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Effects of Different Feed Supplements on Nutrient Intake, Body Weight Gain and Economic Feasibility of Grazing Abera Sheep

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Abstract- The study was carried out in Darra district of Abera Gelede village in Abera sheep type improvement substation with the aims of investigating the effects of supplementing concentrate and urea molasses feed block /UMB/ on intake and body weight gain of grazing Abera sheep. Thirty two yearling male Abera sheep with mean initial body weight of 21.93 ± 0.23 kg (mean ±SE) were taken from six Abera sheep improvement member co-operatives. The experiment was conducted using a complete randomized block design with four treatment diets and eight replications. The sheep were blocked based on their initial body weight into eight blocks and each of the four treatment diets were randomly assigned to each animal in each block. Dietary treatments comprised of T(1)= grazing control; T(2), wheat bran 66 %: noug seed cake 33 % and 1% salt; T(3), wheat bran 66 %: cotton seed cake 33 % and 1% salt, and (T4), urea molasses feed - block (wheat bran 25%, molasses 36%, cement 10%, noug seed cake 13%, urea 10%, salt 3% and limestone 3%).

Keywords: *abera sheep, supplementation, weight gain; urea molasses feed- block.*

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Keywords: abera sheep, supplementation, weight gain; urea molasses feed- block.

I. Introduction

Sheep production in Ethiopia plays a very important role in contributing to the food security, domestic meat consumption and generating cash income as well as providing continuous service to the economic stability of smallholder farmers (Alemu Yami & R. C. merkel, 2008). Smallholder farmers depend on sheep for much of their livelihood, often largely than on cattle (ESGPIP,2008). Sheep serve as a bank account which can be drawn upon when cash money is needed. These sheep represent only 7% of the average total capital invested in livestock, but they account on average for 40% of the cash income and 19% of the total value of subsistence food derived from all livestock production (Hirpa and Abebe, 2008). Sheep also contributes 21% of the total ruminant livestock meat output of the country (Sebsbie, 2008).

Short-term intensive feeding prior to sale is economically more feasible than the current systems where animals are kept for long periods of time on maintenance level feeding. Because of decline in grazing lands and low productivity of animals, coupled with irregular pattern of rainfall, grazing with supplementation is nowadays adopted by the farmers in sheep production. Shortage of feed and fodder and their poor nutritive value could be tackled to some extent by way of supplementation (ESGPIP, 2008). Urea Molasses Mineral Block (UMMB) is made by combining urea, molasses and minerals in a form that can be used for feeding of animals and it has been used successfully in cattle and small ruminants (Forsberg *et al*., 2002). Mineral deficiency in grazing ruminants has been reported by several authors (Gowda *et al.*, 2004 and Khan *et al*., 2007).

Cost benefit analyses of short term fattening compared to maintenance feeding for extended periods show that short term fattening can be a viable business venture for small scale farmers in Ethiopia (ESGPIP, 2008). The goal of any feeding program is to provide the correct amount and balance of nutrients to animals at proper time to achieve the desired level of performance and profitability (Adugna, 2008). Therefore, this experiment was conducted to improve feed intake and body weight gain of Abera sheep supplementation of different types of concentrate mixes and urea molasses feed block.

II. Materials and Methods

a) Study area

The study was, conducted at community based Abera sheep improvement substation in Sidama Zone, Southern Ethiopia; one of the mandated woredas of Hawassa agricultural research center, Abera Gelede

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village. It is 100 km from capital of SNNPRS, Hawassa city. Hawassa, is located at 275 km south of the city of Addis Ababa. Sidama zone is currently divided in to 19 *woredas* in which each *woreda* on average has a population of 100,000 (CSA, 2007). Agro-ecology of the *woreda* includes 30.35% Kolla, 54.54% *Woynadega* and 15.13% *Dega*. Altitude of the *woreda* ranges from 1400-2800 m.a.s.l. Mean annual temperature is 27°c (BOARD, 2011).

b) Experimental animals and their management

Intact yearling Aberra sheep type with mean body weight of 21.93 ± 0.23 kg were taken from six co-operatives involved in community based sheep improvement and the sheep /ram/ which was not selected for breeding purpose was used for the feeding experiment. The age of the sheep was determined by recorded data from Darra sheep breed improvement substation. During the adaptation period, animals were Dewormed with a broad spectrum anti-helemantic (Albendazole) against internal parasites. The animals were penned individually in well ventilated pens (1.5 m × 90 cm × 1.10 m) with concrete floors and had access to feeding and watering trough. Pen cleaning has taken every morning after feed supplement offered and the sheep allow for grazing. The house is made of corrugated iron roof. The experiment was carried out from December 4, 2015 to March 2, 2016.

c) Feeds Experimental feed and feeding

The experimental feeds were formulated at required level and purchased from Sidama Elto Union/ Hawassa, feed processing center/. The concentrate supplements were composed of (wheat bran, noug seed cake/ cotton seed cake, salt) and urea molasses feed block composed of (wheat bran, noug seed cake, urea, molasses, salt, limestone and cement). The basal diet, natural grass, grazed for 7 hr. Daily body weight gain were calculated by the difference between final and initial body weight divided by the feeding days.

Table 1: Experimental Treatments

Ingredient	Treatment diet			
	T 1	T 2	T3	T4
Natural pasture	Grazing	Grazing	Grazing	Grazing
Molasses	-	0	0	36
Urea	-	0	0	10
Wheat bran	-	66	66	25
Cotton seed cake	-	0	33	0
Noug seed cake	-	33	0	13
Salt	-	1	1	3
Cement	-	0	0	10
Lime stone	-	0	0	3
Total	-	100	100	100

T1= grazing , T2= grazing, 66% wheat bran, 33 Noug seed cake, 1% salt, T3=grazing ,66% wheat bran, 33 cotton seed cake, 1% salt, T4= grazing , UMB /wheat bran 25%, noug seed cake 13%, salt 3%, limestone 3%, molasses 36% urea 10% and cement 10%/

d) Experimental Design

The experimental design used was a complete randomized block design (CRBD) with four treatments and eight replications. Based on their initial body weight, thirty two sheep were blocked into eight. Each of the four treatment diets was randomly assigned to each animal in each block. The treatment diets consists of supplementing different types of concentrate and urea molasses block on DM basis in sheep fed on grazing natural grass as a basal diet.

e) Feeding Trial

The feeding trial lasted for 90 days following an acclimatization period of 14 days to the experimental pens and treatment diets. Three hundred gram concentrate supplement and 100 gram UMB was given once a day at 8:00 AM (0%) and (maximum 25%) refusal, respectively. Grazing was limited for 7hr. clean drinking water was provided all the time. Daily feed offered and the refusal was weighed for each animal and recorded throughout the trial period to determine the amount of feed consumed as a difference between that offered and refused. Representative samples were then taken for the feed offered every morning before feeding, dried, ground and placed in air tight container until it was taken for analysis. Treatment refusals were pooled and sub-sampled for analysis. The daily average feed intake was estimated by the difference between the amounts of feed offered less the amount of feed refused on DM basis. Body weight of each sheep was recorded every 14 days after overnight fasting to determine body weight change. Average daily weight gain was calculated as the difference between final body weight and initial body weight of the sheep divided by the number of feeding days.

f) Chemical analysis of the feed samples

The DM content of feed offered and refusal was determined by the standard methods of the Association of Official Analytical Chemists (AOAC, 1990) and ash

was determined by igniting the sample in muffles furnace at 550 0C for 3 hrs (AOAC, 1990). Total nitrogen (N) content of the feed was determined using Micro-Kjeldahl method. The crude protein content was calculated as N* 6.25. Acid Detergent Fiber (ADF) and Neutral Detergent Fiber (NDF) content were determined according to Van Soest et al. (1991) using in an ANKOM® 200 Fiber Analyzer (ANKOM Technology Corp., Fairport, NY, USA).

g) Statistical analysis

Data on feed intake and body weight gain were analyzed using the General Linear model (GLM) procedure of the statistical analysis system (SPSS). Duncan Multiple Range test was used for comparison of mean differences between treatments. The model used for data analysis was Yij= μ + Ti + Bj + eij where Yij= response variable (feed intake and body weight gain); μ = overall mean; Ti = the fixed effect of diet; Bj = the block effect; eij = random error. Results are presented as least square means with their standard errors of mean SEM.

h) Partial Budget Analysis

Partial budget analysis was performed to evaluate the profitability of sheep fed a basal diet of natural grass supplemented with concentrate diet and UMB which was considering the main cost component. Experienced animal dealers estimated the selling price of each sheep at the end of the experiment. Economic analysis was done by using partial budget analysis. The price of concentrate feed mix, UMB, buying and selling prices of animals; price of natural grass and labor cost were recorded and used for the analysis. The partial budget analysis was employed using the procedure of Upton (1979). The purchasing and selling price difference of sheep in each treatment before and after the experiment was considered as total return (TR) in the analysis. The net income (NI) was calculated by subtracting total variable cost (TVC) from the total return (TR). NI = TR-TVC Marginal revenue MR = NI / TVC.

III. Results

a) Chemical Composition of Experimental Feed

Table 2: Chemical compositions of experimental feed and treatment diets

Feed Items	Nutrients							
	DM	OM	CP (6.25*N)	NDF	ADF	Ca	P	ME cal /kg
Natural grass	96.80	88.73	9.78	65.59	47.02	-	-	-
T2	93.62	93.83	19.62	39.27	32.42	0.34	1.16	2.44
T3	97.84	94.26	19.06	38.90	26.25	0.19	1.30	2.57
T4	97.48	80.02	27.46	19.43	2.57	6.82	0.48	1.93

DM= Dry matter, CP= Crude protein, NDF= Nutral detergent fiber, ADF= Acid detergent fiber. Laboratory analysis was worked at Hawassa University Animal Nutrition Laboratory Result

The chemical composition of the natural grazing grass and the three treatment diets was not significantly different in their DM and OM content. But there was significant difference on the CP, NDF, ADF and energy contents of the concentrate supplement T2 and T3 and the basal diet natural grass. But there was a difference in CP content of natural grass; it has lower crude protein than T2, T3 and T4. Fiber analysis indicates that/ UMB/Urea molasses block contain lower NDF (19.43) and ADF (2.57) than the two treatments T2 and T3.

b) Feed intake

Table 3: The mean daily DM (dry matter) and nutrients intakes of sheep fed concentrate mixture and UMB

Intake	Treatments				SL
DM	*T1	T2	T3	T4	
Concentrate	-	269.46±3.86	288.50±3.86	0	NS
UMB	-	0	0	73.11±10.93[a]	*
OM	-	253.97±4.23	279.75±4.23	58.5±11.96	*
CP	-	53.64±1.2	62.81±1.2	20.1±3.39	*
NDF	-	106.66±1.97	120.05±1.97	14.21±5.58	*
ADF	-	86.05±0.82	83.55±0.82	2.33± 1.88	*

*T1= grazing for all treatments a basal diet and control. NS= Non significant, * Significant*

The average voluntary feed intake by sheep fed on the three different treatment diets given above in the Table3. The Dry matter intake /DMI/ in T2 (269.46 g/day/h) and T3 (288.50g/day/h) has significant

differences (P<0.05) than T4 (73.11g/day). T4 intake value was similar to those reported by Ibrahim (1991). The higher DMI on both T2 and T3 improves OMI /organic matter intake/CPI, and NDFI by the animals. Concentrate was acceptable by the animals and that shows no refusal in T2 and T3, but there was on average 25 gm urea molasses feed block refusal from the expected 100 gm daily intake with T4 groups.

Weight gain

Table 4: Body weight gain of sheep fed natural grass grazing basal diet supplemented with different concentrate mixture and urea molasses feed block

Body weight	Treatments				Sig
	*T1	T2	T3	T4	
Initial (kg)	21.5± 0.46	22.00 ± 0.46	22.13 ±0.46	22.13 ± 0.46	NS
Final (kg)	23.25 ± 0.86	28.63 ± 0.86	26.5 ± 0.86	24.63 ± 0.86	< 0.001
Total gain(kg)	1.75 ± 0. 66^{b}	6.63 ± 0. 66^{a}	4.38 ± 0. 66^{ab}	2.5 ± 0.66^{b}	< 0.001
Gain/ day (g)	19.25±7.32^{b}	73.75 ± 7.32^{a}	48.75 ± 7.32^{ab}	27.63 ± 7.32^{b}	< 0.001

In this study the body weight gain of the experimental sheep fed with graded level of noug seed cake and wheat bran (T2) and supplemented with grade levels of cotton seed cake and wheat bran mixture (T3) and UMB supplemented group T(4) are presented in Table 3. The final body weight, total body weight and daily body weight gain was significantly different (P<0.05) in (T2) than the UMB (T4), (T3) and to the control treatment (T1).

The average daily weight gain range in concentrate supplemented group T2 and T3 (48.75-73.5 g/day) observed in the present study was higher with the result (25-34 g/day) reported by Abebe (2008). The higher live weight gains of the supplemented groups with concentrate supplementing T2 and T3 may be due to adequate amount of nutrients in concentrate mixture the CP and energy are comparable than natural grass grazing without supplementation in T1. Treatment 4 UMB with lower energy (1.93) but high CP (27.46) affects the synergetic effects of the two nutrient. The supplemented sheep with similar gm /day have got lower weight gain results was observed (27.3 g/day)in this study than 21.6g, 42.4g, 46.1g, and 46,4g respectively to those of Ibrahim (1991).

The concentrate supplemented group average daily body weight gain observed in this study were lower than the gain (60- 95 g/day) reported by Wegene (2008) in Blackhead Somali sheep supplemented with energy and protein source. However, the range of body weight gain as observed in the current finding is higher than the values (32-63 g/day) reported by Hirut (2008) for Hararghe highland sheep supplemented with concentrate mixture and also (70gram/day) reported by Habtemariam,e.t.a.l,,(2011)

There was no weight loss observed as a result of non-supplementation. This may be attributed to the appreciable amount of nutrients in the grazed natural grass during experimental time. The higher live weight gains of the supplemented groups with concentrate supplementing T2 and T3 may be due to adequate amount of nutrients in concentrate mixture than natural grass grazing without supplementation in T1. The intake in (T4) multi nutritional blocks was lower than the two supplemented groups, which the feeding habit of the sheep limits the supplemented feed block intake; it results low nutrient supplement intake and results low weight gain.

c) Partial Budget Analysis

The result of partial budget analysis is indicated in Table 4. In this study the partial budget analysis observed that T2, T3 and T4 has similar marginal return than, but T1 has lower than the other treatments. Marginal return was 1.55, 1.52, 1.40 and 1.44 for T1, T2, T3 and T4, respectively.

Table 5: Partial budget analysis on body weight gain of Abera sheep fed a basal diet of grazing natural grass; supplemented with different types of concentrate mixtures and urea molasses feed block

Parameters	Treatments			
	* T1	T2	T3	T4
Average final weight kg/ head	23.25	28.63	26.5	24.63
Cost of live weight kg/ head (ETB)	40	40	40	40
A. Total gross income(ETB)	930	1145.20	1060	985.20
Cost of sheep/head (ETB)	600	600	600	600
Feed cost				
Total Cost of concentrate (ETB	0	155.25	155.25	38.81
B. Total input cost(ETB	600	755.25	755.25	683.75
Gross profit (A-B)	330	390	304.75	385.20
Marginal revenue (A/B)	1.55	1.52	1.40	1.44

IV. Summary and Conclusion

The study was carried out at Darra district of Abera Gelede village in Abera sheep type improvement substation with the aims of investigating the effects of supplementing concentrate and urea molasses feed block /UMB/ on intake and body weight gain of grazing Abera sheep. All treatment diets had higher CP content than the rumen microbial requirement. The UMB had higher CP and lower NDF, energy and ADF content than the other two experimental supplemented feeds, but the low intake of urea molasses feed block resulted in lesser amount DM, OM, CP, NDF, energy and ADF intake. That attributed to lower weight gain than concentrate supplemented (T2 and T3) groups. The significant difference among treatments was due to the different quantities of nutrient contents of both concentrate diet. Sheep fed on T2 and T3 supplements had higher weight gain than those fed T4 and un supplemented control group T1. T2 has significant difference ($P<0.05$) on weight gain performance than T1 and T4, but comparable weight gain with T3. The net return obtained from all treatments were T2 >T4 >T1 >T3 across the treatments.

V. Recommendations

Three hundred gram concentrate /head /day supplementation (66% noug seed cake mixed with 33% wheat bran and 1% salt) has significant difference on short term weight gain and economically feasible for the areas where community based sheep improvement and small holder farmers. It was also economical at small-scale farmers' level, with average gross profit of 390 ETB in the study area. Besides, famers and extension workers had appreciate fattening practice with concentrated feed supplementation than conventional fattening practice.

VI. Acknowledgment

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Additional Documents

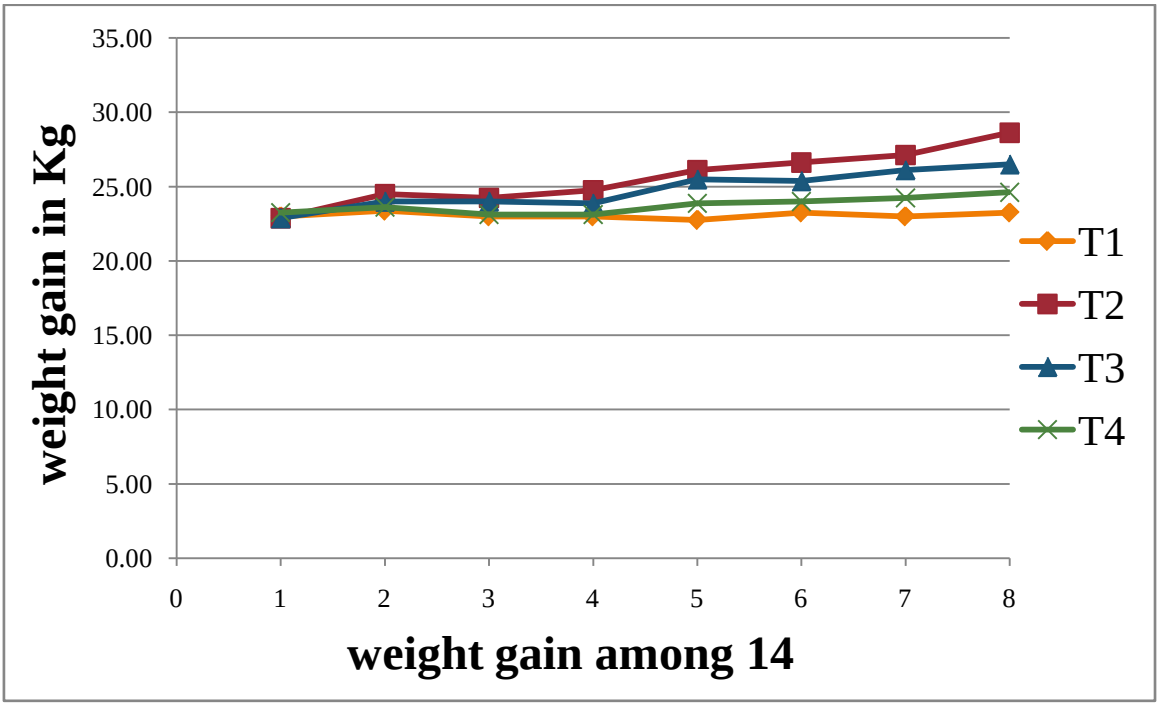

Fig. 1: The body weight gain/change/ trend