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Effects of Replacing Maize Offal With Dried Sweet Orange Peel Meal on the Performance and Blood Profile of West African Dwarf Goats

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Abstract
A total of nine grower West African dwarf (WAD) goats aged 5-6 months and weighing between 6.93 - 7.00kg were randomly divided into 3 groups of 3 animals each and housed individually in concrete floor compartments. Three experimental diets A, B and C were formulated and randomly allocated to the 3 animal groups in a completely randomized design. The diets were formulated to contain 0%,65% and 70% dried sweet orange peel meal (DSOPM). These were used to feed the goats for 12 weeks. Results show that performance parameters measured were similar ($p>0.05$) among the treatments. The mean daily feed intake values were 300.10g, 314.70g and 369.05g/day and the mean daily weight gains were 11.19g, 33.50g and 40.68g for treatment A, B and C respectively. There was also no treatment effect ($p>0.05$) on both the haematological and serum biochemical indices measured. Dried sweet orange peel meal can be used to replace maize offal up to 70% level without harmful effect on growth and the blood profile of goats.

Key words: Performance, sweet orange peels, maize offal, WAD goats, blood profile

Introduction

The inability of ruminant livestock farmers to feed their animals with high-quality forage all the year round remains the most widespread technical constraint facing ruminant animal productivity in the developing nations (Bawala and Akinsoyinu, 2006). Ruminants slowly gain weights in the rainy season and rapidly lose it in the dry season, yet in the traditional animal husbandry, ruminants in the tropics especially Nigeria, are mainly fed with grasses, so that improved livestock production is not likely attainable and sustainable by grasses alone (Babayemi and Bamikole, 2006). This necessitates supplementation to improve voluntary feed intake and digestibility. However, high cost of conventional energy and protein sources coupled with the competition for these ingredients by man and other monogastrics has led animal nutritionist to search for alternative feed resources for small ruminants. Sweet orange peels are one such alternative feed and it is available the year round. Sweet orange peels contain some anti-nutrients and its influence can alter the constituents of the blood. However, through studies normal ranges of these constituents for healthy species have been determined (Obe *et al.,* 2015) and so the health status of an animal can be evaluated from the blood constituents. Sweet orange peels have been used in the diets of goats up to 50% levels (Oloche *et al.,* 2013) without adverse effects.

This study was therefore designed to evaluate the effect of replacing maize offal with dried sweet orange peel meal at slightly higher levels on the performance and blood profile of West African dwarf goats

Materials and Methods

The study was conducted at a private farm situated at Lower Benue, within Makurdi metropolis. Sweet orange peels were gathered from roadside retailers. The collected peels were immediately sun-dried for about 48 hours, thereafter it was packed and crushed using mortar and pestle into a meal and stored in synthetic bags for use. Three experimental diets, diets A, B and C were compounded to contain 0%, 65% and 70% dried sweet orange peel meal (DSOPM) respectively. A total of nine male grower West African dwarf goats of about 5 - 8 months and weighing between 6.93 - 7.00 kg were used for the experiments. The animals were randomly distributed into three treatment groups of three animals each and two weeks were allowed for the animals to adjust to feed and environment before data collection commenced. The experimental animals were served 200g of the concentrate supplement daily at 8:00 h, and at about 10:00 h the Gmelina forage was served *ad libitum* to the goats. Fresh clean water was daily provided for the animals, mineral blocks were also provided for the goats. Feed intake was calculated by subtracting the quantity of remnant feed, from the quantity of the feed that was fed. The animals were weighed weekly to evaluate their growth rate. On the last day of the experiment, before morning, blood samples were collected from all the animals via the jugular vein for haematological and serum biochemical assay. Data generated from the study were subjected to the analysis of variance (ANOVA), using the Minitab 14 (1991) statistical software. The study lasted for 12 weeks

Results and Discussion

The feed composition of the experimental diets is presented in Table 1. The result of the performance of the West African dwarf goats fed the experimental diets is presented in Table 2. All the parameters measured were similar (p>0.05) among the treatments. The mean body weight gains were between 33.50g - 40.68g. The result suggests that treatments containing the test ingredient also supplied sufficient nutrients to support muscle development and growth of the experimental animals. The similarity of all the mean daily feed intake values (p>0.05) among the treatments shows that all the diets were acceptable to the animals, implying that the test diets which contained the DSOPM were also palatable and accepted. The result for the haematology of the experimental goats is presented in Table 3. All the haematological indices were also similar (p>0.05) among the treatments. The PCV values ranged from 31.67 - 35.30%, this was normal and within the normal reference range of 22 - 38% reported by Plumb (1999) for goats. Observed values were comparable with 35.48 - 36.77% reported by Odoemelam *et al.* (2014) for WAD goats fed bambara nut seed meal supplemented diets. The Hb values were between 10.13 - 10.67g/dl, this was within the range of 7 – 15g/dl reported by Daramola *et al.* (2005) for WAD goats, and this means that the animals on the treatments with DSOPM also had adequate oxygen carrying capacity. The WBC values which ranged from 5.28 - 8.71 ($x10^3$/ul) and were within normal range of 4 - 13 ($x10^3$ul) established for goats (Charles and Margi, 2007), meaning that the animals were not battling with any disease condition.

Table 1: Ingredient composition of the experimental diets fed to the goats

	Experimental diets		
Ingredients	A	B	C
Rice offal	20.00	20.00	20.00
Maize offal	53.56	18.75	16.07
PDSOPM	0	34.81	37.49
Soya beans (Full fat)	23.47	23.47	23.47
Bone ash	2.00	2.00	2.00
Common salt	1.00	1.00	1.00
Total	100	100	100
Crude protein	11.01	10.20	10.15

A = 0% dried sweet orange peel meal, B = 65% dried sweet orange peel meal, C = 70% dried sweet orange peel meal.

The result for the serum biochemistry of the experimental goats is presented in Table 4. These were no variations (p>0.05) among the means for all the parameters measured. The total protein values ranged from 56.30 - 63.77g/l and were similar (p>0.05) among the treatments, implying that the protein level of the diets was adequate. The SGOT and SGPT values were 21.00 - 28.00 IU/l and 1.93 - 3.07 IU/l, and were similar (p>0.05) among the treatments implying that the presence of DSOPM in the treatment diets was safe and had no adverse effects on the liver. The creatinine values was between 0.82 - 1.02 mg/dl, and was normal, suggesting that there were no adverse effects on the lean muscle tissues.

Table 2: Performance of the goats fed the experimental diets

	Experimental diets			
Parameters	A	B	C	SEM
Initial weight (kg)	6.93	7.00	7.00	0.96^{ns}
Final weight (kg)	7.87	9.83	10.25	1.00^{ns}
Total body weight gain (kg)	0.94	2.83	3.42	0.54^{ns}
Mean body weight gain g/day	11.19	33.50	40.68	0.95^{ns}
Total forage intake (kg)	10.62	11.84	17.22	0.77^{ns}
Total concentrate intake (kg)	14.6	15.16	13.78	1.58^{ns}
Total feed intake (kg)	25.21	26.44	30.00	1.18^{ns}
Mean daily feed intake (g/day)	300.10	314.7	369.05	1.10^{ns}
Feed conversion ratio	7.82	7.95	6.93	$0..62^{ns}$

SEM= Standard error of mean, ns=Not significant (p>0.05)

Table 3: Haematology of the goatsfed the experimental diets

Parameters	Experimental diets			SEM
	A	B	C	
Packed cell volume (%)	35.3	31.67	32.67	0.80^{ns}
Red blood cell ((x10^6/l)	10.70	9.63	10.03	2.24^{ns}
Haemoglobin (g/dl)	10.67	10.13	10.50	0.42^{ns}
White blood cell ((x10^3/ul)	7.26	5.28	8.71	0.90^{ns}
Lymphocytes (%)	79.97	75.13	84.50	3.21^{ns}
Neutrophils (%)	13.90	18.17	10.80	2.66^{ns}
MCH (pg)	11.43	10.73	11.16	1.79^{ns}
MCV (g/d)	35.49	32.83	34.92	6.18^{ns}
MCHC (H)	33.3	33.10	33.03	0.53^{ns}

MCH= Mean Corpuscular Haemoglobin, MCV= Mean Corpuscular Volume, MCHC= Mean Corpuscular Haemoglobin Concentration.

Table 4: Serum biochemistry of the goats fed the experimental diets

Parameters	Experimental	diets		SEM
	A	B	C	
Total protein (g/l)	63.77	56.93	56.30	7.46^{ns}
Albumin (g/l)	25.17	26.17	26.00	1.63^{ns}
Globulin (g/l)	38.60	30.77	30.53	6.32^{ns}
SGOT (U/l)	23.83	28.00	21.00	4.16^{ns}
SGPT (U/l)	3.07	2.50	1.93	0.88^{ns}
Creatinine (mg/dl)	1.02	0.82	0.94	5.94^{ns}
Urea (m/mol)	6.80	9.93	10.13	1.58^{ns}

SEM = Standard error of mean, ns = Not significant (P>0.05), SGOT = Serum GlutamicTransaminase, SGPT = Serum Glutamic Pyruvic Transaminase

Conclusion

Replacement of maize offal with up to70% level of DSOPM did not have any adverse effect on performance and blood profile of the animals. Therefore, up to 70% level of DSOPM can be used to replace maize offal in the diets of West African dwarf goats.

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