Research Article

Digestibility of Nutrient and Performance of Kacang Goats which are Given Fermented Oil Palm Fronds Extract

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Abstract | The influence of administration of FOPFE (Fermented Oil Palm Fronds Extract) on digestibility and goat performance of Kacang goat is the aims of this study. The fermentation process of oil palm fronds is carried out by adding 10% poultry manure for 21 days with, then extracted with methanol solvent. Twelve male goats>1 year were used in this research, were placed in a metabolic caged which were equipped with feedbox and drink. Randomized block design, 4 treatments with 3 groups was used in this research namely : P0 = complete ration + 0% FOPFE; P1 = complete ration + 0.1% FOPFE; P2 = complete ration + 0.2% FOPFE and P3 = complete ration + 0.3% FOPFE. The measured parameters were digestibility of nutrient (organic matter, dry matter, crude fiber, crude protein, extract eter, ADF, NDF, hemicellulose and cellulose) and goat performance of kacang goats (body weight gain, intake of dry matter, body weight gain, conversion of feed and efficiency of ration). The results showed that FOPFE to 0.3% has no significant effect (P>0.05) on average daily gain, nutrient digestibility, feed conversion and feed efficiency but significantly effect (P<0.05) on goat performance. The administration of 0.3% of FOPFE can maintain nutrient digestibility and goat performance.

Keywords | Fermented oil palm fronds extract, Nutrient digestibility, Feed conversion, Conversion, Goat performance

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INTRODUCTION

Oil palm fronds contain high lignin, namely 30.18% (Febrina et al., 2016a, b) so that their use as feed is very limited but oil palm fronds can be used as antioxidants (Imsya et al., 2013); anti-microbial (Febrina et al., 2018, 2020); and feed (Suyitman et al., 2020). The lignin content in oil palm fronds can be lowered through processing biologically, physically, chemically and by a combination. Febrina et al. (2020) reported that fermented oil palm fronds with 10% of poultry manure reduced the lignin content by 33.93% (decreased from 30.18% to 19.94%).

One part of plant polyphenols are tannins, which can precipitate protein (Hagerman, 2012), bind minerals and reduce the bioavailability of minerals (Naumann et al., 2017). Tannins are grouped into 2 groups, namely condensed tannins (CT) and hydrolyzable tannins (HT) (Patra and Saxena, 2010). Hydrolyzed tannins have a negative effect on livestock because they reduce the ability to degrade by rumen microbes and protein solubility, thereby reducing digestibility (Min et al., 2000). The addition of Quercus pyrenaica leaves which contain hydrolyzed tannins inhibits the digestion of cattle (Doce et al., 2013), this is because more protein is bound to hydrolyzed tannins than condensed tannins (Jayanegara et al., 2015). Condensed tannins have lower toxic effects than hydrolyzed tannins (Corral et al., 2020).

Extract ethanol of oil palm fronds contains compounds of steroid and tannin (Febrina et al., 2018); and methanol extract from oil palm frond fermented with poultry manure containing tannins, steroids and phenolic compounds (Febrina et al., 2020). The administration of tannin extract to livestock effect on nutrient digestibility and performance. Supplementation of acacia tannin extract in Holstein bulls increased the amino acids flow into the duodenum (Orlandi et al., 2015). The administration of 1-6% Quebracho Tannin Extract (QTE) of dry matter in adult heifers, affects the digestibility of crude protein (Ahnert et al., 2015). The administration of 2/3quebracho extract + 1/3 chesnut extract (tannin mixture) with a concentration of 0.45; 0.90 and 1.8% of dry matter decreased the digestibility and milk protein but increased the efficiency of milk production (Aguerre et al., 2016). The addition of condensed tannins by more than 5% decreased palatability and ration consumption, nutrient digestibility, feed efficiency and performance (Naumann et al., 2017).

The tannin extract also functions as an antihelmintic (Engström et al., 2016; Naumann et al., 2014). The results of Quijada's et al. (2015) research reported that condensed tannins from the prodelphinidin subunit had higher anthelmintic activity than procyanidin. Ethanol extract of Artemisia vulgaris is antihelmintic against Haemonchus contortus in goats (Karim et al., 2019).

The minerals bound by condensed tannins such as: Zn, P, Mn, Mg, Fe, Cu, Co, Ca and Al and reduce production of rumen methane (Naumann et al., 2017). The administration of pine bark (containing condensed tannins) decreased the digestibility of Cu, S and K minerals but increased the digestibility of Fe, Mg, Mn, P and Zn in goat meat (Min et al., 2015). The addition of Azadirachta indica (13,8%) and Ficus bengalensis (26%) (containing condensed tannins) reduced the rumen microbial population (ciliated) (Bhatta et al., 2015). The administration of 20% palm oil and 80% canola oil does no affect the intake and digestibility of nutrient in goats (Adeyemi et al., 2016). The administration of 3% activated charcoal (AC), does not affect the digestibility of nutrients in goats (Al Kindi et al., 2017).

Research on the effect of tannin on livestock metabolism has been reported by several researchers but the information about the effect of tannin contained in FOPFE (Fermented Oil Palm Fronds Extract) on the digestibility of nutrient and goat performance of kacang goat has not been reported. Therefore this research aims to determine the effect of administration of FOPFE (Fermented Oil Palm Fronds Extract) on the digestibility of nutrient and goat performance of goat (Kacang).

MATERIALS AND METHODS

Animal and feed

The provision of rations is 4% of body weight (NRC, 1981). The ration consisted of 60% concentrate (rice bran, fermented oil palm fronds and tofu waste) and 40% forage (Elephant grass) and drinking water is given as ad libitum. Oil palm fronds are fermented for 21 days with 10% poultry manure and extracted with methanol solvent 96% (Febrina et al., 2020). The administration of FOPFE with different doses (0; 0.1%; 0.2% and 0.3%) (modified Sunarjoko, 2015) is the treatment in this study. Diluted of FOPFE by adding aquadest then given to the goats through a syringe.

Twelve 12 male goats aged ± one year with an initial weight of 13.1±1.1 kg. The goats are placed in a metabolic cage equipped with a feedbox and drinker. The provision of rations is carried out at 08.00 AM; 16.00 PM (twice a day), FOPFE was given 2 hours after feeding.

This research was conducted at the UARDS (University Agriculture Research and Development Station) research of State Islamic University of Sultan Syarif Kasim Riau (Faculty of Agriculture and Animal Science). The analysis of nutrition and fecal content was carried out at State Islamic University of Sultan Syarif Kasim Riau (Laboratory of Nutrition and Chemistry, Faculty of Agriculture and Animal Science), the composition and nutritional content of ration are shown in Table 1.

Table 1: The composition of ration and nutritional content of ration.

Composition of ration	Composition	Dry matter	Crude protein	Crude fiber	TDN
	%			%	
Fermented oil palm frond	40.00	91.29	6.63	28.71	62.56
Tofu Waste	35.00	28.40	19.08	19.80	73.21
Rice Bran	24.00	90.24	7.28	19.80	74.38
Salt	1.00	-	-	-	
Complete ration	100.00	68.11	11.08	23.17	68.50

Experimental design and data collection

This study consisted of 4 treatments, 3 groups using a Randomized Block Design. The treatments i.e: P0; complete ration + 0% FOPFE; P1 : complete ration + FOPFE 0.1%; P2: complete ration + FOPFE 0.2% and P3: complete ration + FOPFE 0.3%. Parameters measured: digestibility of nutrient (organic matter, dry matter, crude fiber, crude protein, ADF, NDF, hemicellulose and cellulose) and performance of Kacang goat (intake of dry matter, average daily gain, ration efficiency and feed conversion).

This research consists of 2 phases, namely the adaptation phase (1 month) and the phase of data collection (28 days). Ration consumption is calculated every day during the collection period by reducing the ration given with the remaining ration. Animal weighing is done on days 1 and 28, in the morning before feeding. Feces collected on days 22-28 (for 7 days), with all the feces released by animals for 24 hours, weighed and taken 10%, dried, milled and then analyzed. Analysis of the nutritional content of rations and feces (crude fiber, crude fiber, dry matter and crude protein) based on AOAC (2006) while the fiber fraction content uses Foss Fibretec (based on Van Soest et al., 1991). Data were analyzed by ANOVA (Analysis of Variance) (Steel and Torrie, 2002), then DMRT (the Duncan's Multiple Range Test) is carried out if there are differences between treatments.

RESULTS

Digestibility of nutrient

Table 2 shows the administration of FOPFE 0-0.3% in the ration did not significantly affect (P>0.05) on the nutrients digestibility. Treatment P0 (without FOPFE) results in lower digestibility compared to treatments P1, P2 and P3. The addition of 0.1-0.3% FOPFE in the ration showed a tendency of increased digestibility.

Goats performance

The addition of FOPFE in ration (Table 3) affected (P<0.05) on dry matter. Treatment 3 showed the lowest of dry matter intake and not different (P>0.05) with P2. The highest intake of dry matter at P3 and it the same as P0 (P>0.05) and P1 was different with P3 (P<0.05). Dry matter intake at P3 showed the same result as P0 (P>0.05) but P1 was different than P3 (P<0.05) higher consumption compared to the P1 and P2 treatments. This shows that the more FOPFE is given, the consumption will also increase. The addition of FOPFE 0-0.3% in the ration did not significantly (P>0.05) on body weight gain, conversion of feed and efficiency of ration of goats.

DISCUSSION

Digestibility of nutrient of goats, which were given FOPFE as shown in Table 2.

In the absence of the effect of adding FOPFE to the digestibility of nutrient, it is assumed that the FOPFE dose in the ration was still low (0-0.3%) and the low tannin content in FOPFE (0.33%, analysis of the Balitnak Laboratory, 2018) so that it did not interfere with microbial growth and rumen digestion. The administration of extract tannin did not affect on dry matter digestibility (Jolazadeh et al., 2015), administration of Dalea purpurea at Condensed

Table 2: Digestibility of nutrient.

No	Digestibility (%)	Treatment			
		P0=CR+0% FOPFE	P1=CR+0.1% FOPFE	P2=CR+0.2% FOPFE	P3=CR+ 0.3% FOPFE
1	Dry Matter	69.66±7.05	72.19±1.66	73.35±1.12	72.12± 0.69
2	Organic Matter	79.32±4.71	80.94±1.23	81.89±0.80	80.94±0.44
3	Crude Protein	80.77±4.49	81.76±0.13	83.72±0.57	82.06±0.97
4	Crude Fiber	59.72±10.08	58.05±4.87	62.10±3.09	66.94±8.54
5	Extract Eter	71.84±8.02	67.25±1.20	67.41±4.15	66.58±12.71
6	NDF	72.65±5.97	75.11±0.68	76.29±1.49	75.29±0.91
7	ADF	68.79±5.75	71.89±1.26	73.35±0.57	72.32±2.91
8	Hemicelulose	81.83±7.38	82.78±0.70	83.29±5.44	82.38±4.03
9	Celulose	69.88±2.65	73.71±0.19	75.64±2.62	73.17±4.67

Notes: CR: Complete ration; FOPFE: Fermented Oil Palm Fronds Extract.

Table 3: Goats Performance of Kacang.

No	Performances	Treatment			
		P0 = CR+ 0% FOPFE	P1= CR+ 0.1% FOPFE	P2= CR+ 0.2% FOPFE	P3 = CR+ 0.3% FOPFE
1	Dry matter intake (g/h/d)	736.83^{ab}±68.62	645.97^{c}±18.97	676.97^{bc}±8.58	809.21^{a}±20.71
2	Average Daily Gain (g/h/d)	31.43±7.89	32.32±8.23	32.74±7.21	39.76±11.59
3	Feed conversion	24.03±3.55	20.58±4.71	21.38±4.81	21.76±7.29
4	Feed efficiency	4.2±0.006	4.9±0.011	4.8±0.010	4.9±0.013

Notes: CR: Complete ration; FOPFE: Fermented Oil Palm Fronds Extract.

Tannin (CT) concentration 6-9% dry matter, does not affect the digestibility of crude protein and dry matter (Jin et al., 2012) but the administration of Quebracho Tannin (QT) extract reduces nutrient digestibility on crossbred steers (Norris et al., 2020). Tannins in low concentrations do not affect rumen ecosystems and digestibility (Husnaeni et al., 2015). Tannins in high doses affect rumen digestibility and fermentability (Jayanegara et al., 2012; Min et al., 2015) this is because tannin binds minerals and proteins and interferes with Fe absorption (Fajrina et al., 2016).

Rumen pH in this study was 7.74-8.15. The same was reported by other researchers rations containing 30% elephant grass and 70% concentrate in Madura cattle and Onggole Peranakan's produce rumen pH of 7.6-8.4 (Umar et al., 2011). The rumen pH is still within the normal range for microbial growth and does not interfere with the stability of complex tannin-protein. This is beneficial because the supply of feed protein is protected by rumen degradation, so the addition of 0-0.3% FOPFE in the ration does not affect nutrient digestibility. The same research was reported by Lima et al. (2019) that supplementation of tannin in sheep did not affect the digestibility. The bond between tannin and protein will be released at a low pH that occurs in abomasum and protein will be hydrolyzed by pepsin so that amino acids will be utilized by livestock (Jayanegara et al., 2008).

The administration of 0.1-0.3% FOPFE in the ration showed a tendency of increased digestibility. This shows that goats can tolerate FOPFE in low doses, even increasing digestibility. This is because tannin can function as a defaunation agent that inhibits the growth of rumen protozoa, thus encouraging the growth of bacteria to degrade feed, thereby increase the digestibility. Tannin supplementation reduces protozoa populations (Tan et al., 2011) and increases organic matter digestibility (Wahyuni et al., 2014).

The administration of 0.1% FOPFE (Table 3), that reducing intake of dry matter compared without the administration of FOPFE (P0). This shows the reduced palatability of the ration caused by tannin has a chelate taste so that the increase in FOPFE in the ration, causes a decrease on dry matter intake. The increase in FOPFE from 0.1% to 0.3% has led to an increase in dry matter intake. This is because livestock has adapted to the taste of chelat in tannins so that an increase in FOPFE in rations also increases the consumption of dry matter. Different results were reported (Tseu et al., 2020) administration of tannins 0.00; 0.75; 1.50 and 2.25% of dry matter significantly decreased the feed intake in the of Nellore cows this was due to the astringent properties of tannins.

Consumption of dry matter in P0 treatment (without the addition of FOPFE) was 736.83 g/h/d and did not differ from treatment P2 (0.2% FOPFE) and P3 (0.3% FOPFE). This shows that the dose of tannin contained in the extract is still low (0.33%) so it does not affect the consumption of rations. Tannins in low quantities do not affect consumption (Frutos et al., 2004), but the addition of 4% Quebracho Tannins Extract affects on digestibility of organic matter, digestibility dry matter and intake of dry matter on crossbred heifers (Vazquez et al., 2018). Tannins have a chelate taste (Silanikove et al., 2001), but the addition of FOPFE in the ration does not affect ration consumption, this is thought because goats are more tolerant of a bitter taste than sheep (Lamy et al., 2011) and the proline content in saliva which can maintain the stability of the feed (Delimon et al., 2017).

In this study all treatments received the same type of ration, the difference was the FOPFE dose of 0-0.3% in the ration so that the palatability and consumption of ration were the same. Factors affecting ration consumption are palatability (Restitrisnani et al., 2013; Suparman et al., 2016) and feed nutrition (Ngwa et al., 2007; Tafsin et al., 2019). The ration consumption (dry matter intake) in this study was 645.97-809.21g/h/day, the same as reported by Rostini and Zakir (2017) and Lawa and Lazarus (2015).

The average daily gain of goats given 0-0.3% FOPFE in the ration was 31.43-39.76 g/h/d and did not differ between treatments. The same researchers were reported by Brown et al. (2018) that the provision of 30-40% tanniniferous Acacia karroo leaf on goats did not have an effect on body weight gain namely 34 and 36 g/h/d. The average daily gain in this study was lower than research by Astuti et al. (2011); Febrina et al. (2017) and Adhianto et al. (2020).

Feed efficiency is the ratio between average daily gain and intake of dry matter. Feed efficiency of goat given FOPFE 0-0.3% in the ration was 4.23-4.99. The administration of FOPFE in ration did not affect the ration of consumption and average daily gain so it did not affect the feed efficiency. Increasing the consumption of dry material will increase feed efficiency (Houlahana et al., 2019). The sheep which were supplemented with soybean meal protected by tannin liquid of banana stems in ration showed an increase of balanced body weight with the ration consumed (Yulistiyani et al., 2011).

Feed conversion in goats which were given FOPFE 0-0.3% in the ration was 20.58-24.03 and did not differ between treatments, this was due to body weight gain and feed efficiency which was not different. The lowest ration conversion score shows the more efficient the cattle use their rations. The addition of tannin in the ration influences the performance and efficiency of the ration (Ebber et al., 2017; Yisehak et al., 2016;Aboagye et al., 2018). Jayanegara et al. (2012) stated that the addition of tannins that exceed 5% in the ration had a negative impact on the digestibility and performance of livestock so that their use in the ration needed to be limited. Providing the right dose of tannin has a beneficial effect on the metabolism of ruminants (Frutos et al., 2004).

CONCLUSION

Fermented Oil Palm Fronds Extract (FOPFE) can be fed to goats, because it does not negatively affect on digestibility and performance of Kacang goats. Administration of 0.2% FOPFE gave the best results assessed from nutrient digestibility and dry matter intake.

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AUTHOR'S CONTRIBUTION

All authors contributed to conducting research and writing this manuscript.

CONFLICT OF INTEREST

The authors have declared no conflict of interest.

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