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Levels of antinutrients and feeding value of *Ficus polita* with ensiled corncob-layer litter diet fed to Yankasa rams in a total mixed ration

***Chukwu, C.G.,**[1,2] **Abdu, S. B.,**[1] **Adamu, H.Y.**[1] **and Musa, A.**[1]

[1]*Department of Animal Science, Ahmadu Bello University, Zaria, Nigeria.*
[1]*Department of Livestock Husbandry Services, Federal Ministry of Agriculture and Food Security, Abakaliki, Ebonyi State.*

Corresponding Author: chinwe.chukwu20@gmail.com
Phone number *+2348038760012*
Target Audience: *Researchers, Livestock farmers, Feed millers.*

Abstract

The study was conducted to evaluate the levels of antinutrients and feeding value of Ficus polita with ensiled corncob-layer litter diet fed to Yankasa rams in a Total Mixed Ration. Sixteen rams weighing averagely 21kg were randomly assigned to four diets containing 0%, 15%, 30%, and 45% inclusion level of Ficus polita leaf meal. The rams were fed at 4% of their body weight and daily feeding was done twice at 8:00am and 4:00pm. Total feed intake, weight gain, average daily weight gain, and faecal outputs were recorded. Data obtained were subjected to analysis of SAS and means were compared using Fisher's least significant difference. The antinutritional profiles of the experimental diet and FPLM were analysed using standard spectrophotometric procedures and the result showed the levels were all within accepted limits. Ensiling the corncob with layer litter significantly (P<0.05) increased the dry matter and crude protein contents and significantly (P<0.05) reduced the crude fibre, neutral detergent fibre and Acid detergent fibre contents of the ensiled corncob. Results obtained showed that rams fed the experimental diet with 15% inclusion level of FPLM recorded a significantly (P<0.05) higher total body weight gain (6.01 kg), ADWG (66.72 g/day), and the best feed conversion ratio (13.84). It was concluded that inclusion of FPLM up to 15% in the diet of rams improved the growth performance of the Yankasa rams and can therefore be used by farmers as a good source of feed supplement during the dry season to maintain live weights of Yankasa rams.

Keywords: *Ficus polita*, Ensiled Corncob, Antinutrients, Layer-litter, Yankasa Ram.

Description of Problem

The nutritional aspect of animal production poses a significant obstacle to the ruminant animal industry in Nigeria [1]. This challenge becomes more pronounced during the extended dry season, wherein animals struggle to fulfil their protein and energy requirements from the limited and poor-quality forage, leading to an uneven growth pattern. This situation presents a substantial hurdle for the effective development of ruminant production in Nigeria [2]. In periods of scarcity, farmers are recommended to strategically incorporate crop residues like corn-cob and browse plants in feeding ruminants to address the feeding challenge.

Corn-cob, being one of the most plentiful crop residues, faces no competition with human consumption but is often overlooked or deemed a waste product [3]. Its potential value in enhancing ruminant nutrition and its widespread availability have sparked interest in its inclusion in livestock feed [4]; [2]; [5]. However, due to its fibrous nature and high lignocellulose content [5], appropriate treatment or supplementation with browse plants and/or additional nutrients is necessary before feeding it to ruminants [4].

Browse plants constitutes a crucial reservoir of sustenance and comprises a substantial proportion of grazing material accessible to ruminants, particularly in arid periods due to their perennial nature [6] as they persistently yield superior quality and quantity of forage even in dry seasons [1]. Despite their commendable nutritional content, the existence of secondary metabolites, also recognized as antinutritional factors, can hinder their acceptance and optimal nutrient utilization by ruminants when surpassing the approved permissible thresholds [7].

Similar to other browse plants, *Ficus polita* has been identified as a potential browsing plant capable of replacing low-protein grass feed as a source of nutrition in dry seasons [8]. *Ficus polita*, also known as durumi in Hausa, belongs to the family Moraceae. It is found grown mostly in towns and villages primarily to provide shade around the houses and forms one of the tropical plants whose leaves and bark are cherished and consumed by ruminants (especially sheep and goats) as feeds [9]. Farmers in rural areas of northern Nigeria typically harvest *Ficus polita* leaves and feed them to these animals. Various feeding materials and systems has been adopted in feeding ruminants, especially during the dry season, but this study seeks to ascertain the levels of antinutrients and feeding value of *Ficus polita* with ensiled corncob-layer litter fed to Yankasa rams.

MATERIALS AND METHODS

Experimental Site

The study was carried out at Teaching and Research Farm of the Department of Animal Science, Ahmadu Bello University Zaria, geo-located between latitudes 11^0 12'' N and longitudes 7^0 33'' E, [10] with a mean relative humidity of 21% and 72% during the harmattan and rainy season respectively, Annual rainfall ranges between 1100-1200 mm per annum with mean temperature range of 9.20^0C- 40.20^0C [11].

Feed Collection and Processing

Twigs of *Ficus polita* representing the Genus Ficus of the family Moraceae were collected and authenticated at the Herbarium section of the Department of Botany, Faculty of Life Sciences, Ahmadu Bello University Zaria, Kaduna Nigeria. The twigs were shade dried for 5 days. Thereafter, the leaves were separated from the twigs and milled to allow for easy mixing with the other ingredients in the concentrate feed, it was then bagged and stored in a room until when it was needed for the study.

The corncobs were collected from the Institute of Agricultural Research (IAR), Ahmadu Bello University Zaria, after their crop harvest and shelling and were ground using a locally fabricated industrial hammer mill, sieved with a 3 mm particle size sieve and stored before ensiling. The layer's litter was sourced from the deep litter system of the NAPRI poultry farm, the litter was shade dried for five days, feathers and caked litters were sieved out, and stored before ensiling.

Ensiling Procedure and Evaluation

The pulverised corncob and layers litter were thoroughly mixed in a ratio of 70:30 respectively [12], 2% molasses was dissolved in 60L of water and added to the mixture to enhance fermentation. The mixture was then put in Purdue Improved Crop Storage (PICS®) plastic bags, compressed to remove air and closed. The bags were stored for 21 days away from sunlight to ferment, At the end of the 21 days fermentation period, samples of ensiled materials were taken from each PICS® plastic bag for physical characteristics, temperature, pH and chemical composition analysis. The observation, appearance, smell, texture, temperature and pH of the ensiled treatment was judged according to the method carried out by [13].

Experimental Animals, Management and Design.

Sixteen (16) growing Yankasa rams at about 8-11 months weighing averagely 21.63kg were obtained from Lamba-Zango Livestock Market in Kaduna South Local Government Area of Kaduna State. The animals were kept under close observation for two weeks and dewormed against internal and external parasites using Ivermectin Injection (Ivermec®), They were vaccinated against Peste des Petits Ruminants (PPR) and long-acting antibiotic (Oxytetracycline LA®) was also administered at the recommendation of a veterinarian. At the end of the two weeks, they were weighed and randomly allotted to four dietary treatment groups, with four (4) animals per treatment in Completely Randomized Design (CRD).

Experiment Treatment, Feeding and Growth Trial

Four iso-nitrogenous supplementary diets were formulated, containing *Ficus polita* leaf meal at 0, 15, 30, and 45% inclusion levels, with each inclusion level serving as a treatment.

Animals were fed the ensiled corncob-layer litter (ECLL) and the supplementary feed containing varying levels of *Ficus polita* leaf meal at 4% of their body weight in a total mixed ration (TMR). The daily feeding of the experimental diet was offered twice to the animals (at 8:00 am, and 4:00 pm), freshwater was provided *ad libitum.* Moor Lick®; multi-nutrient was also provided for the animals. The ensiled corncob-layer litter and supplementary feed were fed in the ratio of 60:40 respectively.

The growth trial was carried out for 90 days, daily feed intake, daily water intake and fortnight body weight was recorded throughout the study. Feed intake was calculated by the difference between feed supply and feed left over in each pen. Weight gain was determined as the difference between the weight of the animal at the beginning of the experiment and subsequently at two weeks' intervals. The feed conversion ratio was calculated as the ratio of total feed intake (kg) and total weight gain (kg) for each treatment group.

Chemical Analysis

Samples of experimental diets and faeces were taken to the National Animal Production Research Institute (NAPRI) Biochemical Laboratory and analysed for dry matter, crude protein, ether extract, crude fibre and Ash analysis according to the procedure of [14], and NFE by difference. Acid Detergent Fibre, Neutral Detergent Fibre, and Hemicellulose were analysed using the method of [15]. Metabolizable (ME) energy was determined by the Pauzenga equation ME (kcal/kg) =37×%CP+81.1×%EE+35.5×%NFE [16]. Urine samples were analysed for nitrogen using the Kjeldahl technique [17]. Tannin content and other antinutritional factors (ANFs) were analysed by the method of [18].

Statistical Analysis

Data collected at the end of the experiment was analysed using the procedure of the statistical analysis system [19]. Significant differences among treatment means were compared at a 5% probability level using Fishers Least Significant Difference (LSD) test of the SAS Package.

RESULTS AND DISCUSSION

Chemical Composition of Corncob with layer Litter Before and After Ensiling

The chemical composition of corncob before and after ensiling is presented in Table 1. Ensiling corncob with layer litter and molasses significantly ($P<0.05$) improved the chemical composition of the corncob. Earlier fermentation studies indicated that fermentation enhances the nutritive values of feed stuff.

There was a significant ($P<0.05$) increase in the CP content from 10.31 to 12.19%. This occurred because ammonia was generated through the breakdown of urea during the ensiling process [22]. The CP content (12.19%) of the ensiled corncob is higher than 4.45-6.0% reported by [20] when they ensiled corncob with varying levels of urea and soluble carbohydrates. The significant ($P<0.05$) reduction in the crude fibre content of the ensiled corncob from 16.25 to 12.19% could probably be due to the presence of microbes in the layer litter which were able to break down cellulose and hemicellulose polymers [23]. The NDF and ADF content was significantly ($P<0.05$) reduced from 64.27 to 49.15%, and 29.05 to 27.39%, respectively after ensiling. This may due to the availability of molasses which supplied fermentable carbohydrate, hence enhancing the breakdown of cell wall [24; 25]. The reduction observed in this study conforms with the report of [26] who recorded that, increased levels of molasses decreased NDF and ADF contents when they ensiled foxtail millet with varying levels of molasses.

Table 1: Chemical composition of corncob with layers litter before and after ensiling

Parameters (%)	Composition		
	Before Ensiling	After Ensiling	LSD
Dry Matter	92.10^{b}	92.32^{a}	0.22*
Organic Matter	86.71^{a}	81.95^{b}	0.17*
Crude Protein	10.31^{b}	12.19^{a}	0.20*
Crude Fibre	16.25^{a}	12.92^{b}	0.20*
Ether Extract	8.13^{a}	7.36^{b}	0.17*
Ash	13.29^{b}	18.05^{a}	0.17*
Nitrogen Free Extract	60.37^{a}	54.72^{b}	0.18*
Neutral Detergent Fibre	64.27^{a}	49.15^{b}	0.14*
Acid Detergent Fibre	29.05^{a}	27.39^{b}	0.17*
Lignin	1.01^{a}	0.75^{b}	0.08*
Hemicellulose	35.22^{a}	21.76^{b}	0.16*
Cellulose	28.04^{a}	26.64^{b}	0.10*
ME (Kcal/DM)	3183.95^{a}	2990.49^{b}	2.17*

^{ab} Mean values with different superscripts within a row differed significantly; ME= Metabolizable Energy; LSD= Least Significant Difference; *Significant at 0.05.

Levels of Antinutritional Factors in *Ficus polita* leaf and Experimental Diet.

The antinutritional factors present in the *F. polita* leaf and various levels of supplementation is presented in Table 2. This study recorded various levels of antinutrients present in the FPLM and in the experimental diets. The study revealed that FPLM contained varying concentrations of oxalate, phytate, HCN, saponin, and tannins at low levels, which are below the values reported by [27] after feeding *F. polita* leaf meal to growing Bunaji bulls. The antinutrients present in the experimental diets were found to vary numerically across the various levels of *F. polita* leaf meal supplementation. The level of tannin varied from 5.95mg/100g at 0% to 10.9mg/100g at 45%. The level of phytate at 30 and 45% recorded similar values of 0.19mg/100g. The level of oxalate recorded a progressive increase from 0.09mg/100g to 0.19mg/100g as the levels of inclusion increased, and a then a decrease to 0.17mg/100g as the level of supplementation increased to 45%. It was observed that the levels of antinutrients present in the diets increased with increase in the levels of supplementation of the *F. polita* leaf meal with the exception of oxalate. Similar pattern was reported by [28], when he supplemented *F. sycomorus* leaf meal at various levels to the basal diet of yankasa rams. The levels of antinutrients present in the FPLM and in the experimental diets are found to be within the acceptable limit **(< 30g/Kg Dm) reported by [8], to be safe for ruminants.**

Table 2: Levels of antinutritional factors in *F polita* leaf and experimental diet

	Inclusion Levels (%)				
Parameters	0	15	30	45	FPLM
Tannin (mg/100g)	5.95	8.90	9.90	10.90	0.68
Phytate (mg/100g)	0.11	0.14	0.19	0.19	0.16
Oxalate (mg/100g)	0.09	0.16	0.19	0.17	0.18
Saponin (%)	1.24	1.69	1.98	2.43	3.65
HCN (mg/g)	0.22	0.39	0.42	0.44	1.28

HCN= Hydrogen Cyanide; FPLM= *Ficus polita* Leaf Meal

Ingredient Composition of Supplementary Diet and Chemical Composition of Experimental Diet.

The ingredient and chemical composition of the experimental diet is presented in Table 3. The dry matter (DM) content of the experimental diets varied from 89-92.52%. These values are lower than the 90.78-94.80 recorded by [29] when they evaluated the composition of varying levels of ensiled sugarcane with poultry litter, and comparable to those reported by [30], when they fed *F. sycomorus* to rams. The results in this study are also similar to the values 91.71-92.73% reported by [31] when they fed varying mixture of *F. polita* to Bunaji bulls. The dissimilarities in values could be as a result of differences in browse combination, age difference and season of harvest, and could also be attributed to variations in ingredient composition of experimental diets. The elevated DM values indicate a favorable energy and roughage source, potentially fostering rumination and guarding against digestive disturbances in the rumen of sheep, thereby supporting the generation of volatile fatty acids [29].

The crude protein (CP) content of experimental diet varied between 14.75 - 16.69%. Some of the values are lower and some are similar to the range of 16.0-16.60% reported by [32] when he analysed the chemical composition of urea treated corncob. The different source of NPN may have accounted for the lower levels recorded in this study. The CP levels in this study are generally higher than the critical level of 8% for ruminants reported by [33], necessary to provide minimum ammonia levels required by rumen microorganism to support optimum activity [34].

The crude fibre content of the experimental diet ranged between 13.31-17.41% and are lower than 21.18-31.09% documented by [36], falls within the range 14.83-32.45% reported by [35] when they evaluated the nutritive value of corncob-poultry dropping mixture silage, and higher than 10-15% published by [36] when they evaluated the feeding value of different agro-industrial by-products for WAD goats. According to the report of [33], ruminants have the ability to tolerate CF level of 20.75%, but level above 60% depresses intake.

Neutral detergent fibre (NDF) values which reflect the bulkiness of feed material and the amount of forage an animal can consume ranged from 35.74 - 40.97%. These values are similar to the 36.7-40.7% reported by [37] when they supplemented natural pasture with graded levels of *F. thonningii* leaf meal to lambs, and higher than the 18.90-31.77% reported by [31] when they evaluated the feeding value of varying mixture of *F. polita*. The variation in values could be attributed to the difference in specie, environment, and age of the plant used.

The acid detergent fibre (ADF), which is associated with an animal's digestive capability for a diet, was found to vary between 22.96% to 26.88%. The ADF contents increased as the inclusion levels of *F. polita* leaf meal increased. The ADF were similar to the values documented by [3] in a similar study and comparable to those of [37] when they fed graded levels of *F. thonningii* to Washera lambs. Muhammad and Oluwaniyi [38] reported that diets containing a high level of ADF content constitute an indigestible fibre fraction depressing the degradability rate.

Growth Performance of Yankasa Rams Fed Varying Levels *F. polita* Leaf Meal with Ensiled Corncob-Layer Litter Based Diet.

The result of the intake and weight gain of Yankasa rams fed *F. polita* leaf meal at varying levels is shown in Table 4. Although there were numerical variations in the parameters evaluated, the statistical analysis reflected no significant ($P>0.05$) difference in the intake, and final weight of the animals. Yashim [28] reported a decline in dry matter intake with an increase in the levels of supplementation of *Ficus sycomorus* leaf meal when *D. smutsii* supplemented with Ficus sycomorus was fed to Yankasa rams, while [39], reported an increase in total feed intake with progressive increase in the levels of supplementation, when he fed urea treated maize stover basal diet, supplemented with fresh *Ficus sycomorus* leaf meal to Yankasa rams. While there was an increase and decrease in dry matter intake with increase in supplementation level in both reports, this study recorded no significant ($P>0.05$) difference in dry matter intake with varying levels of supplementation of *F. polita* leaf meal. The variations in their results could be as a result of differences in location, species of Ficus leaf, age of leaves, and the mode of feeding (sole, fresh, TMR) the animals. A significant ($P<0.05$) difference was however,

Table 3: Ingredient composition of supplementary diet

	Inclusion Levels of Ficus Leaf Meal (%)				
Ingredients	0	15	30	45	
Maize Offal	68.65	57.65	46.65	35.65	
Ficus Leaf Meal	00.00	15.00	30.00	45.00	
Brewers Dried Grain	19.00	15.00	11.00	07.00	
Cowpea Husk	10.00	10.00	10.00	10.00	
Bone Meal	01.50	01.50	01.50	01.50	
Salt	00.60	00.60	00.60	00.60	
Premix	00.25	00.25	00.25	00.25	
Total (Kg)	100	100	100	100	
Calculated Analysis					
Crude Protein (%)	13.42	13.53	13.64	13.75	
Metabolizable Energy (Kcal/DM)	2453.99	2034.91	1615.83	1196.75	
Chemical Composition of Experimental Diet (%)					**FPLM**
Dry Matter	92.52	91.69	89.00	91.55	86.57
Crude Protein	14.75	16.31	16.69	16.12	11.17
Crude Fibre	16.74	13.51	17.41	13.31	19.28
Ether Extract	10.77	12.80	11.35	9.72	13.81
Ash	10.53	8.96	9.20	8.17	15.84
Nitrogen Free Extract	56.47	53.62	51.76	57.55	45.75
Neutral Detergent Fibre	35.74	35.87	39.94	40.97	42.36
Acid Detergent Fibre	22.96	24.40	25.53	26.88	17.62
Lignin	7.69	7.80	8.62	8.94	2.48
Hemicellulose	12.78	11.47	14.41	14.09	24.74
Cellulose	15.27	16.60	16.91	17.94	15.14
ME (Kcal/DM)	3423.88	3545.06	3375.50	3427.38	3157.16

ME= Metabolizable Energy

observed in the total weight gain, average daily weight gain, and feed conversion ratio of the animals.

The total weight gain of the animals recorded a significant (P<0.05) increase when the supplementary diet was fed at 15%, which contradicts the result of [29], who recorded a significant increase at 10% supplementation level, and a subsequent decrease as the level of supplementation increases. The present study recorded a significant (P<0.05) decrease in total weight gain as the inclusion rate of *F. polita* leaf meal increases. This decline follows a similar trend reported by [29], and contradicts the report of [22], who recorded an increase in the total weight gain of the animals with progressive increase in the inclusion levels of *F. sycomorus* leaf meal.

Table 4: Growth performance of yankasa rams fed varying levels of *f. polita* leaf meal with ensiled corncob layer-litter based diet.

Parameters	Inclusion Levels (%)				LSD
	0	15	30	45	
Initial weight (kg)	21.63	21.63	21.63	21.63	1.48^{NS}
Final Weight (kg)	27.38	27.63	26.93	26.09	2.96^{NS}
Total weight gain (kg)	5.76^{a}	6.01^{a}	5.30^{ab}	4.46^{b}	1.52*
ADWG (g/d)	63.97^{a}	66.72^{a}	58.80^{ab}	49.56^{b}	16.88*
Dry Matter Intake (kg)	83.22	80.02	83˙29	82.92	11.26^{NS}
Average feed intake (g/d)	924.63	889.12	925.5	921.35	124.96^{NS}
FCR	14.76^{ab}	13.84^{b}	15.72^{a}	18.88^{a}	4.02*

^{abc} Mean values with different superscripts within a row differed significantly;LSD= Least Significant Difference, * Significant at 0.05 ADWG = Average daily weight gain

Conclusion and Application

Conclusion

The following conclusions were made from this study.

1. The levels of antinutrients present in the experimental diet and FPLM showed that the processing of the leaves (drying and grinding) reduced the levels of antinutrients in the leaves to a safe level.
2. The study showed that rams fed experimental diet containing *F. polita* at 15% inclusion level had higher weight gain of 6.01kg compared to those on 30 and 45% inclusion levels, and increasing the levels of *F. polita* leaf meal to 30 and 45% did not result in additional weight gain.

Application

From the results of this study, the following can be applied as thus:

1. *Ficus polita* leaf meal should be used by farmers as a good source of feed supplement during the peak of the dry season to maintain live weights of Yankasa rams.
2. Optimum performance was obtained at 15% level of inclusion of *Ficus polita*, therefore, *F. polita* should be included in supplementary diets of Yankasa rams at 15% inclusion level.

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