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Evaluation of alternative feed resource in milk yield and milk quality of Lactating West African Dwarf goats

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Abstract

Dry season feeding is a major challenge to ruminant farmers and animals as this results in low productivity, death of the animals and economic loss to the farmer. Hence, the need to search for alternative sustainable feed resources in circumventing this occurrence. Sixteen West African Dwarf (WAD) does were fed cassava peel-*Gmelina arborea* leaves silage to evaluate their intake, milk yield and milk constituents. Four experimental diets were anaerobically made from varying proportions of cassava peel (CSP) and *Gmelina arborea* (GML) leaves as shown; 100GML, 90GML+10CsP, 70GML+30CSP and 50GML+50CSP. The does were divided into four (4) groups of four animals per group as each animal served as a replicate for each treatment in a completely randomized design (CRD). The experiment lasted for 56 days. Data on voluntary feed intake was collected daily while the milk yield was obtained once a week. Results showed significant ($p < 0.05$) differences in intake, feed conversion ratio, and milk yield. Goats fed 50GML+ 50 CSP silage had the highest (520.96g/day) intake and the least (289.23g/day) was observed in goats fed 100GML. Highest (2.28) FCR was observed in goats fed 100GML while the least (2.07g/day) was observed in goats fed 50GML+ 50 CSP silage. The milk yield was highest (323.51g/day) in goats fed 50GML+ 50 CSP silage while the least (192.89g/day) was observed in goats fed 100GML. Milk constituents did not vary significantly ($p > 0.05$) as values ranged from 3.57-3.86% for protein while fat, lactose, ash, total solids, solids-not -fat varied from 4.02-4.32%, 4.11-4.59%, 0.71-0.89%, 12.95-13.18% and 8.74-8.98% respectively. Milk energy did not differ ($P > 0.05$) among treatment groups as the values ranged from 3.16-3.24(MJ/Kg). Negative but significant ($P < 0.05$) correlation coefficients existed between mean milk yield and milk components. Values ranged from $r = 0.29^*$ between mean milk yield and total solid to $r = 0.51^*$ for lactose. Positive and significant ($P < 0.05$) relationship were observed between protein and total solid (0.71*) and between fat and total solid (0.59*). Conclusively, feeding cassava peel-*Gmelina arborea* leaves silage at equal proportions (50:50) as off season feed could best sustain and support milk production in WAD goats.

Keyword: cassava peel, *Gmelina arborea*, Lactating, milk constituents, milk yield, WAD goats

Introduction

Goats have been found to be alternative source of milk to cow. However, these animals are bedeviled with low productivity (milk and meat), stress, death and consequent economic loss to the farmers arising from poor quality forages due to seasonal fluctuations (Ibhaze, 2020).

Although, Nigeria's indigenous breeds of goat are not genetically milk producers, however, their production can be improved on sustainable basis through adequate nutrition in terms of quality and quantity. *Gmelina arborea* leaves is a good source of energy for livestock diets (Amata, 2014), has protein content of 14.6% (Amata and Lebari, 2011). It is a readily available cheap non-conventional feed resource for ruminants in Nigeria (Ibhaze et al., 2015) during the dry seasons. Cassava peel has become a useful waste from processing of cassava tuber. Ensiling cassava peel with *Gmelina arborea* leaves has been reported to improve its feeding value for growing goats (Ibhaze et al., 2015). The objective of this study was to evaluate the feed intake, milk yield, feed conversion ratio in relation to milk yield and milk constituents of WAD goats fed *Gmelina arborea* leaves and cassava peel silage.

Material and Methods

Gmelina arborea leaves and Cassava peels were chopped into smaller sizes (3cm) in the following proportions; 100%GML, 90%GML +10%CSP, 70%GML + 30%CSP and 50%GML+50%CSP and ensiled for 21 days. Sixteen WAD does weighing 10.75-11.69 kg were randomly allotted to the four diets with four goats per diets. Animals were synchronized using prostaglandin (PGF 2α) at 1ml/10kg intramuscularly. Data collection for this study commenced immediately after kidding. Animals were offered equal quantity of concentrate at 7.00hr and silage was offered immediately after the consumption of the concentrate. Silage intake was estimated as the difference between offered and refused. Milk yield was determined as described by Irina et al. (2015). Milk constituents were determined according to the methods of AOAC (2003) while the milk energy Y (MJ/Kg) was computed using the multiple regression equation: $Y = 0.386F + 0.205SNF - 0.236$ (MAFF, 1975).

Experimental Design and Statistical Analysis:

The completely randomized design was adopted for this study. Data obtained were subjected to analysis of variance and means were separated by Duncan's multiple range tests using the SPSS (2012) version 21 procedures

Results and Discussion

Table 1. Intake, milk yield and feed conversion ratio of Lactating WAD goats fed cassava peel - *Gmelina arborea* leaves silage

Variables	Diets				SEM
	100GML	90GML+10 CSP	70GML+30 CSP	50GML+50 CSP	
Silage intake (g/day)	289.23 ^d	335.56 ^c	475.21 ^b	520.96 ^a	2.14
Concentrate intake (g/day)	150.00	150.00	150.00	150.00	3.21
Total intake (g/day)	439.23 ^c	485.56 ^c	625.21 ^b	670.96 ^a	4.35
Dry matter intake (% BW)	2.65 ^c	3.45 ^b	3.89 ^b	4.25 ^a	0.32
Milk yield (g/day)	192.89 ^d	214.02 ^c	282.20 ^b	323.51 ^a	21.03
Feed conversion ratio (intake/milk yield)	2.28 ^a	2.26 ^a	2.21 ^b	2.07 ^c	0.05

a,b,c: Means along the same row with identical superscripts are not significantly ($p > 0.05$) different. GML = *Gmelina arborea* leaves, CSP= Cassava peel

Table 2: Milk constituents of Lactating WAD goats fed cassava peel - *Gmelina arborea* leaves silage.

Variables	Diets				SEM
	100GML	90GML+ 10 CSP	70GML+30 CSP	50GML+50 CSP	
Total solid	13.18	13.00	12.95	13.09	0.47
Protein	3.86	3.82	3.65	3.57	0.18
Fat	4.32	4.02	4.21	4.22	0.23

Lactose	4.11	4.33	4.30	4.59	0.16
Ash	0.89	0.83	0.79	0.71	0.07
Protein/ Fat ratio	0.89	0.95	0.86	0.84	0.06
Solid- not –fat	8.86	8.98	8.74	8.87	0.19
Milk energy (MJ/Kg)	3.24	3.16	3.18	3.21	0.14
Calcium (mg/100g)	113.45	129.56	134.23	133.21	3.02
Potassium	148.38	158.45	150.34	152.62	3.45
Phosphorus	88.55	95.45	93.74	94.42	2.12
Magnesium	13.68	14.76	15.21	15.87	0.31
Sodium	55.34	51.82	49.67	57.32	1.85
Zinc	0.31	0.38	0.35	0.31	0.21

Table 3: Correlation Coefficient of milk yield and milk constituents of West African does fed cassava peel - *Gmelina arborea* leaves silage.

Variables	Milk yield	Protein	Fat	Lactose	Total solid	Ash	Solid– not- fat	Milk Energy
Milk yield	1.00							
Protein	-0.35*	1.00						
Fat	-0.48*	0.62*	1.00					
Lactose	-0.51*	-0.10	0.12	1.00				
Total solid	-0.29*	0.71*	0.59*	0.52	1.00			
Ash	- 0.39*	-0.23	-0.42	-0.47	0.56	1.00		
Solid-not-fat	-0.45*	0.63	-0.67	0.62*	0.45	0.71*	1.00	
Milk Energy	-0.35*	0.74	0.78	0.74	0.59	0.42	0.23	1.00

Dry matter intake, milk yield, feed conversion ratio of lactating WAD goats fed cassava peel-*Gmelina arborea* leaves silage are presented in Table 1. Significant ($p < 0.05$) differences were observed in the variables considered. Goats fed 50GML+ 50 CSP silage had the highest (520.96g/day) intake, milk yield (323.51g/day) and the best feed conversion ratio. Milk constituents (Table 2) indicated no significant ($P > 0.05$) variation among the treatment groups. The mineral constituents are comparable to the reports of (Efthymia et al., 2007; Fajemisin et al., 2014). The range of milk yield obtained in this study is higher than 174.86-298.66g/day reported by Odoemelam et al. (2013). The highest milk yield observed in goats fed equal proportions of cassava peels and *Gmelina arborea* leaves silage could be that the animals found the diet more palatable, resulting in their highest feed intake and also provided a balanced diet for the animals for more milk synthesis. The milk constituents obtained in this study are comparable to reports of other researchers for WAD goats (Ibrahim et al., 2015). The negative correlations observed in milk yield and milk constituents indicates independence of the variables. Milk protein, fat and total solid were positively correlated among each other which points out that as one component increases the other also increases. This suggests that selection for one will not affect the other because the gene that affect them are independently inherited

Conclusions and Outlook

The results obtained in this study suggest that readily available cheap sources of protein and energy can be harnessed from cassava peel-*Gmelina arborea* leaves silage as feed resource for WAD goats. Also, incorporating CSP at equal proportion with GML (50:50) improved and sustained milk production in WAD goats.

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