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The Effect of the Supplement of Cobalt Mineral with Cassava Leaf in the Diet of Corn Bran Fed to Sheep

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Abstract: - A 56-day feeding trial was carried out to study the influence of cassava leaf meal and cobalt mineral supplement on the feeding value of cassava peeling waste-based diet in the sheep. Sixteen (16) weanling West African Dwarf sheep of average initial live weight; 9.27 + 2.94kg were divided into four groups. Each group was randomly assigned to one of four treatment diets in a 2 × 2 factorial experiment. The animals were fed at 3% of their body weights. They had unrestricted access to clean drinking water and mineralized salt lick throughout the 56-day feeding trial. Dietary treatments consisted of two inclusion levels (7.74 and 37.53%) of cassava leaf meal; and two levels (0, and 1.0 ppm) of cobalt supplement. The diets were in four treatments; A (Low inclusion level of cassava leaf meal (7.74%) without cobalt supplement), B (Low inclusion level of cassava leaf meal (7.74%) with 1ppm cobalt supplement), C (High inclusion level of cassava leaf meal (37.53%) without cobalt supplement), and D (High inclusion level of cassava leaf meal (37.53%) with cobalt supplement) respectively. All measurements were taken at the 4th and 8th weeks of the feeding trial. Body weight gains in the sheep were; 19.21, 8.28, 23.75, and 34.46 g/day at the 28th day measurement and 8.93, 5.36, 24.82, and 26.34 g/day at the 56th day measurement for dietary treatments A, B, C, and D respectively. The body weight gain values obtained in sheep on diet D were higher ($P<0.05$) than for those on diets A and B at the 28th and 56th days measurements. Similar trends were obtained for nitrogen retention in the sheep. Sheep receiving dietary treatment D had higher ($P<0.5$) serum thiocyanate level at the 56th day measurement when compared to those on dietary treatment A or B. Similar trends were obtained for urea-nitrogen. Effect of the treatments on serum total protein and urinary thiocyanate levels were not significant ($P>0.05$) among the four treatment groups. It was concluded that sheep consuming high level of cassava leaf meal in cassava peeling waste-based diet, benefited from dietary cobalt supplement in terms of body weight gain and nitrogen retention.

Key Words: Supplement, Cassava, Diet, Cobalt

I. Introduction

Cobalt is considered an essential trace element, because it is required in the human diet and of some animal species in very small amounts, close to 100 mg per kg of dry matter (Brewer *et al.*, 2016; Miller *et al.*, 2020; Viglierchio *et al.*, 2000). As such, cobalt has no known nutritional function, except as a component of vitamin B12, so when we refer to the Co status, we are really referring to the vitamin B12 status (Herdt and Ho, 2011; Weiss, 2011). The inadequacy of some of these trace minerals may mar some vital functions of the tissues or organs leading to much distress (Awolaja *et al.*, 1997). The only known animal requirement of cobalt is as a constituent of vitamin B12 which has 4% Co in its chemical structure (Anon, 2006). The deficiency of cobalt does not usually immediately affect the production of Vitamin B12 in sheep but it is only when long standing (Underwood, 1977).

The value of cassava leaves in these regards is further accentuated by the low rumen degradability of the protein fraction. Ravindran (1993) report a high true protein level of 85% for cassava leaf that was attributed (Wanapat, 1995) to the formation of protein-tannin complex within the digestive tract cannot sustain production.

1.1 Statement of the problem

A major problem of sheep production in developing countries today, is that of high cost of feeds and feedstuffs. This is caused by an acute shortage of energy and protein rich feedstuffs of the right nutritive value that can support production in the animals. This problem emanates from the increased competition between man and his livestock for the little energy and protein concentrates available. Researches had predicted a continuous decline in the supply and availability of grains in the world market. The problem of inadequate feed supply for ruminant livestock production is aggravated during the dry season when forage grasses become dried, devoid of chlorophyll, highly lignified and contain little nutrients which cannot sustain production.

1.2 Justification and importance

The challenge of high cost of feedstuffs can be ameliorated when cassava waste is used and supplemented with cassava leaf in providing energy for increased productivity in sheep. Cassava leaf can be used as substitute to conventional protein feedstuffs in meeting the sheep protein requirement for increased productivity. Both cassava waste and cassava leaf are cheap feed ingredients

A justifiable way of utilizing the cassava wastes, is to use them in feeding the ruminants livestock. Cassava peeling wastes can be used as a source of readily fermentable energy in ruminants. Reports have shown that cassava leaf and peels has a high but variable protein content 17 to 40% C.P and 3.45 to 6.50% on dry matter basis, with almost 85% of the crude protein fraction in the form of true protein (Fasae et al.2022).

1.3 Objectives

The objectives of this study were;

To examine the feeding values of cassava leaf in a cassava peeling waste based diet that was fed to the sheep

To examine the influence of dietary cobalt intake in a cassava waste- based diet fed to the sheep

II. Materials and Methods

2.1 Housing and pre-experimental treatments

Metabolism cages were constructed with wood to house the experimental animals. Each sheep was housed in a 1 x 0.6m^2 . Cassava leaves were obtained from cassava farm during harvest. The leaves were sun-dried for 2 to 3 days. Corn bran used was, obtained from corn milling mills and stored. Bone meal and table salt were bought from a feed mill, while cobalt chloride salt was bought from a chemical shop

2.2 Animals and dietary treatments

Sixteen (16) weanling lambs of 7-8 months old with an average initial body weight of 9.27 ± 2.94kg were divided into four groups, balanced for weights and assigned randomly to four treatments. Each animal represented a replicate. Dietary treatment consisted of sun dried cassava leaf meal at two inclusion levels, in a corn bran based concentrate diet that was fed with or without 1ppm cobalt supplement. The resulting treatment diets were;

A= Low inclusion level of cassava leaf meal (7.74%) without cobalt supplement.
B= Low inclusion level of cassava leaf meal (7.74%) with 1ppm cobalt supplement.
C= High inclusion level of cassava leaf meal (37.53%) without cobalt supplement
D= High inclusion level of cassava leaf meal (37.53%) with cobalt supplement

Animals were fed at 3% of their body weights which allowed for feed refusals in all the treatment groups. Feeds were offered at 0800 and 1400 hrs daily after being mixed with 5 drops of water to reduce dustiness. Clean drinking water was made available to each lamb free –choice throughout the 56-day growth and digestibility trial.

III. Result and Discussion

Average total dry matter intake by sheep on control diet during the first 28 days of the feeding trial was 269 g/day. Dry matter intake by sheep fed diets B, C and D were 249, 323, and 268 g/day, respectively during the same period. Total crude protein intake by sheep receiving test diets C and D were 49 and 41 g/day, respectively. The values were relatively higher than the crude protein intake for sheep on Diet A or Diet B (Table 1.1). There were no (P>0.05) significant differences in crude protein intake between treatment C and treatment D or between treatment A and treatment B.

. The proximate composition of the experimental diets showed that Diet A (control) has 8.51% crude protein; Diet B has 8.31% crude protein; Diets C and D have 15.20% crude protein.

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Table 1.1 Effect of treatments on some performance characteristics in sheep

Parameters	Diets					
	A	B	C	D	± SEM	Significance
At the 28th day						
Mean initial live weight (kg)	10.33	9.94	11.77	9.56	5.88	**NS**
Mean final live weight (kg)	10.86	10.18	12.43	10.53	0.71	**NS**
Mean live weight gain (kg	0.54^{b}	0.23^{c}	0.67^{ab}	0.97^{a}	0.10	**S**
Mean live weight gain (g/day)	19.21^{b}	8.28^{c}	23.75^{ab}	34.46^{a}	3.47	**S**
Feed efficiency ratio gain (g)/ feed (g)	0.08^{ab}	0.04^{b}	0.07^{ab}	0.13^{a}	0.017	**S**
Total dry matter intake (g/day)	269	249	323	268	33.20	**NS**
Total crude protein intake DM/(g/day)	23^{b}	21^{b}	49^{a}	41^{a}	3.76	**S**
Total crude fiber intake DM(g/day)	38^{b}	36^{b}	56^{a}	48^{ab}	5.18	**S**
At the 56th day						
Mean final live weight (kg)	10.83^{ab}	10.24^{b}	13.16^{a}	11.04^{ab}	0.72	**S**
Mean live weight gain (kg)	0.50^{b}	0.30^{b}	1.390^{a}	1.475^{a}	0.14	**S**
Mean live weight gain (g/day)	.93^{b}	5.36^{b}	24.82^{a}	26.34^{a}	2.53	**S**
Feed efficiency ratio gain(g)/ feed(g)	0.03^{b}	0.02^{b}	0.08^{a}	0.09^{a}	0.0089	**S**
Total dry matter intake (g/day)	296	269	304	308	25.12	**NS**
Total crude protein intake DM/(g/day)	26^{b}	23^{b}	46^{a}	47^{a}	3.27	**S**
Total crude fiber intake DM(g/day)	42^{b}	39^{b}	53^{ab}	55^{a}	4.10	**S**

Table 1.2 Effects of treatments on apparent dry matter and nutrients digestibility (%)

Item	Diets					
	A	B	C	D	± SEM	Significance
At the 28th day						
Dry matter	58	64	64	63	2.96	**NS**
Crude protein	71	66	72	72	3.58	**NS**
Crude fiber	38^{b}	47^{a}	56^{a}	54^{a}	2.79	**S**
At the 56th day						
Dry matter	66	67	69	69	3.08	**NS**
Crude protein	80	80	82	82	1.83	**NS**
Crude fiber	. 54	55	61	59	4.48	**NS**

At the end of the 28th day feeding period, apparent dry matter digestibility coefficient for sheep on diets A, B, C and D were 58, 64, 64, 63%, respectively. Apparent dry matter digestibility coefficient for sheep on diet B, C, or D was higher than the value for the sheep on diet A (Table 1.2). The apparent crude protein digestibility for sheep on diet A, C, or D was higher ($P<0.05$) than for sheep on diet B. At the 56th day measurements, apparent dry matter digestibility coefficient for sheep on diet B, C or D was higher ($P<0.05$) than for those on diet A. Similar trends were obtained for the digestibility of crude protein and crude fibre. The results of the dry matter crude fibre and crude protein digestibility were similar to those reported by Pathoummalansy *et al* (2006); Him Aun (2002) and Wanapat (1997).

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Table 1.3**: Effects of Treatments on Nitrogen Metabolism in the Sheep**

Parameters	**Diets**					
	A	**B**	**C**	**D**	**± SEM**	**Significance**
At the 28th day						
Average nitrogen intake (g/day)	3.67^{b}	3.31^{b}	7.85^{a}	6.52^{a}	0.44	**S**
Average feacal nitrogen (g/day)	1.07^{b}	0.83^{b}	2.21^{a}	1.94^{a}	0.17	**S**
Average urinary nitrogen (g/day)	0.37^{b}	0.40^{b}	1.02^{a}	1.03^{a}	0.045	**S**
Average nitrogen retention (g/day)	2.23^{b}	2.08^{c}	4.62^{a}	3.65^{ab}	0.45	**S**
At the 56th day						
Average nitrogen intake (g/day)	4.04^{b}	3.58^{b}	7.40^{a}	7.46^{a}	0.51	**S**
Average feacal nitrogen (g/day)	0.808^{b}	0.664^{b}	1.331^{a}	1.450^{a}	0.091	**S**
Average urinary nitrogen (g/day)	0.6164^{bc}	0.3513^{c}	1.004^{a}	0.8254^{ab}	0.099	**S**
Average nitrogen retention (g/day)	2.62^{b}	2.56^{b}	5.06^{a}	5.21^{a}	0.41	**S**

At the 28th day measurements, the average nitrogen intake for sheep on diets A and B were not (P>0.05) significantly different (Table 1.3). The values were significantly (P<0.05) lower than those for sheep on diet C or D. At the end of the 56th day, average nitrogen intake and retention, for sheep on diets A and B were not (P>0.05) significantly different (Table 1.3). The average nitrogen intake and retention, for sheep on diet C or D was higher (P<0.05) than those for sheep on diet A or B.

IV. Conclusion and Recommendation

The results shows that offering cassava leaf meal with cobalt supplement at a high inclusion level as used in the present study causes;

1. An increase in live weight gain and in feed efficiency ratio in the sheep.
2. An increase in dry matter, crude protein and crude fibre intakes
3. An increase in digestibility of crude protein and crude fibre.

The present study shows that dietary cobalt mineral supplement improved the performance of sheep fed cassava peeling waste based- diets at high level of inclusion of cassava leaf meal. However sheep receiving diets at low level (7.74 % DM) of inclusion of cassava leaf meal did not respond favourably to dietary cobalt supplement. Cobalt is not present in appreciable quantity in forage based diets. It is recommended to offer cobalt supplement to sheep on high cassava leaf meal-based diets. This will stimulate the propagation of rumen microbes, enhance microbial activity and improve performance of the animals.

Reference

1. Him, Aun. (2002). Digestibility and N- retention in goats fed on gliricidia and cassava foliage as sole diet. From http:/www.utafoundation.org/utacambod.
2. Pathoummalangsy, K. and Preston, T.R. (2006). Effective of a supplement of fresh water spinach (*Ipomoea aquatic*) on feed intake and digestibility in goats fed a basal diet of cassava foliage. *Livestock Research for Rural Development 18 (3).*
3. Ravindran, V. (1993). Utilization of cassava *(Manihot esculenta crantz*) leaves in animals nutrition. *Journal of the National Science Council of Sri-Lanka 21:1-26*
4. Wanapat, M. (1995). *The use of local feed resources for l.ivestock production in Thailand. Proceedings of the international conference on increasing animals production with local resources (Guo Tinshuang ED.). China forestry publishing house, Ministry of Agriculture China.*
5. Wanapat, M., Pimpa, O., Petlum, A., and Bootao, U., (1997). Cassava hay; a new
6. Strategic feed for ruminants during the dry season. *Livestock Research for Rural Development* 9 (2).
7. Brewer, K., Maylin, G. A., Fenger, C. K., Tobin, T. (2016). Cobalt use and regulation in horseracing: A review. Comp. Exerc. Physiol., 12, 1–10.

ISSN 2278-2540 | DOI: 10.51583/IJLTEMAS | Volume XII, Issue II, February 2023

8. Miller, J., Wentworth, J. and McCullough, M. E. (2020). Effects of Various Factors on Vitamin B12 Content of Cows' Milk. Available online: https://pubs.acs.org/doi/pdf/10.1021/jf60145a006 (accessed on 18 June 2020).
9. Viglierchio, M. C. (2000) Aportes de la Bioquímica a la Interpretación del Metabolismo del Cobalto; Anuario 2000 Facultad de Ciencias Veterinarias; Universidad Nacional de la Pampa: La Pampa, Argentina, 2000; pp. 22–28.
10. Herdt, T. H. and Ho, B. (2011). The use of blood analysis to evaluate trace mineral status in ruminant livestock. Vet. Clin. N. Am. Food A., 27, 255–283.
11. Weiss, W. P. (2020). Recommendations for Trace Minerals for Dairy Cows. Available online: https://ecommons. cornell.edu/handle/1813/48026 (accessed on 18 June 2020).
12. Awolaja. O. A., Antia, R. E. and Oyejide, A. (1997). Trace element levels in plasma/serum and erythrocytes of Keteku and White Fulani cattle. *Tropical Animal Health and Production*, **29**: 2-6.
13. Anonymous, (2006). Salt and trace minerals for livestock, poultry and other animals: Cobalt for animals. *www.saltinstitute.org/publication/stm/stm-1.htlm*.
14. Underwood, E.J. (1977). *Trace Elements in Human and Animal Nutrition (4th edition)*. Academic Press, London. pp. 132-157.