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Performance and Economy of Production of Lactating West African Dwarf goats offered Cassava Leaf Supplement

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Target Audience: *Animal/Dairy Scientist, Livestock farmers, Nutritionist, Researchers*

Abstract

The experiment was conducted to determine the effect of feeding cassava leaf meal on the performance and lactation parameters of West African does. Sixteen (16) West African Dwarf (WAD) goats with mean body weight of 15.70 ± 0.81 kg were assigned to four dietary treatments of 0, 10, 20 and 30% of inclusion of concentrate with varying levels of sun cured cassava leaves. Results showed that concentrate with 10% cassava leaf contained, the highest crude protein while concentrate containing 20% cassava hay inclusion contained the least crude protein and feed conversion ratio. The energy values decreased as level of cassava leaf meal inclusion increased. The dry matter, ether extract, crude protein (CP), crude fiber, ash and NFE contents however, failed to follow a specific pattern across the treatment groups. Mean daily weight gain, total feed intake, water intake and feed conversion ratio of lactating goat does were not affected (p>0.05) by diet. The cost benefit of feeding was not significantly (p>0.05) affected but cost of feed consumed tended to be highest for does on control diet and least for does on 30% cassava leaf meal Therefore, the high cost of Brewers Dry Grain in lactating West African Dwarf does could be off set with the inclusion of up to 30% cassava leaf meal without any detrimental effect on performance.

Keynote: *Lactation performance, Brewers Dry Grain, Cassava leaf, West African Dwarf doe and Cost benefit*

Description of Problem

Goats require nutrients for body maintenance, growth, reproduction, pregnancy, and production of products such as meat, milk and hair. However, goats suffer from scarcity of feed supply and pasture quality in the humid zone of West Africa especially during the dry season.

Generally, ruminants in the tropics are raised predominantly on grasses which are inherently poor in digestibility, nutritive value and not even available in the dry season (1). At this period, the performance of the grazing animals, which is dependent on the native pasture, is seriously curtailed as the quality is associated with the fibrous and lignified nature of the pasture which limits voluntary intake, digestibility and utilization (2). Inability of ruminant livestock producers, especially peasant farmers, who cannot afford the cost of forage conservation (3) to feed their animals adequately throughout the year, is a major constraint to meeting demands for meat and milk intake. This has necessitated the search for non-conventional feedstuffs which are cheap and not in high demand by humans (4). It has been reported that any approach targeted at improving goat for meat, milk production and quality must first address the issue of nutrition. This has prompted farmers to search for readily available alternative and crop by-products such as cassava leaves and peels. Cassava leaves and peels are considered to contribute significantly to environmental problems when left in the surroundings of processing plants or carelessly disposed of (5). Cassava leaf meal is rich in crude protein, which is a major limiting nutrient to ruminants on fibrous crop residues and agro-industrial wastes and have been found to have high nutrient profile which can effectively speed up the growth of small ruminant production thereby assisting farmers to formulate and process a simple adoptable low cost feed for ruminants during off season (6). Despite these qualities, the nutritional potentials of cassava leaf meal and concentrates-based diets in lactating West African Dwarf goat remain currently under researched in Nigeria. Therefore, the purpose of this study was to assess the effects of cassava leaf meal-based concentrate diets on lactation performance, cheese yield and kid growth rate of West African Dwarf does.

Materials and Method

Experimental Site

This experiment was carried out at the Small Ruminant Unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture Abeokuta, Nigeria. This site is located on the rain forest vegetation zone of south-western Nigeria between latitude 7^0 and 10^0 N and longitude 3^0 2^1 E and an altitude of 76m above sea level. The climate is humid with a mean annual rainfall of 1100 mm and annual temperature range between 22.5-30.72^0 C. Relative humidity ranged from 63% in January to 96% in August with a yearly average of 86% (7).

Experimental animals and their management

Sixteen (16) West African Dwarf (WAD) goats, in their 2nd and 3rd parity, aged 2-3 years, with mean body weight of 15.70 ± 0.81 kg were used in this study. The animals were housed in individual open-sided pens with wooden slatted floors with a dimension of (180×100cm; L×B) and were maintained under semi-intensive system. They were allowed to graze and supplemented with concentrate. The actual feeding trial commenced after the adaptation period of 14 days and the animals were fed at 3.5% body weight and fresh water were offered *ad libitum* between 08:00-10:00 hours. The feeding trial lasted for 56 days.

Experimental diets

Fresh cassava leaves with petiole of the variety TME 419 were sourced from Demonstration and Experimental farms of the Centre of Excellence in Agricultural Development and Sustainable Environment

(CEADESE), Federal University of Agriculture Abeokuta, Nigeria, and sun-dried for two weeks and milled. Cassava leaves were used at 10%, 20% and 30% to replace Brewers Dry Grain (Table 1). 0% Brewers Dry Grain served as the control. Data were collected on performance characteristics of the animals and cost benefits of the experimental diets. Five grams of samples from each of the experimental diets were collected on weekly basis for dry matter determination and chemical analysis (8). Data were collected on daily feed provided and feed refusals, and the differences calculated to determine feed intake. The animals were weighed at the beginning of the experiment and weekly thereafter to monitor the growth pattern of the animals in response to dietary treatments. Water intake of the animals were monitored to assess the relationship between dry matter intake and voluntary water consumption. Two (2) litres of water were offered to each animal once daily. Water intake was measured as the difference between the quantity supplied and the leftover. Evaporative water loss was measured as the difference between a known quantity of water kept in a pen without experimental animal and the leftover. Addition of water intake and evaporative water loss equals Actual water intake.

Table 1: Composition of the experimental diets at different inclusion levels (%)

Ingredients (%)	0	10	20	30
Yellow maize	5	5	5	5
Dried cassava peel	40	40	40	40
Dried cassava leaf	0	10	20	30
Brewers Dry Grain	25	15	7	0
Palm Kernel Cake	20	21	20	19
Ground Nut Cake	5	4	3	1
Bone meal	2	2	2	2
Limestone	1.5	1.5	1.5	1.5
Salt	1	1	1	1
*Premix	0.5	0.5	0.5	0.5
Total	100	100	100	100

*Premix (each kg contains): Vitamin A: 10,000 IU; Vitamin E: 70,000 IU; Vitamin D: 1,600,000 IU; Fe: 50 g; Zn: 40 g; Mn: 40 g; Co: 0.1 g; Cu: 10 g; Se: 0.1 g; I: 0.5 g.

Cost- benefit analysis of the experimental diets

The prevailing prices per kilogram of feed ingredients were taken into consideration over the entire experimental period. Milling of the dried cassava leaf and transportation of feed were included as part of feed cost. The total cost of each experimental diet was recorded and the cost of feed consumed by each animal per weight gain was calculated.

Feed cost/kg diet = Quantity of each ingredient x Unit price/kg of the ingredient.

Cost of feed consumed = Cost/kg diet x Total feed consumed per replicate.

Cost per kilogram weight gain = FCR x Cost/kg diet.

Statistical analysis

The data obtained from the study were subjected to statistical analysis using general linear model (GLM) procedures of (9) in a completely randomized design. Where significant differences were observed, treatment means were separated using Tukey's honestly significant difference

(HSD) test adopting the level of 5% probability.

Statistical model

$Yij= \mu+Ti+\sum ij$

Where:

Yij= observed value of the dependent variables

μ= population mean

Ti= effect of the ith dietary treatment

∑ij= random residual error

Results

Chemical composition of the experimental diet

Proximate composition of the experimental diets is as shown in Table 2. Concentrate with 10% cassava leaf contained the highest crude protein while concentrate containing 20% cassava hay inclusion contained the least. The energy values decreased as level of cassava leaf meal inclusion increased. The dry matter, ether extract, crude protein (CP), crude fiber, ash and NFE contents however, failed to follow a specific pattern across the treatment groups. The dry matter, ether extract and ash were higher in Cassava hay compared to Brewers Dry Grain while the crude protein was higher in Brewers dry waste compared to Cassava hay.

Table 2: Proximate composition of experimental diets at different levels of cassava leaf inclusion

Parameters	0	10	20	30	Brewers dry waste	Cassava hay
Dry matter (%)	91.18	92.08	91.19	92.05	25.1	73.65
Crude protein (%)	17.37	17.44	15.38	15.67	24.5	22
Ether extract (%)	9.14	8.65	7.57	8.08	5.9	10.13
Crude fibre (%)	8.57	7.91	7.67	8.21	-	
Ash (%)	10.78	11.91	11.76	13.59	1.2-5	16.07
NFE (%)	45.32	46.17	48.81	46.50	-	-
ME (MJ/kg/DM)	12.35	12.27	12.26	12.14	-	14.25

NFE: Nitrogen-Free-Extract, ME: Metabolizable energy

Performance characteristics of lactating West African Dwarf does fed graded levels of cassava leaf meal

Mean daily weight gain, total feed intake, water intake and feed conversion ratio of lactating goat does were not affected ($p>0.05$) by diets but tended to be highest for does on control diet and least for does on 10 and 20% diets (Table 3). The initial weight ranged from 14.92 in 20% cassava hay inclusion to 16.55kg in 0% inclusion while the total weight gain varied from 0.77kg in 30% to 1.73 in 10% inclusion level. Daily weight gain ranged from 13.75g in 30% to 30.89g in 10% cassava leave meal inclusion. Moreover, does on control diet had numerically highest final weight of 17.92kg, total feed intake of 12.35kg and feed conversion ratio of 9.01 respectively. The feed intake decreased with increase in the level of cassava leaf meal inclusion in the diets.

Table 3: Effect of cassava leaf meal concentrate on the performance of lactating West African Dwarf does

Parameters	0	10	20	30	SEM	P-value
Mean initial weight (kg)	16.55	15.20	14.92	15.20	0.82	0.926
Mean final weight (kg)	17.92	16.38	15.97	15.97	0.85	0.870
Total weight gain (kg)	1.37	1.73	1.06	0.77	0.13	0.507
Daily weight gain (g)	24.47	30.89	18.92	13.75	2.40	0.507
Total feed intake (kg)	12.35	9.46	9.45	9.45	0.85	0.585
Daily Feed intake (g/day)	220.54	168.93	168.75	168.75	23.67	0.068
Water intake (l/doe/day)	0.96	0.70	0.59	0.56	0.06	0.068
Feed conversion ratio	9.01	5.47	5.46	12.27	1.47	0.853

SEM = Standard Error of Mean

Cost benefit of West African Dwarf Does fed cassava leaf meal concentrate

The cost benefit of feeding West African Dwarf does cassava leaf meal concentrate is presented in table 4. All parameters measured were not significantly affected but cost of feed consumed tended to be highest for does on control diet and least for does on 30% cassava leaf meal.

Table 4: Cost benefit of West African Dwarf does fed cassava leaf meal concentrate

Parameters	0	10	20	30	SEM	P-value
Feed cost/Kg diet (₦/kg)	106.70	94.45	84.90	74.45	0.00	
Cost of feed consumed/doe (₦)	1318.21	893.18	801.88	703.55	93.71	0.069
Cost/Kg weight gain(₦/Kg)	994.80	1108.84	832.300	960.16	130.70	0.930

SEM: Standard error of means

Discussion

The proximate compositions of the leaf meal in this study are comparable with the findings of (10) for the same leaf meal. However, the differences in the proximate compositions could be attributed to the location, season, test ingredients, the level of dryness of the test ingredient and the processing method used.

The non-significant decrease in feed intake in animals could be due to the high fibre levels of the diets and unpalatable nature of cassava leaf. However, (6) reported a higher feed intake on high cassava hay based diet. The crude fibre value reported in this study was lower than 16.15-19.35% crude fibre reported by (3) for cassava leaf meal while the crude protein was higher than 12.56-13.52% but comparable with 14.7-20.5% reported by (6). Protein content of forages is a major determinant of ruminant performance due to increased availability of fermentable nitrogen and other nutrients (11) and hence, the high feed intake of lactating does on diet with higher protein content.

The non-significant results obtained in the growth performance indices of the does is at variance with study of (4) who reported higher growth rates and lower feed conversion ratio which indicated better goat performance in terms of weight gain with the high level of cassava foliage as supplement in growing goat and this is in agreement with earlier findings of (12). The reason for the variation observed in the current study and that of (4) could be attributed to the differences in season, the level of dryness of the test ingredient and the state of the animal used.

According to (13), the relative advantage or disadvantage of using any of these diets could be determined by the price of ingredients at the time of use and the current price of live and dressed goat. From this present study, it was observed that, despite the high cost of producing the diet containing Brewers Dry Grain (Diet 1), it is still economically comparable with diet 3 which had least cost per kg feed.

Conclusion and Applications

1. Inclusion of cassava leaf hay had no significant effect on performance of lactating West African Dwarf goat does however, inclusion of up to 20% cassava leaf hay may enhance performance of lactating West African Dwarf goat does.
2. Inclusion of cassava leaf meal concentrate in the diet of lactating West African Dwarf does did not have any effect on the cost benefit analysis.
3. High cost of Brewers Dry Grain in lactating West African Dwarf does could be off set with the inclusion of up to 30% cassava leaf meal without any detrimental effect on performance.

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