Growth and carcass characteristics of old Menz ewes supplemented with different levels of concentrate feed

Tesfaye Getachew, Solomon Gizaw, Beneberu Tefera and Ayele Abebe
Debre Berhan Agricultural Research Center, P. O. Box 112, Debre Berhan, Ethiopia.

Abstract

Supplementation of old ewes with different level of concentrate feed was conducted at Debre Berhan Agricultural Research Center aiming to assess the effect of feeding levels on ewe body condition, carcass characteristics and market price. A total of 55 old ewes (6 to 9 years old) culled from the ongoing Menz sheep selection program were used for the experiment. Sheep were allocated into five treatment groups randomly after stratifying by age and initial live weight. Treatment groups were grazing only, grazing + supplemented with 150, 300, 450 and 600 g day^{-1} concentrate feed. The experiment was conducted for 90 days from April to June, 2010. Concentrate supplementation had significantly improved ($p<0.05$) final weight average daily gain, ewe body condition at slaughter, carcass characteristics and market price of old ewes. Ewes supplemented with 150 g day^{-1} were higher ($p<0.05$) in final live weight, average daily gain and carcass weight than ewes maintained on grazing only and not different ($p>0.05$) from other supplemented groups. Feeding was also improved ($p<0.05$) the carcass characteristics of old ewes. Supplementation of an old ewe with 150 g day^{-1} concentrate feed gave both biologically and economically optimum level to condition old ewes before marketing which gave net benefit of 55.00 ETB over the non-supplemented group. Ewes culled from the breeding could be an additional source of income in the traditional sheep production system. Thus, instead of keeping unproductive old ewes for longer period of time in the flock, it is advisable to condition and sell them at reasonable price.

Key words: Carcass, concentrate, ews, supplementation.

Introduction

Traditional sheep production is an important component of the Ethiopian agriculture. Sheep production is considered as the main source of income for the family in the cool highland areas where crop productivity is low due to land degradation and frost. Despite their importance, the performance of the sector is very low due to insufficient feed and nutrition, health problem and unimproved breeding practices. In Menz sheep flocks, the proportion of ewes takes the largest share (Abebe, 1999; Tesfaye, 2008) than other classes of sheep; and ewes are mainly maintained for the purpose of breeding. Research results indicated that

ewe productivity is higher at middle age. Productivity of Horro ewe is reached maximum between 2 and 3 years age; productivity slightly reduced at 6 years and dramatically reduced after 6 years of age (Solomon *et al.,* 1996; Solomon and Gemeda, 2000). Ewe of 1st and 7th parity produces lighter lambs than the ewes of middle age in Afar sheep (Yibrah, 2008). In flock of farmers in Menz area, about 15% of the available breeding ewes are having 7 and above parity (Tesfaye, 2008). Keeping of such old ewes for longer period of time in the flock has reduced productivity of sheep due to their poor reproductive performance. Furthermore, these classes of sheep compete for the available feed resource. Thus, promoting the sale of ewes before the decline of their productivity will certainly improve the productivity of sheep farming. Generally, old ewes are sold at lower price in the market because of their poor body condition due to age and poor feeding situation. Acceptance of meat from old ewes is also low due to less tenderness. Thus, the aim of this study was to assess the effect of supplementation of concentrate feed levels on body condition, carcass characteristics and market price of old Menz ewes.

Material and methods

The experiment was conducted at Debre Berhan Agricultural Research Center from April to June 2010 for 90 days. A total of 55 old ewes, 6 to 9 years old culled from the ongoing selection program were used for the experiment. Sheep were allocated into five treatment groups randomly after stratifying by age and initial live weight. Treatment groups were grazing only, grazing+supplemented with 150, 300, 450 and 600 g day-1 concentrates feed. The concentrate feed was bought from Addis Ababa (Kality feed processing plant) and the feed had 21% crude protein and 14 MJ/kg metabolizable energy on dry matter basis. All animals were grazed together during the day and supplemented groups were provided their corresponding amount of concentrate feed individually twice a day at 10:00 am and 4:00 pm local time. All sheep had access to water twice a day just after supplementation time

Initial live weight, fortnightly weights and body condition scores were recorded for each animal. Body Condition scoring was done subjectively using five scoring scales from 1 (emaciated) to 5 (obese or extremely fat). At the end of the feeding trial all ewes were

slaughtered for carcass evaluation. After bleeding and removal of digestive tract and non-carcass components, hot carcass weight was recorded. Tail was removed from the hind quarter. Dressing percentage was calculated on hot carcass weight basis and expressed as proportion of final weight before slaughter. Fat thickness and rib eye muscle area were measured at the longissimus between 11^{th} and 12^{th} rib using plastic ruler and planimeter, respectively. Sensory carcass evaluation was employed using panelist selected purposely from the employees of the research center based on their relative local experience of meat tasting. For carcass sensory evaluation, the five treatment groups were categorized in to three groups (animals maintained on grazing only, grazing + medium level of concentrate supplement and grazing + high level of concentrate supplement). Ewes supplemented with 150 g day^{-1} and 300 g day^{-1} were grouped as medium and ewes supplemented with 450 g day^{-1} and 600 g day^{-1} grouped as high level of supplement. Carcasses of three ewes were randomly selected for sensory evaluation from each of the three treatment groups. Three carcasses from young ram lambs of about yearling age were used as check. Small cube, about 1 cm^3 of meat from different carcass cuts (leg, loin and shoulder) and small piece of ribs from an animal were cooked on local charcoal until the internal temperature of the meat reached 70 ^{O}C. Then, the cooked meat from a ewe was offered to a panel of 8 evaluators. The panelist scored 1 to 6 (less preferred and most preferred) for each of tenderness, juiciness, taste and overall acceptance. Between the two consecutive tastes, a panelist took a piece of bread and small amount of water to reduce the possible carry over effect.

Live weigh and carcass data were analyzed fitting a general linear model of SAS (2009), by fitting concentrate level as main effect and initial live weight as co- variant. The co-variable was kept in the model only when significant. Carcass sensory evaluation data were analyzed using mixed model procedure of SAS (2009) by fitting feed level as fixed factor and panelist as random factor. Least square means were separated using adjusted Tukey–Kramer test. Partial budget and sensitivity analysis were employed to assess profitability and sensitivity of the recommendations with fluctuations in feed cost and sheep price. Ewe's price was estimated by three local experienced people at the end of feeding trial.

Feed cost and animal treatment cost were considered as a variable cost in the analysis since the other costs (like labor) were similar for all treatment groups.

Results and discussion

Least square means (SE) of initial weight, final weight, average daily gain and body condition score of old ewes supplemented with different levels of concentrate feed are presented in Table 1. Supplementation had significantly improved final weight, average daily gain and ewe's body condition at slaughter. Supplemented groups were not different from each other in final weight and body condition score at slaughter. Body condition score was also improved by supplementation. During the 90 days of feeding, old ewes in supplemented group gained live weight in the range of 40.44 g to 64.59 g day^{-1}. However ewes in the non-supplemented group gained 8.08 g day^{-1}. Old ewes maintained with grazing only had lower ($p<0.05$) body condition score than the supplemented group. And the entire supplemented groups were not different from each other. The improvement of final body weight and body condition due to concentrate supplementation obtained in this study is in agreement with the result obtained for Horro old ewes (Ulfina *et al.,* 2000). In all cases, ewes supplemented with 150 g day^{-1} were higher than the non-supplemented groups and similar with other supplemented groups. This result showed that supplementation of culled breeding ewes with small amount of concentrate feed (150 g day^{-1}) for 90 days improved their final weight and body condition.

Carcass weight, dressing percentage, tail weight, fat thickness and rib eye muscle area of old ewes supplemented with different levels of concentrate feed are presented in Table 2. Carcass weight, tail weight and fat thickness were significantly improved by supplementation. Ewes in supplemented group had produced 3 to 4 kg more carcass than the non supplemented group. Supplementation of 150 g day^{-1} concentrate feed was higher than the non supplemented group and was not different from the other supplemented group. Thus supplementation of 150 g day^{-1} concentrate feed considered as optimum level of supplement for old ewe. Dressing percentage and rib eye muscle area were not affected ($p<0.05$) by feeding.

Table 1. Initial weight, final weight, average daily gain and body condition score of ewes supplemented with different levels of concentrate feed.

Feed level	N	Initial weight (kg)	Final weight (kg)	Average daily gain (g)	Body condition score
Grazing	10	29.28(1.11)	9.19(0.60)[a]	8.08(5.17)[a]	1.94(0.23)[a]
Greazing + 150	10	28.38(1.12)	32.50(0.65)[b]	40.44(5.80)[b]	3.24(0.25)[b]
Greazing + 300	11	28.59(1.07)	33.19(0.64)[b]	54.90(5.77)[bc]	3.27(0.25)[b]
Greazing + 450	11	28.57(1.o7)	33.53(0.58)[b]	63.43(5.47)[c]	3.71(0.25)[b]
Greazing + 600	10	28.65(1.12)	34.68(0.58)[b]	64.59(5.17)[c]	3.67(0.23)[b]

N = Number of observations. Means with different letter within a column are different at p = 0.05.

Table 2. Carcass weight, dressing percentage, tail weight, fat thickness and rib eye muscle area of ewes supplemented with different levels of concentrate feed.

Feed level	N	Carcass weight (kg)	Dressing percentage (%)	Tail weight (kg)	Fat thickness (cm)	REM area (cm^2)
Grazing	10	12.20(0.67)[a]	42.73(1.23)	336.25(64.09)[a]	0.38(0.09)[a]	12.04(0.49)
Greazing + 150	10	15.20(0.72)[b]	45.17(1.31)	602.86(68.51)[b]	0.73(0.09)[b]	11.43(0.49)
Greazing + 300	11	15.31(0.67)[b]	46.22(1.23)	686.50(64.09)[b]	0.78(0.09)[b]	11.25(0.49)
Greazing + 450	11	16.30(0.67)[b]	47.59(1.23)	677.50(64.09)[b]	0.72(0.10)[b]	11.57(0.51)
Greazing + 600	10	16.02(0.63)[b]	45.59(1.16)	788.89(60.43)[b]	0.92(0.10)[b]	10.96(0.49)

N = number of observations. Means with different letters within a column are different at $p \leq 0.05$.

Carcass tenderness, Juiciness, taste and overall acceptance are presented in Table 3. Supplementation improved ($p<0.05$) the carcass characteristics of old ewes. Mean comparison of carcass sensory evaluation is presented in Figure 1. Carcass from ram lams which was used as check was higher ($p<0.05$) in tenderness than ewes in all treatment groups. However carcass from supplemented ewes was tenderer than carcass from the non-supplemented ewes.

Table 3. Carcass sensory evaluation score.

Feed level	N	Tenderness	Taste	Juiciness	Overall acceptance
Grazing only	3	3.12(0.10)	3.39(0.11)	2.88(0.11)	3.30(0.12)
Medium feed	3	3.49(0.10)	3.59(0.11)	3.04(0.11)	3.64(0.12)
High feed	3	3.57(0.10)	3.73(0.11)	3.15(0.11)	3.73(0.12)
Check	3	3.93(0.10)	3.60(0.11)	3.32(0.11)	3.73(0.12)

N = Number of observations. Values in parenthesis are standard errors.

Carcass from all treatment groups showed similar taste except carcass from high level supplemented group was higher than carcass from the non-supplemented group (Figure 1). In overall acceptance, carcass from the non-supplemented ewe was less ($p<0.05$) accepted than carcass from supplemented group. Generally this result showed that carcass from supplemented group had better acceptability than the carcass from the non-supplemented group. The effect of age on meat quality and its improvement through better feeding is in agreement with other studies (Plessis and Hoffman, 2007; Maria *et al.,* 2011).

Economic analysis

The economic data from the center generated from five treatments (1 control (farmers' practice) and other 4 treatments) fed for 90 days, and accordingly the feed quantity were converted into monetary terms based on the market price. In all cases, labor cost was not considered since there is no labor allocated for these practice only. The economics of old ewes fattening showed that treatment 2 (grazing + 150 g concentrate) was the best which gained a net return of 313.36 ETB. Net benefit over the control was 55 ETB. The marginal rate of return (MMR) for the selected treatment is 139%, this means that for every 1 Birr invested in concentrate feed and medication, farmers can recover the 1ETB and obtain an additional 1.39 ETB.

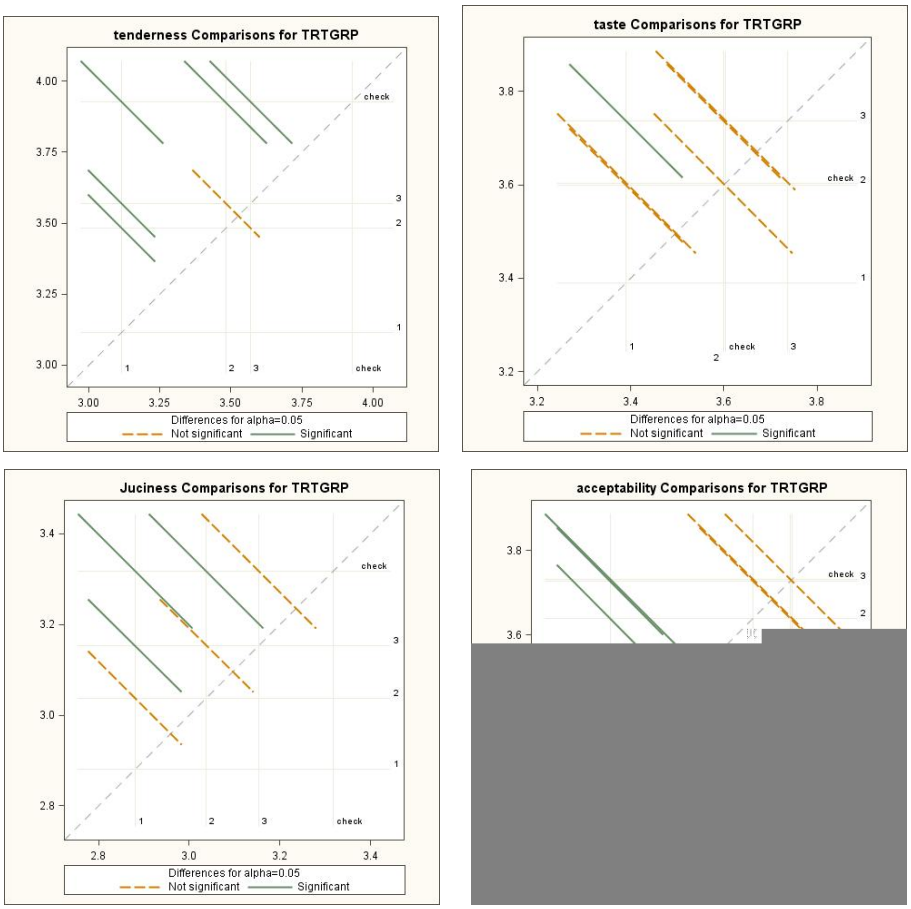

Figure 1. Mean comparison of carcass sensory evaluation for tenderness (above left), juiciness (lower left), taste (above right) and overall acceptance (lower right) of carcass obtained from ewes in different feeding level and check (young un-fattened male sheep). TRTGRP = treatment group; 1 = grazing only, 2 = medium level of feed, 3 = high level of feed. Values in x and y axis are sensor evaluation scores.

Sensitivity analysis was done to confirm to what extent the result will sustain to the variables or bad expectations. That is, assuming changes towards the worse in input and output prices or in some aspects of the enterprise that lead to a decrease in the volume of the production. Profitability of fattening practice would result in a positive net benefit for the study area up to 5% output price reduction and a 5% input price increment from current estimated average output price and input price levels (Table 4).

Table 4. Partial budgeting and Sensitivity analysis for old ewes fattening.

Description	Treatments				
	T1	T2	T3	T4	T5
Selling price (ETB/head)	258.33	353.54	368.75	378.96	386.48
Average medical cost (ETB/head)	0.4	0.4	0.4	0.4	0.4
concentrate cost (ETB/head)	0	39.78	79.56	119.34	159.12
total cost (ETB/head)	0.4	40.18	79.96	119.74	159.52
Net return (ETB/head)	257.93	313.36	288.79	259.22	226.96
Net return over the control	-	55.43	30.86	1.29	-30.97
marginal rate of return (MRR), %	-	139.34	D	D	D
Sensitivity analysis					
+5% fattening cost (ETB/head)	0.42	42.19	83.96	125.73	167.49
-5% selling price (ETB/kg)	245.41	335.86	350.31	360.01	367.16
Net benefit (ETB/head)	244.99	293.67	266.35	234.29	199.66
Marginal rate of return (MRR), %	0	53.82	D	D	D
+10% fattening cost (ETB/head)	0.44	44.20	87.96	131.71	175.47
-10% selling price (ETB/kg)	232.49	318.17	331.88	341.06	347.83
Net benefit (ETB/head)	232.06	273.99	243.92	209.35	172.36
Marginal rate of return (MRR), %	-	48.93	D	D	D

*T1 = Grazing(G); T2 = G+150g concentrate; T3 = G+300g concentrate; T4 = G+450g concentrate and T5 = G+600g concentrate D = Dominated.

Conclusion

Ewes culled from the breeding could be an additional source of income in the traditional sheep production system. Instead of keeping unproductive old ewes for longer period of time in the flock, it is advisable to condition and sell at reasonable price. Supplementation of 150 g day^{-1} concentrate feed gave both biologically and economically optimum level of supplementation to condition old ewes which give a net benefit of 55.00 Ethiopian Birr over the non-supplemented group.

References

Abebe Mekoya. 1999. Husbandry practice and productivity of sheep in Lalo-mama Midir woreda of central Ethiopia. An M.Sc. thesis presented to the School of Graduate Studies of Alemaya University of Agriculture, Dire Dawa, Ethiopia, 99 pp.

Maria Cristina Bressan, Erika Cristina Rodrigues, Lizandra Vercezi Rossato, Eduardo Mendes Ramos, Luis Telo da Gama. 2011. Physicochemical properties of meat from Bos taurus and Bos indicus. R. Bras. Zootec., 40:.6, p.1250-1259.

Plessis I. Du. and Hoffman, L.C. 2007. Effect of slaughter age and breed on the carcass traits and meat quality of beef steers finished on natural pastures in the arid subtropics of South Africa . South African Journal of Animal Science 37:3.

SAS (Statistical Analysis System), 2009. SAS for windows, Release 9.2. SAS Institute, Inc., Cary, NC, USA.

Solomon Abegaz and Gemeda Duguma, 2000. Genetic and phenotypic parameters of growth, reproductive and survival performance of Horro sheep at Bako Agricultural Research Center. Research Fellowship Report. International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia.

Solomon Abegaz, Thwaites, C.J. and Goshu Mekonnen. 1996. The relationship of ewe productivity with body weight and age of Horro ewes. In: proceedings of the 4th Ethiopian Society of Animal Production (ESAP). pp. 75-80.

Tesfaye Getachew. 2008. Characterization of Menz and Afar Indigenous sheep breeds of smallholders and pastoralists for designing community-based breeding strategies in Ethiopia. An M.Sc. thesis presented to the School of Graduate Studies of Haromaya University, Dire Dawa, Ehiopia, 138 pp.

Ulfina Galmessa, Solomon Abegaz, Gemeda Dhuguma, Fiqiru Terefe, Girma Aboma and Solomon Gizaw. 2000. Response of aged Horro ewes to pre-market supplementary feeding. Livestock production and the improvement-Implication for sustainable livelihood. Proceedings of the 7th annual conference of the Ethiopian Society of Animal Production held in Addis Ababa, Ethiopia. 26-27 May 1999. Pp. 96-103.

Yibrah Yacob, 2008. Environmental and genetic parameters of growth, reproductive and survival performance of Afar and Blackhead Somali sheep at Werer Agricultural Research Center, Fellowship report submitted to International Livestock Research Institute (ILRI) and Ethiopian Institute of Agricultural Research. Ethiopia. 70p.