

ENHANCING THE UTILIZATION OF LOW QUALITY FEED RESOURCE (MAIZE STOVER) IN GOATS USING VEGETABLE OIL DRENCH

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Abstract

The research was carried out to investigate the defaunating potential of vegetable cooking oil and its effect on the digestibility of maize (*zea mays*) stover by West African dwarf goats. Twenty-four West African dwarf goats with average live weight of 8.4kg $\pm$ 0.59kg aged 10-12 months were fed a basal diet of maize stover and cassava peel concentrate supplement at 0, 25 and 50% supplementation with or without a single oil drench at 5ml/kgLW in a Completely Randomised Design. Daily feed intakes and weekly weight changes were monitored for 84 days. Digestibility of nutrient intakes was also monitored. The Dry Matter, Organic Matter, Ash and Neutral Detergent Fibre intakes (g/kgW^{0.75}) were significantly different among the diets. Zero (0%) supplementation with oil drench had significantly higher values in all nutrient intakes than 0% supplementation without oil drench. Growth rate was better at 50% supplementation with or without oil drench. Sole forage diet without oil drench had a significantly high weight loss (-20.2g/d). Digestibility values of DM, OM, CP and NDF were generally high but better in diets with oil drench. Vegetable oil drench can enhance feed intake and digestibility in goats on basal diets of maize stover and cassava peel-based concentrate supplement.

Key words: Maize, stover, oil drench, cassava peel.

Introduction

Sheep and goats suffer a setback in terms of adequate protein and energy during the critical periods of the year when there is reduction in quality and quantity of fodder (Nwaigwe *et al.*, 2011). Crop residues and agricultural wastes such as maize stover and cassava peels abound and have a potential in small ruminant feeding during such critical period. However, they are beset with low efficiency of utilization due to high fibre (Mawuenyegah *et al.*, 1997). The ever increasing population of small ruminants has further increased the inadequacies (gaps) in their feed supply during such critical periods of the year resulting in a major constraint in the livestock production subsector (Nwaigwe *et al.*, 2011). Enhancing the utilization of abundant crop residues through supplementation with a protein or energy source has been documented (Alli-Balogun *et al.*, 2003, Bamikole and Babayemi, 2008). There is need to find alternative sources of supplementing or enhancing these crop residues for livestock feeding without sacrificing efficiency in livestock production. One of such ways is to manipulate the rumen microbes by the use of fats and oils as defaunating agents (Dutta *et al.*, 2008). The essence of this work therefore is to explore the defaunating potential of vegetable cooking oil and its effect on the digestibility of maize stover by West African dwarf goats.

Materials and Methods

The experiment was carried out at the Small Ruminant Unit of the University of Benin Farm Project, University of Benin is located on Lat. 6.02°N and Long. 5.06°E in the humid rain forest zone of Southern Nigeria (Metrological Section of the Nigeria Airports Authority Benin City, Edo State Nigeria, 2006). Twenty-four West African dwarf goats (8.40.59kg) aged 10 – 12 months were purchased from a goat market and adapted to the farm project environment during which they were given prophylactic treatments against PRR, endo- and ecto-parasites and bacterial infections. The goats were housed in individual pens with concrete floor measuring 1x1.5m. The experimental diet consisted of maize stover harvested from various maize plots within the university and environs, cassava peels from various garri processing centres in Benin City and vegetable cooking oil from the open market. The maize stover were chop into 2-3cm length, sundried and stored while the cassava peel were also sun dried and were crushed into tiny particles and used to formulate a concentrate supplement as presented in Table I. The animals received a basal diet of maize stover and cassava peel concentrate (Table 2) at 0, 25 and 50% supplementation with or without a single oil drench of 5ml/kgLW. The animals were randomly allotted to the treatments in a completely randomized design and diet was fed daily at 8.00hrs at the rate of 50gmDM/kgLW for 84 days. Daily feed intake and weekly weight changes were determined.

The feeding trial was followed by a seven (7) days digestibility trial. Faeces and urine were collected separately and aliquots of each days' collection were pooled and sub-sampled for chemical analysis. Feed and faecal samples were analysed for chemical components (AOAC, 2000) as well as NDF and ADF (Van Soest *et al.* 1991). Data were analysed using SAS (2004) package and mean separation by Duncan Multiple Range Test (SAS, 2004).

Results and Discussion

The Dry Matter (DM), Organic Matter (OM), Ash and Neutral Detergent Fibre (NDF) intakes ($\text{g/kgW}^{0.75}$) were significantly different ($P < 0.05$) among the diets (Table 3). Crude protein intake (CPI) $\text{g/kgW}^{0.75}$ was higher in the supplemented diets with or without oil drench. This result agrees with Ali *et al.* (2009) who reported higher dry matter intake when corn stover was supplemented with different nitrogen sources. Bamikole *et al.* (2003) reported higher DMI ($55.11\text{--}59.90\text{g/kgW}^{0.75}$) in supplemented forage diets as compared to $36.01\text{--}36.24\text{g/kgW}^{0.75}$ for sole forage diets. Abubakar *et al.* (2013) corroborated the above result that goats showed no negative effect on intake when fed straws or stovers supplemented with a nitrogen source or when defaunated with vegetable oil. Zero (0%) percent supplementation plus oil drench had significantly higher values in all nutrient intakes than zero (0%) percent supplementation without oil drench. Dry matter intakes were $59.25\text{g/kgW}^{0.75}$ and $27.14\text{g/kgW}^{0.75}$ respectively. This is in agreement with Seng *et al.* (2001) and Dutta *et al.* (2008) but contrary to Connor *et al.* (2006) who reported a decrease in DMI after defaunation. The inclusion of oil in ruminant diet tends to increase the microbial protein available to the animal (Seng Mon *et al.*, 2001). This could have accounted for the significant difference in the observed DMI and consequently intake of other nutrients in defaunated goats.

The growth rate (Table 4) followed the same trend as the nutrient intake. However, average daily weigh gain (ADG) were better at 50% supplementation with or without oil drench. All other treatments lost weight in varying levels. However, significant highest loss in weight (-20.2g) was observed in 0% supplementation without oil drench. This is similar to the observation of Ogore *et al.* (2013) who reported low ADG with an initial loss of weight in goats fed sole maize stover diet DMI is positively correlated with ADG. The significant difference in weight loss between 0% supplementation with

oil drench (-7.1g/d) and 0% supplementation without oil drench (-20.2g) is indicative of the defaunating effect of oil in the digestion of fibrous feeds. Eugene *et al.* (2004) reported a significant increase in ADG after defaunation. This is contrary to values obtained in this study with supplemented diets. The result indicated a more efficient use of diets in defaunated animals when poor diets limiting growth is given. The non-significant differences in ADG between treatments that gained weight and those that lost weight showed that those that lost weight could also have gained weight. The FCE did not follow a particular trend but had low values in all diets. Apparent digestibility values (Table 5) were high in general but showed no significant variation across the treatments. The observed improvements in the digestibility values of nutrients in animals with oil drench over animals without oil drench is a chance effect and is similar to that reported by Chaudhary *et al.* (1999). Improvement in nutrient digestibility has been reported when roughage of low nutritive value was supplemented with browse tree leaves Allibalogu *et al.* (2003) and Ogore *et al.* (2013). Other reports like Manso *et al.*, (2006), and Abubakar *et al.* (2013) indicated that modification in nutrient digestibility produced by adding fat to ruminant rations, may vary depending on the amount and type of fat used. Ash digestibility was averagely low ($<40\%$, FAO, 1995) however 0% supplementation without oil drench recorded 53%. This indicates an effective utilization in ash intake and could have accounted for the improved digestibility values observed in other nutrients.

Conclusion

Vegetable oil drenching can enhance intake and feed digestibility of supplemented and unsupplemented straw-based diets in goats.

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Table 1: Ingredient Composition (%) of the Concentrate Supplement

Ingredient	Composition (%)
Dried cassava peel	47.50
Wheat offal	47.50
Limestone	2.25
Bone meal	2.25
Common Salt	0.50

Table 2: Chemical Composition (g/100gDM) of the Experimental Diet

Parameters	Maize Stover	Cassava peel concentrate supplement
DM	86.54	88.86
OM	88.79	84.56
Ash	11.21	15.44
CP	9.41	13.54
NDF	73.68	49.23
ADF	31.5	19.50
HEM	42.18	29.73

Table 3: Nutrient intake of West African Dwarf Goats fed basal diet of Maize Stover (MS) and Cassava Peel Concentrate Supplement (CPS) with or without Oil Drench (OD)

Parameters	Dietary Treatments						SEM
	Supplementation + oil			Supplementation without oil			
	0	25	50	0	25	50	
Intake (g/d)							
DM	300.60	252.07	328.12	154.50	242.68	287.96	48.78
OM	259.65	201.90	261.80	126.59	194.37	223.39	14.73
CP	15.43 ^b	29.39 ^{ab}	43.53 ^a	15.43 ^b	28.77 ^{ab}	38.00 ^{ab}	6.46
Ash	35.55 ^{ab}	33.08 ^{ab}	47.18 ^a	16.66 ^b	32.43 ^{ab}	42.72 ^a	6.22
NDF	147.12	124.52	132.19	90.41	117.31	121.82	17.75
ADF	88.23	84.83	91.37	69.99	77.56	80.07	15.26
Hemicellulose	57.39	47.28	26.60	47.86	40.80	22.31	7.5
Intake (g/kgW^{0.75}/d)							
DM	59.52 ^a	51.08 ^a	63.14 ^a	27.14 ^b	50.23 ^a	58.59 ^a	6.99
OM	51.41 ^a	40.33 ^{ab}	50.21 ^a	21.92 ^b	40.20 ^{ab}	44.42 ^{ab}	7.55
CP	6.34 ^a	5.94 ^a	8.36 ^a	2.76 ^b	5.89 ^a	7.61 ^a	0.88
Ash	7.23 ^a	6.75 ^a	9.08 ^a	2.87 ^b	6.65 ^a	8.78 ^a	0.81
NDF	29.08 ^a	25.67 ^a	25.57 ^a	15.73 ^b	24.06 ^a	26.38 ^a	2.13
ADF	17.44	18.99	17.10	13.36	15.90	17.75	1.85
Hemicellulose	11.29 ^a	10.34 ^a	4.89 ^b	8.44 ^{ab}	8.42 ^{ab}	5.06 ^b	1.28

Means along the same row having different superscripts are significantly different ($P < 0.05$)**Table 4: Total Weight Change (TWC) of Experimental goats fed diets of Maize Stover (MS) with Cassava Peel Concentrate Supplement (CPS) with or without oil drench (OD).**

Parameters	Dietary Treatments						SEM
	Supplementation + oil			Supplementation without oil			
	0	25	50	0	25	50	
TWG (kg)	-0.60 ^{ab}	-0.35 ^{ab}	0.22 ^a	-1.70 ^b	-0.12 ^a	0.44 ^a	0.44
Av. Daily Weight change (g/d)	-7.10 ^a	-4.16 ^a	2.66 ^a	-20.20 ^b	-1.48 ^a	5.31 ^a	4.76
FCE (g/d)	-0.02 ^a	-0.01 ^a	0.01 ^a	-0.13 ^b	-0.01 ^a	0.02 ^a	5.63
DMI (g/d)	300.60	252.07	328.12	154.50	242.68	287.96	48.78
DMI (g/kgW ^{0.75})	59.52 ^a	51.08 ^a	63.14 ^a	27.14 ^b	50.23 ^a	58.59 ^a	6.99

Means along the same row having different superscripts are significantly different ($P < 0.05$)

FCE = Feed Conversion Efficiency, DMI = Dry Matter Intake, TWG = Total Weight Gain

Table 5: Nutrient Digestibility (%) of West African Dwarf goats fed basal diets of Maize Stover (MS) and Cassava Peel Concentrate Supplement (CPS) with or without Oil Drench (OD)

Cassava Peel Concentrate Supplement (CPS) with or without Oil Drench (OD)							SEM
Parameters	Dietary Treatments						
	Supplementation + oil			Supplementation without oil			
	0	25	50	0	25	50	
DMI (g/d)	256.60	346.60	320.50	264.80	288.60	301.60	81.19
DMI (g/kgW ^{0.75} /d)	52.73	58.54	65.32	43.51	49.76	57.10	6.08
DM digestibility	84.79	75.87	72.92	77.49	74.50	68.35	6.98
CP digestibility	83.27	66.93	68.48	69.99	65.83	68.49	8.37
OM digestibility	86.55	84.09	82.55	85.63	82.79	79.66	3.66
Ash digestibility	53.95	36.52	36.69	43.83	46.13	33.66	12.21
NDF digestibility	86.69	78.73	76.43	82.60	75.40	69.38	7.09
ADF digestibility	70.59	76.81	66.76	82.72	80.61	57.82	6.95
HEM digestibility	93.79	91.21	95.27	97.11	96.04	90.46	2.54