sci. 89:761-771.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Byers, F.M. and G.T. Schelling. 1988. Lipid in ruminant. Pages 298-324 In The Ruminant Animal Digestive Physiology and Nutrition. Prentice Hall, 2146 Englewood Cliffs, New Jersey.

Cabiddu, A., L. Salis, J. K. S. Tweed, G. Molle, M. Decandia and M. R. F. Lee. 2010. The influence of plant polyphenols on lipolysis and biohydrogenation in dried forages at different phenological stages: in vitro, study. J. Sci. Food Agric. 90:829–835.

Calsamiglia, S., Busquet, M., Cardozo, P. W., Castillejos, L and Ferret, A. 2007. Invited review: essential oils as modifiers of rumen microbial fermentation. J. Dairy Sci. 90(6):2580-2595.

Cao, N., Wu, H., Zhang, X. Z., Meng, Q. X and Zhou, Z. M. 2020. Calcium propionate supplementation alters the ruminal bacterial and archaeal communities in pre-and postweaning calves. J. Dairy Sci. 103(4):3204-3218.

Caporaso, J. G., Lauber, C. L., Walters, W. A., Berg-Lyons, D., Lozupone, C. A., Turnbaugh, P. J and Knight, R. 2011. Global patterns of 16S rRNA diversity at a depth of millions of sequences per sample. Proc. National Acdm of Sci. 108(Supplement 1):4516-4522.

Castillejos, L., Calsamiglia, S and Ferret, A. 2006. Effect of essential oil active compounds on rumen microbial fermentation and nutrient flow in in vitro systems. J. Dairy Sci. 89:2649–2658.

Castillejos, L., Calsamiglia, S., Ferret, A and Losa, R. 2007. Effects of dose and adaptation time of a specific blend of essential oil compounds on rumen fermentation. J. Anim. Feed Sci. Technol. 132:186–201.

Castro-Montoya, J.M., Makkar, H.P.S and Becker, K. 2011. Chemical composition of rumen microbial fraction and fermentation parameters as affected by tannins and saponins using an in vitro rumen fermentation system.J. Anim Sci. 91:433–448.

Chaney, A. L and E. P. Marbach. 1962. Modified reagents for determination of urea and ammonia. Clin. Chem. 8:130–132.

Chaudhry, A. S., Mehedi, M and Khan H. 2012. Impacts of different spices on in vitro rumen dry matter disappearance, fermentation and methane of wheat or ryegrass hay based substrates. J. Livest. Sci. 146:84–90

Cheeke, P. R and Dierenfeld, E. S. 2010. Comparative Animal Nutrition and Metabolism. CAB International, Wallingford, UK.

Chen, X. B. 1996. An Excel Application Program for Processing Feed Degradability Data: User Manual. Rowett Res. Insitute Aberdeen, UK.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Chilliard, Y., F. Glasser, A. Ferlay, L. Bernard, J. Rouel, and M. Doreau. 2007. Diet, rumen biohydrogenation and nutritional quality of cow and goat milk fat. Eur. J. Lipid Sci. Technol. 109:828–855.

Choudhury, P. K., Salem, A. Z. M., Jena, R., Kumar, S., Singh, R and Puniya, A. K. 2015. Rumen microbiology: An overview. Rumen microbiology: from evolution to revolution. 3-16.

Chung, K.T., Lu, Z and Chou, M. 1998. Mechanism of inhibition of tannic acid and related compounds on the growth of intestinal bacteria. J. Food Chem Toxicol. 36:1053–60.

Cieslak, A., M. Szumacher-Strabel, A. Stochmal and W. Oleszek. 2013. Plant components with specific activities against rumen methanogens. Animal. 7.

Cobellis, G., M. Trabalza-Marinucci, and Z. Yu. 2016. Critical evaluation of essential oils as rumen modifiers in ruminant nutrition: A review. Sci. Total Environ. 545–546:556–568.

Comlekcioglu, U., Akyol, I., Ozkose, E., Kar, B and Ekinci, M. S. 2008. Carboxymethylcellulase production by the anaerobic rumen fungus Neocallimastix sp. GMLF7. Ann. Microbiol. 58(1):115-119.

Côrtes, C., D. C. da Silva-Kazama, R. Kazama, N. Gagnon, C. Benchaar, G. T. D. Santos, L. M. Zeoula, and H. V Petit. 2010. Milk composition, milk fatty acid profile, digestion, and ruminal fermentation in dairy cows fed whole flaxseed and calcium salts of flaxseed oil. J. Dairy Sci. 93:3146–3157.

De Nardi, R., Marchesini, G., Khafipour Li, S., Plaizier, E., Gianesella, K. J and Segato, S. 2016. Metagenomic analysis of rumen microbial population in dairy heifers fed a high grain diet supplemented with dicarboxylic acids or polyphenols. *BMC. Vet. Res. 12(1):1-9.*

Deusch, S., Camarinha-Silva, A., Conrad, J., Beifuss, U., Rodehutscord, M and Seifert, J. 2017. A structural and functional elucidation of the rumen microbiome influenced by various diets and microenvironments. Front. Microbiol. 8:1605.

Dewanckele, L., P. G. Toral, B. Vlaeminck, and V. Fievez. 2020. Invited review: Role of rumen biohydrogenation intermediates and rumen microbes in diet-induced milk fat depression: An update . J. Dairy Sci. 103:7655–7681.

Diaz, A., M. Avendano, and A. Escobar. 1993. Evaluation of Sapindus saponaria as a defaunating agent and its effects on different ruminal digestion parameters. Livest. Res. Rural Dev 5:1–6.

Dijkstra, J., J. L. Ellis, E. Kebreab, A. B. Strathe, S. López, J. France and A. Bannink. 2012. Ruminal pH regulation and nutritional consequences of low pH. J. Anim. Feed Sci. Technol. 172:22–33.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Drackley, J. 2004. Overview of Fat Digestion and Metabolism in Dairy Cow. University of Illinois Urbana.

Drazat. 2007. Meraup Laba dari Pala. Agro Media. Bogor.

Durmic, Z., Mcsweeney, C.S., Kemp, G.W., Hutton, P., Wallace, R.J and Vercoe, P.E. 2008. Australian plants with potential to inhibit bacteria and processes involved in ruminal biohydrogenation of fatty acids. J. Anim. Feed Sci Technol. 145:271-284.

Edgar, R. C. 2004. MUSCLE: Multiple sequence alignment with high accuracy and high throughput. Nucleic Acids Research.32(5):1792–1797.

Edgar, R. C. 2013. UPARSE: Highly accurate OTU sequences from microbial amplicon reads. Nature Methods.10(10): 996–998.

Enjalbert, F., S. Combes, A. Zened and A. Meynadier. 2017. Rumen microbiota and dietary fat: a mutual shaping. J. Appl. Microbiol. 123:782–797

Filípek, J and R. Dvořák. 2009. Determination of the volatile fatty acid content in the rumen liquid: comparison of gas chromatography and capillary isotachophoresis. Acta Vet. Brno. 78:627–633.

Frutos, P., G. Hervas, F. J. Giraldez, and A. R. Mantecon. 2004. Review. Tannins and ruminant nutrition. Span. J. Agric. Res. 2:19–202.

Getachew, G., Pittroff, W., Putnam, D. H., Dandekar, A., Goyal, S and DePeters, E. J. 2008. The influence of addition of gallic acid, tannic acid, or quebracho tannins to alfalfa hay on in vitro rumen fermentation and microbial protein synthesis. J. Anim. Feed Tech. 140(3-4):444-461.

Ghasemi, S., Naserian, A.A., Valizadeh, R., Tahmasebi, A.M., Vakili, A.R., Behgar, M., Ghovvati, S., 2012. Inclusion of pistachio hulls as a replacement for alfalfa hay in the diet of sheep causes a shift in the rumen cellulolytic bacterial population. Small Rumin. Res. 104, 94–98.

Goel, G., Puniya, A. K., Aguilar, C. N and Singh, K. 2005. Interaction of gut microflora with tannins in feeds. Naturwissenschaften. 92(11):497-503.

Gonzalez, A. R. C., M. E. B. Barraza, J. D. Viveros and A. C. Martinez. 2014. Rumen microorganisms and fermentation. J. Arch. Med. Vet. 46(3):349-361.

Gurung, N., S. Ray, S., Bose and V. Rai. 2013. A broader view: Microbial enzymes and their relevance in industries, medicine, and beyond. BioMed Res. Int. 11: 1-18.

Hackmann, T. J. 2014. Strategies to improve rumen microbial efficiency. In *Florida* Rumin. Nutr. Symp. Univ. Florida, Gainesville.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Hadianto, I. 2020. Kajian penggunaan sinamaldehid kulit kayu manis (Cinnamomum burmanni Ness ex Bl.) untuk proteksi protein pakan secara in vitro. Tesis. Pascasarjana. Fakultas Peternakan. Universitas Gadjah Mada. Yogyakarta.

Halliwell, G and J. Lovelady. 1981. Utilization of carboxymethylcellulose and enzyme synthesis by Trichoderma koningii. Microbiol. 126:211–217.

Harfoot, C. G., R. C. Noble, and J. H. Moore. 1973. Factors influencing the extent of biohydrogenation of linoleic acid by rumen micro-organisms in vitro. J. Sci. Food Agric. 24:961–970.

Hart, K. J., Ya´n˜ez-Ruiz, D. R and Duval, S. M. 2008. Plant extracts to manipulate rumen fermentation. J. Anim. Feed Sci Technol. 147:8–35.

Hartadi, H., S. Reksohadiprojo, dan A. D. Tilman. 1997. Tabel Komposisi Pakan untuk Indonesia. Cetakan Keempat. Universitas Gadjah Mada Press, Yogyakarta.

Hartanto, S.E and Silitong, F.R. 2018. Extraction of myristic acid from Myristica Fragrans Houtt and its industrial waste. Balai Besar Industri Agro.IHP. 35(1),38-45.

Harwanto, L. M. Yusiati dan R. Utomo. 2014. Pengaruh kayu manis (Cinnamomum burmanni Ness ex Bl) sebagai sumber sinamaldehid terhadap parameter fermentasi dan aktivitas mikrobia rumen secara in vitro. Buletin Peternakan 38(2): 71-77.

He, Q., Shi, B and Yao, K. 2006. Interactions of gallotannins with proteins, amino acids, phospholipids and sugars. *Food Chem. 95*(2):250-254.

Herdian, H., Istiqomah, L., Febrisiantosa, A dan Setiabudi, D. D. 2011. Pengaruh penambahan daun Morinda citrifolia sebagai sumber saponin terhadap karakteristik fermentasi, defaunasi protozoa, produksi gas dan metana cairan rumen secara in-vitro. JITV. 16(2):99-104.

Hervás, G., Frutos, P., Serrano, E., Mantecón, A.R and Giráldez, F.J. 2000. Effect of tannic acid on rumen degradation and intestinal digestion of treated soya bean meals in sheep. J. Agric. Sci. 135:305–310.

Hoff mann, E. M., Selje-Assmann, N and Becker, K. 2008. Dose studies on anti-proteolytic eff ects of a methanol extract from Knautia arvensis on in vitro ruminal fermentation. J. Anim. Feed Sci. Technol. 145: 285-301

Hristov, A.N., Ivan, M., Neill, L., and McAllister, T.A., 2003. Evaluation of several potential bioactive agents for reducing protozoal activity in vitro. J. Anim. Feed Sci. Technol. 105:163–184.

Hussain, I and Cheeke, P. 1995. Effect of dietary Yucca schidigera extract on rumen and blood profiles of steers fed concentrate- or roughage-based diets. J. Anim. Feed Sci. Technol. 51:231–242.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Huws, S. A., Creevey, C. J., Oyama, L. B., Mizrahi, I., Denman, S. E., Popova, M., and Morgavi, D. P. (2018). Addressing global ruminant agricultural challenges through understanding the rumen microbiome: past, present, and future. Frontiers Microbiol. *9*:2161.

Huyen, N. T., Verstegen, M. W., Hendriks, W. H and Pellikaan, W. F. 2020. Sainfoin (Onobrychis viciifolia) silage in dairy cow rations reduces ruminal biohydrogenation and increases transfer efficiencies of unsaturated fatty acids from feed to milk. J. Anim. Nutr. 6(3):333-341.

Jafari, S., G. Y. Meng, M. A. Rajion, M. F. Jahromi and M. Ebrahimi. 2016. Manipulation of rumen microbial fermentation by poliphenol rich solvent fractions from papaya leaf to reduce green-house gas methane and biohydrogenation of C18 PUFA. J. Agric. Food Chem. 64:4522–4530.

Janssen, P.H and Kirs, M. 2008. Structure of the archaeal community of the rumen. J. Appl. Environ Microbiol. 74:3619–25.

Jayanegara, A. 2014. Ruminal biohydrogenation pattern of poly-unsaturated fatty acid as influenced by dietary tannin. WARTAZOA. Indonesian Bulletin of Anim and Vet Sci. 23(1):8-14.

Jayanegara, A and Palupi, E. 2010. Condensed tannin effects on nitrogen digestion in ruminants: a meta-analysis from in vitro and in vivo studies. Med. Pet. 33:176–181.

Jayanegara, A dan Sofyan, A. 2008. Penentuan aktivitas biologis tanin beberapa hijauan secara in vitro menggunakan'Hohenheim gas test'dengan polietilen glikol sebagai determinan. Media Peternakan.

Jayanegara, A. 2014. Pattern of Polyunsaturated Fatty Acid Biohydrogenation as Influenced by Dietary Tannin. JITV. 19.1.

Jayanegara, A., F. Leiber and M. Kreuzer. 2012. Meta-analysis of the relationship between dietary tannin level and methane formation in ruminants from in vivo and in vitro experiments. J. Anim. Physiol. Anim. Nutr. 96:365–375.

Jayanegara, A., G. Goel, H. P. S. Makkar and K. Becker. 2015. Divergence between purified hydrolysable and condensed tannin effects on methane emission, rumen fermentation and microbial population in vitro. J. Anim. Feed Sci. Technol. 209:60–68.

Jayanegara, A., Kreuzer, M and Leiber, F., 2012. Ruminal disappearance of polyunsaturated fatty acids and appearance of biohydrogenation products when incubating linseed oil with alpine forage plant species in vitro. Livest. Sci. 147, 104–112.

Jayanegara, A., Kreuzer, M., Wina, E and Leiber, F. 2011. Significance of phenolic compounds in tropical forages for the ruminal bypass of polyunsaturated fatty acids and the appearance of biohydrogenation intermediates as examined in vitro. Anim. Prod. Sci. 51:1127–1136.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Jayanegara, A., Marquardt, S., Kreuzer, M and Leiber, F. 2011. Nutrient and energy content, in vitro ruminal fermentation characteristics and methanogenic potential of alpine forage plant species during early summer. J. Sci. Food and Agrc. 91:1863–1870.

Jayanegara, A., Marquardt, S., Wina, E., Kreuzer, M., and Leiber, F., 2013. In vitro indications for favourable non-additive effects on ruminal methane mitigation between highphenolic and high-quality forages. Brit. J. Nutr. 109: 615–622.

Jenkins, T. C. 1993. Lipid Metabolism In the Rumen. J. Dairy Sci. 76:3851–3863.

Jenkins, T.C., Wallace, R.J., Moate, P.J and Mosley, E.E. 2008. Recent advances in biohydrogenation of unsaturated fatty acids within the rumen microbial ecosystem. J. Anim Sci. 86:397–412.

Jouany, J. P., and Morgavi, D. P. 2007. Use of'natural'products as alternatives to antibiotic feed additives in ruminant production. Anim. an Int. J. Anim. Biosci. 1:1443.

Jouany, J.P and Morgavi, D.P. 2007. Use of 'natural' products as alternatives to antibiotic feed additives in ruminant production. J. Animal. 1:1443–1466.

Kamalak, A., Canbolat, O and Gurbuz, Y. 2005. Protected protein and amino acids in ruminant nutrition. J. Sci. Eng. 8(2): 84-88.

Khattab, M. S. A., Kholif, A. E., Abd El Tawab, A. M., Shaaban, M. M., Hadhoud, F. I., El-Fouly, H. A and Olafadehan, O. A. 2020. Effect of replacement of antibiotics with thyme and celery seed mixture on the feed intake and digestion, ruminal fermentation, blood chemistry, and milk lactation of lactating Barki ewes. J. Food. Func. 11(8):6889-6898.

Khejornsart, P., and M. Wanapat. 2010. Effect of chemical treatment of rice straw on rumen fermentation characteristic, anaerobic fungal diversity in vitro. J. Anim. Vet. Adv. 9:3070–3076.

Khiaosa-ard, R., Bryner, S.F., Scheeder, M.R.L., Wettstein, H.R., Leiber, F., Kreuzer, M and Soliva, C.R. 2009. Evidence for the inhibition of the terminal step of ruminal α-linolenic acid biohydrogenation by condensed tannins. J. Dairy Sci. 92:177–188

Khoiriyah, M., Chuzaemi, S and Sudarwati, H. 2017. Effect of flour and papaya leaf extract (Carica papaya L.) addition to feed on gas production, digestibility and energy values in vitro. J. Trop. Anim Prod. 17(2):74-85.

Kholif, A. E., Gouda, G. A., Anele, U. Y and Galyean, M. L. 2018. Extract of Moringa oleifera leaves improves feed utilization of lactating Nubian goats. Small Rum. Research. *158*:69-75.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Kim, H., Jung, E., Lee, H. G., Kim, B., Cho, S., Lee, S and Seo, J. 2019. Essential oil mixture on rumen fermentation and microbial community–an in vitro study. Asian-Australasian. J. Anim Sci. 32(6):808.

Lee, S. S., J. K. Ha, and K.-J. Cheng. 2000. Relative contributions of bacteria, protozoa, and fungi to in vitro degradation of orchard grass cell walls and their interactions. Appl. Environ. Microbiol. 66:3807–3813.

Leiber, F., Kreuzer, M., Jörg, B., Leuenberger, H and Wettstein, H.R. 2004. Contribution of altitude and Alpine origin of forage to the influence of Alpine sojourn of cows on intake, nitrogen conversion, metabolic stress and milk synthesis. J. Anim Sci. 78:451-466.

Leiber, F., Kreuzer, M., Nigg, D., Wettstein, H.R and Scheeder, M.R.L. 2005. A study on the causes for the elevated n-3 fatty acids in cows‘ milk of Alpine origin. Lipids. 40:191- 202

Lestari, Y.F., Ismono, H.R., Prasmatiwi and E.F. 2019. Prospect Development of Nutmeg in Lampung Province. JIIA Volume. 7 No. 1.

Liu, H., Vaddella, V and Zhou, D. 2011. Effects of chestnut tannins and coconut oil on growth performance, methane emission, ruminal fermentation, and microbial populations in sheep. J. Dairy Sci. 94:6069–77.

Liu, S. J., Bu, D. P., Wang, J. Q., Liu, L., Liang, S., Wei, H. Y and Loor, J. J. 2012. Effect of incremental levels of fish oil supplementation on specific bacterial populations in bovine ruminal fluid. J. Anim. Phys. Anim Nutr. 96(1):9-16.

Liu, X. L., Hao, Y. Q., Jin, L., Xu, Z. J., McAllister, T. A and Wang, Y. 2013. Anti-Escherichia coli O157: H7 properties of purple prairie clover and sainfoin condensed tannins. Molecules.18(2):2183-2199.

Lourenco, M., Ramos-Morales, E and Wallace, R.J. 2010. The role of microbes in rumen lipolysis and biohydrogenation and their manipulation. J. Anim. 4: 1008–1023

Luo, M., Liu, Y., Wu, P., Luo, D. X., Sun, Q., Zheng, H and Zeng, Y. 2017. Alternation of gut microbiota in patients with pulmonary tuberculosis. Front Phy. 8:822.

Magoč, T and Salzberg, S. L. 2011. FLASH: Fast length adjustment of short reads to improve genome assemblies. Bioinformatics. 27(21):2957–2963.

Mahpudin., Wahyono, F. dan Harjanti, D.W., 2016. Efektivitas ekstrak daun babadotan sebagai green antiseptic untuk pencelupan putting sapi perah. J. Agripet. 17(1): 15-23.

Maia, M. R., Chaudhary, L. C., Bestwick, C. S., Richardson, A. J., McKain, N., Larson, T. R and Wallace, R. J. 2010. Toxicity of unsaturated fatty acids to the biohydrogenating ruminal bacterium, *Butyrivibrio fibrisolvens*. BMC. Microbiol. 10(1):1-10.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Makkar, H. P., Blümmel, M and Becker, K. 1995. In vitro effects of and interactions between tannins and saponins and fate of tannins in the rumen. J Sci Food Agric. 69:481–93.

Makmur, M., Zain, M., Agustin, F., Sriagtula, R., and Putri, E. M. 2019. In vitro rumen biohydrogenation of unsaturated fatty acids in tropical grass-legume rations. J. Vet World. 13(4):661.

Malecky, M., Broudiscou, L. P and Schmidely, P. 2009. Effects of two levels of monoterpene blend on rumen fermentation, terpene and nutrient flows in the duodenum and milk production in dairy goats. J. Anim. Feed Sci Technol. 154:24–35.

Matloup, O. H., Abd El Tawab, A. M., Hassan, A. A., Hadhoud, F. I., Khattab, M. S. A., Khalel, M. S and Kholif, A. E. 2017. Performance of lactating Friesian cows fed a diet supplemented with coriander oil: feed intake, nutrient digestibility, ruminal fermentation, blood chemistry, and milk production. J Anim. Feed Sci Tech. 226:88-97.

Maynard, L. A., Loosli, J. K., Hintz, H. F and Warner, R.G. 2005. Animal Nutrition. 7th ed.

McCann, J. C., Wickersham, T. A and Loor, J. J. 2014. High-throughput methods redefine the rumen microbiome and its relationship with nutrition and metabolism. *Bioinformatics and biology insights*. *8*:BBI-S15389.

McDonald, P., Edwards, R. A, Greenhalgh, J. F. D., Morgan, C. A., Sinclair, L.A and Wilkinson , R.G. 2011. Animal Nutrition. 7th ed. Pearson, UK.

McDonald, P., Edwards, R.A and Greenhalgh, S. F. D. 2002. Animal Nutrition. 4 th Ed. Longman, London.

McSweeney, C. S., Palmer, B., Bunch, R and Krause, D.O. 2001. Effect of the tropical forage calliandra on microbial protein synthesis and ecology in the rumen.J. Appl. Microbiol. 90:78–88.

McSweeney, C. S., S. E. Denman, A.-D.-G. Wright and Z. Yu. 2007. Application of recent DNA/RNA-based techniques in rumen ecology. Asian-Aust. J. Anim. Sci. 20:283–294.

McSweeney, C.S., Palmer, B., Bunch, R and Krause, D.O. 2001. Effect of the tropical forage calliandra on microbial protein synthesis and ecology in the rumen. J. Appl Microbiol. 90:78–88.

Mehta, D and T. Satyanarayana. 2016. Bacterial and Archeal α-Amylase: Diversity and Ameolioration of the Desirable Characteristics for Industrial Applications. Front. Microbiol. 7:1-21

Membrive, C. M. B. 2016. Rumenology: Anatomy and Physiology of the Rumen. Pages 1-38 in Rumenology. D. D. Millen, M. D. B. Arrigoni, R. D. L. Pacheco, ed. Springer, Switzerland

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Menke, K. H., and H. Steingass. 1988. Estimation of the energetic feed value obtained from chemical analysis and in vitro gas production using rumen fluid. Anim. Res. Dev. 28:7–55.

Milen, D.D., Arrigoni, M.D.B., Pacheco, R.D.L., eds. Springer, Switzerland.Choudhury, P. K., A. Z. M. Salem, R. Jena, S. Kumar, R. Singh, and A. K. Puniya. 2015. Rumen microbiology: An overview.Pages 3–16 in Rumen Microbiology: From Evolution to Revolution. Springer.

Min, B.R., Attwood, G.T., Reilly, K., Sun, W., Peters, J.S ., arry, T.N and McNabb, W.C. 2002. Lotus corniculatus condensed tannins decrease in vivo populations of proteolytic bacteria and affect nitrogen metabolism in the rumen of sheep. Can J Microbiol. 48:911–921.

Moate, P. J., S. R. Williams, V. A. Torok, M. C. Hannah, B. E. Ribaux, M. H. Tavendale, R. J. Eckard, J. L. Jacobs, M. J. Auldist and W. Wales. 2014. Grape marc reduces methane emissions when fed to dairy cows. J. Dairy Sci. 97:5073–5087.

Morsy, T. A., Kholif, A. E., Matloup, O. H., Elella, A. A., Anele, U. Y and Caton, J. S. 2018. Mustard and cumin seeds improve feed utilisation, milk production and milk fatty acids of Damascus goats. J. Dairy Research. 85(2):142-151.

Nagaraja, T. G. 2016. Microbiologi of The Rumen. Pages 39–61 in Rumenology.

Nelson, D. L., and M. M. Cox. 2017. Lehninger principles of biochemistry. 7th editio. Macmillan Higher Education, Houndmills, Basingstoke.

Newbold, C. J., De La Fuente, G., Belanche, A., Ramos-Morales, E and McEwan, N. R. 2015. The role of ciliate protozoa in the rumen. Frontiers Microbiol.6:1313.

Nigam, P. S. 2013. Microbial enzymes with special characteristics for biotechnological applications. Biomol. 3(3):597-611.

Nsahlai, I., Fon, F and Basha, N. 2011.The effect of tannin with and without polyethylene glycol on in vitro gas production and microbial enzyme activity. S Afr. J. Anim. Sci. 41:337–44.

Nur Cahyo, D. 2021. Kajian penggunaan minyak ikan lele (Clarias sp) sebagai suplemen untuk menurunkan produksi gas metan rumen secara in vitro. Tesis. Pascasarjana. Fakultas Peternakan. Universitas Gadjah Mada. Yogyakarta.

Nurhasanah. 2014. Antimicrobal Activity Of Nutmeg (Myristica fragrans) Fruit Methanol Extract Againts Growth Staphylococcus aureus dan Escherichia coli. Skripsi FKIP Program Studi Pendidikan Biologi Universitas Khairun

Oskoueian, E., N. Abdullah and A. Oskoueian. 2013. Effects of flavonoids on rumen fermentation activity, methane production, and microbial population. BioMed Res. Int. 2013:349129.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Owens, F. N., and M. Basalan. 2016. Ruminal fermentation.Pages 63–102 in Rumenology. Milen, D.D., Arrigoni, M.D.B., Pacheco, R.D.L., eds. Springer, Switzerland.

Owoleke, O. E., B. K. Tanimomo, T. Z. Adama, H. O. Akanya, I. C. Alemede, M. Abdulrahaman, and V. O. Kolawole. 2016. Feed Evaluation and Growth Performance of Rabbits Fed Diets Containing Different Forages. Vom J. Vet. Sci. 11:101–111.

Ozkan, C. O and Sahin, M. 2006. Comparison of In situ Dry Matter Degradation with In vitro Gas Production of Oak Leaves Supplemented with or without Polyethylene Glycol (PEG). AsianAust. J. Anim. Sci. 19(8): 1120-1126.

Patra, A. K and J. Saxena. 2011. Exploitation of dietary tannins to improve rumen metabolism and ruminant nutrition. J. Sci. Food Agric. 91:24–37.

Patra, A. K., Kamra, D. N and Agarwal, N. 2006. Effect of plant extracts on in vitro methanogenesis, enzyme activities and fermentation of feed in rumen liquor of buffalo. J. Ani Feed Sci. Tech. 128(3-4):276-291.

Patra, A.K and Saxena, J. 2009. Dietary phytochemicals as rumen modifiers: A review of the effects on microbial populations. Antonie van Leeuwenhoek, Int. J. Gen Mol Microbiol. 96:363–375.

Patra, A.K and Saxena, J. 2009. The effect and mode of action of saponins on the microbial populations and fermentation in the rumen and ruminant production. Nutr Res Rev. 22:204–219.

Patra, A.K and Saxena, J. 2011. Exploitation of dietary tannins to improve rumen metabolism and ruminant nutrition. J. Sci. Food Agric.91:24–37.

Patra, A. K., Stiverson, J., and Yu, Z. 2012. Effects of quillaja and yucca saponins on communities and select populations of rumen bacteria and archaea, and fermentation in vitro. J Appl Microbiol. 113(6):1329-1340.

Paul, S. S., D. N. Kamra, and V. R. B. Sastry. 2010. Fermentative characteristics and fibrolytic activities of anaerobic gut fungi isolated from wild and domestic ruminants. Arch. Anim. Nutr. 64:279–292.

Peclzar, M. J. and Chan, E. C. S. 1988. Dasar-Dasar Mikrobiologi II. (diterjemahkan oleh R. S. Hadioetomo, Teja Imam, SW. S. Tjitrosomo dan Sri Lestari Angka). Indonesia University Press, Jakarta.

Plummer, D. T. 1971. An Introduction to Practical Biochemistry. McGraw-Hill Publ, New Delhi.

Reed, J. D. (1995). Nutritional toxicology of tannins and related polyphenols in forage legumes. J. Anim Sci. 73(5):1516-1528.

Robertson, T. B. 1929. Animal Nutrition. 7th editio. Pearson, Harlow, UK.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Russell, J. B. 2002. Rumen microbiology and its role in ruminant nutrition. Department of Microbiology, Cornell University

Salami, S. A., Valenti, B., Bella, M., O'Grady, M. N., Luciano, G., Kerry, J. P and Newbold, C. J. 2018. Characterisation of the ruminal fermentation and microbiome in lambs supplemented with hydrolysable and condensed tannins. FEMS Microbiol Ecol. 94(5):fyi061.

Sallam, S. M. A., I. C. S. Bueno, P. Brigide, P. B. Godoy, D. M. S. S. Vitti and A. L. Abdalla. 2009. Efficacy of eucalyptus oil on in vitro ruminal fermentation and methane production. Nutr. foraging Ecol. sheep goats. 85:267–272.

Samal, L., L. C. Chaudhary, N. Agarwal and D. N. Kamra. 2016. Effects of plants containing secondary metabolites as feed additives on rumen metabolites and methanogen diversityof buffaloes. J. Anim. Production Sci. 56(3):472–481.

Saminathan, M., Sieo, C. C., Gan, H. M., Abdullah, N., Wong, C. M. V. L and Ho, Y. W. 2016. Effects of condensed tannin fractions of different molecular weights on population and diversity of bovine rumen methanogenic archaea in vitro, as determined by high-throughput sequencing. J. Anim. Feed Sci and Tech. *216*: 146-160.

Santos, M. B., Robinson, P. H, Williams, P and Losa, R. 2010. Effects of addition of an essential oil complex to the diet of lactating dairy cows on whole tract digestion of nutrients and productive performance. J. Anim. Feed Sci Technol. 157:64–71.

Scalbert, A. 1991. Antimicrobial properties of tannins. Phytochem. 30:3875–83.

Scollan, N. D., Enser, M., Gulati, S. K., Richardson, I and Wood, J. D. 2003. Effects of including a ruminally protected lipid supplement in the diet on the fatty acid composition of beef muscle. British. J. Nutr. 90(3):709-716.

Seradj, A., L. Abecia, J. Crespo, D. Villalba, M. Fondevila and J. Balcells. 2014. The effect of Bioflavex® and its pure flavonoid components on in vitro fermentation parameters and methane production in rumen fluid from steers given high concentrate diets. Anim. Feed Sci. Technol. 197:85–91.

Silanikove, N., Perevolotsky, A and Provenza, F.D. 2001. Use of tannin-binding chemicals to assay for tannins and their postingestive effects in ruminants. J. Anim. Feed Sci and Tech. 91:69–81.

Simitzis, P. E. 2017. Enrichment of animal diets with essential oils a great perspective on improving animal performance and quality characteristics of the derived products. Medicines. 4(2):35.

Sivakumaran, S., Molan, A. L., Meagher, L. P., Kolb, B., Foo, L. Y., Lane, G. A and Tavendale, M. 2004. Variation in antimicrobial action of proanthocyanidins from Dorycnium rectum against rumen bacteria. Phytochemistry. *65*(17): 2485-2497.

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Smith, A. H and Mackie, R. I. 2004. Effect of condensed tannins on bacterial diversity and metabolic activity in the rat gastrointestinal tract. J. Appl. Environ Microbiol. 70(2):1104-1115..

Smith, A. H., Zoetendal, E and Mackie, R. I. 2005. Bacterial mechanisms to overcome inhibitory effects of dietary tannins. Micro Eco. 50(2):197-205.

Spanghero, M., Zanfi, C., Fabbro, E., Scicutella, N and Camellini, C. 2008. Effects of a blend of essential oils on some end products of in vitro rumen fermentation. J. Anim. Feed Sci Tech. 145(1-4):364-374.

Steel, R. G. D., and J. H. Torrie. 1980. Principles and Procedures of Statistics McGraw-Hill Book Co. Inc., New York 481.

Sterk, A.-R. 2011. Ruminal fatty acid metabolism: altering rumen biohydrolgenation to improve milk fatty acid profile of dairy cows.

Suharti, S., Astuti, D. A., Wina, E dan Haryanto, B. 2009. Kecernaan nutrien dan performa produksi sapi potong Peranakan Ongole (PO) yang diberi tepung lerak (Sapindus rarak) dalam ransum. JITV. 14(3):200-207.

Tan, H.Y., Sieo, C.C and Abdullah, N. 2011. Effects of condensed tannins from Leucaena on methane production, rumen fermentation and populations of methanogens and protozoa in vitro. J. Anim. Feed Sci Technol 169:185–193.

Tapio, I., Snelling, T. J., Strozzi, F., and Wallace, R. J. 2017. The ruminal microbiome associated with methane emissions from ruminant livestock. J. Anm Sci Biotec. 8(1):1-11.

Tharwat, M., Al-Sobayil, F., Ali, A and Buczinski, S. 2012. Transabdominal ultrasonographic appearance of the gastrointestinal viscera of healthy camels (Camelus dromedaries). Res. Vet Sci. 93(2):1015-1020.

Tilley, J. M. A., and R. A. Terry. 1963. a Two-Stage Technique for the in Vitro Digestion of Forage Crops. Grass Forage Sci. 18:104–111.

Ungerfeld, E. M. 2020. Metabolic Hydrogen Flows in Rumen Fermentation: Principles and Possibilities of Interventions. Front. Microbiol. 11:589.

Unni, K. N., P. Priji, S. Sajith, P. A. Faisal and S. Benjamin. 2016. Pseudomonas aeruginosa strain BUP2, a novel bacterium inhabiting the rumen of Malabari goat, produces an efficient lipase. Biologia. 71:378–387.

Valdes, K. I., Salem, A. Z. M and Lopez, S. 2015. Influence of exogenous enzymes in presence of Salix babylonica extract on digestibility, microbial protein synthesis and performance of lambs fed maize silage. J. Agric Sci. 153:732–742.

Vargas, J. E., S. Andrés, T. J. Snelling, L. López-ferreras, D. R. Yáñez-ruíz, C. García-estrada and S. López. 2017. Effect of Sunflower and Marine Oils on

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Ruminal Microbiota, In vitro Fermentation and Digesta Fatty Acid Profile. 8:1– 15

Vasta, V., Daghio, M., Cappuci, A., Buccioni, A., Serra, A., Viti, C and Mele, M. 2018. Plant polyphenols and rumen microbiota responsible faty acid biohydrogenation, fiber digestion, and methane emission: Experimental evidence and merhodologic. J. Dairy Sci. 102:3781-3804.

Vasta, V., Makkar, H. P., Mele, M and Priolo, A. 2008. Ruminal biohydrogenation as affected by tannins in vitro. British. J. Nutr. 102(1):82-92..

Vasta, V., Makkar, H.P.S., Mele and M., Priolo, A. 2009. Ruminal biohydrogenation as affected by tannins in vitro. Brit. J. Nutr. 102, 82–92.

Vasta, V., Yáñez-Ruiz, D. R., Mele, M., Serra, A., Luciano, G., Lanza, M and Priolo, A. 2010. Bacterial and protozoal communities and fatty acid profile in the rumen of sheep fed a diet containing added tannins. Appl. Environ. Microbiol. 76(8):2549-2555.

Wahrmund JL, JR Ronchesel, CR Krehbiel, CL Goad, SM Trost, CJ Richards. 2012. Ruminal acidosis challenge impact on ruminal temperature in feedlot cattle. J. Anim Sci 90, 2794-2801.

Wahyuni, I. M. D., Muktiani, A dan Christiyanto, M. 2014. Kecernaan bahan kering dan bahan organik dan degradabilitas serat pada pakan yang disuplementasi tanin dan saponin. J. Agripet. 14(2):115-124.

Wallace, R.J., Arthaud, L and Newbold, C.J. 1994. Influence of Yucca schidigera extract on ruminal ammonia concentrations and ruminal microorganisms. J. Appl. Environ Microbiol. 60:1762-1767.

Wallace, R.J., McEwan, N.R and McIntosh, F.M. 2002. Natural products as manipulators of rumen fermentation. AsianAustralasian. J. Anim Sci. 15:1458–1468.

Wang, C.J., Wang, S.P and Zhou, H. 2009. Influences of flavomycin, ropadiar, and saponin on nutrient digestibility, rumen fermentation, and methane emission from sheep. J. Anim. Feed Sci Technol. 148:157–166.

Wei-lian, H., Yue-ming, W., Jian-xin, L., Yan-qiu, G and Jun-an, Y. 2005. Tea saponins affect in vitro fermentation and methanogenesis in faunated and defaunated rumen fluid. J. Zhejiang University Sci. B. 6(8):787-792.

Weimer, P. J. 2015. Redundancy, resilience, and host specificity of the ruminal microbiota: Implications for engineering improved ruminal fermentations. J. Front. Microbiol. 6:296.

Wijayanti, A.P., Kunarto, B., Pratiwi, E and Rohardi. 2018. Total Phenolic, Flavonoids, Anthocyanins and Antioxidant Activity of Nutmeg Fuli Oleoresin (Myristica fragrans Houtt) Extracted Using Solid Liquid Microwave Assisted

UNIVERSITAS GADJAH MADA
PENGARUH PENAMBAHAN EKSTRAK BIJI PALA (Myristica fragrans) SEBAGAI SUMBER FENOL DALAM PAKAN TINGGI
ASAM LEMAK TIDAK JENUH TERHADAP METAGENOM MIKROBA, KOMPOSISI ASAM LEMAK, DAN FERMENTASI RUMEN SECARA
IN VITRO
NUR IKE RAKHMAWATI, Ir. Muhlisin, S.Pt., M.Agri., Ph.D., IPP; Dr. Ir. Chusnul Hanim, M.Si., IPM., ASEAN Eng.
Universitas Gadjah Mada, 2021 | Diunduh dari http://etd.repository.ugm.ac.id/

Extraction Method. JTPHP Vol. 1. No. 1. FTP-USM Semarang P-ISSN: 1693-9115

Wischer, G., Greiling, A. M., Boguhn, J., Steingass, H., Schollenberger, M., Hartung, K and Rodehutscord, M. 2014. Effects of long-term supplementation of chestnut and valonea extracts on methane release, digestibility and nitrogen excretion in sheep. J. Animal. 8(6):938-948.

Witzig, M., M. Zeder, and M. Rodehutscord. 2018. Effect of the ionophore monensin and tannin extracts supplemented to grass silage on populations of ruminal cellulolytics and methanogens in vitro. Anaerobe 50:44–54.

Wu, D., L. Xu, S. Tang, L. Guan, Z. He, Y. Guan, Z. Tan, X. Han, C. Zhou, and J. Kang. 2016. Influence of Oleic Acid on Rumen Fermentation and Fatty Acid Formation In Vitro. :1–13

Wu, G. 2017. Principles of Animal Nutrition. CRC Press, Boca Raton, FL.

Yang, K., C. Wei, G. Y. Zhao, Z. W. Xu and S. X. Lin. 2017. Effects of dietary supplementing tannic acid in the ration of beef cattle on rumen fermentation, methane emission, microbial flora and nutrient digestibility. J. Anim. Physiol. Anim. Nutr. (Berl.) 101:302–310.

Yang, W. Z., Benchaar, C., Ametaj, B. N., Chaves, A. V., He, M. L and McAllister, T. A. 2007. Effects of garlic and juniper berry essential oils on ruminal fermentation and on the site and extent of digestion in lactating cows. J.Dairy Sci. 90(12):5671-5681.

Yuliana, P., Laconi, E. B., Jayanegara, A., Achmadi, S. S dan Anjas A. S. 2019. Modulasi pola fermentasi dan semisi gas metan dari penambahan ekstrak Lerak pada silase Gamal. J. Veteriner. 2:202-210.