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HAEMATOLOGICAL AND HISTOLOGICAL EVALUATION OF THE RESPONSE OF PIGS TO *LEUCAENA LEUCOCEPHALA* LEAF MEAL SUPPLEMENT

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Target Audience: Researchers in animal production and pig farmers

ABSTRACT

Sixteen growing Large White boars (20±2Kg) were used in a completely randomised design experiment to evaluate the effects of four levels of inclusion of *L. leucocephala* leaf meal (0%, 5%, 10%, and 15%) on some haematological and morphometrical parameters. The graded levels of inclusion of *L. leucocephala* in the diets did not have any significant effects on the adrenal and thyroid glands weights, haemoglobin percentage, packed cell volume, red blood cells, white blood cells and plasma protein (P>0.05). Histometric examination of the adrenal and thyroid glands showed significant differences (P<0.05) in cortex/ medulla ratio of the adrenal gland, tubular diameter and epithelial cell thickness of the thyroid glands with pigs on Leucaena supplemented diets showing higher values than the control. However, these differences were not consistent with increasing level of inclusion. The study shows that satisfactory performance and organ development can be achieved by inclusion of up to 15% *L. leucocephala* leaf meal in the diet of growing pigs.

Key Words: Haematology, histology, pigs, evaluation, *Leucaena leucocephala*

DESCRIPTION OF THE PROBLEM

L. leucocephala has been recognised for many decades as a potential contributor of plant protein (1) and minerals (2) in animal feeds especially ruminant livestock (3). There have also been several reports of its use in the diet of non-ruminant animals (4). Some of the excellent attributes include its high yield of dry matter of up to 20 tons of dry matter/ hectare, its ability to withstand repeated defoliation and its capacity to remain evergreen in the dry season when other forage crops must have turned brown. The agronomic characteristics and its climate and soil requirements make it a potential forage crop for the humid tropics.

Inspite of these excellent qualities, *L. leucocephala* has remained obscure and unpopular as a forage crop especially in the humid tropics.

The [illegible]ous set back of this forage crop is its toxicity to livestock [illegible] which is reported to include interference with iodine and [illegible]tabolism resulting in hypothyroidism and goitre (5). Other clinical symptoms reported include alopecia, excessive salivation, oesophageal lesions, reproductive disorders, reduced appetite and hence loss of weight (6). All these have been attributed to the presence of a toxic amino acid mimosine in the leaf and seeds of the plant.

The essence of this work is not only to evaluate the general performance of pigs when fed diets supplemented with graded levels of *L. leucocephala* leaf meal but also to examine the haematological and histological characteristics of such pigs.

MATERIALS AND METHODS:

Dried milled *L. leucocephala* leaf meal was obtained from fresh cuttings from pure stands of *L. leucocephala* (CV Peru) pasture in the International Institute Of Tropical Agriculture (IITA) Experimental Farm at Ibadan. The fresh cuttings were sundried for two days and later milled at the Teaching and Research Farm of the University of Ibadan.

This study was carried out at the Physiology Unit (Piggery) of the University of Ibadan Teaching and Research Farm. The experimental animals were sixteen growing large white boars of an average weight of 20±2kg live weight assigned in a completely randomised design experiment to four dietary treatments. The four corn based diets were formulated to include 0%; 5%, 10% and 15% *L. leucocephala* leaf meal respectively (Table1). The experiment lasted 12 weeks.

Table 1: Gross Composition of Experimental Diets

INGREDIENTS (%)	DIET I 0%*L.leucocephala*	DIET II 5%*L.leucocephala*	DIET III 10%*L.leucocephala*	DIET IV 15%*L.leucocephala*
Maize	52.15	51.68	51.24	50.77
Maize Offal	25.00	20.00	15.00	10.00
L.leucocephala	—	*5.00*	*10.00*	*15.00*
Groundnut cake	12.35	12.82	13.26	13.73
Fish Meal	2.0	2.0	2.0	2.0
Blood Meal	4.0	4.0	4.0	4.0
Bone Meal	2.0	2.0	2.0	2.0
Oyster Shell	1.00	1.00	1.00	1.00
Premix	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50
TOTAL	100.0	100.0	100.0	100.0
Crude Protein	19.0	19.3	19.5	19.5
Crude Fibre	3.4	4.2	6.5	6.8

Blood Collection and Analysis

Blood was collected from the experimental animals every week beginning from the end of the first week. The blood was collected via the cranial vena cava and immediately processed for haematological parameters. Red blood cells and White blood cells counts were determined using haemocytometer as described by Dacie and Lewis (7). Packed Cell Volume (PCV) was determined using a Wintrobe haematocrit. Haemoglobin content was determined as described by Crosby (8) and plasma protein was determined by the refractometric method using the American Diagnosis refractometer.

Histological Examinations

At the end of the feeding trials, the animals were slaughtered and the thyroid and adrenal glands were removed, weighed and processed for micro-stereological examination.

The slides prepared from tissues section of these organs were used to determine the cortex/medulla ratio of the adrenal gland and the tubular diameter as well as epithelial cell thickness of thyroid glands. For the cortex-medulla ratio the slides were mounted on a slide projector and projected on a screen. The outline of the tissue sections for the entire tissue and that of the medulla were traced on plain white sheets and the surface area of the entire tissue section in square millimetre as well as the surface area of the Medulla were determined using a plannimeter. The ratio of the medullar to the cortex was determined using the relationship (9).

$$\frac{\text{Area of the cortex (mm)}^2}{\text{Area of the medulla (mm)}^2}$$

The tabular diameter and epithelial cell thickness of the thyroid gland were measured using a stage micrometer with a calibrated eye-piece.

Statistical Analysis

All results were subjected to computer based (SPSS) multi-factor analysis of variance. Where statistical differences were observed, the means were compared by the least significant difference method (10)

RESULTS AND DISCUSSION:

The results of the haematological parameters evaluated are as presented in Table 2. The haematological parameters varied between the dietary treatment but these variations were not significant ($P>0.05$). The values were within normal levels reported for pigs elsewhere (11)

The results of both the cortex: medulla ratio of the adrenal gland and tubular diameter and epithelial cell thickness of the thyroid are shown in Table 3.

Table 2: Effects of graded levels of *L. leucocephala* on Haematological parameters of growing pigs

PARAMETERS	DIETS (%*Leucaena leucocephala*)			
	0	5	10	15
Haemoglobin (gm/100ml)	9.99±0.24	10.75±0.13	10.77±0.17	10.95±0.21
Packed cell Volume (PCV)%	37.65±5.05	42.15±3.97	40.49±4.22	39.51±4.60
Red Blood Cells count ($x10^6$)	5.22±0.04	5.54±0.28	5.26±0.11	5.11±0.03
White Blood Cell ($x10^3$)	16.95±1.72	19.02±1.14	16.36±0.23	15.11±0.15
Plasma Protein (gm/100ml)	7.88±0.02	8.35±0.15	7.99±0.06	8.03±0.11

Values are means ±± S.E.M.
Values are not significantly different (P> 0.05)

Table 3: Effects of graded levels of *L. leucocephala* on Histological parameters of the thyroid and adrenal glands of growing pigs

PARAMETERS	DIETS (%*Leucaena leucocephala*)			
	0	5	10	15
Cortex / medulla ratio (Adrenal gland)	3.30 ± 0.28^{b}	3.94 ± 0.17^{a}	$4.54\pm.16^{a}$	3.92 ± 0.231^{a}
Tubular diameter (μm) (Thyroid gland)	1.13 ± 0.02^{ab}	1.26 ± 0.12^{a}	1.16 ± 0.04^{ab}	0.91 ± 0.06^{b}
Epithelial cell thickness (thyroid gland) (μm)	0.098 ± 0.02^{c}	0.149 ± 0.04^{b}	0.174 ± 0.04^{ab}	0.184 ± 0.08^{a}
Mean weight of Thyroid gland (g)	3.88 ± 0.28^{a}	4.94 ± 0.46^{a}	5.20 ± 0.33^{a}	3.80 ± 0.42^{a}
Mean weight of Adrenal gland (g)	2.40 ± 0.19^{a}	2.90 ± 0.31^{a}	2.57 ± 0.24^{a}	2.76 ± 0.30^{a}
Mean Weight of adrenal cortex (g)	1.79 ± 0.15^{a}	2.23 ± 0.09^{a}	1.96 ± 0.07^{a}	2.06 ± 0.11^{a}
Mean Weight of adrenal medulla (g)	0.40 ± 0.02^{a}	0.66 ± 0.06^{a}	0.53 ± 0.14^{a}	0.68 ± 0.19^{a}

Values are means ± S.E.M.
Values in the same horizontal column differently superscripted differ significantly (P<0.05).

The cortex/medulla ratio was highest for the group on 10% (P<0.05) *L. leucocephala* diet and lowest in the animals on zero *L. leucocephala* supplementation.

The tubular diameter and epithelial cell thickness of the thyroid gland showed significant differences among different dietary treatments ($P<0.05$). Animals on 15% *L. leucocephala* had significantly lower tubular diameters than those on 5% *L. leucocephala* but the other diets did not show any significant effects.

The epithelial cells of the thyroid glands of animals on *L. leucocephala* supplemented diets were generally thicker than animals on the control diet with the highest level recorded in the animals on the 15 % inclusion level ($P<0.05$).

The result of the haematological parameters point to the fact that inclusion of *L. leucocephala* leaf meal up to 15% level did not adversely affect blood formation. The blood is of high physiological significance in the animal body and any significant change would have had imposed serious limitations to the utilisation of the plant in non-ruminants. These findings agree with the reports of Adejumo and Akpokodje (12)

The increases observed in organ parameters are indications of the growth enhancing properties of *Leucaena*. The slight but significant increases in organ weights of animals fed *L. leucocephala* supplemented rations may be due to the relatively safe inclusion levels and the nutritive profile of the rations.

The thyroid gland has been particularly identified as a target organ of the toxic effects of *L. leucocephala* on the animal body. The weight of the thyroid gland of the control group did not differ from those of the treated group, which may point to the fact that there was no enlargement of the thyroid gland as reported elsewhere (13).

The results of the adrenal cortex/medulla ratios showed that the level of *L. leucocephala* in the diets were within tolerable limits and growth enhancing.

However, the epithelial cell thickness, which increases as the level of inclusion increases poses interesting questions and it suggests a form of correlation between the epithelial cell thickness and the level of *Leucaena* in the diet. This observation will need further investigation to confirm this trend.

This study therefore shows that the use of *L. leucocephala* leaf meal in diets of growing pigs up to 15% promoted organ development while haematological parameters were unaffected. *L. leucocephala* can therefore, be safely utilised at this level without toxic effects.

CONCLUSIONS AND APPLICATIONS

In the light of rising costs of feed ingredients, Leucaena leaf meal is a potential cost saving protein supplement for non-ruminants up to 15% supplementation level

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