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The Digestibility of Different Level of Palm Kernel Cake and Rice Bran Supplementation in Sheep

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ABSTRACT
The purpose of this study was to evaluate the effect of giving oil Palm Kernel Cake (PKC) and rice bran with different proportions to the digestibility of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), and energy in sheep. Twelve (12) sheep were divided into 3 treatments with 4 animals each, namely T1: supplementation of 15% PKC + 40% rice bran, T2: supplementation of 20% PKC + 35% rice bran, and T3: supplementation of 25% PKC + 30 % rice bran. All livestock received supplementation of 2% body weight and were given *ad libitum* fresh grass and drinking water. This research was conducted for 21 days, consisting of 14 days adaptation period and 7 days collection period. Samples feed offered, feed residue, and fecal output were daily collected, dried in the sun to reduce water content, stored, and measured by DM, OM, CP, energy, CF, and energy. The data obtained were then analyzed using ANOVA, and continued with Duncan's Multiple Range Test to see the difference among the means. The results showed that increasing percentage of PKC in feed supplementation did not significantly increase ($P > 0.05$) the digestibility of DM, OM, CP, and CF in all treatments, while the energy digestibility was increased especially at P3 which was significantly higher ($p<0.05$) compared to P1. The increasing percentage of PKC in feed supplementation has reduced the DM intake.

Keywords: *Palm kernel cake, Digestibility, Sheep*

1. INTRODUCTION

Palm kernel cake (PKC) is a by-product of the palm oil industry. Indonesia was estimated to produce 49,1 million tons of oil palm fresh fruit bunch/FFB [1], and produce 1.3 million tons of PKC Indonesia. PKC contained 14 to 16% [2] or to 20% [3, 4] crude protein and 9.5 to 10.5 MJ metabolizable energy per kg [2], making this abundant oil palm by-product can be used as ruminant feed [2,3, 5, 6]. However, PKC also contains high amounts of Cu [2, 5, 7], which could be potentially toxic to sheep [8, 9]. The high addition of PKC (80 % of total DM) could reduce the DM and nutrient intake by 40 % [10] and might have an adverse effect on growth performance and carcass quality in ruminants [11]. Rice bran is widely used for feed supplementation for ruminants in Indonesia, especially for energy supplementation [12]. Although representing a small portion of rice by-products, rice bran contains one of the most nutritious, supplying protein, energy, and minerals [13].

This study aimed to evaluate the effect of giving oil PKC and rice bran supplementation with different proportions to the digestibility of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), and energy in sheep.

2. MATERIALS AND METHODS

The research was conducted in Setyolembu Farm, Sukoharjo, Central Java. The processing samples were prepared in the Department of Animal Science, University of Bengkulu, while the laboratory work was conducted in the Laboratory of Microbiology and Biochemistry, the University of IPB, Bogor.

2.1 Animals and feeding treatment

Twelve (12) 10-month-old thin-tail sheep, weighing 19.1 $\pm$ 1.2 kg and having similar Body Condition Score. All 12 animals were divided into 3 treatments with 4 animal each, namely
T1: supplementation of 15% PKC + 40% rice bran,
T2: supplementation of 20% PKC + 35% rice bran, and
T3: supplementation of 25% PKC + 30 % rice bran.

All animals were placed in metabolic cages, and given 2% body weight supplementation and given *ad libitum* of fresh *Pennisetum purpuroides* grass. Free access to clean drinking water was also provided. This research was conducted for 21 days, consisting of 14 days adaptation period and 7 days collection period. Samples feed offered, feed residue and fecal output were daily collected, dried in the sun to reduce water content, stored, and measured by dry matter (DM), organic matter (OM), crude protein (CP), energy, and crude fiber (CF) [14]. Feed composition and feed nutritive content are presented in Table 1.

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Table 1 Chemical composition of the feeds used in the experiment.

Parameter	Treatments		
	T1	**T2**	**T3**
Feed suplementation composition (%)			
Palm Kernel Cake (PKC)	15	20	25
Rice bran	40	35	30
Cassava by-product Tapioca	30	30	30
Salt	2,5	2,5	2,5
Starbio	2,5	2,5	2,5
Molasses	10	10	10
Total	100	100	100
Feed Suplementation - Nutritive Content			
CP (%)	7.44	8.76	8.89
CF (%)	12.25	12.70	16.36
GE (cal/kg)	3,998	4,010	5,822
Grass Nutritive Content			
CP (%)	13.48	13.60	13.75
CF (%)	21.07	22.30	22.53
GE (cal/kg)	4,588	4,697	4,702

2.2 Evaluation of digestibility

The digestibility of feed was calculated using this formula [15]:

$$Digestibility\ (\%) \quad = X\ 100\%$$

2.3 Statistical analysis

Data generated from this study were analyzed using a one-way analysis of variance [16] which was performed using the SPSS for Windows (IBM Corp., USA). Significant treatment means were separated using Duncan's Multiple Range Test and indicated by $p<0.05$.

3. RESULTS AND DISCUSSIONS

It is apparent in the present study that increasing PKC percentage in the supplementation resulted in lower total DM intake (both in the abssolute terms or in the %liveweight) as shown in Table 2, in which T3 has significantly lower ($p<0.05$) than of T1. However, due to similar trend on the their faecal output, the DM digestibility remained similar for all treatments, ranging from 66.7 to 71%. The non significantly difference on OM digestibility value for all treatments in the present study seems to follow the DM digestibility value. When it was calculated in terms of DMI/liweight, the DMI in this experiment ranging 2,5 – 2,9% was within the normal range for sheep of 1.8 to 4.7% [17].

Table 2 Dry matter and organic matter intake, fecal output, and digestibility fed different PKC concentration of the experiment.

Parameter measured	Treatments		
	T1	**T2**	**T3**
Dry matter (DM)			
Intake (g/head/day)			
Grass	366.1±97.64^{a}	319.4±137.74^{ab}	294.3±91.59^{b}
Supplementation	192.7±34.88^{a}	182.4±20.20^{a}	198.6±30.45^{a}
Total	558.7±99.54^{a}	501.8±146.62^{ab}	492.9±90.85^{b}
% Liveweight (%)	2.9±0.55^{a}	2.7±0.60^{ab}	2.5±0.52^{b}
Fecal Output (g/head/day)	163.1±44.7^{a}	136.8±41.64^{ab}	159.5±44.96^{b}
Digestibility (%)	70.5±6.96^{a}	71.0±11.15^{a}	66.7±11.26^{a}
Organic matter (OM)			
Intake (g/head/day)			
Grass	294.1±79.06^{a}	265.5±100.10^{a}	242.8±74.97^{a}
Supplementation	159.3±28.86^{a}	152.3±16.88^{a}	167.0±25.63^{a}
Total	453.4±80.98^{a}	417.9 ±107.31^{a}	409.8±74.34^{a}
Fecal Output (g/head/day)	325.2±71.07^{a}	303.5±100.73^{a}	283.4±79.58^{a}
Digestibility (%)	66.4±8.07^{a}	67.3±12.31^{a}	62.7±12.84^{a}

$^{a–b}$Means within the same row followed by different superscript letter are statistically different at $p<0.05$. T1: supplementation of 15% PKC + 40% rice bran. T2: supplementation of 20% PKC + 35% rice bran. and T3: supplementation of 25% PKC + 30 % rice bran.

The present study also showed that the digestibility value of CP and CF were all similar for all three treatments (see Table 3).

Table 3. Crude protein, crude fiber, energy intake, fecal output, and digestibility fed different PKC concentration of the experiment.

Parameter measured	Treatments		
	T1	T2	T3
Crude Protein (CP)			
Intake (gram/head/day)			
Total	66.38±13.248[a]	65.87±16.059[a]	60.76±12.359[a]
Output feses (g/head/day)	10.95±3.179[a]	10.45±2.451[a]	11.59±3.566[a]
Digestibility (%)	83.32±4.228[a]	83.41±4.806[a]	80.35±6.996[a]
Crude fiber (CF)			
Intake (gram/day)			
Total	102.2±21.34[a]	97.3±21.65[a]	84.1±20.56[b]
Output feses (g/head/day)	36.0 ±8.84[a]	31.0± 7.73[b]	28.0 ±7.40[b]
Digestibility (%)	63.9±9.16[a]	66.9±9.52[a]	65.4±10.88[a]
Energy			
Intake (gram/day)			
Total	2,435±435.6[a]	2,376±480.1[a]	2,544±422.01[a]
Output feses (g/head/day)	579±137.4[a]	493±119.45[b]	505±135.9[b]
Digestibility (%)	75.8±5.72[a]	78.6±5.92[ab]	79.9±5.70[b]

[a–b]Means within the same row followed by different superscript letter are statistically different at $p<0.05$. T1: supplementation of 15% PKC + 40% rice bran. T2: supplementation of 20% PKC + 35% rice bran. and T3: supplementation of 25% PKC + 30 % rice bran.

In general, the similar digestibility value of DM, OM, CP, and CF for all treatment in this experiment has directly resulted from the relationship between total intake and its respective output feces. The other reason for similar digestibility value (DM, OM, CP, and CF) was that, as [18] and [19] mentioned, the value of digestibility was directly influenced by feed consumption, feed composition, degradability, the ratio of protein to energy, and the factors associated with livestock. The somewhat similar nutrient value of CP, CF, and GE (Table 1) and its respective total intake and fecal output (Table 2 and Table 3) would also explain the similar digestibility value among treatments.

Although CP content of feed T3 was relatively higher than those of T2 and T2, the CP intake and digestibility were non-significant differences among treatments (Table 2). This was also caused by reducing DMI as PKC supplementation increased (Table 1). The average CP intake in this study of 60.76 – 66.38 g/head/day was lower than those of the [20] which was reported to be of 127-167 gram/head/day. The average CP digestibility in this study ranging from 80.35-83.41% was higher than the research results of [21] by 74.73%-80.63% with sheep being given complete rations with different proteins sources. The high CF content of PKC (66%) and ether extracts (11%) [10, 22] could affect the health of rumen, eating behavior, and eventually affects digestibility.

Interestingly, the increasing PKC supplementation (Table 3) has improved the energy digestibility value, in which T3 was significantly higher ($p<0.05$) than that of T1; while the T2 were similar($p>0.05$) to T1 and T3. The results of energy digestibility of 75.8-79.9% higher than the results reported by [23] *i.e.* 52.8-55.3%. The difference in energy consumption in this research is likely due to the differences in feed energy content and the quality of feed provided.

4. CONCLUSION

The results showed that increasing levels of PKC on feed supplementation reduced the DMI, but had no effect on the digestibility of DM, OM, CP, and CF on sheep. Increasing PKC level at 25% increased energy digestibility.

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