Performance and Nutrient Digestibility of Rabbits Fed Fermented and Unfermented Cocoa Pod Husk

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Abstract

This study was designed to investigate the performance and nutrient digestibility of rabbits fed cocoa pod husk (CPH). Thirty weaner rabbits of about five weeks old were used for the study. They were allotted to five treatments consisting of three replicates of two rabbits each. Diet T₁ served as the control with 0% CPH, Diet T₂ and T₃ contained 30% unfermented and fermented CPH respectively while Diet T₄ and T₅ contained 40% unfermented and fermented CPH respectively. The experiment lasted for ten (10) weeks. The results showed a significant increase ($P < 0.05$) in feed intake, body weight gain and feed conversion ratio of rabbits fed increasing levels of inclusion of fermented and unfermented CPH in experimental diets. The apparent nutrient digestibility also improved with increasing levels of fermented and unfermented CPH in the diets. However, rabbits performed better on the fermented CPH than the unfermented CPH based diets.

Key words: Performance, Nutrient Digestibility, Fermented, Unfermented Cocoa Pod Husk

Introduction

The acute shortage of animal protein in Nigeria has called for an increased interest in rabbit production. Rabbits are highly prolific animals with short gestation period of 30 ± 2 days and attain maturity weight within a short period of time. Rabbit meat is tasty, delicious and highly digestible.

Among non-ruminants, rabbits have a special ability to digest substantial amount of fibre thus making dietary fibre (non-starch polysaccharide and lignin) a major constituent of commercial rabbit feed. The cost of conventional sources of fibrous ingredients such as corn bran, rice bran, palm kernel cake, etc have been on the increase from year to year leading to an increase in prices of animal protein. Hence, there is need to find

alternatives, which have no direct relevance to man.

Cocoa pod husk, a farm waste in several cocoa producing countries had been used to replace maize partially in livestock feeds (Boa-Amponsen *et al.*, 1985, Smith *et al.*, 1988). However, there has been a limitation to its use considering the low protein, energy content as well as high fibre content. Sobamiwa and Longe (1994) reported that the effect of lignin and pectin was most critical in the utilization of CPH as it impairs the digestion and absorption of nutrients in monogastrics. Sobamiwa, (1997) observed that 30% CPH dietary inclusion was suitable for rabbits, but this could still be improved upon. Various physical and chemical methods have been employed to improve the

utilization of CPH such as the use of alkali (sodium hydroxide) (Smith *et al.*, 1988), cocoa pod ash (Sobamiwa and Longe, 1994) and urea (Sobamiwa and Akinwale, 1995). There is still paucity of information on the effect of fermentation of CPH in rabbit diets. This experiment was therefore designed to investigate the performance and nutrient digestibility of rabbits fed 30% and 40% fermented and unfermented cocoa pod husk based diets.

Materials and Methods

Experimental site: The experiment was carried out at the Rabbitary Unit of the Federal College of Animal Health and Production Technology, Institute of Agricultural Research and Training, Ibadan.

Experimental design: Thirty New Zealand White and Chinchilla crossbred weaned rabbits of about five weeks old weighing between 500.00–537.80g were used. They were randomly allotted to five treatment groups with six rabbits per treatment in a completely randomized design arrangement. Each replicate consist of two rabbits. Diet T₁ served as the control with 0% CPH, T₂ and T₃ contained 30% unfermented and fermented CPH respectively while T₄ and T₅ contained 40% unfermented and fermented CPH respectively.

Preparation of experimental diets: Freshly dehulled CPH were collected from the fermentary unit of the Cocoa Research Institute of Nigeria, Ibadan. The fresh husks were divided into two equal parts. The first half was sun-dried for three weeks until a constant weight was obtained. It was then milled for incorporation into the experimental diets. The second half was packed into a plastic bucket and soaked in cold water at room temperature for five (5) days. By the fifth day the water had turned turbid with the CPH becoming soft and swollen. It was then drained, sun-dried for three weeks until a constant weight

was obtained. Five samples each of the fermented and unfermented CPH were taken from different positions in the milled bag of CPH. These samples were subjected to chemical analysis and the average of the results of the proximate composition is presented in Table 1.

The milled CPH were then incorporated in the experimental diets and the gross compositions are presented in Table 3.

Animal management: The hutches were cleaned, washed, and disinfected before the onset of the experiment. Two rabbits were housed in each apartment of all wire metabolic cage designed for easy collection of faeces and urine in pans placed beneath the cages. They were provided feed and water *ad libitum* twice daily at 07:30hrs and 16:00hrs. However, at the 6th week, fecal samples were collected during the last four days for digestibility studies. Feecal samples were oven dried on daily basis at 80°C for 48hrs and stored in sample bottles. Feed intake was recorded daily and live weight on weekly basis. The experiment lasted for ten (10) weeks.

Chemical analysis: The proximate analysis of the diets and faecal, samples were determined according to A. O. A. C. (1990). Gross energy was determined using adiabatic oxygen bomb calorimeter.

Statistical analysis: The data on performance and nutrient digestibility obtained during the experimental period were subjected to one-way Analysis of Variance (ANOVA) (Steel and Torrie, 1980). Significant means were compared using Duncan's Multiple Range Test (Duncan, 1955).

Results and Discussion

The proximate composition of the fermented and unfermented CPH are presented in Table 1. The

Table 1: Proximate composition of fermented and unfermented cocoa pod husk (CPH)

Component	Fermented CPH (%)	Unfermented CPH (%)
Dry matter	89.42	88.67
Crude protein	7.42	7.00
Crude fibre	22.18	29.60
Ether extract	1.04	1.09
Ash	9.73	13.37
Nitrogen free extract	49.05	37.61
Gross energy (kcal/kg)	1953	2100

crude protein, dry matter and nitrogen free extract content of the fermented CPH were slightly higher than that of the unfermented CPH while the crude fibre, ether extract, ash and gross energy content of the unfermented CPH were slightly higher than that of the fermented CPH. The values obtained for both fermented and unfermented CPH are comparable to those reported by Donkor *et al* (1991), Sobamiwa and Longe (1994). The variations observed in the proximate composition of the CPH could be attributed to varietal difference, differences in the stage of pod maturity at harvest and the effect of the fermentation process. The proximate composition of the experimental diets are presented in Table 2. The dry matter, ash, crude fibre and nitrogen free extract content were slightly lower in diets containing fermented CPH while the crude protein and ether extract content were slightly higher in the diets containing fermented CPH. This could

be attributed to the microbial activity in the CPH, which might have softened the fibrous nature of the CPH and increased the protein content of the CPH. Feed intake of rabbits on diets with fermented CPH was numerically higher than those on diets with non-fermented CPH. This is probably due to the flavour that the fermented CPH added to the diets. Hence, feed intake increased with increase in the level of CPH in the diets. Schlolaut (1985) observed the quantity of feed intake in rabbits is dependent to a large extent on the palatability of the feed, the consistency and in roughages the crude fibre content are influential. He noted that with advancing age, rabbits compensate the low nutrient concentration of feed mixtures rich in fibre by a corresponding increase in feed intake. He therefore suggested that crude fibre content of feed concentrate for rabbits should be between 12 – 14% and not less than 10%. This

Table 2: Proximate composition of experimental diets (%)

Diets	DM	Moisture	Ash	CP	EE	CF	NFE
T ₁ (0% CPH)	91.17	8.83	10.23	17.47	7.21	5.92	50.34
T ₂ (30% UFCPH)	92.13	7.87	9.47	16.91	7.69	13.88	44.18
T ₃ (30% UFCPH)	91.45	8.55	9.92	17.87	7.93	9.85	45.88
T ₄ (40% UFCPH)	90.87	9.13	10.19	17.03	7.95	14.38	41.32
T ₅ (40% UFCPH)	90.23	9.77	9.96	18.21	8.56	13.43	40.07

UFCPH – Unfermented cocoa pod husk

FCPH – Fermented cocoa pod husk

Performance of rabbits fed fermented and unfermented cocoa pod husk

Table 3: Composition of experimental diets

Ingredients	T ₁ 0% CPH	T ₂ (30% Unfermented CPH)	T ₃ (30% Fermented CPH)	T ₄ (40% Unfermented CPH)	T ₅ (40% Fermented CPH)
Maize	66.25	36.25	36.25	27.25	27.25
Cocoa pod husk	-	30	30	40	40
Brewer's dried grain	11.25	11.25	11.25	11.25	11.25
Groundnut cake	13.00	13.00	13.00	12.00	12.00
Fish meal (72%)	4.50	4.50	4.50	4.50	4.50
Salt	0.50	0.50	0.50	0.50	0.50
Oyster shell	1.50	1.50	1.50	1.50	1.50
Bone meal	2.50	2.50	2.50	2.50	2.50
Premix	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100
Calculated Analysis					
Crude protein (%)	17.24	16.99	17.85	17.82	17.90
Crude fibre (%)	4.22	13.66	7.90	16.50	12.19
Metabolizable energy (Kcal/kg)	2969.67	2565.27	2682.42	2464.82	2621.01
Cost (₦/kg)	32.88	26.86	26.86	24.76	24.76

Premix (Agricare-mix, Lagos) contained Vit. A, D₃, K, B₁₂, riboflavin, panthothenic and folic acids; iodine, copper, zinc, terramycin, anti-oxidant and anti caking agent

Table 4: Performance of the experimental animals

Parameters	T ₁ 0% CPH	T ₂ (30% Unfermented CPH)	T ₃ (30% Fermented CPH)	T ₄ (40% Unfermented CPH)	T ₅ (40% Fermented CPH)	SEM
Ave. daily feed intake (g)	81.33 ^b	84.55 ^b	99.43 ^a	95.81 ^a	100.17 ^a	5.04
Ave. weekly feed intake (g)	569.45 ^c	591.82 ^c	695.99 ^a	670.64 ^b	701.16 ^a	24.68
Ave. initial live wt. (g)	537.80	525.00	525.00	537.50	500.00	44.07
Ave. final live wt. (g)	1374.50 ^c	1377.50 ^c	1838.80 ^a	1787.50 ^b	1880.00 ^a	54.30
Ave. total wt. gain (g)	837.00 ^c	852.50 ^c	1313.00 ^a	1250.00 ^b	1380.00 ^a	95.09
Ave. weekly wt. gain (g)	83.70 ^c	85.30 ^c	131.40 ^a	125.00 ^b	138.00 ^a	10.03
Ave. daily wt. gain (g)	12.00 ^c	12.20 ^c	18.80 ^a	17.90 ^b	19.70 ^a	1.36
Feed conversion ratio	6.80 ^a	6.94 ^a	5.30 ^b	5.36 ^b	5.10 ^b	0.47

Means on the same row with the same letter are not significantly different ($P > 0.05$)

explains the higher feed intake and body weight gains with increasing levels of CPH in the diets and the lower feed intake, body weight gain and nutrient digestibility values obtained in the rabbits fed the control diet. Lebas *et al.*, (1986) stated that a growing rabbit is able to adjust its voluntary feed intake according to the energy

concentration of the diet in order to maintain constant daily intakes of 920 – 1000 KJDE/kg W 0.75 per day. Thus weight gain was observed to increase linearly with corresponding increase in feed intake. The weight gain of the rabbits on T₁ was the least, this can be linked to low feed intake, which consequently prevented the intake

Table 5: Apparent digestibility of nutrients (%)

Parameters	T ₁ 0% CPH	T ₂ (30% Unfermented CPH)	T ₃ (30% Fermented CPH)	T ₄ (40% Unfermented CPH)	T ₅ (40% Fermented CPH)	SEM
Dry matter digestibility	20.10 ^e	37.42 ^d	60.05 ^b	55.48 ^c	65.66 ^a	3.07
Crude protein digestibility	49.82 ^b	60.83 ^{ab}	75.40 ^a	73.55 ^a	81.49 ^a	22.95
Ash digestibility	54.27 ^c	62.65 ^b	76.96 ^a	76.25 ^a	81.86 ^a	9.05
Ether extract digestibility	67.90 ^b	65.63 ^b	91.92 ^a	82.18 ^a	86.37 ^a	20.43
Crude fibre digestibility	52.25 ^c	61.96 ^b	78.17 ^a	76.30 ^a	85.08 ^a	10.81
NFE digestibility	37.12 ^c	51.02 ^b	67.33 ^a	66.05 ^a	72.34 ^a	11.47

Means on the same row with the same letter are not significantly different ($P > 0.05$)

of other nutrients required for growth (Lebas and Lapace, 1975). The feed conversion ratios for diets with fermented and unfermented CPH were lower and better than the diets without CPH. However, diets with fermented CPH were better utilized. The apparent digestibility trial showed that nutrients were better digested in the diets containing fermented CPH. This is probably due to the partial digestion of CPH cellulose and fibre by enzymes secreted by microbes during fermentation; thus, making it easy for the CPH to be easily digested by the animals.

Conclusion

Based on the result of the experiment, rabbits fed diet T₃ and T₅ (diets with fermented CPH) had overall better performances in feed intake, weight gain, FCR and better apparent nutrient digestibility of nutrients. This may be attributed to the effects of fermentation on cocoa pod husk namely: enzymatic pre-digestion, acquisition of flavour, friability and reduction of anti-nutritional factors such as theobromine, the poisonous alkaloid. Therefore, feeding rabbits with diets containing fermented CPH up to 40% replacement level for maize encouraged better performance.

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