

Feeding Quality of Fermented Maizecob Based Diets as Feed for West African Dwarf Goats

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ABSTRACT

An experiment was conducted to evaluate the nutritive value of maizecob based silages as feeds for ruminants in a growth study and assessment of blood profile using twelve (12) West African dwarf (WAD) goats. Animals were randomly allotted to three maizecob based silage diets made from composite maizecob (MC), cassava peel (Csp) and brewers' grain (BG). Diets were (MC/Csp), (MC/BG) and (MC/Csp/BG). The completely randomized design was adopted and the study lasted for a period of ninety (90) days. Chemical composition, feed intake, weight gain, feed conversion ratio and blood profile were determined using standard procedures. Results obtained revealed that the protein concentration of diets ranged from 16.18 - 22.06%, significant differences were observed in the average dry matter intake, average daily weight gain and feed conversion ratio. The packed cell volume, haemoglobin did not differ ($P>0.05$) significantly, however, other haematological indices studied showed significant ($P<0.05$) differences. No significant ($P>0.05$) differences were observed in total proteins, albumin, globulin, alanine amino transferase, and creatinine. However, significant difference was observed in aspartate amino transferase and urea across the dietary treatments. These results showed that maizecob when adequately furnished with protein source can be preserved as feed for ruminants in times of feed scarcity.

Keywords: agro-industrial by-products, growth, haematology, serum, silage, small ruminants

INTRODUCTION

Inadequacy of quality feeds especially during the dry periods has necessitated the use of alternative feed resources. However, some of these feed resources contain anti-nutrients, are low in nutrient, digestibility and even unpalatable to animals. Conversely, in improving these resources, various methods of treatment such as biological, chemical, fungal, ensiling, supplementation with urea and other high quality protein source had earlier been reported (Ibhaze *et al.*, 2011; Olorunnisomo and Ibhaze, 2013; Akinfemi, 2014). Such crop residues and by-products include maizecob, cassava peel, and brewers' grain. Maizecob is an energy source for ruminants, has low palatability and poor in nutrients. Due to its nutrient deficiency, it must be fortified with other feed materials that furnish these important nutrients (Ibhaze *et al.*, 2014). It is one of the most available and abundant agricultural wastes during the cropping season. Brewers' grain is a less expensive protein rich concentrate with high digestibility, can meet a significant portion of supplemental protein requirements, energy and fibre needed as bulk in diets of ruminants (Westendorf and Wohlt, 2002). Both wet brewer's grain and maizecob can act as conditioners, i.e the maizecob has the advantage of absorbing the juice from brewers' grain thereby limiting loss of nutrients during fermentation through seepage while brewers' grain improves the moisture content of maizecob to aid compaction during ensiling.

Cassava peel is a source of energy in ruminant feeding and it is highly digestible (Baah, 1999) due to its high soluble carbohydrate content. It is relatively cheap and easily available all through the year due to the large quantity of cassava tuber produced for diverse uses. However, in the use of alternative feed resources, the health status of the animal requires close scrutiny. Dietary feed

components have been reported to have considerable effects on blood constituents and clinical examination of the blood has been used to assess the physiological, pathological, nutritional and health status of animals (Muhammad *et al.*, 2004; Lamidi *et al.*, 2014). This study was conducted to evaluate the performance and blood profiles of WAD goats fed fermented maizecob based diets.

MATERIALS AND METHODS

Study Area

The study was conducted at the Dairy Unit of the Teaching and Research Farm, University of Ibadan, Nigeria (7° 27'N and 3° 45'E) with mean temperature of 27 °C and average annual rainfall of about 1250 mm.

Feed preparation and Chemical analysis

Composite maizecob and fresh cassava peels were collected from maize shelling and cassava processing centres respectively in Ibadan. The cassava peel was wilted for 12 hrs prior to ensiling to reduce the moisture content. The maizecob and cassava peels were chopped using an automated chopper for easy compaction and mixed in the proportions specified below (Table 1) and filled into 120 litres plastic drums lined with polythene sheets and in laboratory mini silos for chemical analysis and compressed manually in the silos and drums, sealed, weighted with a sand bag and covered with a plastic lid. The material was fermented for 21 days under anaerobic condition before being fed to experimental animals. Samples were taken from the mini silos for proximate and detergent fibre analyses determination using the methods of AOAC (1997) and Van Soest and Robertson (1985) respectively.

Table 1: Ingredient composition of experimental diets (%)

Ingredient	MC/Csp	MC/BG	MC/Csp/BG
Maizecob	13	13	13
Cassava peels	80	-	40
Brewers' grain	-	81	41
Palm kernel cake	5	5	5
Urea	1	-	-
Dicalcium phosphate	0.5	0.5	0.5
Sulphur	0.5	0.5	0.5
Chemical composition (%)			
Crude protein	16.18	22.06	19.50
Crude fibre	20.97	18.11	22.13
Ether extract	7.11	9.15	8.05
Ash	5.46	5.61	4.92
Nitrogen free extract	50.28	45.07	45.40
Neutral detergent fibre	46.03	39.12	40.15
Acid detergent fibre	29.11	23.03	27.23
Acid detergent Lignin	0.34	0.44	0.36
GE(MJ/kgDM)	17.66	14.23	15.69

MC/Csp (Maizecob/Cassava peel); MC/BG (Maizecob/brewers' grain); MC/Csp/BG (Maizecob/ Cassava peel/brewers' grain)

Management of animals

A total of twelve (12) West African dwarf does weighing 9.10 ± 0.55kg were tagged and randomly selected to three groups of four animals. They were all kept in individual pens and had free access to fresh feed and water daily. Animals were offered concentrate feed at 1% to take care of animals' basic nutrient requirements and experimental diets were offered ad-libitum. The experiment lasted for a period of 90 days. Animals' daily intake, daily weight gain were calculated.

Blood collection

At the end of the experiment, three animals from each replicate were randomly selected and their blood were collected via the jugular vein into sterilized specimen bottles for haematology and blood serum analyses using standard procedures (Reihold, 1953; Doumas et al., 1971; Lamb, 1981; Jain, 1986; Benson et al., 1989).

Experimental Design and statistical analysis

The experimental design adopted in this study was the completely randomized design. Thus, data obtained were analysed using one-way analysis of variance (ANOVA) of statistical analysis software (SAS, 2000) and means were separated using the Duncan Multiple Range Test (Duncan, 1955)

Results and Discussion

Feed intake of West African dwarf goats fed the experimental diets.

Daily intake by experimental animals is presented in Table 2. Significant differences were observed in the average daily intake, weight gain and feed conversion ratio among the diets. Animals on MC/BG recorded the highest intake value (354.43g/day) among all the treatments while those on MC/Csp had the least (334.41g/day). The higher values recorded by animals on diets having brewers's grain could be attributed to the higher crude protein content of the diets. This also suggests that goats likely relish brewers' grain when ensiled. Ahameful and Elendu (2010) indicated that palatability, gut fill, dietary crude protein, rumen outflow rate/retention time in the rumen affects feed intake. The highest value obtained in this study is relatively higher than 215.30 -290.25g/day reported by Fasae et al. (2012) who fed cassava residues and agro- industrial by products to WAD goats. Similarly, goats on MC/BG had the highest weight gain (38.44g/day) and the best feed conversion ratio (9.22). The highest weight gain recorded by goats on MC/BG could be attributed to the higher dry matter intake, better utilization of nutrients by the animals and invariably the overall performance of the animals. The feed conversion ratio results obtained were similar to values 7.89-10.79 reported by Ajayi et al. (2014) for WAD goats fed concentrate diets with corncob in varying inclusion levels. However, a reverse result was reported by Ibhaze et al. (2014) who fed dried ground corncob based meals to WAD goats, as goats offered dried ground corncob and brewers' grain mixture recorded the least feed intake (190.27g/day), daily weight gain (14.68g/day).

Table 2. Feed intake of West African dwarf goats fed fermented maizecob based diets

Parameters	MC/Csp	MC/BG	MC/Csp/BG	SEM
Initial weight (kg)	9.10	9.45	9.56	1.08
Final weight (kg)	11.71 ^b	12.19 ^a	12.16 ^a	1.19
Average daily intake (g/day)	334.4 ^b	354.43 ^a	340.6 ^b	27.13
Average daily intake (% BW)	2.4	2.7	2.6	0.21 ^{ns}
Average daily weight gain (g/day)	29.00 ^c	38.44 ^a	32.88 ^b	3.36
Feed conversion ratio	11.53 ^a	9.22 ^c	10.36 ^b	1.73

Means abc along the same row with identical superscripts are not significantly different (P>0.05), ns- not significant. MC/Csp (Maizecob/Cassava peel), MC/BG (Maizecob/brewers' grain), MC/Csp/BG (Maizecob/ Cassava peel/brewers' grain)

Haematological indices of West African dwarf goats fed experimental diets

The results of the haematological values obtained from WAD goats are shown in Table 3. Packed cell volume (PCV), Haemoglobin (HB) were not significantly (P>0.05) different across the dietary treatments. However, significant (P<0.05)

differences were observed in red blood cells and white blood cells. Packed cell volume values which indicates the relative proportions of plasma and red blood cells obtained in this study was higher than $25.7 \pm 3.1\%$ obtained by Tambuwal et al. (2002) for Red Sokoto goats, 23.94-25.34%, by Piccione et al. (2010) for Girgentana goats, but within the normal range of 21-35% reported by Daramola et al. (2005) for healthy female WAD goats. Results obtained were also higher than the range (20-21.67%) reported by Oloche et al. (2014) who fed Shea butter leaves supplemented with concentrate diets containing graded levels of sweet orange peel meal to WAD goats. Results also corroborate the findings of earlier studies of 29.9% obtained by Opara et al. (2010) for female WAD goats. The higher PCV observed in animals on MC/csp/BG is a function of the RBC.

Generally, the results obtained may be an indication of the relatively good quality of the feed, better utilization of the diets by the goats. Red blood corpuscles (RBC) which transport oxygen from the lungs to body cells showed significant ($P < 0.05$) variation. Goats on diet MC/Csp/BG recorded the highest value of $18.81 \times 10^6 \text{mm}^3$ while those on MC/BG had the least value ($10.00 \times 10^6 \text{mm}^3$). Results obtained were higher than 6.67-7.73g/dl obtained by Oloche et al. (2014) but comparable to $11.64 \times 10^6 \text{mm}^3$ reported by Ajayi et al. (2005). The higher values recorded in animals on diets MC/Csp/BG and MC/Csp may be due to the presence of cassava peels in the mixture. This suggests that cassava peel has the potential in stimulating erythropoiesis and consequently enabling the animal to maintain a stable healthy status. White blood cells count showed significant variation among the dietary treatments. Goats on MC/Csp/BG had the highest value ($7.60 \times 10^3 \text{mm}^3$) and those on MC/BG ($4.91 \times 10^3 \text{mm}^3$). Results obtained indicates that the experimental diets could improve the immune system of the goats to fight against infection.

Table 3. Haematological indices of West African dwarf goats fed fermented maizecob based diets

Diets	PCV (%)	HB (g/dl)	RBC ($\times 10^6 \text{mm}^3$)	WBC ($\times 10^3 \text{mm}^3$)
MC/Csp	36.01	12.17	10.30 ^b	5.73 ^b
MC/BG	35.00	11.73	10.00 ^b	4.91 ^b
MC/Csp/BG	37.01	12.30	18.81 ^a	7.60 ^a
SEM	2.18 ^{ns}	1.57 ^{ns}	1.79	1.88

Means a,b along the same column with identical superscripts are not significantly different; ($P > 0.05$), ns-not significant. MC/Csp (Maizecob/Cassava peel), MC/BG (Maizecob/brewers' grain), MC/Csp/BG (Maizecob/Cassava peel/brewers' grain); PCV= Packed Cell Volume; %, HB=Haemoglobin; g/dl, RBC=Red blood Cells; ($\times 10^6 \text{mm}^3$), WBC=White Blood Cell; ($\times 10^3 \text{mm}^3$)

Serum proteins of West African dwarf goats fed fermented maizecob based diets

Serum proteins are important in osmotic regulation, immunity and transport of several substances in the animal body (Jain, 1986). There were no significant ($P > 0.05$) differences across the treatments on serum parameters measured but were slightly

different numerically. The non-significant values obtained in this study suggest nutritional adequacy of the dietary proteins, sufficient protein intake by the animals and better utilization for protein synthesis. Results obtained may be related to the findings of Tewe and Maner (1980) who indicated that serum protein and albumin synthesis are related to availability of proteins and not calories. The mean total protein values obtained in this study are within the range of 5.5-10.0g/dl reported for various ruminant species (Jain, 1986) and in agreement with similar studies in a tropical environment (Ogunsanmi, 1994). The albumin values (3.1-4.65 g/100ml) obtained in this study were higher than (2.8-2.9 g/100ml) while the globulin (1.09 g/100ml) obtained were comparable to (2.1-2.3 g/100ml) reported by Opara et al. (2010) for apparently healthy WAD goats.

Table 4: Serum proteins of dry West African dwarf does fed fermented maizecob based diets

Diets	Total Proteins (g/100ml)	Albumin (g/100ml)	Globulin (g/100ml)
MC/Csp	6.68	4.54	2.14
MC/BG	7.99	4.65	3.34
MC/Csp/BG	6.92	4.30	2.62
SEM	2.71 ^{ns}	1.94 ^{ns}	1.17 ^{ns}

ns = not significant; MC/Csp (Maizecob/Cassava peel); MC/BG (Maizecob/brewers' grain); MC/Csp/BG (Maizecob/ Cassava peel/brewers' grainns)

Serum enzymes and metabolites of West African dwarf goats fed experimental diets

Serum transaminases (ALT and AST) are found in the serum and their levels in the serum are reliable tests for liver damage. Values obtained for ALT were not significantly ($P > 0.05$) different, however, significant ($P < 0.05$) variation was observed among the treatments for AST. Findings from this study were comparable with the values 74.2 and 39.0 iu/l for AST and ALT respectively as reported by Taiwo and Ogunsanmi (2002) which is an indication of normal functioning of the liver of the experimental animals. Significant ($P < 0.05$) differences were observed in the serum urea values among the treatments. Blood urea and creatinine levels are indices of protein catabolism and renal function test respectively in mammals. The lower the value, the higher the protein quality. The values of urea observed in all the treatments suggest the nutritional adequacy of the diets. However, the least value (13.56 iu/l) obtained by animals on MC/BG could be due to the nature of the protein in the diet as brewers' grain has by pass protein. This indication was also observed in animals on MC/Csp/BG. The nature of dietary protein do influence blood urea level of normal subjects which could be due to the nature of the amino acids in the protein thereby varying the quality of proteins in the experimental diets (Bolouch et al., 1985) and its ultimate utilization. There were no significant ($P > 0.05$) variations in creatinine values. Although, results obtained in this study were slightly higher than 0.7 mg/dl reported by Opara et al. (2010) for WAD goats.

Table 5: Some serum metabolites of West African dwarf goats fed fermented maizecob based diets

Diets	ALT	AST	Urea	Creatinine
MC/Csp	31.31	65.61 ^a	19.52 ^a	0.94
MC/BG	30.96	60.26 ^b	13.56 ^c	1.06
MC/Csp/BG	29.49	66.11 ^a	15.91 ^b	1.06
SEM	2.55 ^{ns}	2.88	2.12	0.49 ^{ns}

Means along the same column with identical superscripts are not significantly ($p > 0.05$) different. ALT (Alanine amino transferase), AST (Aspartate amino transferase).

CONCLUSION

Results showed that fermented maizecob, cassava peel and brewers' grain combinations can serve as potential unconventional ruminant feed especially during the dry period. Diets containing cassava peel enhanced red blood cell and packed cell volume, suggesting that cassava peel when furnished with rich protein source could be fed to goats with anaemic conditions. Fermented maizecob, cassava peel and brewers' grain combinations could be good source of roughage that can confer nutritional benefits on ruminants as no negative effects on the health of the animals was recorded.

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