Performance and Nutrient Digestibility of West African Dwarf Goats Fed Corncob-Poultry Dropping Silage.

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ABSTRACT

This study was conducted to evaluate the performance and nutrient digestibility of West African Dwarf (WAD) goats fed corncob-poultry dropping silage comprising corncob-cassava peel mixtures ensiled with varying percentages of poultry droppings. Diet 1 (control) is concentrate feed. Sixteen WAD goats were allotted to four (4) dietary treatments (Diet 1 – diet 4) in a completely randomized design. The crude protein, ether extract and ash increased with increasing proportion of poultry dropping in corncob-cassava peel mixtures, while the Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) declined from Diet 4 to Diet 2.

Feed Intake (FI) was highest in goats fed control diet (588g/day) and lowest in goats fed diet 4 (457 g/day). However, Feed Conversion Ratio (FCR), and Final Weight Gained (FWG) of goats fed diet 2 (13.75 and 11.66 kg) and diet 3 (15.83 and 11.14 kg), respectively, were better and statistically comparable to ($P>0.05$) with goats fed diet 1, even though diet 1 gave the best FCR (13.64) and FWG (12.15kg). Weight gain (g/day) of goats fed diet 1 (43.1g/day) and diet 2 (38.57g/day), respectively, were also remarkable ($P>0.05$).

Dry matter digestibility was highest in goats fed diet 2 (85.14%) and lowest in goats fed diet 4 (76.68%). Crude protein digestibility was highest in goats fed diet 1(89.49%) and followed by goats fed diet 2 (84.80%). Nitrogen (N) balance among the goats differed ($P<0.05$) significantly. N-intake (2.57 and 2.42 g/day), Percentage N-absorbed (42.23 and 36.23%), Percentage N-retained (26.46 sand 20.66%), and apparent N-digestibility (62.64 and 57.02) values were highest in goats fed concentrate (diet1); and followed by those fed diet 2 respectively. It can be concluded that goats fed corncob-cassava peel mixtures ensiled with 25% poultry dropping (diet 2) had FI, FCR, N-retention and FWG relatively comparable with goat fed control (concentrate) diet. Hence, poultry dropping could be harnessed as alternative nitrogen supplement to reduce the cost of feed production and enhanced optimal performance of WAD goats.

(*Keywords*: cassava peel, corncob, nitrogen balance, performance, poultry dropping, silage, animal feed)

INTRODUCTION

A major problem of ruminant production in the tropics particularly during the dry season is nutrition, often orchestrated by scarcity of fresh fodder for feeding animals. Dry season in most parts of Nigeria is characterized by an abundance of roughages consisting mainly of highly lignified grasses, crop residues, and agro industrial wastes (Ademosun, 1992), which are low in protein and other essential nutrients. Although, crop residues are relatively low in digestible nutrients, the high energy potential makes it an important feed resource for ruminants during periods of dry season (Smith, 1988).

In Nigeria, the increasing demand for food and sustenance of food security by the rapidly growing human population led to intensification of more farm land for crop production. This situation resulted to abundance of crop residues, which are left on the field following harvest or farm level processing. Corncob and cassava peel are crop residues obtained during processing of maize and cassava after harvesting from the field. They are available in large quantities and could be utilized as feedstuffs during periods of acute fodder shortage for ruminant in small holder farming systems in South Western parts of Nigeria.

Although, corncob are of low digestibility due to its high ligno-cellulose contents (Kategile, 1981), however, they are important source of energy in ruminant feeding (Wanapat and Rowlinson, 2007). Improved performance have been reported (Ajayi and Ogunleke, 2015a; Ajayi *et al.,* 2015b) for West African Dwarf goats and N'dama heifers fed corncob in compounded ration. In the same vein, cassava peel (a by-product of tuber processing) is widely used as an important energy feed in ruminant diets or as energy supplement to forage in ruminant feeding. Depending on the variety, cassava peel is low in protein content but high in fiber, fermentable carbohydrates, and is rapidly or well degraded in the rumen (Smith *et al.,* 1988; Adegbola *et al.*, 2010). Although, cassava peel is well relished by ruminants, the concentration of hydrocyanic acid, which is approximately 623 ppm (Tewe and Iyayi, 1989) could be harmful except they are reduced to a level not harmful to the animals either by oven drying, sun drying or ensiling.

Various feed supplementation strategies compatible with on-farm feeding practices have been researched (Owen and Jayasuriya, 1989; Uza *et al.,* 2005) through the use of locally available feed resources to improve ruminant production systems and more importantly, dietary supplements of nitrogen sources that will enhance feed intake and utilization by ruminant fed poor roughage diets. However, the high cost of conventional protein or nitrogen supplements are beyond the reach of resource poor livestock farmers. This necessitated the search for a cheap and alternative dietary protein supplement that can provide fermentable nitrogen in order to ensure an adequate level of ammonia nitrogen within the rumen and release of nitrogen to support meaningful productivity. Supplemental non-protein nitrogen (NPN) is most efficiently utilized in rations low in protein and relatively high in energy (Satter and Roffler, 1977).

Poultry droppings are waste product (excreta) of broiler or laying birds, and have been used as source of dietary crude protein to replace or supplement cotton seed cake and groundnut cake in ruminant diets (Bayemi *et al.,* 2004; Adegbola et al., 2010). Approximately half of the CP is made up of true protein and remainder is non-protein nitrogen, which is primarily the uric acid excreted by poultry (Bhattacharya and Taylor, 1975). Uric acid is more efficiently utilized by rumen microbes for protein production than other non-protein nitrogen sources (Abdel – Baset and Abbas, 2010). Although, utilization of poultry droppings in animal feeding systems is constrained by the presence of pathogenic micro-organisms (Rogers and Poore, 1994), it still remains a valuable source of Non-protein nitrogen, minerals and energy for ruminants (Abdel – Baset and Abbas, 2010) when properly processed.

Since corncob is high in ligno-cellulose but low in nitrogen contents; it would require a fermentable carbohydrates and nitrogen sources for maximum utilization by ruminants. Also, the fact that crop residues are seasonally produced, there is also a need to embrace silage production as an efficient conservation technology to improve the feeding value and ensure adequate supply of feed when required. Ensiling roughages with poultry waste improved the crude protein content (Owen *et al.,* 2008) and reduced pathogen population in poultry manure (Al-Rokayan *et al.,* 1998). Poultry manure ensiled with whole corn or sorghum forages have been reported to improve fermentation quality, feeding value, palatability and digestibility in cattle, goats and sheep (Harmon *et al.,* 1975; Kim *et al.,* 2000).

Although, urea and poultry litter have been researched as alternative non-protein nitrogen sources to ensile low quality crop residues for feeding ruminants in dry season (Fajemisin *et al.,* 2013; Olorunisomo and Ososanya, 2015), there is little information on utilization by WAD goats fed corncob-cassava peel mixtures ensiled with cured poultry droppings at varying inclusions. As a mitigation strategy against the global climatic change caused by environmental pollution from agricultural wastes (crop and livestock wastes), research efforts in the tropics are now geared towards providing a healthy environment through utilization of crop residues, agro-industrial and animal wastes for improved animal productivity and food security.

Hence, this study was conducted to evaluate the performance, apparent digestibility and nitrogen utilization by West African Dwarf goats fed corncob-cassava peel mixtures ensiled with varying proportion of poultry dropping.

MATERIALS AND METHODS

Study location

The experiment was conducted at the Sheep and Goat Unit of the Institute of Agricultural Research and Training, Moor Plantation, Ibadan. Nigeria. Latitude 7°15'–7°30'N and longitude 3°45'–4°0'E). The area has a tropical humid climate with a mean annual rainfall of 1,415mm and an average daily temperature between 28 and 35°C.

The experimental house and individual pens for the goats were washed and cleaned with disinfectant. The floor of individual pens was covered with wood shavings up to 5 cm in depth. Sixteen West African Dwarf (WAD) breed of goats aged 5 and 6 months weighing 8.42 - 8.57kg were used for the study that lasted 105 days. Animals were sourced from nearby villages; about 45km away from the study area.

Each goat was given prophylactic treatments on arrival at the farm; long acting injectable antibiotics (Oxytetracycline) and levamisole were administered at a dose of 1 mL per 10 kg. Goats were dipped in Diazintol at a dose of 2 mL to 6 L of water to protect against ectoparasites. The goats were also vaccinated against *Peste de Petit Ruminant* (PPR). The adaptation period lasted 14 days after which the goats were introduced to dietary treatments of concentrate feed (control) and silage diets.

Silage Preparation and Ensiling Procedures

The silo used for ensiling was 120L plastic drums lined with 20mm thick nylon sheets. Corncob was collected at the out station farm of the Institute after maize shelling, sun dried and ground to 2mm particle size. Cage layer dropping was collected from the poultry layer unit of the farm and air-dried under a shade for 3 weeks to reduce the moisture content to about 30%. Fresh cassava peel was collected from a gari processing plant and spread on a concrete floor to wilt to about 50% DM, while fresh pineapple pulp was collected from a fruit juice processing factory (Apata Lafia canning factory). All these materials were mixed in varying proportion to form a homogenous mixture as specified (Table 1).

Each mixture were packed in the plastic drums (lined with 20mm thick nylon sheets) and compressed to eliminate air. The nylon sheets were sealed and a heavy bag of sand (about 25kg) was placed on it. Immediately, the silo was closed with a plastic lid; and all the materials were allowed to ferment for 28 days.

Feeding Trial

The composition of the concentrate feed is as shown (Table 2). Goats were allotted to the four experimental diets as specified below in a completely randomized design of four goats per treatment diet for a period of 84 days in an individual pen with unrestricted access to feeding and water troughs.

Diet 1 = Concentrate feed

Diet 2 = Corncob (40%), Cassava peel (25%), Poultry dropping (25%), Pineapple pulp (10%)

Diet 3 = Corncob (50%), Cassava peel (20%), Poultry dropping (20%), Pineapple pulp (10%)

Diet 4 = Corncob (60%), Cassava peel (15%), Poultry dropping (15%), Pineapple pulp (10%)

Corncob-poultry dropping silages, concentrate and guinea grass were offered separately, with guinea grass serving as the basal diet at 3% body weight while the concentrate and silages were fed at 2% body weight. Provision was also made for a daily feed allowance of 10% above the previous week’s consumption. Feed was offered twice daily (08:00 h and 16:00 h).

The guinea grass (*P. maximum*) was harvested at 6 weeks re-growth interval, wilted and chopped to 5cm before feeding. Fresh water was served *ad libitum*. The daily feed intake by the goats was determined by subtracting the weight of feed remnants from the feed offered the previous day while the body weight change were monitored by weighing them every week before feeding in the morning.

Digestibility and Nitrogen Balance

The goats were transferred to metabolic cage during the last 28 days of the experiment to collect urine and fecal samples. During the 28 day period, the quantity of feed offered, feed residues, feces and urine from each goat were determined. Volatilization of nitrogen from urine was prevented by adding 10ml of 10% H_2SO_4

into each container for collection of urine (Chen and Gomez, 1992). Daily collections of feces and urine were bulked and 10% sub sample of each was taken. Urine samples were frozen for nitrogen determination while the fecal samples were oven dried at 105^{o} C.

Chemical Analysis

Dried samples of the experimental diets (concentrate, silages and *P. maximum* and fecal samples were analyzed for Crude protein (N×6.25), Dry matter, Ether extract, Ash, calcium and phosphorus contents as described (AOAC, 1990), while the Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) were determined according to the method of Van Soest *et al.* (1991).

Statistical Analysis

Data obtained were analyzed with the general linear model of SAS (1998) and the Duncan option of SAS (1998) and multiple range tests were used to detect significant differences among means at a level of 5%.

RESULTS AND DISCUSSION

Table 1 and 2 shows the gross composition of the experimental diets, while Table 3 shows the chemical composition of corncob and cured poultry dropping. The Chemical composition of the experimental diet (Table 4) shows that, DM content of the silage treatments was almost similar. The crude protein content (11.67% to 16.04%) in diet 1 to diet 4 were above the minimum of 7% or 10–12 % required by small ruminants for rumen microbial function (ARC 1980; NRC, 1981). The CP values of silage treatments ranged from 11.67% (Diet 4) to 15.17% (Diet 2). CP values was highest (16.04%) in the concentrate diet (Diet 1) and lowest (11.67%) in Diet 4.

Table 1: Gross Composition of Corncob-Poultry Dropping Silages fed to West African Dwarf Goats.

Ingredients (%)	Diet 2	Diet 3	Diet 4
Cured Poultry dropping	25	20	15
Wilted cassava peel	25	20	15
Ground corncob	40	50	60
Sun dried Pineapple pulp	10	10	10

Table 2: Gross composition of Concentrate diet (Diet 1) fed to West African Dwarf Goats.

Ingredients	Quantity (Kg)
Corn bran	25
Wheat offal	20
Palm Kernel cake	25
Ground nut cake	15
Oyster shell	14.25
Fish meal (72%)	0.25
Salt	0.25
Grower premix	0.25

Table3: Chemical Composition of Corncob and Cured Poultry Dropping.

Parameters (%)	Corncob	Cured poultry dropping
Dry Matter	90.61	76.21
Crude protein	3.40	25.65
Ash	10.35	21.78
Crude fibre	48.72	8.67
Ether extract	2.11	1.85
Nitrogen free extract	35.42	42.05

Table 4: Chemical Composition of Corncob-Poultry Dropping Silage and Concentrate Diet fed to West African Dwarf Goats.

Parameters (%)	Concentrate	Silage			Guinea grass
	Diet 1	Diet 2	Diet 3	Diet 4	
Dry matter	83.4	81.0	80.8	81.0	68.5
Crude protein	16.04	15.17	13.07	11.67	80.7
Ether extract	4.21	3.58	3.49	3.39	5.51
Ash	8.20	7.49	6.18	5.10	2.11
Neutral detergent fiber	68.11	65.38	71.37	76.69	63.5
Acid detergent fiber	55.4	51.65	62.35	65.76	48.2
Acid detergent lignin	15.12	14.26	17.95	19.56	11.4
Hemicellulose	12.71	13.73	9.02	10.93	15.3
Cellulose	40.28	37.39	44.4	46.20	36.8
Nitrogen free extract	50.15	48.07	43.53	42.62	38.91

The differences in CP levels of diet 1 to diet 4 in this study could be attributed to the protein sources, proportion and composition of ingredients in each diet; particularly the varying proportion of poultry dropping in relation to the proportion of corncob-cassava peel mixtures. Increased CP content has been reported in sorghum forages ensiled with increased proportion of poultry litter (Flachowsky and Hennig, 1990). However, the Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) declined as the proportion of poultry dropping increased from Diet 4 to Diet 2. This is in agreement with the findings of Rassol *et al.* (1998) who observed a decrease in Fiber fractions in Sudax fodder ensiled with broiler litter and molasses.

The decreased Fiber fractions of silage diets in this study might be due to the breakdown of the cell wall components in corncob and cassava peel due to hydrolysis of uric acid from poultry dropping to ammonia (Ngele *et al.,* 2006) during ensiling. Ether extract (3.39% to 3.58%) and ash (5.10% to 7.49%) contents of silage treatments (Diet 2 to Diet 4) also increased with increased proportion of poultry droppings, though, lower than the control (Diet 1) as reported (Al-Rokayan *et al.,* 1988; Flachowsky and Hennig, 1990; Baba *et al.,* 2010). The Nitrogen Free Extract (NFE) content followed the same trend as the CP. Values for NFE among silage treatments varied from 42.62 to 48.07% and was lower than the control diet (50.15 %).

The performance characteristics of West African Dwarf Goats fed the experimental diets are shown in Table 5. Total feed intake (DM g/day) and Dry matter (DM) intake (g/KgW$^{0.75}$) differed significantly ($P<0.05$) across the treatments.

Highest feed intake was observed in goats fed control diet (588g/day) and lowest in diet 4 (457 g/day). However, among the silage treatments (diet 2 to diet 4), feed intake was higher in goats fed diet 2 and lower in goats fed diet 4. Although, Dry matter intake (g/KgW$^{0.75}$) of diets 1 to 4 differed significantly ($P<0.05$), similar trend were observed in metabolic feed intake (g/KgW$^{0.75}$) by goats on diets 3 and 4 ($P>0.05$), with values of 103.3(g/KgW$^{0.75}$) and 98.8(g/KgW$^{0.75}$), respectively.

Table 5: Performance Characteristics of West African Dwarf Goats Fed Corncob-Poultry Dropping Silage and Concentrate Diet.

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	SEM
Feed intake (DM g/d)					
Grass	416	394	352	336	
Concentrate	172				
Silage		136	133	121	
Total	588[a]	530[b]	485[c]	457[d]	22.46
Dry matter Intake (g/KgW$^{0.75}$)	119.4[a]	110.5[b]	103.3[c]	98.8[c]	6.78
Feed conversion ratio (FCR)	13.64[b]	13.75[b]	15.83[b]	24.93[a]	3.05
Initial weight gain (Kg)	8.53	8.42	8.57	8.51	
Final weight gain (Kg)	12.15[a]	11.66[a]	11.14[a]	10.05[b]	0.83
Weight gain (g/day)	43.1[a]	38.57[a]	30.60[b]	18.33[c]	5.75

[abcd] = Means on the same row with different superscripts differ significantly (P <0.05).
SEM = Standard error of mean

Table 6: Apparent Digestibility (%) of West African Dwarf Goats Fed Corncob-Poultry Dropping Silage and Concentrate Diet.

Parameters (%)	Diet 1	Diet 2	Diet 3	Diet 4	SEM
Dry matter	82.36[b]	85.14[a]	79.31[c]	76.68[d]	2.24
Crude protein	89.49[a]	84.80[b]	80.20[c]	76.40[c]	4.08
Ash	73.30[a]	71.70[a]	66.12[b]	54.56[c]	3.74
NDF	86.41[b]	87.70[a]	86.51[b]	85.18[c]	1.13
ADF	88.16[a]	83.52[b]	80.41[c]	78.80[c]	2.58
ADL	86.97[a]	80.67[b]	82.44[b]	76.50[c]	2.15
Calcium	97.50[a]	93.00[b]	90.66[b]	87.42[b]	3.26
Phosphorus	93.07[a]	90.68[b]	90.25[b]	88.73[b]	1.88

[abcd]= Means on the same row with different superscripts differ significantly (P<0.05)
SEM = Standard error of mean
NDF= Neutral detergent fiber; ADF= Acid detergent fiber; ADL= Acid detergent lignin

The feed conversion ratio (FCR), and final weight gain (FWG) of goats on diets 2 and 3 were better and statistically comparable (P>0.05) with goats fed diet 1, even though, it gave the best FCR (13.64) and FWG (12.15kg). However, the weight gain (g/day) of goats on diet 1 (43.1g/day) and diet 2 (38.57g/day) were remarkable (P>0.05) compared to goats fed diets 3 and 4. This suggests that the proportion of fermentable energy and nitrogen from cassava peel, pineapple pulp and poultry dropping in diet 2 could have improved palatability, DM intake and rate of digestibility which resulted to better performance (weight gain and feed conversion ratio) observed in this study. This finding corroborated the work of Bello and Tsado (2013) who observed higher feed intake and improved performance in rams fed sorghum stover supplemented with varying levels of dried poultry droppings.

Apparent digestibility of WAD goats were significantly (P>0.05) different across the treatments (Table 6). DM digestibility was highest in goats fed diet 2 (85.14%) and lowest in goats fed diet 4 (76.68%). The DM digestibility of diet 2, 3 and 4 in this study is higher than the reported value (64.05%) for corncob-poultry litter silage fed to WAD goats (Fajemisin *et al.,* 2013). The least DM digestibility values of goats fed diet 4 (76.68%) compared to diet 2 (85.14%) could be attributed to the proportions of corncob and poultry droppings in the diet; which resulted to the high fibre and low crude protein contents in the feed mixtures (Table 4). Low nitrogen content of highly fibrous feedstuffs reduced dry matter digestibility in sheep and goats (Johnson and Djajaneraga, 1989) due to reduced nitrogen supply to the rumen microbes.

Table 7: Nitrogen Balance (%) of West African Dwarf Goats fed Corncob-Poultry Dropping Silage and Concentrate Diet.

Parameters	Diet 1	Diet 2	Diet 3	Diet 4	SEM
Nitrogen Intake(g/day)	2.57[a]	2.42[a]	2.09[b]	1.86[c]	0.19
N-Feces	0.95[ab]	1.04[a]	1.08[a]	1.07[a]	0.08
N-urine	0.94[a]	0.88[b]	0.81[c]	0.68[d]	0.03
N-retained	0.68[a]	0.50[a]	0.20[b]	0.11[b]	0.14
N-absorbed	1.61[a]	1.38[b]	1.01[c]	0.79[d]	0.18
N-retained (%)	26.46[a]	20.66[b]	9.57[c]	5.91[d]	3.54
N-absorbed (%)	42.23[a]	36.23[b]	19.80[c]	13.92[d]	4.66
Apparent N- digestibility	62.64[a]	57.02[b]	48.32[c]	42.47[d]	3.37

[abcd] =Means on the same row with different superscripts differ significantly (P<0.05)

SEM = Standard error of mean; N- Feces = Fecal nitrogen; N- urine = Urinary nitrogen; N-retained = Nitrogen retained; N- absorbed = Nitrogen absorbed; N-retained (%) = Percentage nitrogen retained; N-absorbed(%)=Percentage nitrogen absorbed.

Crude protein digestibility was highest in goats fed diet 1(89.49%), followed by goats fed diet 2 (84.80%); and not significantly (P>0.05) different in goats fed diets 3 and 4. Variations observed in CP digestibility in this study could be linked to the source of the protein, CP content in the diet (percentage inclusion of poultry droppings in the diets) and solubility in the rumen. The high CP digestibility observed in goats fed diets 1 is an indication that concentrate feed contained highly soluble and degradable nitrogen while the uric acid in poultry droppings, which is a nitrogen source is slowly degraded and not easily dissolved in rumen fluid (Abdel–Baset and Abbas, 2010). Feed protein degradability in the rumen is dependent on solubility of the protein (Hume *et al.,* 1970); physical form of the diet (Orskov, 1982), voluntary feed intake and rumen turnover rate (Satter and Roffler 1975).

Ash digestibility in goats fed corncob-poultry dropping silage differed significantly (P<0.05) while values of ash digestibility in goats fed diet 1 and 2 were similar (P> 0.05). Calcium and phosphorus digestibility in goats fed diet 2, 3 and 4 were not affected (P>0.05) by the varying inclusion of poultry droppings. However, calcium (97.50%) and phosphorus (93.07%) digestibility values were highest in goats fed diet 1.

NDF digestibility was highest in goats fed diet 2 (87.70%) but not significantly (P>0.05) different among goats fed diet 1 and 3. ADF digestibility values were similar (P>0.05) in goats fed 3 and 4, ditto ADL digestibility values in goats fed 2 and 3. The differences observed in digestibility values of cell wall fractions among the goats might be due to the lignin contents in the feed mixtures. However, apparent nutrient digestibility values observed in goats fed diet 1 confirmed FAO (1983) reports that, concentrate feed contain highly digestible nutrients. In the same vein, high nutrient digestibility values observed among the goats fed corn cob-poultry dropping silage were remarkable, but higher than values reported (Fajemisin, *et al.,* 2013) for poultry litter-corncob silage fed to WAD goats.

Results from this study suggests that, ensiling with poultry dropping could have broken down the lignin-carbohydrate or ligno-cellulose complexes in the crop residues, thus liberating free cellulosic fraction to improve its feeding value and digestibility (Yu *et al.,* 2009).

Nitrogen balance of West African Dwarf Goats fed the experimental diets is shown on Table 7. Nitrogen (N) balance of the goats differed (P<0.05) significantly across the treatments. Nitrogen intake (g/day) values of goats fed diets 1 and 2 were similar (P>0.05), but significantly different (P<0.05) from goats fed diets 3 and 4. Fecal excretion of N by the goats did not differ (P>0.05) across the treatments, however, urinary excretion of N differed (P<0.05) across the treatments. Urinary N values ranged from 0.68 to 0.94 g/day. Absorption of N (g/day), were highest (1.61) for goats fed diet 1 and lowest (0.79) for goats fed diet 4; and similar trend (P<0.05) was observed for percentage N absorbed by the goats across the treatments. However, goats fed diet 2 had a maximal (P<0.05) percentage N absorption than goats fed diets 3 and 4, respectively.

Nitrogen retention (g/day) values were similar (P>0.05) for goats fed diet 1 and 2; ditto diet 3 and 4, respectively. Numerically, N-retention (g/day) values was highest (P<0.05) for goats fed diet 1 and lowest (0.11g/day) for goats fed diet 4. The percentage N- retained differed (P<0.05) significantly among the treatments; with highest (26.46%) value in goats fed diet 1; followed by goats fed diet 2 (20.66%) and least (5.91%) in goats fed diet 4. Variations observed in N retained among the goats fed the control diet and corn cob poultry silages in this study is a function of the apparent N-digestibility; which, differed (P<0.05) significantly.

Although, apparent N-digestibility was best for goats fed diet 2 compared to those on diet 3 and 4, however, N-balance was remarkable for all the goats fed the silage diets. This suggests that uric acid, from poultry waste is less soluble in rumen fluid and slowly degraded by rumen microbes to yield ammonia (NH_3); thus, less subjected to loss by direct absorption (Abdel-Baset and Abbas, 2010). Protein sources and solubility affects the level of ammonia production and utilization in the rumen (Hume *et al.,* 1970).

CONCLUSION

Intake and utilization of corncob by ruminant can be improved when ensiled with fermentable carbohydrates and nitrogen sources. The results obtained from this study revealed improved nutritive potential of corncob ensiled with poultry droppings and cassava peel. Feeding of corncob-poultry dropping silage had no detrimental effect on growth performance and nutrient digestibility of goats. Goats fed corncob-cassava peel mixtures ensiled with 25% poultry dropping (diet 2) had feed intake, feed conversion ratio, nitrogen retention and weight gained relatively comparable with goat fed the control (concentrate) diet. Therefore, corncob-poultry dropping silages could be a diet for sustainable goat production during periods of acute fodder shortage.

REFERENCES

1. AOAC. 1990. *Official Methods of Analysis, 15th Edition*. Association of Analytical Chemist: Washington, DC. 69-88 pp.

2. Abdel-Baset, N.S. and S.F. Abbas. 2010. "Study on the Use of Dried Poultry Litter in the Camel's Ration". *Veterinary Research Forum*. 1(2):65-71.

3. Adegbola, A.A., O.B. Smith, and N.J. Okeudo. 2010. "Response of West Africa Dwarf Sheep Fed Cassava Peel and Poultry Manure Based Diets". FAO Corporate Document Repository Produced by ILRI, 1-8 pp. www.fao.org/airdocs/ILRI/x5536eop.htm

4. Ademosun, A.A. 1992. "*Constlaints ana* Prospects for Small Ruminant Research and Development in Africa. In: Small Ruminant Research and Development in Africa". Lebbie, S.H.B; B. Rey, and E.K. Irungu (eds.). *Proceedings of the Second Biennial Conference of the African Small Ruminant Research Network*. AlCC Arusha, Tanzania. 1-6 pp

5. Ajayi, F.T. and F.O. Ogunleke. 2015a. "Performance, Nutrient Utilization and Rumen Fermentation Characteristics of West African Dwarf Goats Fed Concentrate Diet with Corncob in Varying Inclusion Levels". *Pacific Journal Science and Technology*. 16(1):274 –279.

6. Ajayi, F.T., O.J. Babayemi, and A.A. Taiwo. 2015b. "Performance and Digestibility of N'dama Cattle Fed Concentrate Diets Containing Varying Levels of Corncob". *Nigerian Journal of Animal Production*. 43(1):223-230.

7. Al-Rokayan, S.A., Z. Naseer, and S.M. Chaudhry. 1998. "Nutritional Quality and Digestibility of Sorghum-Broiler Litter Silages". *Animal Feed Science and Technology*. 75:65-73.

8. ARC. 1980. *The Nutrient Requirements of Ruminant Livestock no 2*. Ruminants Agricultural Research Council: Commonwealth Agricultural Bureaux: London, UK. 351 pp.

9. Baba, M., T. Uba, and A.R. Halim. 2010. "Nutritive Value of Kyasuwa Hay (*Pennisetum pedicelltum*) Ensiled with Poultry Litter at Varying Proportions". *Research Journal Animal Science*. 4(5):117-120.

10. Bayemi, P.H., E.B. Tiabou, A. Ngoemdjom, P. Kanga, J. Mbanya, C. Ndi, A. Nfi, and O. Mangeli. 2004. "Effect of Replacing Cotton Seed Cake with Poultry Droppings on Weight Gain of Growing Cattle at Bambui, Cameroon". *Tropical Animal Health and Production*. 33(1): 49-56.

11. Bello, A.A. and D.N. Tsado. 2013. "Feed Intake and Nutrient Digestibility of Growing Yankasa Rams fed Sorghum Stover Supplemented with Graded Levels of Dried Poultry Droppings Based Diets". *Asian Journal Animal Science*. 7(2):56-63.

12. Bhattacharya, A.N. and J.C. Taylor. 1975. "Recycling Animal Waste as a Feedstuff: A Review". *Journal Animal Science*. 41:1438-1557.

13. Chen, X.B. and M.J. Gomex. 1992. *Estimation of Microbial Protein Supply to Sheep and Cattle Based on Urinary Excretion of Purine Derivative: An Overview of the Technical Details*. International Feed Res. Unit, Ronett Res. Inst. : Aberdeen, UK. 2 – 20.

14. Fajemisin, A.N., O.B. Omotoso, J.O. Agbede, and O.P.A. Olowu. 2013. "Growth Response of WAD Goats Fed Differently Treated Corncob Silage Diets". Conference on International Research on Food Security, Natural Resource Management and Rural Development organized by the University of Hohenheim Stuttgart, Germany: Tropentag. September 17-19, 2013.

15. FAO. 1983. *Production Year Book*. Food and Agriculture Organization: Rome, Italy.

16. Flachowsky, G. and A. Hennig. 1990. "Composition and Digestibility of Untreated and Chemically Treated Animal Excreta for Ruminants: A review". *Biolological Waste*. 31:17-36.

17. Harmon, B.W., J.P. Fontenot, and K.E. Webb, Jr. 1975. "Ensiled Broiler Litter and Corn Forage: 2. Digestibility, Nitrogen Utilization and Palatability by Sheep". *Journal of Animal. Science*. 40:156-160.

18. Hume, I.D., R.J. Moir, and M. Somers.1970. "Synthesis of Microbial Protein in the Rumen. I. Influence of the Level of Nitrogen Intake". *Australian Journal of Agricultural Research*. 21:283- 296.

19. Johnson, W.L. and A.I. Djajanegara. 1989. "A Pragmatic Approach to Proving Small Ruminant Diets in the Indonesian Humid Subtropics". *Journal of Animal Science*. 67:3068-3079.

20. Kategile, J.A. 1981. "Digestibility of Low Quality Roughages Supplemented with Concentrate." In: *Utilization of Low Quality Roughages in Africa*. Proceedings of a Workshop held in Arusha, Tanzania. AUN Agr. Dev. Rep., Norway, AUS. NLH. 181-184.

21. Kim, S.C., J.H. Kim, C.H. Kim, J.C. Lee, and Y.D. Koo. 2000. "Effects of Whole Crop Ensiled with Cage Layer Manure on Nutritional Quality and Microbial Protein Synthesis in Sheep". *Asian-Australian Animal Science*. 13:1548-1553.

22. Ngele, M.B., T.A. Adegbola, and S.E.S. Bagoro. 2006. Nutritive Value of Rice Straw Treated with Poultry Litter". In: *31st Annual Conference of Nigerian Society for Animal Production*. Bayero University, Kano, Nigeria, 12-15 March 2006. 31: 417-420.

23. NRC, 1981. *Nutrient Requirement of Goats: Angora, Dairy and Meat Goats in Temperate and Tropical Countries*. National Academy of Sciences: Washington D.C. 93 pp.

24. Olorunnisomo, O.A. and T.O. Ososanya. 2015. "Physical Characteristics, Nutritive Value and Preference of Zebu Heifers for Ensiled Mixtures of Corn Cob, Cassava Peel and Urea". *Scientific Journal of Animal Science*. 4(2):19-23.

25. Orskov, E.R. 1982. *Protein Nutrition in Ruminants*. Academic Press: London, UK. 160 pp.

26. Owen, E. and M.C.N. Jayarisuya. 1989. "Use of Crop Residues as Animal Feeds in Developing Countries: A Review". *Research and Development in Agriculture*. 6(3):124-138.

27. Owen, O.J., E.M. Ngodigha, and A.O. Amakiri. 2008. "Proximate Composition of Heat Treated Poultry Litter (Layers)". *International Journal of Poultry Sciences*. 7:1033-1035.

28. Rassol, S., M.A. Sial, Ahsan-ul-Haq, and A. Jamil. 1998. "Chemical Changes during Ensiling of Sudax Fodder with Broiler Litter". *Animal Feed Science and Technology*. 72:347-354.

29. Rogers, G.M. and M.H. Poore. 1994. "Alternative Feed for Reducing Beef Cow Costs". *Veterinary Medicine*. 89:1073-1084.

30. Satter, L.D. and R E. Roffler. 1975. "Nitrogen Requirement and Utilization in Dairy Cattle". *Journal of Dairy Science*. 58:1219-1223.

31. Satter, L.D. and R.R, Roffler. 1977. "Protein Requirement and Non Protein Nitrogen Utilization". *Tropical Animal Production*. 2(3):238-259.

32. Statistical Analytical Systems (SAS). 1998. *SAS/STAT User's Guide*. Statistical Analysis Institute Inc. Version 6, 3rd ed. Cary, NC. 943 pp.

33. Smith, O.B. 1988. "A Review of Ruminant Responses to Cassava Based Diets". *Proc. IITA/ILCA/University of Ibadan Workshop on the Potential Utilization of Cassava as Livestock Feed in Africa*. In: Hahn, S.K., L. Reynolds, and Egbunike, G.N. (Eds.). 14-18 Nov., 1988. http://www.fao.org/wairdocs/ILRI/x 5458E/x5458e07.htm

34. Tewe, O.O. and E.A. Iyayi. 1989. "Cyanogenic Glycosides". In: *Toxicants of Plant Origin. Vol. 2, Glycosides*. Cheeke, P.R. (ed). CRS Press: Boca Raton, FL. 43-60 pp.

35. Uza, D.V., R.E. Barde, and J.A. Ayoade. 2005. "The Effect of Urea Treated Cassava Peels as Supplement to WAD Goats Grazing Natural Pasture". *Nigerian Veterinary Journal*. 26(1):1-9.

36. Van Soest, P.J. and J.B. Robertson. 1985. *A Laboratory Manual for Animal Science.* Cornell University: Ithaca, NY. 202 pp.

37. Van Soest, P.J., J.B. Robertson, and B.A. Lewis. 1991. "Methods for Dietary Fiber, Neutral Detergent Fiber and Non-Starch Polysaccharides in Relation to Animal Nutrition". *Journal of Dairy Science*. 74:3583-3597.

38. Wanapat, M. and P. Rowlinson., 2007. "Nutrition and Feeding of Swamp Buffalo: Feed Resources and Rumen Approach". *Italian Journal of Animal Science*. 6:67-73.

39. Yu H., G. Guo, X. Zhang, K. Yan, and C. Xu. 2009. "The Effect of Biological Pretreatment with the Selective White-Rot Fungus *Echinodontium taxodii* on Enzymatic Hydrolysis of Softwoods and Hardwoods". *Bio-Resource Technology*. 100: 5170-5175.

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SUGGESTED CITATION

Ajayi, F.T., S.O. Omotoso, and T.O. Dauda. 2016. "Performance and Nutrient Digestibility of West African Dwarf Goats Fed Corncob-Poultry Dropping Silage". *Pacific Journal of Science and Technology*. 17(2):278-287.

Pacific Journal of Science and Technology