Bukti Mereviuw Jurnal Internasional Bereputasi

Nama Jurnal	Advances in Animal and Veterinary Sciences
Link Jurnal	https://nexusacademicpublishers.com/journal/4
Indeks Jurnal	**Scopus (Q3)**
Link SJR	https://www.scimagojr.com/journalsearch.php?q=21100818501&tip=sid&exact=no
Bukti Permintaan Reviuw	Tanggal 25 Mei 2023 (Terlampir)
Bukti Persetujuan Mereviuw	Tanggal 30 Mei 2023 (Terlampir)
Dokumen hasil Reviuw	Dokumen Terlampir

HOME MAIL NEWS FINANCE SPORTS ENTERTAINMENT LIFE SEARCH SHOPPING YAHOO PLUS Upgrade Now

Find messages, documents, photos or people Advanced

Home

Compose

Back Archive Move Delete Spam

palupiarda@... 639
palupiarda 1.4K

Inbox 639
Unread
Starred
Drafts 278
Sent
Archive
Spam
Trash
Less

Views Hide
Photos
Documents
Emails to myself
Subscriptions
Shopping
Receipts
Travel

Folders Hide
+ New Folder
facebook
Unwanted

Manuscript Handler

Invitation to review a manuscript in Advances in Animal and Veterinary Sciences

Yahoo/Inbox

Manuscript Handler <info@manuscripthandler.com> Thu, May 25 at 3:34 PM
To: palupiarda@yahoo.com

Dear Dr. Rizki Palupi ,

I am writing to invite you to review a manuscript for Advances in Animal and Veterinary Sciences entitled "Substitution of Soybean Meal with Fermented Kapok Seeds and its Effect on the Growth Performance and nutrient digestibility of Sheep Raised in Cages with Thatched and Zinc Roofs" with manuscript ID MH20230520050508.

Please let me know as soon as possible if you will be able to accept this invitation by clicking on the appropriate link below. We request reviewers to return their reviews preferably in track changes functionality of the Microsoft Word within 15 days of agreeing to review.

Yes, I will review the manuscript (click)

No, I cannot review the manuscript this time. (click)

To review this manuscript, please use the log-in information below:
URL : https://www.manuscripthandler.com/researcherslinks/Advances-in-Animal-and-Veterinary-Sciences
Username : palupiarda@yahoo.com
Password : ub34ggk1

To submit your review report, please click "Yes, I will review the manuscript (click)" and you will be directed to online portal, Manuscript Handler.

We ask reviewers to help ensure studies are scientifically credible and were conducted ethically and in accordance with appropriate reporting guidelines. We do not require a judgement on priority or breadth of appeal.

We have placed Abstract at the end of this email to give you an estimation of contents of the manuscript. We really appreciate this support, which is required to assure speedy processing of the manuscript.

If you are unable to review at this time, I would greatly appreciate your recommendations for other expert reviewers. You may click on "No, I cannot review the manuscript this time. (click)" to provide appropriate recommendations in our online manuscript submission and review system, Manuscript Handler.

Sincerely,

HOME MAIL NEWS FINANCE SPORTS ENTERTAINMENT LIFE SEARCH SHOPPING YAHOO PLUS Upgrade Now

Find messages, documents, photos or people Advanced

Home

Compose

Back Archive Move Delete Spam

palupiarda@... 639
palupiarda 1.4K

Inbox 639
Unread
Starred
Drafts 278
Sent
Archive
Spam
Trash
Less

Views Hide
Photos
Documents
Emails to myself
Subscriptions
Shopping
Receipts
Travel

Folders Hide
+ New Folder
facebook
Unwanted

Reminder to review a manuscript in Advances in Animal and Veterinary Sciences 2

Yahoo/Inbox

Manuscript Handler <info@manuscripthandler.com> Tue, May 30 at 6:01 AM
To: palupiarda@yahoo.com

Dear Dr. Rizki Palupi ,

Thank you very much for agreeing to review the manuscript entitled Substitution of Soybean Meal with Fermented Kapok Seeds and its Effect on the Growth Performance and nutrient digestibility of Sheep Raised in Cages with Thatched and Zinc Roofs for Advances in Animal and Veterinary Sciences on Fri, 26 May 2023, 04:19 AM.

The deadline to submit your report for above-mentioned manuscript is approaching in 12 days.

To keep minimum processing time, it would be great if you could send your evaluation as soon as possible or before the deadline, so we can make a decision via Manuscript Handler at:

http://manuscripthandler.com/researcherslinks/Advances-in-Animal-and-Veterinary-Sciences

Username: palupiarda@yahoo.com

Password: ub34ggk1

Thank you for your cooperation.

Editorial Office

ResearchersLinks, Ltd
35 Oxford Road,
Burnley, Lancashire
BB11 3BB
United Kingdom
Email: journals@researcherslinks.com
Tel: +44 (0)1524383621
+44 (0)7733040586
Twitter: @ResearchersLinks
Facebook: https://www.facebook.com/researchers.links.1
LinkedIn: https://www.linkedin.com/in/researchers-links-94a72478
Web: www.researcherslinks.com

Email: journals@researcherslinks.com

Web:

Advances in Animal and Veterinary Sciences - Submission Proof

Advances in Animal and Veterinary Sciences
Indexed in: NAAS Scopus CrossRef

Substitution of Soybean Meal with Fermented Kapok Seeds and its Effect on the Growth Performance and nutrient digestibility of Sheep Raised in Cages with Thatched and Zinc Roofs

Journal	Advances in Animal and Veterinary Sciences
Manuscript ID	MH20230520050508
Manuscript Type	Research Article
Area of Interest	Husbandry
Date Submitted by the Author	Thu, 25 May 2023, 07:42 AM
Complete List of Authors:	■ Dr Abdullah Naser, Universitas Tadulako, Indonesia ■ Dr Nirwana Nirwana, Universitas Tadulako, Indonesia ■ Dr Sri Wulan, Universitas Tadulako, Indonesia ■ Dr Zaenal Zaenal, Universitas Tadulako, Indonesia ■ Dr Mustafa Mustafa, Universitas Tadulako, Indonesia ■ Prof Effendy Effendy, Universitas Tadulako, Indonesia

Substitution of Soybean Meal with Fermented Kapok Seeds and its Effect on the Growth Performance and nutrient digestibility of Sheep Raised in Cages with Thatched and Zinc Roofs

Abdullah Naser[1*], Nirwana[1], Sri Wulan[1], Zaenal[1], Mustafa[1], Effendy[2]

[1] *Animal Husbandry Study Program, Faculty of Animal Husbandry and Fisheries, Tadulako University, Palu 94118, Indonesia*

[2] *Department of Agriculture Economics, Agriculture Faculty of Tadulako University, Palu 94118, Indonesia*

Email: abdullah.naser76@yahoo.com

ABSTRACT

Fermented kapok seeds (FKS) are rich in various nutrients, so they can be used as animal protein feed to replace soybean meal (SBM) in animal feed. This study aimed to study the effect of substituting soybean meal with fermented kapok seeds on the growth performance and digestibility of lambs reared in corrals thatched with either thatch roofs or zinc roofs. This study used a 2 x 5 split plot pattern randomized block design and was replicated three times.

Livestock was grouped based on body weight. The main plots are two types of stable roofs (thatched roofs and zinc roofs). The subplots were five levels of soybean meal being substituted with fermented kapok seeds, namely: R1: 100% Soybean Meal, R2: 75% Soybean Meal + 25% Fermented Kapok Seeds, R3: 50% Soybean Meal + 50% Fermented Kapok Seeds, 25% Fermented Kapok Seed Soybean + 75% Fermented Kapok Seeds and R5: 100% Fermented Kapok Seeds. The results showed that the cage roof showed a significant difference ($P \leq 0.05$) in body weight, dry matter intake, growth performance, and digestibility in rams, with the highest value in the thatched roof. Likewise, substituting soybean meal with fermented kapok seeds makes a significant difference ($P \leq 0.05$) with the highest value in the R4 and R5 diet groups. However, there was no interaction between the roof of the cage and substituting soybean meal with fermented kapok seeds ($P > 0.05$) on body weight, dry matter intake, growth performance, and digestibility in rams.

Keywords: Fermented kapok seeds, Soybean meal, Growth performance, Digestibility, Sheep

INTRODUCTION

According to Ewing et al. (1999), the body's heat load increases when the temperature rises. The heat will be released into the environment as water as an evaporation product through the mouth, skin, and lungs. According to Dukes (1995), heat currents and other stresses can affect feed consumption, whereas in mild heat stress with an ambient temperature of 25°c - 35°c, feed consumption decreases by 3-10 percent. At a cold ambient temperature of around 5°c - 15°c, feed consumption increases by 2 - 5 percent.

Sheep are ruminant livestock that can utilize low-quality forage, such as corn leaf forage, as food for high-quality products due to the presence of microorganisms in the rumen. Using forage as a single ration causes the livestock in question to only obtain food substances for their basic living needs and little for production. Efforts to meet the nutritional content of forages can be carried out by adding solid foods or concentrates (Gonzaga dos Santos et al., 2019). Concentrates can increase the ration's protein, carbohydrates, minerals, or vitamins (Gonzaga dos Santos et al., 2019). However, giving concentrate depends on the quality of the forage provided. The higher the forage quality, the fewer nutrients are supplied from the concentrate (Metkono et al., 2011). According to Nugroho et al. (2021), foods that contain a lot of concentrates and high starch content will cause a high concentration of microorganisms, so digestibility increases. Furthermore, Supratman et al. (2016) stated that increasing livestock productivity is only possible by providing high-quality concentrates.

One type of concentrate that can be given to ruminants is soybean meal. Soybean meal contains protein: 41.3%, fat: 4.9%, crude fiber: 5.3%, and BETN: 26.5% (Hartadi et al., 1993). The availability of soybean meal for the global animal industry is limited, where daily use competes with human needs. Soybean production cannot meet livestock needs, so soybean imports increase rapidly in Indonesia. The high price of soybean meal affects the cost of animal feed in Indonesia. Therefore other alternatives are sought. One alternative to soybean meal is kapok seed (Ceiba Pentandra). Kapok seeds are widely available in various regions in Indonesia, and the price is relatively low.

According to the Directorate General of Plantations (2019), kapok seed production in 2018 reached 83,820 tons, while the DPPPST (2020) reported that kapok seed production in Central Sulawesi during 2019 reached 385.59 tons per year. This condition supports the need for animal feed ingredients because the crude protein content in kapok seeds is relatively high, reaching 27.30% (Hartadi et al., 1993).

One obstacle in using kapok seeds as animal feed is their low palatability. In addition, they contain a type of poison, cyclopropenoid acid, and as much as 10-13% of their fatty acids. Efforts to eliminate or reduce the adverse effects of kapok seeds can be fermented using the services of Neorospora sitophila. Neorospora sitophila can grow freely at 25° - 30°c with a humidity of 70 - 90% and a pH of 4.5 - 6.5. Neorospora sitophila mold can produce protease enzymes which have the role of breaking down kapok seed protein into easily digestible amino acids, lipase enzymes which break down fats or glycerides into free fatty acids and amylase enzymes which convert carbohydrates into simple sugars; or esters which produce flavors and Attractive aroma at the end of the product. In addition, Neorospora sitophila can protect its products from aflatoxin poisons and even reduce them. The nutritional content of kapok seeds after being fermented using Neorospora sitophla was 41.84% (Result of laboratory analysis at Tadulako University, 1996).

Research on combining soybean meal and fermented kapok seeds for fattening sheep is still limited. The findings of Hao et al. (2020) demonstrated that soybean meal could be effectively replaced by linseed meal in fattening sheep feeds. Kapok seeds contain 28-34% crude protein, 22-40% fat, and 25-35% nitrogen-free extract (Lubis, 1998). Kapok seed oil contains about 50% oleic acid, 30% linoleic acid, 15% palmitic acid, and 5% linolenic fatty acid (Allen et al., 2002). In addition, it has been reported that using kapok seeds is based on protein digestibility, the optimum enzyme concentration that gives the best digestibility value is 0.20% (68.43%) at an error rate of 0.05 (Primadona et al., 2013). However, it also contains Gossipol, an antifertility substance that affects the control of reproductive hormones and has a cytotoxic effect. Giving kapok seed extract (Ceiba pentandra Gaertn) can reduce testosterone levels and the weight of male rats' reproductive organs (Wiratmini et al., 2019). Therefore, we hypothesized that replacing an appropriate proportion of soybean meal with fermented kapok seeds could benefit lamb growth performance and nutrient digestibility. Therefore, this study aimed to determine the effect of replacing soybean meal portions with fermented kapok seeds in sheep feed on the growth performance and nutrient digestibility of sheep reared in cages with thatch and zinc roofs.

MATERIALS AND METHODS

ANIMALS AND EXPERIMENTAL TREATMENT DIETS

The study was conducted in the experimental land Faculty of Animal Husbandry and Fisheries, Tadulako University (Palu, Indonesia). The Animal Care and Ethics Committee of the Faculty of Animal Husbandry and Fisheries, Tadulako University, approved all animal procedures. Thirty local rams aged 8-10 months weighing 10-16 kg were randomly divided into three groups and assigned to one of the five treatment diets (Table 1).

The treatment diets contained a similar ratio of corn and Rice Bran but with different proportions the concentrate of SBM and FKS, which were as follows: R1 = 100% soybean meal; R2 = 75% soybean meal + 25% fermented kapok seeds; R3 = 50% soybean meal + 50% fermented kapok seeds; R4 = 25% soybean meal + 75% fermented kapok seeds; R5 = 100% fermented kapok seeds.

The manufacture of fermented kapok seeds consists of one part onggok (onggok is a solid waste in the form of dregs from cassava processing into tapioca) and four parts of kapok seeds. The two ingredients are mixed until homogeneous and steamed for 30 minutes, then cooled and sprinkled with Neurospora sitophila and stored in a place of 25°c - 30°c for two days. Neurospora sitophila was obtained from boiled corn cobs and stored at room temperature. The concentrate is 1.5% of the body weight of the animal. Comparison between forage and concentrate as a ration used in research is 50%: 50%. The pelleted total mixed ration was prepared using a horizontal feed mixer. The research implementation consisted of the first 10 days for an adaptation period and 50 days for the data collection stage.

SAMPLE COLLECTION AND ANALYSIS

Feed consumption was calculated daily. BW for each ram was measured on days 10 and 50 of the experimental period before the morning feeding. On day 51, all the sheep were moved to individual metabolism cages to determine the apparent total tract digestibility. After five days of adaptation, the quantity of feeds and feces was recorded daily for each ram for five consecutive days.

The fecal samples collected for five days were then mixed homogeneously, and then a sub-sampling of 10% of the total sample was carried out for further analysis for the content of crude protein, crude fiber, and crude fat. The feed and feces samples obtained during the sampling period were baked in the oven at 65^{o} C for 48 hours. Furthermore, the feed and feces samples were milled finely for analysis of crude protein, crude fat, and crude fiber content. The content of crude protein, crude fiber, and crude fat was determined following the Association of Official Analytical Chemists (2000) procedures. The chemical composition of R1-R5 is presented in Table 2.

EXPERIMENTAL DESIGN

This study used a 2 x 5 Split Plot Pattern Randomized Group Design with three replications. Grouping livestock based on body weight. The main plot consists of 2 types of stable roofs, namely:

1. Cages with thatched roofs
2. Cage with zinc roofs.

Subplots consist of 5 levels of substitution of soybean meal with fermented kapok seeds, namely:

R1 = 100% soybean meal

R2 = 75% soybean meal + 25% fermented kapok seeds

R3 = 50% soybean meal + 50% fermented kapok seeds

R4 = 25% soybean meal + 75% fermented kapok seeds

R5 = 100% fermented kapok seeds

STATISTIC ANALYSIS

Sheep production performance data such as body weight, dry matter intake, growth performance, and digestibility were analyzed using the PROC MIXED procedure from SAS (version 9.4; SAS Institute Inc., Cary, NC, USA), with cage treatment as plots main and substitution of soybean meal with fermented kapok seeds as subplots and body weight of sheep in the treatment group. The statistical model is as follows:

$$Y_{ijk} = \mu + \rho_k + \alpha_i + \beta_j + \delta_{ik} + (\alpha\beta)_{ij} + \varepsilon_{ijk} \quad (1)$$

With:

Y_{ijk} = observed value on factor A level I and factor B level j in the k-th block,

μ = additive component of the general average,

ρ_k = main group effect,

α_i = main effect of factor A,

β_j = main effect of factor B,

$(\alpha\beta)_{ij}$ = interaction component of factor A and factor B,

δ_{ik} = main plot random component,

ε_{ijk} = subplot random component,

i = 1, 2, 3, … a; j = 1, 2, 3, … b; k = 1, 2, 3, … r.

Statistical significance was defined at $P \leq 0.05$; the trend is expressed at $0.05 < P \leq 0.10$.

RESULTS AND DISCUSSION

DM INTAKES AND GROWTH PERFORMANCES

Dry matter intake and growth performance in rams in each treatment is shown in Table 3. The ram's body weight, dry matter intake, growth performance, and digestibility were significantly ($p \leq 0.05$) influenced by the type of roof of the cage (Table 3 and Table 4). Likewise, the feed treatment (substitution of soybean meal with fermented kapok seeds) significantly ($p \leq 0.05$) affected the ram's body weight (Table 3). However, the interaction effect between the cage's roof type and the substitution of soybean meal with fermented kapok seeds was insignificant (data not presented). The body weight of rams was significantly ($p \leq 0.05$) higher in the cage with a thatched roof when compared to the zinc-roofed cage. A thatched roof is a bad temperature conductor, receiving and reflecting heat. In contrast, a tin roof is a good temperature conductor (Ponni and Baskar, 2015), receiving heat and continuing it into the cage. The temperature of the cage using a thatched roof was 24°C - 30°C or an average of 27°C, while the temperature in the cage using a tin roof was 24°C - 36°C or an average of 30°C. An increase in the temperature of the cage can cause ration consumption to decrease so that the sheep's growth slows down. At high ambient temperatures, livestock will try to dissipate the heat received so that the temperature remains constant by reducing consumption and increasing evaporation. According to Gonzaga dos Santos et al. (2019), every 1°C increase can reduce ration consumption by 1.7%. In addition, if the temperature continues to increase, it can affect the central nervous system so that ration consumption decreases and water consumption increases, resulting in reduced sheep growth. Consumption of dry matter will decrease if there is an increase in temperature. According to Dukes (1995), heat stress could affect feed consumption, where in heat stress with an ambient temperature of 25°C - 35°C, ration consumption decreases by 3 - 10%. This is relevant to the findings of Sudita (2016) and Dwipayana et al. (2019), who stated that livestock shelters affect dry matter consumption. There tends to be a higher level of dry matter consumption in shelters due to a higher level of digestibility. The high level of digestibility correlated with the level of dry matter consumption. According to McDonald et al. (2002), feed digestibility and feed digested rate affect ration consumption.

Feed treatment responded positively to the BW of rams ($P \leq 0.05$), with the highest value in the R4 and R5 diet groups (Table 3). This indicates that fermented kapok seeds could replace soybean meal as animal feed. Hosoda et al. (2019) and Botkin et al. (1988) state that various types of rations containing dry matter, protein, crude fiber, and energy can increase body weight. Protein functions to form new tissue and replace damaged tissue (Harm et al., 2022). Kapok seeds can replace soybean meal as animal feed if fermented first. In fermentation, Neurosporo sitophila can remove the toxic cyclopropenoid acid present in kapok seeds. Grubješic´et al. (2020) stated that fermentation causes improvements to specific properties of the basic food ingredients, changes in organoleptic properties, and can reduce toxic compounds. Other benefits of fermentation are changing the taste and aroma for the better, increasing durability, and reducing toxic compounds from the basic ingredients (Bernardini et al., 2012). In addition, fermented feed will have better palatability, so sheep prefer it (Palupi et al., 2023).

Some studies have reported the protein content in kapok seeds is 28.79% (Primadona et al., 2013) and 29% (Ariani, 1999), but the results of this study are lower. FKS is a good protein source for rams at concentrations of up to 54% of DM. In the present study, the partial replacement of SBM with FKS affects the DMI and increases the growth performance. Studies have shown that FKS and its by-products can improve the growth performance of animals (Primadona et al., 2013).

Kapok fiber has a hollow tubular structure with a diameter of 14.5 ± 2.4 µm (Huang and Lim, 2006) and a length ranging from 0.8 to 3 cm (Vázquez Yanes et al., 1999). Due to these morphological characteristics, kapok fiber has been used for heavy metal absorption (Chung et al., 2008); this indicates that substituting soybean meal with fermented kapok seeds can improve livestock health.

According to Wu et al., 2017 increased feed efficiency might be attributed to the balanced amino acid profile. Additionally, Quezada and Cherian (2012) and Hao et al. (2020) concluded that high antioxidant activity and higher phenolic and flavonoid content would enhance ADG animals. However, the actual concentration of those functional components in FKS and their effects on rams should be analyzed in the future.

DIGESTIBILITY

The digestibility in CP, CF, and fat of ram livestock rations during the study is shown in Table. 4.

Substitution of Soybean Meal with Fermented Kapok Seeds at increasing levels increased digestibility in CP, CF, and fat (P = 0.05), with the highest value in the R4 and R5 groups. The highest crude protein digestibility results were in R4 (65.17%) and R5 (66.33%). These results are higher than the research by Rahman et al. (2013), which stated that the digestibility of crude protein in goats fed palm kernel meal was 52.1%. However, this is lower than the results of Aregheore's (2000) study, which stated that the digestibility of crude protein in goats-fed corn cobs was 70.1%.

The higher digestibility coefficient of crude protein is directly proportional to the increase in the body weight of livestock. Digestibility can be influenced by several factors, such as the composition of feed ingredients, the composition ratio between one feed ingredient and another feed ingredient, feed treatment, enzyme supplementation in feed, livestock, and feed level (McDonald et al., 2002). Gultom et al. (2016) added that the administration of rations with physical (chooper), biological (chooper and Aspergillus niger), and chemical (chooper and urea) treatments affected the digestibility of crude protein. Paramita et al. (2008) stated that in vivo, the quality of the feed ingredients given was seen through consumption and the magnitude of the digestibility value, which indicates the amount of nutrients that can be used as necessities for life and growth. Tillman et al. (2005) stated that one factor affecting the digestibility of crude protein is the protein content in the ration consumed by livestock. Rations with low protein content generally have low digestibility and vice versa. Therefore, the level of protein digestibility is influenced by the protein content of the ration ingredients and the amount of protein that enters the digestive tract.

We have shown that substituting soybean meal with fermented kapok seeds can increase body weight, consumption of dry matter rations, and feed efficiency of ram sheep. This is relevant to the findings of Aziza et al. (2013) and Nitrayová et al. (2014), who stated that flaxseed and its by-products could improve the growth performance and quality of animal carcasses due to essential amino acids and fatty acids, especially α-linolenic acid (18:3, n-3). Therefore, we emphasize that fermented kapok seeds are a good source of protein, fiber, and fat, making them an excellent healthy food choice for livestock. However, the actual concentrations of the functional components of fermented kapok seeds and their effects on livestock should be analyzed in the future.

The highest crude fiber digestibility results were in R4 (43.67%) and R5 (47.00%). These results are lower than the results of Antisa et al. (2020) study, which stated that the digestibility of crude fiber in corn stalks in rams was 56.44%. According to McDonald et al. (2002), the fraction of feed fiber greatly determines digestibility in the amount and chemical composition of the fiber itself. Reinforced by the opinion of Tillman et al. (2005) states that the digestibility of crude fiber depends on the crude fiber content in the ration and the amount of crude fiber consumed. Too high levels of crude fiber can interfere with the digestion of other substances. In addition to the content and amount of crude fiber in the ration, another factor that affects the digestibility of crude fiber is the activity of cellulolytic bacteria in the rumen. Maynard et al. (2005) stated that several factors, including fiber content in the feed, the composition of the crude fiber constituents, and the activity of microorganisms, influenced the digestibility of crude fiber.

The highest crude fat digestibility results were in R4 (62.83%) and R5 (63.50%). These results are lower than the results of Mastopan et al. (2014) study, which stated that the digestibility of crude fat in a diet Containing Oil Palm in rams was 95.76%. This is to the statement of Sandri (2009), which states that the digestibility of a feed depends on the quality of the nutrients contained in the feed. In addition, it affects the growth of microorganisms. Tillman et al. (2005) stated that digestibility was not only influenced by the composition of a feed but also affected by the composition of other foods consumed with the feed.

CONCLUSION

We evaluated the substitution of soybean meal with fermented kapok seeds on body weight, dry matter intake, growth performance, and digestibility in rams. The results showed that the type of roof of the cage had a significant effect ($p \leq 0.05$) on increased body weight, dry matter intake, growth performance, and digestibility in rams. The feed treatment (substitution of soybean meal with fermented kapok seeds) had a significant effect ($p \leq 0.05$) on the increase in body weight, dry matter intake, growth performance, and digestibility in rams. The interaction effect between the cage's roof type and feed treatment (soybean meal substitution with fermented kapok seeds) was insignificant. We emphasize that livestock cages with thatched roofs are better livestock-rearing facilities than those with zinc roofs. The soybean meal can be substituted with fermented kapok seeds for animal feed. Fermented kapok seeds are a good source of protein, fiber, and fat, so they are a healthy food choice for livestock. Further research is needed regarding the actual concentration of the functional components of fermented kapok seeds and their effects on livestock. In addition, it is also necessary to carry out a cost-efficiency analysis for the commercialization of the proposed feed.

ACKNOWLEDGEMENTS

The authors thank Faculty of Animal Husbandry and Fisheries, Tadulako University, and the Ministry of Education, Culture, Research, and Technology for funding this study.

CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

NOVELTY STATEMENT

A study on the Substitution of Soybean Meal with Fermented Kapok Seeds and its Effect on the Growth Performance and nutrient digestibility of Sheep has never been done before.

AUTHORS CONTRIBUTION

Abdullah Naser conceptualized this study. Then, Abdullah Naser and Effendy surveyed the literature and drafted and revised the manuscript, while Nirwana and Sri Wulan edited and suggested changes. In addition, Zaenal and Mustafa also studied and played a part in drafting the manuscript. Finally, all authors checked and approved the final version of the manuscript for publication in this journal.

REFERENCES

Allen PG, Botsford LW, Schuur AM, Johnston WE (2002). Bioeconomics of aquaculture. Elsevier, Amsterdam. https://search.sl.nsw.gov.au/primo-explore/fulldisplay?vid=SLNSW&docid=SLNSW_ALMA2195977360002626&lang=en_US&context=L

Antisa A, Natsi A, Syahrir S (2020). Digestibility of crude protein, crude fat and crude fiber complete ration contains the main ingredients of corn stalk in Capra aegagrus. Bulletin Makanan Ternak, 2020-02-11: 1-13

Aregheore J, Krizova L, Richter M, Carry V, Iha J (2000). Effect of rumenprotected methionine, lysine or both on milk production and plasma amino acid of high-yielding dairy cows.Czech. J. Anim. Sci.54(6): 239-248.

Ariani E (1999). Uji banding biji kapuk (Ceiba petandra, GAERTN) terhadap dedak, bungkil kelapa dan bungkil kedelai sebagai sumber protein lemak ruminansia. Skripsi.Fakultas Peternakan, Institut Pertanian Bogor.

Association of Official Analytical Chemists (AOAC) 2000. Official methods of analysis, 17th edition. AOAC, Arlington, VA, USA

Aziza AE, Panda AK, Quezada N, Cherian G (2013). Nutrient digestibility, egg quality, and fatty acid composition of brown laying hens fed camelina or flaxseed meal. Journal of Applied Poultry Research 22, 832–841. https://www.sciencedirect.com/science/article/pii/S1056617119304581

Bernardini D, Gerardi G, Peli A, Costa N, Amadori M, Segato S (2012). The Effects of Different Enviromental Conditions on Thermoregulation and Clinical and Hematological Variables in Long-Distance Road-Transported Calves. Journal of Animal Science 90: 1183-1191. https://pubmed.ncbi.nlm.nih.gov/22100587/

Botkin MP, Field RA, Johnson CL (1988). Sheep and Woll. Scinece, Production and Management. Prentice Hall, Inc. Englewood Cliffs, New Jersey.

Chung BY, Cho JY, Lee MH, Wi SG, Kim JH, Kim JS, et al. (2008). Adsorption of heavy metal ions onto chemically oxidized Ceiba pentandra (L.) Gaertn. (kapok) fibers. J Appl Biol Chem. 2008, 51:28–35. http://koreascience.or.kr/article/JAKO200818259611607.page

DPPPST (Dinas Perkebunan and Peternakan Provinsi Sulawesi Tengah), 2020. Statistik Peternakan . Dinas Perkebunan Dati I Provinsi Sulawesi Tengah. https://sulteng.bps.go.id/subject/24/peternakan.html

Dukes HH (1995). Physiology of Domestic Animal. Newyork. Comstock Pub University Coilage Camel. 13th Edition, 748 pages.

Dwipayana IKB, Suryani NN, Mahardika IG (2019). Nutrition Consomption, Dry Matter and Dry Weight Digestability of Bali Cattle Ration in Evacuation Zone at Nongan Vilage. Karangasem. Peternakan Tropika, 7(2): 559- 569. https://ojs.unud.ac.id/index.php/tropika/article/view/49945

Ewing SA, Lay DC, Borell EV (1999). Farm Animal Well Being, Stress Physiology, Animal Behavior and Environmental Design. Prentice Hall, Inc, New Jersey. 357 pages.

Gonzaga dos Santos AC, Yamin M, Priyanto R, Maheshwari H (2019). Physiological Response on Local Sheep in Rearing System and Different Concentrate. Jurnal Ilmu Produksi dan Technology Hasil Peternakan, 7(1): 1-9. https://journal.ipb.ac.id/index.php/ipthp/article/view/25034

Grubješic G, Titze N, Krieg J, Rodehutscord M (2020). Ruminal fermentation characteristics and related feeding values of compound feeds and their constituting single feeds studied by using in vitro techniques. Animal, 14:9: 1829–1840. https://www.sciencedirect.com/science/article/pii/S1751731120000889

Gultom EP, Wahyuni TH, Tafsin M (2016). Kecernaan serat kasar dan protein kasar ransum yang mengandung pelepah daun kelapa sawit dengan perlakuan fisik, biologis, kimia dan kombinasinya pada domba. Jurnal. Peternakan Integratif. 4 (2) : 193-202.

Hao XY, Yu SC, Mu CT, Wu XD, Zhang CX, Zhao JX, Zhang JX (2020). Replacing soybean meal with flax seed meal: effects on nutrient digestibility, rumen microbial protein synthesis and growth performance in sheep. Animal, 14:9: 1841–1848. https://www.sciencedirect.com/science/article/pii/S1751731120000397

Harm TA, Smith JD, Cassmann ED, Greenlee JJ (2022). Combinatorial treatment of brain samples from sheep with scrapie using sodium percarbonate, sodium dodecyl sulfate, and proteinase K increases survival time in inoculated susceptible sheep. Research in Veterinary Science, 152: 497–503. https://pubmed.ncbi.nlm.nih.gov/36162234/

Hartadi H, Reksohadiprodjo, Tillman AO (1993). Tabel Komposisi Pakan Untuk Indonesia. Gajah Mada University Press, Yogyakarta. https://ugmpress.ugm.ac.id/en/product/peternakan/tabel-komposisi-pakan-untuk-indonesia

Hosoda K, Ohmori H, Nakamura YN, Kamiya M (2019). Effect of inclusion rate of corn silage in ensiled total mixed ration on dry matter intake, nutrient digestibility, and ruminal fermentation in Japanese Wagyu steer. Livestock Science, 229: 126-130. https://www.sciencedirect.com/science/article/abs/pii/S1871141319308029

Huang X, Lim T (2006). Performance and mechanism of a hydro- phobic–oleophilic kapok filter for oil/water separation. Desalination, 190: 295–307. https://www.sciencedirect.com/science/article/abs/pii/S0011916406001469

Lubis DA (1998). Ilmu makanan ternak. P.T. Pembangunan, Jakarta. https://onesearch.id/Author/Home?author=LUBIS%2C+D.A.

Mastopan, Ma’ruf Tafsin M, Hanafi ND (2014). Crude Fat Digestibility and TDN (Total Digestible Nutrient) of Diet Containing Oil Palm Frond Treated by Physical, Chemical, Biological and Their Combination on Sheep.

Maynard LA, Loosil JK, Hintz HF, Warner RG (2005). Animal Nutrition. McGraw-Hill Book Company. New York, USA.

McDonald P, Edward RA, Genhalgh BFD (2002). Animal Nutrition. 2nd. Longmen, New York.

Metkono OAF, Kardaya D, Sudrajat D (2011). Local Sheep Performances FED Natural Grass and Tahu Waste Product Under Traditional Rearing. Jurnal Pertanian, 2(2): 88-96. https://ojs.unida.ac.id/jp/article/view/562

Nitrayová S, Brestenský M, Heger J, Patráš P, Rafay J, Sirotkin A (2014). Amino acids and fatty acids profile of chia (Salvia hispanica L.) and flax (Linum usitatissimum L.) seed. Potravinarstvo Scientific Journal for Food Industry 8, 72–76. https://potravinarstvo.com/journal1/index.php/potravinarstvo/article/view/332

Nugroho J, Purwadi, Suhardi (2021). The Effect of Adding Beer Druge in the Rate on the Growth and Consumption of Local Male Sheep. Tropical Animal Science, 3(2): 16-21. https://ejournal.uby.ac.id/index.php/tas/article/view/707

Palupi R, Lubis FNL, Pratama ANT, Muhakka (2023). Effects of Lactobacillus-Fermented Feed on Production Performance and Carcass Quality of Broiler Chickens. J. World Poult. Res., 13(1): 127-135. DOI: https://dx.doi.org/10.36380/jwpr.2023.14

Paramita WL, Susanto WE, Yulianto AB (2008). Konsumsi dan kecernaan bahan kering dan bahan organik dalam haylase pakan lengkap ternak sapi peranakan Ongole. Media Kedokteran Hewan. 24: 59-62.

Ponni M, Baskar R (2015). Comparative Study of Different Types of Roof and Indoor Temperatures in Tropical Climate. International Journal of Engineering and Technology, 7(2): 530-536. https://www.researchgate.net/publication/282926251_Comparative_study_of_different_types_of_roof_and_indoor_temperatures_in_tropical_climate

Primadona F, Wardoyo SE, Hasan ODS (2013). Protein Digestibility of Kapok Seeds in Vitro for Fish Feed. Jurnal Sains Natural Universitas Nusa Bangsa, 3(2): 112 – 128. https://ejournalunb.ac.id/index.php/JSN/article/view/61

Quezada N, Cherian G (2012). Lipid characterization and antioxidant status of the seeds and meals of Camelina sativa and flax. European Journal of Lipid Science and Technology 114, 974–982.

Rahman MM, Abdullah RB, Wan Khadijah WE, Nakagawa T, Akashi R (2013). Feed intake, digetibility and growth performance of goats offered napiergrass suplemented with molasses proctected palm karnel cake and soya waste. Asian Journal of Animal and Veterinary Advances. 8 (3) : 527-534.

Sandri A (2009). Suplementasi Blok Multinutrisi Berbasis Hijauan Lapangan terhadap Kecernaan In Vivo pada Domba Jantan. Departemen Peternakan, Fakultas Pertanian, Universitas Sumatera Utara, Medan.

Sudita IDN (2016). Pemenuhan nutrien untuk induk sapi bali pada kelompok ternak program “SIMANTRI” di Bali. Prosiding Seminar Nasional Peternakan; 2016 Agustus 25; Makasar (ID): Universitas Hasanuddin. hlm 57–66.

Supratman H, Setiyawan H, Budinuryanto DC, Fitriani A, Ramdani D (2016). Effect of Balance Complete Forage and Feed Concentrate on Consumption Increse of Body Weight and Sheep Feed Conversion. Jurnal Ilmu Ternak, 16(1): 31-35. https://jurnal.unpad.ac.id/jurnalilmuternak/article/view/9822

Tillman AO, Hartadi A, Reksohadiprodjo, Prawirokusumo S and Lebdohadiprodjo (2005). Ilmu Hakanan Ternak Dasar. Gajah Mada University Press, Yogyakarta.

Vázquez Yanes C, Batis MuñozAlcocer Silva AI, Gual Díaz MI, Sánchez Dirzo MC (1999). Árboles y arbustos nativos potencialmente valiosos para la restauración ecológica y la reforestación. México: CONABIO - Instituto de Ecología, UNAM.

Wiratmini NI, Setyawati I, Narayani I (2019). Rats testosterone level and reproductive organ weight treated by kapok (Ceiba pentandra Gaertn.) seed extract. IOP Conf. Series: Earth and Environmental Science, 347: 012023. https://iopscience.iop.org/article/10.1088/1755-1315/347/1/012023

Table 1: Arrangement and chemical composition of experimental rations (%)

	Treatment				
Items	**R1**	**R2**	**R3**	**R4**	**R5**
Ingredients					
Forage Corn	50	50	50	50	50
Milled Corn	5	5	5	5	5
Rice Bran	5	5	5	5	5

Coconut Cake	20	20	20	20	20
Soybean meal	20	15	10	5	0
Fermented Kapok Seeds	0	5	10	15	20
Amount	**100**	**100**	**100**	**100**	**100**
Composition					
Dry Material	54.00	54.00	54.00	54.00	54.00
TDN	60.25	60.20	60.15	60.10	60.05
Proteins	14.20	14.16	14.11	14.06	14.01
Coarse Fiber	7.00	8.11	9.22	10.33	11.44
Fat	3.76	4.06	4.37	4.67	4.98

Note: R1 = 100% soybean meal; R2 = 75% soybean meal + 25% fermented kapok seeds; R3 = 50% soybean meal + 50% fermented kapok seeds; R4 = 25% soybean meal + 75% fermented kapok seeds; R5 = 100% fermented kapok seeds

Table 2: Composition and chemical composition (%) of soybean meal (SBM) and fermented kapok seeds (FKS)

Composition	**R1**	**R2**	**R3**	**R4**	**R5**
Dry Material	17.2	17.2	17.2	17.2	17.2
TDN	14	14	13.9	13.9	13.8
Crude Proteins	8.52	8.51	8.46	8.42	8.37
Crude Fiber	1.17	2.28	3.36	4.5	5.61
Fat	0.34	0.65	0.95	0.26	1.56

Note: R1 = 100% soybean meal; R2 = 75% soybean meal + 25% fermented kapok seeds; R3 = 50% soybean meal + 50% fermented kapok seeds; R4 = 25% soybean meal + 75% fermented kapok seeds; R5 = 100% fermented kapok seeds

Table 3: Dry matter intake and growth performance in rams fed five experimental diets

Treatment	BW (kg)	DMI (gr/day)	ADG (gr/day)	Feed efficiency
Cage roof				
Thatched	23.84a	533.73a	101.85a	0.192a
Zinc	16.45b	461.45b	70.25b	0.153b
Substitution of SBM with FKS				
R1	16.97a	485.95a	75.48a	0.155a
R2	18.30a	484.89a	79.64ab	0.165a
R3	19.61ab	494.91ab	83.73ab	0.170ab
R4	21.81bc	507.55b	91.24bc	0.178ab
R5	24.02c	514.66b	100.17c	0.195b

Note: different letters in the column indicate significantly different treatment at $\alpha = 5\%$; BW = Body Weight; DMI = Dry Matter Intake; ADG = average daily gain.

Table 4: Digestibility in rams fed the five experimental diets (%)

Treatment	CP	CF	Fat
Cage roof			
Thatched	64.60a	42.33a	64.20a
Zinc	61.93b	39.93b	57.20b
Substitution of SBM with FKS			
R1	59.83a	37.83a	57.50a

R2	61.00a	37.83a	58.83ab
R3	64.00b	39.33a	60.83abc
R4	65.17bc	43.67b	62.83bc
R5	66.33c	47.00b	63.50c

Note: different letters in the column indicate significantly different treatment at α = 5%; CP = Crude Protein; CF = Crude fiber