TREATMENT EFFECT OF LEUCAENA LEAF MEAL ON THE CARCASS CHARACTERISTICS OF RABBITS.

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ABSTRACT

A total of forty five white rabbit weaners were fed for 8 weeks on a control diet and four other diets containing 20% *Leucaena leucocephala* leaves that have been subjected to sundrying, ensilage, heat treatment or soaking in water.

The rabbits fed the diet containing ensilled *leucaena* leaves had the least feed intake, daily weight gain and in general performed worst than rabbits on any other diet in most of the parameters evaluated. The rabbits fed the heat treated leaf meal diet ranked next to those fed the control diet which performed best in most of the parameters evaluated. The rabbits fed the diet containing sun dried leaves experienced alopecia. In general, the results obtained indicate that heat treated *leucaena* leaves could serve as a dry season feed ingredient for rabbits in the tropics.

Key words: Rabbits, treated *Leucaena* leaf meal, performance, carcass evaluation.

INTRODUCTION

In recent years, there has been a reduction in animal protein consumption in most Nigerian homes as a result of the economic doldrum facing the nation. There is a high production cost occasioned by high feed cost. There is therefore an unsteady supply of meat particularly from the major meat animals. It is therefore imperative to look inward for animals that are more prolific, with short generation interval such as rabbits (Cheeke, 1986).

Raising rabbits on a commercial basis will require sourcing for feeding materials that are of high nutritive value, readily available and cheap. *Leucaena leucocephala* Lam (de wit), a deep rooted legume which has its origin in Mexico (N.R.C. 1984), but has become naturalised in Nigeria (Nzamane and Agishi, 1987) and thrives throughout the year readily comes to mind.

Leucaena leaves, flowers, seeds and shoots are good sources of nutrients for livestock (N.R.C. 1984). Adeneye (1979) observed the protein contents of *leucaena* leaves to vary with age, young and succulent leaves contain more protein than the matured ones. He also reported that the ash content increased from 52gkg-1 DM in semi-open leaves to 90gkg-1 DM in more mature leaves. Ekpenyong (1986) reported crude fibre concentrations of 82.4gkg-1 DM for fresh leaves but only 93.3gkg-1 DM for sundried leaves of the same batch.

The use of *leucaena* as fodder for ruminants have been well researched (Jones, 1979; D'mello and Taplin, 1978; Rangnekar *et al.*, 1983 and Cirdhar *et al.*, 1991). One major striking results of these researchers is that *leucaena* contain mimosine, a toxic amino acid occurring naturally in the plant. The toxicity effects of mimosine in ruminants are highly contradictory, this ranges from total absence of symptoms (Owen, 1958) to acute poisoning symptoms and death (Jones, 1979). In monogastric animals there is no evidence of any adaptation against mimosine or its derivative, DHP, (dihydroxypyridine), hence *leucaena* has a limited feeding role (Tangendjaja *et al.*, 1990). The toxic nature of *leucaena* leaf meal (LLM) appears to be unaffected by the age of poultry and it is not always mediated via depression in feed intake (D'Mello *et al.*, 1987). Although the levels of inclusion in poultry feed are usually very low (3%) with more than 10% inclusion level, adverse growth effect were reported (D'Mello and Taplin, 1978).

In recent time efforts have been made to reduce the mimosine contents of LLM by applying heat (D'Mello, 1982), soaking prior to cooking (D'Mello *et al.*, 1983; Kadam *et al.*, 1987) ensilage (Lyon, 1985) wilting and leaching (Szyzka *et al.*, 1983). Tangendjaja *et al.*, (1990) reported that dipping *leucaena* leaves in water at 70C for 10 minutes and then sundried reduced mimosine contents of the leaves by 80%. This experiment was therefore designed

to verify the efficacy of some of these post harvest treatments of *Leucaena* leaves in feeding rabbits under tropical conditions.

MATERIALS AND MEHODS

Animal: Forty five rabbits weaners with a mean initial weight of 517g were obtained from Ogbomosho town in Nigeria. The rabbits were randomly allotted to five experimental diets such that each dietary group consisted of nine weaners. Each group had three replicates of three rabbits per replicate. The rabbits were housed in a colony of three in acage of 85 x 70 x 40cm for a period of eight weeks. Identification was done by means of ear tag.

soaked leaves were strained through a sack and re-introduced into fresh water before it was finally sundried. Four test diets each containing 20% of each treated leaf meal were, along with a control diet (without LLM) formulated. The ingredient and chemical composition of each experimental diet are shown in Table 1. All diets were in mash form. Feeding trial was for a period of eight weeks. The rabbits were fed a known quantity of the feed once a day such that there was a left over by the next day. The left overs were screened of faeces before been measured. The difference between the feed given and left overs was the feed intake. Body weight was measured weekly.

TABLE 1: GROSS AND CHEMICAL COMPOSITION OF THE EXPERIMENTAL DIETS.

Ingredients	Control I	Treated II	Leucaena III	Leaf Meal IV	dietsI(%) V
Maize	34.54	33.18	33.18	33.18	33.18
Maize offals	25.00	25.00	25.00	25.00	25.00
Soybean cake	13.64	7.88	7.88	7.88	7.88
Blood meal	6.82	3.94	3.94	3.94	3.94
Rice husk	18.00	8.00	8.00	8.00	8.00
Oyster shell	1.00	1.00	1.00	1.00	1.00
Bone meal	0.50	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50	0.50
Leucaena leaf	-	20.00	20.00	20.00	20.00
CHEMICAL COMPOSITION					
Crude protein (%)	16.39	16.14	16.45	16.02	15.79
Ether extract (%)	8.03	5.95	2.23	7.56	6.96
Gross energy (Kcal/g)	3.49	3.11	3.47	3.54	3.05

- I: Diet II - Sun dried leaves before making into meal
 Diet III - Ensilled leaves
 Diet IV - Heat treated leaves (60C for 5 minutes)
 Diet V - Soaked in water for 72 hours.

Preparation of feed meal

Leucaena leucocephala leaves were harvested before flowering or seed formation during the dry season. They were divided into four treatment groups as follows. The first group was of leaves that were sun dried before making into meal. The second group was ensilled for a period of six weeks before sun drying and then made into leaf meal. The leaves in the third group were heat treated at a temperature of 60°C for 5 minutes before sundrying. The fourth group was first sun dried, before soaking in water for 72 hours. At every 24 hours the

Slaughtering and Carcass Evaluation

At the end of the eight weeks experimental period, six rabbits from each dietary treatment were randomly selected, fasted overnight and weighed before slaughtering. Their external offals: head, tail, feet and pelts were removed and weighed individually. The internal organs (liver, heart, lungs and kidneys) were likewise removed and weighed separately. The dressed carcass weights were obtained, carcass length was measured from the first thoracic vertebrae to the *Tuber ischiadicum* (pin bones). The width of loin

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TABLE 2: GROWTH PARAMETERS AND SLAUGHTER INFORMATION ON RABBITS FED TREATED LEUCAENA LEAF MEAL (LLM) DIETS

Parameter	Control I	Treated II	Leucaena III	Leaf Meal IV	Diet V	±SEM
Feed intake (g)	43.99 ^b	40.20 ^b	29.10 ^a	42.91 ^b	40.37 ^b	±6.36
Live weight (g)	941.75 ^d	795.49 ^b	656.60 ^a	865.91 ^c	759.32 ^b	±35.13
Daily weight gain (g)	18.28 ^b	10.98 ^a	8.43 ^a	16.47 ^b	10.05 ^a	±3.55
Dressed carcass (g)	428.97 ^d	323.75 ^b	253.27 ^a	351.23 ^c	288.70 ^{ab}	±33.26
Dressing percentage (g)	44.97 ^b	39.94 ^a	37.62 ^a	39.86 ^a	37.19 ^a	±4.15
Carcass length (cm)	22.43	21.67	20.83	21.00	20.83	±1.82
Loin Width (cm)	3.83	3.43	3.00	3.80	3.60	±0.31
Mortality	2	2	4	2	2	
Leg weight	169.77 ^d	127.90 ^{bc}	97.37 ^a	144.20 ^c	113.62 ^{ab}	±9.84
Shoulder weight	108.33 ^c	84.53 ^b	68.37 ^a	84.40 ^b	77.60 ^b	±6.18
Loin weight	88.50 ^d	61.50 ^{bc}	45.63 ^a	68.00 ^c	55.87 ^{ab}	±4.83
Rack weight	42.02 ^c	34.00 ^b	26.20 ^a	36.10 ^{bc}	27.93 ^a	±4.13

Different superscript letter denote significant differences ($P < 0.05$)

SEM: Standard Error of means.

was obtained as the lateral distance (cm) from the right to the left transverse processes of the lumbar vertebrae over the top of the mid loin. The dressing percentage was computed for each carcass.

After the collection of measurement data, the carcasses were split into left and right halves along the vertebral column. Each half was cut into the following primal parts, tailored after the beef cutting methods: shoulder, rack (rib), loin and legs. Their individual weights were recorded. Muscle samples were taken from the longissimus dorsi for histological measurements, of fibre diameter and sarcomere length (Locker, 1960). From the same muscle samples, water retaining index was obtained using the method of Ham and Grau (1953). The data were analyzed by the analysis of variance, the means were compared by the Duncan Multiple range test (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The growth and carcass information are shown in Table 2. The feed intake by rabbits fed diet III was significantly ($P < 0.05$) the lowest. Intake of other diets, including the control did not differ ($P > 0.05$). Tangendjaja *et al.*, (1990) did not observe any significant difference in the feed intake of rabbits fed a diet containing 20% boiled leucaena leaves and those fed the control diet. Tangendjaja and Lowry, (1984) have postulated that DHP could act as an appetite depressant when present in a diet. The

presence and quantity of DHP in different LLM was not determined in this study. It may be substantial enough to depress the intake particularly of diet III exposed to microbial activity during ensilage. Lyon, (1985) postulated that most, if not all, of the DHP in LLM probably comes from post-harvest enzymatic degradation of mimosine. Hegarty *et al.*, (1976) and Christie, *et al.*, (1979) have shown that microbial action could cause mimosine to undergo autolytic degradation to DHP.

The highest daily weight gain was recorded for rabbits fed the control diet which was statistically similar to what was obtained with those on diet IV, (heat treated LLM) but was significantly higher ($P < 0.05$) than what were obtained with the other three diets. The values reported by Tangendjaja *et al.*, (1990) for rabbits fed the control diet and those on soaked (in hot water 60°C) LLM and unsoaked LLM at 20% level of inclusion were 23.71gday⁻¹, 17.43gday⁻¹ and 16.00g day⁻¹ respectively. These values were better than the corresponding values obtained in the study for the control (18.28gday⁻¹) heat treated (16.47gday⁻¹) and sundried (10.98gday⁻¹). The disparity in these studies could have been due to breed differences and other environmental factors.

Toxicity effect of LLM was observed with the rabbits fed diet II (sundried LLM), where nearly all the rabbits experienced alopecia. However, mortality could not be said to be due to mimosine or its derivative as two rabbits were lost from each of the experimental diets except with diet II where four rabbits were lost. Postmortem examination indicted coccidiosis. Subjecting leucaena leaves to various treatment had significant effect on the rabbit carcass weight. The rabbits fed the control diet had

TABLE 3: EFFECT OF TREATED LEUCAENA LEAF MEAL DIETS ON THE EXTERNAL AND INTERNAL ORGANS OF RABBITS.

Parameters (g)	Control I	Treated II	Leucaena III	Leaf meal IV	Diets V	±SEM
Head	102.77 ^b	94.40 ^{ab}	89.00 ^a	106.45 ^c	84.00 ^a	3.26
Pelt	77.43	67.52	57.17	68.70	55.10	8.36
Feet	29.17	28.53	28.53	33.50	28.85	3.71
Tail	6.10	5.17	5.33	5.72	5.37	0.88
Liver	29.43 ^b	29.53 ^b	19.27 ^a	29.93 ^b	21.30 ^a	6.24
Heart	3.40	2.33	2.87	2.80	2.60	0.47
Lungs	8.50 ^c	5.33 ^a	6.83 ^b	8.23 ^c	5.73 ^{ab}	1.05
Kidney	8.80 ^c	6.63 ^b	5.83 ^a	8.10 ^c	5.67 ^a	0.82

Different superscript letters denote significant differences ($P < 0.05$)

SEM: Standard Error of Means.

TABLE 4: HISTOLOGICAL ANALYSIS AND WATER RETAINING INDEX OF RABBITS GIVEN TREATED LEUCAENA LEAF MEAL DIETS.

Parameter	Control I	Treated II	Leucaena III	Leaf meal IV	Diets V	±SEM
Fibre diameter (U)	32.59	29.70	28.11	31.41	30.38	1.11
Sarcomere length (U)	1.51	1.49	1.11	1.69	1.29	0.03
Water retaining index (%)	2.98	2.96	3.00	2.90	-	0.19

SEM: Standard Error of Means.

significantly the biggest (428.97g) weight. This was closely followed by those on diet IV (351.23g). The smallest carcass (253.27g) was obtained with rabbits on diet III. The low carcass weights generally observed in this study could be due to low crude protein contents in the diets.

The dressing percentage of rabbits fed the control diet was low when compared to what Tangendjaja *et al.*, (1990) reported (51%). The reason could be due to breed and environmental differences. Feeding leucaena leaves reduced the dressing percentage of the rabbits significantly. This agrees with the report of Tangendjaja *et al.*, (1990) where values of 44% and 43% were recorded for rabbits fed untreated (the mimosine contents were unmodified) and treated (with the mimosine largely converted to DHP) leucaena leaves at 20% level of inclusion. These values are low when compared with 51% observed for the control diet. The reason for low dressing percentage was due to low carcass fat and high gut contents. Awosanya (1989) observed that rabbits fed low energy diet had heavier gut weights than those fed high energy diet. Both the carcass length and loin width were not statistically affected ($P > 0.05$) by the treated LLM diets.

The weights of primal cuts are presented in Table 2. Devendra, (1966) stated that division of a carcass into primal parts (e.g. loin, shoulder, flanks, ribs and legs)

will enable comparison to be drawn between various defined area of the carcass. The primal cuts were significantly influenced by the treatment effect on the LLM. The leg and loin portion had a similar pattern, these cuts were significantly bigger ($P < 0.05$) with the control diet than any of the other diets. This was closely followed by diet IV which in turn was similar to diet II. In general the least cuts were obtained with diet III. With the shoulder portion diets II, IV and V produced similar weights which were significantly lighter than the control but heavier than diet III. The rabbits on the control diet had the biggest rack weight ($P < 0.05$), though statistically similar to those on diet IV which in turn was similar to those on diet II. The least weights ($P < 0.05$) were observed with rabbits fed diets V and III.

Doonenbal and Tong, (1981) highlighted the need for a knowledge of the relationship between the weight of an organ and the weight of the body in nutritional, biological and medical studies. The weights of both the external and internal organs as influenced by the treatment effect of LLM are shown in Table 3. The head was the only external organ that was significantly ($P < 0.05$) influenced by the diets. The heart weight was not influenced ($P > 0.05$) by the diets. However, the lungs, liver and kidney weights were significantly influenced ($P < 0.05$) by the diets. In the work of Tangendjaja *et al.*, (1990), they found the weights of

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liver, kidney and spleen to be similar between the dietary treatments. The fibre diameter, sarcomere length and water retaining index were not affected ($P>0.05$) by the treatments of leucaena (Table 4).

In conclusion, heat treatment of leucaena leaves at 60°C for 5 minutes could further enhance its great potential as an ingredient in feeding rabbits most especially during the dry seasons.

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