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Biological and Carcass Characteristics of Rabbits Fed Delonix Regia Meal Diets

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Abstract

Forty (40) weaner rabbits with an average weight of 390-590 g obtained from College of Agriculture and Science Mando, Kaduna State were assigned to eight (8) dietary treatments such that their ages, sizes and group weights were balanced as much as possible. The animals were allowed to adjust to the test diets and cages for 7 days before the start of the experiment. During the period of acclimatization, the rabbits were dewormed with Ivermatin injection. Each of the treatments contained five (5) rabbits in a Completely Randomised Design (CRD). All cages were supplied with feeders and drinkers. The study lasted 63 days.

The diets were formulated to contain 18% crude proteins and fortified with minerals and vitamin premix in accordance with NRC nutrient requirements for rabbits. Proximate analysis and carcass characteristics of weaner rabbits fed *Delonix regia* meals were determined. So also feed intake, efficiency and cost per kg live weight were calculated using the prevailing market price of that season. The result showed that both the duration of cooking and the level of inclusion had a significant ($P<0.05$) effect on the proximate composition of *Delonix regia* seeds. However, above 60 minutes of cooking, the level of protein in the seed reduced. The result of the carcass evaluation showed that the slaughter weight of rabbits increased as the concentration of *Delonix regia* increased in their diets. Rabbit fed 40% *Delonix regia* had the highest carcass weight of 496.67g.

Keywords: Delonix regia; Carcass; Determination; Meal diets

Introduction

Efforts are being made by animal nutritionists to explore the possibilities of incorporating unconventional proteins feed stuffs in rabbits feed in order to reduce the cost of feed and maximize the return to rabbitary. Esonu et al. [1] *Delonix regia* seed had been found to contain crude protein 20.50%, ether extract 4.18 – 4.23% and crude fibre 4.45-6.84% [2]. The continued increase in cost of conventional feeding ingredients especially grains, cakes and meals and the effective competition from both the poultry industry and human population are a major constraints for progressive growth of the rabbitary industry in Nigeria.

One of the methods that have been utilized for some time now in alleviating this problem is the replacement of a percentage of grains and cakes in rabbitary diets with agro-industry by products however, the present trend in the annual increase in the cost of feed products coupled with the increasing attention on their utilization by the confectionary and baking industry has necessitated the need to conduct investigation into the utilization of unconventional feeding stuffs for livestock, that is free of competition from other industries. One promising material is *Delonix regia* seeds. This study was meant to evaluate proximate and carcass characteristics of rabbits fed *Delonix regia* and cost benefit of using *Delonix regia* as an alternative to Ground nut.

Material and Methods

Processing of *Delonix regia* seeds

The seeds were collected from Ahmadu Bello University Zaria, Basawa and Palladan areas of Sabon Gari Local Government Area of Kaduna State. Large quantities of the pods were collected and soaked in a pool of water batch by batch for 3 days to ensure splitting of pods, since *Delonix regia* seeds are dispersed by explosive mechanism. The seeds were sun-dried for two days and 200 kilograms of the seeds were ground and included in the formulation of the ration.

To process the seeds, batches of 3 kg of *Delonix regia* seeds were subjected to various duration of cooking, namely: 0, 15, 30, 45, 60, 75 and 90 minutes, respectively, each duration of cooking represented a treatment. For each cooking time, 15 litres of water were brought to boiling point (100°C) in a 20 litres aluminium pot and the seeds were poured into the boiling water. The specified time for boiling was taken. At the end of each boiling, the water was drained-off. The seeds were washed with tap water and sun-dried for four (4) days, and milled in a hammer mill.

The milled samples of *Delonix regia* seeds were oven dried and used for each sample analysis. The analyses for each sample were done in triplicate. The Dry Matter (DM) content was determined based on the weight loss after 24 hrs in an oven at 100°C [3]. Nitrogen (N) content was determined by the Micro-Kedahl method of AOAC [3] and Crude Protein (CP) calculated as $N \times 6.23$. The ash content was determined as the residue remaining after incinerating the sample at 600°C for 3 hrs in a muffle furnace. The AOAC [3] methods were employed for the Ether Extracts (EE) and Crude Fibre (CF) determinations.

Chemical analysis

The chemical compositions of the seeds were determined using the methods of the Association of Official Analytical Chemist AOAC [3] in Department of Animal Science Ahmadu Bello University. The chemical components analysed were moisture content, ash, lipid, crude protein, crude fibre, and amino acids. These were determined in triplicates - with the help of the Chief Technologist.

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Determination of moisture content and dry matter

The weighed samples were labeled and placed in pre-weighed crucibles. The samples in crucibles were oven dried in Gallen Kemp hotbox humidity-oven model OV-620 at 105°C for forty eight hours. The weights were taken at intervals of six hours after the first twenty four hours. The samples were dried and cooked in air-tight desiccators and later weighed directly on electronic meter balance. The samples were dried until constant weights were obtained. The moisture content was obtained from the weight loss of the fresh sample

Wt of crucible with fresh sample - wt of crucible with dry sample = moisture content

Dry Matter Weight = constant weight after drying

$$\% \text{ Dry Matter} = \frac{\text{Dried sample wtx 100}}{\text{Fresh sample wt}}$$

$$\% \text{ Moisture Content} = \frac{\text{Wt of } H_2O \text{ wt} \quad \text{x 100}}{\text{Fresh sample wt}}$$

Where wt = weight

Determination of ash

Each dry sample was ground into a homogenous powder with laboratory electric grinder (Glen Creston) and transferred into labeled sample bottles for further chemical analysis. 1.5 grams was removed from each of the homogenous sample powder labeled and placed in a pre-weighed procelain crucible. The crucibles and their contents were ignited in an ashing Carbolite (QLM) Muffle furnace maintained at 600°C for twenty four hours. The white ash obtained was then cooled in the oven to 100°C and later transferred to a desiccator and cooled further for another twelve hours. The crucibles and contents were then weighed. The heating, cooling and weighing were repeated at four hours intervals until no further changes in colour and weight occurred. The percentage ash content was estimated.

$$\%\text{Ash} = \frac{\text{Weight of Ash x100}}{\text{wt of sample powder taken}}$$

Total organic matter

The Total Organic Matter (TOM) was determined by the procedures of AOAC [3]. The percentage of the Total Organic Matter in the seed samples was determined by subtracting the ash weight from the dry sample weight then dividing organic matter weight by dry sample weight multiply by 100. Organic matter consists of fats, protein and carbohydrates.

$$\text{TOM} = \frac{\text{Wt of dry matter} - \text{Ash x 100}}{\text{Wt of dry matter}}$$

Determination of lipid content (Soxhlet Continuous Method)

The lipid content was determined using the Soxhlet Continuous Extraction method of AOAC [3]. From each sample 5 grams was put into a known weighed extraction thimble and weighed. The thimble was plugged with fat free cotton wool and the contents were placed in the central syphon portion or extractor of the Soxhlet apparatus. A 250 ml ground glass-joint flask was weighed and 40ml of analytical grade (60-80°C) Diethyl ether plus 40ml analytical grade Petroleum Ether were poured into the flask. The flask was connected to the Soxhlet syphon and condenser with the flask sitting in the heating mantle. The mantle was then connected to the electric supply and heating was slowly increased until the solvent boiled.

The vapour of the boiling solvent which condensed in the Soxhlet syphon where the sample was placed and the lipid was dissolved. At a certain level, the solvent with the dissolved lipid ran back into the 250cml ground - glass-joint flask. The heating and the extraction was continued for 8 hrs. At the end of the 8 hrs, the thimble was removed and placed in an oven at 105°C for 3 hrs distillation. The glass flask was cooled in the desiccators and weighed. The flask and the content were replaced in the oven for another 30 minutes and reweighed. This was repeated until a constant weight was obtained. The increase in weight of the flask was taken as me weight of the lipid or crude fat extracted.

$$\% \text{ lipid or crude fat} = \frac{\text{Weight loss of sample}}{\text{Weight of sample}}$$

The defatted material was preserved for protein analysis.

Determination of crude fibre

1.5 grams of sample powder was transferred to a Soxhlet apparatus and extracted with petroleum ether and diethyl as in the Soxhlet continuous extraction process. The extracted sample was air dried and transferred into dry 1000 ml conical flask. 200 ml boiled 0.255 N sulphuric acid was added. The content of the flash was boiled gently for half an hour with me flask rotated to mix the content and remove particles from me sides. A Buchner funnel fitted with a perforated plate covered with filter paper was prepared. Boiling water was poured into the funnel and allowed to remain until the funnel was hot. The water was then drained by suction.

At the end of half an hour boiling period, the acid mixture was allowed to stand for one minute and then poured immediately into a shallow layer of hot water under gentle suction in the prepared funnel. Suction was adjusted so mat the bulk of me 200 ml was completed within 10 minutes. The insoluble matter was washed with boiling water until the washings were free from acid, then the insoluble matter was washed back into the original flask by means of a wash bottle containing 200 ml of 0.313 N sodium hydroxide solution measured at ordinary temperature and brought to boiling point The boiling was continued for half an hour after which the mixture was allowed to stand for one minute and then filtered immediately through a whatman No. 1 filter paper.

All the insoluble materials were transferred to the filter paper and washed first with boiling water men with one percent hydrochloric acid and finally with boiling water until free from acid. The washing was continued twice with alcohol and three times with ether. The insoluble matter was then transferred to a dry, weighed ash less filter paper and dried at 100°C to a constant weight. The paper and content were incinerated to an ash at a dull red heat. The weight of the ash was subtracted from the increase of weight on the paper due to the insoluble matter. The difference was reported as the fibre content.

$$\% \text{ crude fibre} = \frac{\text{Y} - \text{X x 100}}{\text{Z}}$$

Where X = weight of the ashless filter paper,

Y = weight of Ash after incinerating

Z = weight of powdered sample

Determination of crude protein

0.5 grams of each sample powder was accurately weighed on a filter paper. The filter paper and samples were transferred into small kjehdahl flask containing 0.8 g of catalyst mixture and anti bumping granules.

To another flask 0.165 grams of glycine was added as standard. 10ml of concentrated sulphuric acid was added to each of the flasks. The flasks were warmed gently at first to minimize frothing then fee heat was increased until the solution was cleared.

Digestion was carried out for six hours. Boiling was continued for a further 30 minutes, after which the solution were allowed to cool. The content of the flask was transferred into 1000ml volumetric flask and the volume made up to 100ml mark with distilled water.

Distillation: The contents of the flasks were transferred into the distillation apparatus. A receiving flask was set up containing approximately 25ml of boric acid and 4 drops of screened methyl red. The digest was made alkaline by addition of 40% sodium hydroxide solution. The mixture was distilled for 40 minutes. Care was taken to ensure that ammonia did not escape into the atmosphere. The ammonia was boiled over into the receiving flask.

Titration: The distillate was titrated with 0.IN sulphuric acid. This was reported for all samples.

Calculations: The percentage crude protein was calculated as percentage Nitrogen (%N) x 6.25. The (%N) was calculated as follows: $NH_3 + H_2SO_4$ NH_4SO_3 = 1 ml of H_2S0_4 =1 ml of 0.02 m Nitrogen (N) = 0.00028gN.

$$\% \text{ Crude protein} = \frac{M \times 0.014 \times D \times T \times 6.25 \times 100}{W \times L}$$

Where:

M = Molarity of acid.

0.014 = Nitrogen content per 100ml

D = Dilution factor

6.25 = Protein conversion factor (1 mg nitrogen = 6.25 Protein)

W = Weight of sample powder

L = Volume of liquor distillate

Determination of calorific values: Conversion factors as described by Winberg (2010) were used to derive calorific values as follows:

- % carbohydrate was multiplied by 4.0 K cal/100 grams
- % Lipid (Fat) was multiplied by 9.0 K cal/l00 grams
- % Protein was multiplied by 4.0 K cal/l00 grams

All the three values were added to give calorific value for each sample.

The data obtained from this study were subjected to the analysis of variance and where statistical significance difference were observed, the means were compared using the Duncan's Multiple Range Test according to SAS [4].

Results and Discussion

Delonix regia is a Greek word meaning conspicuously clawed petals. Leaflets are less than 12 mm long, very numerous flowers with long stalks. Leaflets are opposite. Flowers are conspicuous and scarlet. This handsome ornamental tree is known as the flame of the forest in Nigeria. It is a fast growing tree usually with very wide spreading branches producing a broad flat of crown. The flowers are borne short and upright terminal racemes'. There are 5 large scarlet petals with one mottle red and white.

There are 10 free stamens, the fruits are large flat pods up to about 60-70 cm long by 5-8 cm broad almost black when ripe, hard and woody hanging conspicuously for a long time on the and eventually split open there are numerous elongated seeds about 2.5 cm long arranged lengthwise across the pods. The tree is widely cultivated and self sown throughout the tropics, a very rare native of Madagascar. The result of the proximate analysis is presented in Table 1 while Table 2 is the performance of rabbit fed *Delonix regia* seed meal. Table 3 showed the result of carcass evaluation.

The result showed that the slaughter weight of rabbit increased as the concentration of *Delonix regia* increased in their diets. Rabbits fed

Parameters	0	10%	20%	30%	40%	50%
Dry Matter (%)	93.89	93.89	93.99	94.23	93.50	94.59
Crude Protein (%)	20.16	20.47	20.54	20.72	21.35	20.50
Crude Fibre (%)	4.18	6.84	9.77	6.71	7.74	4.23
Ether Extract (%)	5.99	5.54	6.34	6.39	6.39	6.45
Ash (%)	4.96	6.88	6.36	5.08	5.98	5.28
Nitrogen Free Extract (%)	63.93	60.28	57.00	61.18	58.56	63.54

Table 1: Proximate Analyses of Experimental Diets Containing Graded Levels of Cooked Delonix regia Seeds at 100˚c for 60 minutes.

	Duration of cooking									
	Control	0 min	15 min.	30 min.	45 min.	60 min.	75 min	90 min	SEM	LOS
Initial Weight	390	570	390	440	430	530	500	520	25.045	NS
Final Weight Gain (G)	960	1040	720	664	750	1150	1040	1020	86.961	NS
Average Daily Feed Intake (G)	37.78^{a}	33.22^{bcd}	37.00^{de}	30.88^{e}	46.14^{bcd}	52.29^{ab}	40.70^{cde}	49.96^{abc}	3.544	*
Average Daily Weight Gain (G)	21.15^{a}	18.82^{a}	11.75^{c}	12.76^{bc}	18.97^{a}	17.44^{abc}	15.78^{abc}	17.85^{ab}	1.882	*
Feed Efficiency (G)	2.79^{ab}	3.32^{b}	3.30^{a}	2.45^{b}	2.44^{b}	2.27^{d}	2.85^{ab}	2.81^{ab}	0.230	*
Cost/Live-Weight (₦)	70.18^{a}	42.37^{c}	60.23^{ab}	44.74^{bc}	44.41^{bc}	59.68^{ab}	51.99^{bc}	51.23^{bc}	7.715	*
Mortality (%)	10	10	10	10	20	0	0	10		

Figures followed by the same letter(s) in each row are not significantly different (P< 0.05) using DMRT
SEM: Standard error of means
* LOS: Level of Significance
*: Significant (P 0< 0.05)
NS: Non-significant difference

Table 2: The Effect of Cooking Delonix Regia Seeds on the Performance of Weaner Rabbits Duration (in minutes).

Parameter /organ	0	10	20	30	40	50	SEM	LOS
Pre-slaughter Weight (g)	926.9	960.0	1166.7	1153.3	1133.3	1100.0	7.91	NS
Carcass Weight (g)	383.33	383.33	470.00	493.33	496.67	433.33	2.90	NS
Dressing Percentage (%)	41.36	39.93	40.28	43.00	43.83	39.39	1.64	NS
Small Intestine (cm)	310.00 ab	296.67 ab	336.67 a	276.67 ab	312.67 ab	316.67ab	1.05	*
Large Intestine (cm)	78.00 a	86.67 ab	76.67 b	94.67 a	77.33 b	88.33 ab	3.56	*
Heart (g)	0.55 a	0.63 a	2.81 a	3.18 a	2.56 a	2.74 a	0.24	*
Lungs (g)	6.09	3.04	13.33	15.00	15	10.00	2.04	NS
Liver (g)	11.30 a	9.57 a	40.00 a	36.67 a	33.33 a	30.00 a	3.04	*
Kidney (g)	2.14	2.54	9.77	9.59	10.28	7.78	0.51	NS
Stomach (g)	16.52	17.39	66.67	93.33	80.00	70.00	9.62	NS
Intestine (g)	49.57	48.70	216.67	180.00	190.33	186.67	1.84	NS
Head (g)	23.13	20.87	106.67	106.67	100.00	86.67	6.42	NS
Skin (g)	20.87	16.52	96.67	93.33	91.67	76.67	8.73	NS
Feet (g)	13.04	11.30	50.00	50.00	46.67	50.00	1.36	NS
Tail (g)	3.04	2.61	11.67	11.67	10.00	10.00	0.83	NS
Shoulder (g)	36.52	34.78	176.67	11.67	10.00	10.00	2.03	NS
Loin (g)	21.74	17.39	110.00	113.33	93.33	90.00	1.27	NS
Thigh (g)	34.78	36.52	176.67	173.67	176.67	150.00	1.81	NS

Figures followed by the same letter(s) in each row are not significantly different (P< 0.05) using DMRT
SEM: Standard error of means
* LOS: Level of significance
*: Significant (P 0< 0.05)
NS: Non-significant difference

Table 3: Carcass characteristics of weaner rabbits fed varying levels Delonix regia seeds Diets.

on 40% *Delonix regia* seed diets had the highest. The carcass weight of (476.67 g) fell below the value obtained by Memieth et al. [5], who reported a dressing percentage of 50.7 – 58.5%. The lower value reported here were due to the removal of skin, head and legs, which is the standard value reported in Europe and United State of America [6]. Similarly, rabbits feed with 40% *Delonix regia* seeds had the higher dressing percentage (43.73) compared to those feed 50% *Delonix regia* seeds with 39.12kg both duration of cooking and level of inclusion of *Delonix regia* seeds had no effect on the lengths of small and large intestines.

There was no significant difference (P>0.05) in the length of small and large intestines of rabbits fed at various levels. The level of inclusion of *Delonix regia* seeds in the diet had no significant (P>0.05) effect on the hearts of rabbits fed at various levels. The lung yield was affected by the level of inclusion. However there was no significant difference (P>0.05) in the raw and cooked seed diet. Percentage kidney yield was affected by the level of inclusion up to (40%). The skin, limbs and toe showed no significant difference (P>0.05) across dietary treatments. So also is the shoulder, groin and the thigh had no significant difference (P>0.05) across dietary treatment. The dressing percentage on the average was (41.11%) this fell below the value obtained by Memieth et al. [5] who report a dressing percentage of 50.7-58.5 g depending on grades, while Szendro et al. [7], indicated a carcass yield of 56%.

Animals with good meat character have higher dressing percentage than thin animals [8]. Also, carcass yield has been shown to be an indication of good quality and utilization of the ration [9]. This diets did not have any significant (P>0.05) influence on the relative weight of organs Abdulmalik [10] and Dale-Zolle [11] reported similar effects. The purpose of research into non-conventional feed sources (NCFS) such as *Delonix regia* in monogastric diets was to reduce feed cost. With the discovery of lesser expensive non conventional ingredients like *Delonix regia* seeds can bring about 50% reduction in cost of feed using graded levels of *Delonix regia* in place of groundnut cakes (GNC) may be obtained in rabbit production. The cost of producing a unit weight gain in the rabbits decreased with increased level of *Delonix regia* seeds in the diets.

Conclusion

The results obtained from the proximate and carcass analysis can be concluded that both duration of cooking and level of inclusion has no significant difference (P>0.05) and from the carcass analysis, *Delonix regia* seeds can be utilized for ration formulation.

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