THE PERFORMANCE OF YEARLING KENANA (SUDAN ZEBU) CALVES GIVEN THREE LEVELS OF CRUDE PROTEIN AS A CONCENTRATE SUPPLEMENT TO AD LIBITUM GROUNDNUT HAY

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The growth response to dietary protein by Sudanese Zebu (Kenana) calves of initially about 75 kg and 8 months of age was measured in a growth trial of 112 d Forty-five animals were allocated to one of three groups (balanced for age, weight and sex) and given groundnet hay ad libitum plus a sorghum based concentrate containing 117, 155 or 201 g CP/kg DM (offered at to 3 kg/animal/d). The average growth was 0.55, 0.75 and 0.85 ± .03 kg/d with intakes of 2.0, 2.5 and 2.7 kg hay DM/d; 2.3, 2.5 and 2.3 kg concentrate DM/d; and 443, 605 and 700 g CP/d; with DM feed conversion of 7.8, 6.6 and 5.8 for increasing protein levels respectively. Initial liveweight was shown to have a significant relationship with rate of gain at the two lower protein levels, but not at the highest protein level. Four animals from each group were slaughtered and butchered using a traditional Sudanese procedure. Few differences were found between group means for a range of carcass parameters.

Key Words: Cattle, liveweight gain, groundnut hay, protein supplementation

There is a paucity of data concerning the nutrient requirements of tropical Zebu cattle as compared to the immense literature on this subject for the temperate breeds. The experiment reported here was the first of a series investigating the response of Sudanese Zebu cattle to the major nutrients. Sudan possesses a great agricultural potential, and agro-industrial by-products such as oil cake, molasses and low quality forages will become increasingly available for livestock feeding. Traditional finishing of cattle relies on grass and forages supplemented with oil cake, although a number of feedlots have recently been constructed. Economic constraints, in many cases, dictate the minimum use of concentrate supplements, and information on the value of low quality roughages is needed urgently.

Almost 1 million ha of groundnuts are grown annually (Anon 1977), and groundnut hay is a plentiful by-product from this sector of Sudanese agriculture. For this reason, it was used as the principle roughage source in this experiment.

Ahmed et al (1977) showed that some commercial feedlot rations contained an excess of crude protein, which could be reduced without adverse effects on the performance of the animals. The present experiment was carried out with the objective of studying the performance of yearling Kenana (Northern Sudan Zebu) calves given a concentrate supplement varying in crude protein level with a low quality forage, namely groundnut hay, ad libitum. The experiment was conducted at Um Banein Livestock Research Station (13°N 33°E; 43 m above sea level) between 11th February and 3rd June 1978, during the hot dry summer period.

Materials and Methods

Animals and Treatments: Forty-five yearling Kenana calves (20 entire males and 25 females) were chosen from the station herd and were allocated to one of three groups, so that the average weight and age of each group was similar. All calves had been weaned at four months of age, and kept on pasture until the start of the experiment. All animals were healthy.

The three concentrate supplements were formulated so as to contain different amounts of crude protein (CP) (approximately 100, 150 and 200 g/kg DM), but similar concentrations of metabolizable energy (ME) (Tables 1 and 2).

Table 1:
The percentage composition of the concentrate supplements

Protein level	Sesame cake	Dura grain (sorghum)	Molasses	Common salt
Low	3	81	15	1
Medium	17	67	15	1
High	34	50	15	1

Table 2:
Proximate composition (g/kg)[1] and calculated ME (MJ/kg DM) content of the feed ingredients and the diet supplements

	Dry matter	N x 6.25	Crude fibre	Ether extract	NFE	Total ash	ME
Sesame cake	941	392	120	39	317	132	11.7
Dura grain (sorghum)	918	121	41	2.5	797	16	13.4
Sugar cane/molasses	662	50	7	8	769	166	12.7
Groundnut hay	926	88	395	5	410	102	8.3
Supplement[2]							
Low	871	117	38	23	770	42	13.1
Medium	874	155	119	25	703	58	12.9
High	878	201	62	27	622	78	12.6

[1] DN basis (except for DM content column)
[2] Supplement protein level

Supplementation was initially at 2 kg/head/d but after 35 d on trial was increased to 3 kg/head/d. Groundnut hay was offered ad libitum throughout the experiment.

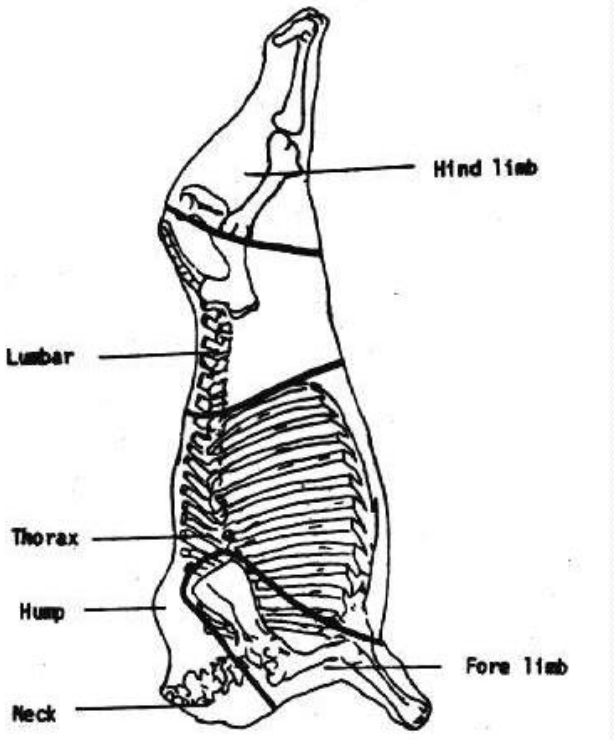
Management: Each group was penned separately and given groundnut hay during a 3 week adaptation period. The concentrate supplement was introduced gradually during this period as a once daily feed at 07.00 hr. The initial weight of animals was taken at the end of this period, after an overnight fast. The experiment was of 112 d,

and individual liveweights were recorded after an overnight fact every 14 d. The supplements were offered once daily at 07.00 hr and weighed on a group basis. Supplement refusals were collected daily. Groundnut hay was fed daily in separate troughs, and the refusals also weighed daily. Clean water was always available and each animal received 2 vitamin A injections (each supplying 100,000 IU) during the experiment. Mineral and trace elements were provided by means of premix blocks in the feeding troughs. The animals were dosed with Thibenzole (Merke, Sharpe and Dohme) before the start of the experiment. The animals were also sprayed with Gamatox (Cooper Ltd) for external parasites.

Analysis of Diets: Samples of the concentrate supplement and the groundnut hay were taken every 14 d for chemical analysis by standard methods, ME was calculated according to MAFF, DAFS and DANI (1975),

Slaughter: Four male animals were slaughtered from each group and the left side of the hot carcass weighed. A traditional Sudanese procedure was adopted in cutting the carcass into the four major cuts. The forelimb was separated by cutting through the musculature attaching it to the thorax and neck. The thorax and neck were separated by cutting along the posterior of the last rib, through the flank. The hind limb was separated by cutting through the pelvic joint. These cuts are illustrated in Figure 1. These cuts and the internal organs and other parts were weighed.

Figure 1:
A side of a Kenana carcass showing the traditional Sudanese cutting methods



Results

Diet Composition: The composition and estimated ME content of the four major ration components and the three diets are shown in Table 2. The actual CP levels in the three diets were in agreement with those planned (117, 155 and 201 g CP/kg DM). Similarly, the aim of producing nearly isocaloric diets was also realised.

Animal Performance: The liveweights, feed intakes and feed conversion rates are shown in Table 3. Fortnightly group means for liveweight are plotted in Figure 2. Although there were no statistically significant differences in rate of liveweight gain

Figure 2:
The growth curves of yearling Kenana calves fed groundnut hay and supplements of low (▲), medium (○) or high (●) levels of crude protein

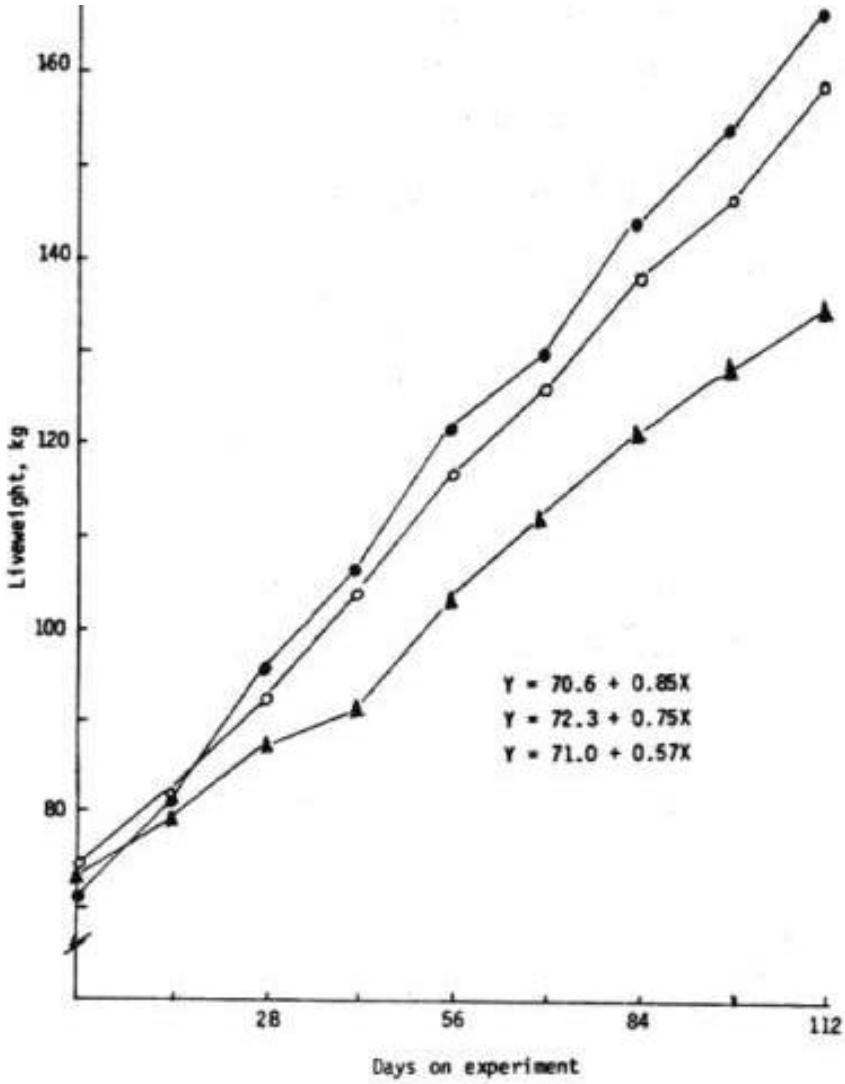


Table 3:
Mean values for animal performance and feed and nutrient intake for Zebu (Kenana) cattle fed groundnut hay and concentrate supplements with three levels of crude protein (15 cattle per group)

	Crude protein in supplement, g/kg DM			
	117	155	201	LSD[1]
Initial age, mth	8.1	7.3	7.9	2.25
Liveweight, kg				
Initial	73	74	70	9.7
Final	135	158	166	19.3
Daily gain	0.55	0.75	0.85	0.105
Feed intake, kg DM/d				
Concentrate DM, kg/d	2.3	2.5	2.3	
Roughage DM, kg/d	2.0	2.5	2.7	
Total DM, kg/d	4.3	5.0	5.0	
Crude protein, g/d	443	605	700	
ME, MJ/d	46	52	51	
Conversion[2]	7.8	6.6	5.8	

[1] Least Significant Difference (P <.05)
[2] DM intake/LW gain

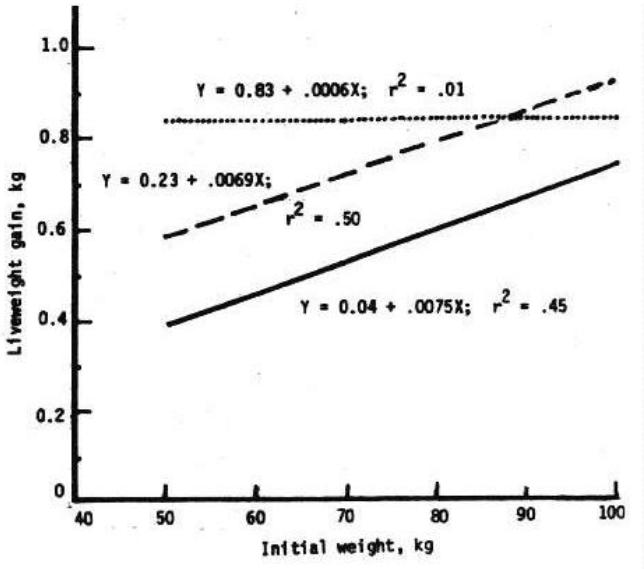
between the medium and high protein concentrates, they were both better (P < .001) than the low protein group. There was a clear trend for performance to improve as protein was increased.

Feed conversion data are the group means, and since the animals were not individually fed, no statistical analysis was possible. However, certain trends are clear. The lower total DM intake by animals on the lowest protein treatment was the result of a lower roughage intake by this group. CP intake increased as planned, but ME intake deviated slightly due to the lower roughage intake of the low protein group. Feed conversion rate increased with protein level.

The three within group regressions of daily liveweight gain on initial weight are shown in Figure 3. Whilst no relationship was found for the highest protein group, at both lower levels of protein there was a strong positive relationship between daily liveweight gain and initial weight (P < .01). Regression coefficients were compared using the pooled deviation method after Snedecor and Cochran (1967), and this showed that the values for the two lower protein groups did not differ significantly from each other. However, the differences between these values and that of the high protein group were significant (P <.01).

Slaughter Data: A summary of the slaughter data is shown in Table 4. Although differences between group means were expected due to the small number of animals slaughtered per group, these figures give a useful guide to the carcass characteristics of young Kenana bulls. Differences between the low and high protein group were found (P < .05) for slaughter weight, and rumen, liver,gall bladder and spleen weights. An estimate of the average daily carcass gain for the three groups was made by

Figure 3:
Regression of liveweight gain (kg/d) on initial weight (kg) of yearling Kenana calves given groundnut hay and supplements with low (___), medium (- - -) or high (...) levels of crude protein



multiplying the daily liveweight gain by the killing out percentage, which gave 0.28, 0.38 and 0.42 kg of carcass gain/d for the low, medium and high protein groups respectively.

Discussion

In economic terms, the contribution made by the protein component of the feeds is the most important, since it is far more expensive per unit weight than other components in livestock rations. Manipulation of the CP to the minimum level permitting optimum economic gain is one of the major targets in livestock intensification programmes. The results of the experiment reported here indicate that Kenana yearlings respond to increased protein level by an increase in liveweight gain. The total CP which was available to the lowest protein group was substantially above the requirements suggested by the ARC (1965) of the UK and the NRC (1964) of the USA.

Fontenot and Kelly (1963), using rations varying from 9.9% to 14.3% CP for fattening steers, reported a linear increase in the rate of gain as the level of protein was increased. Later, the same workers (Fontenot and Kelly 1967), using rations ranging from 10.9% to l9.0% CP, found that both the average daily gain and feed conversion efficiency increased up to a level of 14.7% CP in the ration. Beyond this, no increase was observed. However, their diets contained 90% concentrate. In our experiment, the concentrate : roughage ratio was approximately 50:50. With similar ratios, Keith et al (1965) reported that there was no improvement in daily gain by increasing the level of protein from 11% to 15% in steer finishing rations. However,

Table 4:
mean weights for the carcass parameters of Zebu (Kenana) cattle given groundnut hay and concentrate supplements with low, medium or high protein levels (4 animals/treatment)

	Protein in concentrate, g/kg DM			LSD[2]
	117	155	201	
Slaughter liveweight	139	161	166	28.1
Weight of left side (excl KKCF)[1]	35.5	41.0	42.0	7.90
Killing out, %	51.1	50.8	50.4	3.75
Neck and thorax	11.6	14.0	14.6	3.15
Fore limb	6.63	7.25	7.38	1.26
Lumber cut	7.38	7.75	7.50	1.76
Hind limb	9.13	10.50	11.50	2.48
Intestines (empty)	3.35	6.15	6.48	1.24
Stomach (empty)	5.70	6.33	6.00	1.28
Omentum (Caul fat)	1.13	1.25	1.55	0.69
KKCF	0.98	1.20	1.38	0.52
Heart and Lungs	3. 75	3.85	4.30	0. 90
Liver and gall bladder	2.68	3.07	3.75	0.63
Spleen	0.60	0.78	0.83	0.21
Head, hide and other by-products	26.3	28.3	30.2	4.51

[1] KKCF - Kidney knob and channel fat
[2] Least Significant Difference (P< .05)

using a 75:25 concentrate : roughage ratio, they reported that the daily gain in the steers increased significantly in response to an increase of CP from 11% to 20%. Roy (1969) found that good growth rates were obtained in heifers given ad libitum mixtures containing 18.8% CP, whilst levels of 15.2% and 11.7% gave slower growth rates. Preston and Bowers (1965), using animals of 90 kg initial weight, reported that with protein levels ranging from 11-20%, weight gains and feed efficiency were best when the CP level was 17%.

With heavier Zebu cattle than those reported here, Ahmed et al (1977) found no significant difference in liveweight gain in animals given diets containing 12.3 and 21.9% CP. However, the killing out percentage was higher in the group fed the higher protein level. Differences in killing out percentage were not observed in the experiment reported here, although there was a tendency towards a fatter carcass as dietary protein was increased (Table 4), and this was particularly evident in the omentum and the marbling of the musculature in the hump. No differences in the relative proportions of the cuts was observed, in agreement with the results of Shafie and Osman (1965) who found that the plane of nutrition did not influence the proportions of the different wholesale cuts in the carcasses of Zebu calves.

The results reported here, with animals of lower initial weights than those used by Ahmed et al (1977), support the work of Shafie et al (1977), who fed Sudanese Zebu calves on a range of rations with varying roughage sources with protein levels ranging

between 11.6 and 14.8%. It was concluded (Shafie et al 1977) that both initial weight and the type of ration had a highly significant effect on the average daily gain, but that initial age had no effect. The fact that at the highest level of protein used in the experiment reported here (20%), no relationship between initial weight and rate of gain could be demonstrated (Figure 3) is of importance in feedlot situations. Animals of low initial weight would be expected to gain fastest if given a high protein diet. There seems to be little justification for maintaining this practice once higher weights are reached when similar liveweight gains can be realised with a lower protein intake. Clearly, further work is required to elucidate to what point protein levels can be reduced without affecting the optimum economic gain of the animals. Similarly, more work is required to investigate these factors in animals of higher weight and using diets with different protein sources.

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