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THE EFFECT OF UREA TREATED CASSAVA PEELS AS SUPPLEMENT TO WEST AFRICAN DWARF (WAD) GOATS GRAZING NATURAL PASTURE

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SUMMARY

The performance of West African Dwarf (WAD) goats grazing natural pasture and supplemented with different levels of urea-treated cassava peels (UTCP) was evaluated. The urea treatments were 0% UTCP, 4% UTCP (40g urea/kg), 6% UTCP (60g urea/kg) and 8% UTCP (80g urea/kg).Twenty WAD bucks aged between 6 and 9 months and weighing on the average 7.7±1.2kg were randomly allocated to five treatment diets consisting of either natural herbage alone (NH); NH + 0% UTCP (0% UTCP,) NH + 4% UTCP (4% UTCP), NH + 6% UTCP (6% UTCP) and NH + 8% UTCP (8% UTCP) respectively in a completely randomized design experiment lasting 84 days to evaluate the potentials of UTCP as a supplement to natural pasture. Total daily feed intake, daily weight gain and weight gain per gramme nitrogen intake varied significantly (P<0.05) among treatments,. Similarly, significant (P<0.05) effect of urea treatment was observed on thoracic girth change, daily water consumed and feed conversation ratio (FCR). Animals on 4% UTCP recorded superior performance in daily weight gain, weight gain per gramme nitrogen intake, FCR and thoracic girth change. This indicated that ammoniation at 4% improved weight gain significantly (P<0.05) compared to other treatment levels. No significant (P>0.05) increase in blood urea accompanied ammoniation and blood urea concentration did not exceed the toxic level of 10mg per litre.

KEY WORDS: Effect, urea treated cassava peels, goats.

INTRODUCTION

About 85% of the small-holder farmers in Nigeria keep West African Dwarf (WAD) goats exploiting their ability to convert roughage to edible meat, convenience of handling, early maturity and short reproductive cycle; hence making them a major source of income for daily cash needs and security for crop failures. Goats are usually raised on enclosed natural pasture or tethered during cropping season hence inducing feed stress; while during the dry season, crude protein of natural grazed herbage decline to about 2-5 percent and the concomitant deficiency of vital nutrients especially nitrogen cannot sustain them (Umunna and Lufadeju, 1986).

Although protein supplements such as soyabean, groundnut cake, cotton seed cake etc, are available, high cost and competition by man make them uneconomical feed supplements. Research efforts must therefore be geared towards economically viable alternatives to replace the expensive ingredients and improve existing traditional management of the ruminant WAD goats.

Ruminant nutrition has been extensively researched, but there are opportunities for developmental research technology that is

cheap, safe and adaptable in rural communities and also in animals indigenous to the tropical environment. Though many workers (Job *et al.*, 1976; Omole and Sonaiya, 1981) carried out various investigations on improving the nutritive value of cassava peels for use in balancing diets for non-ruminants, little is known of trials employing non-protein nitrogen (NPN) with cassava peels particularly for ruminants considering its reduction in cost of feeding.

Since cassava peel has low nitrogen content (Hanh *et al.*, 1986), there is the need to combine this high caloric root waste with complementary cheap protein sources that can satisfy the maintenance and growth requirements of the ruminant animal. This study was designed to evaluate different levels of urea-treated cassava peels as a supplement for WAD goats grazing natural pasture.

MATERIALS AND METHODS

Location

The experiment was carried out at the small ruminant unit of the livestock complex of the College of Agriculture, Lafia, Nasarawa State, Nigeria. Lafia is located between latitude 80°N and 90°N and, Longitude 80°E and 90°E and lies within the guinea savanna of Nigeria's vegetation zone; with an average rainfall of about 823mm annually (Collins, 1976).

Urea treatment of cassava peels

Fresh cassava peels were obtained from the Family Support Programme's Gari Processing industry, Shabu, Lafia and sun dried for six days as described by Adegbola *et al.* (1990). Three levels of urea solution: 4,6 and 8 percent were prepared by dissolving 40, 60 and 80 grammes of fertilizer grade urea in 200ml of water for every kg cassava peels sprayed. One hundred (100kg) stack was sprayed (garden sprayer) with 20 litres of one of each of the three levels of urea solution, sealed and made airtight with plastic sheeting covered with a layer of earth on impervious floor as described by Ibrahim *et al.* (1984) and left undisturbed for a period of twenty one days to allow the ammonia produced by hydrolysis of urea diffuse through the stack.

Experimental animals and their management

Twenty WAD intact bucks, aged between 6 and 9 months and having an average weight of 7.7±1.2kg were obtained from a flock at the farm and routinely given Ivomec ® injection against endo and ecto parasites before the start of the experiment. Four bucks were randomly allocated to five treatments (NH, natural herbage only; natural herbage + 0% UTCP; natural herbage + 4% UTCP; natural herbage + 6% UTCP and natural herbage + 8% UTCP) in a completely randomized design format. The goats were housed in individual pens measuring 1.5m2 each with feeding and watering troughs. The animals, four per treatment were tagged and allowed access to water and mineral salt lick ad libitum. Supplement diets were offered to animals between the hours of 0900 and 1100 before they were allowed to zero graze the natural pasture between 1100 and 1700 hours daily for 84 days during the dry season (January – April). The pasture was harvested at 1800 hours daily and allowed to stay overnight before the next day's feeding. The animals were weighed at the beginning of the experiment and weekly thereafter for twelve (12) weeks to assess live weight changes. Supplement and forage intake were determined by subtracting refusal from quantity offered. Blood samples were obtained via jugular veins of the

goats before commencement and at 4th, 8th and 12th week of the experiment.

Data collection

Body weights, height at withers and thoracic girth were taken weekly. Daily water intake, feed consumption and feed refusal were weighed every morning between 0800 and 0900 hours for 84 days.

Metabolizable energy content of the experimental diets were calculated (Steele, 1996), using the formula:
ME (MJ/kg) = 0.156 x DOM, Where DOM = digestible organic matter

$$1 \text{ kcal/kg} = 4.18 = \frac{\text{MJ/Kg}}{4.18} \times 1000$$

Chemical analysis

The grazed herbage, untreated cassava peels and faecal samples were oven dried to constant weight and milled. Five grammes each of the samples were analyzed for organic matter and nitrogen by AOAC (1980) procedure, while Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were determined according to the method of Van Soest and Roberston (1980). Blood urea was analysed by Bertholet Urease methods (Tietz, 1987).

Statistical analysis

Means of weight gained, changes in height at withers and thoracic girth, gain per gramme nitrogen intake were subjected to analysis of variance and significant means were separated using Ducan's multiple range test (Steel and Torrie, 1980).

RESULTS

The chemical composition of natural herbage grazed and the urea treated cassava peels (UTCP) consumed are presented in Table I. The crude protein (CP) content of the natural herbage consumed (13.13±+0.05% was higher than CP content of UTCP which however increased with increasing urea concentration. The ash content decreased with increasing ammoniation from 0-6% UTCP but rose again at 8%. The NDF and ADF content of the NH were high but decreased from 0% UTCP to 4% UTCP and increased again in 6% and 8% UTCP respectively. NDF and ADF contents of 4% UTCP were the lowest. The ME values decreased with increased urea treatment of cassava peels: 2911.48, 1901.91, 2727.76 and 2296.65 kcal/kg for 0% UTCP, 4% UTCP, 6% UTCP and 8% UTCP respectively; while ME value of 1598.44 kca/kg for natural herbage was the lowest.

TABLE I: Chemical composition of natural herbage, untreated cassava peels and urea treated cassava peels

Chemical Component	NH	0% UTCP	4% UTCP	6% UTCP	8% UTCP
DM (%)	97.75±0.03	98.86±0.15	98.03±0.32	99.48±0.14	99.37±0.11
OM (%)	89.68±0.15	92.68±0.04	92.52±0.15	94.5±0.14	93.7±0.12
CP (%)	13.13±0.05	8.94±0.05	9.75±0.04	9.88±0.07	10.5±0.10
NDF (%)	55.55±0.19	26.50±0.00	24.37±0.30	29.63±0.04	29.33±0.28
ADF (%)	40.48±0.37	20.19±0.01	19.85±0.16	24.53±1.57	25.41±0.27
ASH (%)	8.07±0.12	6.18±0.71	5.51±0.15	4.98±0.00	5.67±0.12
ME (Kcal/kg)	1598.44	2911.48	2901.91	2727.76	2296.65

NH - Natural herbage
UTCP - Urea treated cassava peel

The performance of the WAD goats fed urea treated cassava peels as supplement to natural pasture are summarized in Table II. The mean total feed intake by goats on NH and 8% UTCP were similar (P>0.05) while total intake increased significantly (P<0.05) with increased urea treatment of cassava peels. Similarly, daily forage and supplement intake by goats on 0% UTCP, 4% UTCP, and 6% UTCP improved significantly (P<0.05) with supplement ammoniation but declined at 8% UTCP. The highest (P<0.05) forage intake (324g) was observed with goats on NH. Animals on 4% UTCP recorded superior total daily feed intake, total weight gain and weight gain per gramme nitrogen intake. Similarly goats on 4% UTCP had better (P<0.05) feed conversion ration (FCR) compared to NH, 0% UTCP, 6% UTCP and 8% UTCP. The lowest (P<0.05) weight gain per gramme nitrogen intake of 2.55g and FCR of 19.33 were recorded in goats on 8% UTCP. Daily water consumed by goats also increased significantly (P<0.05) with increasing ammoniation and consumption increased from 0.391/d for NH to 0.79 1/d in 8% UTCP.

Thoracic girth change obtained for all goats showed a significantly (P<0.05) superior change of 7.07cm with goats on 4% UTCP, while the goats on 8% UTCP were least. Goats on 0% UTCP, 4% UTCP and 6% UTCP were similar (P>0.05) in height at withers but significantly (P<0.05) superior to goats on NH and 8% UTCP.

TABLE II: Performance of WAD goats fed urea treated cassava peel supplement

Parameters	NH	0% UTCP	4% UTCP	6% UTCP	8% UTCP	SEM
No. of bucks	4	4	4	4	4	-
Feeding period (days)	84	84	84	84	84	-
Initial mean wt (kg)	7.63	7.05	7.05	8.67	7.53	0.26
Final mean wt (kg)	9.65	9.31	12.87	11.29	8.89	0.74
Total wt gain (kg)	2.02c	2.26c	5.82a	2.62b	1.36d	1.21
Daily wt gain (g)	24.05c	26.90c	62.14a	31.19b	16.19d	7.89
Wt gain/N2 intake(g)	4.18c	7.19 b	14.48 a	7.07 b	2.55 d	2.04
Total feed intake (kg)	27.22b	18.73d	21.00C	32.00a	26.29 b	2.35
Daily forage intake (g)	324a	153 d	169d	301b	273c	34.86
Daily supplement intake(g)	-	70b	81a	80 a	40 c	9.58
Total daily feed intake (g)	324b	223c	250d	381a	313 bc	27.99
Daily N2 intake (g)	5.75 a	3.74 c	4.29b	4.40b	6.36a	0.49
Feed conversion ratio	13.47d	8.29b	4.02a	12.2c	19.33e	2.56
Daily water consumed (1/d)	0.39e	0.61d	0.68c	0.74 a b	0.79 a	0.07
Initial thoracic girth (cm)	45.53	45.38	46.38	47.38	48.50	0.59
Final thoracic girth (cm)	49.49	49.26	53.45	50.83	51.50	0.76
Thoracic girth change (cm)	3.96b	3.88b	7.07a	3.45c	3.00d	0.72
Initial height at withers (cm)	37.00	34.70	37.03	38.10	39.25	0.75
Final height at withers (cm)	37.37	35.18	37.46	38.62	39.42	0.72
Height withers change (cm)	0.37b	0.48a	0.43a	0.52a	0.17c	0.06

NH - Natural herbage
UTCP - Urea treated cassava peel
SEM - Standard Error of Mean
a, b, c, d, e Means on the same row with different superscripts are significantly (P<0.05) different

TABLE III: Effect of urea treated cassava peels supplement on blood urea (mg/1)

	Week 0	Week 4	Week 8	Week 12	SEM
NH	4.95	5.38	5.39	5.01	0.12
0% UTCP	5.27	5.33	5.17	5.39	0.05
4% UTCP	5.66	4.77	4.84	559	014
6% UTCP	5.66	4.77	4.84	5.59	021
8% UTCP	6.58a	5.07b	6.55 a	6.58 a	0.37

NH - `Natural herbage
UTCP - Urea treated cassava peel
SEM - Standard Error of Mean
a,b - Means of the same row with different superscripts are significantly (P<0.05) different

Mean blood urea values of goats are summarized in Table III. There were no significant (P>0.05) differences in blood urea between the treatments before commencement of the feeding trial and throughout the twelve weeks of feeding except in 8% UTCP where blood urea at the 4th week was significantly (P<0.05) lower than the rest of the treatment periods.

DISCUSSION

Chemical composition of diets

The relatively high CP content (13.13%) of the natural herbage consumed by goats on NH was higher than the range (3.2-9.4%) reported by Adegbola (1985) for forage during the dry season in the derived guinea savannah of Nigeria. This could be due to maximized selective consumption common with goats, because of their preference for higher CP forage (Burns *et al.*, 1985). The increased CP content of cassava peels from 8.94±0.05 (0% UTCP) to 10.5±0.1 (8% UTCP) was as a result of increased ammoniation of cassava peels as more of the ammonia from urea-break down were distributed and adhered on the peels; this boosted their nitrogen contents, hence crude protein. Similar results have been reported for different urea treated fibrous agricultural residues (Wanapat *et al.*, 1986, Taiwo *et al.*, 1992; Oliveros *et al.*, 1993; Mgheni *et al.*, 1993 and Oduguwa *et al.*, 1999).

The variable responses of effect of urea treatment on ash content in this study was similar to the findings of Taiwo *et al.*, (1992) and Mgheni *et al.*, (1993) and could be attributed to variable acid insoluble ash (silica) as reported by Mgheni *et al.*, (1993).

The finding in this study that ME decreased with increased urea treatment of cassava peels is similar to that of Wanapat *et al.* (1986) but different from observations by Boonsrem and Boonlon (1986) who reported a 12.9% improved ME of crop residues due to treatment with urea. However, ME values of 0% UTCP, 4% UTCP and 6% UTCP in this study met the energy requirement of between 2340-2520 kcal/kg recommended for small breeds of goat (Ranjhan, 1980).

Performance of WAD goats

The findings that total daily feed consumed by goats significantly (P<0.05) increased with increased urea treatment is similar to other reports (Boonserm and Boonlom, 1986; Wanapat *et al.*, 1986, Oliveros *et al.*, 1993, Mgheni *et al.*, 1993, Sutton *et al.*, 1997 and Oduguwa *et al.*, 1999) for various agricultural crop residues. The decline experienced by goats on 8% UTCP however, could probably be due to the unpalatable supplement as a result of excess pungent ammonia released on hydrolysis of urea at

that level of urea concentration (Preston and Leng, 1987). The higher intake of forage by goats on NH could be due to the improved microbial degradation and maximized selectivity of high CP forage (Burns *et al.*, 1985). Intake is influenced by the rate, extent of ruminal digestion, the rate of passage and microbial digestion of treated cell walls (Van Soest and Robertson, 1980). Urea treatment of cassava peels could have increased microbial degradation and amount of digesta that moved through the gastro-intestinal tract with a consequent increase in intake.

The high daily weight gain (62.14g/day) and weight gain per gramme nitrogen intake in goats on 4% UTCP suggests that available energy in cassava peel (Ifut, 1992) and 4% urea treatment improved weight gain more than other levels of urea treatment.

The FCR value of 4.02 in 4% UTCP indicated that only 4.2 grames of feed was required for a gramme gain in weight by goats on 4% UTCP which indicate greater conversion efficiency than in goats on 6% UTCP and 8% UTCP. The poorest FCR observed with goats on 8% UTCP could be an indicator of the poor performance of goats on 8% UTCP. So, it could be assumed that urea treatment beyond 4% does not favour efficient conversion of feed.

The superior thoracic girth change of 7.07cm observed with goats on 4% UTCP could be a reflection of the superior growth performance of goats on 4% UTCP; since the same parameter could be used to estimate the weight gain or growth of goats (Vanderhoof, 1988). The identical result noticed in 0% UTCP, 4% UTCP, and 6% UTCP goats indicated that there was no influence of urea treatment of the supplements on height at withers of goats.

Water intake increased with feed intake because increased ammoniation of peels improved microbial activity resulting in more intake of treated material and water (Chesworth, 1992 and Aina, 1999). Goats on NH recorded the lowest daily water consumption (0.39 litres) because herbage contains some free water. The metabolic water source that arose from metabolism of cassava peels and intake of water through the fibrous diet was obviously little because of the dry nature of the peels.

Effect of urea treated cassava peels supplement ion blood urea

Blood urea concentration was well below the 10mg/l toxic level (McDonalds *et al.*, 1987). Toxicity could be experienced if the liver cannot cope with increased absorption of ammonia produced from urea hydrolysis or the absence of readily available energy. The readily available energy of cassava peel could have encouraged ammonia utilized for protein synthesis (Chesworth, 1992) avoiding the situation of unused ammonia reaching the peripheral blood. It would appear that urea treatment of cassava peels at 4,6 and 8% was not detrimental to goats.

CONCLUSION

Urea treatment improved the CP content of cassava peels from 8.94±0.05 (4% UTCP) to 10.5±0.0 (8% UTCP) because ammonia from urea breakdown was distributed and adhered on the peels. Unlike CP, NDF and ADF decreased with ammoniation being lowest at the 4% application rate. Even though ammoniation decreased ME of cassava peels, the ME values obtained in the study met the energy requirement of the goats used in this study.

Goats on treatment 4% UTCP showed better daily supplement intake (81g), FCR (4.02), total weight gain (5.22kg), weight gain per gramme nitrogen intake (14.48) and thoracic change (7.07cm). Urea treatment of cassava peels in this study has indicated 4% UTCP as superior to other treatments.

Since blood urea levels recorded for all goats during the 84 days trial period were below the toxic level of 10mg per litre, no risk was associated with urea treatment at 4,6 and 8% application rates.

Urea treatment of cassava peels increased feed intake but a general decrease in performance was observed beyond 4% level of application.

The results from this experiment have clearly demonstrated that urea treatment at 4% is effective in improving intake and performance in WAD goats. Although natural herbage is the common feed resource for WAD goats, its performance would benefit from supplementation with 4% urea treated cassava peels. The present study shows that of the various applications of rates of urea to cassava peels; the 4% rate of application is recommended.

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