

PENGARUH PENAMBAHAN BUNGKIL PALA DALAM PAKAN TINGGI ASAM
LEMAK TIDAK JENUH TERHADAP KERAGAMAN MIKROBA,
PARAMETER FERMENTASI DAN PROFIL ASAM LEMAK
CAIRAN RUMEN KAMBING SECARA *IN VITRO*

INTISARI

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Bungkil pala merupakan *by product* industri penyulingan minyak atsiri yang mengandung senyawa fenol dan dapat dimanfaatkan sebagai bahan pakan alternatif ternak. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan bungkil pala dalam pakan tinggi asam lemak tidak jenuh terhadap keragaman mikroba, fermentasi, profil asam lemak cairan rumen kambing secara *in vitro*. Penelitian menggunakan rancangan acak lengkap (RAL) pola searah dengan 4 perlakuan dan 3 ulangan *batch in vitro* dengan setiap ulangan dilakukan *duplo*. Bahan pakan terdiri dari rumput odot, bungkil kedelai, *wheat* pollard, minyak kanola dan bungkil pala dengan perbandingan setiap perlakuan P0 40%:10%:45%:5%:0%; P1 40%:10%:40%:5%:5%; P2 40%:10%:35%:5%:10%; P3 40%:10%:30%:5%:15%. Penelitian produksi gas menggunakan metode (Menke dan Steinggas, 1988) dengan parameter terdiri dari nilai pH, jumlah protozoa, produksi gas metana, aktivitas enzim amilase, CMCase, protease, VFA total, asetat, propionat dan butirrat, NH₃, protein mikroba, produksi gas total, kinetika produksi gas, profil asam lemak cairan rumen dan keragaman mikroba rumen. Analisis keragaman mikroba rumen menggunakan metode *Next Generation Sequencing* (NGS). Evaluasi pencernaan *in vitro* menggunakan metode Tilley dan Terry (1963) terdiri dari pencernaan bahan kering dan organik, protein kasar dan serat kasar dalam rumen dan total. Data parameter fermentasi, asam lemak dan evaluasi pencernaan dianalisis menggunakan analisis variansi rancangan acak lengkap pola searah, jika terdapat perbedaan secara nyata dilanjutkan uji *Duncan's New Multiple Range Test* dibantu dengan aplikasi IBM SPSS Statistik versi 23. Data keragaman mikroba rumen dianalisis secara deskriptif. Hasil penelitian menunjukkan bahwa penambahan bungkil pala mulai level 5% menurunkan kelimpahan bakteri utama proses biohidrogenasi *anaerovibrio*, *butyrivibrio fibrisolvens* dan *pseudobutyrovibrio*. Penambahan bungkil pala mulai 5% menurunkan ($P < 0,05$) total asam lemak jenuh dan meningkatkan ($P < 0,05$) total asam lemak tidak jenuh. Penambahan bungkil pala mulai level 10% menurunkan ($P < 0,05$) pencernaan PK, SK, konsentrasi amonia, asam asetat, rasio asetat:propionat, jumlah protozoa, produksi metan dan kinetika produksi fraksi b, serta meningkatkan ($P < 0,05$) asam propionat. Penambahan bungkil pala mulai level 15% menurunkan ($P < 0,05$) aktivitas protease. Penambahan bungkil pala mulai level 5% ($P > 0,05$) tidak berpengaruh terhadap pencernaan BK dan BO, enzim amilase, enzim CMCase, produksi gas total, kinetika produksi fraksi a dan c, pH, total VFA, asam butirrat dan protein mikroba. Kesimpulan penelitian ini adalah bungkil pala dapat ditambahkan sebagai bahan pakan ternak sebanyak 5% yang dapat menurunkan kelimpahan bakteri dalam proses biohidrogenasi tanpa mengganggu proses fermentasi dan pencernaan dalam rumen.

Kata kunci: bungkil pala, biohidrogenasi, keragaman mikroba, profil asam lemak, fermentasi rumen.

THE EFFECT OF NUTMEG MEAL SUPPLEMENTATION IN A DIET HIGH
UNSATURATED FATTY ACIDS ON MICROBIAL DIVERSITY,
FERMENTATION, AND PROFIL FATTY ACID
GOAT RUMEN *IN VITRO*
ABSTRACT

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Nutmeg meal is a *by-product* of the atsiri oil refining industry which contains phenol compounds and can be used as an alternative feed ingredient for livestock. This study aims to determine the effect of the addition of nutmeg meal in feed high in unsaturated fatty acids on microbial diversity, fermentation, and fatty acid profile of goat rumen fluid *in vitro*. The study used a complete randomized design (RAL) pattern in the same direction with 4 treatments and 3 *in vitro batch* tests with each test carried out *by Duplo*. The feed ingredients consist of odot grass, soybean meal, *wheat* pollard, canola oil and nutmeg meal with a ratio of each treatment P0 40%:10%:45%:5%:0%; P1 40%:10%:40%:5%:5%; P2 40%:10%:35%:5%:10%; P3 40%:10%:30%:5%:15%. Gas production research using methods (Menke and Steinggas, 1988) with parameters consisting of pH value, number of protozoa, methane gas production, amylase enzyme activity, CMCCase, protease, total VFA, acetate, propionate and butyrate, NH₃, microbial proteins, total gas production, the kinetics of gas production, rumen fluid fatty acid profile and rumen microbial diversity. Analysis of rumen microbial diversity using *the Next Generation Sequencing* (NGS) method. *In vitro* digestibility evaluation using *the* Tilley and Terry method (1963) consists of the digestibility of dry and organic matter, crude protein, and crude fiber in the rumen and total. Data on fermentation parameters, fatty acids, and digestibility evaluation were analyzed using a complete randomized design variance analysis of unidirectional patterns if there were noticeable differences followed by *Duncan's New Multiple Range Test* assisted by IBM SPSS Statistics vs 23. Data on the diversity of rumen microbes were analyzed descriptively. The results showed that the addition of nutmeg meal starting at the level of 5% decreased the abundance of the main bacteria in the biohydrogenation process of *anaerovibrio*, *butyrivibrio fibrisolvens* and *pseudobutyrvibrio*. The addition of nutmeg meal began to 5% decrease ($P < 0.05$) total saturated fatty acids and increase ($P < 0.05$) total unsaturated fatty acids. The addition of nutmeg meal starting at the level of 10% decreases ($P < 0.05$) the digestibility of PK, SK, ammonia concentration, acetic acid, acetic: propionic ratio, the number of protozoa, methane production, and the kinetics of b fraction production, as well as increasing ($P < 0.05$) propionic acid. The addition of nutmeg meal starting at the level of 15% decreased ($P < 0.05$) protease activity. The addition of nutmeg meal starting at the level of 5% ($P > 0.05$) has no effect on the digestibility of BK and BO, amylase enzyme, CMCCase enzyme, total gas production, the kinetics of production of fractions a and c, pH, total VFA, butyric acid, and microbial proteins. The conclusion of this study is that nutmeg meal can be added as an animal feed ingredient as much as 5% which can reduce the abundance of bacteria in the biohydrogenation process, without disturbing the fermentation and digestibility processes in the rumen.

Keywords: nutmeg meal, biohydrogenation, microbial diversity, fatty acid profile, fermentation of rumen.