THE USE OF COCO PEAT AS A SOURCE OF FIBER WITH OR WITHOUT MULTIENZYME SUPPLEMENTATION FOR RABBITS.

Raharjo Y. C., Haryati T., Mudaris A, Sweet

Full text of the communication
+
Photos of the oral presentation

How to cite this paper
Raharjo Y. C., Haryati T., Mudaris A, Sweet, 2013. The use of coco peat as a source of fiber with or without multienzyme supplementation for rabbits. *3rd Conference of the Asian Rabbit Production Association, 27-29 August 2013, Bali, Indonesia, 110-114 + presentation*

The Use of Coco Peat as a Source of Fiber with Or without Multienzyme Supplementation for Rabbits

Yono C Raharjo[1], Haryati T[1], Mudaris A[2], Sweet[2]

[1]Indonesian Research Institute for Animal Production Bogor, PO Box 221, Bogor 16002
[2]Faculty of Animal Husbandry. University of Pajajaran Bandung
Corresponding e-mail: raharjoyc2009@yahoo.com

ABSTRACT

Coco peat is a waste product of coconut oil industry and sometimes is considered to causing pollution to the environment. It contains a very high content of fiber, especially lignin, hence is hardly utilized as an economically valued product. Rabbits, on the other hand, requires a certain amount of indigestible fiber, including lignin to facilitate the normal digestion in the gastrointestinal tract. An experiment was carried out to study the lignin inclusion in the rabbit diet supplemented with or without enzymes on the performance of the rabbits including the digestibility of coco peat. A factorial 2 × 3, in which 2 levels of enzyme (0 and 30g/100 kg) and 3 levels of cocopeat (0, 6, 1, and 12,2%, which contribute 0, 4 and 8% crude fiber to the diet, respectively) was applied. Each treatment combination consisted of 6 replicates, each of 3 weanling rabbits. All treatments were formulated to contain 18% crude protein, 2550 kcal/kg DE and 14% crude fiber. Trial was carried out for 10 weeks. Therefater, 1 animal from each replicate was slaughtered for carcass percentage. A digestibility study was carried through a total collection method in 5 strains of rabbit (Rex, Satin, Reza, NZW and Meat-type crossed). For digestibility purpose, coco peat was mixed 50 : 50 with the basal diet. Fecal collection was carried out for 10 days following a 3 days adaptation. All results were subjected to an Anova analysis which was followed by DMRT (Duncan Multiple Range Test) for any significant differences among treatment means. Results indicated that there was no significant interaction of level of cocopeat with level of enzymes among all measured parameters. No significant differences were noted in feed consumption, carcass percentage, FCR, meat and pelt production among levels of dietary coco peat or among levels of enzyme. It is observed however, that higher levels of coco peat consistently decreased the performance, which was significant in bodyweight and bodyweight gain, when 8% dietary coco peat fiber was included. Inclusion of enzyme slightly but not significantly improved the performance of measured parameters. When basal diet was used, body weight gain of the NZW was significantly higher than other treated rabbits. However no differences were noted on feed consumption and dry matter digestibility (DMD). On the other hand, when coco peat was included at 50% in the basal diet, BWG was negative for all rabbits and feed consumption was lower compared with those at basal diet. The DMD was poorer ($P<0.05$) in Rex, Satin and Reza compared with faster growing rabbits (Cross and NZW). In Conclusion, coco peat can be included at a very low level (4%) in the diet. It however could be used as a source of lignin to balance the ratio of cellulose: lignin when the indigestible lignin is limitedly available.

Key Words: Cocopeat, Digestibility, Fiber

INTRODUCTION

Coco peat is abundantly available in many areas that produce coconut oil or coconut products in Indonesia. Coco peat, which is almost similar to soft wood, contains high levels of fiber. Chemical analyses from Balitnak showed crude fibers 30%, cellulose and lignin 65-70%, hemicellulose 8.50%. Coco peat is also reported to contain pentosans, tar, and tannins and that to some extent contribute to a rather sticky property of coco peat. It is hardly used for any purpose, except as a filler in compost to loosen soil solidity, and very few, if any, has been used as part of animal diet. In contrast, as a herbivore animals, rabbits require a certain amount of indigestible fiber, including lignin, in their diet to ensure a digestive health (Gidenne 1992), hence support the optimal gowth of the animal. Requirement of fiber fractions for rabbits needs an appropriate ratio of cellulose to lignin, *e.g.* 3-3.5 : 1 (Gidenne 2013). For commercial rabbit pellet in Indonesia, some commonly used ingredients such as rice bran, wheat bran, copra meal and palm kernel meal contribute a certain amount of fiber (Raharjo 2007). However the most substantial amount of fiber comes from

available dried sugar cane tops or dried grass (Nasrullah & Raharjo 2013). As the sugar cane tops is now exported, while production of grasses, is low at dry season and need a drying facilities at rainy season, therefore its availability is uncertain. Moreover, lignin content of these forages are moderately low. One of few available sources in the tropics is cocopeat, which contain high level of indigestible fiber, lignin content in particular.

High levels of crude fiber and tannin in calliandra caused adverse effect to rabbit performance as it reduces the nutrient digestibility (Raharjo et al. 1986). Similar situation may apply to the use of coco peat. The use of enzyme or multi enzymes to improve digestibility has been reported elsewhere (Danicke et al. 1999; Hubener et al. 2002) and hence its used in coco peat containing diet is hypothesized to some extent reduce the negative effect of high levels of fiber and tannins. This experiment was to explore the possibility of using cocopeat as a source of fiber for rabbit and was combined with various levels multienzyme to optimize such use of cocopeat. A study on the digestibility of coco peat in different strains of rabbits was also conducted.

MATERIALS AND METHODS

A 2 × 3 factorial design applying 2 levels of enzyme (0 and 0.03%) and 3 levels of cocopeat (0, 6.01, and 12.02%) was used in the experiment. A commercial enzyme used was a cocktail of enzymes containing protease, carbohydrase, oligosaccaharidase and phytase. Contribution of crude fiber from cocopeat was 4,01 (treatment 3 and 4) and 8,02% (treatment 5 and 6) , while total dietary dietary crude fiber level was about 14%. Chemical composition of cocopeat and of treatments is presented in Table 1. Other main feed ingredients in the diet were corn, soybean meal, rice bran, wheat bran, copra meal and cane tops. Molasses, vitamin-mineral premix, limestone, and bone meal were also added to fit the nutrient requirements (NRC 1977). Each treatment combination consisted of 6 replicates, each of 3 weanling Rex rabbits. All treatments were formulated to contain 18% crude protein, 2550 kcal/kg DE and 14% crude fiber. Trial was carried out for 10 weeks. One animal from each replicate was slaughtered for carcass percentage. A digestibility study was also carried out through a total collection method in 5 strains of rabbit (Rex, Satin, Reza, NZW and Meat-type crossed). In this digestibility trial, coco peat was mixed 50 : 50 with the basal diet. Basal diet contains 16% crude protein, 2500 kkal/kg DE and 9% crude fiber. Fecal collection was carried out for 7 days following a 3 days adaptation. All results were subjected to an Anova analysis which was followed by DMRT (Duncan Multiple Range Test) for any significant differences among treatment means.

Table 1. Calculated chemical composition of diets used in the trial

Nutrient	Treat-1	Treat-2	Treat-3	Treat-4	Treat-5	Treat-6
Level of coco peat (%)	0.00	0.00	6.01	6.01	12.02	12.02
Fiber contribution from cocopeat (%)	0.00	0.00	4.01	4.01	8.02	8.02
Level of enzyme (%)	0.00	0.03	0.00	0.03	0.00	0.03
Digestible energy (kcal/kg)	2520.00	2520.00	2544.00	2544.00	2589.00	2589.00
Crude protein (%)	18.02	18.02	18.05	18.05	18.08	18.08
Crude fiber (%)	14.20	14.20	14.03	14.03	14.08	14.08
Cacium (%)	0.82	0.82	0.72	0.72	0.69	0.69
Phosphorus, total (%)	0.79	0.79	0.93	0.93	0.98	0.98
Lysine (%)	0.89	0.89	0.89	0.89	0.89	0.89
Methionine (%)	0.58	0.58	0.60	0.60	0.60	0.60

RESULTS AND DISCUSSION

Growth performance

Effects of coco peat and enzyme inclusion in the diets on rabbit performance are presented in Table 2. Statistical analysis indicated that there were no interaction detected between levels of coco peat and levels of enzyme used and therefore further analyses were performed between means of treatments within variables (level of coco peat and level of enzyme). Increasing level of coco peat in the diet decreased all parameters measured. However, differences among treatments were significant only in level of coco peat treatments on bodyweight (BW), bodyweight gain (BWG) and meat production. Increasing levels of coco peat decreased the BW, BWG and meat production. However, inclusion of 6% of coco peat is statistically similar to those of 0%. Therefore, the use of coco peat up to 6% is tolerable and in fact, as the diet price is lower (coco peat is of no price, while replaced cane tops is almost 60-70% of corn price), hence any level of the use of dietary coco peat inclusion up to 6% will reduce diet cost while maintaining the animal production. Feed consumption in this trial were somewhat low (56-65 g/rabbit/d) compared with those (70-80 g/rabbit/d) reported by Raharjo and Sartika (1992) on Rex rabbits raised in the cool room. It is therefore not surprising that their BWG was also low (12.0-15.2 g/r/d). Common results of BWG of Rex in Bogor was about 20-25 g/h/d (Raharjo 2008).

Improvements, but not statistically significant, were noted on all parameters measured when the rabbits are fed with the enzyme containing diet. This indicated that the enzyme used had positive effect but was not sufficiently effective to work on the coco peat. The inclusion of 12% coco peat decreased digestibility of the diet by 9.03%, while the addition of enzyme improved its digestibility by 5.07%. This fact suggests that coco peat may be of useful mostly as a source of indigestible fiber for rabbit, to help the health of digestive tract.

Digestibility of dry matter in different rabbit breed

Digestibility of dry matter of coco peat was performed in the growing and mature animal. In the growing animal, coco peat was included in the diet at 6 and 12% with or without enzyme supplementation. Results clearly indicated that inclusion of coco peat in the diet caused a decrease of DM digestibility from 72.4 to 66.4%. The decrease however was not statistically significant. The use of multi enzyme also increased the digestibility from 67.0 to 70.4%. However, the increase did not cause significant difference (P>0.05).

Table 2. Effects of levels of cocopeat and enzymes on the parameters measured.

Parameter	Levels of dietary Cocopeat (%)			Levels of enzyme (%)	
	0.00	6.01	12.02	0.00	0.030
CF from Cocopeat in diet (%)	0.00	4.00	8.00	4.00	8.00
Feed consumption (g/h/d)	65.00	65.00	56.00	58.0	63.00
Bodyweight (g/head)	2116.00[a]	2039.00[ab]	1886.00[b]	1996.00	2060.00
Bodyweight gain (g/h/d)	15.20[a]	14.60[ab]	12.00[b]	12.80	14.80
Carcass percentage (%)	52.00	54.00	51.00	52.00	54.00
Feed Conversion Ratio	4.30	4.45	4.67	4.30	4.20
Meat production (g/head)	887.00[ab]	916.00[a]	796.00[b]	845.00	887.00
Pelt Production	205.00	206.00	185.00	197.00	199.00
Dry matter digestibility of diet (%)	72.40±5.40	67.30±5.50	66.40±2.20	67.00±3.70	70.40±5.80

[a,b,c] in the same row differ significantly

The decrease of DM digestibility in coco peat containing diet is predicted because of the nature of coco peat that contains very high fiber fraction and also contains tannin/phenolic group, which contribute to the undigestion of dietary nutrient component (Raharjo et al. 1986).

Dry matter digestibility of basal, mixed diet and calculated coco peat in different breed of rabbits is presented in Table 3. Feeding basal, irrespective of breeds, to the mature male rabbits gave small but positive gain. This indicated adequate nutrient intake to meet the need for growth maintenance. This probably supported by the fact that feed consumption of basal diet by these 5 breeds were normal, about 71 g/h/d (rex) - 90 g/h/d (crossed bred rabbit. In addition, a diet containing 18% crude protein and 2550 kcal digestible energy plus addition of energy (fat), vitamins and minerals, provides somewhat adequate nutrients and that, reduce the negative effect of the coco peat. A somewhat high variation in the replication among treatments, on the BWG was also noted and contributed to the non-statistical difference, eventhough the improvement by enzyme addition was almost 15%.

Dry matter digestibility of the basal diet was similar to those in young rabbits (68.9-74.6%). On the other hand, feed consumption of coco peat containing diet, were surprisingly low. Range of intake of coco peat diet were 44 g/h/d (Reza) to 60 g/h/d (crossed rabbit). This results indicated that coco peat was less palatable to the rabbit. Not only it was less palatable, coco peat mixed diet also very low in their digestibility value (19.3-35.2%) and consequently it caused negative weight gain to the rabbit, regardless of the breed.

When those digestibility data from basal and mixed diet were calculated, the DMD of coco peat in 5 breeds of rabbits were extremely poor and were negatives in the Reza, Satin and Rex rabbits (-7.63, -7.98, and -11.69, respectively). This results suggest that coco peat binds the nutrients of basal diet and makes those nutrients undigested by the rabbits. It is particularly true, because coco peat is very high in lignin and other indigestible fiber fractions and also tannin, whose properties is their ability to bind nutrients and cause them undigested (Gidenne 2013). The binding effect occurred more with the drying process in forage materials (Raharjo et al. 1986).

Between breeds (Reza, Rex and Satin), in terms of BW, BWG, feed consumption, and their DMD, were comparable. Those 3 breeds are medium type breeds and each has exotic fur. Digestibility results of crossed bred and NZW were also very small (7.23 and 6.20%,

Table 3. Digestibility of basal diet solely or mixed with coco peat included solely or is mixed with basal diet in different strains of rabbits

Breed	Basal				Mixed diet (basal : coco peat = 50 : 50)				Coco peat (%)
	Initial weight (g/head)	Weight gain (g/head)	Feed Intake (g/head)	DM Digest (%)	Initial weight (g/head)	Weight gain (g/head)	Feed Intake (g/head)	DM Digest (%)	DM Digest coco (%)
Reza	2583.00	28.00[a]	567.00[ab]	70.30	2571.00	-195.00	306.00[a]	21.60[a]	-7.63
sd	185.00	76.00	56.00	6.30	135.00	113.00	74.00	21.80	7.09
Satin	2309.00	57.00[a]	552.00[ab]	69.20	2377.00	-144.00	317.00[a]	22.80[a]	-7.98
sd	264.00	37.00	63.00	5.00	266.00	64.00	55.00	15.00	4.93
Rex	2313.00	61.00[a]	497.00[b]	68.90	2354.00	-164.00	335.00[a]	19.30[a]	-11.69
sd	408.00	117.00	89.00	3.80	316.00	71.00	56.00	14.60	1.64
Cross	3478.00	32.00[a]	627.00[a]	71.70	3451.00	-130.00	419.00[b]	35.20[b]	7.23
sd	157.00	67.00	28.00	4.40	195.00	87.00	35.00	8.10	4.24
NZW	3201.00	110.00[b]	575.00[ab]	74.60	3254.00	-205.00	373.00[ab]	32.50[ab]	6.20
sd	74.00	158.00	58.00	5.00	224.00	96.00	41.00	11.00	8.09

[a,b,] in the same column differ significantly

respectively) yet were comparable between these breeds. The NZW and crossed bred rabbit are meat-type rabbit, have been more selected to multiplying and growing fast. So probably their digestive system mechanism is better than the Rex/Satin/Reza group.

These results suggested that coco peat is highly indigestible to the rabbit and its use at more than 6% may cause adverse effect to the efficiency of nutrient metabolism and to the growth of animal.

CONCLUSION

Since rabbits do need certain indigestible in their diet and also to make use of this waste product, the level of coco peat is not more than 3% in rabbit diet.

REFERENCES

Danicke S, Vahjen W, Simon O, Jeroch H. 1999. Effects of dietary fat type and xylanase supplementation to rye-based broiler diets on selected bacterial groups adhering to the intestinal epithelium. on transit time of feed, and on nutrient digestibility. Poult Sci. 78:1292-1299.

Gidenne T. 2003. Fibres in rabbit feeding for digestive troubles prevention: respective role of low-digested and digestible fibre. Livest. Prod. Sci. 81:105-117.

Gidenne T. 2013. Dietary fiber: their analysis in animal feeding and their role in rabbit nutrition and health. 2nd International Conference on Rabbit Production in Indonesia. Bali, 27-29 August 2013.

Hubener K, Vahjen W, Simon O. 2002. Bacterial responses to different dietary cereal types and xylanase supplementation in the intestine of broiler chicken. Arch Tierernahr. 56:167-87.

Nasrullah, Raharjo YC. 2013. Recent Advances in Rabbit Research in Indonesia. 2nd International Conference on Rabbit Production in Indonesia. Bali, 27-29 August 2013.

Raharjo YC. 2008. Strategy on the development of small- and medium-scale rabbit farming based on farmers cooperation. A case of rabbit production in Indonesia. In: Xiccato G, Trocino A, Lukefahr SD, editors. Proceedings of the 9th World Rabbit Congress. 9th World Rabbit Congress. Verona, June 10-13, 2008. Brescia (Italy): Fondazione Iniziative Zooprofilattiche e Zootecniche. p. 1609-1614.

Raharjo YC, Sartika T. 1992. Effects of environmental temperatures and restricted feeding on the performance, carcass percentage and fur quality of the Rex rabbit. J Appl Rabbit Res. 15:1590-1598.

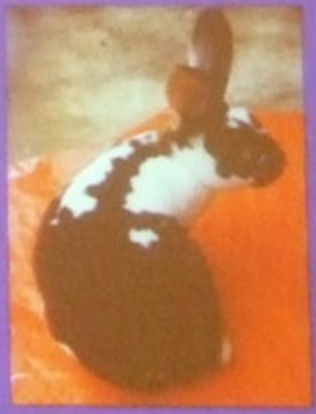
Raharjo YC, Cheeke PR, Patton NM, Supriyati K. 1986. Evaluation of tropical forages and by-product feeds for rabbit production. 1. Nutrient digestibility and effect of heat treatment. J Appl Rabbit Res. 9:56-66.

THE USE OF COCO PEAT ON THE GROWTH AND CARCASS PERCENTAGE OF REX RABBITS

Yono C Raharjo, Tuti Haryati, Aries, Sweet

Indonesian Research Institute for Animal Production

Bogor. PO Box 221 – Bogor. Indonesia



Dr Yono C. RAHARJO during his presentation

Introduction :

- Rabbit is a cecotroph-herbivore, prolific, grow and reproduce from forages/vegetable waste - potential, cheap feed, prospective, especially for people living in the village area

- Rabbit requires high percentage of indigestible fiber in the diet in order to assure the normal health of digestion.
- Indigestible fiber reduce the digestibility, lower the efficiency of feed utilization
- Type of indigestible fiber may affect palatibility

Introduction :

Availability of source of fiber,
at wet season is highly abundant,
yet during the dry season,
the availability of dry feedstuffs
is s hort and for medium scale
operation is insufficient
→ need choices of source of indigestible fiber

- Inappropriate level of fibers,
digestible or indigestible fiber,
cause high incidence of diarrhea
in the pre and post weaning
(25 - 60%)

Introduction :

Coco peat :

- Shredded, soft materials produced during the grinding of coconut pod
- obtained abundantly in many areas where coconut is planted and a factorry is build.
- In Lampung - usd 0.025/kg
- contains→ CF 65, NDF 72, ADF 69, selulosa 32, lignin 37
- Could be potential as source of indigestible fiber
- Possibility of secondary compounds, toxicants ?

→ Higher indigestible fiber → reduce feed efficiency

- Use of enzyme → improves feed efficiency → especially in the low plane of dietary nutrition

Aim :

- To improve production of weanlings through the use of coco peat as a source of indigestible fiber and to improve growth and efficiency through the use of multiple enzymes.

Methodology

1. A Short trial on digestibility :

Animal used : Rex, Satin, Reza, Cross and NZW

- *10 adult males of each breed*
- *10 days total collection following 3 days adaptation to the diet*
- *basal is a mixture of common ingredients containing 17 % crude protein and 9 % crude fiber*
- *for trial, coco peat was mixed with basal at 50 : 50 ratio.*

Methodology

2. Growth Trial :

- T1 = 0% coco peat + 0 % enzym
- T2 = 0 % coco peat + 0.2 % enzym
- T3 = 6.1 % CF dari coco peat + 0 % enzym
- T4 = 6.1 % CF dari coco peat + 0.03 % enzym

T5 = 12.2 % CF dari coco peat + 0 % enzym

T6 = 12.2 % CF dari coco peat + 0.03 % enzym

- Factorial design 3 x 2, each treatment = 6 reps @ 3 weanlings
- experiment at 6 – 12 week-old.

- measurements on, bodyweight (/gain), mortality , carcass percentage (2 rabbits from 3 reps/treatment)

- Enzyme used is a multienzyme containing proteases, phytase, selulase.
- A DM digestibiity by total collection was also performed at 10 days before the trial ended

Methodology

Chemical	T0	T1	T2	T3	T4	T5
PK	18.02	18,2	18,5	18.05	18,8	18,8
SK (Total)	14.2	14.2	14.3	14.3	14.8	14.8
bahan lain	14.2	14.2	8.29	8.29	6.78	6.78
Cocopeat	**0.00**	**0.00**	**4.01**	**4.01**	**8.02**	**8.02**
Ca	0.82	0.82	0.72	0.72	0.69	0.69
P	0.79	0.79	0.93	0.93	0.98	0.98
Lysin	0.89	0.89	0.89	0.89	0.89	0.89
Metionin	0.58	0.58	0.60	0.60	0.60	0.60
DE(Kkal/kg)	2520	2520	2544	2544	2589	2589

RESULTS

Digestibility of cocopeat in adult males :

cocopeat: basal = 50:50, pada 5 breed kelinci @ 10 e @ 10 h

Treatment	Basal diet (907)			Basal : Cocopeat = 50:50		
Rabbit	Weight gain	Con-sump	DM Digest	Weight gain	Con-sump	DM Digest
Reza	52	567	70.3	-195	308	19.8
Satin	57	552	69.2	-144	317	19.9
Rex	61	497	68.9	-164	335	19.3
Cross	77	627	71.7	-130	419	35.2
NZW	110	525	74.6	-184	397	31.6

The use of coco peat in rabbits :

Ransum percobaan (serat kasar = 14 %) for 6 weeks

Level cocopeat, %	Level Enzym, %	Initial BW, g/h	Feed Consum g/h/d	BW Gain g/h/6 w	Slaughter BW g/h	Carcass %	DM Digest, %
0	0	1215	61	1014	2229	52	69.04
0	0.02	1019	68	1183	2202	55	76.26
6.1	0	1031	54	848	1879	52	65.53
6.1	0.02	1114	56	1085	2199	50	68.27
12.2	0	1267	48	523	1790	51	60.10
12.2	0.02	1235	63	746	1981	56	66.00

- CONCLUSION :
- At a more digestible feed, DM digestibility did not seem to vary among breeds
- At a higher fiber levels, Rex, Satin and Reza were comparable and significantly lower than those of Crossbred and NZW rabbits.

- Coco peat decreased DM digestibility, weight gain, and slaughter weight, but did not affect the carcass percentage
- Enzyme did slightly improved the performance but at 12 % coco peat did not reach the performance without cocopeat.