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EFFECT OF FEEDING UREA-MAIZE STOVER DIETS ON MINERAL BALANCE OF WEST AFRICAN DWARF (WAD) BUCKS.

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ABSTRACT
Twelve West African dwarf (WAD)bucks, with average weight of 10.50 kg were monitored during a -98 day feeding experiment to investigate the mineral balance of goats fed urea-maize stover diets during the dry season. The bucks were randomized into four dietary treatments of three animals per group balanced for body weight. Each group was randomly assigned to one of the four diets containing 0, 5, 7.5 and 10% inclusion levels of urea and 60% maize stovers. Feed, faecal, urinary and blood samples were collected and analysed. Data were analyzed using one-way analysis of variance in a completely randomized design. Results showed that mineral intake by bucks decreased (P<0.05) with increase in dietary urea. The highest value of mineral retention was recorded for goats on the control diet. The inadequacy of some minerals in experimental diets may require supplementation when urea-maize stover diet is fed.

INTRODUCTION
For optimum production and physiological functions minerals are needed in the diet of goats (Luginbuhl, 2015), however, mineral bioavailability and balance are more important than how much is ingested (Miller, 1981).Calcium is reported as necessary for physiological processes like milk production, blood clotting,muscle contraction and nerve conduction (Hart 2008). Goat diets low in calcium can result in reduced goat milk production (Haenlein, 1980), hypocalcemia and urinary calculi (Hart 2008).The quality of feed fed to goat determines calcium content in goat milk (Yuli *et. al*. 2015), Deficiency of dietary calcium and potassium are predisposing factors for parturient paresis (Patel, 2011) and urinary calculi (Gugjoo *et. al.*, 2013). Luginbuhl, 2015 reported that the ratio of calcium to phosphorousin goat diet should be between 2:1 and 3:1 for optimum productivity.Goats compensate for magnesium deficiency by reducing output amounts in urinary excretion and milk production (Pugh 2019). Electrolyte solution for treatment of diarrhea in goats isreported to containsodium, potassium and chloride (Hart, 2008).Unavailable feed stuffs during the dry seasons necessitated the use of maize stover observed to beabundantafter crop harvesting,as ruminant feed.There is scarcity of data oneffect of feeding low quality feedstuffs on mineral nutrient intake in by goats.Therefore, the objective of this study is to determine the effects of urea-maize stover diets on mineral nutrient intake by WAD goats.

MATERIALS AND METHODS

Twelve (12) West African dwarf (WAD) bucks weighing between 9 and 12kg were purchased from surrounding villages.The study was conducted in the small ruminant experimental unit of the Teaching and Research Farm, Federal University of Agriculture, Abeokuta. The maize stovers were collected from neighbouring farms, cut into pieces of 2-3cm, sun- dried, and milled. Wilted elephant grass was fed as basal feed. Four experimental diets containing 60% by weight of maize stover each plus 0, 5, 7.5 and 10% urea inclusion levels was fed. Feeding trial lasted for 98days.and was based on 5% body weight of the animals once daily. The animals were divided into four groups containing three replicates each, balanced for body weight and fed the experimental diets every morning (008h). The feed residues were weighed daily to estimate intake.10% of the total faeces and Urine samples were saved for analyses. Mineral analysis was by wet digestion of samples in HNO_3/$HCLO_3$ and concentration of Ca, P and Mg were obtained with atomic absorption spectrophotometer (Bulk Scientific Model 2000, East Norwalk, U.S.A).Data were analysed using the one-way analysis variance (ANOVA) in a completely randomized design with the statistical package SPSS (1999). Means were separated where necessary using Duncan's (1955) Multiple Range Test.

RESULTS AND DISCUSSION

The Mineral composition of sundried milled maize stover and wilted elephant grass are shown in Table 1. Ca, Na and K content of maize stover used in this study were lower in value than previous studies reported by Vaswani *et al.* (2016). In contrast, Caand P content hadhighervaluesthan that reported byLi *et al*. (2014). These observed differences in mineral contents may be due to maize crop varieties therefore, selection should be made for maize crop variety with high yield and desirablecrop residues qualities (Geleti *et al*. 2011). The Na content of*Pennisetum purpureum*hadhigher values than that reported by Little *et al*. (1989). K and Ca contents were however lower than values from previous studies (McDowell *et al.*, 1993 and Little *et al.*, 1989).These varied values in mineral content of grass forage may be due to the environment, soil in which the forage was grown and / or species (McDowell*et al.*, 1993).Table 2 showed the mineral balance of the WAD goats.Na intake from all dietary treatment was above the required recommendation of 0.8-1.0 g/Kg DM (NRC 1985). This indicated that goats were able to meet their Na requirements from experimental diets however;Na intake by bucks in the present study was greater than findings by Ribeiro *et al.*(2018). Ca and P intakes from the experimental feeds were less than the recommendations of NRC(1985)for goats. This suggeststhat there may be need to supplement Ca and P when Urea-maize stover-based diet is fed to goats. In contrast however, the pattern of Ca utilization for all diets in the present study is better when compared to previous study (Bamikole and Babayemi, 2009) who reported negative Ca balance and retention values. Mg intake is within the range 0.8 – 2.5 g/kg reported by Kessler (1991) and Heilein (1980) for goats while K intake was lower than the value of 5g/kg DM recommended by NRC (1985). This generally better utilization of Mg agrees with the findings of earlier study by Bamikole and Babayemi (2009).This observationon Mg intake may be due to the low intake K, since reports (Schonewille *et al., 1999*) showed that high intake of K depresses the absorption of Mg in cows. In the same vein Low intake of potassium across the dietary treatment may lead to inadequate energy metabolism since reports have shown that imbalance in the intake of Na and K can result in inhibition of ATP (which depends on Na^+ - K^+ pump) andmetabolism of energy in animals. (Underwood and Suttle, 1999).

In conclusion, there was inadequate intake of some minerals from the experimental diets therefore goats would benefit from Ca, P, Mg and K supplementation when Urea-maize stover diet with pennisetum purpureum is fed as dry season feed. In addition, in maize crop breeding, selection should be made for maize crop variety with high yield and desirable crop residues qualities to meet the nutrient requirement of ruminants.

Table 1: Mineral composition (g/100g DM) of feed to the West African Dwarf goats

Mineral	DMMS	PP	t- value	LOS	R
Na	0.7	1.23	6.49	0.00	s
K	0.27	0.39	1.47	0.22	ns
Ca	0.55	0.17	4.65	0.01	s
Mg	0.29	0.39	1.23	0.29	ns
P	0.16	0.11	0.61	0.57	ns

Note: DMMS –Dried Milled Maize Stover, PP- *Pennisetum Purpureum*
LOS- Level of significance, s- significant, ns- not significant, R- Remark

Table 2: Mineral balance of the West African dwarf goats fed the experimental diets (g\day).

Parameters	0% urea	5% urea	7.5%urea	10% urea	SEM
Sodium					
Na intake	2.23	2.19	2.06	2.11	0.04
Faecal Na output	0.20^{b}	0.24^{a}	0.13^{c}	0.16^{bc}	0.01
Urinary Na output	0.03^{b}	0.03^{b}	0.03^{b}	0.04^{a}	0.00
Total Na output	**0.23^{b}**	**0.28^{a}**	**0.17^{c}**	**0.20^{bc}**	**0.01**
Sodium Retained	2.00	1.91	1.89	1.91	0.04
Sodium Retention %	89.62^{ab}	87.33^{b}	91.87^{a}	90.75^{a}	0.57
Calcium					
Ca intake	1.22^{a}	0.92^{b}	0.92^{b}	0.90^{b}	0.05
Faecal Ca output	0.75^{a}	0.74^{a}	0.69^{a}	0.45^{b}	0.04
Urinary Ca output	0.06	0.06	0.06	0.06	0.00
Total Ca output	**0.81^{a}**	**0.80^{a}**	**0.75^{a}**	**0.51^{b}**	**0.04**
Calcium Retained	0.41^{a}	0.12^{b}	0.17^{b}	0.39^{a}	0.05
Calcium Retention %	66.39^{bc}	86.96^{a}	81.52^{b}	56.67^{c}	4.17
Phosphorus					
P intake	1.27^{a}	1.26^{a}	0.91^{b}	1.15^{a}	0.05
Faecal P output	0.27^{a}	0.29^{a}	0.18^{b}	0.21^{b}	0.01
Urinary P output	0.03	0.03	0.03	0.03	0.00
Total P output	**0.30^{a}**	**0.32^{a}**	**0.21^{b}**	**0.24^{b}**	**0.01**
Phosphorus Retained	0.98	0.95	0.70	0.91	0.05
Phosphorus Retention %	76.25	74.93	77.22	78.98	0.96
Magnesium					
Mg intake	1.79^{a}	1.48^{ab}	1.53^{ab}	1.34^{b}	0.06
Faecal Mg output	0.39^{ab}	0.30^{bc}	0.41^{a}	0.23^{c}	0.02
Urinary Mg output	0.04^{b}	0.05^{b}	0.04^{b}	0.31^{a}	0.05

Total Mg output	**0.44**	**0.35**	**0.46**	**0.55**	**0.04**
Magnesium Retained	1.36[a]	1.14[ab]	1.07[ab]	0.79[b]	0.08
Magnesium Retention %	75.11	76.73	69.94	59.11	3.10
Potassium					
K intake	2.08[a]	1.91[ab]	1. 69[b]	1.67[b]	0.06
Faecal K output	0.29[a]	0.32[a]	0.26[ab]	0.21[b]	0.01
Urinary K output	0.04	0.04	0.04	0.04	0.00
Total K output	**0.33[a]**	**0.36[a]**	**0.30[ab]**	**0.25[b]**	**0.01**
Potassium Retained	1.75	1.55	1.39	1.42	0.06
Potassium Retention %	83.95	81.37	82.11	84.80	0.72

a, b, c –Means on the same row having different superscripts are significant (P<0.05).

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