Further Studies on the Utilization of Cocoa Husk in Ruminant Rations

by

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SUMMARY

THE effect on body weight changes of sheep and goats and digestibility of maintenance rations in which cocoa husk constituted, 0%, 20%, 40% and 50% of the basal ration respectively were studied. These rations were fed to wethers and castrated goats (castrates) in two separate but concurrent digestibility trials. There was no significant change in body weight of both the sheep and the goat. Significant decreases in apparent digestibility occurred in dry matter, organic matter, crude protein, crude fibre and total digestible nutrients. The 40% cocoa husk ration in which cocoa husk existed with maize in the ratio 2:1 appeared to be next best to the control ration for crude fibre digestibility. Apparent digestibility of the crude fibre component of the feed was significantly higher in the sheep than in the goats.

INTRODUCTION

Cocoa husk is one of the by-products of the cocoa industry that have been evaluated as a feedstuff (Haines and Echeverria, 1955; Greenwood-Barton, 1965; Adeyanju, Ogutuga, Ilori and Adegbola,

1975). The alkaloid, theobromine, which has limited the use of cocoa beans (Braude, 1943) and cocoa shell (Greenwood-Barton, 1965) in livestock feeds, exists only in traces in cocoa husk (Haines and Echeverria, 1955; Greenwood-Barton, 1965). The results of a previous study (Adeyanju, *et al.* 1975) have suggested that both sheep and goats might be able to tolerate more than 25% cocoa husk in maintenance rations.

The study reported here was therefore carried out to find out whether, in the presence of a readily available energy source, cocoa husk could be incorporated into maintenance rations for sheep and goats at a higher level than 25% without any deleterious effects on the animals.

MATERIALS AND METHODS

The maize components of a basal ration (Table 1) was replaced in such a way that cocoa husk constituted 0%, 20%, 40% and 50% of the ration respectively.

TABLE 1

Rations Fed to Wethers and Castrates (%) on Air Dry Basis

Ingredients	Rations			
	I	II	III	IV
Groundnut Cake (GNC)	20.0	20.0	20.0	20.0
Palmkernel Meal (PKM)	10.0	10.0	10.0	10.0
Maize	60.0	40.0	20.0	10.0
Cocoa Husk (CH)	—	20.0	40.0	50.0
Dicalcium Phosphate (DCP)	5.0	5.0	5.0	5.0
Bone Meal	4.5	4.5	4.5	4.5
Agricare ¹	0.5	0.5	0.5	0.5
Total	100.0	100.0	100.0	100.0

¹A trace mineral - vitamin supplement prepared by Pfizer Livestock Feeds Company, Lagos.

These rations were fed twice daily at computed maintenance levels of 0.22 kg and 0.26 kg feed, on air dry basis, to four West African Dwarf wethers with an average body weight of 11.7 kg and four castrated West African dwarf goats (castrates) with an average body weight of 13.3 kg, respectively. The sheep and the goats, which were randomly allotted to the 4-treatment rations in a 4 x 4 latin square design, were confined in metabolism crates in two separate but concurrent metabolism studies lasting 63 days. The experimental design allowed a 10-day initial feed adjustment period before the first fecal collection in period 1 and 7-day adjustment period between the last fecal collection and the first collection of each of the subsequent periods. All animals were given free access to water throughout the experimental period.

The procedure for quantitative fecal collections, storage and chemical analysis were as described in an earlier study (Adeyanju *et al.*, 1975). Table 2 presents the chemical composition of the experimental rations. The data obtained were subjected to analysis of variance and the treatment means tested by Duncan's multiple range test according to Steel and Torrie (1960).

RESULTS AND DISCUSSION

Body weight changes

The results on body weight changes (Table 3) indicated that only 0.8 kg and 0.7 kg were respectively lost by the wethers

and the castrates over the experimental period, showing that the rations were adequate for maintenance. The observation that the major losses in weight by the animals occurred in period 4 might be attributed to the strain of confinement on the animals which could have resulted in some physiological disorder in the animals. This result supported a previous finding (Adeyanju *et al.*, 1975) that cocoa husk could make up to 25% of maintenance rations for sheep and goat.

Digestibility values

Table 4 presents the digestibility coefficients for the feed components.

In both the sheep and the goats dry matter digestibility decreased with increases in the level of cocoa husk in the experimental rations. Although the difference between rations 1 and 2 was not significant in the sheep, there were significant differences in rations 3 and 4 when compared with the control ration. The trend in dry matter digestibility by the goats was similar to that by the sheep. Compared with the control, rations 2, 3 and 4 were significantly inferior in dry matter digestibility. In addition, dry matter digestibility in ration 4 was significantly lower than in ration 2.

Since cocoa husk contains only traces of theobromine (Haines and Echeverria, 1955; Greenwood-Barton, 1965) which is very well known for its deleterious effect on animals (Ellengerger and Newlander, 1924; Temperton and Dudley 1943), it is unlikely that this alkaloid was responsible for the depressed digestibility of dry matter

TABLE 2
Chemical Composition of Experimental Rations (%) on Air Dry Basis

Ration Components	Rations			
	I	II	III	IV
Moisture	8.5	9.5	12.3	13.8
Dry Matter	91.5	90.5	87.7	86.2
Crude Protein	16.7	14.3	13.8	13.1
Ether Extract	4.5	4.5	4.5	4.5
Crude Fibre	10.8	12.6	19.6	24.0
Ash	9.0	11.6	13.6	14.9
Nitrogen Free Extract	50.3	47.4	36.2	29.6

TABLE 3
Body weight changes (kg)

	<i>Animals</i>				<i>Average</i>
	1	2	3	4	
<i>WETHERS</i>					
Initial Bwt.	11.5	12.9	10.2	12.0	11.7
Period 1	11.6	12.7	11.1	13.6	12.3
Period 2	11.1	13.1	11.3	13.1	12.2
Period 3	11.3	12.4	11.3	12.7	11.9
Period 4 (Final Bwt)	10.2	11.3	10.0	12.0	10.9
Bwt	-1.3	-1.6	-0.2	-0.0	-0.8
<i>CASTRATES</i>					
Initial Bwt	13.3	13.3	13.3	13.3	13.3
Period 1	13.3	13.3	13.3	13.3	13.3
Period 2	13.8	13.6	13.6	13.7	13.7
Period 3	13.9	13.3	13.5	13.6	13.6
Period 4 (Final Bwt)	12.8	13.0	12.7	12.0	12.6
Bwt	-0.5	-0.3	-0.6	1.3	-0.7

TABLE 4
Apparent Digestibility Coefficients (%) for the Experimental Rations

<i>Feed Components</i>	<i>I</i>	<i>Rations II</i>	<i>III</i>	<i>IV</i>	<i>S.E. Mean</i>
<i>WETHERS</i>					
Dry Matter	79.3a	69.3ab	59.3bc	46.4c	±3.90
Organic Matter	83.7a	76.9ab	68.0bc	59.5c	±3.10
Crude Protein	83.4a	73.9ab	65.9bc	55.0c	±3.36
Crude Fibre	68.0a	53.8a	58.3a	51.6a	±5.60
Ether Extract	92.3a	88.5ab	73.7b	75.8b	±4.13
Nitrogen Free Extract	86.3a	80.2ab	73.1ab	67.9b	±4.04
Total Digestible Nutrients	74.6a	64.4b	54.5c	45.8c	±2.82
<i>CASTRATES</i>					
Dry Matter	74.8a	55.6b	45.3bc	38.3c	±3.35
Organic Matter	79.6a	64.4b	59.1bc	52.0c	±2.08
Crude Protein	80.1a	61.4b	58.4bc	49.8c	±2.60
Crude Fibre	55.7a	31.9b	46.6a	44.2ab	±3.48
Ether Extract	88.9a	77.4b	70.6b	67.5b	±3.29
Nitrogen Free Extract	83.4a	72.0ab	64.5bc	56.8c	±3.89
Total Digestible Nutrients	70.7a	54.8b	47.6c	40.8d	±1.60

Means within rows with different letters are significantly ($P < 0.05$) different.

with increases in the level of cocoa husk in the experimental rations. The depression in dry matter digestibility might be related to the increasing crude fibre content of the rations as the level of cocoa husk increased. Cocoa husk is very high in crude fibre, containing between 26% and 42% crude fibre, depending on the variety (Unpublished data). Fraps (1946) reported that increasing the level of a feedstuff which is high in crude fibre will increase the crude fibre content of the ration, decrease the amount of available energy, and produce lower growth rate.

Apparent digestibility of organic matter by both the sheep and goats decreased as the level of cocoa husk in the rations increased. In the wethers there was no significant difference between the control ration and ration 2. Significant decrease in organic matter however, occurred in rations 3 and 4 respectively, compared with the control ration. Similar digestibility values were obtained in the goats in which significant decrease in organic matter digestibility occurred in rations 2, 3 and 4 respectively, compared with the control ration. The observed decreases in organic matter digestibility might be related to the crude fibre contents of the rations. Similar results had been obtained by Halnan (1930) who reported decreasing organic matter digestibility due to the presence of crude fibre in poultry rations.

Decreases occurred in crude protein digestibility by both the sheep and the goats, as the level of cocoa husk in the rations increased. Although the decrease in crude protein digestibility by the wethers fed ration 2 was not significant compared with the control ration, significant decreases occurred in rations 3 and 4 respectively. Similar results were obtained in the castrates in which, compared with the control ration, significant decreases occurred in rations 2, 3 and 4, respectively. The results agree with reports by Glover and Dutchie (1958) and Adeyanju *et al.* (1975) who observed decreasing crude protein digestibility due to the increase in crude fibre content of rations for non-ruminants and ruminants respectively.

Both the wethers and the castrates showed an inconsistent decrease in crude

fibre digestibility as the level of cocoa husk in the rations increased. Although none of the decreases in digestibility was significant in the wethers, significant decreases occurred in ration 2 compared with the control while in ration 3 the castrates compared with the control there was a significant increase in crude fibre digestibility compared with ration 2 in spite of the general trend in decreased digestibility of crude fibre as the level of cocoa husk in the rations increased. This general trend towards decreases in crude fibre digestibility as the crude fibre content of the rations increased agreed with those of Burroughs, Long, Gerlaugh and Bethke (1950) but were in contrast with those of Adeyanju *et al.* (1975). The difference in the results might be related to the relative proportion of maize in the experimental rations used in both studies.

In their study (Adeyanju *et al.* (1975) the maize which constituted only 25% of the basal ration was replaced with cocoa husk in such a way that cocoa husk constituted 0%, 6.25%, 12.5% and 25% respectively of the rations fed to sheep and goats. In the present study, however, the basal ration contained 60% maize for which cocoa husk was substituted in such a way that cocoa husk constituted 0%, 20%, 40% and 50%, respectively, of the experimental rations. Thus, the maize component of the rations in the present study offered the microbes responsible for breaking down crude fibre to supply energy to the animal readily available energy and, hence, deemphasized their dependence on crude fibre for energy.

The wethers were able to utilize the crude fibre in the rations better than the castrates as indicated by the significantly obtained by the wethers. The result of this study compared with those of an earlier study (Adeyanju *et al.*; 1975) appears to indicate that the composition of the ration influenced the digestibility of crude fibre in the ration. Furthermore, it shows that both in the sheep and the goats, the substitution of cocoa husk for maize in maintenance rations in ratio 2: 1 was, besides the control ration, the best for crude fibre digestibility. This ratio was provided by ration 3 which showed no

significant difference in crude fibre digestibility compared with the control ration for both the sheep and the goats.

Apparent digestibility of ether extract in both the wethers and castrates decreased with increases in the level of cocoa husk in the experimental rations. Similar results were obtained for nitrogen free extract and total digestible nutrients. The results, however, indicated that apparent digestibility of all feed components studied were generally higher in the sheep than the goats.

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Dystocia in Ndama Cattle—Case Report

by

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SUMMARY

DYSTOCIA cases were observed in 8 Ndama cows bred by a particular German Brown bull at the University of Ibadan farm. The cases were caused by malpresentation and relative oversize of the foetuses. No dystocia was observed in the herd after this particular bull was culled. The sequelae of dystocia observed are discussed.

INTRODUCTION

Dystocia is an economically important problem in cattle in that cows having difficulty at calving produce a smaller percentage of live calves (Sagabiel *et al* 1969), (Rice and Wiltbank 1970).

Dystocia was observed to be high when Friesians, Ayrshires and Jerseys are crossed with Carolais bulls (Stables 1969). Dystocia cases have also been reported in reciprocally crossed Angus, Hereford and Charolais cattle (Sagabiel *et al* 1969), (Young 1970).

One of the duties of an obstetrician is to assist the farmer in the breeding programme and to advise on the culling of bulls which genetically produce malpresented calves leading to dystocia.

In the crossbreeding programme at the University of Ibadan, a German Brown bull GB 40 was used to breed Ndama cows in order to produce a crossbreed which will combine the tolerance to trypanosomiasis of Ndama with heavier carcass weight of the German Brown cattle.

The Ndama breed of cattle in Nigeria is a slow maturing beef breed which attains maximum weight of about 280–300 kg compared with the German Brown cattle which is an exotic breed with maturity weight of about 600 kg.

This paper reports observations of cases of dystocia mainly due to foetal malpresentation produced by crossbreeding a German Brown bull with Ndama cows.

CASE REPORTS

All the cases reported in this paper are of Ndama cows that were pasture bred to a German Brown bull GB 40 between February and August 1973. They were observed either in dystocia or dead as a result of dystocia at their overnight paddock at different dates between November 1973 and June 1974 during routine morning inspections before the herd was released out for grazing.

All the foetuses were found dead during clinical examinations.

Case 1

The dam in Case 1 was Ndama cow ND 12.

The foetus in this case was in anterior presentation, dorso-sacral position and bilateral shoulder flexion posture. The fetal head was visible at the vulva. The posture was corrected and the foetus was delivered by forced traction. Its weight was 25 kg.

Case 2

The dam in Case 2 was Ndama cow ND 15.

The foetus was in anterior presentation dorso-sacral position with lateral deviation of the head. It was delivered by forced traction after correction of the postural abnormality. Its weight was 25.5 kg.

Case 3

The dam in Case 3 was ND 23.

The foetus was in anterior presentation dorso-sacral position and foot-nape posture. It was delivered, after correction of the abnormal posture by forced traction. It weighed 25 kg.

Case 4

The dam in Case 4 was ND 29.

The foetus was in breech presentation. The posture was corrected and the foetus was extracted after performing an episiotomy. The weight of the foetus was 24 kg. The vulval incision was closed with single interrupted sutures using monofilament nylon size 3. Parenteral penicillin and streptomycin injections were administered. The vulval sutures were removed on the 14th day.

The temperature of the cow was 40°C on the first day and did not fall to the normal temperature of 38.3°C until the 8th day. The placenta was retained for four days before it was manually removed.

Twenty days after the dystocia was corrected, pus was observed draining from the external os of the cervix, when vaginal examination was performed using a coldlite vaginoscope. The condition was diagnosed to be metritis. The temperature at this time was subnormal 37.8°C. 1.33 mega units procaine penicillin and 1.67 gms streptomycin were infused into the uterus. The cow was found dead twenty-six days after it was presented with the dystocia.

Post Mortem Report

There was severe gangrenous metritis characterized grossly by darkblack mucosa, muscular layer and the scrota with accompanying yellow grey fluid in the uterine lumen. The edges of the liver were swollen. The muscles of the heart appeared cooked-pale-grey in colour. The kidney appeared mottled, pale-grey with pinpoint hyperaemic areas. This picture might have been as a result of toxæmia arising from gangrenous metritis.

Ndama Cows ND 226, ND 32, ND 47, ND 34 which were bred by the same bull GB 40 were found dead overnight at different dates. Postmortem examinations showed that these animals were carrying

foetuses which were fully developed and at term. The weights of the foetus were 23.5 kg, 24.5 kg, 25.5 kg, 25 kg respectively and they had different presentation and postural abnormalities.

The dams in Cases I, II and III calved normally when they were bred by other German Brown bulls.

DISCUSSION

Observations at the University farm show that the average birthweights of pure Ndama, pure German Brown and German Brown-Ndama cross breeds were 11.5 kg, 35.43 kg and 22.24 kg respectively. The average birthweight for the foetuses that caused dystocia in this paper was 24.75 kg. This can be expected because in most cases the birthweight of the crossbred calves exceeds the average of the pure-breeds (Sagabiel *et al.* 1973).

It seems that the average weight of foetuses produced by Ndama cows when bred by bull GB 40 is more than that of pure Ndama calves and other German Brown-Ndama cross bred calves. It seems therefore that the relatively oversized foetuses with postural abnormalities were responsible for the dystocia in the cases reported in this paper. This ability to produce relatively large foetuses with postural abnormalities is peculiar to basis GB 40. This bull was culled on this bull and since then no case of dystocia had been observed in the cross-breeding programme.

Possible sequelae of dystocia are placental retention, endometritis, pyometra, which may eventually lead to toxæmia and perhaps terminate in death as shown by one of the cases reported in this paper. Even when these conditions do not terminate in death, they may give rise to infertility or sterility. In this paper none of the surviving cases showed evidence of infertility or sterility.

From the cases reported in this paper it is evident that dystocia may be regarded as one of the factors that reduce productivity in farm animals because of loss of calves, leading to decreased calf crop,

increased intercalving interval where there is endometritis, pyometra and delayed uterine involution. Other indices of reproductive efficiency may be adversely affected.

ACKNOWLEDGEMENT

The authors wish to thank Professor T. T. Iseun for performing post mortem on one of the animals.

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