Effect of Level of Inclusion of Lablab Meal in Diet on Carcass Characteristics of Blackhead Persian Sheep

Muhikambele*,V.R.M., L.A. Mtenga, and W.D.Mafwere
Department of Animal Science and Production, Sokoine University of Agriculture, PO Box 3004, Morogoro, Tanzania.

Abstract

*Twenty four Black Head Persian (BHP) castrate lambs weighing 14.1 ± 2.7 kg were randomly allotted to four dietary treatments. Animals on treatment A (control) were fed Rhodes (**Chloris gayana**) hay, **ad libitum** as basal diet, plus 380-g maize bran daily. Animals on treatments B, C and D were fed basal diet plus 380 g of "maize bran and lablab meal" mixture at a ratio of 2.8:1, 0.9:1 and 0.27:1, respectively daily. Four animals from each treatment were selected for slaughter at the end of 99th day of feeding. The level of inclusion of lablab in the lambs' diet had no significant effect on all killing-out characteristics. However, the increase in dietary lablab level in supplement increased the hot carcass weight (HCW) and empty body weight (EBW). The mean HCW for treatments A, B, C, and D were 8.0, 8.8, 9.2 and 9.7 kg, respectively, while the respective mean EBWs were 15.3, 16.9, 17.8 and 18.2 kg. Dressing percentage showed no definite pattern. Regression of HCW on EBW and on slaughter weight showed high correlation coefficients (r = 0.91 and r = 0.90, respectively). Lean tissue weight increased with increasing lablab level in the supplement diet, while fat tissue decreased with increased dietary lablab levels (P < 0.10). Differences among treatments in carcass fat were however small and statistically non-significant. Although bone tissue did not show any defined trend, animals on treatment C had heavier (830 vs 716 g) carcass bone than animals on treatment A (P < 0.10). Expressed as percentages of the carcass, the weights of lean, fat and bone showed no significant treatment effects. However, the trend was an increase in percentage of lean tissue and a decrease in percentage of fat tissue with increasing level of lablab in the supplement diet (60.9, 51.3, 61.1 and 63% lean and 19.1, 20.2, 18.4 and 17.5% fat, for treatments A, B, C and D, respectively).*

Keywords: Lablab meal, sheep, killing out characteristics, carcass composition

Introduction

One of the most limiting factors to livestock production in the tropics is poor or inadequate nutrition. Tropical ruminant livestock mainly rely on natural pastures and crop residues for feed. Low intake of digestible nutrients, particularly during the dry season, are the main causes of poor performance (Butterworth, 1985).f

In order to increase animal performance, there is need to supply adequate high quality feeds throughout the year. Several workers have suggested ways of improving the nutrition of livestock in the tropics. The suggestions include the utilisation of crop residues (El-Hag and Kurdi, 1985), physical and chemical treatment of crop residues (Urio, 1982), use of

*Corresponding author

agro-industrial by-products such as molasses, urea and oil cakes (El-Hag and Kurdi, 1985) and use of multipurpose leguminous trees (Shoo and Mtenga, 1988). However, very little has been achieved in terms of improved animal performance in the dry season.

While supplementary feeding to grazing animals is recognised to be important in the dry season, most of the supplements, particularly protein supplements, are normally expensive and not readily available. There is a need to look for new sources of protein, which can be easily integrated into the current production systems. Dual-purpose crops, such as lablab bean (*Lablab purpureus*), mung bean (*Vigna radiata*), cowpea (*Vigna unguiculata*) and other related legumes can be easily intensified to serve such purposes.

Lablab bean can be used as a protein supplement in Tanzania and in other parts of Africa because it is less preferred for human consumption, compared to conventional legumes like kidney beans. Feeding lablab beans to livestock can provide an alternative use of the crop and hence increase the farmer's income. The legume can be cultivated and grown successfully in the dry areas with annual rainfall as low as 400 mm (Luck, 1965). It can also be intercropped with maize or sorghum. In addition, the plant forage can be used for hay and silage making (Thurbon *et al.*, 1970). After seed harvest, the lablab straw provides a potential supplement to low quality roughage (Thurbon *et al.*, 1970).

In view of the fact that little research has been done in Tanzania as far as evaluation of *Lablab purpureus* is concerned, in terms of its chemical composition and influence on feed utilisation, the aim of the present study was to assess the effect of different levels of lablab meal in the diet on killing out characteristics and carcass composition of Blackhead Persian (BHP) sheep.

Materials and methods

Twenty-four BHP castrate lambs, 4 - 7 months of age and weighing 14.4±2.7 kg were randomly assigned to four dietary treatments:

A: *Chloris gayana* hay, *ad libitum*, and 380 g maize bran (Control)

B: *C. gayana* hay, *ad libitum*, 280 g maize bran and 100 g lablab

C: *C. gayana* hay, *ad libitum*, 180 g maize bran and 200 g lablab

D: *C. gayana* hay, *ad libitum*, 80 g maize bran and 300 g lablab

The experiment was conducted following a completely randomised design with four treatments and six replications per treatment.

Data collection was preceded by a 14-day preliminary period, during which the animals were de-wormed using IVOMEC(R) and introduced to the experimental diets. Each animal was provided with 380 g daily, of concentrate, whose composition was according to the animal's treatment group (See Table 1).

Concentrates were provided at 8.00 h, followed by hay after one hour. In order to minimise spillage, hay was offered in two portions, the second half was offered at 14.00 h. Water was made available to the animals all the time.

During data collection period (99 days), samples from the offered hay were collected weekly, oven-dried and bulked for subsequent chemical analyses. Hay of known DM was weighed for individual animals before feeding daily. For each animal, refusals from previous day's feeding, both for hay and concentrate were collected every morning. These were weighed to the nearest 0.001 kg and

Table 1: Concentrate formulation

Ingredients %	Treatments			
	A	B	C	D
Lablab	0	25	50	75
Maize bran	95	70	45	20
Mineral mix	5	5	5	5
Total	100	100	100	100
CP g/kg	100.7	141.7	182.7	223.7

their DM determined. Daily intakes were then calculated as the differences between total daily allowances and total daily refusals. The animals were weighed to the nearest 0.1 kg every Saturday to determine weekly weight gains.

Four animals from each treatment were slaughtered at the end of the growth and intake study. The slaughtering procedure was the same as that adopted by Kyomo (1978). The animals were weighed immediately before slaughter to obtain live weight (LW) at slaughter. They were bled by severing the carotid arteries and jugular veins on both sides of the neck using a sharp knife. The blood was collected and weighed to the nearest 0.05 kg. Dressing was done as described by Kyomo (1978). The following non-carcass components were isolated and weighed: Skin, head, feet, heart, liver, kidneys, spleen, lung + trachea and gut fat. The total gastro-intestinal tract (GIT) was weighed when full as well as when empty. The gut fill content was obtained as the difference between full and empty GIT.

The carcass was jointed into seven standardised joints (neck, shoulder middle neck, best end neck breast, loin, chump and leg) using the technique by Cuthbertson *et al* (1972) for lambs. The joints were then dissected into lean, fat and bone. Intramuscular fat was separated from subcutaneous fat. All the components were weighed.

Data were analysed by one-way analysis of variance for a completely randomised design. The statistical model employed was:

$$Y_{ij} = \mu + a_i + e_{ij}$$

Where:

Y_{ij} = Response of the j^{th} animal in the ith treatment

μ = Overal mean

a_i = Effect of i^{th} treatment, i = 1,2,3 and 4

e_{ij} = Random error effect

The data were processed in a DPD-11 computer system, employing the "Statistical Package for Social Scientists (SPSS)" programme. Linear regression analyses were carried out in order to establish relationships between hot carcass weight (HCW) and empty body weight (EBW) or slaughter weight (SW).

Results

The dietary protein levels for the four treatments (Table 1) were 100.7, 141.7, 182.7 and 223.7 for treatments A, B, C and D respectively. The treatment mean values for SW, EBW, HCW and dressing percentage are shown in Table 2.

The level of inclusion of lablab in the ration had no significant effect on killing-out characteristics. When the level of dietary lablab increased, there were in-

creases in HCW and EBW with a highest value being found in lambs on treatment D. Dressing percentage (HCW % of SW or HCW % of EBW) showed no definite pattern. Pooled linear regression of HCW on EBW and SW revealed a high correlation coefficient (r =0.91 and r = 0.90, respectively).

Lean tissue weight increased with increasing level of lablab in the diet. However, the treatments were not significantly different (Table 3).

Table 2: Mean treatment effects of level of lablab supplementation on the killing-out characteristics of sheep[1]

	Treatments				
	A	B	C	D	SED and Signif.
No. of animals	4	4	4	4	
LW at slaughter (kg)	19.5	21.5	22.8	22.8	1.2 NS
EBW (kg)	15.3	16.9	17.8	18.2	1.1 NS
HCW (kg)	8.0	8.8	9.2	9.7	0.5 NS
Dressing percentage					
HCW % SW	41.3	41.0	40.5	42.3	0.8 NS
HCW %EBW	52.5	52.0	52.3	53.5	1.1 NS
Saleable % of SW[2]	54.3	54.1	52.6	52.5	1.0 NS

[1]Legend

LW = Live weight in kg

EBW = Empty body weight

HCW = Hot carcass weight

SW =Slaughter weight

[2] Includes heart, lungs, spleen, liver, kidney fat, gut and gut fat plus hot carcass weight

Table 3: Mean treatment effects of level of lablab on carcass composition

	Treatments				
	A	B	C	D	SED and Signif.
No. of animals	4	4	4	4	
Tissue weights (g)					
Side carcass	3997.5	4380.0	4650.0	4805.0	223.99NS
Lean	2433.3	2684.5	2843.3	3026.0	149.64NS
Intermuscular fat	305.0	351.8	391.8	331.3	51.57NS
Subcutaneous fat	456.5	536.8	465.5	512.0	33.34NS
Total fat	761.5	888.5	857.3	843.3	60.25NS
Bone	715.5	727.8	830.8	800.8	34.56NS
Tissue proportions (% CW)					
Lean	60.9	51.3	61.1	63.0	1.19NS
Intermuscular fat	7.6	7.9	8.4	6.9	0.95NS
Subcutaneous fat	11.5	12.3	10.4	10.6	0.64NS
Total fat	19.1	20.2	18.4	17.5	0.86NS
Bone	17.9	16.7	17.9	16.7	0.47NS
Tissue ratios					
Lean:Fat	3.2	3.1	3.3	3.6	0.20NS
Lean:Bone	3.4	3.7	3.4	3.8	0.14NS
Lean+Bone:Fat	4.1	3.9	4.3	4.5	0.23NS

There were no consistent trends and the treatments did not differ significantly for fat and bone tissues.

Expressed as percentages, weights of lean, fat and bone tissues of the left side of carcass revealed no significant treatment effect. Tissue ratios were also not significantly affected by treatments.

Treatment effects on most of the non-carcass components were small and nonsignificant, except for kidney and kidney fat (Table 4). Weights of kidneys expressed in absolute values or as percentage of EBW were significantly affected by the level of lablab in the diet. Lambs on treatment C had significantly heavier kidneys than lambs on treatments A and B. Differences in weight of kidney between other treatments were small and non-significant.

Kidney fat was significantly affected by treatment only when expressed as percent of EBW. Animals on treatments A and B had significantly heavier kidney fat than animals on treatment D. There was no significant difference in % kidney fat between animals on treatments A and B.

Discussion

The dressing percentage of 40.5 - 42.5% based on live weight obtained in the present study is in a similar range (40 - 50%) reported by Devendra and McLeroy (1982). Based on EBW the dressing percentage from this study (52.5 - 53.5%) compares well with the value reported by Owen and Norman (1977) for indigenous Botswana sheep (52%). Increasing the level of protein in the diet had no significant influence on the dressing percentage (one of the killing out characteristics). Similar results were obtained by Kemp *et al* (1976) in lambs given diets of varying protein levels (10 - 16% CP). Opposing results were reported by Robinson and Forbes (1970) and Levy *et al.* (1980) who observed increased dressing

Table 4: Mean treatment effets of level of lablab supplementation on non-carcass components as percentage of empty body weight (EBW)

	Treatments				
	A	B	C	D	SED and Signif.
No. of animals	4	4	4	4	
Heart	0.77	0.78	0.80	0.73	0.17 NS
Lungs + Trachea	1.29	1.32	1.49	1.22	0.34 NS
Spleen	0.19	0.18	0.19	0.14	0.05 NS
Liver	1.69	1.79	1.80	1.66	0.09 NS
Kidney	0.32^{a}	0.29^{b}	0.34^{a}	0.33^{a}	0.01**
Kidney fat	1.20^{a}	1.29^{b}	1.00^{ab}	0.71^{b}	0.14*
GIT-Empty	8.44	8.55	7.80	7.86	0.31 NS
Gut fat	2.66	2.32	1.70	1.32	0.38 NS
Head	8.47	7.99	8.01	7.40	0.29 NS
Skin	9.61	9.47	10.15	9.02	0.40 NS
Feet	3.10	3.11	3.47	3.11	0.20 NS

^{ab} Means in the same row, with different superscripts are significantly different

percentages with increasing levels of dietary protein in supplement concentrate.

The small and non significant differences among treatments observed in the present study imply that the level of protein in the diet had little influence on body composition (Table 3).

Considering the definition of dressing percentage however, its importance in some developing countries like Tanzania remains questionable. Practically all the by-products of the slaughtered animal are consumed as food, and some organs (e.g. liver) even sell at higher prices than carcass meat (Devendra and McLeroy, 1982; Mtenga, 1979).

The overall mean carcass composition obtained from the present study are similar to those obtained by Nyaki (1981). French (1938) reported relatively lower values for lean and bone tissues but higher values for fat tissues (49.9 - 57.5%, 8.9 - 11.1% and 25.5 - 28.7% respectively).

The non-significant effect of dietary protein level on carcass composition (as percentage of lean, bone and fat) observed in the present study agrees with the findings reported by Croddack *et al.* (1974). However, the present results are contrary to those reported by Fattet *et al.* (1984) and Vipond *et al.* (1989). Factors such as age and weight at slaughter, sex and breed may account for the disparity of results between workers. Small and insignificant effects of dietary protein level on weights of non-carcass components (heart, lungs, alimentary tract and gut fat) observed in the present study are in agreement with those of Kitalyi (1982). Gut fat showed a tendency to decrease with increasing protein levels (from the mean of 403 g in treatment A to 242 g in treatment D), a trend similarly reported by Kitalyi (1982) and Mtenga (1979). Significant treatment effects were observed in kidney, possibly due to this organ being important reserve of labile protein.

Conclusion

Inclusion of lablab (*Lablab purpureus*) meal in hay diet had positive effects on killing out characteristics of sheep. However, since the improvements in the present study were not significant it would be of interest to study the effects of higher levels of inclusion on sheep performance.

Acknowledgements

The Norwegian Agency for Development Co-operation (NORAD) is acknowledged for financing the work. The Department of Animal Science and Production provided experimental animals and various facilities for this study.

References

Butterworth, M.H. 1985. Beef cattle nutrition and Tropical pastures. Longman, London and New York. 500 p.

Croddack, B.F., Field, R.A and Riley, M.L. 1974. Effect of protein and energy levels on lamb carcass composition. *J. Anim. Sci.*, 39:325-330.

Cuthbertson, A., Harrington, A. and Smith, R.J. 1972. Tissue separation to assess beef and lamb variation. *Proc. Brit. Soc. Anim. Prod.*, 1:113-122.

Devendra, C. and McLeroy, G.B. 1982. Goat and Sheep production in the tropics. *Intermediate Tropical Agriculture Series*, Longman, London and New York. 271 p.

El-Hag, M.G. and Kurdi, O.F. 1985. Prospects for efficient utilisation of agro-industrial by-products and crop residues for ruminant feeding in the Sudan. In: ARNAB (1986), Workshop Proc., Univ. of Alexandria, Egypt, October, 1985. pp 22-32.

Fattet, I., Hovel, F.D., Ørskov, E.R., Kyle, D.J., Pennie, K. and Smart, R.I. 1984. Under-nutrition in sheep: The effect of

supplementation with protein on protein accretion. *Brit. J. Nutr.*, 52:561-574.

French, M.H. 1938. Development of livestock in Tanganyika Territory: II. Tanganyika breeds of sheep and mutton qualities of long-tailed type and its crosses with Black Head Persian sheep. *Emp. J. Exp. Agr.*, 12:112-124.

Kemp, D.J., Johnson, A.E., Stewart, D.F., Ely, D.G. and Fox, J.D. 1976. Effect of dietary protein, slaughter weight and sex on carcass composition, organoleptic properties and cooking losses of lamb. *J. Anim. Sci.*, 42:575-583.

Kitalyi, A.J. 1982. Effect of supplementing hay with different levels of protein on growth performance and carcass composition of Tanzanian local goats. *MSc. Thesis,* University of Dar es Salaam. 157 p.

Kyomo M.L. 1978. Meat from goats in Tanzania. *Ph D. thesis,* University of Dar es Salaam. 272 p.

Levy, D., Holzer, Z., Folman, Y. and Bleiberg, M. 1980. Protein requirements of male cattle fattened on diets differing in energy concentration. *Anim. Prod.*, 30:189-197.

Luck, P.E. 1965. *Dolichos lablab* available grazing crop. *Queensl. Agr. J.*, 91:308-309.

Mtenga, L.A. 1979. Meat production from Saanen goats: Growth and development. *Ph D. thesis,* University of Reading. 527 p.

Nyaki, F.P. 1981. Meat production from sheep: The effect of breed and supplementation of growth performance and carcass composition. *MSc. Thesis,* University of Dar es Salaam. 184 p.

Owen, J.E. and Norman, G.A. 1977. Studies on the meat production characteristics of Botswana goats and sheep. II. General body composition, carcass measurement and joint composition. *Meat Science,* 1:283-306.

Robinson, J.J. and Forbes, T.J. 1970. A study of protein utilisation by weaned lambs. *Anim. Prod.*, 12:95-105.

Shoo, R.A. and Mtenga, L.A. 1988. *Leucaena leucocephala* in diets of goats and sheep. Occasional paper series B. No. 8 In: Agricultural Development Report. Improved Dairy Production from cattle and goats in Tanzania (Ed: O. Syrstad). NORAGRIC/AUN pp 74-87.

Thurbon, P., Byford, I. and Winks, L. 1970. Evaluation of hays of *Dolichos lablab* cv Zulu and Townsville lucerne (*Stylosanthes humilis* H.B.K.) on the basis of organic matter and crude protein digestibility. Proc. 11th International Grassl. Congr. pp 743-747.

Urio, N.A. 1982. Energy utilisation of alkali treated roughages fed to sheep and goats. *Ph D thesis,* University of Dar es Salaam. 159 p.

Vipond, J.E., Margaret, E.K., Ørskov, E.R. and Wetherill, G.Z. 1989. Effect of fish-meal supplementation on performance of over-fat lambs fed on barley straw to reduce carcass fatness. *Anim. Prod.*, 48:131-138.