NUTRIENT DIGESTIBILITY AND MINERAL UTILIZATION OF WEST AFRICAN DWARF (WAD) WEANER GOATS FED MIXTURE OF *Gmelina arborea* LEAVES AND *Panicum maximum*

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ABSTRACT
A total of twenty (20) West African Dwarf (WAD) goats of aged 4-6months weighing between 6.5-9.0kg were used in a completely randomized design todetermine the nutrient digestibility and mineral utilizationby feeding varying proportions of *G. arborea* leaves and *P. maximum* as a basal diet for 56days in a feeding trial. The animals were randomly allocated to five treatments.The results showed that dry matter (DM) digestibility was similar (P>0.05) across the treatments. However, crude protein (CP) and crude fibre (CF) digestibility were higher (P<0.05) in treatments containing *Gmelina*. However NFE NDF and ADF digestibility were higher (P0.05) in the control diet compared to others. The highest value of calcium (0.85%) was recorded in the diet containing 50% *Gmelina*: Pancum combination (P<0.05). Also, values of phosphorus (1.89%) and sodium (0.05%) were higher (P<0.05) in diets containing 100% *Gmelina*. It was concluded that farmers should include *Gmelina* leaves in diets of WAD goats for improved performance and good bone formation in goats.

INTRODUCTION
Small ruminants, particularly goats, play an important role in the life of small-holder farmer via their ability to convert low cost feed resource to high value products (meat, milk and skin). In most tropical countries, ruminant animals are maintained on native pastures, crop residues and agro-industrial by-products as their main source of nutrients (AFRC, 1991). Hence, the use of pasture grass and legumes has been advocated for small ruminant animal production as they readily serve as feed source. The use of *G. arborea* leaves (a leguminous browse plant) has been identified as oneof the cheapest way in reducing feeding cost in ruminant production in the tropics (Okpara, 2012).The leaves are relished by small ruminant animals especially sheepand WAD goats. *P. maximum* (a tropical, tufted and perennial grass) is one of the most naturaloccurringgrasses in tropics and sub-tropics of Africa which has high yield and re-growth, very responsive to nitrogenous fertilizer (Crowder and Chhenda, 1992) and highly palatable to livestock at all stages of growth which makes it one of the best fodder grasses. Hence, the mixture of *G. arborea* leaves and *P. maximum*has been identified as a cheapest way of feeding small ruminant animals.

MATERIALS AND METHODS
Experimental site and Experimental Animals
The experiment was carried out at the Goat and Sheep Unit, Teaching and Research Farm, Oyo State College of Agriculture and Technology, Igboora. Twenty (20) weaner West African Dwarf goats of both sexes weighing between 6.5-9.0kg were used for the experiment. The animals were acclimatizedfor two weeks andtreated against ectoparasites and endo-parasites prior to the commencement of the experiment.

Experimental Layout, Design and Feeding
The animals were allocated by weight into five treatments of four goats per treatment and each animal serves as a replicate, ina completely randomized block design (CRD). The experimental diets were: T_1(0% *G. arborea* leaves and 100% *P. maximum*), T_2 (25% *G. arborea* leaves and 75% *P. maximum*), T_3 (50% *G. arborea* leaves and 50% *P. maximum*), T_4 (75% *G. arborea* leaves and 25% *P. maximum*), and T_5 (100% *G. arborea* leaves and 0% *P. maximum*). Each groupof animalswereassigned to an experimental diets, andwere fed *ad libitum*while fresh water was made available.

Data Collection and Analysis
Urine and feaces were collected separately from each animal daily throughout the last seven days of the experiment in metabolic cages. The fecal sample collected were oven dried at 80^0C until constant weight was reached. The urinary output were collected in sample bottles with plastic cover containing 20%dilute tetraoxosulphate(IV) acid and then stored at 20^0C for subsequent analysis. The faecal samples were chemically analyzed using A.O.A.C procedure (AOAC, 1995) while the fiber fractions (NFE, NDF and ADF) were determined using Van Soest (1991) procedure. All nutrient digestibility data obtained were

subjected to one-way analysis of variance (ANOVA) (SAS, 1999). Differences among the means were separated using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

The percentage chemical composition of *G. arborea* leaves and *P. maximum* mixture on dry matter basis are shown in Table 1. Table 2 shows the percentage summary of nutrients digestibility of WAD goats fed varying levels of *G. arborea* leaves and *P. maximum* mixture. The DM digestibility content of the mixture obtained fell within the range of 87.68% (T_2) to 88.06% (T_3), which is still enough to meet the production and maintenance requirements of small ruminants. The differences in DM digestibility of experimental diets may be due to differences in stages of harvest. The highest CP digestibility (9.58%) was recorded in T_5while the lowest value of 8.73% was recorded in T_1.The CP digestibility of the experimental diets ranges from 8.73- 9.58% and fell within the recommended value(9.5-10%)for maintenance in small ruminant animals (Ahamfule, 2001). It was observed that with increase in the level of inclusion of *G. arborea* leaves, there is corresponding increase in CP digestibility of the experimental diet. The percentage CF digestibility ranged from 19.88-22.53.This observation supports the findings of McDonald *et al.*(1998) who reported that the fibre fraction of a feed has the greatest influence on its digestibility, and both the amount and chemical composition of the fibre are important. The highest ADF digestibility (42.23%), NDF digestibility (59.72%) and NFE digestibility (52.58%) was observed in T_1,which could be attributed to the fact that as the plant matures, the fibre fraction (ADF, NDF and NFE)also increases. This observation was in accordance with the findings of McDonald *et al.* (1998) who reported that with advance in forage plant maturity, there is an increase in its dry matter, ADF, NDF and NFE content with appropriate decrease in its crude protein. Table 3 showed the percentage mineral utilization by WAD goats fed varying levels of *G. arborea* leaves and *P. maximum* mixture. The highest value of phosphorus (1.89%) was observed in T_5 and the lowest Phosphorus value(1.67%) was found in T_3. The highest calcium value (0.85%) was recorded in T_3 whileT_5 has the lowest calcium value(0.62%).The mineral utilization fell within the values obtained for calcium and phosphorus by Carew *et al.* (1980). Mineral elements presence in animal feed is vital for the animal's metabolic processes (Onwuka and Akinsoyinu, 1988). The Ca:P ratios obtained in this study were moderate in all the experimental diets, and is in line with the recommended ratio of 1:2 by NRC (1981) for ruminants animal. Other minerals (Na, K and N)value obtained in this study also met the recommended value. which is needed for optimum growth, maintenance and production of small ruminants

Conclusion

Variations were observed in the nutrients digestibility and mineral utilization of the experimental animals. These variations were in respect of varying levels of inclusion of *G. arborea* leaves and *P. maximum* mixture fed to the WAD goats. The highest dry matter digestibility and crude protein digestibility levels should be given prominent consideration as major nutrients in goat production. However, the major mineral requirement for small ruminants to meet the maintenance and production are calcium and phosphorus. The result obtained showed that treatment 5 have the highest crude protein digestibility (9.58%) and the highest phosphorus (1.89%) which contained 100% inclusion levels of *G. arborea* leaves only.

Recommendation

It is therefore recommended that farmers should incorporate *G. arborea* leaves at 25-100% in diets of small ruminants because it is readily available, cheap and high in crude protein

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Table 1:Chemical composition of *G. arborea* leaves and *P. maximum* on dry matter basis

Parameters (%)	G. arborea Leaves	P. maximum
Dry Matter	93.71	32.80
Crude Protein	23.00	5.30
Ether Extract	13.60	2.90
Ash	5.39	3.30
Crude Fibre	17.15	22.20
Nitrogen Free Extract	34.48	66.00
Gross Energy (Kcal/g)	2.98	3.15

Table 2: Summary of nutrient digestibility of WAD Goats fed varying levels of *G.arborea* leaves and *P. maximum* mixture.

Parameters (%)	T_1	T_2	T_3	T_4	T_5	SEM(±)
DM	87.87	87.68	88.06	87.98	87.84	1.70
CP	8.73^{b}	9.02^{a}	9.38^{a}	9.48^{a}	9.58^{a}	0.86
CF	19.88^{b}	21.44^{a}	20.77^{a}	21.65^{a}	22.53^{a}	1.14
Ash	5.36^{b}	5.59^{b}	6.11^{a}	6.07^{a}	6.31^{a}	1.64
NFE	52.58^{a}	50.25^{b}	50.45^{b}	49.36^{c}	47.94^{c}	1.07
NDF	59.72^{a}	57.39^{b}	57.19^{b}	56.10^{b}	54.68^{c}	1.72
ADF	42.23^{a}	40.35^{c}	41.52^{b}	40.75^{c}	41.28^{b}	1.24

DM=Dry matter; CP=Crude protein; CF=Crude fibre; NFE=Nitrogen free extract; NDF=Neutral detergent fibre; ADF= Acid detergent fibre. $^{a, b, c}$ *epresents Means in the same row with different superscript are significantly different (P<0.05).*

Table 3:Mineral utilization by WAD goat fed varying levels of *G. arborea* leaves and *P. maximum* mixture.

Parameters (%)	T_1	T_2	T_3	T_4	T_5	SEM(±)
Phosphorus	1.80^{b}	1.75^{cd}	1.67^{d}	1.85^{c}	1.89^{a}	1.98
Calcium	0.81^{a}	0.77^{b}	0.85^{a}	0.78^{b}	0.62^{c}	0.58
Sodium	0.02^{d}	0.03^{cd}	0.03^{cd}	0.04^{b}	0.05^{a}	0.00
Potassium	0.24	0.08	0.08	0.08	0.10	0.04
Nitrogen	0.08	0.08	0.08	0.08	0.08	0.00

$^{a, b, c, d}$ *Means in the same row with different superscript are significantly different (P<0.05).*