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Nutritional effects on growth and carcass characteristics of Ankole, Nganda and Ankole x friesian crossbred bulls

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Abstract

The study investigated the effect of protein supplementation on growth and carcass characteristics of grazing Ankole, Ankole x Friesian and Nganda bulls. Seventy two bull calves, 24 of each breed-type were randomly assigned to one of the three dietary treatments; the control of grazing alone (GZ), grazing followed by a 17.6% crude protein (CP) supplement (GZ + MD) and grazing followed by a 19.4% CP supplement (GZ + HG). The bulls were weighed fortnightly, and at the end of the feeding period all the bulls were slaughtered. Before slaughter, the live weight of each animal was taken, carcasses weighed hot, scored for grade and their dressing percentages determined. No significant ($P > 0.05$) breed-type effects were observed in average daily gain (ADG). Significant variation ($P < 0.05$) attributable to diet in ADG was observed. The supplementary diets (GZ + MD and GZ + HG) produced higher ($P < 0.05$) ADGs than the grazing alone diet. However, there were no significant ($P > 0.05$) differences observed between the two supplementary diets. Significant variation ($P < 0.05$) attributable to diet and breed-type in hot carcass weight, carcass grade and dressing percentage was observed. The (GZ + HG) bulls exhibited the highest ($P < 0.05$) dressing percentages, heaviest ($P < 0.05$) hot carcass weights and the highest ($P < 0.05$) carcass grades. The grazing alone diet averaged poorest and was significantly different ($P < 0.05$) from all the carcass measurements. Under the (GZ + HG) diet, the Ankole bulls possessed the highest ($P < 0.05$) carcass grades and the heaviest ($P < 0.05$) hot carcass weights.

Key words: Beef quality, beef yield, cattle breeds, supplemantary feeding, Uganda

Introduction

Improvements in livestock production are achieved by the selection of suitable animals in conjunction with management methods intended to enhance the beneficial attributes in the animal (Ledger, 1968). Accordingly, the beef industry and researchers have been prompted to evaluate the performance of various breed-types of cattle and their production methods (Myers *et al.*, 1999). In beef production, the important factors are the weight of the animal and the time taken to produce the edible portion that is acceptable to the consumers. Therefore, successful beef production depends upon fast growth of muscle tissue in conjunction with just that amount of fat that will make the carcass saleable.

The current Uganda's cattle stock includes 5.6 million heads, with the indigenous breeds (*Bos indicus*) accounting for 96% and the introduced (exotic) breeds (*Bos taurus*) accounting for 4% (MAAIF, 1998). The indigenous cattle population consists of the long horn Ankole, Small East African short horn (Zebu) and the intermediate non descriptive Nganda cattle. The bulk of the meat produced in Uganda comes from these indigenous stocks. Whereas, desired levels of performance are not always achieved when forage is consumed alone (Forster *et al.*, 1993), these stocks are predominantly raised on natural pastures, which are of low/poor quality and with a variable supply pattern. The thirty years

of studies on indigenous stocks in Uganda have focused mainly on dairy traits (MAAIF, 1998). Consequently a study was conducted to investigate the effect of protein supplementation on the growth and carcass characteristics of grazing Ankole, Ankole x Friesian and Nganda bulls.

Materials and methods

The study was conducted for a period of 407 days at Namulonge Agricultural and Animal Production Research Institute (NAARI) from 1999 to 2001. The study used seventy two bull calves, 24 of each breed-type (Ankole, Ankole x Friesian and Nganda) in a 3 x 3 factorial randomized block design. The bulls of each breed-type were randomly assigned to one of the three dietary treatments; the control of grazing alone (GZ), grazing followed by a 17.6% crude protein (CP) supplement (GZ + MD) and grazing followed by a 19.4% CP supplement (GZ + HG). The supplementary diets were composites of 17% cotton seedcake + 83% maize bran and 29% cotton seedcake + 71% maize bran for the (GZ + MD) and (GZ + HG), respectively, and were offered in group pens every evening after grazing. The formulation was based on the nutrient requirements of ruminant livestock (ARC, 1980), taking into account of the dry matter that the animals were getting from grazing, and the targeted live weight gain per day. The targeted live weight gains per day for the three dietary treatments were: GZ: = 200 g day^{-1}; (GZ + MD): = 500 g day^{-1} and (GZ + HG): = 700 g day^{-1}. The bulls were weighed fortnightly, and at the end of the feeding period all the bulls were slaughtered and dressed at the Uganda Meat Industries abattoir under commercial circumstances. Just before slaughter, the slaughter weight of each animal was taken, carcasses weighed hot, scored for grade (basing on the abattoir's 7-point scale of carcass grading (where 1 = Very poor fullness of meat, fat cover and roundness; 7 = Excellent fullness of meat, fat cover and roundness), and the ratio of carcass weight to slaughter weight (dressing percentage) was calculated. The average daily gain (ADG) was estimated by regression of the fortnightly body weights on days of feeding. Initial and slaughter weights were used as the covariates. All the data obtained were analysed using the General Linear Models procedure of SAS (1991).

Results and discussion

Average daily gain was significantly ($P < 0.05$) higher in the GZ + HG diet than in the GZ + MD and GZ diets (Table 1). However, there were no significant ($P > 0.05$) differences observed between the breed-types. The breed-type x diet interaction effect observed was found non-significant ($P > 0.05$). The results from the analyses that included initial weight as a covariate to the model, to adjust for the lower weights of the Ankole x Friesian and the Nganda bulls at the beginning of the study were not significantly ($P > 0.05$) different. This indicates that the significant differences among the ADGs (Table 1) were not a function of the initial weight differences. The present results are in agreement with other researchers, in which ADG increased in response to providing increasing quantities of dietary CP (Forster, 1993; Hafley *et al.*, 1993; Fluharty and McClure, 1997). The growth differences within

Table 1. Least square means for average daily gains (g) of cattle bulls within breed-type and diet.

Feeding regime	Breed type		
	Ankole	Ankole x Friesian	Nganda
Grazing alone	199.44	221.34	159.65
Grazing + Medum	334.94	270.14	267.67
Grazing + High	380.94	323.48	349.42
SE*	30.90	34.06	41.05

All breed effects were not-significant ($P > 0.05$); *SE = standard error.

the dietary treatments in the present study reflected the differences in the quantities of protein supplied, which is consequently used for tissue gain. However, values presented are lower than what was expected, and this was attributed to the influences of under grazing.

Diet and breed-type were significant ($P < 0.05$) sources of variation in hot carcass weight, dressing percentage and carcass grade (Table 2). Hot carcass weight, dressing percentage and carcass grade were higher ($P < 0.05$) in GZ + HG diet than in the GZ + MD and GZ diets. Ankole bulls possessed higher ($P < 0.05$) hot carcass weights and higher ($P < 0.05$) carcass grades than the Ankole x Friesian and Nganda bulls. However, the dressing percentage for the Ankole bulls was similar to that of the Nganda bulls, but higher ($P < 0.05$) than for the Ankole x Friesian bulls. The results from the analyses that included slaughter weight as a covariate indicated that hot carcass weight differences were largely ($P < 0.05$) a function of the slaughter weight differences. The carcass grade and dressing percentage were not a function ($P > 0.05$) of the slaughter weight. Therefore, the significant differences in carcass grade and dressing percentage (Table 2) observed are not a function of the slaughter weight differences.

In the present study diet was associated with differences in growth and carcass yield. These results are in agreement with most of the published literature comparing different planes of nutrition. Oman *et al.* (1999) reported that goats fed in a feedlot possessed heavier live and carcass weights and higher carcass conformation scores than did the goats fed on range-land. Studies have verified this for beef cattle (Schroeder *et al.*, 1980; Nour *et al.*, 1994). Plane of nutrition has been found to alter metabolic processes and result in changes in growth rate, body weight and body composition (Schroeder *et al.*, 1980; Ellis *et al.*, 1996). Tropical forages are generally low in nitrogen and digestible organic matter (Leng, 1990), therefore, no longer ensure a functional rumen ecosystem (Smith, 1992). Protein, not energy, has been considered the first-limiting nutrient for beef cattle grazing native rangeland when forage availability is not limiting (Freeman *et al.*, 1992).

Currently, there is a general agreement that protein supplementation has beneficial effects on growth and carcass traits, manifested in greater daily dry matter intakes (DMI), feed efficiency and improved daily gains (hence, fewer days on feed), carcass weights and carcass characteristics (Fahmy *et al.*, 1992; Coleman *et al.*, 1995; Fluharty and McClure, 1997). Feeding diets rich in protein may favour more rapid development of lean tissue and lower fat deposition (Fahmy *et al.*, 1992). The additional protein supplied by the supplements may have met an amino acid deficiency *per se* (Owens *et al.*, 1993) or may have improved the efficiency of metabolizable energy (ME) utilization or may have increased the dry matter intake (MacRae *et al.*, 1985; Owens *et al.*, 1993). MacRae *et al.* (1985) reported that abomasal infusion of casein increased the efficiency of ME utilization in sheep, possibly by supplying more gluconeogenesis precursors.

Conclusions

These studies show that better feeding of cattle results in higher daily live-weight gains, resulting into heavier carcass weights. The Ankole bulls showed a better response to protein supplementation than the Ankole x Friesian and the Nganda bulls. This would imply that high protein level supplementation

Table 2. Least square means of carcass yield and quality measurements of cattle bulls within breed-type and diet.

Item	Ankole			Ankole x Friesian			Nganda			SE
	GZ	GZ+MD	GZ+HG	GZ	GZ+MD	GZ+HG	GZ	GZ+MD	GZ+HG	
Hot Carcass Weight (kg)	127.9	164.6	189.9	89.9	107.1	121.9	83.1	115.6	134.4	9.9
Dressing Percentage	44.3	48.1	53.0	44.6	46.5	47.3	44.8	49.9	51.6	1.1
Carcass Grade[e]	2.8	4.7	6.2	2.1	2.9	4.0	2.6	4.5	4.6	0.5

[e]Means based on a 7-point scale (1 = Very poor fullness of meat, fat cover and roundness; 7 = Excellent fullness of meat, fat cover and roundness).
GZ: Grazing alone; GZ+MD: Grazing followed by 17.6% CP supplement; GZ+HG: Grazing followed by 19.4% CP supplement.

may not be necessary in feedlot beef production where Ankole bulls are involved. Therefore, if given proper nutritional management, the Ankole stock can do well in commercial beef production.

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