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# The Effect of Graded Levels of Dietary Inclusion of Siam Weed *(Chromolaena odorata)* Leaf Meal in Grower Rabbits Diet in a Tropical Environment

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**Abstract:** A feeding trial was conducted using 24 grower rabbits to evaluate the effect of graded levels of dietary inclusion of *Chromolaena odorata* (Siam weed) leaf meal in their diets. The rabbits were divided in to 4 treatments with 3 replicates per treatment arranged in a Completely Randomized Design (CRD). Four diets were formulated. Diet 1 was the control diet while diets2, 3 and 4 contain 15,25 and 35 % dietary levels of the test ingredient (Siam weed leaf meal), respectively. Each diet represented a treatment. Feed and water were given ad -libitum. The experiment lasted for 56 days. Data were colleted for feed intake, weight gain, carcass quality and organ weight from where other parameters like feed conversion ratio, percent mortality, organ and carcass weight expressed as percentage dressed weight were calculated. For growth performance, there was significant difference (p<0.05) between the treatment means for all the parameters measured. The feed intake the weight gain, final live weight and gross margin decreased as the quantity of the test ingredient increased in the diets while feed conversion ratio and percent mortality also increased.15, 25 and 35 % level of inclusion of test ingredient did not support efficient growth performance. For cut parts and organ weight expressed as percent dressed weight, rabbits fed diets 1 and 3 showed significantly higher (p<0.05) values than others with diet 1 having highest numerical values than diet 3 making it a more superior diet. The liver, kidney and heart were higher for test diets than that of control diet. In conclusion, 15, 25 and 35 levels of inclusion of Siam weed leaf meal do not support good growth performance, carcass quality and organ weight.

**Key words:** Siam weeds leaf meal, rabbits diet, tropical environment

## INTRODUCTION

Animal protein constitute about 17% of the total protein consumption in the average Nigerian diet compared to 68% in New Zealand, 71% in United Kingdom (world bank[1]).There is therefore the need to increase the protein intake to a level which compares to that of the developing Nations. Odunsi[2]). The above situation have been blamed on shortage of animal production, as a result of high cost of production of which 70-80% of it is feed cost (Tulen[3]). The high feed cost also, have been blamed on competition between man, livestock and poultry and industry. This has led to searching for alternative feedstuffs that will meet the nutrient requirements of these farm animals at reduced cost.

The alternative feed stuff being considered in this study is Siam weed *(Chromolaena odorata)*. Siam weed is a perennial weed that is very abundant with aggressive reproductive and spreading capacity. The weed can subsist for a greater part of the season (Anyaehie and Onifade,[4]). Its crude protein content ranges from 17.53-18.86%, with gross energy of about 2930 kcal/kg -3860 kcal/kg[4,5]. The objective of this study is to determine the optimal level of dietary inclusion of Siam weed in grower rabbits diet, using growth performance, carcass quality, organ weight and economics of diet.

## MATERIALS AND METHODS

**Environment of study:** The study was carried out at the rabbitry unit of the livestock and teaching research farm, Michael Okpara University of Agriculture, Umudike, Abia state.

Umudike bears the coordinates of 5° 28$^1$ North and 7° 31$^1$ East and lies at an attitude of 122m above sea level. It is located within the tropical rainforest zone. The environment is characterized by high rainfall of about 2177 mm. The relative humidity during raining season is well above 72%. Monthly ambient temperature ranges from 17 to 36°C. march is the warmest month with an average temperature range of 22-30°C.

**Housing:** The experimental grower rabbits were housed in a long 3-tier wire cage consisting of 15 hutches, 3 hutches

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Table 1: Experimental diets

| | T1 (0%) | T2 (15%) | T3 (25%) | T4 (35%) |
|---|---|---|---|---|
| Maize | 42 | 33 | 24 | 18.62 |
| Soybean | 14 | 11 | 8 | 6 |
| Leaf meal | - | 15 | 25 | 35 |
| PKC | 22.5 | 26.5 | 23.5 | 17.04 |
| Wheat offal | 18 | 11 | 16 | 19.84 |
| Vitamin-premix | 0.25 | 0.25 | 0.25 | 0.25 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Bone ash | 3 | 3 | 3 | 3 |
| Lysine | .01 | 0.1 | 0.1 | 0.1 |
| Total | 100 | 100 | 100 | 100 |
| Crude protein (%) | 17.36 | 17.365 | 17.367 | 17.367 |
| ME(kcal $kg^{-1}$) | 2631.975 | 2632.51 | 2633.81 | 2636.23 |

To provide the following per kg feed; vitamin A-4000,000,vitD3-500,000,vitE-12,000,vitK-0.080,vitD2-1.60,calciumD-panthenate-4.00,vit.B6-120,vitB12-8.00,folic acid-0.08,vit C-100.00,Biotin-0.06,choline celenium-0.044

in columns and 5hutches across the rows. The hutches were of 50cm x 50cmx50cm type made of wooden skeleton and wire mesh of 0.3mm on the sides and the floor. Each hutch had a feeding trough and water trough for concentrates and water, respectively. The cage was housed in a well-ventilated high roofed building of asbestos roofing and long windows transverse almost whole length of the wall. This is to facilitate proper ventilation and proper dissipation of heat as fast as possible. The floor was made of hard concrete for easy proper cleaning.

**Feedstuff and processing:** Fresh young leaves of *Chromolaena odorata* was harvested from the environment of Micheal Okpara University of Agriculture, Umudike. They were sun dried and milled before used to formulate diets.

**Experimental diets:** The four diets were formulated iso-caloric and iso -nitrogenous (Table 1). The test ingredient was included in three diets at 15,25 and 35% for diets 2,3 and 4, respectively.

**Chemical analysis:** The test ingredient (Siam weed) and respective diets were analyzed for proximate composition using the procedure of (AOAC,[6]). The gross energy was determined using Gallenlamp Ballistic Bomb Calorimeter. The anti- nutrients of the test feed ingredient such as Tannin, nitrate, cyanogenic glycosides and phytic acid were determined using the methods of [6-9], respectively.

**Experimental designs and statistical analysis:** The experiment was carried out in a Completely Randomized Design (CRD). The data collected were subject to analysis of variance (ANOVA) as described by Steel and Torrie[10] while mean separation was carried out using Duncan's multiple range test as described by Duncan[11].

## RESULTS AND DISCUSSION

The results of the proximate composition of experimental diets are as shown in Table 2. The observed similar result for the experimental dietsis not surprising since, the diets were formulated to be iso- energetic and iso-nitrogenous. Table 3 shows the proximate composition of test ingredient. The dry matter observed (89.79%) is not in line with the report of Anyaehie and Onifade[4] who reported 98.75% dry matter but in line with[5,12] who reported 87.4% and 90%, respectively .The difference between dry matter value observed and that of Anyaehie and Onifade[4] could be attributed to different geographical sources of the test ingredient (Apata,[13] Akinmutimi,[14]). The crude protein value observed (21.7%) is in line with the report of Akinmutimi[4] who reported same (21.7%) but slightly higher than the values obtained by other workers such as Aro[12] (18.67%), Anyaehie and Onifade[4] (18.86%) and Asafa *et al.*[15] (17.63%).The slight variation may be due to same reason given above( Apata,[13] and Akinmutimi,[14]). The results of growth performance of rabbit fed graded levels of dietary inclusion of Siam weed leaf meal is as shown in Table 4.There was significant ($p<0.05$) difference between the treatment means for all the parameters measured. The feed intake significantly ($p<0.05$) decreased as the quantity of the test ingredient increased. The low feed intake of the animals placed on the test diets as opposed to the control diet is in agreement with earlier workers (Aro,[12]; Akinmutimi,[4]), who reported decline in feed intake when Siam weed leaf meal were fed to birds and albino rats, respectively. This maybe attributed partly to low palatability of the leaves and the presence of anti-nutritional factors, such as tannin, nitrate etc.

Tannin (Table 5) for example have been reported to cause poor palatability in diets containing it in high quantity, due to its astringent property as a result of its

Table 2: Proximate composition of experimental diets

| Constituent (%) | T1 (0%) | T2 (15%) | T3 (25%) | T4 (35%) |
|---|---|---|---|---|
| Dry matter | 89.63 | 89.74 | 89.86 | 89.97 |
| Crude protein | 16.45 | 16.62 | 16.98 | 19.80 |
| Crude fibre | 6.52 | 7.09 | 6.95 | 7.29 |
| Fat | 3.95 | 4.08 | 3.92 | 4.02 |
| Ash | 7.29 | 6.52 | 6.39 | 6.51 |
| Gross energy (kcal $kg^{-1}$) | 3049 | 3052 | 3046 | 3058 |

Table 3: Proximate composition of test feed ingredient

| Proximate (%) | |
|---|---|
| Dry matter | 89.51 |
| Crude protein | 21.7 |
| Crude fibre | 13.72 |
| Ether extract | 2.61 |
| Moisture | 10.49 |
| Ash | 9.64 |
| Gross energy (kcal $kg^{-1}$) | 2949 |

Table 4: Growth performance of rabbits fed graded levels of dietary inclusion of siam weed leaf meal

| Parameters | DIET1 | DIET2 | DIET3 | DIET4 | SEM |
|---|---|---|---|---|---|
| Initial weight (g) | 919.1 | 937.5 | 920.8 | 937.5 | 8.838 |
| Final weight (g) | $1725^{a}$ | $1295.83^{b}$ | $1100.0^{b}$ | $670.8^{c}$ | 258.6 |
| Weight gain (g) | $14.19^{a}$ | $6.3667^{b}$ | $3.2^{b}$ | $-4.77^{c}$ | 18.25 |
| Feed intake/rabbit/day (g) | $127.67^{a}$ | $96.67^{b}$ | $94.33^{b}$ | $51.67^{c}$ | 10.77 |
| Feed conversion ratio | $9.0553^{b}$ | $17.4633^{b}$ | $32.7867^{a}$ | $-10.96^{c}$ | 4.714 |
| % Mortality | $0^{b}$ | $0^{b}$ | $0^{b}$ | $50^{a}$ | 5.00 |
| Gross margin (N) | $399.54^{a}$ | $-20.56^{a}$ | $-56.79^{a}$ | $-242.^{b}$ | 28.46 |

a-d treatment Means different superscript in the same row differ significantly ($p<0.05$)

Table 5: Anti nutrients of the test ingredient

| %Tannin | $\%NO_3$ | HCN(Mg per kg) | %Phytic acid |
|---|---|---|---|
| 0.47 | 0.0078 | 396.2 | 1.52 |

ability to bind with the protein of saliva and mucosa membranes (Devendra,[16];Aletor and Fasuyi,[17]).

The weight gain which cumulatively affected the final live weight follow similar trend like that of feed intake in that they decreased as the quantity of the test ingredient increased in the diets. This could be attributed to the effect of poor feed intake as well as poor nutrient utilization .due to inherent anti-nutritional factors present in the test ingredient such as nitrate, Cyanogenic glycosides, Phytic acid (Table 5) Cyanogenic glycosides on hydrolysis release hydrogen cyanide (HCN),a substance reported to have the ability to cause marked weight reduction (Aletor and Fasuyi,[17]). Cyanide detoxification route in man and animals is through cyanide

Thiocyanate Sulphur transfererase (Rhodenase) pathway, which generally requires organic sulphur donors in the form of methionine and cysteine, thereby precipitating methionine deficiency in an otherwise balanced diet (Aletor and Fasuyi,[17]). It is this methioine deficiency that results in poor growth. Nitrate also has been reported to change to nitrite and this combine with haemoglobin of the blood to form methamoglobin, which makes it unable to act as an oxygen carrier and this might possibly lead to the loss of weight and death of animals through tissue anoxia (Akinmutimi,[5]). This problem probably explains the high %mortality as seen at 35% dietary level of inclusion of the test ingredient. Phytin on the other hand, exerts its anti-nutritional ability by chelating proteins forming compounds that are not readily broken down, hence loss of protein as well as its component amino acid leading to poor growth and final live weight (Akinmutimi,[14]) For feed conversion ratio, it increases as the quantity of the test ingredient increased and became significantly different ($p<0.05$) from the control diet at 25% and above. The higher value for test diets which became negative at 35% dietary inclusion of the test ingredient could be attributed to the effect of poor feed intake and weight gain which has been discussed above. The negative value observed for rabbits placed on 35% dietary level of inclusion of test diet could be attributed to higher effect of anti-nutritional factors leading to the rabbits living on their body reserves. The resultant effect of this was loss of weight, which invariably affected the feed conversion ratio.

The gross margin values decreased numerically and became significant at 35% dietary level of inclusion of the test ingredient. This could be attributed to poor feed intake, utilization of nutrients and growth, resulting in the poor market price of the rabbits placed on the test diets. This implies that the test diet cannot be

Table 6: Weight of cut parts expressed as percentage dressed weight

| Parts | DIET1 | DIET2 | DIET3 | DIET4 | SEM |
|---|---|---|---|---|---|
| Back cut | $28.94^{a}$ | $21.1567^{b}$ | $20.44^{b}$ | $27.6798^{a}$ | .762 |
| Drumstick | $2.73^{c}$ | $4.5667^{b}$ | $10.22^{a}$ | $4.62^{b}$ | .118 |
| Forearm | $8.19^{c}$ | $10.743^{a}$ | $9.99^{ab}$ | $9.23^{bc}$ | .332 |
| Shoulder | $10.92^{ab}$ | $11.4067^{a}$ | $10.22^{a}$ | $9.23^{bc}$ | .332 |
| Thigh | $24.59^{b}$ | $24.5^{b}$ | $25.55^{a}$ | $23.08^{c}$ | .175 |
| Chest | $16.39^{c}$ | $17.9533^{b}$ | $15.33^{d}$ | $18.47^{aa}$ | .202 |
| Dressed weight(%) | $53.83^{a}$ | $43.2367^{c}$ | $48.92^{b}$ | $49.23^{b}$ | .0775 |

a –d, treatment Means different superscript in the same row differ significantly ($p<0.05$)

Table 7: Organ weighted express as percentage dressed weight

| Parts | 0% Diet 1 | 15% Diet 2 | 25% Diet 3 | 35% Diet 4 | SEM |
|---|---|---|---|---|---|
| Heart | $0.3716^{b}$ | $0.4446^{ab}$ | $0.4483^{ab}$ | $0.5110^{a}$ | .0258 |
| Spleen | $0.1620^{a}$ | $0.1710^{a}$ | $0.0799^{b}$ | $0.0600^{c}$ | .000 |
| Kidney | $1.3902^{b}$ | $1.4470^{b}$ | $1.5490^{a}$ | $1.5990^{a}$ | .073 |
| Liver | $5.2300^{d}$ | $7.3233^{a}$ | $5.9433^{b}$ | $5.4996^{c}$ | .0258 |

a-d treatment Means different superscript in the same row differ significantly ($p<0.05$)

compared with the control diet in terms of profitability. In view of the above, Siam weed leaf meal does not enhance good growth performance at 15% and above of its dietary level of inclusion. This result is not in agreement with Bankole *et al.*[18] who reported good performance at 30% dietary level of siam leaf meal. This may be due to different stage of harvesting the Siam weed leaf. It has been reported that the use of extremely young leaf for leaf meal leads to increase in anti-nutritional factors especially nitrate resulting in poor performance Bankole[18].

Table 6 shows the weight of cut parts expressed as percentage dressed weight .The re was significant difference ($p<0.05$) for all the parameters measured. The values for cut parts measured did not follow a specific pattern to be attributed to the effect of the test diets but the percentage dressed weight does. Despite this, diets 1 and 3 shows ($p<0.05$) significantly higher values for cut parts and percentage dressed weight. Comparing diets 1 and 3, diet 1 shows higher numerical values than diet 3 making it a superior diet. This implies that diet 1 supports tissue deposition than all the test diets (Abiola,[20]).

Table 7 present the mean organ weight expressed as percentage of dressed weight. There was significant ($p<0.05$) difference for all the parameters measured. The values for spleen and liver did not follow a specific pattern that could be attributed to the effect of the test ingredient but the value s for the test diets were ($p<0.05$) significantly higher than that of controls diet for liver. This may be attributed to the effect of anti-nutritional factors present in the test diets, liver being a major detoxification organ and hence increase in its activities leading to an increase in weight. (Akinmutimi,[14]). The values for heart and kidney followed a specific pattern that could be attributed to the test diet.

The value for heart for test diets where numerically higher and became significantly ($p<0.05$) different at 35% dietary level of inclusion of the test ingredient. The observed result could be due to anti nutritional factors resulting in increase in weight (Abeke *et al.*,[19]). Nitrate a toxic component of Siam weed (Table 5) have been reported to be converted to nitrite, this in turn combines with haemoglobin to form methamoglobin and hence causing poor carriage of oxygen (tissue anoxia) (Akinmitumi[5]). In order to overcome the effect of nitrate this may make the heart to pump more blood, leading to increased metabolic activities of the heart and its resultant effect such as enlargement and increase in weight .The values for kidney also follow similar pattern, like that of the heart in that values increased numerically but differs from that of the heart by becoming significantly different ($p<0.05$) at 25% and above of dietary level of inclusion of the test ingredient.

The progressive increase in the weight of kidney could be attributed to increase in activity that probably leads to increase in weight. This is perhaps due to the fact that kidney contains rhodenase, a key enzyme in cyainde detoxification Ologhobo[21]).

## CONCLUSION

In view of the above result and discussion, 15% and above dietary level of inclusion of Siam weed do not support good growth performance, carcass quality and organ weight. Actual level of dietary inclusion of the test ingredient that will support good growth performance, carcass quality and organ weight is subject to further investigation.

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