JPPIPA 9(6) (2023)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Effect of Durian By-Product on Nutrition Intake, Productivity, and Physiological Conditions of Kacang Goats (*Capra aegagrus hircus*)

Padang[1], Sirajuddin Abdullah[1*], Sagaf[1], Sri Wulan Cakrawati[1], Harmoko[2]

[1] Animal Husbandry, Faculty of Animal and Fishery, Tadulako University, Palu, Indonesia.
[2] Animal Study Program, Campus External Pattimura University, Maluku, Indonesia.

Received: April 8, 2023
Revised: May 13, 2023
Accepted: June 25, 2023
Published: June 30, 2023

Corresponding Author:
Sirajuddin Abdullah
sirajuddin_abdullah@yahoo.co.id

DOI: 10.29303/jppipa.v9i6.3869

Abstract: The native plant of mainland Asia, Durian, presents a considerable opportunity to be used as animal feed due to the high by-product production, with almost 70% of every durian fruit being waste. This presents an excellent opportunity to repurpose durian skin and seeds as animal feed. An experiment was conducted to evaluate the impact of durian by-product on the productivity and physiological condition of kacang goats. The research was conducted from September to November 2020 at the Experimental Cage owned by CV. Prima BREED, Palu City, Central Sulawesi Province. The research cages were stage cages, with a size of 2 x 10 m, and one animal was placed in each cage. A total of 18 Peanut goats were divided into 3 treatment levels and 6 replications according to a completely randomized design. The study found that the nutritional intake of durian by-product in the form of rind and seed flour as much as 0.5% in the feed affected the carcass percentage, the amount of red blood cell, hemoglobin level, and hematocrit value but had no effect on body weight gain, dry matter consumption, feed use efficiency, carcass weight, weight and percentage of non-edible carcasses, body temperature, respiration frequency, pulse frequency, and white blood cell count of kacang goats. This indicates that the utilization of 0.5% durian by-product (seeds and rind) in feed did not have a negative effect on the productivity and physiological condition of kacang goats, making it a viable option for animal feed.

Keywords: Carcass; Durian By-Product; Kacang Goat; Physiological Condition; Productivity.

Introduction

Indonesia as an agricultural country, the role of the plantation sub-sector and the livestock sub-sector can be used as a milestone for the development of the national economy. The plantation sub-sector, mainly durian, is one of the prima donna plantation crops in Central Sulawesi. This fruit can be found all year round in fruit markets. Durian (*Durio zibenthinus* Murr.) is one of the native tropical plants to Southeast Asia and is popular as the king of fruit (Sihaloho et al., 2021; Zhou et al., 2021) which is widely cultivated in gardens along with other plants. This plant is a native fruit of Indonesia, occupies the 4th position of the national fruit with a production of approximately 700 thousand tons per year. The harvest season generally takes place from September to February with a lean period from April to July (Ei & Ismail, 2022).

Durian production in Central Sulawesi in 2020 is quite high, which is around 19,382.00 tons/year (Indonesian Central Bureau of Statistics, 2021). The total weight of the durian consists of 3 parts, the first part is about 20-25% flesh, the second is about 5-15%, and the rest is 60-70% rind weight (Mahyiddin et al., 2022). Based on this composition, durian seed by-product is 969.10-2,907.30 tons/year, while durian rind by-product is 11,629.20-13,567.40 tons/year.

Durian by-product still contains quite a lot of water content so it is easy to rot and has the potential to pollute the environment. So that this by-product can be utilized

How to Cite:
Padang, Abdullah, S., Sagaf, Cakrawati, S. W., & Harmoko. (2023). Effect of Durian By-Product on Nutrition Intake, Productivity, and Physiological Conditions of Kacang Goats (Capra aegagrus hircus). *Jurnal Penelitian Pendidikan IPA*, *9*(6), 4820–4826. https://doi.org/10.29303/jppipa.v9i6.3869

according to the nature of the material and used for a relatively long time, further processes such as flour are needed. Durian rind and seeds are the result of durian by-product which is not widely used by the community because people do not know other benefits of rind and seeds, but durian rind and seeds can be used as alternative feed ingredients for livestock, because they still contain nutrients that can be utilized for livestock.

Durian seeds still contain nutrients in the form of dry matter (BK) = 90.28%, crude fiber (SK) 1.82%, crude protein (PK) 6.05%, crude fat (LK) 0.41% and ash 4, 86% (Sistanto et al., 2017), while the durian rind still contains nutrients in the form of BK = 91.11%, SK 41.24%, PK 4.73%, LK 0.90% and ash 8.31% (Suciyanti et al., 2016). Utilization of durian by-product in the form of rind and seeds which are only considered trash and useless items can be collected and reprocessed as alternative feed ingredients.

The high nutritional content of durian by-product opens up opportunities to be used as animal feed. However, its use as animal feed must be limited because durian by-product also contains anti-nutritional substances in the form of tannins. A practical way that can be done to reduce the tannins contained in durian by-product is by drying, this can be done to reduce the tannins in the seeds and skin of the durian fruit.

Method

Place and Time of Research

This research was conducted in the Experimental Cage owned by CV. Prima BREED, Tondo Village, Mantikulore Sub-District, Palu City, Central Sulawesi, which takes place from September 17 to November 26, 2020.

Experimental Cattle

The livestock used in this study were 18 female Kacang goats aged 12 months with a body weight range of 9.93 to 16.85 kg. Determination of the age of livestock is based on the condition of the goat's incisors which are still temporary and in a state of tenuousness.

The Cage

The cages used were stage cages with a tin roof, plank floors, walls made of boards measuring 2 x 10 m. The cages were divided into 18 plots, each measuring 1 x 1 meter, which was occupied by an experimental female Kacang goat. Each plot is equipped with a feed trough made of planks and a basin for drinking. Three days before the cage is used, it is first cleaned and sprayed with Rodalon with a dilution rate of 15 cc per 10 liters, so that the cage is free from germs.

Animal Feed

The feed given during the research consisted of concentrate and *Brachiaria decumbens*. The concentrate used consisted of a mixture of ingredients in the form of 18% ground soybeans, 48% rice bran, and 34% milled corn as well as skin flour and durian fruit seeds as treatments. The source of forage was *Brachiaria decumbens* grass which was given after the concentrate and treatment had been consumed ad libitum. The nutritional content of the feed used is listed in Table 1

Table 1. Nutritional Content of Feed Ingredients Used

Feed Ingredients	Dry Ingredient*	Crude Protein*	Crude Fiber*	Crude Fat*	TDN**
Ground soybean	92.13	31.35	9.73	11.65	61.00
Rice bran	89.92	10.67	18.39	4.64	68.41
Milled corn	86.89	9.54	4.92	8.30	69.82
Durian rind flour	90.79	8.62	26.63	0.56	71.35
Durian seed flour	87.86	9.68	1.39	0.50	85.45
Brachiaria decumbens	26.29	11.51	30.20	1.90	59.54

Description: *The results of the analysis of the Feed Nutrition Laboratory of the Faculty of Animal Husbandry and Fisheries, Tadulako University in 2020. ** Total Digestible Nutrient (Hartadi et al., 2019).

Durian Rind Flour and Seed Flour Preparation

To prepare durian rind flour, start by choosing ripe and fresh durian with thick rind. Remove the durian flesh from the rind and cut the rind into small pieces. Sun-dry or oven-dry the rind until it becomes brittle, and then grind it into a fine powder using a food processor or grinder. Sift the powder to remove any large particles, and store the durian rind flour in an airtight container in a cool, dry place.

For durian seed flour, remove the seeds from the durian fruit and remove the thin brown skin covering the seeds. Rinse the seeds with water to remove any remaining flesh or debris. Boil the seeds in water for 30 minutes or until they are soft, then drain the water and spread the seeds on a flat surface to dry. Once the seeds are completely dry, grind them into a fine powder using a food processor or grinder. Sift the powder to remove any large particles, and store the durian seed flour in an airtight container in a cool, dry place. The flowchart can be seen in figure 1.

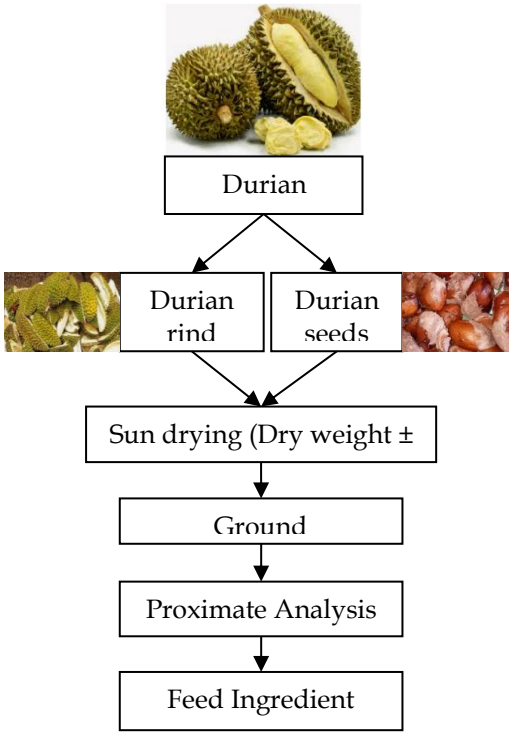

Figure 1. Preparation steps of durian rind and seed flour

The Treatment

This research was designed using a completely randomized design (CRD) which consisted of 3 treatments and repeated 6 times. The treatments tried were:

P1 = 1% concentrate without rind flour and durian seeds
P2 = 1% concentrate + 0.5% durian seed flour
P3 = 1% concentrate + 0.5% durian rind flour

Result and Discussion

The Effect of Treatment on Productivity

The observation result of the effect of nutritional intake of durian by-product addition to the kacang goats productivity are presented in Table 2. Analysis of variance showed that the use of durian by-product as nutrient intake had a significant effect (P<0.05) on the percentage of carcasses but had no significant effect (P>0.05) on body weight gain, dry matter consumption of rations, efficiency of ration use, slaughter weight, carcass weight, weight and percentage of non-carcass edible kacang goat.

The results of the Honestly Significant Difference (HSD) test showed that the percentage of goat carcasses fed with nutrients from durian seed flour was significantly lower (P<0.05) compared to goats not fed with nutrients from durian by-product (rind and seeds) and rind flour.

Table 2. Average Productivity of Kacang Goats

Parameter	Treatment		
	Control (P0)	Seeds Flour (P1)	Rind Flour (P2)
Weight gain (g/head/day)	29.76	29.02	29.82
CDMF (g/head/day)	382.83	449.40	464.65
Ration usage Efficiency	0.078	0.066	0.065
Slaughter Weight (kg/head)	13.32	13.62	14.36
Carcass Weight (kg/head)	6.15	6.13	6.67
Carcass Percentage (%/head)	46.17[a]	44.95[b]	46.44[a]
Non-Edible Carcass Weight (kg/head)	2.69	2.73	2.87
Non-edible Carcass Percentage (%/head)	20.17	20.04	20.06

Description: Different letters toward the row indicate significantly different (P<0.05), CDMF = Consumption of dry matter feed

The increase in body weight, dry matter consumption, feed use efficiency, slaughter weight, carcass weight, non edible carcass weight and the percentage of non edible carcass that did not differ between treatments indicated that nutrient intake from durian by-product (seeds and rind) could be used as a source of feed, This is because the results of the observed production performance parameters did not provide a difference with the use of basic concentrate and forage *Panicum sarmentosum* on an ad-libitum basis. Based on the need for feed for livestock, it will fulfill it both in quantity and quality. Durian by-product (seeds and rind) administration can replace forage sources by 0.5% of dry matter based on body weight on goat.

Consumption of feed for livestock is fundamental to meet their nutritional needs. Ruminants will consume a certain amount of feed to meet the basic needs of life, production and reproduction, then feed consumption will increase in line with the development of conditions and the level of production they produce. Feed consumption for ruminants is based on body weight and the ability to eat feed (acceptability). By giving durian by-product as much as 0.5% dry matter based on body weight, of course it will fill the rumen space and result in limited nutritional fulfillment because the capacity of the rumen canal is full. This is supported by (Aphale et al., 2019; Raju et al., 2021) that rumen capacity will determine the level of feed consumption, because livestock will stop eating when the rumen is full of feed

even though their nutrient needs have not been met. Thus, the nutritional fulfillment will be the same which results in the production performance parameters of kacang goats fed with nutrients from durian by-product not giving a significant difference. Meanwhile, the different carcass percentages, where 0.5% of durian seed flour was given significantly lower than goats that were not fed with nutrients from durian by-product (rind and seeds) and durian rind flour, was probably caused by differences in growth rates, where goats that were given durian seed flour, the carcass percentage was lower due to the presence of higher anti-nutritional substances in the form of tannins.

Tannins have a weakness in their function as defaunation agents because the phenol group in tannins also has antibacterial properties (Armando et al., 2021; Islamy, 2017, 2019; Kilawati et al., 2021; Kilawati & Islamy, 2019), especially gram-positive bacteria that are sensitive to certain polyphenols (Giridhar et al., 2018) whereas some fiber-digesting bacteria are gram-positive. Administration of tannins in high doses will reduce fiber digestibility in the rumen (Prapaiwong et al., 2021). Plant secondary compounds such as saponins and tannins at low levels did not interfere with the digestibility of the ration and were even able to increase the digestibility of the ration, but if the amount was high, it would reduce the digestibility of the ration. Thus it will affect digestibility, where even though the consumption of dry matter is high, the low digestibility of the feed will have an impact on the low utilization of the nutrients consumed, with the provision of durian rind flour which contains high tannins, of course, it will have an impact on the low efficiency of feed use due to low feed digestibility.

Based on the results of this research, it showed that the slaughter weight of each treatment did not show a significant difference so that the carcass weight, non edible carcass weight and the percentage of non edible carcass were also not different. This is in accordance with the statement of (Tahuk & Bira, 2020) that the factors that can affect the carcass production of an animal are the nation, age, sex, growth rate, slaughter weight and nutrition.

The Effect of Treatment on Physiological Conditions

The results of observations of the effect of adding nutritional intake to durian by-product on the physiological conditions of kacang goats are presented in Table 3

Table 3. Average Physiological Condition of Kacang Goats

Parameter	Treatment		
	Control	Seeds Flour	Rind Flour
Rectal Temperature (^{0}C)	38.69	38.72	38.77
Respiratory Frequency (times/minute)	38.85	39.72	39.64
Pulse Frequency (times/minute)	69.49	69.86	70.54
White Blood Cells (thousands/mm3)	11.05	11.48	12.22
Red Blood Cells (million/mm3)	9.93^a	9.48^b	10.27^a
Hemoglobin (g/dL)	10.75^a	10.00^b	11.38^c
Hematocrit (%)	23.85^a	23.45^a	24.28^b

Notes: - Different letters towards the row indicate significantly different (P<0.05)

Analysis of variance showed that the nutritional intake of durian fruit by-product in feed had a very significant effect (P<0.01) on the number of red blood cells, hemoglobin levels and hematocrit values, but had no significant effect (P>0.05) on body temperature, respiration frequency, pulse frequency and white blood cell count of Kacang goat.

The results of this research indicate that the body temperature of the goats obtained is almost the same as the results of the research conducted by (Harmoko & Padang, 2019) namely 38.23°C-38.48°C. Parameters of the physiologic status of goats fed with durian fruit by-product nutrients (seeds and rind) which are no different from those without durian fruit by-product nutrition indicate that durian fruit by-product does not interfere with metabolic activity as a manifestation of the fulfillment of food substances for basic life, production and reproduction. This is due to the parameters of body temperature, respiration frequency and pulse frequency are not different between the treatments.

The metabolic process in the body of livestock is a physiological activity to meet the needs of livestock, where when there is a process of anabolism and catabolism of food substances it will release energy that can affect body heat, as well as when there is a metabolic process it will require oxygen and release carbon dioxide which can be met by livestock through activities of respiration and food substances from metabolism will be transported throughout the body through the medium of blood which will be pumped by the heart and can affect the pulse activity of livestock. However, this research did not show any differences in physiological status parameters (body temperature, respiration frequency and pulse frequency) which could illustrate that the nutritional contribution from Durian by-product did not affect the metabolic activity of

experimental livestock assessed from the physiological status of the Kacang goat.

White blood cells that did not differ between treatments also indicated that the intake of nutrients from by-product (seeds and rind) of durian was neither a foreign object nor a substance that was toxic to livestock, because the number of white blood cells did not differ between treatments. This is in line with the statement of (Simsek, 2021) that leukocytes are a mobile/active unit of the body's defense system. The main function of white blood cells (leukocytes) is to fight infection, protect the body by phagocytosing foreign organisms and producing or transporting/distributing antibodies (Peter et al., 2019). Further explained that animals that have low white blood cells will be susceptible to infectious diseases, meanwhile a high number of leukocytes are able to generate antibodies in the phagocytosis process and have a high degree of resistance to disease, as well as improve their ability to adapt to the local environment (Soetan et al., 2013). and disease prevalencere, respiration frequency and pulse frequency which did not differ between treatments (Simsek, 2021).

The results of the Honestly Significant Difference Test (BNJ) showed that the number of red blood cells of goats that did not receive nutritional intake of durian fruit by-product (rind and seeds) was not significantly different from the number of red blood cells of goats that were given nutritional intake of durian rind, but significantly different from that of goats that given nutritional intake from durian seeds. The hemoglobin level of goats that did not receive durian fruit by-product (rind and seeds) was significantly different from that of goats that received nutritional intake of durian rind and durian seeds, while the hematocrit value of goats that did not receive nutrients from durian fruit by-product (rind and seeds) did not. significantly different from goats receiving nutrition from durian seeds but significantly different from goats receiving nutrition from durian rind.

The low red blood cells, hemoglobin levels and hematocrit values of goats receiving durian seed flour are thought to be caused by the presence of precursors for the formation of red blood cells and the formation of heme. Ration is an important ingredient for blood metabolism because protein, vitamins and minerals are needed in the formation of red blood cells. The formation of erythrocytes requires many processes so that there needs to be a sufficient supply of protein, iron, copper and cobalt while durian seeds contain anti-nutritional substances in the form of cyclopropene acid and oxalic acid which are toxic and have an effect on protein binding, anti-nutritional durian seeds are dominated by cyclopropene acid, but some of the oxalic acid which cannot be absorbed in the blood binds to calcium and is excreted in the urine (Nissa et al., 2019). Oxalate which binds with calcium forms calcium oxalate which causes kidney disorders (Bijsmans et al., 2021; Kelliher, 2022). Furthermore, according to (Abramowicz et al., 2022; Riswanda, 2017) that the main cause of nutritional anemia is not yet known, but it is suspected that there is a lack of consumption of iron found in daily food and a disturbance in the absorption of iron by the body due to the presence of substances that inhibit the absorption of iron by the body such as tannins, phytates, oxalate and lack of substances that can increase iron absorption such as vitamin C and lack of protein consumption.

Conclusion

Based on the research results, it can be concluded that the intake of nutrients from durian by-product seeds and skin can be carried out. It was found by the researchers that the utilization of 0.5% durian by-product (seeds and rind) in feed did not have a negative effect on the productivity and physiological condition of kacang goats.

Acknowledgments
The authors would like to express their sincere gratitude to the Faculty of Animal and Fishery, Tadulako University for their support in the collection of data for this research. The authors also wish to acknowledge the Animal Study Program, Campus External of Pattimura University for their valuable contribution to this study. Without their assistance, this research would not have been possible.

Author Contributions
P, S and SA collects data and provides research facilities, SWC and H analyzes data, Compiles and prepares articles.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

References

Abramowicz, B., Kurek, Ł., Lutnicki, K., Abramowicz, B., Biernacka, D., Şahinduran, Ş., & Urošević, M. (2022). Changes in red blood cell characteristics over the course of subclinical phosphorus deficiency in dairy cows. *Journal of Elementology, 1/2022*. https://doi.org/10.5601/jelem.2022.27.1.2232

Aphale, D., Natu, A., Laldas, S., & Kulkarni, A. (2019). Administration of Streptococcus bovis isolated from sheep rumen digesta on rumen function and physiology as evaluated in a rumen simulation

technique system. *Veterinary World*. https://doi.org/10.14202/vetworld.2019.1362-1371

Armando, E., Lestiyani, A., & Islamy, R. A. (2021). Potential Analysis of Lemna sp. Extract as Immunostimulant to Increase Non-Specific Immune Response of Tilapia (Oreochromis niloticus) against Aeromonas hydrophila. *Research Journal of Life Science*, *8*(1), 40–47. https://doi.org/10.21776/ub.rjls.2021.008.01.6

Bijsmans, E., Queau, Y., Feugier, A., & Biourge, V. (2021). The effect of urine acidification on calcium oxalate relative supersaturation in cats. *Journal of Animal Physiology and Animal Nutrition*. https://doi.org/10.1111/jpn.13503

Ei, N. S. S., & Ismail, M. R. (2022). Evaluation on Durian var. Musang King Pollination Compatibility Regarding High Fruit Set. *Pertanika Journal of Tropical Agricultural Science*, *45*(2), 469–479. https://doi.org/10.47836/pjtas.45.2.08

Giridhar, K., Prabhu, T. M., Singh, K. P., Nagabhushan, V., Thirumalesh, T., Rajeshwari, Y., & Umashankar, B. C. (2018). Nutritional potentialities of some tree leaves based on polyphenols and rumen in vitro gas production. *Veterinary World*, *11*(10), 1479–1485. https://doi.org/10.14202/vetworld.2018.1479-1485

Harmoko, H., & Padang, P. (2019). Kondisi Performa dan Status Fisiologis Kambing Kacang dengan Pemberian Pakan Tepung Daun Jarak (Jatropha gossypifolia) Fermentasi. *Jurnal Peternakan Indonesia*. https://doi.org/10.25077/jpi.21.3.183-191.2019

Hartadi, H., Reksohadiprojo, S., & Tillman, A. D. (2019). *Tabel komposisi pakan untuk Indonesia* (7th ed.). Universitas Gadjah Mada Press, Jogyakarta, Indonesia.

Isaac, L.A. (2013) Haematological Properties of Different Breeds and Sexes of Rabbits. 18th Annual Conference of Animal Science Association of Nigeria, Animal Science Association of Nigeria, Nigeria, 24-27. Retrieved from https://scirp.org/reference/referencespapers.aspx?referenceid=2591635

Islamy, R. A. (2017). *Pengaruh Flavonoid Rumput Laut Coklat (Sargassum sp.) Terhadap Hematologi, Mikronuklei dan Histologi Pada Ikan Nila (Oreochromis niloticus) Setelah Dipapar Pestisida Berbahan Aktif Metomil -Brawijaya Knowledge Garden* [MA Thesis]. Brawijaya University.

Islamy, R. A. (2019). Antibacterial Activity of Cuttlefish Sepia sp. (Cephalopoda,) Ink Extract Against Aeromonas hydrophila. *Majalah Obat Tradisional*, *24*(3), 184. https://doi.org/10.22146/mot.45315

Kelliher, C. M. (2022, February 7). *The role of nutrition in the prevention and management of feline obstructive urolithiasis*. LSMU DSpace/CRIS. Retrieved from https://hdl.handle.net/20.500.12512/112802

Kilawati, Y., & Islamy, R. A. (2019). The Antigenotoxic Activity of Brown Seaweed (Sargassum sp.) Extract Against Total Erythrocyte and Micronuclei of Tilapia Oreochromis niloticus Exposed by Methomyl-Base Pesticide. *The Journal of Experimental Life Science*. https://doi.org/10.21776/ub.jels.2019.009.03.11

Kilawati, Y., Arsad, S., Islamy, R. A., & Solekah, S. J. (2021). Immunostimulant from Marine Algae to Increase Performance of Vanamei Shrimp (Littopenaeus vannamei). *Journal of Aquatic Pollution and Toxicology*, *5*(6). https://doi.org/10.36648/2581-804X.5.6.26

Mahyiddin, Z., Indani, N., Suhairi, L., Ulya, Z., & Munanda, Z. (2022). The addition of nutmeg (Myristica fragrans) essential oil to intensify the aroma as a replacement of rum considering halal supply chain for cookies that use durian (Durio zibethinus) seeds waste-based flour to create sustainable advantages. *IOP Conference Series*, *956*(1), 012007. https://doi.org/10.1088/1755-1315/956/1/012007

Nissa, K., Wahyono, F., & Suthama, N. (2019). Pengaruh pemberian tepung biji durian sebagai subtitusi jagung dalam pakan ayam petelur terhadap rasio heterofil-limfosit dan produksi telur. *Jurnal Ilmu-ilmu Peternakan*. https://doi.org/10.21776/ub.jiip.2019.029.02.01

Peter, S. G., Gakuya, D. W., Maingi, N., & Mulei, C. M. (2019). Prevalence and risk factors associated with Ehrlichia infections in smallholder dairy cattle in Nairobi City County, Kenya. *Veterinary World*, *12*(10), 1599–1607. https://doi.org/10.14202/vetworld.2019.1599-1607

Prapaiwong, T., Srakaew, W., Cherdthong, A., & Jarassaeng, C. (2021). Effects of hydrolyzable tannin extract obtained from sweet chestnut wood (Castanea sativa Mill.) against bacteria causing subclinical mastitis in Thai Friesian dairy cows. *Veterinary World*, 2427–2433. https://doi.org/10.14202/vetworld.2021.2427-2433

Raju, J., Narasimha, J., Kumari, N. S., Raghunanadan, T., Preetam, V. C., Kumar, A., & Reddy, P. H. (2021). Feeding value of sorghum stover fed to tropical hair sheep as complete rations in chop, mash, pellet, and block forms. *Veterinary World*, 2273–2281.

https://doi.org/10.14202/vetworld.2021.2273-2281

Riswanda, J. (2017). Hubungan asupan zat besi dan inhibitornya sebagai prediktor kadar hemoglobin ibu hamil di kabupaten muara enim. *Jurnal Biota*, *3*(2), 83. https://doi.org/10.19109/biota.v3i2.1319

Sihaloho, M., Hanafia, D. S., Julianti, E., & Basyuni, M. (2021). Morphological Characters of Local Origin Durian (Durio zibethinus Murr.) Fruits and Seeds from Central Tapanuli Regency, North Sumatra, Indonesia. *International Journal on Advanced Science, Engineering and Information Technology*, *11*(1), 213. https://doi.org/10.18517/ijaseit.11.1.11211

Simsek, A. (2021). Investigation of serum beta-defensin-1 levels in bovine trichophytosis cases. *Veterinary World*, 2508–2511. https://doi.org/10.14202/vetworld.2021.2508-2511

Sistanto, S., Sulistyowati, E., & Yuwana, Y. (2017). Pemanfaatan Limbah Biji Durian (Durio zibethinus Murr) sebagai Bahan Penstabil Es Krim Susu Sapi Perah. *Jurnal Sain Peternakan Indonesia, 12*(1), 9-23.https://doi.org/10.31186/jspi.id.12.1.9-23

Soetan, K. O., Akinrinde, A. S., & Ajibade, T. O. (2013, March). Preliminary studies on the haematological parameters of cockerels fed raw and processed guinea corn (Sorghum bicolor). In *Proceedings of 38th Annual Conference of Nigerian Society for Animal Production* (Vol. 2013, pp. 49-52). Retrieved from Retrieved from https://www.scirp.org/(S(351jmbntvnsjt1aadkposzje))/reference/referencespapers.aspx?referenceid=2913476

Statistics Indonesia. (2021). *Produksi Tanaman Buah-buahan 2021*. Retrieved from https://www.bps.go.id/indicator/55/62/1/produksi-tanaman-buah-buahan.%20html.

Suciyanti, H., Sulistyowati, E., & Fenita, Y. (2016). Evaluasi Nutrisi Limbah Kulit Durian (Durio zibethinus) yang Difermentasi Jamur Tiram Putih (Pleurotus ostreatus) pada Masa Inkubasi yang Berbeda. *Jurnal Sain Peternakan Indonesia, 10*(2), 77-86.https://doi.org/10.31186/jspi.id.10.2.77-86

Tahuk, P. K., & Bira, G. F. (2020). Carcass and meat characteristics of male Kacang goat fattened by complete silage. *Veterinary World*, *13*(4), 706–715. https://doi.org/10.14202/vetworld.2020.706-715

Zhou, X., Wu, H., Pan, J., Chen, H., Jin, B., Yan, Z., Xie, L., & Rogers, K. M. (2021). Geographical traceability of south-east Asian durian: A chemometric study using stable isotopes and elemental compositions. *Journal of Food Composition and Analysis*, *101*, 103940. https://doi.org/10.1016/j.jfca.2021.103940