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Performance of local rabbit (*Lepus nigricollis*) fed diets containing different level of fermented coffee pulp

I. Made Nuriyasa, I. Made Mastika and G. Ayu Mayani Kristina Dewi

Department of Animal Nutrition, Faculty of Animal Husbandry, Udayana University, Denpasar, Bali, Indonesia.

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An experiment to study the hematological energy and protein retention of body rabbit, performance and carcass quality responses of rabbit (*Lepus nigricollis*) fed diets containing different levels of fermented coffee pulp was carried out for 12 weeks. A Completely Randomized Design Consisted of five treatments and eight replicates was used in this experiment. A total of 80 rabbits were divided into 40 lots of two rabbits, each were randomly assigned and offered diet without coffee pulp as control diets (R0), diets contained 10% unfermented coffee pulp (R1), 20% unfermented coffee pulp (R2), diets contained 10% fermented coffee pulp (R3) and diets contained 20% fermented coffee pulp (R4). Hematological variable of rabbit fed diet R3 was better than R4, R2, R1 and R0. Rabbit offered diets R3 produce energy and protein retention makes the performance and carcass of rabbits higher than the other treatment. From this experiment, it can be concluded that hematology, energy and protein retention, performance and carcass quality of the rabbit fed diets contained 10% fermented coffee pulp was better than other treatment.

Key words: Local rabbits, coffee pulp, energy and protein retention, performance.

INTRODUCTION

Raising rabbits were done by people in developing countries, especially in rural areas being one of the solutions to sufficient animal protein of farmers in addition, also aims to increase the income of farmers. This is partly that raising rabbit is not needing a wide area and capital needed is relatively small (Nuriyasa, 2012). The failure of the farmers in raising rabbit at present is because of farmers knowledge about rabbit nutrition is not enough (Nuriyasa et al., 2013).

Coffee pulp is a waste of harvest coffee agro industry. The fact that currently coffee pulp is regarded as rubbish and only a few farmers use coffee pulp as organic fertilizer. Coffee pulp is often regarded as cause of environmental pollution because it is sprinkled around the coffee plants that cause the growth of fungi. Utilization of coffee pulp as rabbit diet can increase the value coffee pulp.

Bio fermentation for the coffee pulp could improved nutrient value of these by product, increased digestibility coefficient and reduced the pollutant gas which is important to create sustainable agriculture (Dubey, 2006). Mastika (2013) reported one of the alternatives for the cheap and competitive feed is through the utilization of agriculture waste. One of the wastes that can be used as

*Corresponding author. E-mail: madenuriyasa@yahoo.com.

animal feed is coffee pulp that has a high nutrient content, low price and it is available with lower production costs.

The coffee pulp production is very important for animal feed and the availability is 4,118.24 ton/ha of coffee plantation. Using *Aspergillus niger* in coffee pulp fermentation, the protein content could be increased from 9.94 to 17.81%, and crude fiber content decreased from 18.74 to 13.05% (Lestari et al., 2005). The study of Parwati et al. (2008) found that the fermented coffee pulp using *A. niger* could replaced rice bran utilization up to 5% in the diet and had no ad versed effect on performance of kampong chicken. Guntoro et al. (2004) has recommended that the level of coffee pulp utilization for pig and chicken diet is 10 to 15% respectively. Due to limitation of information about the utilization of fermented coffee pulp on rabbit nutrition especially the local rabbit, this experiment was carried out.

MATERIALS AND METHODS

Rabbit

A total of 80 local rabbits with the average body weight 258.50 g ± 1.08 g were used in this experiment.

Cage of the rabbit

In this experiment, a total of 40 battery cages measuring 70 cm length, 50 cm width and 45 cm height following the recommendation of (Schiere, 1999) were used.

Feed and drinking water

The feed used in the experiment composed of yellow corn, fish meal, rice brand, copra meal, soy bean meal, elephant grass, cassava meal, fermented coffee pulp, coconut oil and bone meal. Feeds were composed of the same protein and calorie content which contain 16% CP and 2.500 kcal/kg (Nuriyasa et al., 2014). Feed was given in crumble form and drinking water was *ad lib*.

Hematological responses

Observation of hematological variables consist of hemoglobin (%), erythrocytes (10^6/ µl), leukocyte (10^3/ µl), hematocryte (%), glucose (mg/100 ml), triglyceride (mg/100 ml) and Cholesterol (mg/100 dl) following the method of Bivin and King (2012). Anti frozen blood used is lithium heparin (Xiangmei, 2008), hematologic analysis performed in Bina Medika laboratory, Denpasar.

Body composition

Calculation of energy and protein retention in the body of rabbits follows the formulation of Fernandez and Fraga (1996). Briefly, the rabbit samples were taken at 17 week old. The fresh body from each treatment was chopped, ground using meat grinder, then the ground meat were mixed thoroughly. Four samples from each treatment were taken for calorie and protein determination. Energy content of the carcass was determined using bomb calorimeter and Kejelldhal apparatus for protein determination. Energy and protein concentration of diets, feces and empty bodies was measured with adiabatic bomb calorimeter and Kejelldhal apparatus (Xiccato et al., 1999).

Performance

Feed and water consumption were calculated each week by deduction of the feed and water given for one week. Before measurement rabbit was fasted for 12 h. Feed conversion ratio was calculated from feed consumption divided by weight gain at 12 weeks.

Carcass

Data carcass was carried out following the method of Alhaidary et al. (2010). Briefly, rabbit sample was killed at 84 days aged, as recommended by Owen and Owen (1981). All data were recorded, tabulated, and analyzed using analysis of variance. Whenever significantly differences among treatment were found, analysis will continue using Duncan's Multiple Range Test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

Hematologic responses of the rabbit fed diet R3 also was never better. This indicated the hemoglobin content, either erythrocyte and hematocryte significantly ($P<0.05$) was higher than those fed diet R4, R2 R1 and control (R0). Linder (1992) reported hemoglobin in the blood as transportation agent for oxygen in the body tissue and this is important in metabolism process. There is no significant different ($P<0.05$) found on leukocyte of the blood of rabbit fed diets R0, R1, R2, R3 and R4, respectively. The values are 6.74 × 103/µl, 6.11 x 10^3/µl, 6.03 x 10^3/µl, 5.98 x 10^3/µl, respectively. This figure showed that rabbit given coffee pulp are healthy and had no stress. This finding is in line with the report of Bivin and King (2012) that the leukocyte content of the healthy rabbit is ranging from 5.2 – 12 x 10^3/µl. Table 1 shows that cholesterol content of the rabbit blood fed diet R4 was lower ($P>0.05$) than given diet R3 but significantly higher ($P<0.05$) compared to R2, R1 and R0. Utilization of 20% fermented coffee pulp could retain fat so it could decrease cholesterol content of the blood. Linder (1992) staled crude fiber could bound the fat and bile salt in the gut of the rabbit so the cholesterol absorbed also decrease.

Energy consumption, digestible energy and metabolizable energy of rabbit fed diet R3 was higher ($P<0.05$) than R2, R1 and R0, but not significantly different ($P>0.05$) than R4 (Table 2). Diet containing coffee pulp causing sweetness taste and more preferable causes increased feed consumption, higher energy consumption, digestible energy and metabolizable energy. Rabbit offered diets R3 produce energy retention (55.20 kcal/day) was higher ($P>0.05$) than R4 (53.77 kcal/day), R2 (53.83 kcal/day), R0 (52.90 kcal/day) but significant higher ($P<0.05$) than R1 (51.56 Kcal/day).

Table 1. Hematology of Rabbit (*Lepus nigricollis*) fed diet containing different level fermented coffee pulp.

Variable	Treatment[1])					
	R0	R1	R2	R3	R4	SEM
Hemoglobin (g/100 dl)	11.43[b]	10.98[c]	11.78[b]	12.85[a]	12.05[a2)]	0.09[3)]
Leukocyte (10^3/µl)	6.74[a]	6.11[a]	6.03[a]	5.98[a]	7.12[a]	0.36
Erythrocyte (10^6/µl)	5.57[b]	5.07[c]	5.44[b]	5.84[a]	5.65[a]	0.02
Hematocryte (%)	37.69[b]	36.14[c]	37.97[b]	40.58[a]	38.02[b]	0.17
Cholesterol (mg/100 dl)	131.33[a]	133.05[a]	133.17[a]	120.12[ab]	88.64[b]	3.06

R0 : Diet without coffee pulp (control feed); R1 : Diet containing 10% non fermented coffee pulp; R2 : Diet containing 20% non fermented coffee pulp; R3 : Diet containing 10% fermented coffee pulp; R4 : Diet containing 20% fermented coffee pulp; Value with same superscripts in same row indicate no significant different (P>0.05); SEM : Standard error of the treatment means.

Table 2. Energy and protein retention of rabbit (*Lepus nigricollis*) fed diet containing different level fermented coffee pulp.

Variable	Treatment[1)]					
	R0	R1	R2	R3	R4	SEM
Energy balance of body rabbit						
Energy consumption (kcal/day)	316.24[d]	323.73[c]	341.24[b]	337.83[ab]	350.76[a1)]	1.99[3)]
Energy feces (kcal/day)	106.36[c]	112.02[b]	117.46[a]	108.54[c]	119.30[a]	0.94
Digestible energy (kcal/day)	209.87[c]	211.71[c]	223.78[b]	229.29[a]	231.46[a]	1.47
Metabolizable energy (kcal/day)	199.38[c]	201.13[c]	212.59[b]	217.82[a]	219.89[a]	1.39
Energy retention (kcal/day)	52.90[ab]	51.56[a]	53.83[ab]	55.20[b]	53.77[ab]	0.30
Protein balance of body rabbit						
Protein consumption(g/day)	6.17[c]	6.43[b]	6.53[b]	6.76[a]	6.48[a]	0.09
Protein feces (g/day)	0.35[a]	0.34[a]	0.33[a]	0.35[a]	0.32[a]	0.004
Digestible protein (g/day)	5.81[c]	6.09[b]	6.19[b]	6.41[a]	6.16[a]	0.07
Protein retention (g/day)	0.53[b]	0.52[b]	0.50[b]	0.55[a]	0.53[b]	0.002

R0 : Diet without coffee pulp (control feed); R1 : Diet containing 10% non fermented coffee pulp; R2 : Diet containing 20% non fermented coffee pulp; R3 : Diet containing 10% fermented coffee pulp; R4 : Diet containing 20% fermented coffee pulp; Value with same superscripts in same row indicate no significant different (P>0,05); SEM : standard error of the treatment means.

Rabbits given R3 consumed diet, had weight gain and feed conversion lower than other treatments. Rabbits given R3 and R4 consumed higher protein (P<0.05) than the ones given R2, R1 and R0 respectively. Sweet taste of diet R3 and R4 made the rabbits to consumed more fed so protein consumption was also more. This result is supported by Mc Nitt et al. (1996). Diets R0, R1, R2, R3 and R4 have no effect on the protein content of the feces. Rabbit given diet R3 had protein retention of 0.55g/day higher (P<0.05) than those given R4 (0.53 g/day), R2 (0.50 g/day), R1 (0.52 g/day) and R0 (0.53 g/day), respectively. Growth rate and feed efficiency with higher protein retention is also reported in the body, this finding confirmed the result reported by Nuriyasa et al. (2014). Rabbits offered diet R3 have significant (P<0.05) final body weight and weight gain compared to those given diet R4, R2, R1 and control diet (Table 3). Bio fermentation process had increased the nutrient availability and digestibility of the coffee pulp (Dubey, 2006).

Krisnan (2002) stalled that *Aspergillus niger* caused decreased tannin content of feed stuff. Rabbit fed diet R3 had higher body weight. This finding is in line with the report of Nuriyasa et al. (2014). He postulated that the best growth rate is due to higher retention of energy and protein on body of rabbit. Feed conversion of the rabbit fed diet R3 was significantly (P<0.05) lower compared to other treatment. This is due to hematological response in rabbit fed diet R3 so they grew faster than other treatments.

Jorgensen et al. (1997) stated that better metabolism has strong effect of crude fiber content of diets especially for non ruminant nutrition. The laboratory analysis showed that diet R3 had the lowest crude fiber (11.96%) compared to other diets such as control that had 12.13%, diet R1, R2 and R4 were 12.72, 13.38 and 12.96%, respectively. This is in line with the report of Nuriyasa et al. (2014). Rabbit given diet R3 at 70 days age had carcass weight, carcass percentage and carcass length

Table 3. Performance and carcass of rabbit (*Lepus nigricollis*) fed diet containing different level of fermented coffee pulp.

Variable	Treatment[1)]					
	R0	R1	R2	R3	R4	SEM
Performance variable						
Final weight (g)	1744.52[b]	1730.13[b]	1735.37[b]	1878.45[a]	1745.71[b2)]	11.74[3)]
Feed consumption (g/day)	76.39[c]	79.63[b]	83.47[b]	80.63[b]	86.55[a]	43.46
Weight gain (g/day)	21.47[b]	21.32[b]	21.03[b]	22.99[a]	21.01[b]	11.15
Feed conversion ratio	3.56[b]	3.73[b]	3.96[a]	3.51[b]	4.12[a]	0.03
Carcass variable						
Carcass weight (g)	836.15[b]	760.57[c]	731.00[d]	892.08[a]	742.54[d]	8.16
Carcass percentage (%)	47.93[a]	43.96[b]	42.12[b]	47.49[a]	42.54[b]	0.57
Carcass length (cm)	32.76[b]	30.63[c]	30.43[c]	33.16[a]	31.34[c]	0.14

R0 : Diet without coffee pulp (control feed); R1 : Diet containing 10% non fermented coffee pulp; R2 : Diet containing 20% non fermented coffee pulp; R3 : Diet containing 10% fermented coffee pulp; R4 : Diet containing 20% fermented coffee pulp; Value with same superscripts in same row indicate no significant different (P>0,05); SEM : Standard Error of The Treatment Means.

significantly (P<0.05) higher than those fed other diets. This is due to the fact that the feed consumption and growth rate of the rabbit fed diet R3 were significantly (P<0.05) higher than those getting other treatments (Table 3). Jorgensen (1997) has stated that crude fiber content of diet had increased the digestibility of diets so nutrient could be absorbed well and finally causing carcass weight, carcass percentage, carcass length higher than other diet.

Conclusion

From the result of the experiment it can be concluded that rabbits containing 10% of fermented coffee pulp had performance carcass and hematological better than other treatments. Energy retention of the rabbit given diet R3 (55.20 kcal/day) are higher than those given diet R4 (53.77 kcal/day), R2 (53.83 kcal/day), R1 (51.56 kcal/day) and R0 (52.90 kcal/day), respectively. Protein retention of the rabbit given diet R3 (0.55 g/day) were higher than the rabbits given R4 (0.53 g/day), R2 (0.50 g/day), R1 (0.52 g/day) and R0 (0.53 g/day), respectively.

Conflict of Interests

The authors have not declared any conflict of interests.

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