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INTAKE, NUTRIENT DIGESTIBILITY AND WEIGHT GAIN IN WEST AFRICAN DWARF BUCKS FED *DELONIX REGIA* (FLAMBOYANT) SEED MEAL

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ABSTRACT

Sixteen West African dwarf bucks aged between 7 and 8 months with an average weight of 6.95kg were used to ascertain the effect of level of replacement (0, 25, 75, 100%) of soybean meal with *Delonix regia* seed meal on growth performance, nutrient intake and nutrient digestibility. The bucks were randomly assigned to four treatments, with four bucks per treatment in a completely randomized design. No significant ($p<0.05$) difference was observed in dry matter intake and crude protein intake across the dietary treatments. Dry matter intake ranged from 176.87 in T1 to 208.53g/day in T4. Crude protein intake ranged from 30.41 in T2 to 31.80g/day in T4. The crude fibre, ether extract and ash intakes were significant and followed similar pattern with crude protein. Significant difference ($p<0.05$) was observed in all the growth performance measured parameters across the treatments. Average daily weight gain of 30.71-78.10g/day was recorded with T3 recording the highest. Significant differences ($p<0.05$) were observed in all the digestibility parameters measured except for dry matter. Crude protein digestibility ranged from 76.50% in T4 to 84.89% in T3. Crude fibre digestibility ranged from 57.51% to 70.25% with T3 having the highest. It can be concluded from the results of this study that replacement of *Delonix regia* seed meal at 75% had no adverse effect on intake, nutrient digestibility and weight gain in West African dwarf bucks.

Keywords: West African dwarf goat, *Delonix regia*, *Dry matter* Intake, Nutrient digestibility, Nitrogen balance

INTRODUCTION

The small ruminant species is made up of the sheep, goat, llama and alpacas. These animals are so described as a result of their physiology of feed digestion and comparative small body size compared to buffalo and cattle (Adeloye, 1998). Goats are classified as an important small ruminant on account of their unique ability to adapt and maintain themselves in harsh environment. They are considered superior to other ruminant species in their utilization of poor quality and high fibre feeds (Oyeyemi and Akusu, 2005). Nsahlai *et al.* (1998) reported poor nutrition as one of the main problems of livestock productivity in many parts of Nigeria. However, due to high cost, most smallholder livestock farmers cannot afford to supplement the diet of their animals with highly expensive feed ingredients (Rumirez-Orduna, 2005). One possible way to alleviate poor nutrition challenge is to feed crop residues and leaves which can be utilized by ruminants because of the complexity of the stomach. This will thus reduce the cost of production without a decrease in productivity (Odeyinka, 2001). *Delonix regia* is a wild leguminous plant which produces 25-40cm long pods containing seed which laboratory analysis has reported to contain crude protein of 36.92%, crude lipid 4.17% and crude fiber 11.39% (Grant *et al*., 1991).

The objectives of this study is to determine the dry matter intake, nutrient digestibility, weight

gain and nitrogen balance of west African dwarf goat fed flamboyant seed meal.

MATERIALS AND METHODS

Experimental Site

The Experiment was conducted at the Small Ruminant Section of the Teaching and Research Farm, University of Ilorin, Kwara State, Nigeria. Ilorin is located between latitude 8.4799ºN and longitude 4.5418ºE with an altitude of 290m above sea level (GPS, 2015).

Sources and Preparation of Ingredients

Flamboyant plant pods were collected within the University of Ilorin main campus. The pods were allowed to dry and the seeds removed manually by opening the pods and ground to a seed meal powder using a hammer milling machine.

Experimental Diet and Design

- T_1 contained 0% ***Delonix regia*** seed meal.
- T_2 was fed with ***Delonix regia*** seed meal to replace 50% soyabean meal.
- T_3 was fed with ***Delonix regia*** seed meal to replace 75% soyabean meal.
- T_4 was fed with ***Delonix regia*** seed meal to replace 100% soyabean meal.

The goats were randomly assigned to four treatments (T_1-T_4) with 4 goats per treatment each serving as replicate in a completely randomized design.

Animals and Management

Sixteen (16) West Africa dwarf bucks between the age of 7-8 months with average weight of 6.95kg were used for the experiment. The animals on arrival were first housed in an open shed and provided with feeds and vitamins incorporated in water which served as an anti-stress to the animal. The animals were later treated using ivermectin injection subcutaneously at 200µg/kg body weight against ecto and endo parasite. The animals were also injected intra-muscularly with Tetranor 20 L.A Oxytetracyline.

Table 1: The Ingredient Composition of Diets (%) fed to West African dwarf bucks

Parameters		**Level of *Delonix regia* seed meal inclusion (%)**		
Ingredients(%)	T1(0%)	T2(50%)	T3(75%)	T4(100%)
Cassava Peels	50.00	45.50	47.00	46.00
SBM	30.00	15.00	7.50	0.00
DSM	0.00	23.57	35.36	47.14
Rice bran	19.00	15.43	13.14	11.86
Bone meal	0.5	0.5	0.5	0.5
Table Salt	0.5	0.5	0.5	0.5
Total	100	100	100	100

SBM=Soybean meal DSM= *Delonix regia* seed meal

Growth and Metabolism Trials

Concentrate diet was offered every morning by 8:00am at 3% animal's body weight. Fresh clean water was provided *ad-libitum*. The growth trial lasted for a period of 42 days with 7 days adjustment period. Measurements were taken daily for feed intake before feeding each morning throughout the growth trial. The body weight of the bucks was also measured and recorded fortnightly using spring balance.

At the end of the growth trial, the animal were adjusted for 7 days and housed in individual metabolism crates, ideal for easy collection of urine and faeces as described by Osuji *et al.* (1993). Faecal and urinary samples were collected from each animal seven days before the experiment was terminated. Total faeces produced by each buck within 24hours was weighed and 10% collected for seven days and oven dried at 65˚C. 10g of the dried faecal sample was preserved, mixed and ground and sub sampled for dry matter determination and chemical analyses (AOAC 2000). Daily urine output was collected in a plastic container containing 0.1N H_2SO_4 placed under metabolic crates, 10% of the daily urine output was collected from each bucks and stored in the refrigerator. At the end of the 7-day collection period, 10% of the urine taken from each buck was bulked and sub sampled and stored in the refrigerator for nitrogen determination.

Chemical and Statistical Analysis

The feeds and faecal samples were analyzed for Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fibre (CF), and Ash using the procedures outlined by the Association of Official Analytical Chemists (AOAC 2005). Urine N was determined using Micro Kjeldal method (AOAC 2005).

Data were subjected to Analysis of Variance (ANOVA) of a completely randomized design (Steel and Torrie, 1980). Significant differences between tretament means were determined using the Duncan multiple range test (Duncan, 1955).

RESULTS AND DISCUSSSIONS

The result of the chemical composition of the feed ingredients and experimental diets are presented in Table 2. The dry matter and nutrient composition of all the treatments were comparable. The crude protein, ether extract and ash tended to decrease with the level of replacement of soybean meal with *D.regia* seed meal while the dry matter, nitrogen free extract and energy appeared to increase. The proximate composition of *Delonix regia* seed meal in this study revealed dry matter of 90.24%, crude protein content of 28.00%, ash of 11.1%, crude fat of 2.0% and crude fibre of 13.59%. This was closer to 25.11% crude protein value reported by Gabriel *et al.* (2014) but differed from the value of 36.92% crude protein, crude fat 4.17% and crude fiber 11.39% reported by Grant *et al.* (1991). The differences might be attributed to differences in environmental conditions such as soil types, harvesting time, seed age, location and the processing conditions. The National Research Council (NRC, 1981) had recommended a range of 11-13.0% crude protein for maintenance and adequate growth of goat.

Table 2: Proximate compositions of concentrate diets and feed ingredients

Parameters	T1	T2	T3	T4	*D.regia* seed
Dry matter	94.58	95.58	95.19	94.04	90.24
Crude protein	17.5	16.26	15.90	15.25	28.00
Crude fibre	13.78	13.90	14.96	14.20	13.59
Ether extract	3.11	2.91	2.12	2.03	2.0
NFE	49.27	53.51	53.50	54.51	35.58
Ash	10.92	9.00	8.82	8.02	11.1
Energy(kcal/kg)	2103.48	2391.14	2535.76	2678.79	

NFE=Nitrogen free extract

Table 3: Performance of West African Dwarf Bucks fed *Delonix regia* seed meal inclusion

Parameters(kg)	T1	T2	T3	T4	SEM
Total feed intake	7.87^{d}	8.37^{c}	8.75^{b}	9.50^{a}	0.06
AFI (g/d)	187.38^{d}	199.28^{c}	208.33^{b}	226.19^{a}	1.54
Initial weight	6.25^{b}	6.63^{b}	7.70^{a}	7.23^{ab}	0.48
Final weight	7.54^{c}	9.08^{b}	10.98^{a}	9.05^{b}	0.47
Total weight gain	1.29^{d}	2.45^{b}	3.28^{a}	1.83^{c}	0.22
AWG(g/d)	30.71^{d}	58.33^{b}	78.10^{a}	43.57^{c}	5.2
FCR	6.10^{d}	3.42^{b}	2.67^{a}	5.19^{c}	0.04

^{a,b,c,d,e,}=Mean values with different superscripts within a row differ significantly ($p<0.05$) SEM standard error of mean, AFI=Average feed intake, AWG=Average weight gain FCR=Feed conversion ratio

Table 3 shows the result of performance of West African Dwarf Bucks fed *Delonix regia* seed meal inclusion. Significant difference ($p<0.05$) was observed in all the measured parameters across the treatments. The average feed intake ranged between 190-230g/day with T4 inclusion level having the highest. This range of average body weight gain was in consonance with the value (171-286g/d) reported by Adeloye *et al* (2006). However, the values obtained were not in line with 260.32-296.16g/d reported by Okafor (2012). At the end of the growth trial, the initial live weight of the bucks on T1, T2, T3 and T4 were improved by 1.29, 2.45, 3.28, and 1.83kg respectively and the average weight gain increased across treatment from 30.71 to 78.10g/d. FCR ranged between 2.67-6.10. The best FCR (2.67) was obtained at 75% inclusion level. Daily weight gain was not in line with Okafor (2012) and Adeloye *et al*. (2006). Difference in the value obtained in this study might be due to season of the experiment, experimental diets, age, span of experiment and individual differences of the bucks.

Table 4: Nutrient intake and Digestibility of West African Dwarf Bucks fed *Delonix regia* seed meal inclusion.

Parameters	T1	T2	T3	T4	SEM
DMIntake (g/day)	176.87	187.07	197.01	208.53	2.76
DMDigestibility (%)	62.43	71.49	66.75	68.25	
CP Intake (g/day)	30.95	30.41	31.32	31.80	0.43
CP Digestibility (%)	76.50^{a}	82.49^{b}	84.89^{b}	79.65^{b}	
CF Intake (g/day)	24.37^{a}	26.03^{b}	29.47^{c}	29.67^{c}	0.40
CF Digestibility (%)	57.51^{a}	69.17^{b}	70.25^{b}	62.23^{ab}	
EE Intake (g/day)	5.50^{b}	5.44^{b}	4.35^{a}	4.23^{a}	0.06
EE Digestibility (%)	75.67^{b}	68.34^{b}	58.48^{a}	55.22^{a}	
Ash(g/day)	19.31^{b}	16.84^{a}	16.84^{a}	16.72^{a}	0.24
Ash digestibility (%)	62.53^{ab}	57.99^{ab}	60.98^{b}	52.36^{a}	

^{a,b,c}=Means on the same row with different subscript are significantly different ($p<0.05$) CF=Crude fibre CP=Crude protein EE=Ether Extract DM=Dry Matter SEM=Standard error of means.

Table 4 shows the result of nutrient intake and digestibility of West African Dwarf Bucks fed *k* seed meal. Dry matter intake and digestibility showed no significance difference ($p>0.05$). Dry matter intake of all the diets was relatively high with animals on T4 having the highest dry matter intake of 208.53g/day and animals on T1 (control) having the lowest intake of 176.87g/day. The high dry matter intake indicated that flamboyant seed meal was more palatable and acceptable to goat as feed. Dry matter intake (DMI) is an important factor in the utilization of feed by ruminants and is a critical determinant of energy intake and performance (Devendra, 1997). The result obtained in this study showed that supplementation with flamboyant seed meal increased voluntary feed intake. The dry matter digestibility showed that all the diets could be considered as ruminant diets in line with the report of Preston (1986) that for any feedstuff or ration to be considered as ruminant feed, it should have a dry matter digestibility coefficient of 40-50 %.

Crude protein and crude fibre digestibility was significantly ($P<0.05$) different among treatment means. Animals on treatment 4 had the highest crude protein intake of 31.80g/day while animals on treatment 2 had the lowest

value of 30.41g/day. Highest crude protein digestibility of 84.89% was recorded in treatment 3. The crude protein intake was above the recommended range of 7.0-8.0g/100g dry matter for efficient functioning of rumen reported by Van soest (1994) and Norton (1994). This submission agrees with the speculation of Giri *et al*. (2000) that digestibility of nutrient varies with nutrient composition of feedstuffs. Treatment 4 recorded highest crude fibre intake of 31.80g/day in comparison with lowest value of 24.37g/day recorded by the control. T3 had the highest digestibility of 70.25%. Adeloye (1998) reported that crude fibre and crude protein of composite diet determine the digestibility of feed. In sheep and goat, fiber is useful for maintaining bulk, motility and an increase in intestinal peristalsis by surface extension of the food in the intestinal tract (Mathenge, 1997).

CONCLUSION

The inclusion of *Delonix regia* seed meal as total replacement for soybean meals had positive effect on performance and nutrient digestibility. Bucks fed 75% (T3) had highest nutrient intake, feed intake, weight gain, FCR and nutrient digestibility. However, *Delonix regia* seed meal can be included up to 100% without adverse effect on nutrient intake and digestibility in West African dwarf goat.

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