GROWTH PERFORMANCE AND RUMEN MICROBIAL POPULATION OF WEST AFRICAN DWARF GOATS FED DIETS CONTAINING SCENT LEAF (*Ocimum gratissimum*)

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Abstract
A study was carried out to determine the growth performance and rumen microbial population of twenty West African dwarf goats fed scent leaf (*Ocimum gratissimum*) as additive in a concentrate supplement. The goats were divided into four treatment groups (T1, T2, T3 andT4) with five replicates in a completely randomized design. Four concentrate supplements were formulated to contain scent leaf at levels 0,5,10, and 15g/kg DM. *Panicum maximum* was the basal diet. Chemical composition of scent leaf and the diets were determined; Rumen fluid was collected from the goats before and after the experiment to determine microbial population. Results showed that scent leaf has moderate crude protein of 10.61% and rich in tannin, saponin and oxalate. Scent leaf (*O. gratissimum*) inclusion did not have any significant ($p>0.05$) effect on feed intake and weight gain. At the end of the experiment, bacteria and protozoa counts were not significantly ($p>0.05$) influenced by the experimental diets, however there was a reduction in their values. Fungi count was significantly ($p<0.05$) affected by the diets and their values reduced as the level of scent leaf in the diets increased. The highest count (0.35×10^6cfu/ml) was obtained in T1 (control) and the lowest value (0.05×10^6cfu/ml) obtained in goats fed 15g/kg DM scent leaf (T4). It can therefore be concluded that scent leaf can be included in the diets of West African dwarf goats up to 15g/kg DM without any negative effect on feed intake and weight gain.

Introduction
There is need for increased animal performance and protein intake in Nigeria in view of the population growth rate (Nworgu, 2016). Improvement of animal performance has usually been achieved through breeding and genetics but nutrition plays an important role. Antibiotics has been widely used in improving animal performance but in recent years there is restriction or outright ban in some countries on the use of feed antibiotics. This has shifted interest to the use of alternative products. A group of natural products known as phytogenics has been the focus of several studies in recent years (Windisch *et al*., 2008). Phytogenic feed additives include herbs, which are non woody flowering plants known to have medicinal properties; spices, which are herbs with intensive smell or taste, commonly added to human food; essential oils, which are aromatic oily liquids derived from plant materials such as flowers, leaves, fruits and roots; and oleoresins, which are extract derived by non aqueous solvent from plant material (Windisch *et al.*, 2008). Some of the useful herbs and spices that are indigenous to Africa include ginger (*Zingiber officinale*), garlic (*Allium sativium*), scent leaf (*Ocimum gratissimum*), bitter leaf (*Vernomnia amygdalia*), they have been reported to enhance the performance of livestock animals (Muhmmad *et al.*, 2009).
Scent leaf (*Ocimum gratissimum*) belongs to the family Lamiaceae, the mint family. It is cultivated in many gardens around village huts and homes in the rural areas in Nigeria for its medicinal purposes. With the need to improve nutrient utilization in ruminants through the use of natural and safe substance, there is need for research into the use of scent leaves (*Ocimum gratissimum*) as phytogenic feed additive in the diet of West African dwarf goats.

Materials and Methods
The study was carried out at the Small Ruminant Unit of the Directorate of University Farms and Animal Nutrition laboratory of the Federal University of Agriculture, Abeokuta (FUNAAB) Ogun State, Nigeria. Ogun State is in the rainforest zone of South West Nigeria. The area has an annual mean temperature of

34.7°C, a relative humidity of 82% and an annual mean rainfall of 1,037 mm. It is about 70 m above sea level and lies on latitude 7°5'-7°8'N and longitude 3°11.2'E.

Processing of test materials and Formulation of diets

Scent leaves (*Ocimum gratissimum*) were harvested from villages around the University and air-dried for 3-5days after which they were ground to pass through 1mm sieve and used in diet formulation. The dietary treatments consisted of a basal diet (*Panicum maximum*) and concentrate supplement formulated to contain *O. gratissimum* as an additive at levels 0, 5, 10 and 15g/kg DM (Table 1). The diets; basal and concentrate supplement were offered to the animals at 5% of their body weight in a ratio of 60:40 respectively.

Table 1: Gross composition of concentrate diets (%)

Ingredients	T1	T2	T3	T4
Wheat offal	50.00	50.00	50.00	50.00
Maize bran	30.00	30.00	30.00	30.00
Palmkernel cake	17.00	17.00	17.00	17.00
Bone meal	2.00	2.00	2.00	2.00
Salt	1.00	1.00	1.00	1.00
*Scent leaf	-	+	++	+++
Total	100.00	100.00	100.00	100.00
Crude protein	12.80	12.80	12.80	12.80
Crude fibre	11.66	11.66	11.66	11.66

-, +, ++ and +++ means 0, 5, 10 and 15g/kg DM scent leaf inclusion level

Experimental animals and management

Twenty (20) West African dwarf goats with an average live weight of 7.38 - 8.53kg were used for the experiment. Pens were cleaned and disinfected with Izal solution prior to the arrival of the animals. The goats were kept in the quarantine section for two weeks for proper prophylactic treatment which consisted of intramuscular application of oxytetracycline LA and vitamin B complex at the dosage of 1 mL/10 kg body weight of the animal. The animals were maintained on *Panicum maximum* grass and concentrate and clean water was supplied *ad libitum.* They were thereafter divided into four treatment groups of five animals each on weight equalization basis and housed in individual pens. The study comprises 14 days of adaptation followed by 12 weeks feeding trial and 2 weeks nutrient digestibility study. The diets were offered at 8:00am in the morning and 12.00pm in the afternoon. The concentrate diets were offered first and then the basal diet in separate feeding trough. Left over of the feed offered was weighed and recorded every morning to compute feed intake on dry matter basis. Initial weights of the animals were taken on the first day of the experiment and thereafter fortnightly throughout the experiment.

Chemical analyses

Oven dried feed samples were analyzed for their proximate compositions: crude protein, crude fibre, ether extract and ash according to AOAC (2000). Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined by the methods of Van Soest *et al.* (1991).

Rumen fluid collection and Analysis

Rumen fluid was collected from four goats in each treatment before and after the experiment. Samples of unstrained rumen fluid collected from each animal was fixed with 10% formalin solution (1:9 v/v, rumen fluid: 10% formalin solution) for the determination of microbial population by total direct count of bacteria, protozoa and fungi (Galyean, 1989).

Statistical analysis

All data collected were subjected to one-way analysis of variance in a completely randomized design using version 9.1 of SAS software (SAS, 2003)

Results and discussion

Presented in table 2 is the chemical composition of scent leaf (*Ocimum gratissimum*). It is rich in nutrients as depicted by the dry matter value (82.48%). The crude protein value (10.61%) and crude fibre value (22.32%) obtained were higher than (6.38% CP and 18.52% CF) reported by Nworgu (2016). scent leaf is rich in tannin, oxalate and saponin. According to Sofowora (1993) these chemical substances possess antimicrobial, antioxidative, anti-inflammatory and immune-modulatory properties. The result is

in line with the report of Akujobi *et al*. (2004) that scent leaf is rich in glycosides, tannins, saponins and alkaloids.

Table 2: Chemical composition of scent leaf *(Ocimum gratissimum)*%

Parameters	Percentage
Dry matter	82.48
Crude protein	10.61
Crude fibre	22.32
Ether extract	6.22
Ash	13.25
Tannin	1.46
Saponin	1.07
Oxalate	2.11

Table 3 shows the growth performance parameters of the experimental goats. The diets did not have any significant (P>0.05) effect on all the parameters measured. The results obtained revealed that scent leaf (*O. gratissimum*) did not have any deleterious effect on feed intake, weight gain and feed conversion ratio of the experimental animals up to 15g/kg DM inclusion level. However, windisch *et al*. (2008) reported that scent leaf promote growth in poultry and swine.

Table 3: Growth performance of West African dwarf goats fed experimental diets

Parameters	T1	T2	T3	T4	SEM	P-value
Initial weight (kg)	7.54	7.56	7.62	7.46	0.44	0.78
Final weight (kg)	10.97	10.53	10.58	10.56	0.50	0.99
Total weight gain (kg)	3.43	2.97	2.96	3.10	0.09	0.19
Daily weight gain (g/d)	49.00	42.43	42.34	44.29	1.24	0.19
Concentrate intake (kg)	11.29	10.18	10.25	10.30	0.25	0.37
Grass intake (kg)	18.50	16.58	16.58	17.18	0.37	0.20
Total feed intake (kg)	29.79	26.76	26.83	27.48	0.60	0.26
Daily feed intake (g/d)	425.62	382.24	383.24	392.48	8.60	0.26
Feed conversion ratio	8.67	9.01	9.05	8.86	0.14	0.78

T1, T2, T3, and T4 represent 0, 5, 10 and 15g/kg DM levels of inclusion of scent leaf

There were no significant (p>0.05) differences in the bacteria, fungi and protozoa counts across the treatments before the commencement of the experiment (Table 4). However, at the end of the experiment fungi count was significantly (p<0.05) influenced by the diets. The count reduced as the level of inclusion of scent leaf in the diets increased with the highest value (0.35×10^{6}cfu/ml) obtained from animals fed the control diet (T1) and the lowest value obtained in goats fed 15g/kg DM scent leaf (T4). This further affirm scent leaf as antifungal as previously reported by (Lemos *et al*., 2005). Although no significant difference was observed in bacteria and protozoa count at the end of the experiment, there was a reduction in their counts by the end of the experiment as the levels of scent leaf in the diets increased. This is also an indication that scent leaf is antibacterial and antiprotozoal and this supports the findings of Nakamura *et al*. (1999) and Holetzl (2003) that scent leaf is anti bacterial and anti protozoal respectively.

Table 4:Rumen microbial count of West African dwarf goats fed experimental diets

Parameters	T1	T2	T3	T4	SEM	P-value
Before the study						
Bacteria count	3.03	2.73	2.33	3.10	0.14	0.18
Fungi count	0.15	0.13	0.15	0.12	0.03	0.98
Protozoa count	0.57	0.30	0.73	0.87	0.12	0.45
After the study						
Bacteria count	3.05	2.43	2.06	2.85	0.12	0.07
Fungi count	0.35^{a}	0.20^{b}	0.15^{bc}	0.05^{c}	0.04	0.01

Protozoa count	0.68	0.33	0.27	0.25	0.11	0.51

Means on the same row with different superscripts are significantly different (P<0.05). T1, T2, T3, and T4 represent 0, 5, 10 and 15g/kg DM levels of inclusion of scent leaf. Bacteria Count (10^6cfu/ml), Fungi Count (10^6cfu/ml), Total Protozoa Count (10^3cell/ml)

Conclusion and Recommendation

Scent leaf (*O. gratissimum*) is a valuable plant that can be used in diet of West African dwarf goats owing to its crude protein content. It has no deleterious effect on feed intake and weight gain up to 15g/kg DM inclusion level. This study has also shown that it can be used as a rumen modifier because of its content of secondary metabolite. However, its long term use in the diet of West African dwarf goats need to be studied because of is antimicrobial property which might interfere with degradation of feed in the rumen.

References

Akujobi, C.O., Anyanwu, B.N., Onyeze, G.O.C. and Ibekwe, V.I. (2004). Antibacterial activities and preliminary phytochemical screening of four medicinal plants. *J. Appl. Sci*. 7 (3): 4328-4338.

A.O.A.C., 2000. Official Mrthods of Analysis, 17th edition, Association of Official Analytical Chemists. Gaithersburg, MD, USA.

Galyean, M. (1989). Laboratory procedure in Animal Nutrition Research. Department of Animal and Life science, New Mexico state University USA.

Holetzl, F.B., Nakamura, T.U., Filho, B.P.D., Cortez, D.A.G., Draz, J.A.M. and Nakamura, C.V. (2003). Effect of essential oil of *Ocimum gratissimum* on *Herpetomonas samuelpessoai*. *Acta Protozool*, 42: 269-276

Lemos, J.A., Passos, X.S., Fernandes, O.F.L., Paula, J.R., Souza, L.K.H., Lemos, A.A. and Silva, M.R.R. (2005). Effect of essential oil of *Ocimum gratissimum* towards *Crytococcus neoformans*. Men. Inst. Oswaldo Cruz Rio de Janeiro 100 (1): 55-58

Muhammad Javed, Fazil –Raziq Durrani, Abdul Hafeez, Rifatullah khan and Ijaz Ahmad (2009), Effects of aqeous extract of plant mixture on carcass quality of broiler chicks. Research Publishing Network (ARPN)

Nakaruma, C.V., Nakaruma, T.U., Bando, E., Melo, A.F.N., Cortez, D.A.G. and Diaz Filho, B.P. (1999). Antibacterial activity of *Ocimum gratissium* L. essential oil. Mem. Inst. Oswardo cruz. 94: 675-578

Nworgu, F.C. (2016). Effect of basil leaf (*Ocimum gratissimum*) supplement on performance and carcass characteristics of growing pullets. *Sustainable Agriculture Research*, 5 (3): 24-31.

Sofowora, A. (1993). Medicinal Plant and Traditional Medicine. Spectrum books Ltd. Ibadan, Nigeria. Pp. 224-227.

SAS (2001). Statistical Analysis Systems, SAS/STAT User's guide, SAS Institute Inc., Cary, North Carolina, U.S.A.

Van Soest, P.J., Robertson, J.B. and Lewis, B.A. (1991). Methods for dietary fibre, neutral detergent fibre and non-starch polysaccharides in relation to animal nutrition. *Journal of Dairy Science*, 74: 3583-3597.

Windisch, W., Schedle, K., Plitzner, C. and Kroismayr, A. (2008). Use of phytogenic products as feed additive for swine and poultry. *Journal of Animal Science* 86: 140-148.