

Theobroma cacao pod silage diets; effect on mineral and anti-nutrients utilization by goats

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Abstract

A 63-day study was conducted to evaluate the mineral and anti-nutrients utilization and weight gain by west African dwarf goats fed *Theobroma cacao* pod silage diets. Cocoa pod husk used was collected, crushed to 2 cm particle size, divided into 4 equal portions, and ensiled differently with synthetic and non-synthetic fertilizer for 28 days under anaerobic conditions to increase the nutrients. Thereafter the ensiled products were dried and incorporated with other convectional feed ingredients at fixed amount to make four diets to feed twenty-four goats (six goats per treatment). Nutrient, mineral and anti-nutrient composition were assayed; sex effect on intake (nutrient, mineral and anti-nutrient), utilization, weight gain and feed conversion ratio were evaluated. From the results, the non-protein nitrogen sources proved to improve the nutritional values of the diets, and rich enough to support the growth of goats. The goat-does were observed to consume more of their feeds than the bucks. Anti-nutrients were tolerable and did not hinder utilization/depress weight gain. Goats fed diet D (5% urea ensiled CPH) had the highest weight gain and lowest feed conversion ratio. Hence, it could be recommended to ruminant farmers for adoption, to improve livelihoods in sub-Saharan Africa.

Introduction

“Agricultural waste” is increasingly being viewed as a valuable resource though they are usually fibrous, with poor quality nutrients and minerals, considerably high anti-nutrients which make their digestibility low. In Nigeria, there are more than 21 million tonnes of plant by-products produced annually, among them is the cocoa (*Theobroma cacao*) pod husk (CPH). Silage can be an economical source of nutrients for ruminants. The use of urea or ammonia, lye solution and poultry litter to increase the nutritive value of low quality crop residues have been worldwide spread. Inexpensive non-protein nitrogen (NPN) is alternative source and attractive protein replacement compared with nowadays tremendously expensive natural proteins. Hence, this study was conducted to evaluate the mineral and anti-nutrients utilization of CPH ensiled with urea, lye or poultry litter in feeding West African Dwarf (WAD) goats.

Methods

The experiment was carried out at the small ruminant unit of the Teaching and Research farm, Federal University of Technology, Akure. Cocoa pod husk used was collected, crushed to 2 cm particle size and divided into 4 equal portions, the 1st portion was untreated, 2nd portion was treated with lye solution (1 litre lye solution/1 kg CPH), 3rd portion was treated with poultry litter (1 kg poultry litter / 1 kg CPH) and the 4th portion was treated with 5% urea solution (1 litre urea solution / 1 kg CPH) and each ensiled in 400 litres capacity plastic drums under anaerobic condition for 28 days. Four diets were formulated such that each air-dried ensiled product was incorporated at 30% level with cassava peels (20%), palm kernel cake (15%), wheat offal (5%), brewer's dried grain (27%), other micro-ingredients (3%). Twenty-four WAD goats were assigned to the 4 diets (six goats/diet, balanced for sex and weight) in a completely randomized design for a period of 63 days. Feed, faecal and urine samples were analyzed for proximate, minerals and anti-nutrients using AOAC (2002) methods and data generated were statistically analyzed.

Results and Discussion

The use of NPN such as urea and/or uric acid to improve the nutritional value of low quality crop residues is still considered as the most favourable (Table 1).

Table 1. Chemical compositions of CPH silage diets fed to WAD goats

<i>Parameters (%)</i>	Diets				SEM
	A	B	C	D	
Dry matter	88.52	88.49	88.75	88.91	0.54
Crude protein	12.71 ^d	14.15 ^c	19.17 ^a	17.57 ^b	0.16
Crude fibre	16.74 ^a	14.62 ^b	11.39 ^c	10.43 ^d	0.74
Calcium(Ca)	0.41 ^e	0.61 ^c	0.69 ^b	0.75 ^a	0.06
Phosphorus(P)	0.18 ^d	0.22 ^c	0.31 ^b	0.37 ^a	0.02
Phytate	1.30 ^a	1.15 ^c	1.08 ^d	0.86 ^e	0.97
Tannin	2.27 ^a	1.89 ^c	1.89 ^c	0.93 ^d	0.13
Theobromine	1.70 ^d	1.51 ^c	1.42 ^d	1.36 ^e	0.12

^{abcd}Means within the same row with different superscripts are significantly ($P < 0.05$) different. **A:** Untreated CPH, **B:** Lye treated ensiled CPH, **C:** Poultry droppings treated ensiled CPH, **D:** Urea treated ensiled CPH.

Female goats consumed more of their feed than the bucks (Table 2). This might be attributed to the design of the pen, because they could sight each other. Hence, the male goats might have increased libido to service the does, and therefore lost their appetite/ingestive drive. Phytate, tannin and theobromine concentrations were at tolerable level and did not hinder nutrients/mineral bioavailability and utilization, as goats fed diet D had highest weight gain.

Table 2. Response of WAD goats to CPH silage diets

Source variation	of	Intake(g/d)		Balance(g/d)		Intake(g/d)		Growth				
		Ca	P	Ca	P	Phytate	Tannin	Theo-bromine	Initial wt.(kg)	Final wt.(kg)	Wt. gain (g/d)	FCR
Sexes	F	1.94	0.85	1.69	0.71	3.70	5.99	4.99	9.14	10.72	18.83	17.33
	M	1.87	0.81	1.62	0.68	3.55	5.75	4.79	8.78	10.26	19.23	17.05
	SEM	0.05	0.04	0.07	0.04	0.04	0.10	0.05	0.03	0.03	0.11	0.02
Diets	A	1.21 ^d	0.53 ^d	1.01 ^d	0.42 ^d	3.84 ^a	6.70 ^a	5.07 ^a	9.03	9.86 ^d	9.22 ^c	28.34 ^a
	B	2.05 ^c	0.74 ^c	1.81 ^c	0.59 ^c	3.86 ^a	6.34 ^b	5.02 ^a	8.93	10.83 ^b	21.10 ^b	14.06 ^b
	C	2.34 ^b	1.05 ^b	2.07 ^b	0.89 ^b	3.66 ^b	6.40 ^b	4.81 ^{bc}	8.93	10.80 ^b	20.78 ^c	14.46 ^b
	D	2.55 ^a	1.26 ^a	2.26 ^a	1.10 ^a	2.93 ^c	3.16 ^c	4.63 ^c	8.93	11.33 ^a	26.56 ^a	11.39 ^c
	SEM	0.06	0.03	0.12	0.05	0.03	0.19	0.02	0.51	0.23	0.36	0.03

^{abcd}Means within the same row with different superscripts are significantly ($P < 0.05$) different. FCR-Feed conversion ratio

Conclusions and/or Implications

Use of urea and/or poultry litter treated cocoa pod husk in goat diets could lead to enhanced goat production in sub-Saharan Africa.

References

AOAC (2002). Official Methods of Analysis of the Association of Official Agricultural Chemists Washington D. C., USA.