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PHYSICO-CHEMICAL AND PREFERENCE EVALUATION OF ENSILED CORNCOB-LAYERS DROPPING BY YANKASA RAMS

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ABSTRACT

This study was carried out to evaluate the effect of ensiling graded levels of corncob and layers dropping (CCLD) on fermentative and nutritional characteristics of ensiled CCLD, short time intake and preference by Yankasa rams. Ground corncob was ensiled with poultry dropping in a ratio of 50:50, 60:40, 70:30 and 80:20, each ratio serves as treatment. The physical characteristics, pH and chemical composition of the ensiled CCLD were determined after 21 days of ensiling. Five Yankasa rams aged between 10 – 12 months with live weight ranged between 17 – 20 kg were used to evaluate acceptability and preference of the ensiled CCLD in a cafeteria feeding style in a completely randomized design (CRD). Data obtained were subjected to analysis of SAS and significant means were compared. The chemical content ranges between 9.12-10.84%. The changes in fibre fractions indicated that neutral detergent fibre ranges from 15.60-16.81% and acid detergent fibre ranges from 9.92-22.79% with increasing level of corncob in the mixture. Percent acid detergent lignin also ranges between 12.61-19.03%. The pH values ranged between 4.4-4.68. CCLD mixture with 70:30 ratio has a pleasant smell. Ensiled CCLD score revealed that the best physical attributes were attained at 70:30 and 80:20% inclusion levels. Percent preference of Yankasa sheep significantly ($P<0.05$) varied from 18.85 – 36.22 % and the order of preference was 70:30 > 80:20> 60:40 > 50:50. The coefficient of preference (CoP) and percent preference indicated that ensiled CCLD with 70:30 and 80:20 were more acceptable and preferred by Yankasa rams than the other graded levels. This finding suggest that ensiling corncob with layers dropping improves its nutritive value hence, it is recommended that farmers could ensile corncob with layers dropping at the ratio of 70:30 and 80:20 to the extent that it can be utilized as an alternative livestock feed.

Keywords: *corncobs, ensiling, layers droppings, preference, Yankasa rams*

INTRODUCTION

Shortages of animal feed resources especially during dry season often impose major constraints on the development of animal production in Nigeria. Adebowale (1981) stated that the dominant forage which is the natural pasture grassland grazed by ruminants and crop residues from farm lands in Northern Nigeria cannot meet the energy and protein requirement of the animals. Most of the available by-products for feeding ruminant animals are now becoming co-products, scarce and relatively expensive. The feed shortage is more severe from March to May. The detrimental effect of the long dry season in arid and semi-arid regions on quantity and quality of feeds available to livestock are well documented (Sirajo *et al*. 2010; Bibi-Farouk, 2008 and Maigandi and Tukur, 2002). Ibeawuchi and Adamu (1990) also estimated that as much as 15% of the animal body weight attained at the end of the previous rainy season could be lost during the following dry season. Small scale farmers cannot afford the investments required to establish improved pastures and feed concentrate supplements to alleviate dry season

growth checks (Smith *et al.,* 1991). Ngele *et al.* (2006) reported that the crude protein of rice straw could be improved with poultry litter especially in the ratio of 5:5 when ensiled for 21 days. Gerald and Thomas (2006) reported that unconventional feeds could be conserved and their nutritional value improved by way of ensiling the feed material which aims at controlling microbial fermentation that could improve the feeding value of a feedstuff.

Corncob is a by-product obtained following shelling of maize and it is readily available. A major use of corncob to date has been a source of fuel energy for cooking. It is used as animal feed and has been restricted to ruminant because of its high fibre content. Corncob contains about 3.40% crude protein and 48.70% crude fibre (Ajayi *et al*., 2015).

Layer's dropping, although not aesthetically pleasing, has been recognized as a safe, nutritionally valid and environmentally friendly animal feed, especially when combined with other feed resources as supplements. It refers to pure excreta from layers in battery cages and poultry litter to the mixture of excreta and bedding material obtained largely from broiler houses and also from houses where pullets and layers are kept on deep litter systems. A small amount of feed spillage may be present in the material (Ajayi and Ogunleke 2015).

Also, economic value of excreta as feed supplement in balanced diets for several classes of ruminants may be 3 to 10 times greater than their value as plant nutrients (Smith and Wheeler, 1979). In both nutritional and economic terms, a poultry excreta has the highest value (Islam and Hossain, 1990). Two serious obstacles to the feeding of poultry excreta to livestock are pathogenic organisms and medicinal drugs. Research by Jakhmola *et al*. (1988) showed that poultry waste can be rendered free of pathogens by autoclaving, fumigation and dry heat alone or in combination with formaldehyde.

Furthermore, other methods of processing such as ensiling (Hadjipanayiotou, 1984; Daniels *et al*., 1983) and deep stacking (Strickler, 1977) have been proposed. It has also been argued recently that the challenges posed by global warming and resource depletion (Leng, 2009) can best be met by developing feeding systems that make better use of locally available feed resources (Preston, 2006). This study was therefore, carried out to evaluate the Physico-Chemical properties and preference of ensiling graded level of Corncob-Layers dropping fed to Yankasa rams.

MATERIALS AND METHODS

Experimental Site

The study was conducted at the Teaching and Research Farm of the Department of Animal Science, Ahmadu Bello University Zaria, located in the Northern Guinea Savannah Zone of Nigeria. It has a Latitude and Longitude of 11^{o} 33 N $07^{o}38`$E, coordinates: $11^{o}$ 33 N $07^{o}38`$E with an elevation of 610m above sea level (Ovimap, 2021). The average relative humidity is 21 and 72% during the harmattan and rainy season, respectively. Annual rainfall in the area ranges from 950mm to 1200mm per annum which lasts from early May to early October. The daytime temperature fluctuates between 16 to 47^{o}C during the dry season and 18 to 27.7 ^{o}C during the wet season (IAR Metrological service Unit, 2021).

Sourcing of feedstuff

The corncob was collected from the Practical Training Fields of the Faculty of Agriculture, Ahmadu Bello University Zaria. After crop harvest, the cob was shelled and ground using hammer mill with a mesh of 4mm diameter and was stored before ensiling.

The layers' dropping (deep litter system) was collected from Poultry Production Research Programme of National Animal Production Research Institute (NAPRI). The layers dropping was screened using hand and rake to

remove caked material and shade dried to avoid petrification and stored before ensiling.

Experimental Diets and treatments

Four diets were formulated containing graded levels of corncob-layers dropping as follows:

- Corncobs 50% +50% Layers dropping (50:50)
- Corncobs 60% +40% Layers dropping (60:40)
- Corncobs 70%+ 30% Layers dropping (70:30)
- Corncobs 80%+ 20% Layers dropping (80:20)

Ensiling procedure and evaluation

Each treatment containing the proportions specified above was thoroughly mixed, (corncob 91.82 % DM and layers dropping 91.99 % DM) was sprayed with water to obtain DM 40% as described by (Stock and Grant, 1994). The mixed corncobs - poultry dropping was packed in a Perdue Improved Cowpea (PIC) triple bags and compressed to remove air and then closed. The PIC bags were stored for 21 days away from sun light to ferment. At the end of the fermentation period, samples of ensiled corncobs - poultry dropping were taken for physical quality assessment. The appearance, smell, texture and pH were judged by a 5-man panel that had experience with silage-making using a 0 – 5 scale as follows:

Table 1: Five-man panel physical assessment scale for silage making

Parameters	**0**	**1**	**2**	**3**	**4**	**5**
Observation	Very bad	Bad	Going bad	Moderate	Good	Excellent
Colour	Very dark	Dark	Dark Brown	Deep brown	Brown	Light brown
Smell	Offensive	Poor	Almost pleasant	Fairly pleasant	Pleasant	Very pleasant
Texture	Slimy	Very soft	Soft	Moderately firm	Firm	Very firm
pH	>6.5	6.1 – 6.5	5.6 - 6.0	4.6 – 5.5	4.0 – 4.5	<4.0

Source: Ososanya and Olorunnisomo, (2015)

Source of Animals

The rams were purchased from Anchau central market in Kubau Local Government Area of Kaduna State. Prior to preference evaluation, the animals were quarantined and treated using Ivermectin (Ivomec®) against endo and ecto-parasites and oxytetracycline (a broad-spectrum antibiotic), respectively.

Preference study

Five Yankasa rams aged between 10 – 12 months with live weight ranged between 17 – 20 kg were used to evaluate the free choice intake of the four ensiled corncob-layers dropping (CCLD) in a cafeteria method (Larbi *et al*., 1993). The animals were housed together in a pen with short walls and cemented floor. The feeding period lasted for 10 days with 5 days adjustment and 5days of data collection periods. The four feeding troughs used per feed were randomly placed at four locations within the pen. The animals were offered 2kg each (wet basis) of ensiled CCLD for two hours daily between 08:00 -10:00 a.m and after which feeds refused were weighed. The order of placement of the ensiled CCLD offered in the pen was randomized every day to avoid "habit reflex" by the sheep (Kaitho *et al*., 1996). The rams were fed with a formulated diet for the rest of the day and clean fresh water was offered *ad libitum*.

Coefficient of preference (CoP) was calculated as the ratio of dietary intake to average intake of all the ensiled CCLD according to the procedure described by Karbo *et al*. (1996), while percentage of preference was calculated as the ratio of dietary intake to total intake multiplied by 100. According to this study ensiled CCLD was considered acceptable when the CoP is greater than one while ranking was done based on percentage of preference.

Chemical analysis

Samples of the experimental diets were determined before and after ensiling for Dry Matter (DM), Crude Protein (N × 6.25), Crude Fibre, Ether Extract and Ash contents as described by (AOAC,1995). Nitrogen Free Extract (NFE) was calculated by difference. The Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF), and Acid Detergent Lignin (ADL) were also determined using the method of Van Soest *et al.* (1991). Metabolizable (ME) energy was determined by calculation (Pauzenga, 1985).

$$ME\ (Kcal/kg) = 37 \times \%CP + 81.1 \times \%EE + 35.5 \times \%NFE$$

Statistical Analysis

Data collected at the end of the experiment were analyzed using General Linear Model procedure of statistical analysis system (SAS 2002) and significant differences among treatment means were compared at 5% probability level using Duncan Multiple Range test of SAS (2002).

RESULTS AND DISCUSSION

Chemical composition of ensiled CCLD

The chemical composition of the un-ensiled and ensiled CCLD is presented in Tables 2 and 3. The result shows that, DM content of before and after ensiling ranges between 58.10-58.63%. The crude protein content ranges between 9.12-10.84%. The CP obtained in the present study was higher than the minimum of 7% but lower than the ARC (1990) recommendation of 15 to 18% for growing sheep weighing 10 to 30 kg. Crude protein could be a single nutrient that could determine the quality of a feed as reported by McDonald *et al*. (1998).

Table 2: Chemical composition of the graded levels of CCLD before ensiling

Parameters (%)	CCLD ratio			
	50:50	**60:40**	**70:30**	**80:20**
Dry Matter	58.94	59.27	59.88	59.98
Organic matter	40.77	41.08	41.87	42.48
Moisture	41.06	40.73	40.12	40.02
Crude protein	6.87	5.89	5.01	4.12
Crude fibre	19.70	22.01	25.02	28.00
Ether Extract	1.64	1.79	1.87	1.90
Ash	18.17	18.19	18.01	17.50
Nitrogen Free Extract	53.62	52.12	49.91	48.48
Neutral Detergent Fiber	67.56	68.83	70.29	72.10
Acid Detergent Fiber	30.23	30.65	33.40	35.10
Hemicellulose	37.33	38.18	36.89	37.00
Acid Detergent Lignin	10.13	10.95	11.10	12.61
Cellulose	20.10	19.70	23.30	22.49
ME (Kcal/DM)	2290.704	2213.359	2108.832	2027.57

ME=Metabolizable Energy

The numerical differences in CP values from 50:50 to 80:20 in this study could be attributed to the varied proportion of ingredients in each treatment; particularly the varying proportion of layers dropping in relation to the proportion of corncob. 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) and Acid Detergent Lignin (ADL) declined as the proportion of layers dropping increased from 80:20 to 50:50 ratios.

Table 3: Chemical composition of the graded levels of ensiled CCLD

Parameters (%)	CCLD ratio			
	50:50	60:40	70:30	80:20
Dry Matter	58.63	57.67	58.10	57.36
Crude protein	10.84	9.95	9.51	9.12
Crude fibre	16.10	18.02	20.30	22.07
Ether Extract	1.58	1.61	1.96	1.89
Ash	11.01	10.40	10.01	10.50
Nitrogen Free Extract	60.47	60.02	58.22	56.42
Organic Matter	47.62	47.27	48.09	46.86
Neutral Detergent Fiber	56.20	58.03	59.29	60.10
Acid Detergent Fiber	27.23	26.65	26.40	27.10
Hemicellulose	28.97	31.38	32.89	33.00
Acid Detergent Lignin	8.80	9.14	9.70	10.21
Cellulose	18.43	17.51	16.70	16.89
ME(Kcal/DM)	2675.903	2629.431	2577.636	2493.629

ME=Metabolizable Energy

Percent changes in fibre fractions of ensiled CCLD

The percent changes in fibre fractions of ensiled graded levels of CCLD was presented in table 3. According to the result, percent neutral detergent fibre (NDF) increased from 15.60-16.81% and acid detergent fibre (ADF) ranges between 9.92-22.79% with increasing level of corncob and decreasing levels of layers dropping in the mixture. The percent changes of NDF and ADF values represent a great reduction from the corresponding respective values of the original CCLD material, probably due to the action of cellulolytic microorganism during the ensiling process. Percent acid detergent lignin also ranges between 12.61-19.03%.

The increase in the percent fiber fraction which is as a result of the decreased fiber fraction of ensiled CCLD in this study might be due to the breakdown of the cell wall component in corncob due to hydrolysis of uric acid from poultry dropping to ammonia (Ngele *et al.*, 2006) during ensiling. Reduction in fibre

fraction of CCLD agrees with previous findings Olafadehan *et al.* (2017) who attributed reduction in fibre fraction of crop residues to dissolving effect of ammonization on the hemicelluloses fraction and subsequent removal from cell wall component.

Table 4: Percentage changes in fibre fractions of ensiled graded levels of CCLD fed to Yankasa rams

Parameters	CCLD ratio			
	50:50	**60:40**	**70:30**	**80:20**
NDF	16.81	15.60	15.65	16.64
ADF	9.92	13.05	20.96	22.79
A.Lignin	13.13	16.53	12.61	19.03

NDF=neutral detergent fibre, ADF=acid detergent fibre and A.Lignin=acid detergent lignin

Physical characteristics and pH of ensiled CCLD

The physical characteristics and pH of the ensiled CCLD are presented in Table 5. The parameters measured were colour, smell and texture of the ensiled CCLD (50:50, 60:40, 70:30 and 80:20). Ensiling with layers dropping significantly ($P<0.05$) increased the colour quality from Dark brown to brown. Treatment with CCLD 80:20 and 70:30 had brown colour which is better than 50:50 and 60:40 CCLD ratios, having Dark brown. The slight difference in colour is as a result of varying ratios of corncob and layers dropping in each treatment and also due to the white colour of corncob which had a dilution effect on the dark colour of layers dropping. Ensiled CCLD with 50:50 ratio had fairly pleasant smell, while those of 60:40, 70:30 and 80:20 had a pleasant smell. The higher inclusion level of layers dropping in 50:50 ratio as compared with 60:40, 70:30 and 80:20, is responsible for the decrease in the aroma quality. CCLD ratio 50:50 and 70:30 had a firm texture while 60:40 and 80:20 had a moderately firm texture, the variations in the texture may be due to the varying ratio of the corncobs to layers droppings in the ensiled materials, indicating that addition of layers dropping to corncobs enhanced the texture of the ensiled diet. This result does not agree with finding of Ososanya and Olorunnisomo (2015), who stated that addition of maize cob to wet brewer's grain enhanced the texture of the mixture. This was due to the high level of structural fibres in corncob which improved the general structure of the silage. Corncob as a fibre source was also expected to enhance rumination in sheep fed these diets (Ibhaze *et al.,* 2014). The pH of the ensiled CCLD ranged between 4.4-4.56. The values recorded in this study were not within the acceptable range for good silage in the tropics as stated by (Bilal, 2009 and Nhan *et al* 2009). This suggests that there is need for addition of soluble carbohydrates which will enhance the complete fermentation of the ensiled corncob. It was also supported by the findings of Ososanya and Olorunnisomo, (2015) who reported that the soluble carbohydrates responsible for

fermentation of the silage were supplied by WBG rather than maize cob.

Table 5: Physical characteristics and pH of ensiled CCLD

Parameters	CCLD ratios			
	50:50	**60:40**	**70:30**	**80:20**
Observation	Moderate	Moderate	Good	Good
Colour	Dark brown	Dark Brown	Brown	Brown
Smell	Fairly pleasant	Pleasant	Pleasant	Pleasant
Texture	Firm	Firm	Moderately firm	Moderately firm
pH	4.40	4.56	4.48	4.54

Physical characteristic and pH of ensiled CCLD

The results of score for physical characteristics are shown in Table 6. The observed colour and smell increased as the level of corncob increases in the mixture, whereas texture decreased with increase in the proportion of corncob. Average score of the ensiled CCLD indicates that the best physical characteristics were achieved with 70:30 and 80:20 % graded levels.

Table 6: Ensiled CCLD score (0-5 scale*) based on physical characteristics and pH value

Ensiled diet	CCLD ratios				SEM
	50:50	**60:40**	**70:30**	**80:20**	
Observation	3.80^{b}	3.80^{b}	4.40^{a}	4.80^{a}	0.42
Colour	2.40^{b}	2.80^{b}	4.20^{a}	4.60^{a}	0.54
Smell	3.40^{b}	4.00^{ab}	4.20^{a}	4.80^{a}	0.49
Texture	4.40^{a}	4.00^{ab}	3.60^{ab}	3.20^{b}	0.75
pH	4.40	4.56	4.48	4.54	0.18
Average score	3.68	3.83	4.18	4.39	

^{ab}=means with different superscript along the rows shows significant different($p>0.05$), SEM= Standard Error of Mean.

Preference of CCLD by Yankasa rams

The result of the preference is presented in Table 7. Short time intake of ensiled CCLD was significantly ($P<0.05$) different across the treatments. Coefficient of preferences (CoP) of 50:50 and 60:40 was less than one while those of 70:30 and 80:20 had CoP was greater than one. The assumed implication in this study of

significant difference (P<0.05) in CoP is that sheep would accept 70:30 and 80:20 ratios of CCLD and reject 50:50 and 60:40 CCLD inclusions levels.. Acceptability of diets by livestock can also be measured as a percentage of total dietary intakes. As was reported by Ososanya and Olorunnisomo, (2015), percent preference appears to be a more realistic index of acceptability since it does not foreclose the possibility of changing dietary preference among livestock. Ikhimoya and Imasuen, (2007) also reported that small ruminants readily accept diets with which they have had previous experience while Provenza and Cincotta (1994) reported that pre-conditioning of small ruminants to a particular diet influences their choice among a variety of diets. In this study, the percent preference of Yankasa sheep significantly (P<0.05) varied from 18.85 – 36.22 % and the order of preference was 70:30 > 80:20> 60:40 > 50:50. The CCLD with 50% inclusion of layers dropping may become relatively off flavor. This may be related to the colour and aroma (flavour) hence the decrease in palatability to the Yankasa rams while CCLD mixture with 70:30 ratio has a pleasant aroma.

Table 7: Preference of ensiled graded levels of CCLD by Yankasa rams

Parameter	CCLD ratios				
	50:50	**60:40**	**70:30**	**80:20**	**SEM**
Intake(kg,DM)#	0.66^{b}	0.70^{b}	1.26^{a}	0.88^{b}	0.15
Coefficient of preference (COP)	0.75^{c}	0.79^{c}	1.45^{a}	1.07^{b}	0.11
% Preference	18.85^{c}	19.80^{c}	36.22^{a}	25.13^{b}	2.26
Preference ranking	4^{th}	3^{rd}	1^{st}	2^{nd}	

^{abc}means with different superscript along the rows shows significant different(p>0.05), SEM= Standard Error of Mean.

CONCLUSION

This study revealed that ensiled corncobs and layers dropping (CCLD) in 70:30 and 80: 20 ratios can be incorporated in the diet of Yankasa rams.

RECOMMENDATION

From this finding, it is recommended that ensiling corncob with layers dropping improves its nutritive value hence, farmers could ensile corncob with layers dropping in a ratio of 70:30 and 80:20 to the extent that it can be utilized as an alternative livestock feed.

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