Growth performance, nutrient intake, digestibility and carcass characteristics of goats fed melon husk (*Colocynthis citrillus*) and palm oil slurry (*Elaeis guineensis*) at 50% inclusion level

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Abstract

Diets containing melon husk (MH) and palm oil slurry (POS) were fed as alternative feed stuffs to sixteen West African Dwarf (WAD) goats whose weight ranged between 9-10 kg. The WAD goats were assigned to 4 dietary treatments of 4 replicates each, and fed diets containing 0% MH 0% POS (Control diet, Diet 1), 50% MH 0% POS (Diet 2), 0% MH 50% POS (Diet 3), and 50% MH 50% POS (Diet 4), respectively for 8 weeks as finishing diets. Parameters such as nutrient intake, digestibility and growth performance were measured. Results showed average daily weight gains of 27.83, 26.33 and 22.83g/day by goats on diets 1, 4 and 2 respectively, which differed significantly ($P < 0.05$) and corresponded with dry matter intake of 358.59, 359.39 and 357.29g/day, respectively. Although, animals fed Diet 3 had Dry matter intake of 359.39g/day, they had poor average daily weight gain of 17.17g/day and significantly ($P < 0.05$) poor feed conversion ratio of 16.90, dressing percentage of 51.62% and live weight of 10.67kg. Goats on diets 1, 2 and 4 had dressing percentages of 55.43, 54.01 and 54.66% and corresponding live weights of 11.17, 10.83 and 10.93kg, respectively. Goats on diet 4 had significantly ($p < 0.05$) greater offal weights than goats on other diets. It was evident that all the Diets had positive effect on growth performance except 50% POS. However, all the diets gave good dressing percentage and offal weights were equally influenced by diets.

Keywords: Goat, melon husk, palm oil slurry.

Introduction

The strength of a nation depends on the wealth of food it can provide for its people but it is sad to note that in most developing nations, provision and availability of these foods in their right proportion for the citizens has not been adequate. Making available adequate animal protein for human consumption has led to animal production research most especially in small ruminant research.

In Nigeria, the total population of sheep and goats are estimated to be about 33.9 million and 53.8 million, respectively (FAOSTAT, 2010). Adequate nutrition for these animals has been identified as one of the ways in enhancing performance characteristics of West African Dwarf (WAD) goats which determine the profitability or otherwise of

any livestock venture (Adu *et al.*, 1987).

Feeding, which is now known to account for nearly 70% of production cost in livestock enterprise (Fetuga and Tewe, 1985) has necessitated the need to search for alternative feed resources that will help reduce cost of production, thereby making animal protein affordable for consumption. Hence this studies on melon husk (MH) *Colocynthis citrillus* (L) and Palm oil slurry (POS) *Elaeis guineensis* as alternate feed stuff which have both been incorporated successfully into monogastric and ruminant diets at various levels as substitute for maize (Fanimo and Fashina-Bombata, 1997; Akinola and Abiola, 1999; Abiola and Adekunle, 2002; Sanwo *et al.*, 2010). Abiola *et al.* (2002) fed alkali treated melon husk to broilers and recorded increase in

feed intake and best meat/bone ratio at 20% maize replacement of dietary maize levels while untreated MH could not go beyond 10% level of replacement. Success had also been made with POS incorporated into ruminant (goat) diet at recommended levels between 20 and 40% (Hutagalung, 1981). Fanimu and Fashina-Bombata (1997) in their report on the response of weaner pigs to diets containing POS observed increased feed intake, weight gain and back fat thickness. Sanwo *et al.*, (2011) reported that 30% MH in ruminant diet gave the best performance characteristics and 30% each of MH and POS as combined feed equally gave good growth performance at 16 weeks of age. Therefore, the need to know the performance and carcass characteristics of the goats when fed 50% of MH and POS either singly or as combined feed at older age.

Materials and Methods

The feeding experiment was conducted at the small ruminant experimental unit of the Teaching and Research Farms, University of Agriculture, Abcokuta, and lasted for a period of 60 days.

Melon husks (MH) and palm oil slurry (POS) obtained from a farm were spread on a cemented floor for proper sun drying for a period of 30 days. The sun dried MH and POS were milled and bagged at the feed mill.

Sixteen West African dwarf goats weighing between 9.0 – 10g had earlier been adjusted for 75 days during which they were treated against ectoparasites by bathing them with Asuntol® and also against endoparasites by injecting them subcutaneously with Kepromec at the rate of 0.2ml/10kg BW. Oxytetracycline (LA) antibiotic was also administered to them to help enhance their body resistance against infections such as

respiratory, urinary tract infection, pneumonia etc. They were vaccinated against PPR (*Peste des Petit Ruminant*) with tissue cultured Rinderpest vaccine. During the period of adjustment, they were maintained on *Panicum maximum* (grass), concentrate diet, and water was giving *ad libitum*.

Experimental animals were divided into four treatment groups (each group having four animals per treatment) and each treatment balanced for body weight.

Diet 1(control) which had maize offal as the main energy source contained 0% MH 0% POS; Diet 2 contained 50% MH 0% POS; Diet 3 contained 0% MH 50% POS; while Diet 4 contained 50% MH 50% POS as shown in Table 1.

At the end of the feeding trial and digestibility study, animals were fasted for fourteen (14) hours and weighed before slaughtering. Eight (8) goats (i.e. 2 goats per treatment) were slaughtered for carcass assessment in which the jugular vein and carotid arteries were severed including the trachea, oesophagus and spinal cord. Carcasses were hung upside down for 3 minutes to allow for effective bleeding. An incision was made above the coffin joint, and then a long stick was used to create space subcutaneously. Inflation was made through this opening and it was fully blown with all limbs fully extended and turgid. A sharp blade was used for scalding. An incision measuring about 8cm long was made in the abdominal region to remove internal organs, legs were cut off and eviscerated weights of the carcasses were taken. Internal organs and cut up parts were also weighed. All the data generated in this study were subjected to one – way analysis of variance in a completely randomized design using the statistical package (SAS, 1996).

Table 1: Ingredient composition of experimental diets

Ingredients	50% inclusion levels			
	1	2	3	4
Maize offal	44.50	22.25	22.25	
Melon husk	-	22.25	-	22.25
Palm oil slurry	-	-	22.25	22.25
GNC	4.50	4.50	4.50	4.50
Wheat offal	30.00	30.00	30.00	30.00
PKC	19.00	19.00	19.00	19.00
Bone meal	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50
Total	100.00	100.00	100.00	100.00
Chemical composition				
Dry matter	89.78	89.81	89.53	89.69
Crude protein (%)	14.65	12.84	12.52	11.94
Crude fibre (%)	18.68	33.73	29.58	32.13
Ether extract (%)	3.75	9.17	12.85	15.73
Ash	3.82	8.32	6.47	7.58
Nitrogen Free Extract	59.10	40.09	32.43	31.59
M. E. (KJ/g)	2.31	2.31	2.24	2.24

MH = Melon husk; POS = Palm oil slurry; Diet 1 = 0% MH; 0% POS; Diet 2 = 50% MH; 0% POS; Diet 3 = 0% MH; 50% POS; Diet 4 = 50 % MH; 50% POS;

Results

Nutrient intake shown in Table 2 revealed significant ($p < 0.05$) differences in all parameters considered. Dry matter intake ranged from 268.64g (diet 3) to 358.59g (diet 4). CP intake was highest in diet 1 (58.61g) while Diet 3 had the lowest intake (43.56g). CF (74.72g), EE (21.0g), Ash (14.40) and Lignin (50.20g) intakes were lowest in Diet 1 while Diet 4 comparatively had the highest values obtained in CF (132.53g), EE (60.80g), Ash (30.32g) ADF (181.28g) and Lignin (87.08g). NDF was highest in Diets 2 (237.40g) lowest in diet 1 (136.35g) and diet 3 (87.45g), respectively. Differences in nutrient consumed can be related to nutrient composition of diets. The above results reflected in the growth performance shown in Table 4

Apparent nutrient digestibility of dry matter shown in Table 3 ranged between 68.9% (diet 3) and 84.55 % (Diet 1). CF, EE, Ash, ADF and Lignin were highest in diet 4 with the values of 77.6%, 86.76%, 73.03%,

80.47 and 76.35%, respectively.

CP digestibility decreased across the treatments. While Diet 1 had the highest CP digestibility of 78.99%, Diet 3 recorded the lowest value of 49.81%.

The results of performance indices on Table 4 shows significant ($p < 0.05$) differences in all parameter except in the initial and final weights of the goats. Numerical differences was also only observed for Feed conversion ratio (FCR), where Diet 1, gave the best results for average daily feed intake (403.33g), weight gain (27.83g) and had the best feed conversion ratio of 14.49. However, diet 3 was comparatively the lowest with daily weight gain of 17.17g, feed intake of 290.05g, water intake of 463.06g and the poorest feed conversion ratio of 16.90.

Results for carcass characteristics which were expressed as percentage of live weight shows that the abdominal fat, thoracic region and all the internal organs such as spleen, kidney, liver and heart were

Table 2: Nutrient intake (g/d) by West African dwarf goats fed experimental diets

Parameters (g/day)	50% inclusion levels				SEM
	1	2	3	4	
Dry matter	358.59 ^a	359.39 ^a	268.64 ^b	357.29 ^a	11.73
Organic matter	327.36 ^{ab}	326.13 ^b	242.91 ^c	334.15 ^a	11.34
Crude protein	58.61 ^a	51.36 ^b	43.56 ^c	47.76 ^b	11.34
Crude fibre	74.72 ^c	121.68 ^b	79.74 ^c	132.53 ^a	0.44
Ether extract	21.00 ^d	22.68 ^c	36.36 ^b	60.80 ^a	1.04
Ash	14.40 ^c	24.48 ^{ab}	16.17 ^b	30.32 ^a	12.84
Neutral detergent fibre	136.35 ^d	237.40 ^a	147.0 ^c	192.0 ^b	4.35
Acid detergent fibre	117.48 ^b	120.92 ^b	87.45 ^c	181.28 ^a	2.22
Lignin	50.20 ^c	65.35 ^b	56.64 ^c	84.08 ^a	

^{a, b, c}: Means along the same row with different superscripts are significantly ($p < 0.05$) SEM: Standard Error of Means

MH = Melon husk, POS = Palm oil slurry

Diet 1 = 0% MH; 0% POS; Diet 2 = 50% MH; 0% POS; Diet 3 = 0% MH; 50% POS;

Diet 4 = 50 % MH; 50% POS

significantly ($p < 0.05$) affected by dietary treatments as shown in Table 5. Although, not significant ($p > 0.05$), dressing percentage ranged from 51.62% (Diet 3) to 55.43% (Diet 1). Abdominal fat was highest in diet 1 (3.95%) and lowest in diet 2 (1.75). Values obtained for thoracic region increased across the treatments with animals fed diet 4 having the highest value of 16.22% while the lowest value was obtained for animals fed diet 1 (10.14%). Some offal weights of the goats such as spleen and kidney were highest in diet 4 while liver and heart were highest in diets 3 and 1, respectively.

Discussion

The feed and nutrient intake observed in goats fed diet 1, 4, 2 and 3, respectively, which corresponded with growth performances may be attributed to the low dietary CF which is believed to stimulate feed intake (Huston, *et al.*, 1988). This pattern of feed intake and utilization was equally observed by Sanwo *et al.* (2011) when the above diets were fed to goats at 30% level of substitution. The DM intake

(DMI) has been observed to be proportional to the percentage digestibility. This was equally observed by Abubakar *et al.*, (2005); where DMI ranged from 356.6g - 477.30g and apparent digestibility ranged between 44.95%- 58.10%, respectively when West African Dwarf goats were fed with varying levels of groundnut haulms and cowpea shell.

Taiwo *et al.* (1995) and Adebawale and Taiwo (1996) observed high percentage digestibility being influenced by high nutrient intake when elephant grass, poultry droppings, crop residues and agro-industrial by products were fed to goats. This implies that the weight gained in the goat was stimulated by high dry matter intake and digestibility of nutrients. This may also be attributed to the crude protein content in the diets which has been reported to assist feed intake (Stritzler, 1988) and digestion of concentrate diets as reported by Glimp *et al.*, (1989); Mahgoub *et al.*, (2000); Fimbres *et al.*, (2002); and Berthiaume *et al.*, (2006) who reported positive gain responses in feedlot lambs or

Table 3: Apparent nutrient digestibility of experimental diets fed to West African dwarf goats (%)

Parameters	50 % inclusion levels				SEM
	1	2	3	4	
Dry matter	84.55 ^a	76.71 ^b	68.97 ^c	74.10 ^c	1.85
Organic matter	85.04 ^a	77.73 ^b	70.86 ^c	76.57 ^b	1.69
Crude protein	78.99 ^a	63.68 ^b	49.81 ^d	51.56 ^c	3.60
Crude fibre	64.07 ^c	70.44 ^b	44.29 ^d	77.60 ^a	2.37
Ether extract	53.36 ^c	46.18 ^d	66.88 ^b	86.76 ^a	1.10
Ash	52.07 ^b	59.57 ^{ab}	55.39 ^c	73.03 ^a	3.30
Neutral detergent fibre	74.18 ^d	86.96 ^a	76.94 ^c	82.90 ^b	4.78
Acid detergent fibre	71.47 ^b	73.60 ^b	50.10 ^c	80.47 ^a	4.03
Lignin	64.03 ^b	63.60 ^b	54.03 ^c	76.35 ^a	3.94

^{a, b, c}: Means along the same row with different superscripts are significantly ($p < 0.05$) SEM: Standard Error of Means

MH = Melon husk, POS = Palm oil slurry

Diet 1 = 0% MH; 0% POS; Diet 2 = 50% MH; 0% POS; Diet 3 = 0% MH; 50% POS;

Diet 4 = 50 % MH; 50% POS

steers with dietary concentrate levels near to 700 g/kg.

From this study high percentage nutrient digestibility, which may be attributed to dietary crude protein falling in the recommended range of 6.9 to 21.3%, has been reported to improve fibre digestion in rumen, as reported by McAllan *et al.*, (1982) who observed increased carbohydrate digestion in the rumen when dietary CP was increased from 6.9 to 16.3%. Further increase of dietary crude protein above 16.3% to 21.3% was reported not to have further effect on fibre digestion. Thus, it was observed that dietary CF in the rumen occurred when dietary CP is within the recommended range. Also, the results obtained for crude protein digestibility in

this study corroborated the findings of Taiwo *et al.* (1995) where percentage crude protein digestibility ranged from 49.9 – 62.7% on feeding West African Dwarf Sheep with grass-hay along with protein supplements.

The weak response of goats on diet 3 may be related to rumen acidosis and stasis (Owens *et al.*, 1998). Average daily water intake appeared to be higher with diets containing higher CF as observed. The observation of Fomukong (1997) agrees with the result of this study that dry matter intake was directly proportional to water intake in Yankasa sheep. A possible explanation could be as a result of the increased requirement of water for the dilution of blood in animals whose protein level in the diet is high.

Table 4: Performance indices of West African dwarf goats fed experimental diets

Parameters	50% inclusion levels				SEM
	1	2	3	4	
Average initial weight (kg)	10.50	9.0	9.97	9.0	0.39
Average final weight (kg)	12.17	10.37	11.0	10.58	0.34
Average daily weight gain (g/day)	27.83 ^a	22.83 ^b	17.17 ^b	26.33 ^{ab}	3.00
Average daily feed intake (g/day)	403.33 ^a	360.71 ^{ab}	290.05 ^b	398.09 ^a	19.67
Average daily water intake (g/day)	524.81 ^b	490.38 ^b	463.06 ^b	757.86 ^a	30.45
Feed conversion ratio	14.49	15.80	16.90	15.12	1.71

^{a, b, c, d} means along the same row with different superscripts are significant ($P < 0.05$) SEM: Standard Error of Means.
 Diet 1 = 0% MH; 0% POS; Diet 2 = 50% MH; 0% POS; Diet 3 = 0% MH; 50% POS;
 Diet 4 = 50% MH; 50% POS; MH = Melon husk, POS = Palm oil slurry.

Although NDF and ADF digestibility were observed to be high in diet 4, it did not give digestibility value proportional to its nutrient intake when compared with other diets. Kraiem *et al.*, (1997) seem to agree with the above findings as they reported that both NDF and ADF digestibility decreased as dietary concentrate level increased due to depression of ruminal pH (Merchen *et al.*, 1986).

In this study the dressing percentage of goats on all dietary treatments were just above 50%. Dietary treatments had influence on the dressing percentage, as the feed intake by the animals influenced their live weight before slaughter and hot carcass yield. Research has shown that the dressing percentage of slaughtered goats may be influenced by age, weight, sex, body condition, and amount of gut fill at

slaughter. Ueckerman (1969) reported that dressing percent rises with slaughter weight and feed intake. This implies that feed efficiency (Kg of feed requirement to put on 1kg of gain) decreases as heavier carcasses are produced. Goats fed diets 2, 3 and 4 had lower abdominal fat than goats on the control Diet. This indicates that MH and POS are capable of reducing abdominal fat accumulation in carcass. This was observed by Tewe and Egbunike (1992), that high fibre levels in the diet caused a reduction in the fatness of the carcass.

In Conclusion, except for the slower growth performance in goats fed 50% POS, the inclusion of 50% MH and POS as alternative feed ingredient to maize offal in goats diets gave positive effect on growth

performance, carcass weights, and some offal weights, and could also help reduce abdominal fat.

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Received: 28/01/13

Accepted: 13/02/14