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Growth performance and blood profile of West African dwarf goats fed urea treated wild cocoyam (*Colocasia esculentum*) meal

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Abstract

Wild cocoyam is a non edible plant found growing around riversides and can serve as source of energy to ruminants. Hence, a twelve weeks study was conducted to investigate the effect of wild cocoyam – urea meal on the growth performance and blood profile of West African dwarf (WAD) goats. Twelve WAD goats with an average weight of 7.25 ± 0.04kg were randomly allotted into four dietary treatments: T_1 (raw wild cocoyam), T_2 (urea treated wild cocoyam), T_3 (urea treated cooked wild cocoyam) and T_4 (urea treated fermented wild cocoyam), replicated thrice in a completely randomized design. Results obtained showed that the experimental diets significantly ($p < 0.05$) influenced the growth performance. Goats fed urea treated cooked wild cocoyam had the best feed conversion ratio (10.35), the highest values of dry matter intake (405.35 g/day) and daily weight gain (39.17 g/day) when compared to other dietary treatments. The dietary treatments did not significantly ($p < 0.05$) influence the haematological parameters except the red blood cells (9.62 - 11.67×10^6 mm^3), white blood cells (4.07-9.05×10^6 mm^3) and monocytes (1.00-2.50%). No significant ($p > 0.05$) differences among the dietary treatments were observed in all the serum biochemical indices evaluated except for urea which ranged from 15.50 – 28.70mg/dl. It can therefore be concluded that addition of urea with processing, further improved the utilization of the experimental diets thus improving performance of the animals.

Keywords: Wild cocoyam, Urea, Growth performance, Haematological and Serum biochemical parameters

Introduction

Poor quality feeds and fluctuating seasonal feed supplies are the main constraints facing the livestock industry. One possible way to mitigate this challenge and maintain production in the tropics is to introduce unconventional feeds which cannot be consumed by man but can be converted by ruminants into desirable human food. This will go a long way in reducing the cost of production without a decrease in productivity (Odeyinka, 2001). African wild cocoyam is an example of such unconventional feed not directly consumed by man and equally of no industrial use. It is found growing along river banks, streams, brooks, oases etc and serves as source of energy to ruminants. Unlike the edible cocoyam, it has a prominent and non-hardy cocoyam corm. In fact, it is self sustaining as it has broader leaves, which enable it to suppress other weeds under and around it. However the effective utilization of wild cocoyam in ruminant feed is limited by the presence of anti-nutritional component which require some forms of processing (Uchegbu *et al.,* 2010). Urea as a supplement is of great significance and also a cheap source of non protein nitrogen (NPN) that has been used extensively to increase nitrogen content of low protein feeds in ruminant nutrition (Shultz and Chicco, 1972). It is non-protein nitrogen produced from synthetic ammonia and carbon dioxide whose utilization in ruminant nutrition had been widely reported. It has the highest nitrogen content of all solid nitrogenous fertilizer of 47% N (Juhaz, 1972). It could be utilized as an ingredient to feed at levels between 1-5%

which defines a safe utilization level (Onwuka and Akinsoyinu, 1985). It is better utilized by rumen microbes when readily fermentable carbohydrates are supplied to ruminant diets to provide adequate energy for microbial synthesis (Chanjuala *et al.,* 2007). Blood is a good indicator of physiological and pathological changes in an organism, that is used in assessing the body's ability to respond to hematological and serum biochemical upset (Okoruwa and Ikhimioya, 2014). These changes are of immense value in assessing response of animals to various physiological situations (Khan and Zafar, 2005). Ogunbajo *et al.* (2009) reported that nutritional studies should not be limited to performance alone, but the effect on the blood constituents is also a vital tool that helps to detect any deviation from normal in the animal's body. As reported by Isaac *et al.* (2013), animals with good blood composition are likely to show good performance. The analysis of blood gives the opportunity to trace the presence of several metabolites and other constituents in the body of animals and it plays a vital role in the physiological, nutrition and pathological status of an organism (Aderemi, 2004). There is paucity of information on the utilization of African wild cocoyam, hence the study was designed to investigate the performance and blood profile of WAD goats fed urea treated wild cocoyam meal.

Materials and methods

Experimental site and duration

The study was carried out at the Ruminant section of the Federal College of Animal Health and Production Technology, Moor Plantation, Apata, Ibadan, Nigeria. The study lasted twelve weeks. The area lies within the rain forest ecological zone, and falls within longitude and latitude $7^0 27^l$ and $3^0 25^l$ respectively at altitude 200- 300m above the sea level with an annual rainfall of about 1250mm. The temperature and relative humidity ranges from 30 – 35^{0}C and 76 – 84% respectively.

Preparation of the Experimental Diet

Wild cocoyam (*Colocasia esculentum*) was harvested at Apata and Owode estate areas of Ibadan, Oyo state. The harvested wild cocoyam was rinsed in water to remove all debris on it and fairly peeled to remove the attaching tap roots. It was chopped into pieces and grinded using diesel grinder. The grounded wild cocoyam was weighed and divided into four equal parts. One part was sun dried raw (control) while urea was mixed with the other three parts and later divided into three parts again. A part was sun-dried while the other one part was cooked and the remaining part was fermented (Olorunisomo, 2010). The four various processed meal were kept until time of compounding the feed. T_1 contained raw wild cocoyam, T_2 contained urea treated wild cocoyam, T_3 consists of urea treated cooked wild cocoyam while T_4 contained urea treated fermented wild cocoyam.

Experimental animals and design

A total of twelve WAD bucks about 6 to 7 months and weighing 7- 8kg were obtained from Oranyan market in Ibadan. These were balanced on weight equalization into four treatment groups which were replicated thrice in a completely randomized design.

Management of experimental animals

The animals were confined in well ventilated individual pens, which have been thoroughly cleaned and disinfected with morigad solution prior to the experiment. On arrival, the goats were adapted for 14 days and during this period, were given prophylactic treatments to eliminate both internal and external parasites. Homologous *Pesti des petit ruminant* (PPR) vaccine was also administered against PPR disease. After the adaptation period, the animals were balanced as

closely as possible for their body weights and randomly allotted to one of the four dietary treatments with fresh cool clean water supplied *ad libitum*.

Data collection

Feed intake and live weight changes

The growth of the animals in response to the experimental diets was monitored by taking their initial body weights, followed by weighing on a weekly basis prior to feeding. Feed offered daily per animal was recorded and refusal was weighed and recorded to compute feed intake on daily basis.

Table 1: Chemical composition of the experimental diet

Parameters %	T_1	T_2	T_3	T_4
Dry matter	90.72	90.83	90.97	90.67
Crude protein	13.67	14.13	14.79	15.23
Ash	5.32	5.16	5.41	5.63
Crude fibre	13.16	13.09	13.87	14.03
Ether extract	3.18	3.21	3.94	3.87
NFE	53..83	54.58	53.44	53.47
Phytate	0.79	0.76	0.61	0.61
Oxalate	0.35	0.39	0.40	0.42
Saponin	0.45	0.42	0.37	0.38
Tannin	0.07	0.06	0.04	0.05

T_1: Raw wild cocoyam, T_2: Urea treated wild cocoyam, T_3: Urea treated cooked wild cocoyam T_4: Urea treated fermented wild cocoyam.

The growth performance of WAD goats fed experimental diets is indicated in Table 2. The dietary treatments had significant ($p<0.05$) influence on the Dry matter intake (DMI) with T_3 recording the highest value of 405.35g/day which suggests that cooking improved the palatability of the wild cocoyam. Furthermore, T_1 recorded the lowest DMI and weight gain values. This could suggest the absence of urea and processing in the diet. The daily weight gains in this experiment compared well with the results of Ajayi *et al*. (2005) who obtained 23.81 – 46.64g per day for West African dwarf goat fed *Mangifera indica, Ficus thionningii* and *Gliricidia sepium* foliages as concentrate supplements to basal diet of guinea grass (*Panicum maximum*) but lower than that reported by Oni *et al*. (2010) of a daily gain of 33.8 – 52.9g/day in West African dwarf goats fed different levels of dried cassava leaves (*Manihot esculenta*) based concentrates with *Panicum maximum.* FCR values varied significantly across the dietary treatments with goats on T_3 recording the best value (10.35) while the highest value (13.28) was obtained in goats on T_1. This could be due to the fact that utilization of low protein feed by ruminants has been reported to improve when urea is added to such feeds (Khampa and Wanapat, 2006). Moreover it was revealed that T_3 had the best utilization of the feed.

Table 3 shows the haematological parameters of WAD goats fed experimental diets**.** There was no significant ($p > 0.05$) differences recorded across the treatment groups except for RBC, WBC and monocytes. RBC counts obtained in this study were within the range of 9.2-13.5 $x10^6$ /µl reported for West African dwarf goats (Tambuwal *et al.,* 2002) and 9.9-18.7 $x10^6$ /µl reported (Taiwo and Ogunsanmi, 2003). The white blood cell (WBC) counts obtained in this study increased and later decreased across the dietary treatment. WBC counts were lower than the range of values (9.42 to 13.08 x 10 /L) reported by Waziri *et al.* (2010) for goats. However, following the report of Aiello (2000) WBC values fell within the normal range (4 to 13 x 10^3/µL) for healthy goats. The higher WBCs count recorded in the WAD goats

Table 2: Growth performance of West African Dwarf goats fed the experimental diet

Parameters	T_1	T_2	T_3	T_4	SEM±
Initial Weight (kg)	7.24	7.26	7.26	7.23	0.04
Final Weight (kg)	9.32^{b}	10.05^{ab}	10.55^{a}	10.25^{ab}	1.13
Total Weight gain (kg)	2.08^{b}	2.79^{ab}	3.29^{a}	3.02^{a}	1.21
ADWG (g/d)	24.79^{c}	33.21^{ab}	39.17^{a}	35.95^{ab}	4.38
Dry matter intake (g/d)	329.31^{b}	380.22^{b}	405.35^{a}	399.51^{a}	7.60
FCR	13.28^{a}	11.45^{ab}	10.35^{b}	11.11^{ab}	2.93

[a, b, c,] means on the same row with different superscripts are significantly (p<0.05) different.
ADWG: Average daily weight gain, T_1: Raw wild cocoyam, T_2: Urea treated wild cocoyam, T_3: Urea treated cooked wild cocoyam T_4: Urea treated fermented wild cocoyam. SEM – Standard error of means

fed Urea treated wild cocoyam diet may be due to the response of the animals to protect themselves against invading pathogens. WBCs or leucocytes are the mobile unit of the body's protection system (Aiello, 2000). The Neutrophils normal range (14.5 – 41.5%) for goat reported by Mitruka and Rawnsley (1977) is slightly above the values observed in this study. Although lymphocytes values obtained in this study was not significantly different (p>0.05) but was higher than the normal range of values (49.8 to 53.7 %) for WAD goats as reported by Belewu and Ojo (2007) whereas fell within the normal range (50 – 70%) for goats (Aiello, 2000) . Lymphocytes play an important role of imparting immunity (Sembulingam and Sembulingam, 2002).

Table 3: Haematological parameters of West African Dwarf goats fed the experimental diet.

Parameters	T_1	T_2	T_3	T_4	SEM±
PCV (%)	24.50	31.00	24.50	29.00	1.62
Hb (g/dl)	8.17	10.33	8.17	9.67	0.54
RBC ($\times 10^6 mm^3$)	9.62^{b}	10.40^{ab}	11.17^{ab}	11.67^{a}	0.35
WBC ($\times 10^6 mm^3$)	6.05^{b}	9.05^{a}	8.68^{b}	4.07^{c}	0.81
Neutrophil (%)	43.50	42.50	27.50	41.00	4.66
Lymphocyte (%)	53.50	53.50	70.00	55.00	5.01
Monocyte (%)	2.50^{a}	2.50^{a}	1.00^{b}	2.00^{ab}	0.27
Eosinophil (%)	2.50	1.50	0.50	2.00	0.35
MCV (fl)	6.05	9.05	8.68	10.71	0.81

[a, b, c,] means on the same row with different superscripts are significantly (P<0.05) different; T_1: Raw wild cocoyam, T_2: Urea treated wild cocoyam, T_3: Urea treated cooked wild cocoyam T_4: Urea treated fermented wild cocoyam; SEM:Standard error of means.

Table 4 shows the serum biochemical index of WAD goats fed experimental diets. No significant differences (P>0.05) were observed in all the serum biochemical indices of WAD goats fed experimental diets except the urea values. The higher urea values obtained in this study was an indication of poor efficiency of utilization of nitrogen, urea recycling and could affect the amino acid balance. The blood urea levels in the study were within the recommended limits and suggested that the kidneys and liver in the body of the West African dwarf goats were functioning well. Dairo (2005) reported that albumin is an important blood clot factor due to its ability to prevent haemorrhage, therefore the higher the value, the better it is to the animals. This could be the reason why the goats have comparable total protein content among the different groups. However, the range of values obtained for Alanine amino transferase (ALT) were still normal as reported in earlier study (Daramola *et al.,* 2005). The values of AST below and ALT obtained fell within the normal ranges of 43–132 iu/L and 7–24 iu/L, respectively (Sirois, 1995). ALT is a liver-specific hepatocellular enzyme that is used to assess liver damage (Mahgoub *et al.,* 2008).

Although the Aspartate amino transferase (AST) value obtained in this study was not significantly (P>0.05) influence by the dietary treatments but differed numerically. This variation observed could be due to low plane of nutrition which has adverse effect on the liver. Creatinine values obtained in this study were slightly below the range (1.6- 1.71 mg/dl) proposed for healthy WAD goats (Daramola *et al.,* 2005). The levels of creatinine in serum recorded in this study were higher than the values reported by Ikhimioya and Imasuen (2007) for WAD goats, so the muscle mass and kidney function of the animals were normal (Prvulovic *et al.,* 2012).

Table 4: Serum biochemical parameters of West African dwarf goats fed the experimental diet

Parameters	T_1	T_2	T_3	T_4	SEM±
Total protein (g/l)	5.31	6.06	5.30	5.30	0.23
Albumin (g/l)	4.66	4.38	4.56	4.64	0.28
Globulin (g/l)	0.65	1.68	0.74	0.66	0.15
Urea (mg/dl)	26.60^{ab}	15.50^{b}	28.70^{a}	23.30^{ab}	2.32
Creatinine (mg/dl)	1.50	1.06	1.06	1.26	0.10
AST (iμ/l)	51.20	42.75	36.90	50.50	4.75
ALT(iμ/l)	19.05	15.80	16.50	12.85	1.40
Cholesterol (mg/dl)	119.65	111.78	86.15	108.09	5.91

^{abc} Means with same superscript within the row are not significantly different (P>0.05); AST=Aspartate Amino Transferase, ALT=Alanine Amino Transferase. T_1: Raw wild cocoyam, T_2: Urea treated wild cocoyam, T_3: Urea treated cooked wild cocoyam T_4: Urea treated fermented wild cocoyam.

Conclusion and application

Based on the results obtained in this study, it can therefore be concluded that:

Addition of urea to the experimental diets used in this study improved the nutritive values of the experimental diet. Also processing method employed further enhanced the utilization of the experimental diet and thus can be fed to WAD goats without detrimental effects on their growth performance and blood profile.

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