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Productive Performance and Blood Profile of Weaner Rabbit Fed Different Inclusion Levels of *Ipomoea asarifolia* Leaf Meal in Replacement of Soybean Meal

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Abstract

In an experiment to determine the effect of feeding graded levels of *Ipomoea asarifolia* Leaf Meal (IALM) on the growth, heamatology and serum chemistry of rabbits in the tropics, twenty-four (24) weaned male rabbits, 6-8 weeks old, were randomly allotted to four (4) dietary treatments in which IALM was used to replaced soybean meal (SBM) at 0% (control), 10%, 20%, and 30% with six (6) rabbits per treatment in a completely randomized design experiment. Each rabbit constituted a replicate. Feed and water were offer *ad libitum* while other standard management practices were meticulously observed. The Proximate analysis of the diets and leaf was determined according to the AOAC [1] for crude protein, crude fibre, ether extract (fat) and ash while haematological analysis was done using Sysmex KX-21N automated analyzer and while serum parameters were analyzed following standard procedure. The data obtained were subjected to one-way analysis of variance in a completely randomized design experiment. The IALM had average crude fibre percentage of 7.15%, while crude protein, ash, ether extract and metabolisable energy were 28.40%, 11.00%, 7.10%, 3236.15 KcalKg) respectively. All growth parameters were affected by IALM except weight gained and FCR. Haematological and serological parameters measured at the end of 8 weeks of feeding indicated significant (P<0.05) variations in, mean cell haemoglobin (MCH) and alkaline phosphatase, cholesterol, globulin, platelet, white blood cell count (WBC) and total serum proteins with variations in the level of dietary IALM. The aspartate amino acid, alanine amino acid, red blood cell count, mean cell volume (MCV), and intermediate cell count were, however, unaffected (P>0.05) by variations in the level of dietary IALM.

Keywords: Ipomoea asarifolia leaf meal; Haematology; Serum biochemistry; Rabbits.

1. Introduction

Cost of production of animal generally is associated with the cost of factors of production such as feed. The cost of feeds are relate to the cost of the ingredients used in the formulation of the diet. Apart from the maize, another major ingredient of choice is soybeans in animal production enterprises, this has force it price above expectation. This cost of soybeans is associated with the fact that is one of the plant protein of choice in human food. Soybeans are used in many industries for the production of human foods, this has led to the increase in the cost of soybeans and according to Franklin [2] soybean (*Glycine max*) is one of the most important food plants of the world and since then seems to be growing in importance. It is an annual crop, easy to grow, that produces more protein and oil per unit of land than almost other crop [2]. A versatile food plant used in its various forms is capable of supplying most nutrients. It can substitute for meat and to some extent for milk. It is a crop capable of reducing protein malnutrition. In addition, soybeans are a source of high value animal feed.

In other to reduce the cost of animal feed especially rabbit which is a pseudoruminant, there is need to search for alternative feed resources, which can be used to replace costly soybeans as a way of reducing production costs and making livestock products more readily available to the populace in the tropics. The new global search for forage suitable for feeding livestock has led to the investigation of many Nigerian plants now than previously [3]. It was reported [4] that, there is a wide range of feedstuff on which rabbits can live on, one possible source of cheap protein is leaf meals of some tropical legume plants examples which includes water spinach (*Ipomoea acquatica*), *Gliricidia sepium* [5], sweet potatoes (*Ipomoea batatas*) [6] e.t.c. For instance, *Moringa oleifera* leaves serve as animal feed in many places. *Moringa oleifera* leaves, stems, roots and other parts have popularly used as animal feed in countries such as Nigeria, Senegal, Niger, Kenya, Tanzania, Zimbabwe, Gambia, Malawi, India, Spain, USA and Germany e.t.c [4]. However, there remains a large number of forage plants used traditionally but not scientifically proven safe in relation to animal health such as *Ipomoea asarifolia*. Haematological studies represent a useful process in the diagnosis of many diseases as well as investigation of the extent of damage to the blood [7]. This is relevant since blood constitutes change in relation to the physiological conditions of the animals. Haematological constituents reflects the physiological responsiveness of the animal to its internal and external environments which include feed

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and feeding [8] as well as drugs [9]. Serum biochemical analysis is used to determine the level of heart attack, liver and kidney as well as to evaluate protein quality and amino acid requirements in animals [3]. Therefore, this research work was designed to evaluate the potential usefulness of *Ipomoea asarifolia* leaf meal in the production of rabbit.

2. Materials and Methods

2.1. Experimental Site

The research was carried out at the Rabbitry Unit, Teaching and Research Farm, Ladoke Akintola University of Technology (LAUTECH), Ladoke Akintola University Ogbomosho, Oyo State, in south Guinea Savannah zone of Nigeria.

2.2. Harvesting, Processing of *Ipomoea asarifolia* and Formulation of Experimental Diets

Ipomoea asarifolia leaves were harvested within Ogbomoso, air-dried under shade to reduce moisture until they were crispy to touch. The leaves thereafter crushed with hammer mill to form *Ipomoea asarifolia* leaf meal (IALM), before incorporation in the experimental diets. Four (4) experimental diets were formulated; Diet 1 designated as T1 serve as the control diet and contains no (0%) IALM. Diet 2 designated as T2, Diet 3 as T3 and Diet 4 and T4 contain IALM at the levels of 10%, 20% and 30% respectively in replacement soybean meal.

2.3. Experimental Animals and Management

Prior to the arrival of the animals, the rabbit hutches were cleaned and disinfected, feeding and drinking troughs and collection trays were cleaned and washed. Twenty-four (24) male weaner rabbits of mixed breeds was use for the experiment. The rabbits were between 4-6 weeks of age and weighed between 400g and 500g. The rabbits were randomly divided into four groups of six rabbits per treatment and each rabbit serve as a replicate in a Completely Randomized Design Experiment. Prior to the experiment, each animal was dewormed using Piperazine (Dorpharma B.V. Ltd., The Netherlands). The rabbits were allow adjustment period of two weeks in which the rabbits were allow to adapt to the new environments, during the acclimatization period, the animals were fed on control (Diet T1). The rabbits were intensively managed and housed individually in a cage measuring 47×57×48cm and provided with drinking and feeding facilities made of earthenware pots re-enforced with cement to prevent tipping over and each rabbit were fed at 8.00hr and 16.00hr daily (100-120g each). Water and feed were provided *ad libitum* throughout the experimental periods. The initial weight of rabbits were determined and recorded. The rabbit weights and feed consumed were also weighed and recorded weekly. The experiment lasted for 8 weeks. Daily routine management include cleaning of cages, surrounding floor, feeding troughs and drinking troughs. The feeding troughs were emptied of leftover feed and fresh feed served each day. The drinking troughs were also emptied of the previous dirty water, thoroughly rinsed and then filled with clean, cool fresh water. Known quantities of feed were fed to the rabbits twice daily, feed intake was determined by subtracting the weight of the feed refused from feed served. Feed intake was calculated for each of the replicate on daily basis. Weight change was determined by finding the difference between initial weights and final weight at the end of the eight weeks experimental period. In addition, the feed conversion ratio was calculated by dividing the average total feed intake by average total weight gain. The proximate analysis of the diets and leaf was determined according to the AOAC [1] for crude protein, crude fibre, ether extract (fat) and ash.

2.4. Blood Sample Collection and Analysis

At the end of the feeding period, blood samples were collected from five rabbit per treatment for haematological and serum biochemistry analysis. The blood samples were collected from each rabbit from the lateral saphenous vein located in the back leg using a sterilized disposable syringe and needle between 6.30 and 7.30 am. The blood haematological parameters were analyzed using Sysmex KX-21N (automated haematological analyzer) while serum parameters were analyzed as reported by Ademola, *et al.* [10]. Data obtained were subjected to analysis of Variance (ANOVA) using IBM SPSS 21.0 statistical package, while significant differences between treatments means were separated using Duncan's Multiple Range Test option of the same software.

3. Results and Discussions

3.1. Discussions, Conclusions and Recommendations

The proximate composition of the test ingredients is presented in table 2. The table consists of average determined proximate composition of *Ipomoea asarifolia* leaf meal and value recorded by Madubuike and Ekenyem [11]. The average crude fibre percentage was 7.15, while crude protein, ash, ether extract and metabolisable energy were 28.40%, 11.00%, 7.10%, 3236.15 Kcal/Kg), respectively. The crude fibre and crude protein percent were lower compare to 16.90% and 32.00% recorded by Madubuike and Ekenyem [11]. This may be as a result the age of the plant before harvesting. Although metabolisable energy was higher (3236.16 Kcal/Kg) compare to 2760.00 Kcal/Kg reported by the same authors. The variation in the proximate composition of the test ingredient may also be because of geographical variation. This was in line with the report of Chandralega, *et al.* [12], who reported that geographic locations of the plants might enhance the types and levels of their phytocompounds production.

The productive performance of the weaner rabbits fed the various diets is presented in Table 3. All growth parameters were affected by the *Ipomoea asarifolia* leaf meal except weight gained and FCR. It was observed that T4 (30% IALM inclusion level) had the highest final weight (1.67kg) compared to others (1.50kg, 1.54kg and

1.61kg) for T1 (control), T2 (10% IALM inclusion level) and T3 (30% IALM inclusion level), respectively. This established the significant importance of IALM in the production of rabbits. Feed intake increase linearly from T1 to T3 as the energy content of the feed decreased, except in T4, where there was a slight decrease in feed intake. This trend in feed intake by the rabbits is understandable, since leaf meals contain relatively high fibre which tends to increase the total fibre content of the diet and dilute other nutrients. Rabbits must eat to meet their energy requirement to sustain rapid growth and development, hence the increased feed intake. This assertion generally agrees with the findings of other researcher [13] who reported higher feed intake with increasing level of crude fibre (CF) in the diets of rabbits. The results, however, contrast the findings of Nworgu, *et al.* [14] who reported a reduction in feed intake by rabbits on increased forage meal in the diet. The low feed intake level observed in T4 is similar to the results of Enu [4] who observed that feed utilization was low in rabbits fed 30% levels of MOLM (*Moringa oleifera* Leaf Meal) diets. This could be attributed to the low availability of energy and crude protein, arising from low digestibility of crude fibre (CF) and crude protein (CP) components of the leaves when MOLM was high in the diet. Energy, crude protein (CP) and crude fibre (CF) contents of the diet have been shown to influence feed intake and weight gain in animals Makkar and Becker [15]. Research has also shown that at higher levels of inclusion, unconventional feedstuff may alter the texture, colour, taste and odour of diets. Each of the factors above might affect feed consumption and ultimately utilization, independently or in combination [16]. Final weight gain observed to be highest in rabbits on T4 (30% IALM) diet with a final weight gain of 1.67kg compared with 1.50kg, 1.54kg and 1.61kg for T1, T2 and T3, respectively. This shows that diets containing 30% IALM produced rabbits with higher body weights and higher weight gain than rabbit in the control. This could be an indication that the diets were more nutritionally balance and easily assimilated by the rabbits and these results are in agreement with Kakengi, *et al.* [17]. Economically the farmer will save N5.71 from every 1kg feed produce to feed rabbit, therefore using nonconventional plant protein source such as *Ipomoea asarifolia* leaf meal is cheaper in rabbit production than conventional diet.

The serum components of the weaner rabbits fed various diets is shown in Table 4. All serum parameters were affected by the IALM except albumin, aspartate amino acid transaminase and alanine amino acid transaminase. The rabbits on T2 and T3 (i.e. 10% and 20% IALM inclusion level respectively) diets had cholesterol value significantly similar to control (T1) rabbits, while the rabbits on T4 (30% IALM) recorded the highest value (78.54 mg/dL), although cholesterol values were still within the recommended range according to Mitruka and Rawnsly [18]. The serum total protein levels decrease with increasing inclusion levels of *Ipomoea asarifolia* leaf meal as shown in table 4. The serum globulin level observed to decrease with increasing inclusion levels of IALM. The serum creatinine levels fall within the range of 64.37 – 95.44g/dL and rabbit on control diet had the highest value (91.00g/dL). Apart from creatinine and cholesterol levels which are in line with values provided by Mitruka and Rawnsly [18], all other serum parameters both control and treatment samples were found to be higher than range values provided by Mitruka and Rawnsly [18], but with reference to the control, the values of animals were observed to be within range of the control. This result does not agree with most researches [4, 19, 20].

The Haematological components of the weaner rabbits fed varied inclusion levels of IALM is shown in Table 5. All serum parameters were affected by the IALM except for intermediate cell count, RBC and MCV. The WBC of rabbits on control diet have similar value with T4 (30% IALM inclusion level) while T2 and T3 (10% and 20% IALM inclusion level) have slightly higher values, this follows the trend with lymphocyte count, intermediate cell count, granulocyte cell count, lymphocyte percentage, haemoglobin, haematocrit, MCHC, RDW-SD, MPV and PDW. Furthermore, platelet and PCT of rabbits on 0% IALM (control) had a lower value than T2, T3 and T4 (10%, 20% and 30% IALM inclusion level respectively), while the granulocyte cell percentage reduced with increased level of IALM. All the haematological parameters measured in the present experiment were within the normal physiological ranges reported for rabbits (haemoglobin: 8.0 – 17.5g/dl, red blood cell: 4.0 – 8.0×10^6/µl, white blood cell 5.0 – 12.0 × 10^3/dL and lymphocytes: 25.0 – 50.0% [21, 22]. Also were the mean cell volume (MCV) and mean cell haemoglobin (MCH) 58-79.6 fl and 19.2-29.5pg [18, 23, 24], The mean cell haemoglobin concentration (MCHC) 31.1 - 37.0 g/l as earlier reported [23, 24] for healthy rabbits. Red cell distribution width (RDW -CV and SD), help to understand how much red blood cells vary in size and volume. The RDW according to Fernando and Samuel [25] correlates with the degree of homogeneity/heterogeneity of erythrocyte size and is equivalent to anisocytosis- unequal red blood cells, in blood smears. High value at higher inclusion levels of test ingredients indicates healthy status of the broilers throughout the experimental periods. Madubuike and Ekenyem [11], indicated that there is evidence in literature that haematological characteristics of livestock suggest their physiological disposition to the plane of nutrition. It may then be suggested that, the different diets imposed on the rabbits were balanced in their formulation to support relatively high performance and maintain the normal haematological profile of the rabbits.

4. Conclusion

To conclude this research, it was observed that *Ipomoea asarifolia* leaf meal (IALM) could be used as a feed ingredient in rabbit production. It also shows that IALM could replace soybean meal (SBM) up to 30% in rabbit diets as a non-conventional protein source, without any deleterious effect to the serum and haematological characteristics. The inclusion of IALM in rabbit's diets also reduced the cost of feed and consequently cost of rabbit production, thus fulfilling one of the principal objectives of this trial. Thus, this reduction in cost of rabbit production is capable of boosting production and thus helping to resolve the much-orchestrated animal protein inadequacy in our society.

Recommendation

It can be recommended that, *Ipomoea asarifolia* leaf meal can be included in rabbit feed up to 30% inclusion level to replace soybean meal (SBM) in rabbit feed which is more economical and had no deleterious effect on the serum and haematological parameters in rabbit. More research is suggested to know the effect of *Ipomoea asarifolia* above 30% inclusion level in replacement of soybean meal.

Table-1. Gross Composition of Experimental Diet (g/100g)

Ingredients	T1 (0%IALM)	T2 (10%IALM)	T3 (20%IALM)	T4 (30%IALM)
Maize	19.08	19.08	19.08	19.08
PKC	15.27	15.27	15.27	15.27
Soya meal	9.54	8.59	7.63	6.68
I. asarifolia Leaf Meal	0.00	0.95	1.91	2.86
Wheat Offal	41.98	41.98	41.98	41.98
Maize bran	7.63	7.63	7.63	7.63
Bone meal	3.82	3.82	3.82	3.82
Limestone	1.91	1.91	1.91	1.91
Premix	0.38	0.38	0.38	0.38
Salt	0.38	0.38	0.38	0.38
Total	100.00	100.00	100.00	100.00
Calculated Nutrients				
Crude Protein (%)	16.65	16.46	16.28	16.09
Crude Fiber (%)	7.32	7.33	7.34	7.33
Energy (Kcal of ME/kg)	2220.69	2225.78	2230.93	2155.02

ALM = *Ipomoea asarifolia* leaf meal

Table-2. Proximate composition of *Ipomoea asarifolia* leaf meal

Nutrient	Value %*	Determined Results%
Crude fibre	16.90	7.15
Crude protein	32.00	28.40
Ash	7.10	11.00
Ether Extract	7.60	7.10
NFE	20.79	52.35
Metabolisable Energy(Kcal/kg)	2760.00	3236.15

*Madubuike and Ekenyem, 2006

Table-3. Growth performance of rabbits fed *Ipomoea asarifolia* leaf meal

Parameters (kg)	T1 (0% IA)	T2 (10% IA)	T3 (20%IA)	T4 (IA30%)	SEM
Initial Weight	0.53	0.49	0.54	0.55	-
Final Weight	1.50[b]	1.54[b]	1.61[b]	1.67[a]	0.02
Weight Gained	1.00	1.06	1.03	1.04	0.01
Feed Intake	4.30[b]	4.42[b]	4.92[a]	4.69[a]	0.08
Bled Weight	1.45[c]	1.47[bc]	1.61[a]	1.57[ab]	0.02
Eviscerated Weight	1.04[c]	1.13[b]	1.15[b]	1.26[a]	0.02
FCR	2.87	2.88	2.92	2.92	0.02
Price per Kg feed (N)	82.94[a]	81.37[ab]	79.77[b]	78.20[c]	0.91
Price per kg wt gain (N)	238.04[a]	234.34[b]	232.92[b]	228.34[c]	1.24

Where IA= *Ipomoea asarifolia* leaf meal

Table-4. Serum components of rabbits fed *Ipomoea asarifolia* based diets

Parameters	T1 (0%IA)	T2(10%IA)	T3(20% IA)	T4 (30% IA)	SEM
Cholesterol (mg/dL)	50.40[b]	57.54[ab]	52.08[b]	78.54[a]	4.47
AST (IU/L)	127.37	122.87	134.98	132.63	5.13
ALT (IU/L)	18.28	29.70	16.21	25.83	2.36
Total protein (g/dL)	9.27[a]	9.92[a]	8.04[b]	6.74[c]	0.30
Albumin (g/dL)	2.06	2.19	2.37	2.14	0.03
Globulin (g/dL)	7.22[a]	7.68[a]	5.68[b]	4.60[c]	0.29
Creatinine (mg/dL)	91.00[a]	64.37[b]	89.89[a]	90.44[a]	3.66

Where IA= *Ipomoea asarifolia* leaf meal, AST= Aspartate aminotransferase, ALT = Alanine aminotransferase

Table-5. Haematological components of rabbits fed *Ipomoea asarifolia* based diets

Parameters	T1 (0%IA)	T2 (10% IA)	T3 (20% IA)	T4 (30% IA)	SEM
Haematocrit (%)	32.95[b]	42.25[a]	40.15[ab]	32.70[b]	1.58
Heamoglobin (g/dL)	10.20[b]	13.25[a]	12.40[ab]	9.85[b]	0.53
RBC (10^6µL)	4.45	5.50	5.51	4.40	0.21
WBC(10^3µL)	5.10[b]	7.80[b]	11.60[a]	5.35[b]	0.72
Lymphocyte count (%)	2.30[b]	3.05[b]	5.70[a]	3.05[b]	0.35
Intermediatecell count (%)	0.30	0.55	0.90	0.50	0.72
Granulocyte cell count (%)	1.50[b]	2.45[ab]	3.95[a]	0.80[b]	0.38
Lymphocyte (%)	53.25[b]	56.25[b]	56.70[b]	73.95[a]	2.26
Intermediate cell (%)	7.70	7.70	10.10	9.85	0.71
Granulocyte cell (%)	39.10[a]	36.05[a]	33.20[a]	16.20[b]	2.60
MCV (fL)	74.55	76.50	78.00	75.00	0.69
MCH (pg)	22.85[b]	24.10[a]	24.20[a]	22.30[b]	0.22
MCHC (g/L)	30.75[ab]	31.40[a]	30.95[ab]	29.80[b]	0.23
RDW-CV (fL)	17.45[c]	18.30[bc]	18.90[b]	20.75[a]	0.28
RDW-SD (fL)	8.95[b]	11.70[a]	12.15[a]	11.25[a]	0.29
Platelet	13.03[c]	312.50[a]	260.00[ab]	156.33[b]	30.67
MPV (fL)	8.85[b]	10.10[a]	10.35[a]	8.80[b]	0.17
PDW (%)	31.60[b]	35.70[a]	35.70[a]	32.45[b]	0.44
PCT (%)	0.02[c]	0.31[a]	0.27[a]	0.14[b]	0.03

Where IA= *Ipomoea asarifolia* leaf meal, MCH = Mean corpuscular heamoglobin (pg), MCHC = Mean corpuscular heamoglobin concentration (g/L), MCV = Mean corpuscular volume (fL), MPV = Mean platelet volume (fL), RCD –CV = Red cell distribution width –CV (%), RCD –SD = Red cell distribution width –SD (fL), RBC = Red blood cell count (10^9/L), WBC = White blood cell count (10^9/L), PDW = Platelet distribution width (%), PCT = Plateletcrit (%), RBC = Red blood cell count, WBC = White blood cell count

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