International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Influence Use Mixture Waste Beer and Waste Sago Fermentation (*Aspergillus niger*, (*Van Tieghem*)) Deep Feed Complete Performance Sheep Local

Ahmad Fakhrur Rozi[1], Hartutik[1*], Marzuki[1]
[1]Faculty of Animal Husbandry, Brawijaya University, Malang, Indonesia (65145)
[*] Corresponding Author: saiput972292@gmail.com

Abstract *. The aim of this research is to obtain levels of ABASF Aspergillus niger mixture in complete feed on the performance of local male sheep. The research was carried out in 2 continuous experimental stages. The material used in phase 1 research was ABASF fermentation measurements with a ratio of 50% to 50% using Aspergillus niger 3% in liquid form with a concentration of 10 ^{9} /milli, with incubation period 4 days. The first phase research was reviewed from previous research after phase 1 observations. After completing the research, phase 2 continued. material used in phase 2 was 16 male fat-tail crossbreed sheep with weight 24 ± 37 kg/head. The stage 2 research method is in vivo experiment using Randomized Group Design (RAK) with 4 treatments and 4 replications. The treatment tested stage 2 was the use ABASF complete feed levels 0%(P0),10%(P1),20%(P2), and30%(P3) The data obtained stage 2 the research was then analyzed using analysis variance (ANOVA) and there were significant or very significant differences, was continued with Duncan Multiple Range Test (UJBD). Results phase 1 research. ABAS with ratio 50% to 50% Aspergillus niger 3% liquid form with concentration 10 ^{9} /milli, with incubation period 4 days, increased the nutrient content ABAS before BK(76.66%), Abu,(2.75%) PK,(13.61%), SK,(12.17%), LK,(1.52%), and Beta-N(46.61%).While ABASF after fermentation BK,(90.81%), Ash,(4.18%) PK,(17.19%), SK ,(11.487%), LK, (4.08%), Beta-N(53.52%). ABASF aflatoxin content 23.90 (ppb), organoleptic observation. Yellow Brown Colour. Sour Smell. Texture, Slightly Wet, not lumpy. research continued with phase 2. The research results showed that the use of ABASF at the 30% level had a very significant effect (P0.05) on the average consumption value at P3 (day/head), namely P3(1.50±0.06) . P3, body weight gain (7.38 ± 0.22). Income over feed cost (Rp./head) P3(301,561±23,410). P3 feed efficiency (9.29±0.19). P3 N retention (2.94±0.33). Based on the research results, it can be concluded that P3 with an ABASF level of 30% in the ratio productivity performance of sheep.*

Keywords — *Aspergillus n iger , digestibility of beer dregs , fat tail sheep , fermentation , sago dregs,*

I. INTRODUCTION

Increasing the population and productivity of ruminant livestock, including sheep, in Indonesia has not shown optimal results. Meanwhile, the demand for meat continues to increase every year along with the increase in population. According to the Central Statistics Agency (BPS) 2022, the sheep population in East Java is 1 . 458. 157 heads, while in West Java the sheep population is 9. 987. 870 heads and in Central Java the sheep population is 2. 326. 859 tail. Besides that, the land providing feed is increasingly narrow, as a result of being eroded by the conversion of land into residential areas, industry and so on. Indonesia, as a tropical region, faces a long dry season, animal feed becomes a scarce ingredient. Currently the feed sold on the market has various qualities, to obtain good quality feed requires relatively expensive costs, to minimize feed costs and support maximum profits, of course it is necessary to look for alternative feed ingredients that are cheaper, easy to obtain, contain good nutrition for livestock, but do not compete with human needs.

According to Akmal and Filawati (2008), *Aspergillus niger mold* is a mold that grows quickly, produces high levels of protein and produces quite efficient *cellulase enzymes*, so it is able to utilize *cellulose* for its growth and can hydrolyze crystalline *cellulose*. *Aspergillus niger* is a type of mold which does not produce mycotoxins so it is not dangerous.

Beer dregs are waste from the brewing industry which uses *barley* or wheat grains and other ingredients with high maltose content as the main ingredients. According to Andriyani (2018), beer dregs in wet texture contain dry material BK 18.89%, PK 19.31%, crude fiber SK 19.48%, and *Total Digestible Nutrient* TDN 69.89%. Beer dregs with relatively high protein content are expected to meet the nutritional needs of sheep and optimize rumen microbial growth.

Pulp (*Metroxylon S ago Rotb*) is Factory waste from sago flour production. Sago waste has quite large potential as an energy source feed with a BETN content of 72.59%, but a low PK content of 3.29% and other nutrient content of 0.97% LK and a high SK content of 18.50% (Nuraini, 2018).

II. MATERIALS AND METHODS

A. Material

Study used were local sheep, 16 of them. Each sheep is penned using a 120 m x 1 m stage cage which has been labeled in accordance with the treatment and equipped with a place to feed, a place to drink, as well as light lighting. Other ingredients are 50% beer dregs and 50% sago dregs which are fermented by *Aspergillus niger which* can be called (ABASF) . Homemade corn straw and concentrate feed. Composition and nutrient content of feed in table 1.

TABLE 1. P will be used in research

Material Name	BK	Ash	PK	SK	LK	Beta-N
Beer Dregs	52.50	3.47	11.79	15.60	2.67	18.97
Sgu dregs	84.98	2.40	4.70	15.20	0.53	62.15
ABAS	76.66	2.75	13.61	12.17	1.52	46.61
ABASF	90.81	4.18	17,19	11.84	4.08	53.52

Source (Fakhrur, 2024)

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

B. Method

This phase I research is to support phase II research, the ratio of beer dregs and sago dregs which have been mixed, fermentation using *Aspergillus niger* according to the predetermined ratio. 50% sago dregs and 50% beer dregs. using *Aspergillus niger* using a mixture of ingredients, namely *Aspergillus niger* 3% in liquid form with a concentration of 10^{9} / milli. The mixture was fermented for 5 days, to obtain the product (ABASF) fermented sago dregs. Variables observed, Temperature and pH before and after fermentation, Physical test of fermentation results, Proximate Test, In-vitro digestibility (BK, BO), Aflatoxin content test

Phase II research, this research uses in vivo experimental methods. The data used in the research is primary data. Primary data collection was carried out by observing and collecting data directly in the field. This research was conducted using a Group Randomized Design (RAK) Which consists from 4 treatment And 4 repetitions. The treatment given on research presented in table 2. The nutritional content of the feed can be seen in table 3.

TABLE 2. Ration of feed for each treatment

Treatment	Feed Ration
P_0	Corn Straw 50% + Concentrate Feed 50%+ ABASF 0% in feed
P_1	Corn Straw 45% + Concentrate Feed 45%+ ABASF 10% in feed
P_2	Corn Straw 40% + Concentrate Feed 40%+ ABASF 20% in feed
P_3	Corn Straw 35% + Concentrate Feed 35%+ ABASF 30% in feed

TABLE 3. Feed nutrient content per practice

Treatment	BK%	PK%	SK%	LK%	BETN%
P_0	87.47	15.15	20.46	1.89	41.49
P_1	87.80	15.35	19.60	2.11	42.26
P_2	88.14	15.56	18.74	2.33	43.03
P_3	88.47	15.76	17.47	2.55	44.21

Source (Fakhrur, 2024)

C. Research Procedures

Preparation cages, cages that are available in Petiyen hamlet, Takerharjo Village, Solokuro District, Lamongan Regency. The cages used are made into partitions or cages of 1 or 2 boxes with each box containing 2 sheep with a cage size per box of 120 cm x 40 cm made of wood, type of cage on stilts, equipped with a feeder and drinker, Persiapak sempel sheep. To obtain material diversity, 12 male fat-tailed crossbreed sheep, approximately 10 months to 1.9 years old, were selected and weighed. Making *complete feed*, First prepare beer dregs and sago dregs which have been fermented for more than 4 days, prepare raw feed materials, can be seen in table 1. Medicines, The program applied during the maintenance process is vaccination via injection and injectable worm medicine to be given to sheep before the research. After the research, the sheep were not sick and had no digestive problems . Feeding sheep Feeding is given every morning at 07.30 and in the afternoon at 15.00 WIB. The next day the feed was weighed to determine the feed consumption of each animal per day but with continuous *ablibitum*. *Ablibitum* drinking.

D. Variable study

Variable Which observed on study stage II This among others are:

1. Feed consumption, which is calculated cumulatively once a week. Formula feed consumption according to Widiawati, et al. (2018) are as follows:

consumption = Amount of feed (g) – Remaining feed (g)

2. efficiency is calculated by dividing the amount of feed consumed by the increase in body weight of the sheep (Widiawati, et al., 2018). The formula for calculating feed conversion is as follows:

$$\text{Efisiensi pakan} = \frac{\text{bobot badan}}{\text{konsumsi pakan}}\ x\ 100\%$$

3. Body weight gain is calculated by weighing it every week to determine the growth of the sheep and calculate the coefficient of diversity. Calculation of body weight gain can be done using the following formula (Woro, et al., 2019):

PBB (g/head) = Average final body weight (g) – Average initial body weight (g)

4. Income Over Feed Cost (IOFC), is calculated by subtracting the total income from the sale of live chickens from the total cost of feed consumed during the research (Indra, et al., 2015). The formula for calculating IOFC is as follows

IOFC = (BW × price of live sheep /kg) – (∑feed consumption × feed price/kg

D. Analysis Statistics

Data Which obtained on study stage II tabulated with *Microsoft Excel* Then done analysis statistical uses (*Analysis of Variance*) ANOVA on (Plan Random kelpmpok) SHELF . If there is difference Which real or very real so next withDuncan's Multiple Distance Test (UJBD). The mathematical model of the RA k experiment used is (Sudarwati, et al., 2019)

Information:

$$Y_{ij} = \mu + \tau_i + \varepsilon_{ij}$$

Y_{ij} = observation value in treatment i and replication to-

jμ = mark middle of treatment i

τi = influence treatment i

ε_{ij} = error (error) in treatment i and replication to-

ji = 1, 2, 3, 4, 5

j = 1, 2, 3, 4

III. Results and Discussion

A. The Effect of Fermentation Using Aspergillus Niger in Abasf Mixture on the Quality of Fermentation Results

a. Quality of ABASF Fermentation Results

Results of measuring the quality of ABASF fermentation with a ratio of 50% to 50% using *Aspergillus niger* 3% in liquid form with a concentration of 10^{9} / milli, with an incubation period of 4 days. The aim was to determine changes in Ph

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

value, temperature, in vitro digestibility (BK, BO) and aflatoxin content in ABASF before and after fermentation. The results of the observation values can be seen in Table 4.

TABLE 4. Results of observing the quality of ABASF before and after fermentation

Variable e l	pH	Temperature	KcBK	KcBO	Aflatoxin
ABAS	5.70 - 6.93	25.8±26.0	47.43%	44.22%	-
ABAF	3.79 - 4.50	24.9 ± 25.7	62.39%	66.86%	23.90 (ppb)

Information: results of analysis in the animal nutrition and feed laboratory, Faculty of Animal Husbandry, Brawijaya University and the nutrition and animal feed laboratory, Faculty of Animal Husbandry, Bogor Agricultural Institute.

Based on Table 4, it shows that the pH value of ABASF decreased after fermentation day. This has to do with the overall acid that mold produces. The longer the fermentation, the more microbes utilize the carbohydrates in ABASF for metabolic processes, so that the ability of the microbes to produce lactic acid increases. In accordance with the opinion of Septiani (2014), if after the fermentation process the pH increases, during the fermentation process protein fermentation occurs, so that after the fermentation process the protein in the material will increase, but if during the fermentation process the pH decreases then carbohydrate fermentation occurs. So that after the fermentation process is carried out the carbohydrate content will increase.

The ABASF pH value in this study ranged from 3.79 – 4.50. The results of the pH value are equivalent to research by Sofyan (2003) that fermentation using *Aspergillus niger* has the characteristics of being able to grow quickly at a temperature of 30oC - 37oC, pH 3.0 - 5.5 and a maximum fermentation time of 72 - 96 hours. The more *Aspergillus niger added*, the lower the pH value. This is because the fermentation process will undergo a pyruvate biosynthesis process which produces acid products, such as butyric acid, acetic acid, acetone, acetaldehyde and alcohol. Therefore, the more mold you add, the higher the acid content, causing the pH to become low. According to Yuniarsih (2019), pyruvic acid is the end product of anaerobic fermentation, and it is then transformed into acetic acid, ethanol, and CO2. The pH value is an important factor that needs to be considered during the fermentation process. pH affects the growth of *Aspergillus niger*. Therefore, at the beginning of the research, the pH of the substrate that will be used must first be tested. Based on the pH test results, the initial ABAS pH was 5.70 to 6.93. This is supported by research by Meneurt A, Prasetya Kusuma, 2019, from the results of his research Conclusion: Fermentation of pineapple fruit waste using *Aspergillus niger* 3 % with a fermentation time of 4 days can change the characteristics of the fermented raw material in terms of color, aroma and texture. In the stationary phase of *Aspergillus niger growth* , it was obtained after cultivation for 4-6 days with a maximum number of spores of 1.51 x ^{109} /ml and 1.26 x 109 / ml respectively according to Purwadaria, (2020). The advantage of *Aspergi l lus niger* is that it can reduce crude fiber and can improve nutritional quality, this increase due to the presence of several types of enzymes such as amylase, pectinas e, amino glucosidase and cellulase are produced by *Aspergillus niger* . As for the shortcomings of *Aspergillus niger* the price is quite expensive. *Aspergillus Niger* grows optimally at temperatures of 35-37 °C, with a minimum temperature of 6-8 °C and a maximum temperature of 45-47 ° C. This fungus has a white or yellow base color with a thick layer of dark brown to black conidiospores.

The results of observing the KcBK from ABASF before and after fermentation showed that the ABAS value was 47.43%, while the KcBK ABASF result was 62.39%. The different digestibility before and after fermentation could be caused by the SK content in the complete feed. According to Anggorodi (1019), the more SK there is in a feed ingredient, the thicker the cell walls will be and more resistant to fiber-digesting microorganisms, and this can result in lower digestibility of the feed ingredient. On the other hand, feed ingredients with low SK are generally easier to digest, because the cell walls of these ingredients are thin so they are easily penetrated by microbes. This is in accordance with the opinion of Arora (2015) who states that lignin contained in feed ingredients can reduce carbohydrate digestibility through the formation of hydrogen bonds with cellulose and hemicellulose which limits the activity of the cellulase enzyme to digest crude fiber.

Based on the results of KcBO observations of ABASF, it can be seen that the ABASF value is 66.86% and while the ABAS result before fermentation is 44.22%, the KcBO ABAS value after fermentation tends to be higher than the ABASF value before fermentation, this is because the nutrient content of complete feed is more easily digested. more. According to McDonald et al. (2017), stated that digestibility is influenced by several factors, including the composition of feed ingredients, the comparison of the composition of one feed with other feed ingredients. Another factor that influences KcBO is the PK content. This is in accordance with research by Prayuwidayati and Muhtarudin (2016) that the KcBO of feed is also closely related to its chemical composition, namely the PK content. PK in the rumen will undergo hydrolysis into peptides by proteolytic enzymes produced by microbes, then hydrolyzed into amino acids. Some amino acids are converted into ammonia in the deamination process, which is used by microbes as a building block for body protein so that more BO can be degraded. The decreasing KcBO of complete feed could be due to the low ability of microbes to degrade it. This is not in accordance with the research of Jayanegara et al. (2019), the KcBO value is positively influenced by the PK content, this is because protein is a component that is very easily degraded by rumen microbes, except for proteins that are protected using certain compounds.

The Directorate General of Animal Husbandry has set a maximum standard for aflatoxin levels in ruminant feed of 100 – 200 ppb (SUPARTO, 2020). This standard is much higher than the maximum standard for aflatoxin levels in poultry feed, especially ducks. This relatively high maximum standard and the lack of reports regarding the occurrence of cases of aflatoxicosis in ruminant livestock means that attention to mycotoxins for ruminant feed is still very little or almost non-existent. The maximum standard for aflatoxin levels in dairy cattle feed should probably be revised and should be smaller because now Codex (FAO/WHO Food Standards) has set the maximum standard for aflatoxin contaminants in milk at 0.05

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, “Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local,” *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

ppb (CODEX, 2017). The fungi most often found in corn kernels and waste are Aspergillus and Fusarium fungi. These fungi will produce toxins that are dangerous for livestock and humans who consume these livestock products. Mycotoxins that are often found are aflatoxin produced by Aspergillus flavus and fumonisin produced by the fungus Fusarium moniliforme, deoxynivalenol and zearalenone produced by Fusarium graminearum (TRUNG et al., 2008; TANGENDJAJA et al., 2018).

The concentration of ABASF aflatoxin obtained in this observation ranged from 23.90 ppb. The aflatoxin yield from ABASF is not too high due to the use of the microbe *Aspergillus niger* which does not produce aflatoxin. This is in line with the opinion of Akmal and Filawati (2018), *Aspergillus niger mold* is a mold that grows quickly, produces high protein and produces quite efficient *cellulase enzymes*, so it is able to utilize *cellulose* for its growth and can hydrolyze crystalline *cellulose. Aspergillus niger* is also a type mold which does not produce mycotoxins so it does not harm livestock that consume it. A decrease in aflatoxin concentration can occur because the fungus contained in ABASF is damaged or dies at high temperatures. This high temperature causes disruption to the development of fungal cell structures and enzyme activity, which in the end can cause the death of the fungal cells and toxin production can decrease. Very high temperatures can kill many types of mold.

b. Results of observations of physical quality in ABASF fermentation

Results of observations of physical quality in ABASF *Aspergillus niger fermentation* with a ratio of 50% to 50% using *Aspergillus niger fermentation* with an incubation period of 4 days. Fermentation using *Aspergillus niger* 3% in liquid form with a concentration of 10 ^{9} / milli, aims to determine the results of ABASF organoleptic observations. This organoleptic test observation uses the services of 25 panelists and is carried out in the nutrition and animal feed laboratory, Faculty of Animal Husbandry, Brawijaya University. The results of ABASF organoleptic observations are presented in Table 5.

TABLE 5. Results of ABASF organoleptic observations

Organoleptic Assessment	Rating result	Information
Color	4 and 5	Yellow Brown And Light Yellowish Brown
Aroma	2 and 3	Typical Fermentation And Sour
Texture	2 and 3	Slightly Wet And Dry

Description: results of analysis in the animal nutrition and feed laboratory, Faculty of Animal Husbandry, Brawijaya University.

Observations of the color quality of ABASF with *Aspergillus niger* illustrate that based on the standards for grading the color of the fermentation product, it is yellowish brown and light yellowish brown. according to McEllhlary (2019), the score value for yellowish brown fermentation is 4-7. This is in accordance with the opinion of Hermanto (2017) who states that the color of good silage is light brown (yellowish) with a sour smell. Meanwhile, according to Siregar (2016) added that in general good fermentation results have the characteristics of a light brown or brownish color. ABAS fermentation using *Aspergillus niger* with a ratio of 50% to 50% with an incubation period of 4 days. Fermentation using *Aspergillus niger* 3% in liquid form with a concentration of 10 ^{9} / milli, produces a yellowish brown and light yellowish brown color. This is in accordance with Saun's opinion. and Heinrichs (2008), that good quality fermentation will produce a color that almost matches the original color or feed before fermentation, the color of the fermentation can describe the results of the fermentation, the dominance of acetic acid will produce a yellowish color while the slimy blackish brown color is triggered by high bacterial activity. produces butyric acid in quite high amounts. A brownish or even black color can occur in fermentation that is heated quite high, the dark color of the fermentation indicates aflatoxin levels (Despal et al., 2011).

Observation of the physical aroma characteristics of ABASF fermentation results using *Aspergillus niger* with an incubation period of 4 days. ABASF shows a more typical fermented and sour aroma. This was shown by ABASF fermented with *Aspergillus niger*, that the longer the fermentation time produced the more acidic ABASF. The sour aroma occurs due to the breakdown of nutrients, especially carbohydrates, into organic acids. Kurnianingtyas et al (2012) explained that the aroma produced during the fermentation process occurs because anaerobic bacteria actively work to produce organic acids. In ABASF with a percentage ratio of 50 to 50%. This shows that the aroma shows a very sour aroma, with 96 hours of fermentation the rating in the very sour category is increasing, this shows that the longer the fermentation the resulting aroma is, the more sour it is.

Observation of the physical texture characteristics of ABASF fermentation results using *Aspergillus niger* with an incubation period of 4 days. ABASF shows a slightly wet and slightly dry texture, according to McEllhlary (2018), the score value for moderate fermentation is 2 – 3. Physically, a good fermentation texture is a texture that is not hard, the lumps are not too wet, this can indicate that the silage is organoleptically high quality. good, in accordance with the opinion of Kartadisastra (2017) that good quality silage is one whose texture is not soft, watery, not moldy and not lumpy and the opinion of Siregar (2006) explains that in general good fermentation has textural characteristics that are still clear as its origin. In this organoleptic test research, the texture of the resulting fermentation was still clear as its origin, indicating that the ABASF texture showed a slightly dry texture before fermentation, but after fermentation the texture showed a slightly wet and slightly dry texture and did not clump. Texture is one of the determining indicators of success in making fermentation, an indicator of good fermentation is having a fresh, soft texture without lumps. According to Macaulay (2019), the texture of the fermentation is influenced by the water content of the material at the beginning of the ABASF fermentation. ABASF with a high water content (>50%) will show a slightly wet and soft texture, while a fermentation with a low water content will be slimy and soft, while a fermentation with a low water content (<30%) has a dry texture. Santi et al. (2017) stated that the soft fermentation texture occurs because the aerobic phase which occurs at the beginning of fermentation is too long so that the heat produced is too high causing evaporation in the silo. McDonald et al. (2018) stated

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

that the growth of fungi during fermentation is caused by not yet optimal airtight conditions so that fungi will be active in aerobic conditions and grow on the fermentation surface of the material, limiting the oxygen supply which is less than optimal due to the particle size of the material.

c. Results of observations of physical quality in ABASF fermentation

Based on the results of proximate analysis of the nutrient content of feed ingredients, beer dregs and sago dregs with a ratio of 50% to 50% using *Aspergillus niger fermentation* with an incubation period of 4 days. From several reviews of previous research, it can be concluded that the use of 3% *Aspergillus niger* in the form of a method and an incubation period of 4 days can increase the nutrient content of fermented feed raw materials. Meneurt A, Prasetya Kusuma , (2019), from the results of his research Conclusion: Fermentation of pineapple fruit waste using *Aspergillus niger* 3 % with a fermentation time of 4 days can change the characteristics of the fermented raw material in terms of nutritional content, color, aroma and texture. The results of observations from this research can be seen in table 6.

TABLE 6. Proximate test results of nutritional content of feed raw materials (%)

Material name	BK	Ash	PK	SK	LK	Beta - N
Beer Dregs	52.50	3.47	11.79	15.60	2.67	18.97
Dregs s a gu	84.98	2.40	4.70	15.20	0.53	62.15
ABAS	76.66	2.75	13.61	12.17	1.52	46.61
ABASF	90.81	4.18	17,19	11.84	4.08	53.52

Description: results of analysis in the animal nutrition and feed laboratory, Faculty of Animal Husbandry, Bogor Agricultural Institute.

The feed ingredients are formulated into complete feed according to the treatment where P_0 = Corn Straw 50% + Concentrate Feed 50% + ABASF 0% in the feed. P_1 = Corn Straw 45% + Concentrate Feed 45%+ ABASF 10% in feed. P_2 = Corn Straw 40% + Concentrate Feed 40%+ ABASF 20% in feed. P_3 = Corn Straw 35% + Concentrate Feed 35%+ ABASF 30% in feed. The nutritional content of the treatment feed can be seen in table 7.

TABLE 7. Nutrient content of each treatment

Material Name	BK	PK	SK	LK	Beta-N
P0	87.47	15.15	20.46	1.89	41.49
P1	87.80	15.35	19.32	2.11	62.15
P2	88.14	15.56	18.49	2.33	46.61
P3	88.47	15.76	17.66	2.55	53.52

Information: results of analysis in the animal nutrition and food laboratory, Faculty of Animal Husbandry, Bogor Agricultural Institute.

Proximate test results from ABAS fermentation with a fermentation time of 4 days showed significant changes in nutrient content, before fermentation the ABAS content was BK: 76.66, Ash: 2.74, PK: 13.61, SK: 12.17, LK: 1.42, Beta-N: 46.61, after fermentation using *Aspergillus niger* ABASF nutritional content, namely, BK: 90.81 Ash: 4.18, PK, 17.19 SK: 11.84 LK: 4.08 Beta -N: 53.52, A decrease in the SK content of fermentation results from day 0 to day 4 indicates that *Aspergillus niger* plays an active role in the ABAS fermentation process. It can be seen that *Aspergillus niger* can reduce the SK content and increase the PK content, because it is in the fermentation process for 4 days after adding *Aspergillus niger* to the fermentation. The mold *Aspergillus niger* is a mold that grows quickly, produces high levels of protein and produces *cellulase enzymes* quite efficiently, so it is able to utilize *cellulose* for its growth and can hydrolyze crystalline *cellulose*. According to Dewi et al (2019), stated that the decrease in SK levels is thought to be due to the activity of *Aspergillus niger* producing cellulase enzymes to digest cellulose during the fermentation process so that during this process, the fiber component in the form of cellulose can be degraded by *Aspergillus niger*, while cellulose itself is one one part of SK so that the activity of *Aspergillus niger* in digesting cellulose can reduce SK levels.

B. Nutritional Evaluation of the Use of Abasf in Complete Feeding on the Growth Performance of Local Male Sheep.

a. Feed consumption

Feed consumption is the amount of feed given and consumed by livestock to meet subsistence needs and support livestock production and reproduction. Consumption is the most important aspect for evaluating the nutritional value of feed ingredients. Nutrient consumption of sheep feed by providing ABASF levels can be seen in table 13. Based on the results of analysis of variance with initial sheep weight as a covariate, in this study, the average consumption of concentrate feed was 1.7 kg per head per day or 3.3 – 7 .6% of body weight. Parakkasi (1995) stated that concentrate consumption for sheep is 2-3% of their body weight. Utomo (2004) states that feed consumption per sheep is 4% of body weight. The high consumption of concentrate feed in this study is thought to be due to the concentrate being given adlibtum which is given continuously. The average consumption can be seen in table 8.

TABLE 8. Average feed consumption during the study (60 days)

Treatment	Average (kg)
P_0	70.52 ± 2.39^{a}
P_1	72.00 ± 2.16^{a}
P_2	74.92 ± 4.98^{ab}
P_3	79.42 ± 3.67^{b}

Note: - superscript ^{abc}, indicates the average feed treatment results of ANOVA analysis gave very significantly different results (P<0.01) on feed consumption

The results of the statistical analysis can be seen in table 13. It shows that the use of ABASF in complete feed during the study had a very significant effect ($P < 0.01$) on feed consumption. This provides an indication that the use of ABASF can increase the palatability and digestibility of feed so that feed consumption increases. The results of the smallest real difference test (Duncan) of 1% show that P0 is different from P1, P2 and P3, while P1 is not different from P2. It is suspected that the cellulase enzyme produced by *Aspergillus niger* in P1, P2 and p3 is still relatively the same but the average value shows an increase. Maria (2016) stated that *Aspergillus niger* can grow quickly so it is widely used commercially to produce citric acid, gluconic acid, and the manufacture of several enzymes such as amylase, pectinase, amyloglucoside, and cellulose. The average value of the amount of sheep feed consumed during the study in treatment P3 showed the highest

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

level of consumption with a mean value of 79.42, followed by P2 with a mean of 74.92, and P1 with a mean of 72.00, then P0 showed the lowest level of consumption with a value of mean 70.52. This increase in feed consumption is due to the greater the animal's body weight, the greater the feed consumption to meet its daily needs. As stated by Christi et al. (2018), fermentation is a method of aerobic and anaerobic processing by utilizing the role of microorganisms to break down complex compounds into simple ones which produce physical qualities such as color, smell, taste, good texture and reduce anti-nutrients and increase palatability. Mirnawati (2017) added that fermented feed usually has better nutritional value than the original material. Fermentation can increase the nutrient content and beneficial value of the original ingredients. Material that undergoes fermentation usually has a higher nutrient content than the original material. According to Wulandari (2014), factors that influence feed consumption include the livestock concerned, the feed given, and the environmental conditions where the livestock are kept. According to Kartadisastra (2019), the level of animal feed consumption is influenced by the environment including residence, palatability, form of feed, consumption (external factors) and the livestock itself including physiological status, body weight and livestock production (internal factors). What is meant by internal factors is the physiological demand of the livestock for basic living, and production is in accordance with the capacity of the digestive tract of the livestock concerned. The level of ration consumption is largely determined by palatability (smell, color and texture), the housing and feeding system and the condition of the cage.

b. E fe sie n si Feed

Based on the results of research and analysis of variance, it shows that the use of ABASF in complete feed has no significant effect on treatment and has a significant effect in groups ($P < 0.05$) on feed efficiency. The average results of the feed efficiency treatment can be seen in table 9.

TABLE 9. Average Feed Efficiency

Treatment	Average	Group	Average
P_0	8.38 ± 0.97^{tn}	K1	8.38 ± 0.88^{a}
P_1	8.82 ± 0.63^{tn}	K2	8.82 ± 0.21^{b}
P_2	9.35 ± 0.58^{tn}	K3	9.35 ± 0.16^{BC}
P_3	9.51 ± 0.19^{tn}	K4	9.51 ± 0.33^{c}

Note: - superscript ^{abc}, indicates the average feed treatment results from ANOVA analysis gave very significantly different results ($P<0.01$) to the feed efficiency of the groups

H is the result of calculating the average efficiency value local sheep feed during the study in each treatment, namely P0 of 8.38^{tn}, P1 of 8.82^{tn}, P2 of 9.35^{tn}, and P3 of 9.51^{tn}. Feed efficiency can be influenced by the sheep's ability to digest feed, nutritional adequacy to meet basic living needs, growth and other body functions, as well as the type of feed consumed. From the average value of each successive treatment, it shows an increase in efficiency, sheep that are reared intensively and fed *Complete Feed* can produce a body weight gain of 150 - 165 grams/day and a feed conversion of 5 - 6.5%. Increasing the efficiency of feed use is directly proportional to the increase in consumption and increase in body weight. As we know, feed efficiency is determined by two factors, namely the amount of feed consumed and the speed of growth (PBB). According to (Parakkasi 1999) states that the higher the efficiency value feed, the better the use of feed in increasing sheep growth . This will increase feed efficiency and reduce the feed conversion value. P3 treatment feed using 30% ABASF produces the highest conversion, namely 9.51 . This indicates that P3 has high feed efficiency and is not accompanied by a high increase in animal body weight. Meanwhile, at P0 without the use of ABASF, the lowest efficiency was 8.38 , indicating that the high feed efficiency at P3 was balanced by a high increase in body weight. Apart from that, differences in feed efficiency values can be caused by different physiological status of the livestock and the quality of the feed provided. According to Siregar (2017), feed efficiency can be calculated and determined from feed conversion, namely the amount consumed (BK) to achieve an increase of one kilogram of body weight. Judging from the quality of the feed, edamami straw still has quite high nutritional content, namely in terms of crude protein content. Efforts to improve quality are by carrying out biological fermentation using microbes that are cellulotic and proteolytic (Anggorodi, 2019).

The results of the statistical analysis can be seen in table 13. It shows that the use of ABASF in complete feed during the research had a very significant effect ($P < 0.05$) on the feed efficiency group, during the research it showed K1 8.38^{a}, K2 8.82^{a}, K3 9.35^{b}. and K4, 9.51 groups are also very influential in producing good efficiency, increasing feed efficiency is influenced by initial body weight, where body weight, initial weight of junk sheep influence consumption and lead to an increase in body weight as well. Increased efficiency of feed use is followed by increased consumption and increase in body weight, as we know, the efficiency of feed use is determined by two factors, namely the amount of feed consumed and the speed of growth (PBB). Forbes (2017) states that several things can influence feed efficiency, including this is in accordance with the opinion of (Haryanto and Djajanegara 2023), stating that feed efficiency is influenced by the level of digestibility and the rate of formation of body tissue. The higher the quality of feed can increase the efficiency of utilization of food substances .

C. N retention

Nitrogen (N) retention is the result of the breakdown of nitrogen which is not excreted through urine or feces . Based on the results of the analysis, giving higher ABASF levels had a significant effect ($P>0.05$) on nitrogen retention. Meanwhile, nitrogen N retention in the groups had a significant effect ($P<0.05$) on nitrogen retention. The average results of N retention in the treatments can be seen in table 10.

TABLE 1 0. Results of average treatment and group scores N retention

Treatment	Average	Group	Average
P_0	1.78 ± 0.19^{a}	K1	2.023 ± 0.54^{a}
P_1	2.12 ± 0.21^{a}	K2	2.255 ± 0.56^{ab}
P_2	2.21 ± 0.23^{bc}	K3	2.266 ± 0.267^{c}
P_3	2.94 ± 0.33^{c}	K4	$2,510 \pm 0.61^{c}$

Information: - superscript ^{abc}, indicates the average feed treatment results of ANOVA analysis gave very significantly different results ($P<0.01$) for the N-Retention of the treatment and the N-Retention of the group

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

It can be seen in table 10, the higher the use of ABASF in the ration, the higher the N retention value, the lower the N retention value is in line with the increase in crude protein content for each treatment. N retention values in treatments 0, 1, 2, 3. showed results of 1,781.78 ± 0.19 [a] g, 2.12 ± 0.21 [a] g, 2.21 ± 0.23 [bc] , g, and 2, 94 ± 0.33 [c] , g in line with the increase in crude protein content for each treatment, namely 15.15%, 15.35%, 15.56%, 15.76%, showing that the N Retention value in the P 3 2.94 treatment is increasing with the addition of 30% ABASF, while the low N Retention content value was at P 0 1.78 without the use of ABASF. N retention is the result of the breakdown of nitrogen which is not excreted through urine or feces. The high and low N retention values are thought to be influenced by the protein content of the feed consumed by livestock. The higher the value of feed protein consumption, the protein content entering the livestock's body also increases. (Maulana, Nuraini and Mirzah .2021). Supported by research results from Hanun, Muktiani, and Nuswantara. (2018) which states that the N retention value is also influenced by the size of the feed protein digestibility value. N retention value in sheep treated with basal feed, silage feed without starter. The N retention value is considered good if it is lower than the N content in feces and urine when excreted. The higher the protein content of the feed and the higher the protein digestibility, the greater the protein retention in the body.

The results of statistical analysis showed that the use of ABASF in complete clothing during the study had a significant effect ($P < 0.05$) on N retention, the average value in the group during the study relatively increased because the high initial weight also influenced protein consumption. The high and low N retention values are thought to be influenced by the protein content of the feed consumed by livestock. Judging from the results of the increasing group mean values, K [1] , 2.023 ± 0.54 [a] g, K [2] , 2.255 ± 0.56 [ab] g , K3, 2.266 ±0.267 [cg] . and K [4] .510 ±0.61 [c] g . Nitrogen retention describes proteins that are utilized by body cells . The retained nitrogen will be used by body cells for metabolism and forming new cells. The quality of protein in a feed ingredient is considered good if it has a positive nitrogen retention value. The nitrogen retention value can be zero or negative. If the nitrogen retention value is zero, it means that the nitrogen from protein consumed is the same as the nitrogen wasted from feces and urine. A negative nitrogen value means that the amount of nitrogen wasted is more than consumed. Diet protein digestibility will influence the amount of nitrogen retained, while protein digestibility is influenced by the amount of protein contained in the diet (McDonald et al., 2022). Nitrogen from feed protein can be used and retained by livestock, influenced by the amount of energy available which will affect body weight (Sun and Zhao, 2019). Fermented feed has protein that retains more nitrogen. Feeding rice straw and sago dregs fermented by the Pleurotus ostreatus fungus can increase nitrogen retention in local sheep.

c. Increase in Body Weight

Body weight gain is used to measure how much feed is used, apart from the basic needs of livestock, PBB can also be used as an indicator of livestock performance and to identify livestock health. Based on the results of research and analysis of variance, the evaluation of the nutritional value of using ABASF in complete feed on the growth performance of male local sheep, by providing higher levels of ABASF has a very significant effect ($P < 0.01$) on livestock PBB. The average UN of fat tail crossbreed sheep in each treatment can be seen in table 11.

TABLE 11. Average value of body weight gain during the study for each treatment and group

Treatment	UN (during research)	Group	UN (during research)
P 0	6.13 ± 0.85 [a]	K1	6.00 ± 0.88 [a]
P 1	6.43 ± 0.85 [ab]	K2	6.63 ± 0.62 [ab]
P 2	6.88 ± 0.47 [bc]	K3	7.03 ± 0.46 [bc]
P 3	7.38 ± 0.22 [c]	K4	7.15 ± 0.30 [c]

Note: - superscript [abc] , shows the average PBB, the results of ANOVA analysis gave very significantly different results ($P<0.01$) for treatment PBB and group PBB.

The average level of PBB is caused by increased feed consumption, apart from that the increase in feed consumption can also be influenced by livestock palatability. Alim (2014) reports that an important factor influencing PBB is feed consumption, the higher the amount of feed consumed by livestock, the higher it is. its growth rate. Living PBB can occur if livestock are able to convert the feed substances they absorb into livestock products such as fat and meat after their basic living needs are met. According to McDonald et al. (2022) livestock growth is controlled by nutritional consumption, especially energy consumption. Feed consumption is the factor that most determines the amount of nutrients obtained by livestock and subsequently influences body weight gain (Mirni, 2018). The graph of average body weight gain during the study can be seen below.

Body weight gain (PBB) is closely related to growth. Growth is generally expressed by measuring the increase in body weight which is carried out by repeated weighing, namely every day, every week, or every month. Body weight gain is one of the criteria that can be used to evaluate the quality of animal feed, because the growth obtained from an experiment is an indication of the utilization of the feed nutrients provided. Increasing body weight is one of the important goals to be achieved. Excess food from basic living needs will be used to increase body weight (Nurjannah, 2017).

Body weight gain is influenced by several factors, including consumption of total protein obtained every day, gender, age, genetics, environment, physiological condition of livestock and maintenance management, according to Fakhrur. (2022) that the rate of body weight gain is influenced by age, environment and genetics, where body weight at the start of the fattening phase is related to adult weight. Body weight gain is influenced by the quality and quantity of feed. Fakhrur (2022) states that rations that have high nutritional value and a good level of palatability can quickly increase livestock body weight gain during fattening. Shofi (2022) states that high protein content in the ration can increase body weight gain, while high crude fiber content in the feed will reduce body weight. Mawati et al. (2017) stated that in the sheep farming business, increasing body weight is important because it will affect the slaughter weight, therefore to achieve maximum slaughter weight it is necessary to provide additional feed in the form of concentrate

Ahmad Fakhrur Rozi, Hartutik, and Marzuki, "Influence Use Mixture Waste Beer and Waste Sago Fermentation (Aspergillus niger, (Van Tieghem)) Deep Feed Complete Performance Sheep Local," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 2, pp. 170-178, 2024.

other than forage. Rianto et al. High energy and protein consumption in sheep results in a rapid growth rate thereby increasing daily body weight gain

d. Income Over Feed Cost (IOFC)

The IOFC value is the profit obtained from the difference between livestock sales minus the feed price. Based on the results of the IOFC analysis on the results of research evaluating the nutritional value of using ABASF in complete feed on the growth performance of male local sheep, giving higher levels of ABASF has a very significant effect (P < 0, 01) on *the Income Over Feed Cost* of IOFC fat tail crossbreed sheep in each treatment can be seen in table 12.

TABLE 12 1. Average IOFC value for each treatment and group

Treatment	IOFC (Rp)	Group	IOFC (Rp)
P_0	235,863±67,988 [a]	K1	209,010±54,065 [a]
P_1	253,526±50,791 [a]	K2	254,035±29,664 [a]
P_2	277,473±41,853 [ab]	K3	292,826±22,603 [ab]
P_3	301,561±23,410 [bc]	K4	312,553±9,880 [bc]

Note: - superscript [abc], indicates the average feed treatment results of ANOVA analysis gave very significantly different results (P<0.01) to the IOFC value of feed and group

Where the highest average IOFC in treatment P3 was IDR 319,193 [c], while the lowest average IOFC in treatment P0 was IDR 235,863 ± 67,988 [a], then the average IOFC in treatment P1 was IDR 253,526 ± 50,791 [a], and followed by P2 where the average relatively increased by IDR, 277,473±41,853 [ab], the increase in IOFC is thought to be due to increased levels of ABASF use in complete feed. Where the P3 treatment has a cheap feed ration price but has the highest average body weight gain compared to the other treatments. Using complete feed without forage is more profitable even though the feed costs incurred are also greater than using forage. (fakhrur 2022) stated that the factors that have an important influence in calculating IOFC are body weight gain, feed consumption and feed price during maintenance. High body weight gain accompanied by good feed conversion will show maximum profits. The productivity and quality of livestock products is largely determined by the quality of the feed. Currently, the price of animal feed ingredients is increasing and feed costs incurred for livestock businesses reach 80% of production costs (Ananda, Usman, & Yaman, 2021). One alternative to reduce the cost of sheep feed can be done by using appropriate feed.

It is well established that feed intake and animal body weight gain have an impact on the average IOFC. The size of the IOFC is greatly influenced by feed conversion and feed efficiency. According to Lowrey (2015), feed conversion can be used to determine production efficiency because it is closely related to production costs. This is comparable to research conducted by Jarmuji et al., (2018). With the IOFC calculation, the net profit obtained by farmers in carrying out their business can be determined. In the livestock business, feed itself requires the largest costs, namely 60-70% of the total costs in a livestock business. Therefore, the success of a livestock business is determined by the price of feed used during the maintenance period.

IV. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusion

Based on the results of the research that has been carried out, the following conclusions can be drawn:

1. That the Fermentation Technology of the ABASF Mixture on the Quality of Fermentation Results with a ratio of 50% to 50% using *Aspergillus niger* 3% in liquid form with a concentration of 10^{9}/milli, with an incubation period of 4 days. Obtaining a fairly good quality of fermentation results seen from observing the nutrient content of ABAS before fermentation BK, (76.66%), Ash, (2.75%) PK, (13.61%), SK, (12.17%), LK, (1.52%), and Beta-N (46.61%). While ABASF after fermentation BK, (90.81%), Ash, (4.18%) PK, (17.19%), SK, (11.487%), LK, (4.08%), Beta-N (53.52%). Meanwhile, the aflatoxin content in ABASF was 23.90 (ppb), organoleptic observations. Yellow Brown And Light Yellowish Brown Colors . Typical Fermentation and Sour Aroma. Texture, slightly wet and dry, not lumpy .
2. Based on the research results, it can be concluded that the nutritional value of using ABASF in complete feed is evaluated on the growth performance of male local sheep. On p3, the use of ABASF 30% in Complete Feed has an effect on metabolic consumption and nutrient consumption, nutrient digestibility, digestible consumption, N retention, PBB, IOFC but does not have a significant effect on feed efficiency.

B. Suggestion

Based on the results of this research it is concluded:

1. To get maximum results in fattening, the formula used should be 30% ABASF in the composition of complete feed for livestock.
2. Further observations need to be made regarding the omega-3 fatty acid content and ingredients carcass and quality of lamb meat.

REFERENCE

[1]. Abidin, Z., & Candra Pradhana, C. (2020). Keanekaragaman Hayati Sebagai Komunitas Berbasis Autentitas Kawasan.
[2]. Adamovic, M., G. Grubic, I. Milenkovic, R. Jovanovic, R. Protic, L.Sretenovic & Lj.Stoicevic. 2018. Biodegradasi jerami gandum oleh jamur Pleurotus ostreatus dan pemanfaatannya dalam pakan ternak. J.Anim. Ilmu Pakan. Teknologi. 71: 357-362.
[3]. Anonim. 201 8 . Pengawetan Hijauan Pakan. Buletin PPSKI tahun IX No.41, 21 – 29.
[4]. Akmal dan Filawati.2018. Pemanfaatan Kapang *Aspergillus niger* sebagai Inokulan Fermentasi Kulit *Kopi* dengan Media Cair dan Pengaruhnya Terhadap *Performa Ayam Broiler* . Jurnal Ilmiah Ilmu-IlmuPeternakan11(3):150-158
[5]. Andriyani, AK 2016. Pengaruh Penggunaan Ampas Bir dalam Ransum terhadap Peforman Kelinci New Zealand White Jantan. Skripsi. Fakultas Pertanian. Universitas Sebelas Maret. Surakarta.
[6]. Anggorodi, R. 2019. Nutrisi Aneka Ternak Unggas. PT. Gramedia Pustaka Utama, Jakarta .
[7]. Annett, RW, AF Carson, dan LER Dawson. 2018. Pengaruh pasokan protein tercerna yang tidak dapat terurai (DUP) dan suplementasi minyak ikan pada domba betina pada akhir kebuntingan terhadap produksi kolostrum dan hasil produksi domba. J.Anim. Ilmu Pakan. dan Teknologi. 146: 270-288
[8]. Arora, SP 2022. Pencernaan Mikroba pada Ruminansia. Cetakan ke-2. Pers Universitas Gadjah Mada. Yogyakarta.
[9]. Aziz, MA, Mckenzie, JC, Wilson, JS, Cowie, RJ, Ayeni, SA, dan BK Dunn, (2022). Mayat manusia di era informatika biomedis. *Catatan Anatomi: Publikasi Resmi American Association of Anatomists , 269* (1), 20-32.
[10]. Blakely, J. dan DH Bade. 2018. Ilmu Peternakan. Edisi keempat, Gadjah

Mada University Press, Yogyakarta. (Diterjemahkan oleh B. Srigandono).
[11]. Blakely, J. dan DH Bade. 2018. Ilmu Peternakan. Edisi keempat, Gadjah Mada University Press, Yogyakarta.(Diterjemahkan oleh B.Srigandono).
[12]. Chuzaemi, S. (2019,). Arah dan sasaran penelitian nutrisi sapi potong di Indonesia. Di *Workshop Makalah Dalam Sapi Potong. Pusat Penelitian dan Pengembangan Peternakan Bogor dan Loka Penelitian Sapi Potong, Malang* (hlm. 11-12).
[13]. Hardianto, YW 2016. Penggemukan domba ekor tipis dengan pemberian pakan kulitas ari kacang kedelai (ampas tempe) dan rumput lapanag. Skripsi. Fakultas Peternakan, IPB, Bogor.
[14]. Hartutik. 2019 metode analisis pakan. Malang : UB pers.
[15]. Haryanto, TN (2018). Pengaruh penempatan konsentrat dengan tepung sampah organik dalam ransum terhadap kecernaan bahan kering dan bahan organik pada domba lokal jantan.
[16]. Howard, RL, E. Abotsi, EL Jansen van Rensburg, dan S. Howard. 2023. Bioteknologi lignoselulosa: masalah biokonversi dan produksi enzim. Af. J. Bioteknologi. 2: 602-619.
[17]. Kaerl. 2022. Kebutuhan nutrisi ruminansia di negara berkembang. Ultah (AS). Universitas Negeri Ultah London.
[18]. Kamesworo, S. (2019). Pemberian Wafer Limbah Sayuran Pasar terhadap Konsumsi, Pertambahan Bobot Badan dan Konversi Pakan Ternak Domba.
[19]. Kartadisastra, HR, 2019. Penyediaan dan Pengelolaan Pakan Ternak Ruminansia (Sapi, Kerbau, Domba, Kambing). Kanisius.Yogyakarta.
[20]. Kearl, LC 2022. Kebutuhan Nutrisi Ruminansia di Negara Berkembang. Stasiun Percobaan Pertanian Utah Bahan Pakan Internasional. edisi ke-1. Utah Universitas negeri, Logan.
[21]. Khan, MB, Noor, MA, Noor, KI, & Chu, YM (2021). Pertidaksamaan tipe Hermite–Hadamard baru untuk fungsi bernilai interval fuzzy cembung. *Kemajuan Persamaan Selisih , 2021* , 1-20.
[22]. Kiat, LJ, 2016., Preparasi dan Karakterisasi Limbah Karboksimetil Sagu dan Hidrogelnya, Universitas Putra Malaysia, (Tesis).
[23]. Krause MV. 2016. Terapi Makanan, Gizi, dan Diet. Philadelphia: WB Soundres.
[24]. Kusumo, C. 2023. Estimasi heritabilitas Domba Ekor Gemuk di Balai Pembibitan Ternak Grahan. Fakultas Peternakan Universitas Gadjah Mada. Yogyakarta
[25]. Kuswati, Ravenska, N. Hapsari, AP A Yekti, dan T. Susilawati. 2016. Pengaruh kastrasi terhadap kinerja produksi sapi persilangan Wagyu berdasarkan umur yang berbeda. Jurnal Ilmu-Ilmu Peternakan. 26(3): 53-58. Doi: 10.21776/ub.jiip.2016.026. 03.08.
[26]. Laconi EB, Jayanegara A. 2017. Peningkatan kualitas nutrisi buah kakao (theobroma cacao) melalui perlakuan kimia dan biologi pada pakan ruminansia: Evaluasi in vitro dan in vivo. Asia Austr J Anim Sci. 28(3):343-350.
[27]. Lee, JY, Nagano, Y., Taylor, JP, Lim, KL, dan Yao, TP (2018). Mutasi penyebab penyakit pada parkin merusak ubiquitinasi mitokondria, agregasi, dan mitofag yang bergantung pada HDAC6. *Jurnal Biologi Sel*, *189* (4), 671-679.
[28]. Abrori, AS, Ali, U., & Rozi, AF (2022). Peningkatan Pertumbuhan, Efisiensi Pakan, dan Pendapatan dalam Penggemukan Domba Menggunakan Pakan Debu Sawit Terfermentasi. *Jurnal Peternakan Indonesia , 24* (3), 270-280.
[29]. Rozi, AF (2022). Pengaruh Tingkat Penggunaan Debu Sawit Terfermentasi Aspergillus Nigger pada Complete Feed terhadap Nilai Ekonomis Domba Lokal.