ISSN 0126-4400

PERFORMANCE OF RED JUNGLE FOWL AND BROILER FOWL OFFERED PALM KERNEL CAKE BASED DIET

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ABSTRACT

This present study was conducted to evaluate the performance of red jungle fowl (RJF) and commercial broiler (CB) offered diet containing palm kernel cake (PKC). One hundred eighty day-old chicks from the genotype of RJF and CB were used in a factorial arrangement and assigned to 36 battery cages in-groups of five. The chicks offered a commercial starter diet (crumble form), containing 21% protein and 2900 kcal ME/kg during the first to 20 days of age. From Day 21 to 56, chicks were fed to one of three regimens: (1) a ration containing 19% protein and 3100 kcalME/kg (Diet A), (2) a ration containing 19% protein and 3100 kcalME/kg with 25% PKC (Diet B), and (3) a choice of Diet A or Diet B. Measurements of live weight, feed consumption, feed preference and feed conversion ratio (FCR) were determined weekly and mortality was recorded daily. The data were collected from Day 21 and analyzed with the aid of the General Linear Models of SAS software after transformed to common logarithm. The results of this study indicated that large disparity in body weight, average daily gain, feed, protein and energy consumption's, and FCR between RJF and CB. The CB was found to be far superior in terms of growth and FCR. The feeding regimens were no effects on body weight, feed, protein and energy consumption's, however the diets responded on FCR. It was higher in birds fed Diet B than others on periods of Days 21-27 to 35-41. In the preference of split diet birds, CB consumed Diet A increase with age, however RJF consumed similar quantity Diet A and Diet B at the end of study, suggesting that both RJF and CB can be fed diet containing 25% PKC, although the preference was higher in the former.

(Key words: Performance, Red jungle fowl, Broiler fowl, Palm kernel cake).

Buletin Peternakan 25 (4): 172 - 180, 2001

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KINERJA PRODUKSI AYAM HUTAN DAN BROILER YANG DIBERI PAKAN BUNGKIL KELAPA SAWIT

INTISARI

Penelitian ini bertujuan untuk melihat respon ayam hutan merah dan ayam pedaging broiler yang diberi pakan mengandung 25% bungkil kelapa sawit (pkc, palm kernel cake). Sejumlah 180 ekor anak ayam hutan merah dan ayam pedaging digunakan dalam penelitian ini dan diletakkan dalam 36 kandang batere yang terdiri dari 5 ekor. Rancangan yang digunakan adalah Rancangan Acak Lengkap pola Faktorial (2, strain ayam X 3, jenis pakan). Pakan komersial starter (21% protein; 2900 kkalME/kg, bentuk butiran) diberikan sejak DOC hingga umur 20 hari. Dari umur 21 sampai 56 hari ayam diberi 3 jenis pakan: (1) Pakan yang mempunyai protein 19% dan energi 3100 kkalME/kg (Pakan A), (2) Pakan yang mengandung 25% pkc dengan 19% protein, 3100 kkalME/kg (Pakan B), dan (3) Pakan yang terdiri dari pilihan Pakan A dan Pakan B (Pakan C). Peubah yang diamati meliputi bobot badan, konsumsi pakan, kesukaan pilihan pakan, konversi pakan dan mortalitas. Data dikoleksi dari umur 21 hari dan dianalisis dengan bantuan perangkat GLM dari SAS prosedur setelah sebelumnya ditransformasikan ke dalam logaritma. Hasil penelitian menunjukkan bahwa terdapat perbedaan yang signifikan ($P<0.05$) pada bobot badan, pertambahan bobot badan, konsumsi pakan, konsumsi protein dan energi serta konversi pakan antara ayam hutan dan ayam pedaging. Ayam pedaging broiler jauh lebih baik ($P<0.05$) dalam pertumbuhan dan lebih efisien dalam penggunaan pakan. Jenis pakan tidak berpengaruh pada peubah yang diamati, kecuali nyata ($P<0.05$) pada konversi pakan. Ayam lebih banyak ($P<0.05$) mengkonsumsi Pakan B daripada yang lain pada selang umur 21-27 sampai 35-42 hari. Pada kelompok perlakuan Pakan C, ayam pedaging mengkonsumsi Pakan A meningkat dengan umur, sedangkan ayam hutan mengkonsumsi jumlah yang sama Pakan A dan B pada umur 42-56 hari. Ini dapat disarankan bahwa baik ayam hutan maupun ayam pedaging dapat diberikan pakan yang mengandung 25% bungkil kelapa sawit meskipun hasilnya lebih bagus pada ayam hutan.

(Kata kunci : Performan, Ayam hutan broiler, Bungkil kelapa sawit).

Introduction

The feed cost to produce poultry meat is about 70-80% of the total cost. Corn, soybean and fishmeal, the major constituents in poultry rations are rather expensive, because this foodstuffs are imported and this is the main reason for the high cost of poultry diets (Tan, 1998). According to the high cost of food, the current economics of the poultry industry also indicate that food should be used as efficiently as possible. The alternative for increasing production by minimum cost is using local agriculture by-products. One of the agriculture by-products, which is produced in large quantity in Malaysia is palm kernel cake (PKC).

PKC, the residue discarded after the extraction of palm kernel oil, is readily available in tropical countries and a valuable source of energy and protein for animal foodstuffs (Okai and Ohene-Mante, 1981; Alimon, 1993). In Malaysia, this by-product is easily available and the production of PKC in 1996 was 1.38 million tonnes from an area of 2.6 million hectares oil palm plantations (Jalani, 1998). The nutritive value of PKC as reported by Yeong *et al.* (1981) were: crude protein (CP), 16.1%; crude fibre (CF), 15.7%; ether extract (EE), 1.8%; ash, 4.0%; and metabolisable energy 1480 kcal/kg.

Many researchers have studied on the use of PKC as broiler (Osei and Amo, 1987; Daud *et al.*, 1993), layer (Onwudike, 1988) and pig (Babatunde *et al.*, 1975; McDonald *et al.*, 1995; Rhule, 1996) feed, however, there is insufficient information on red jungle fowl (RJF), the ancestral of our modern poultry breeds. The suggested rate of inclusion of PKC ranges from 100 g/kg to 350 g/kg of diet (Chong *et al.*, 1998). Previous finding indicated that PKC could be utilised as a supplement up to 20% in the broiler poultry meat diet without any adverse effect on production performance (Osei and Amo, 1987). During 0-4 weeks, broiler fed with high level of PKC (30%) had higher cost than the low level (20%), however no difference during 4-6 weeks of ages (Watanasit *et al.*, 1992).Furthermore, Onwudike (1988) reported that maximum level of PKC was 40% for layer diet. There was no effect on performance and egg quality.

Under natural conditions in the palm oil plantation, RJF had ability to select the nutrient, which allowed them to grow and reproduce. They choose animal materials (e.g. insects, spiders, and snails) and some seeds, grains, leaves and roots to satisfy protein and energy requirements (Wood-Gush, 1971). In view of this, the RJF may have ability to improve the performance if suitable diet was offer under intensive management. Level 25% PKC in the diet may give toleration to attain the optimum growth at finisher stage of birds. These studies were carried out to evaluate the performance of RJF and commercial broilers (CB) in response to choice feeding between commercial diet and PKC based diet.

Material and Method

Birds, husbandry and diets

One hundred eighty day old chicks from the genotype of red jungle fowl (RJF) and commercial broiler (Arbor Acre) (CB) were assigned to 36 battery cages with wire floors in-groups of five. The cages were in a conventional open-sided house with cyclic temperatures (minimum, 25.9^{0}C; maximum, 33.8^{0}C) and relative humidity was between 75% to 90%. All chicks were wing banded and vaccinated against New Castle disease (Days 6 and 20).

During the first to 20 days of age, the chicks were given diet (crumble form), containing 21% crude protein (CP) and 2900 kcal ME/kg. Commencing from Day 21, the birds were assigned to one of three regimens, namely:

1) a ration containing 3100 kcal ME/kg, 19% CP (Diet A)

2) a formulated diet including 25% of PKC (Diet B)

3) a choice of Diet A or Diet B (Diet C)

Diets A and B were made iso-caloric and iso-nitrogeneous. All diets were in mash form and the compositions are given in Table 1. Food and water were supplied continuously. Artificial light was provided from 19.00 to 07.00 hours throughout the experimental period. For the choice feeding setting, each type of diet (A or B) was offered in two through, as the chicks, which received a single diet. The diet was provided in two through attached to each cage.

Parameters measured

The live weights, feed consumption, feed preference and feed conversion ratio (FCR) were recorded weekly, while mortality was recorded daily. Protein and energy intakes were calculated by feed consumption multiplied by protein and energy contents of the diet and recorded weekly. The feed cost (RM) was estimated by calculation the feed consumption multiplied by the feed cost diet/kg. The data were collected from Day 21. Analyses of diet and PKC contents were conducted with method of AOAC (1984).

Table 1. The composition of the experimental diets

Ingredient and analyses	A	B
Corn	60.69	42.36
Soybean	29.38	15.02
Fishmeal	3.00	9.10
Palm oil	4.01	7.00
Sodium chloride	0.31	0.26
DCP	0.95	0.11
Limestone	1.31	0.76
dl-methionine	0.15	0.10
l-lysine	0	0.09
Premix *)	0.20	0.20
Palm kernel cake (PKC)	0	25.00
Analyzed nutrient content:		
ME, kcal/kg	3108	3115
CP,%	19.05	19.17
Crude Fat,%	6.7	8.1
Crude Fibre,%	3.2	4.7
Feed Cost calculated (RM/kg)	0.79	0.77

A=standard broiler finisher diet, B=diet formulated with 25 % of PKC.

*) Vitamin, mineral and antioxidant of Premix (Pfactor 007-pfizer) provided vitamin A, 6.666 IU; cholecalciferol, 1.000 IU; vitamin E, 23 mg; vitamin K_3, 1.33 mg; vitamin B_1, 0.83 mg; vitamin B_2, 2 mg; vitamin B_6, 1.33 mg; vitamin B_{12}, 0.03 mg; niacin, 23.3 mg; calcium pantothenic, 3.75 mg; biotin 2%, 0.03 mg; folic acid, 0.33 mg; cobalt, 0.6 mg; cuprum, 20 mg; iodine, 2 mg; ferrum, 100 mg; manganese, 110 mg; selenium, 0.2 mg; zinc, 100 mg; santoquin, 0.6 mg / kg.

Statistical analysis

Data of weight, feed consumption, protein and energy intakes were subjected to in analysis of variance with a factorial arrangement. The main factors for performance observations were genotype (RJF and CB), feeding regimens (Diet A, B and C) and the interaction between them. Prior to analysis, the body weight, feed consumption, protein and energy intakes were transformed to common logarithm. The preference of feed consumption of each diet was subjected to in analysis of variance with genotype, type of diet and interaction between them as the main factor. The data were transformed to arc sin square roots. Mortality data were subjected to chi-square analysis (Steel and Torrie, 1995).

The General Linear Models (GLM) of SAS software (SAS® Institute, 1997) were the aid used for analyzed the ANOVA and regression for body weight of RJF and CB from 21 to 56 days of age. When significant differences were found among the different factor, Duncan's multiple range test was carried out to detect the differences between factor means (Duncan, 1955). When interactions between main effects were significant, comparisons were made within each experimental variable. Statistical significance was considered as $P \leq 0.05$.

Result and Discussion

The nutrients composition analyzed of PKC were: 15.6% CP; 16.8% CF; 2.3% EE;

4.7% Ash; and energy 2100 kcal/kg. It was almost similar to that reported previously (Devendra, 1977; Yeong *et al.*, 1981; Chong *et al.*, 1998). The source of PKC and methods used in processing the fruits in different countries may contribute to the cause of differences in nutrition value of PKC. The method of screw pressed oil extraction of PKC was used in analyses by Chong *et al.* (1998). The average daily gain of CB (58.8 g) was heavier (approximately 8.5 times) than RJF (6.9 g) from 21 to 56 days of age (Figure 1). As expected, that large disparity in body weight, feed, protein and energy consumption's, and FCR between RJF and CB (Tables 2 and 3). The CB consumed more feed and gained more weight than their RJF counterparts. This resulted CB attaining better FCR than that achieved by RJF. In general, RJF the ancestor of the domestic fowl (Crawford, 1990), which inhabits the warmest and humid parts of Asia, are tropically adapted animals. However, CB that has undergone intense selection for economic traits was found to be far superior in terms of growth and FCR (Smith *et al.*, 1990). Siegel *et al.* (1992) compared domestic and jungle fowls by DNA fingerprinting and found a considerable degree of genetic divergence between them as measured by band sharing.

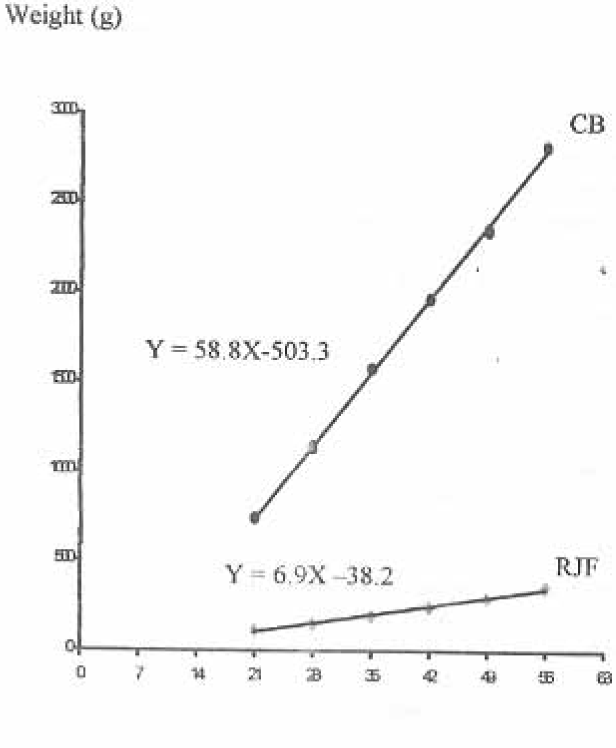

Figure 1. Average body weight of commercial broilers (cb) and red jungle fowl (rjf) at various ages.

Table 2. Effects of genotype and diet on body weight (g) at various ages

	Day 28	Day 35	Day 42	Day 49	Day 56
Genotype:					
CB	1142[a]	1568[a]	1965[a]	2347[a]	2805[a]
RJF	151[b]	196[b]	244[b]	294[b]	357[b]
Diet:					
A	719	998	1260	1443	1700
B	702	969	1200	1368	1685
C	751	972	1197	1318	1606
Pooled SEM	7.87	12.45	15.42	19.10	22.73

[a, b] Means within a column with no common superscripts differ significantly.

Table 3. Effects of genotype and diet on feed consumption (g), protein intake (g), energy intake (kcal) and feed conversion ration (FCR) at various periods of age

		Day 21-27	Day 28-34	Day 35-41	Day 42-48	Day 49-56
Feed consumption						
Genotype:	CB	718[a]	879[a]	948[a]	923[a]	1232[a]
	RJF	132[b]	186[b]	173[b]	206[b]	259[b]
Diet:	A	460	596	597	620	788
	B	474	605	655	613	864
	C	486	569	623	639	828
Pooled SEM		6.73	15.59	16.37	29.37	21.57
Protein intake						
Genotype:	CB	147[a]	180[a]	194[a]	189[a]	240[a]
	RJF	27[b]	38[b]	35[b]	42[b]	53[b]
Diet:	A	93	120	121	125	139
	B	99	126	137	128	180
	C	99	116	126	130	168
Pooled SEM		1.37	3.19	3.35	6.01	7.65
Energy intake						
Genotype:	CB	2,316[a]	2,837[a]	3,063[a]	2,980[a]	3,980[a]
	RJF	425[b]	602[b]	564[b]	666[b]	836[b]
Diet:	A	1,494	1,934	1,946	2,011	2,557
	B	1,519	1,940	2,099	1,965	2,768
	C	1,572	1,844	2,019	2,071	2,685
Pooled SEM		61.68	50.35	52.67	94.86	69.39
Feed conversion ratio						
Genotype:	CB	1.75[a]	2.07[a]	2.42[a]	2.64[a]	2.69[a]
	RJF	3.99[b]	4.26[b]	3.77[b]	4.36[b]	4.17[b]
Diet:	A	2.68[b]	2.79[b]	2.70[b]	3.21	3.20
	B	2.92[a]	3.22[a]	3.34[a]	3.57	3.35
	C	2.45[b]	2.95[b]	2.91[b]	3.29	3.36
Pooled SEM		0.08	0.09	0.09	0.14	0.09

[a, b] Means within a column with no common superscripts differ significantly.

The feeding regimens were no effects on body weight, feed, protein and energy consumption's, however the diets responded on FCR (Table 3). The FCR of birds fed Diet B was higher than the others on periods of Days 21-27, 28-34 and 35-41. By Days 42-48 and thereafter, the diets were no effect on FCR. It was suggested that both RJF and CB were capable to consumed PKC as an alternative feed ingredient. Similarly, Osei and Amo (1987) reported that PKC as a supplement up to 20% in the broiler poultry ration did not effect the production performance. PKC levels (0, 20, 30 and 40%) as reported by Watanasit *et al.* (1992) showed there was no respond on broilers feed intake, live weight gain and FCR during 0-6 weeks of age. Based on birds fed split diet, there was genotype by type of diet interaction for preference of feed consumption from periods Day 21-27 to 49-56 (Table 4). The CB consumed Diet A increase with age. RJF consumed Diet A increase up to Day 35. By days 42-56 the RJF consumed Diet B similar quantity with Diet A. It is indicated that both RJF and CB could be fed diet containing 25% of PKC, although the preference was higher in the former. These findings suggest that physiologically, RJF are more adaptable to diet with high fibre (4.7%) and fat (8.1%) when compared to CB. Under natural conditions, RJF are hardy birds capable to withstand inadequate nutrition. Thus, there is a possibility RJF may tolerate PKC levels higher than 25%. Further studies are necessary to confirm this hypothesis. The total feed cost to produce CB was five times of RJF and presented in Table 8. The total feed cost of

Table 4. Effects of genotype and type of diet on preference of feed consumption (%) of birds fed choice at various periods of age

Diet	Day 21-27		Day 28-34		Day 35-41		Day 42-48		Day 49-56	
	CB	RJF	CB	RJF	CB	RJF	CB	RJF	CB	RJF
A	71.35^{ax}	64.72^{ay}	83.90^{ax}	75.84^{ax}	84.67^{ax}	67.96^{ax}	83.36^{ax}	59.09^{ay}	87.79^{ax}	55.51^{ay}
B	28.65^{bx}	35.28^{bx}	16.10^{bx}	24.16^{by}	15.33^{bx}	32.04^{by}	16.64^{bx}	40.91^{ay}	12.21^{bx}	44.49^{ay}
ANOVA	.... Probability									
Genotype (B)	NS		NS		NS		NS		NS	
Diet (D)	***		***		***		***		***	
B x D	*		***		***		***		***	
SEM	2.26		1.29		1.77		1.84		1.63	

* P≤ 0.05; *** P≤ 0.001; NS= not significant.
a, b Means within a column with no common superscript differ significantly.
x, y Means within a row with no common superscript differ significantly.

Table 5. Total feed cost (RM/bird) to produce RJF and CB of each diet from Day 21 to 56

Diet	RJF	CB
A	0.74	3.65
B	0.75	3.68
C	0.73	3.61

l broiler chickens; RJF= red jungle fowl.

Table 6. Mortality (%) by genotype-diet sub-group

Genotype	Diet	No dead/total	%
CB	A	2/30	6.67^b
	B	2/30	6.67^b
	C	5/30	16.67^a
RJF	A	1/30	3.33^b
	B	0/30	0^b
	C	0/30	0^b

^{a,b} Means with no common superscripts differ significantly.

25% PKC inclusion in the diet was almost similar to commercial finisher diet group in both RJF and CB birds. Thus, it appears that inclusion of PKC has no profound impact on feed cost. Onwudike (1988) reported that the feed cost for producing broilers reduced when PKC was used to replace the groundnut cake, which is a major protein component of poultry feed. Percentage mortality of birds fed choice of CB was the highest among other sub-groups (Table 3). It occurred at the end of study (weeks 7 to 8), associated with health problem. Most cases of this mortality was caused by paralyze. At the beginning, the growth rate of CB as shown by weight gain was very high, while at the end of observation the chicken could hardy eat because they could not move around. Other causes were bacterial diseases. A post mortem observation indicated that birds dead caused by respiratory infection and *leucozytozoonosis*.

Conclusion

It appears from the study that using 25% PKC level recommended to use in the both RJF and CB finisher stage rations without detrimental effect on growth performance.

Acknowledgements

This study was supported by grant from SEAMEO-SEARCA. The authors gratefully acknowledge Associate Professor (Emeritus) Dr. Amin Babjee SM., Associate Professor Dr. Zulkifli Idrus, Associate Professor Dr. Abdul Razak Alimon and Associate Professor Dr. MK. Vidyadaran for helping the research materials (red jungle fowl chicks) and discussion.

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