Jurnal Sain Peternakan Indonesia
Available at https://ejournal.unib.ac.id/index.php/jspi/index
DOI: https://doi.org/10.31186/jspi.id.19.4.198-204

P-ISSN 1978-3000
E-ISSN 2528-7109
Volume 19 Issue 4 October-December 2024

The Effect of Milk Quality and Feed Consumption Substituted Young Coconut Husk Silage into the Ration of Sapera Goats as a Forage Substitution

M. Resthu[1,2*], I. Ilham[1,2], I. Rosita[1], R. Widayat[1], and I. Aldi[1]

[1]Animal Husbandry Departement, Faculty of Agriculture, Universitas Syiah Kuala, Indonesia
[2]Pusat Riset Inovasi dan Teknologi Pakan, Universitas Syiah Kuala, Indonesia
*Corresponding Author: muhammadresthu@usk.ac.id
Revised: 2024-12-14, Accepted: 2024-11-22, Publish: 2024-12-31

ABSTRACT

This study used a Latin Square Design with four dairy goats and 4 periods. Treatments consisted of P0 = no substitution; P1 = 20% substitution of young coconut husk silage; P2 = 40% substitution of young coconut husk; and P3 = 60% substitution of young coconut husk silage. Data were analyzed using analysis of variance (ANOVA) using SPSS 25, and if a significant effect was found, Duncan's multiple range test (DMRT) was followed. The results showed that there was a substantial difference in the substitution of young coconut husk silage on NFE consumption and CF consumption ($P<0.05$) and insignificant in fat content and SNF content of Sapera goat milk ($P>0.05$). In conclusion, the addition of young coconut husk silage as a substitute for forage into the total ration of the best Sapera goats is 40%.

Keywords: Feed consumption, forage substitution, milk quality, Sapera goat, young coconut husk silage.

INTRODUCTION

The success of dairy farming in producing optimal milk production is inseparable from three main factors: breeding, management, and feeding. In addition, feed is the most significant factor based on the operational costs incurred, reaching 60-70%. Thus, providing good quality feed is essential, especially for dairy goats. Dairy goat feed generally consists of forage and concentrates with a ratio of 70:30. Additionally, forage as a source of fiber will be converted by ruminants into energy for the body maintenance, production, and reproduction of livestock. The crude fiber consists of cellulose and hemicellulose, the main element of plant cell walls, and two organic materials that are abundant in nature and have the potential to become an energy source for ruminants (Lamid, 2015; Arief et al., 2020). As a result, in the rumen, crude fiber will be digested by microorganisms to produce Volatile Fatty Acids (VFA). In addition, VFA is composed of organic fatty acids such as acetic acid, propionic acid, butyric acid, and trace of valeric and isovaleric acids. Therefore, a more significant portion of forage in the total ratio of ruminants will increase the production of acetic acid and butyric acid. Moreover, acetic acid acts as a precursor of milk fat synthesis by secretory cells in the udder (Roy and Ghosh, 2020).

The obstacle to providing forage throughout the year in the tropics is fluctuating forage production due to the tendency of forage production to decrease during the dry season, so several alternative forages are needed to provide animal feed. In contrast, agro-industrial waste production has not been optimally utilized as ruminant feed. Furthermore, agricultural waste that is not managed correctly will hurt the environment and public health. Thus, optimization of agro-industrial waste as animal feed is needed to prevent this. Furthermore, several types of agro-industrial waste have been studied as a substitute for forages. Research conducted by Hifizah et al. (2020) reported that corn straw and tofu waste can be utilized as feed substitutes for forages. The use of rice straw mixed with concentrates can replace the use of forage fodder by 30% (Pratama 2013). Similarly, young coconut husk waste has the potential to be a source of fiber to replace forage.

Young coconut husk is one of the agro-industrial wastes that has not been optimally utilized as dairy animal feed. Indonesia will be the largest producer of coconut fruit production in the world in 2022, with 17.19 million tons (Databoks, 2022). Automatically, the amount of coconut fiber produced will also be significant. Based on chemical analysis, the composition of young coconut fiber contains 5.43% moisture content, 30.34% crude fiber, 3.95% ash content, 3.54% lignin, 0.52% cellulose, and 23.70% hemicellulose (Adeyi 2010). The crude fiber component in young coconut husk waste is still too high, so there is a need for feed processing

technology in the form of silage. Although silage is used to preserve the nutritional value of feed, some dietary components change. Research conducted by Narek et al. (2021) reported that young coconut husk silage given 12% rice bran additives produced a chemical composition of 26.77% dry matter, 13.08% ash, 8.36% crude protein, 2.21% crude fat, and 21.98% crude fiber.

Furthermore, the nutritional components in the feed have a strong influence on the milk components. For example, milk fat content is highly dependent on crude fiber content in the feed. So, if crude fiber consumption is low, milk fat content will tend to decrease. (Nurcahyanti et al. 2020). Same with the opinion of Nurhajah et al. (2016) stated that the results of simple linear regression showed a relationship between crude fiber consumption and milk fat content. Similarly, solid-non-fat (SNF) in milk is also influenced by the nutrient content in the feed ingredients. SNF is obtained from calculating the difference between milk fat content and dry matter. The components in SNF are protein, minerals, vitamins, and lactose. The nutrients also influence milk SNF in the feed. Furthermore, nitrogen-free extract (NFE) is a value commonly calculated in assessing the nutrition of ruminant feedstuffs. In addition, NFE is obtained by reducing ash content (%), crude protein content (%), crude fat content (%), and crude fiber content (%) by 100% (Tahuk et al. 2024). Therefore, this study aimed to assess crude fiber intake (kg/h/d), NFE intake (kg/h/d), milk fat content (%), and SNF content (%) in dairy goats given young coconut husk silage as a substitute for forage with different levels.

MATERIALS AND METHODS

The research material used was Sapera dairy goats with lactation period 4 reared on a smallholder farm in Mon Alue Village, Aceh Besar District, Aceh Province. Young coconut fiber was obtained from the Aceh Besar region.

The tools and materials used include blenders, machetes, plastic bags, scales, tarpaulins, chopper machines, buckets, sprayers, gloves, scoops, measuring cups, ropes, furnaces, a set of crude protein analyzers, fume hoods, one set of crude fat analyzer, vacuum suction, filter paper, Erlenmeyer, and drying oven, rice bran, elephant grass, vetway premix, soybean meal, water, indigofera hay, $CaCO_3$, Dicalcium Phospate (DCP), sago stem, H_2S0_4, HCl, aquades, kjeldal tablet, alcohol, NaOH, borac acid.

This experimental study uses a Latin Square Design (LSD) consisting of 4 dairy goats and 4 periods. So, 16 treatment units were obtained. The treatments consisted of (P0: elephant grass silage 60% + young coconut husk silage 0% + indigofera hay 10% + rice bran 1% + $CaCO_3$ 0.75% + DCP 0.5% + dried tofu waste 0.5% + sago stem 12% + soybean meal 14.75% + premix vetway 0.5%; P1: elephant grass silage 40% + young coconut husk silage 20% + indigofera hay 10% + rice bran 1% + $CaCO_3$ 1% + DCP 0.5% + dried tofu waste 0.5% + sago stems 10.5% + soybean meal 16% + premix vetway 0.5%, P2: elephant grass silage 20% + young coconut husk silage 40% + indigofera hay 10% + rice bran 10% + $CaCO_3$ 0.5% + DCP 0.5% + dried tofu waste 2.5% + sago stems 0.5% + soybean meal 15% + premix vetway 0.5%, P3: elephant grass silage 0% + young coconut husk silage 60% + indigofera hay 10% + rice bran 10% + $CaCO_3$ 1% + DCP 0.75% + dried tofu waste 1% + sago stems 0.5% + soybean meal 16% + premix vetway 0.75%. Then, each treatment period for 2 weeks consists of 7 days adaptation period and 7 days treatment period. The research parameters were milk quality, consisting of fat content (%) and lean dry matter content (%). The nutritional value of feed ingredients can be seen in Table 1.

Before collecting NFE and CF consumption data, it is necessary to calculate feed consumption by calculating the difference between the feed given and the remaining feed each day during the treatment period for the amount of feed consumed based on dry matter. The percentage of NFE and CF content was calculated based on dry matter. To obtain milk quality data, milk samples were collected at the end of each treatment period.

Milk fat content (%) and solid nonfat content (%) were measured using a lactose milk analyzer at the Ruminant Animal Production Science and Technology Laboratory, Animal Science Department, Agriculture Faculty, Universitas Syiah Kuala. The nutritional content of feed ingredients was analyzed in the Nutrition Science and Forage Technology Laboratory, Animal Science Department, Agriculture Faculty, Universitas Syiah Kuala. While measuring NFE consumption (Kg/h/d) and crude fiber consumption (Kg/h/d) using the following calculation according to (Luruk et al. 2024).

Table 1. Feedstuff Nutritional Composition

No	Feed Ingredients	Protein (%) *	TDN (%) ***	Crude Fiber (%) *	Dry Matter (%) *	Extract Eter (%) *	Ash (%) *	NFE (%) **
1	Ellephant Grass Silase	8.75	57.7	28.07	38.13	5.21	14.94	43.03
2	Young Coconut Husk Silase	6.15	66.42	24.25	40.41	4.42	7.08	57.40
3	Indigofera Hay	23.11	75.04	19.46	87.72	7.03	9.59	51.59
4	Rice Bran	9.83	53.49	26.43	91.99	11.54	7.88	64.46
5	$CaCO_3$	0	0	0	99.34	0	96.62	3.38
6	Dicalcium Phosphate	0	0	0	99.4	0	96.61	3.39
7	Dried Tofu Waste	36.73	54.53	19.44	95.84	6.2	5.03	34.62
8	Sago	1.95	79.46	3.03	94.32	0.3	5.19	90.23
9	Soybean Meal	42.92	81.03	7.07	91.33	0.85	7.07	46.44
10	Vetways Premix	0	0	0	99.12	0	98.82	1.18

Note: * The proximate analysis results were in the Nutrition Science and Forage Technology Laboratory, Animal Science Department, Agriculture Faculty, Universitas Syiah Kuala.
** Calculated based on Luruk (2024) NFE (%)=100%-%Crude Protein - % Crude Fat - % Crude Fiber - % Ash
*** Calculated based on Wardeh (1981) and Indah et al. (2020).

NFE consumption = amount of feed consumed (Kg/h/d) x NFE content in feed ingredients (%)

Crude fiber consumption = amount of feed consumed (Kg/h/d) x crude fiber content in feed ingredients (%)

Young coconut husk silage preparation follows the method of (Narek et al., 2021). Firstly, the separation between the husk and shell of young coconut husk waste is then chopped by 2-4 cm size and dried in the sun until the moisture content reaches 60%. Secondly, young coconut husk was mixed with rice bran as much as 12% of the substrate weight. Finally, young coconut husk is stored for 21 days.

The ration during the study consisted of elephant grass silage, young coconut husk silage, bran, dicalcium phosphate, premix, CaCO3, Indigofera hay, soybean meal, dried tofu waste, and sago stalk. Forage consisted of elephant grass silage and young coconut husk silage. Concentrates consisted of sago stalks, soybean meal, and premix vetway. Ration formulation is based on the needs of lactating goats according to (NRC, 2007), which is 14% crude protein and 61% TDN. The chemical composition of the feed was analyzed based on AOAC (2005) instructions, which included the content of dry matter (DM), crude protein, ether extract, crude fiber, NFE, and ash in % dry matter. The nutritional value of feed treatments can be seen in Table 2.

Table 2. Nutrition value of feedstuff based on treatment

No.	Feed Nutrition	P0	P1	P2	P3
1	Dry Matter (%)	57.92	56.86	55.32	54.24
2	Crude Protein (%)	14.03	14.41	14.67	14.62
3	Crude Fiber (%)	20.56	19.87	21.54	20.60
4	Extract Eter (%)	2.02	2.06	2.52	2.41
5	NFE (%)	49.52	51.63	51.51	54.34
6	TDN (%)	61.06	61.81	61.35	61.99

Note: P0: elephant grass silage 60% + young coconut husk silage 0% + indigofera hay 10% + rice bran 1% + CaCO3 0.75% + DCP 0.5% + dried tofu waste 0.5% + sago 12% + soybean meal 14.75% + premix vetway 0.5%; P1: elephant grass silage 40% + young coconut husk silage 20% + indigofera hay 10% + rice bran 1% + CaCO3 1% + DCP 0.5% + dried tofu waste 0.5% + sago 10.5% + soybean meal 16% + premix vetway 0.5%, P2: elephant grass silage 20% + young coconut husk silage 40% + indigofera hay 10% + rice bran 10% + CaCO3 0.5% + DCP 0.5% + dried tofu waste 2.5% + sago 0.5% + soybean meal 15% + premix vetway 0.5%, P3: elephant grass silage 0% + young coconut husk silage 60% + indigofera hay 10% + rice bran 10% + CaCO3 1% + DCP 0.75% + dried tofu waste 1% + sago 0.5% + soybean meal 16% + premix vetway 0.75%.

Forage feeding is done twice daily, in the morning between 08.00 am and 09.00 am and between 4.00 pm and 5.00 pm. Furthermore, feeding uses the TMR (Total Mix Ration) method. And the provision of drinking water ad libitum. Besides, milking is done twice daily, namely in the morning and evening. In addition, morning milking was done between 09.00 am to 10.00 am, and afternoon milking was done between 5.00 pm to 6.00 pm.

All experimental data were analyzed using analysis of variance (ANOVA) using SPSS 25, and if a significant effect was found, it was followed by Duncan's multiple range test. (Gomez and Gomez, 2010).

RESULTS AND DISCUSSION

Nitrogen-Free Extract (NFE) Consumption

Based on ANOVA analysis of NFE consumption (Kg/h/d) of Sapera goats given young coconut husk silage with various levels showed significant differences (P<0.05). Results in Table 3. It can be seen in order of NFE consumption ranging from the smallest to the largest is P0=0.79±0.12 kg/h/d, P1=0.83±0.09 kg/h/d, P3=0.90±0.14 kg/h/d and P2=0.97±0.07 kg/h/d. Furthermore, this difference shows that each of the Sapera goats given young coconut husk silage with various levels showed significant differences (P<0.05). Moreover, this difference indicates that each feed ration has a different nutritional content. In addition, the highest NFE content of the ration was found in the P3 treatment at 54.34%, followed by the P1 treatment at 51.63%, then P2 at 51.51%, and the lowest was found in the P0 treatment at 49.52%. Differences in the percentage of young coconut husk silage use cause the difference in nutrition in each feed treatment. Using young coconut husk silage increases the NFE content of the treatment feed. In addition, the level of feed consumption in goats is not only influenced by the nutritional content but also by other factors such as the type of livestock, environmental temperature, palatability, appetite, physiological status, the amount of feed available, feed nutrient content, feed form, and production level (Tahuk and Bira 2022). In this study, the P2 treatment had the highest consumption rate of 0.97 kg/head/day due to the level of palatability of young coconut husk silage feed, which was substituted as much as 40% of the total ration higher than the other treatments. NFE is soluble carbohydrates, including monosaccharides, disaccharides, and polysaccharides, which are readily soluble and have high digestibility. High NFE consumption also illustrates the more carbohydrates that the body can utilize. The higher the feed consumption, the higher the nutrient content obtained by livestock (Luruk et al., 2024).

Table 3. Research result data

No	Parameter	Treatment			
		P0	P1	P2	P3
1	NFE (Kg/h/d)	0.79 ±0.12^{a}	0.83±0.09^{ab}	0.97±0.07^{b}	0.90±0.14^{ab}
2	CF (Kg/h/d)	0.32±0.48^{a}	0.34±0.36^{a}	0.42±0.29^{b}	0.35±0.05^{a}
3	SNF (%)	7.86±0.53^{a}	7.23±1.11^{a}	7.64±1.22^{a}	7.78±0.98^{a}
4	Fat (%)	3.07±1.22^{a}	2.93±1.00^{a}	3.96±1.01^{a}	3.89±1.09^{a}

Note: The difference of superscript shows a significant (P<0.05)

Crude Fiber Consumption

Based on statistical analysis, crude fiber consumption in Sapera goats given young coconut husk silage with different levels as a substitute for forage showed a significant difference (P <0.05). In Table 3, it can be seen that the P2 treatment has the highest CF consumption of 0.42 ± 0.29 kg/h/d, followed by the P3 treatment of 0.35 ± 0.05 kg/h/d, then the P0 and P1 treatments of 0.32 ± 0.48 kg/h/d and 0.34 ± 0.36. Duncan's further test results also showed that P2 differed from the P0, P1, and P3 treatments. The level of crude fiber consumption is influenced by the protein and crude fiber content available in the ration (Carvalho et al. 2010; Bediona et al. 2024). In the P2 treatment, the highest crude protein content was 14.67%. Also, the highest crude fiber content was 21.54%. The difference in the addition of young coconut husk silage affects the crude fiber content in each treatment ration. Thus, it also affects each goat's crude fiber consumption level. The analysis of

the crude fiber content of young coconut husk silage of 24.45% is higher than the research conducted by (Narek et al. 2021), which obtained a crude fiber content of 21.98%. Crude fiber includes cellulose, some hemicellulose, lignin, and a little pentose resistant to hydrolysis by acidic and alkaline solutions. In addition, other factors that affect fiber consumption are feed quality and livestock energy requirements (Luruk et al. 2024). Crude fiber consumption of P2 treatment is much lower when compared to research conducted by (Kharismawan et al., 2020), who obtained crude fiber consumption data of 0.63 ± 39.42 kg /h/d in goats supplemented with garlic flour and organic chromium minerals.

Fat Content

The results showed that the substitution of young coconut husk silage in the total ration of Sapera goats produced different averages of milk fat composition. Table 3. It can be seen that the highest average was obtained by the P2 treatment, namely 3.96 ± 1.01 %, followed by the P3 treatment, namely 3.89 ± 1.09 %, then in the P0 treatment, namely 3.07 ± 1.22 %, and the lowest fat content in the P1 treatment, namely 2.93 ± 1.00 %. Furthermore, based on statistical analysis, the milk fat content in each treatment was insignificant (P>0.05). This means that adding young coconut fiber silage to the total ration of Sapera goats does not affect the fat composition. However, there is a correlation between the level of crude fiber consumption and milk fat. Following the opinion of (Nurcahyanti et al. 2020), which states that milk fat content highly depends on the feed's CF levels. If CF levels are low, milk fat levels tend to decrease because, in feeding, there is low CF acetic acid production in the rumen. If CF consumption is equal to the CF digestibility level, the milk fat production level is also the same. Same as the opinion of (Nurhajah et al. 2016) crude fiber consumed will be decomposed into cellulose, which is then digested fermentatively by rumen microbes and produces VFA. VFA produced in acetic and butyric acids will be used as raw material for forming milk fat, especially fatty acids. At the same time, glycerol comes partly from feed fat and body fat reserves, and glucose metabolism results from the glycolysis pathway. Acetic acid, β-hydroxy butyrate, will be precursors of short-chain fatty acids in synthesizing milk fat in udder epithelial cells.

Solid Non-Fat (SNF) Content

The content of protein and lactose in milk influences the content of dry matter without fat (Arief et al. 2020). In this study, the SNF content of milk varied in each treatment. The highest SNF content was found in the P0 control treatment, namely 7.86 ± 0.53%, followed by the P3 treatment, namely 7.78 ± 0.98%, then in the P2 treatment, namely 7.64 ± 1.22%, and the P1 treatment, namely 7.23 ± 1.11%. Based on statistical analysis, the substitution of young coconut husk silage in the total ration of Sapera goats has no significant effect (P > 0.05). Contrary to the research conducted by (Christi and Rohayati 2017), the SNF content of Ettawa Crossbred goat milk fed with fermented concentrate ranged from 8.03 to 8.95%. The higher the protein and lactose content in milk, the more other milk components, such as increase. The increase in SNF levels occurs because the fat content is not included in the section, so the remaining total protein and lactose can affect the high percentage produced. In addition, the high SNF factor is also influenced by density. The CF and NFE consumption levels did not show the same increase in NFE content. It is suspected that other influences beyond the treatment factors affect the NFE content of Sapera goat milk. Furthermore, milk composition is influenced by several factors such as livestock species, genetics, environmental conditions, lactation period, and nutritional status of livestock (Kalac and Samkova, 2010; Sabariah et al. 2021).

CONCLUSION

This study concludes that the substitution of young coconut husk silage affects nitrogen-free extract and crude fiber consumption but does not affect milk fat and solid non-fat. The best treatment is found in the P2 treatment with the substitution of young coconut husk silage into the total ration of Sapera goats as much as 40%, which obtained the best value from other treatments, namely nitrogen-free extract consumption of 0.97 kg/d/d, crude fiber consumption of 0.42 kg/d/d, and milk fat content of 3.96%.

ACKNOWLEDGEMENT

Thanks to Universitas Syiah Kuala for funding this research through a Penelitian Asisten Ahli (PAA) scheme with contract number 500/UN11.2.1/PG.01.03/SPK/PTNBH/2024.

REFERENCES

Adeyi, O. 2010. Proximate Composition Of Some Agricultural Wastes In Nigeria And Their Potential Use In Activated Carbon Production. J. Appl. Sci. Environ. Manage 14(1), 55–58. https://doi.org/10.4314/jasem.v14i1.56490.

AOAC. 2005. Official Methods of Analysis of the Association of Official Analytical Chemists. Published by the Association of Official Analytical Chemists, Maryland.

Arief, Rusdimansyah, Sowmen, S., Pazla, R., and Rizqan. 2020. Milk production and quality of Etawa crossbreed dairy goat given tithonia diversifolia, corn waste, and concentrate based palm kernel cake. Biodiversitas 21(9), 4004–4009. https://doi.org/10.13057/biodiv/d210910.

Bediona, P., Maranatha, G., and Amalo, D. 2024. Pengaruh Pemberian Silase Komplit Berbasis Sorgum dan Clitoria Ternatea Hasil Integrasi Tanaman Holtikultura yang Berbeda terhadap Konsumsi serta Kecernaan Protein Kasar dan Serat Kasar Kambing Betina Lokal. Animal Agricultura 1(3), 180–189. https://doi.org/10.59891/animacultura.v1i3.26.

Bira, G.F. and Tahuk, P.K. 2022. Konsumsi, dan Kecernaan Nutrient, Serta Kinerja Pertumbuhan Kambing Kacang Muda Dilihat dari Perbedaan Jenis Kelamin dan Perlakuan Kastrasi. Livestock and Animal Research 20(2), 1–5. https://doi.org/10.20961/lar.v20i2.56052.

Carvalho-Castro, G.A., Lopes, C.O., Leal, C. A. G., Cardoso, P. G., Leite, R. C. and Figueiredo, H.C.P. 2010. Detection of Type III Secretion System Genes in Aeromonas Hydrophila and Their Relationship With Virulence in Nile Tilapia. Veterinar Microbiology. 144(3), 371-376. https://doi.org/10.1016/j.vetmic.2010.01.021.

Christi, R. F. & Rohayati, T. 2017. Kadar Protein, Laktosa, dan Bahan Kering Tanpa Lemak Susu Kambing Peranakan Ettawa yang Diberi Konsentrat Terfermentasi (Protein Levels, lactose, and Solid Non Fat of PE Goat Milk Which are Given Fermented Concentrate). JANHUS Jurnal Ilmu Peternakan Journal of Animal Husbandry Science. 1(2), 19. https://doi.org/10.52434/janhus.v1i2.243.

Gomez, K.A. and Gomez, A.A. 2010. Prosedur Statistik Untuk Penelitian Pertanian. Universitas Indonesia, Jakarta.

Indah, A.S., and Despal, I.G.P. 2020. Model Pendugaan Total Digestible Nutrient (TDN) Pada Hijauan Pakan Tropis Menggunakan Komposisi Nutrien. Sains Peternakan 18,(1), 38-43. http://dx.doi.org/10.20961/sainspet.v%vi%i.35684.

Hifizah, A., Faikatushalihat, F., Astati, A., and Jamili, M.A. 2020. Usaha Peternakan Sapi Perah dan olahan susu 'Nursi'di Kecamatan Enrekang Kabupaten Enrekang Melalui Pemanfaatan Limbah Pertanian. Jurnal Ilmu dan Industri Peternakan (Journal of Animal Husbandry Science and Industry) 6(2), 123-128. https://doi.org/10.24252/jiip.v6i2.18317.

Kharismawan, E., Fauziyah, R., Widiyastuti, T., Munasik, M., dan Prayitno, C. 2020. Konsumsi dan Kecernaan Serat Kasar Serta Protein Kasar Pakan Kambing yang Disuplementasi Tepung Bawang Putih (Allium sativum) dan Mineral Chromium Organik. Seminar Nasional Teknologi Agribisnis Peternakan (Stap), 7, 680–689.

Kalac P. and Samkova E (2010). The effects of feeding various forages on fatty acid composition of bovine milk fat: A review. Czech J Anim. Sci. 12, 521–37.

Katadata. (2022). Indonesia produsen kelapa terbesar di dunia pada 2022. Diakses pada 27 November 2024, dari https://databoks.katadata.co.id/agroindustri/statistik/0fe1a2d7c73251b/indonesia-produsen-kelapa-terbesar-di-dunia-pada-2022.

Lamid, M., Al-Arif, M. A., Puspaningsih, N. N., Kurniati, A., Asmarani, O., and Warsito, S. H. 2015. Lignocellulosic Enzymes Characterization and Scanning Electron Microscope Analysis on Rice Bran Surface Structure Changes. J. Chem. Pharm. Res. 7(1), 124–130.

Narek, E.M., Un, F.P., Koten, B.B., Wea, R., and Aoetpah, A. 2021. Komposisi Nutrien dan

Mineral Silase Sabut Kelapa Muda pada Berbagai Level Penambahan Dedak Padi. Jurnal Ilmu Peternakan dan Veteriner Tropis (Journal of Tropical Animal and Veterinary Science) 11, 1, 61. https://doi.org/10.46549/jipvet.v11i1.154.

Nurcahyanti, B.T., Hartanto, R., and Harjanti, D.W. 2020. Konsumsi Serat Kasar, Kecernaan Serat Kasar dan Produksi Lemak Susu dengan Pemberian Tepung Temulawak (Curcuma xanthorrhiza Roxb.) pada Sapi Laktasi. Jurnal Peternakan Sriwijaya 9(2), 35–43. https://doi.org/10.33230/JPS.9.2.2020.11771.

Nurhajah, A., Purnomoadi, A., and Harjanti, D.W. 2016. Hubungan Antara Konsumsi Serat Kasar dan Lemak Kasar dengan Kadar Total Solid dan Lemak Susu Kambing Peranakan Ettawa. Jurnal Agripet 16(1), 1–8. https://doi.org/10.17969/agripet.v16i1.3755.

Pratama, I. bagus G. 2013. Nutrisi dan Pakan Ternak Ruminansia. Udayana University Press, Bali.

Roy, B., and Ghosh, S. . 2020. Dairy Animal Production. New India Publishing Agency, New Delhi.

Sabariah, B., Norlindawati, A.P., Samijah, A., Supie, J., Mohd. Noor, I., and Ali, H. 2021. Feed nutritive value, milk production and milk quality status of dairy cows in Johore. Malaysian Journal of Veterinary Research 12(1), 1–11.

Tahuk, P.K., Bira, G.F., and Luruk, B. 2024. Intake of NFE, Crude Fibre and Extract Eter of Male Kacang Goats in the Realimentation Phase after Experiencing Different Levels of Feed Restriction. Journal of Tropical Animal Science and Technology 6(2), 110–119. https://doi.org/10.32938/jtast.v6i2.7023.

Wardeh, M.F. 1981. Model for Estimating Energy and Protein Utilization for Feeds. Disertasi. Utah State University. Utah, United State of America.