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EFFECT OF UREA-MOLASSES MULTINUTRIENTS BLOCK SUPPLEMENTATION ON NUTRIENTS, ANTI-NUTRIENTS INTAKE AND WEIGHT GAIN OF WAD GOATS FED CASSAVA PEELS

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ABSTRACT

A study was conducted to evaluate nutrients, anti-nutrients and weight gain of West African Dwarf (WAD) goat fed cassava peels with urea-molasses multi-nutrients block (UMMB) supplements. Twenty WAD goats that weighed 8.33±0.35Kg on average were assigned to each of the five experimental diets that contained cassava peels without UMMB supplement (treatment 1) and with UMMB containing 0% urea (treatment 2), 5% urea (treatment 3), 10% urea (treatment 4) and 15% urea (treatment 5), in a completely randomized design (CRD). Results of the study revealed that nutrients intake of the goats were significantly ($P<0.05$) influenced by UMMB supplementation. Best results of dry matter (313.49 g/day) and crude protein (44.67 g/day) intake were observed in goats fed diet T_4. The anti-nutrients intake were significantly ($P<0.05$) influenced by dietary treatments, however, the intake was tolerated by the goats. WAD goats fed diets T_4 and T_5 had the highest live weight gain (2.73 kg and 2.10 kg respectively), and average daily weight gain (39.05 g/day and 30.48 g/day respectively). Conclusively, it can said that urea-molasses multi-nutrients block supplement containing 10 - 15% urea can offers a cheap but reliable source of protein for optimum utilisation of cassava peels or other crop residues by goats (especially during dry season when quality feeds are scarce), for improved performance as well as nutrients and anti-nutrients utilisation without any noticeable detrimental effects on the wellbeing of WAD goats.

INTRODUCTION

There is a noticeable shortage of animal protein in the diet of an average Nigerian. On the other hand, there is a mild to severe shortage of grains for human consumption, particularly in the under-developed and developing countries, which is further aggravated by their increasing population (Dhakad *et al.*, 2002). Ajala *et al.* (2008) suggested that solution to the present meat and grain shortage rests on the promotion and sustenance of more efficient production of all classes of meat animals using unconventional feed resources.

Farm by-products could constitute an important feed resource during the dry season. However, most farm by-products are known to be particularly deficient in protein, minerals and vitamins; they are highly lignified and their digestibility is low. The principles for improving the use of these poor quality feed resource by ruminants according to Sansoucy *et al*. (1988), include, satisfying the requirements of the rumen micro-organisms to ensure efficient fermentation of fibre and increased production of microbial protein relative to volatile fatty acids; balancing the products of fermentative digestion with dietary nutrients (mainly through the use of bypass protein) to meet the needs of growth, milk, meat and wool production. Experiments with sheep and goats have shown that this can be achieved through protein supplementation (Rokomatu and Aregheore 2006). Protein supplementation is

known to enhance utilisation of poor-quality feeds like crop residues as it maximises roughage degradation and optimises rumen microbial protein synthesis (Rokomatu and Aregheore 2006). However, most of the supplements used such as soya beans, cotton seed cake and groundnut cake are expensive and not readily available. Urea offers a cheap and good alternative source of protein (Wanapat *et al*., 2009). When urea is fed as such to a ruminant, it is hydrolyzed instantly in the rumen and the ammonia released is utilized efficiently for microbial protein synthesis (Nisha, *et al*., 2005). The use of solid feed supplementation blocks, i.e. urea-molasses blocks or multinutrients blocks (UMMB), has been used to salvage the deficiency of energy, nitrogen, vitamins and minerals lacking in fibrous feeds (FAO, 2007).

Urea-molasses multinutrient blocks (UMMB) offers several advantages: ease of transport, storage and use, and reduced risks compared with other approaches, such as giving a small amount of urea in drinking water, sprinkling of urea solution on fibrous feeds before feeding, or urea-ammonization of crop residues.

MATERIALS AND METHODS

Experimental sites

This experiment was conducted at the Teaching and Research Farm of the Federal University of Technology, Akure, Nigeria. Samples collected where analyzed in the nutrition laboratory of Department of Animal Production and Health of The Federal University of Technology, Akure, Ondo State, Nigeria.

Experimental animals and their management

Twenty West African Dwarf bucks weighing 8.33±0.55Kg on average were used for the study. The study lasted for 70 days (excluding one month adjustment period). At the end of the adaptation period, the animals were distributed on the basis of their body weights. Four (4) animals were randomly assigned to each of the five experimental diets that contained cassava peels without urea-molasses multinutrients block (UMMB) supplement (treatment 1) and with UMMB supplements containing varying levels of urea (0%, 5% 10% and 15% for treatments 2, 3, 4 and 5 respectively) in a completely randomized design (CRD). The goats were managed on intensive system of livestock production where routine medication as recommended by the Teaching and Research Farm was adopted. Cassava peels were sundried and fed to all of the animals. Daily records of feed intake as well as weekly weight change of each animal were obtained and during the last two weeks of the experiment, the animals were transferred to metabolic cages for digestibility trial where faeces and urine were collected separately for seven (7) days after seven days acclimatization.

Preparation of Urea-molasses Multinutrient Block (UMMB)

i. Ingredients

Formulation of UMMB was done using locally available ingredients namely sugarcane molasses, urea, common salt, vitamin/mineral premix, brewer's dried grain and cement (see table 1). Molasses was the source of fermentable substrate and various minerals and trace elements. Urea will provide fermentable nitrogen. Cement was used as the binding agent. Brewer's dried grain acts as an absorbent for the moisture contained in molasses and gives structure to the block.

ii. Manufacturing process

The various raw materials were weighed accurately before mixing. Mixing was done manually in a bucket. Mixing the molasses with the urea was the first step. The cement powder was introduced next. The bran was added to this mixture and finally, water (with the salt and mineral premix dissolved in it) was added in sufficient quantity to ensure homogenous mixture. Plastic containers with

dimension of about 14cm x 14cm x 8cm were used as moulds. Once the mixture was placed in the mould, it was left in a well-ventilated room to set. The mixture took about 6-8days to set, after which the blocks were ready for feeding.

Table 1: Components of urea-molasses block for each of the treatments

Ingredients	Block A (%)	Block B (%)	Block C (%)	Block D (%)
Urea	0.0	5	10	15
Molasses	0.0	45	40	35
Common salt	5	5	5	5
Cement	15	15	15	15
Brewer's dried grain (BDG)	29.0	29.0	29.0	29.0
Rice bran	55	0.0	0.0	0.0
Premix	0.5	0.5	0.5	0.5
Sulphur	0.5	0.5	0.5	0.5
TOTAL	100	100	100	100

Chemical analysis

The multi-nutrients blocks, feed, faeces and urine were analysed for crude protein/nitrogen, crude fibre, ether extract, and ash were analyzed according to AOAC (1995). Neutral detergent fibre (NDF), acid detergent fibre (NDF) and acid detergent lignin (ADL) were determined as described by Van Soest *et al.* (1991). Hemicellulose was calculated as the difference between ADF and ADL. Blood samples from individual goats were collected from their jugular vein for haematological and serum analyses. Minerals were determined after wet digestion of the samples with a mixture of perichloric acid and concentrated nitric acid (1:4 v/v) and composition of some minerals (Calcium, Phosphorus, Magnesium, Sodium, Potassium, Iron, Copper and Zinc) in the digest were determined by Atomic Absorption Spectrophotometer (AAS). Anti-nutrients (cyanide, oxalate, tannin, alkaloids and phytate) was also analyzed in the central laboratory of Federal University of Technology, Akure, Nigeria.

Data Collection and Statistical Analysis

Data generated were subjected to the one-way analysis of variance (ANOVA) using the general linear model procedure of SAS (2008). Where significant differences are observed, Duncan's Multiple Range Test (Duncan, 1955) was employed to separate the means.

RESULTS AND DISCUSSION

Proximate composition of cassava peels and urea-molasses multinutrients blocks (UMMBs)

The proximate composition of the cassava peels and multi-nutrient blocks are presented in Table 2. The dry matter (DM) contents in the UMMBs ranged between 82.53% and 90.62%, these values were comparable to 83.13 – 88.21% reported by Onwuka (1999) for molasses-urea multi-nutrients blocks, but higher than 71.18 – 78.55% reported by Aye and Adigun (2010) for *Gliricidia* molasses-urea multi-nutrients blocks.. The high DM recorded in UMMB-A may be due to the high percentage of rice bran (55%DM content) and absence of molasses in the diet (Table 2)

The crude protein (CP) of the UMMB supplements increased with increased urea content and the values ranged from 8.05% to 29.79%. The CP values of UMMBs B, C and D were higher than the values of 11-15% reported

by Matal and Cambellas (1992) and Onwuka (1999) when these authors fed crop residue with UMMB supplement to sheep. However, the observed CP values in this study compared favourably to the reported value of 17-33% by Aye and Adigun (2010) when cassava peels with *gliricidia* based molasses-urea multi-nutrients block supplements were fed to sheep. Thus, UMMB supplements containing 5-15% urea could be a good source of alternative protein in goats' nutrition.

The crude fibre (CF) content was higher in UMMB-A than the others, this observation might be due to very high rice bran content (55%). The CF content fell within the range values (7 – 13%) as reported by Onwuka (1999) when UMMB was used as a supplemental feed resource for ruminants. The high nitrogen free extracts (NFE) of the UMMB supplements might be due to the molasses contents of the supplements. The energy content of the supplements increased with increased molasses content and the highest molasses (45%) in UMMB-B resulted in highest gross energy content. The observed poor energy in UMMB-A might be due to the absence of molasses (Table 2) in the supplement. The NFE and energy contents of the multi-nutrients blocks showed its potential as an excellent source of fermentable carbohydrates and energy for optimum ruminal activity.

The DM of the cassava peels was high (86.57%) and the observed value agrees with reports of Oboh (2006). The CP of the cassava peels was 5.35%, this value was lower than 6.5% reported by Adegbola (2002), but comparable to 5.48 reported by Akpabio *et al.* (2012). The crude fibre (CF) content of the cassava peels was 11.83%, this value was higher than 10.0% reported by Adegbola (2002). The fats, NFE and energy of the cassava peels were also in agreement with those given by Adegbola (2002).

Table 2: Proximate composition (%) and gross energy (MJKg-^{1}) of cassava peels and urea-molasses multi-nutrient blocks (UMMBs)

Parameters	CASSAVA PEELS	UREA-MOLASSES MULTINUTRIENTS BLOCKS (UMMB)				CV (%)
		A	B	C	D	
Dry matter	86.57	90.62	82.53	84.88	85.16	3.10
Crude protein	5.35	8.05	17.94	22.93	29.79	14.32
Crude fibre	11.83	15.29	9.95	7.47	7.30	50.45
Ether extract	3.72	6.84	4.53	3.02	4.07	29.28
Ash	15.5	8.12	9.51	7.21	7.91	31.28
Nitrogen free extract	63.6	61.7	61.07	59.00	50.93	5.57
Neutral detergent fibre	52.12	57.04	44.20	43.93	43.74	71.76
Acid detergent fibre	46.06	44.65	36.35	35.89	36.18	57.84
Acid detergent lignin	28.14	34.98	32.62	33.75	33.81	62.32
Hemicellulose	6.06	12.39	7.85	8.04	7.56	26.46
Cellulose	17.92	9.67	4.03	2.14	2.37	77.81
Gross energy (MJ Kg^{-1} DM)	7.96	8.05	14.85	13.08	11.94	24.61

*UMMB A (0% urea, 0% molasses); UMMB B (5% urea, 45% molasses); UMMB C (10% urea, 40% molasses); UMMB D (15% urea, 35% molasses)

Minerals and anti-nutrients composition of urea-molasses multi-nutrients blocks and cassava peels

Minerals and anti-nutrients composition of urea-molasses multi-nutrients blocks and cassava peels are presented in Table 3. The Ca level in the multi-nutrients blocks ranged from 2.46 - 3.18%. These values were higher than the range of 0.76 - 0.89% reported by Aye and Adigun (2010) for *Gliricidia* base molasses-urea multi-nutrients blocks, but compared favourably to 0.90 – 4.00% reported by Liu *et al.* (1995) when UMMB was fed to cattle and goats. The phosphorus level (0.68-1.92%) in UMMBs B, C and D was high compared to previous reports on UMMB; 0.5% (Liu *et al.*, 1995); 0.54% (Chen *et al.,* 2001). Magnesium content of the multi-nutrients blocks supplements ranged from 0.33 to 0.88% and these values were more than the values (0.14 - 0.19%) reported by Aye and Adigun (2010) for *gliricidia* based UMMB. The high mineral content in UMMB makes it a very good source of essential minerals to goats on supplemental feeding.

The Cyanide content (16.02mg/kg) of the cassava peels was higher than the content of the multinutrient blocks (1.33-5.43mg/kg). The values obtained were below toxic level (50mg/Kg) as reported by Nwokoro *et al.* (2005). The tannin content of the cassava peels observed compared favourably to the value of 0.19 - 0.14% in cassava peels from bitter and sweet cassava (Akpabio *et al.,* 2012).

The concentration of these ANFs in the cassava peels and multi-nutrients blocks are below the toxic levels that could exert toxic effects on ruminants, since the goats are capable of hydrolyzing these secondary metabolites to produce other beneficial chemical compound through rumen microbial activities (Aganga and Tshewenyane, 2003).

Table 3: Mineral and anti-nutrients composition of cassava peels and urea-molasses multinutrient blocks.

Parameters	CASSAVA PEELS	UREA-MOLASSES MULTINUTRIENTS BLOCKS			
Minerals (%)		**A**	**B**	**C**	**D**
Calcium	0.21	2.46	3.18	3.02	2.61
Phosphorus	0.18	0.25	1.92	0.94	0.68
Sodium	0.03	0.41	1.01	0.31	0.62
Potassium	0.33	0.82	2.09	1.94	0.85
Magnesium	0.18	0.31	0.76	0.88	0.62
Anti-nutrients					
Cyanide (ppm)	16.02	5.42	1.33	1.94	2.13
Tannins (%)	0.19	1.21	0.10	0.08	0.12
Oxalates (mg/g)	247.62	115.42	43.05	56.22	64.21
Phytate-P (mg/g)	10.93	6.83	2.12	3.14	4.86
Alkaloids (mg/g)	7.02	3.21	0.94	1.27	1.15

*UMMB A (0% urea, 0% molasses); UMMB B (5% urea, 45% molasses); UMMB C (10% urea, 40% molasses); UMMB D (15% urea, 35% molasses)

Nutrients intake by WAD goats fed cassava peels with UMMB supplements

The nutrients intake (g/day) of WAD goats fed cassava peels fed UMMB supplements is shown in Table 4. Dry matter (DM) intake was improved with increased urea level in the multi-nutrients block. The DM intake was higher in goats fed cassava peels with UMMB supplements than goats fed cassava peels alone (diet T_1). This observation was in line with Liu *et al.* (1995) who observed higher dry matter intake in Qingchuan bull cattle fed microbial treated rice straw with UMMB. The DM intake values obtained were lower than the reports of Fajemisin *et al.* (2012) when cassava peels substituted with varying levels of *Cajanus cajan* hay were fed to WAD goats. The DM intake of goats fed diets T_4 and T_5 were statistically ($P>0.05$) similar but differed numerically. However, goats fed diet T_5 had a lower DM intake (300.03 g/day) compared to those fed diet T_4 (313.49 g/day) with a urea level higher than the level in UMMB of goats fed dietT_4. Similar observation was made by Sansoucy (1995) when lambs were fed straw with UMMB containing 15% urea. The author, further stated that at 20% urea level in UMMB, none of the lambs licked the blocks. Sansoucy (1995) attributed the decrease in DM intake by goats fed diet T_5 to the fact that urea at higher levels is unpalatable; hence lesser quantity was consumed by the goat leading to reduced quantity nitrogen and energy available for rumen microbes' activity. The higher DM intake observed in goats fed diet T_4 could be attributed to increased nitrogen and energy supply which enhances rumen microbes activity. This suggested that supplementing crop residue with molasses-urea multi-nutrients blocks containing 10% urea would enhance DM intake in goats.

The crude protein (CP) intake was highest in goats fed T_3. Higher values were also obtained in T_4. This observation reveals that UMMB supplementation enhances protein intake. The observation is in line with the report of McDonald *et al.,* (2010) that ruminants show higher nitrogen intake when offered high protein diets. Crude fibre (CF) intake was significantly ($P<0.05$) influenced by UMMB supplementation. The reason being that, protein supplementation maximises roughage degradation by supplying the needed nitrogen (N) for rumen microbial multiplication (Rokomatu and Areghore, 2006).

Furthermore, UMMB supplementation improved the intakes of fats, ash and NFE significantly. The result agrees with the report of McDonald *et al.* (2010) that nutrients intake increase with protein supplementation.

Minerals and anti-nutrients intake (g/day) by WAD goats fed cassava peels with UMMB supplements

The mineral and anti-nutrients intake (g/day) by WAD goats fed the basal diet with UMMB supplement is presented in table 5. The intake of minerals by the WAD goats was significantly ($p<0.05$) influenced by dietary treatments. Goats fed diet T_2 had the highest sodium (Na) intake (0.86 g/day) while sodium intake was least in goats fed diet T_1 (0.06 g/day). The Na intakes by the goats were above the daily requirement of 0.52 ppmNa/$KgW^{0.75}$ /day for maintenance reported by Aina (1999). The excess Na were most likely excreted via urine and faeces (McDonald *et al.,* 2010) since no visible signs of Na toxicity was noticed in all the goats.

Calcium (Ca) and phosphorus (P) intake ranged from 0.48 to 3.60 g/day and 0.41 to 2.05 g/day respectively. These values were above the daily requirement of 0.7-1.5/day of calcium and 0.5-1.0 g/day of P reported by NRC (1994) for goats. The excess Ca and P were most likely mobilized for bone formation or excreted via urine and faeces.

Magnesium (Mg) is an important element in ruminant nutrition (Mahan, 1990). Deficiency could lead to "Grass tetany" or "hypomagnesaemia". Mg intake by the goats ranged from 0.41 g/day (diet T_1) to 1.55 g/day

(diet T_3). These values were above daily requirement of 0.3 g/day suggested by Sowande *et al.* (2000) for maximum growth rate of WAD goats.

The intake of anti-nutrients by the goats was significantly ($p<0.05$) influenced with increased urea level in the multi-nutrients block, the intake values were within tolerable limits for the goats since the goats are capable of hydrolyzing these secondary metabolites to produce other beneficial chemical compound through rumen microbial activities (Aganga and Tshewenyane, 2003). Tannin intake which ranged between 0.91 and 0.68 g/day was lower than 35 g/day considered beneficial to ruminants (Athanasiadou *et al.*, 2001).

Table 4: Nutrients intake (g/day) of WAD goats fed cassava peels with UMMB supplements

	TREATMENTS					
Nutrients	**1**	**2**	**3**	**4**	**5**	**±SEM**
Dry matter intake	180.00^{c}	234.43^{b}	259.47^{b}	313.49^{a}	300.03^{a}	10.47
Crude protein	12.16^{c}	16.57^{c}	30.47^{b}	44.67^{a}	40.37^{a}	3.46
Crude fibre	26.90^{c}	61.90^{b}	74.01^{ab}	85.05^{a}	81.25^{a}	5.92
Fats	8.46^{c}	11.95^{b}	15.10^{a}	16.55^{a}	16.65^{a}	0.92
Ash	35.24^{b}	42.75$^{\mathbf{b}}$	55.75^{a}	65.05^{a}	61.54^{a}	3.34
Nitrogen free extract	144.61^{b}	159.11^{b}	203.95^{ab}	251.78^{a}	235.38^{a}	12.42
Neutral detergent fibre	116.51^{c}	140.03^{c}	177.67^{b}	231.44^{a}	232.55^{a}	13.09
Acid detergent fibre	81.99^{c}	97.10^{bc}	120.26^{b}	156.75^{a}	158.01^{a}	8.71
Acid detergent lignin	54.89^{c}	64.49^{bc}	80.02^{b}	104.76^{a}	105.49^{a}	5.82
Hemicellulose	36.52^{c}	42.93^{c}	57.41^{b}	74.69^{a}	74.54^{a}	4.40
Cellulose	27.10^{c}	32.61^{bc}	40.23^{b}	51.99^{a}	52.51^{a}	2.88

*$^{a, b, c}$ = Means with different superscripts in the same row are significantly different ($P<0.05$). n=4

TREATMENT 1 = Cassava peels only

TREATMENT 2 = Cassava peels + UMMB supplement containing 0% urea; 0% molasses

TREATMENT 3 = Cassava peels + UMMB supplement containing 5% urea; 45% molasses.

TREATMENT 4 = Cassava peels + UMMB supplement containing 10% urea; 40% molasses.

TREATMENT 5 = Cassava peels + UMMB supplement containing 15% urea; 35% molasses.

Table 5: Mineral and anti-nutrients intake (g/day) by WAD goats fed cassava peels supplemented with UMMB

Parameters	TREATMENTS					±SEM
Minerals	**1**	**2**	**3**	**4**	**5**	
Calcium	0.48^{d}	1.4^{c}	3.11^{b}	3.60^{a}	3.15^{b}	0.32
Phosphorus	0.41^{d}	0.56^{d}	2.05^{a}	1.61^{b}	1.36^{c}	0.17
Sodium	0.06^{e}	0.21^{d}	0.86^{a}	0.40^{c}	0.66^{b}	0.08
Potassium	0.75^{e}	1.14^{d}	2.66^{b}	3.13^{a}	2.13^{c}	0.24
Magnesium	0.41^{d}	0.58^{c}	1.16^{b}	1.55^{a}	1.30^{b}	0.12
Anti-nutrients						
Cyanide	0.36^{b}	0.44^{b}	0.52^{b}	0.69^{a}	0.70^{a}	0.06
Tannin	0.82^{ab}	0.91^{a}	0.68^{b}	0.87^{ab}	0.91^{a}	0.02
Oxalate	7.08^{c}	10.44^{b}	11.22^{b}	15.46^{a}	16.05^{a}	0.67
Phytate	2.84^{b}	3.08^{b}	3.66^{b}	4.87^{a}	5.05^{a}	0.24
Alkaloids	1.82^{b}	1.94^{b}	2.32^{b}	3.06^{a}	3.07^{a}	0.11

$^{*a, b, c, d, e}$ =Means with different superscripts in the same row are significantly different ($P<0.05$). n=4
TREATMENT 1 = Cassava peels only
TREATMENT 2 = Cassava peels + UMMB supplement containing 0% urea; 0% molasses
TREATMENT 3 = Cassava peels + UMMB supplement containing 5% urea; 45% molasses.
TREATMENT 4 = Cassava peels + UMMB supplement containing 10% urea; 40% molasses.
TREATMENT 5 = Cassava peels + UMMB supplement containing 15% urea; 35% molasses.

Weight gain of WAD goats fed cassava peels with UMMB supplements

Table 6 presents the weight gain of WAD goats fed cassava peels supplemented with urea-molasses multinutrient blocks. Average daily weight gain of WAD goats was improved by UMMB supplementation. The values obtained ranged from 3.86 g/day (diet T_1) to 39.05 g/day (diet T_4). Similar observations were made when lambs (Aye and Adigun, 2010), and goats (Vatta *et al.*, 2007) were fed crop residues with UMMB supplements. This could be attributed to improved nitrogen and energy content of the diets which might have improved rumen microbial population, improved nitrogen-energy ratio and consequently improved growth of the goats. It is also assumed that the response may be due to supplementary energy supplied by the UMMB but also the effect of other ingredients in the UMMB supplements on the rumen eco system (Preton and Leng, 1987).

Goats fed diet T_4 had the best feed conversion ratio (FCR) (9.44). This corroborates the earlier observation on growth rate of lambs fed cassava peels with *gliricidia* base molasses-multi-nutrients block supplements (Aye and Adigun, 2010).

Table 6: Weight change of WAD goats fed cassava peels supplemented with UMMB.

	TREATMENTS					
Parameter	**1**	**2**	**3**	**4**	**5**	**±SEM**
Initial live weight (Kg)	8.53	8.40	8.33	8.33	8.27	0.31
Final live weight (Kg)	8.80	8.87	9.28	11.07	10.40	0.45
Mean live weight gain(Kg)	0.27^{d}	0.47^{d}	0.95^{c}	2.73^{a}	2.10^{b}	0.28
Avg. daily weight gain ($gday^{-1}$)	3.86^{d}	6.76^{d}	13.63^{c}	39.05^{a}	30.48^{b}	3.94
Feed intake (g/day)	206.84^{c}	257.62^{bc}	312.62^{b}	368.81^{a}	352.98^{a}	14.70
Feed conversion Ratio	53.59^{a}	38.11^{b}	22.94^{c}	9.44^{d}	11.87^{d}	7.48

$^{*a, b, c, d}$ =Means with different superscripts on the same row are significantly different (P<0.05). n=4
TREATMENT 1 = Cassava peels only
TREATMENT 2 = Cassava peels + UMMB supplement containing 0% urea; 0% molasses
TREATMENT 3 = Cassava peels + UMMB supplement containing 5% urea; 45% molasses.
TREATMENT 4 = Cassava peels + UMMB supplement containing 10% urea; 40% molasses.
TREATMENT 5 = Cassava peels + UMMB supplement containing 15% urea; 35% molasses.

CONCLUSION

Strategic UMMB supplementation, manufactured from locally available raw materials and with formulation taking into account local ecosystem and animal physiological requirements, is an effective means of correcting nutrient deficits in poor quality fibrous feed resources. Its use as a supplement improved the nutrients, anti-nutrients intake as well as weight gain of WAD goats fed cassava peels-based diets. Therefore, high-cost concentrates can be replaced by UMMB licks.

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