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PROTEIN AND ENERGY SOURCES FOR RABBIT DIETS IN CAMEROON. 1 -PROTEIN SOURCES

FOTSO J.M., FOMUNYAM R.T., NDOPING B.N.

Mankon Research Station, BAMENDA, Cameroon.

ABSTRACT : A total of 64 New Zealand and Californian rabbit were caged individually to study the nutritive value of 4 protein sources for growing rabbits. Rabbit fed fish meal and chicken offal as principal protein sources in the diet consumed more and grew significantly (P<0.01) faster (30.1 and 26.7 d/day) than those fed plant proteins of cassava leaf and cotton seed meals (25.0 and 22.3 g/day). Carcass yields of 54 % for rabbits fed fish meal diets, 52.3 % for those fed diets with cassava leaf meal, were similar but significantly (P<0.05) higher than 49.92 % for rabbits fed cotton seed based diets. Calculated meat costs per kilogram based on feed costs only, showed the most efficient diet to be that containing chicken offal meal followed by that containing cotton seed meal, then cassava meal. The most inefficient diet cost-wise, was the diet containing fish meal.

RÉSUMÉ : Sources de protéines et d'énergie pour aliment pour lapins au Cameroun. 1 – Source de protéines.
Un total de 64 lapins Néo-zélandais et Californien ont été mis en cage individuelle pour étudier la valeur nutritionnelle de 4 sources de protéines pour des lapins en croissance. Les lapins qui ont reçu des farines de poisson et de déchets de poulets ont plus consommé et ont eu une croissance significativement (P<0,01) plus rapide (30,1 et 26,7 g/jour) que ceux ayant reçu les protéines végétales des farines de feuilles de manioc et de graines de coton. Les rendements de carcasse de 52,2 % pour les lapins ayant reçu de la farine de poisson, de 52,3 % pour ceux ayant reçu de la farine de poulets et de 50,3 % pour ceux ayant reçu de la farine de feuilles de manioc sont comparables mais significativement (P<0.05) plus élevé, 49.9%, que celui obtenu pour les lapins ayant reçu de la farine de graines de coton. Le calcul du coût d'un kilo de viande, basé uniquement sur le prix de l'aliment, montre que l'aliment le plus avantageux est celui contenant de la farine de poulets, suivi de celui contenant la farine de graines de coton, puis celui contenant la farine de manioc. L'aliment le plus inefficace compte tenu de son prix a été celui contenant de la farine de poisson.

INTRODUCTION

Availability and affordability of rabbit meat in Cameroon, as for other countries South of the Sahara, depends principally on the costs and quality of feed stuffs. The rich variety and substantial quantities of agricultural by-products are usually left t rot in the fields. Thus the costs of these amount to the collection, packaging and transportation from small subsistence farms to processing ore point of use sites (FOMUNYAM *et al.*, 1990).

However, with the increase in population and subsequent demand for more meat products, natural pressure is increasingly bearing on the rational use of natural resources to produce more and cheaper quality meat. Cotton mills in northern Cameroon grade and export cotton seed meal. Fish meal is produced and bagged by the industrial fish firms on the Cameroonian coasts and is very expensive given to added costs of ant-oxidants included in the oil rich production.

ESHIET and ADEMOUSUM (1978) and AGANGA *et al.* (1991) have studied the value of fish meal and cotton seed meal in rabbits ration. The literature is very scantly on chicken meat meal in rabbits diets. This work attempts to evaluate the efficacy of fish meal, chicken offal meal, cotton seed meal and cassava leaf meal in rabbit diets. Cassava leaves can be considered as a protein source because the protein content of dry matter varies from 23 to 29 % according to the origin (GÖHL, 1982).

MATERIALS AND METHODS

Cassava leaves : These were obtained during the harvesting of cassava, sun dried and crunched by hand into 2-5 mm pieces.

Chicken offal : These were obtained from wastes at the slaughter houses, sun dried an ground in a vegetable grinder.
The other ingredients were obtained from the local market.

In this trial, 64 rabbits of New Zealand White and Californian breeds, 45 days old were fed tested diets (Table 1) containing various proteins sources, for six weeks. There were 16 rabbits per treatment. Each rabbit was housed individually in metallic cages measuring 45 cm wide by 45 cm long 45 cm high. Water and feed were given free choice. The experimental design was completely randomised for sex, age and breed. After 6 weeks, 6 male rabbits per treatment were subjected to digestibility studies which lasted 12 days comprising two total collection periods of faeces of 5 days each and 2 days of rest in between. Table 2 shows the chemical composition of test diets.

Carcass characteristics were carried out in 6 rabbits per treatment. Rabbits were stunned, killed, bled and skinned. After removal of head and evisceration, each carcass was divided into two parts and weights of each half recorded. The left side was chilled at + 4°C. The right side was dissected into

Table 1 : Percent composition of test diets fed rabbits

Feed items	Protein source			
	Chicken offal meal	**Fish meal**	**Cotton seed meal**	**Cassava leaf meal**
Chicken offal meal	18.00			
Fish meal		16.00		
Cotton seed meal			24.00	
Cassava leaf meal				42.00
Wheat bran	56.00	58.00	47.50	30.00
Maize	12.00	12.00	12.00	12.00
Palm kernel meal	10.00	10.00	10.00	10.00
Bone meal			2.50	2.50
Pal oil				2.95
Rice hulls	3.45	3.45	3.45	
Amprolium*	0.05	0.05	0.05	0.05
Cost F CFA/kg**	110	130	100	95

* Amprolium = coccidiostat ** One US dollar = 500 F CFA

meat, bone and fat. After 48 hours, the left side was removed and weighed and cut into commercial cuts. Weights of each cut was recorded. Parameters measured were average daily feed intake and weight gains, number of dead rabbits, faecal output and carcass traits.

Data were analysed according to STEELE and TORRIE (1980) and treatment means analysed according to DUNCAN multiple range test.

RESULTS AND DISCUSSION

Table 3 shows that daily feed intake values varied from 75-89 g/rabbit and were low compared to values of 100-130 g/rabbit observed in temperate zones (LAMB, 1985 ; CHEEKE *et al*, 1987) but comparable to values of 57-100 g/rabbit observed under tropical conditions (FOMUNYAM, 1984 ; AGANGA *et al*., 1991 ; DESHMUCK and PATHAK, 1991 ; SANKYAN *et al*., 1991) for the same breed types or for local strains. Apparently, the humid and hot tropical climates limit intake (WINTORFF and PAPP, 1985 ; OZIMBA and LUKEFAHR, 1991 ; WINROCK Int., 1992) for exotic rabbit breeds imported into tropics, but not in a wider extent than local breeds (KPODEKON *et al*., 1998).

Daily feed intake values of 89 g/rabbit for rabbits fed fish meal, 83.3 g/rabbit for rabbits fed chicken offal meal and 80 g/rabbit for those fed cassava leaf meal were significantly higher (P<0.01) than 75.2 g/rabbit for cotton seed meal based diets. FOMBAD (1997) showed that the free gossipol values in the expeller cotton produced in Cameroon varies from 400-800 mg/kg. The hydrocyanic content of sun dried cassava leaves was 100 mg/100 g leaf meal. These levels are considered below toxicity levels and most probably have not contributed to the lowest feed intake values observed.

Apparently the more balanced fish, offal and cassava leaf meals in terms of lysine encouraged feed intake. That is these diets were apparently more palatable. ANGAGA *et al.* (1991) also observed a depression in feed intake when cotton seed meal was fed at 15 % crude protein, as was in this trial, but not when they fed the meal at 30 % crude protein levels.

The growth rate and pattern showed the rabbits fed the animal based proteins grew faster (P<0.01) than those fed the cassava leaf meal. Rabbits fed cotton seed cake as principal source of protein grew slowest (P<0.01) at 22.3 g/rabbit. These daily weight gains of 22-30 g/rabbit are much higher than the 10-18 g/rabbit observed in similar studies in the tropics (ESHIET and ADEMOUSUN, 1978 ; FOMUNYAM, 1984 ; AGANGA *et al*., 1991 ; SANKHYAN *et al*., 1991). OMOLE and SONARYA (1982), observed higher weight gains, 25 g/rabbit, when fish meal was the principal protein source in rabbit diets while AGANGA *et al* (1991) showed slower growth rates of rabbit when cottonseed meal was the principal protein source in diets. This efficiency of utilisation of diets reflects the pattern that diets with a more balanced amino acid picture do support a significantly (P<0.05) faster rabbit growth rate.

Table 2 : Chemical composition of test diets (%), except where specified

Chemical composition	Chicken offal meal	Fish meal	Cotton seed meal	Cassava leaf meal
Dry matter	88.10	88.80	87.30	96.80
Digestible energy (kcal/kg)	2783	2812	2778	2662
Crude protein	21.25	21.99	20.91	19.19
Crude fibre	8.00	8.05	9.33	10.00
Ash	6.16	5.49	6.36	6.39
Methionine + Cystine	0.98	0.98	0.83	0.73
Lysine	0.98	1.10	0.76	0.90
Calcium	0.98	0.98	0.83	0.73
Phosphorus	0.90	0.90	0.79	0.43

The feed/gain ratio of 2.95 for fish meal fed rabbits was significantly (P<0.05) better than 3014 for offal meal fed rabbits which was in turn significantly (P<0.05) more interesting than 3.4 and 3.5 for cotton seed meal and cassava leaf meal rabbits, respectively, confirming the above mentioned observations. Rabbits fed the cassava leaf meal diet probably utilised the sulphur amino acids to detoxify the residual hydrocyanic acid in the lea meal and therefore needed more to effect growth ; thus, the poor feed utilisation. YONO *et al.* (1986) observed rabbit weight losses when fed wilted cassava and pelleted cassava

Table 3 : Performance traits of rabbits fed various proteins

Characteristics	Protein Source				SEM
	Chicken offal meal	Fish meal	Cotton seed meal	Cassava leaf meal	
Daily feed intake (g/rabbit)	83.31^{x}	88.99^{x}	75.3^{y}	88.00^{x}	2.7**
Daily weight gain (g/rabbit)	26.72^{x}	30.14^{w}	22.31^{z}	25.00^{y}	1.41**
Feed gain ratio	3.14^{b}	2.95^{a}	3.40^{c}	3.51^{c}	0.11
DM digestibility (%)	75.20	76.70	75.60	73.80	0.51
CP digestibility (%)	66.17^{a}	66.90^{ab}	66.40^{a}	60.07^{b}	0.59*
Average live weight (g)	2338	2424	2037	2099	
Carcass yield (%)	53.27^{ab}	54.19^{a}	49.92^{b}	50.32^{ab}	0.95*
Carcass cuts					
Fore quarter	23.60	24.26	22.29	21.89	
Back section	23.98	24.28	22.29	22.40	
Hind quarter	52.34	52.06	55.48	55.62	
Meat/bone ratio	3.21	3.40	2.63	2.80	
% shrinkage	7.70	7.00	7.90	8.30	
Cost F CFA/kg meat +	309	342	311	333	

x, y, z : means with different superscripts significant at P<0.01
a, b, c : means with different superscripts significant at P<0.05
** : significant at P<0.01 * : significant at P<0.05
+ cost of meat based on feed cost only ; 1 US dollar = 500 F CFA

tops and pointed to tannins as the probable cause.

Dry matter digestibilities were similar for all treatments suggesting that what was consumed by rabbits was generally retained. Protein-wise, for cotton seed meal, fish meal and chicken offal meal based diets, nitrogen was more digestible (P<0.05) than for cassava leaf based diet. Rabbit carcass yield, of 54.2 % for fish meal, 53.3 % for chicken offal meal and 50.3 % for cassava leaf meal, for rabbits fed these as protein sources in diets were similar but significantly (P<0.05) higher than those 49.9 % for rabbit fed cotton seed meal based diet. The values fall within the range of 50-55 % carcass yield values for rabbit fryers (CHEEKE *et al.*, 1982). Given that, the level of production was directly proportional to the quantity and quality of the ration which in turn was limited by the inherence traits of the rabbit. The low carcass yields of rabbits fed the cotton seed cake based diet resulted from the animals inability to eat enough nor efficiently transform what was ingested into meat. This was emphasised by the meat to bone ratio which showed the carcass from these rabbits to be more bony compared to the others although non-significantly so. There were no significant differences within the various commercial cuts. The percentage shrinkage of warm carcass was non-significantly higher for the plant protein based diets than the animal diets : 8,3 % for cassava meal, 7.9 % for cotton seed meal, 7.7 % for offal meal and 7.0 % for fish meal. The values are similar to 7 % warm carcass shrinkage value observed by CROPPINGS *et al.*, 1996.

The carcass yields reflect cash benefits to the farmer as well as choice among various meats made by house wives when purchasing meats. Calculated costs per kilogram meat, based on feed costs only, showed the cheapest diet to be chicken offal meal, followed by cotton seed meal and cassava leaf meal. The most expensively produced meat was that based on fish meal as principal protein source. It can therefore be argued that the quality of the protein vis a vis amino acid balances in diets fed rabbits in the tropics must be taken into consideration and not just gross protein levels. No rabbit died during the entire experimental period. In addition it is a combination of the availability, costs and quality of the protein source that will determine its utilisation in rabbits diets.

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