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Effect of Urea Molasses Block Supplementation on Weight Gain Performance of Boer X Woyto-Guji Crossbred Female Goats

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Abstract: The experiment was conducted at Key Afer Goat Research Substation of Jinka Agricultural Research Center to identify supplementation effect of different urea levels in urea molasses block (UMB) on weight gain performance of Boer x Woyto-Guji crossbred female goats. Total of 16 female goats with average initial body weight of 16.75±0.5 kg were arranged in a randomized complete block design. Four goats were grouped into four blocks and one goat from each block was randomly assigned to one of the four experimental diets. The experimental treatments used in this study were; grazing + UMB (45% molasses +3% urea+ 30% wheat bran + 2% salt+ 15% noug cake+ 3% cement+ 2% limestone; T1), grazing + UMB (45% molasses+ 5% urea+30% wheat bran+ 2% salt+ 15% noug cake+ 2% cement + 1% limestone; T2), grazing + UMB (42% molasses+ 8% urea+ 30% wheat bran+ 2% salt+ 15% noug cake+ 2% cement + 1% limestone; T3) and grazing only served as control (T4). The results showed that goats fed T1 higher ($P<0.05$) UMB intake than goats fed T3 but similar ($P>0.05$) to diet T2. Goats fed diet T2 shown highest ($P <0.05$) average daily gain than T1 and T3. It was concluded that goats fed on T2 diet showed better weight gain of 67g/day over goats fed T1 (33.88g) and T3 (22.55g/day) was advisable to use as an alternative protein supplements in to pastoral and agro pastoral areas to improve the goat production.

Key words: Feed Intake · Weight Gainand Woyto-Guji X Boer Crossbreed

INTRODUCTION

Ethiopia is home, excluding some non-sedentary pastoral areas of Afar and Somali regions, to have approximately 32.74 million of goats [1]. Goats are amongst the commonest farm animal species which sustain the livelihoods of smallholder farmers, agro pastoralists and pastoralists by generating cash income, serving as household security, accumulating capital and fulfilling cultural obligations [2, 3, 4]. However, despite the huge potential of goat population with diverse agro-ecologies which suitable for goat production in Ethiopia, the contribution of goats to Ethiopia economy and goat producers' livelihoods is very limited [5]. In South Omo Zone, almost all the goats are indigenous breeds and physically described as Woyto-Guji or Konso goats [6] and genetically identified as one of the eight indigenous goat breeds in Ethiopia [7]. So far, the Southern Agricultural Research Institute in collaboration with the Regional Bureau of Agriculture imported Boer goats from South Africa in order to improve meat and milk production performances of local goats. Cross-breeding programs have been carried out at Key Afer site for the last eight years and many of Boer x Woyito-Guji crossbred goats' progenies has been developed and distributed to pastoral and agro pastoral communities. Accordingly, the on farm daily growth performances of Boer x Woyto-Guji cross bred grazing goats were 21.02 and 16.38g/day respectively for male and female [8] which is very low to registered average weight of buck and doe in World. However, in study Regions, particularly South Omo, the goat feeding is predominantly on pasture-based feeding system and hence, the growth performance of goat is very low as compared to intensive feeding system [9]. This is contributing to rise in low growth and reproductive performances in goats and made less benefit of pastoral and agro pastoral communities from goat production [3, 9]. It is apparent that nutrient supplied from

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extensive pasture based feeding system is unable to meet the nutrient requirements of goats beyond maintenance requirements [9]. Therefore, to mitigate nutrient supply and quality shortfall, feeding goats with agro-industrial by- products could be improved the nutrient intake, digestibility and weight gain performance of goats [10]. However, in to study area, the pastoral and agro pastoral communities were not in position to provide concentrate supplements to goats due to the high cost and unavailability of the concentrates [9, 11]. Therefore, finding to locally available protein rich feed source is one of the appealing options/strategies for the pastoral and agro pastoral communities to combat nutritional restrictions [9, 12]. Among the locally available protein rich feed source, urea is one which is none nitrogen protein (NPN) and supplies protein to rumen microbes when supplemented in form of urea molasses block (UMB) to low quality roughage [13]. The study reported by Muralidharan *et al*. [14] shown that UBM donates versatile protein and energy which help the growth and biological performances of rumen bacteria and hence facilitate digestion and consumptions of fibrous feeds [13]. Moreover, the earlier study from the Mid Rift-Valley of Ethiopia had shown that the Arsi-Bale sheep supplemented with UMB containing 8% urea had higher average daily body weight gain (74.8g/day) over non supplemented groups [15]. However, the weight gain performance of the grazing Boer x Woyto-Guji crossbred female goats have not been identified when goats are given the supplement of urea molasses block containing different levels of urea. Therefore, this study aimed to identify the effect of different urea level in the form of UBM to the Boer X WoytoGuji female goats on growth performance.

MATERIAL AND METHODS

Description of the Study Area: This study was conducted at Key Afer Goat Research Substation of Jinka Agricultural Research Center which has been located between 5°01' and 5°73' North latitude & 36°38' and 37°07' East longitude in the Southern Nations, Nationalities and People's Regional States. The area is characterized by semi-arid and arid climatic conditions with mean annual rainfall of 838mm and ambient temperature ranging from 26-35°C. The vegetation of the study area is dominated by varying densities of Acacia, Grewia, Solanum and woody species [16].

Preparation of UMB: Urea molasses block was prepared from wheat bran, molasses, urea, salt, noug cake, cement and limestone which purchased from local market. Molasses and urea needed for each block were mixed and stored overnight in plastic container in order to dissolve urea in molasses. Wheat bran and noug cake were mixed thoroughly and the mixture of molasses and urea were added and mixed by hand, followed by mixture of salt, cement and limestone. Final mixture was transferred to the molding equipment of dimensions 3 x 1 x 1 centimeter. Then it was closed and pressured manually by hand to shape the block. The molding equipment was opened and removed from the block after 1 to 15 min and it was dried for 2 to 3 days under shade on concrete floor at the experimental site.

Experimental Goat and Feeding Management: For this study, total of 16 yearling Boer x Woyto-Guji crossbred female goats with an average initial body weight of 16 ±0.5kg were drawn from Key Afer Goat Research Substation of Jinka Agricultural Research Center. The goats were treated for internal and external parasites by using Albendazole and Acaricide and vaccinated against suspected seasonal disease outbreak in the study area. All goats were ear tagged and housed in individual pen made from locally available woody material and allowed to adapt to UMB supplements for two weeks after each group of goats were randomly allocated to one of four experimental diets. All the goats had free access to the grazing of natural pasture (Basal diet) for 8 hour per day and were supplemented with UMB for 9days. The UMB supplementation was done twice per day (12:00 PA after noon and 6: 00 PM at evening) and all goats had free access to clean water.

Experimental Design and Treatments: The goats were blocked into four groups of four goats per treatment based on their initial body weight and goats in each block were arranged in a randomized complete block design. The experimental diets used in this study were: Grazing of pasture land + UMB supplementation (Prepared from 45% molasses+3% urea + 3% wheat bran+2% salt+ 15% noug cake+ 3% cement +2% limestone; T1), Grazing of pasture land + UMB supplementation (Prepared from + 45% molasses + 5% urea+ 3°% wheat bran + 2% salt 15% noug cake +2% cement + 1% limestone; T2), Grazing of pasture land + UMB supplementation (Prepared from + 42% molasses + 8% urea+ 3% wheat bran + 2% salt 15% noug cake +2% cement + 1% limestone; T3) and Only grazing of pasture land (T4).

Data Collection

UMB Intake Measurements: After adaptation period, the amount offered and the corresponding refusals of UMB were recorded on daily basis throughout the experimental periods to determine the daily UMB intake of goats by using sensitive weight balance. The daily UMB intake of each goat was calculated as a difference between the amount of UMB offered and leftover in the Bucket in the next morning.

Body Weight Change: The initial body weight of the experimental goats was measured before beginning the actual feeding by using spring weight balance. Body weight was measured every 15 days interval and daily weight gain was calculated by deducting initial live weight from the final live weights after the overnight fasting of the experimental goats. Feed conversion efficiency was calculated as the daily body weight gain (g/day) divided by daily UMB intake (g/day).

Chemical Composition Analysis: In order to determine the chemical composition of UMB, UMB offered was dried at $65°_C$ for 48h and ground to pass through 1mm screen by using Thomas Wiley mill at Hawassa University, Nutritional laboratory. For dry matter determination, 0.5g of partially dried sample was drawn and allowed to oven dried at 105°C for 24hrs [17]. The Neutral Detergent Fiber (NDF) content was determined by the procedure of Van Soest *et al.* [18] and the Acid Detergent Fiber (ADF) was determined according to Van Soest and Robert [19] by using ANKOM® 200 Fiber Analyzer (ANKOM Technology Corp., Fairport, NY, USA). Crude Ash content of samples was determined by combusting the sample at 550°C for 6 hours [17]. Total nitrogen content was determined by micro Kjeldahl method and then CP content was calculated as N × 6.25.

Data Analysis: Analysis of variance of UMB intake, total body weight gain, average daily body weight gain and feed conversion efficiency was done according to the general linear model (GLM) procedure of the Statistical Analysis System (SAS 9.1). A difference among treatments means was compared by using Duncan's Multiple Range Tests at 95% of the confident interval with the following model;

$$Y_{ijk} = \mu + A_i + B_i + e_{ij}$$

where:

Yijk= Individual values of the dependent variables (UMB intake, ADG g/day and FCE);

μ = Overall mean of the response variable;

A_i = The effect of the treatment diets (i =1, 2, 3, 4); B_i= Effect of block factor (Initial weight)

e_{ij} = Random errors

RESULTS

Chemical Composition of UMB: The chemical composition of UMB is presented in Table 1 below. Experimental diet T3 had higher CP content but lower Ash content than diet T1 and T2. However, fiber (NDF and ADF) contents were comparable among the diet T1, T2 and T3. Diet T2 had higher CP and Ash contents than diet T1.

Daily UMB Intake: The daily UMB intakes of Boer x Woyto-Gujicross bred female goats are shown in Table 2 below. The lowest ($P<0.05$) UMB intake was observed in goats given diet T3 while the highest UMB intake was observed for goats supplemented T1 and T2 diets; but there is no significant difference for goats fed on diet T1 and T2.

Furthermore, the total daily UMB intake of goats fed T1 and T3 showed decreasing trend until the day 20 of the experimental period (Figure 1). The T3 dramatically increased from 20-30days feeding trials and showed steady increasing trends for 30-60 days. After steady increase, goats fed T2 andT3 showed decreasing trends from 60-90 days, whereas, those goats fed on T1 showed increasing trends from 60-90days.

Body Weight Change and Nutrient Conversion Efficiency: The initial body weight, final body weight, body weight change, daily weight gain and feed conversion efficiency of Boer x Woyto-Guji crossbred female goats supplemented with UBM are presented in Table 3 below. Goats fed T2 diet had the highest ($P < 0.05$)

Table 1: Chemical Composition (% DM unit less specified) of UMB

Treatments	DM	ASH	CP	NDF	ADF
T1	94.43	16.06	16.20	19.36	7.56
T2	94.53	18.46	22.12	18.76	8.14
T3	94.22	15.56	28.37	19.46	7.65

Table 2: UMB intake of Woyto-Guji x Boer crossbred female goats

Treatments	Daily UMB intake (g/day)	SEM	SL
T1	203.35[a]	8.85	*
T2	180.22[a]	8.85	*
T3	128.14[b]	8.85	*
T4	-	-	-

Mean values in a column having different superscripts differ significantly from each other; *= ($P < 0.05$); SEM = Standard error of mean; SL= Significant level.

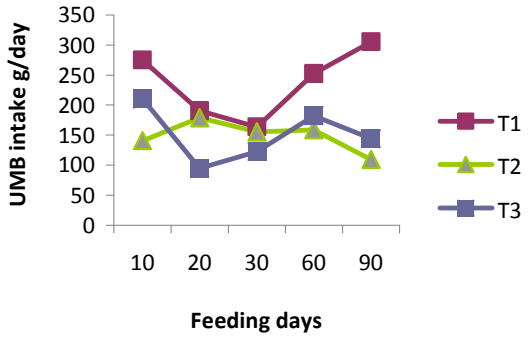

Fig. 1: Trends in daily UMB intake of Boer x Woyto-Guji cross bred female goats supplemented with UMB.

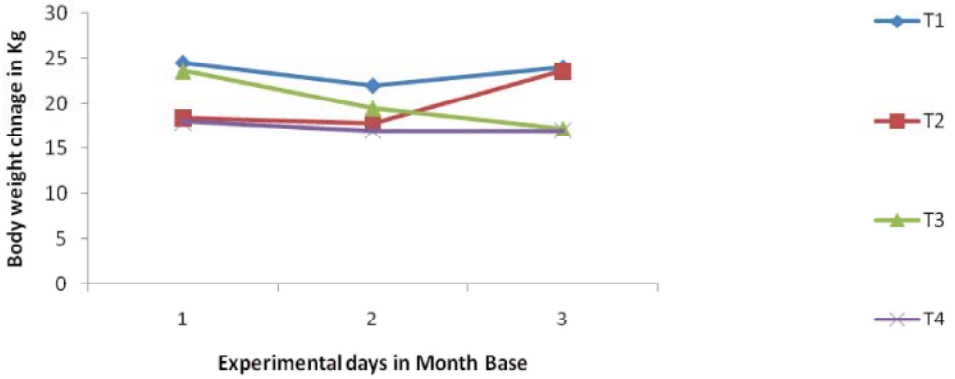

Fig. 2: Trends in body weight change of Woyto Guji x Boer crossbred female goats' supplemented with UBM

Table 3: Body weight change, average daily weight gain and feed conversion efficiency of Woyto-Guji x Boer crossbred female goats.

	Treatments					
Growth indices	T1	T2	T3	T4	SEM	SL
IBW (kg)	17	17	16.5	16.5	0.5	Ns
FBW (kg)	20.05^{b}	23.03^{a}	18.53^{c}	17.65^{b}	1.73	*
BWC (kg)	3.05^{b}	6.03^{a}	2.03^{c}	1.15^{d}	1.5	*
ADG (g)	33.88^{b}	67^{a}	22.55^{c}	12.77^{d}	1.8	*
FCE	16.67^{b}	37.18^{b}	17.59^{b}	-	1.7	*

Mean values in a row having different superscripts differ significantly each other; IBW= initial body weight; FBW= final body weight; BWC= body weight change; ADG = average daily gain; FCE = feed conversion efficiency; Kg= kilo gram; g= gram

final body weight and daily weight gain performances than goats fed T1 and T3 diets. Those goats not supplemented UMB (T4) had the lowest (P<0.005) final body weight and average daily gain than T1, T2 and T3. On the other hand, the trends in body weight gain presented in Figure 2 below. Weight gain showed that goats in T1 T2 and T3 diet showed considerably increasing trends in weight gain across the 1st month and then, had decreasing trends in the second month (30-60days). Furthermore, goats fed on T2 and T1 diet had continuously increasing trends in weight gain performance from 60- 90 days and while, goats fed T3 had decreasing trends in daily weight gain.

DISCUSSION

Goats supplemented with diet T3 had higher in CP content than goats fed on T1 and T2 diet in this study is due to higher urea level in T3 diet than T1 and T2 diet. It is apparent that diet contained high amount of urea level provided higher nitrogen, which is responsible for the increment in CP contents. The comparability in fibers (NDF and ADF) contents among the T1, T2 and T3 diets in this study is due to the similar composition of wheat bran in T1, T2 and T3. The CP contents obtained from our study for T1 and T2 diets were comparable to values reported by Tesfa *et al.* [15]. However, CP content

obtained from this study was higher for T3 diet than value reported by Tesfa *et al.* [15]. The higher CP value from our study for diet T3 than the previous report of Tesfa *et al.* [15] is due to the inclusion of Noug Cake in UMB in this study. However, the CP from our study was comparable to CP value of 28.85% reported by Mirza *et al.* [20] for UMB containing 18% CSM, 45% sugar cane molasses and 8% urea. Pertaining to NDF and ADF contents, the values from our study is lower than the values reported by Tesfa *et al.* [15] for UMB containing 3%, 5% and 8% of urea compositions. This is might be due to higher percent of wheat bran inclusion in our diet study and presence of haricot bean haulms in the study reported by Tesfa *et al.* [15].

From our study we observed the higher daily UMB intake for goats supplemented with T1 and T2 diets than goats fed T3 diet is due to higher urea contents in T3 diet. It is apparent that urea is naturally low in its palatability by the ruminant animals. The previous studies reported by Tesfa *et al.* [15] and Mirza *et al.* [20] had illustrated that daily UMB intake by animal decreased when the percentage of urea in the UMB increased which is corresponds to the findings obtained from our study. Moreover, Habib [21] confirmed that UMB intake by the sheep decreased when the urea percentage increased which indicated that high level of urea has been induced low palatability and formation of excessive ammonia concentrations in the rumen that lower rumen PH. Lower daily UMB intake was observed on goats supplemented T1, T2 and T3 diets from our study than the values (230g, 218g and 206g/day) reported by Tesfa *et al.* [15] for Arsi-Bale sheep supplemented UMB containing 3%, 5% and 8%. This is might be due to either both hardness and palatability of UMB, breed and species difference or the grazing conditions of pastureland [22]. Furthermore, showing the decreasing trend daily UMB intake up to 20 days of experimental periods by goats fed on T1 and T3 in this study might be due to during the trial time in to study area it was too hot. It is apparent that at higher temperature, higher mean retention time of the feedstuff in the digestive tract and hence lower intake. However, goats fed T1 showed increasing trends from 60-90 days might be due to in to study area during these periods, it was too much rain and cold. It could be an increase in gut motility under cold exposure leads to increases in the rate of passage which could be responsible for increases in UMB intake to maintain their internal temperature with the environment.

The higher final body weight (kg) and average daily weight gain (g/day) in goats supplemented with T2 diet than T1 is due to higher CP content in T2 diet. McDanold *et al.* [23] had stated that feed with high protein content could be increased availability of nitrogen in the rumen which enhances the rate of degradation and utilization of the nutrients by the rumen microbes and hence better weight gain performance. The current study weight gain of goats f ed T2higher than goats fed T3 is due to high intake of UMB intake. Findings from this study for goats fed on diet T2 were higher than reported value of 58.53 g/day by Tesfa *et al.* [15]. This inconsistency is due to either breed difference or feeding values of UMB and grazing land. However, average daily weight gain of T2 was less than values which ranged from 100-150g/day reported by Salman [24] for sheep given supplements of multi nutrient blocks and a basal diet of rice straw in Iraq. Moreover, those goats supplemented T1 had higher average daily weight gain than those goats given T3 due to higher UMB intake. Van Soest [25] had stated that an animal has better body weight gain when given quality feed due to optimum nutrient supply to rumen microbes. Furthermore, those goats given T3 had lower average daily weight gain than the former two groups even though the CP concentration was high in T3 diets. This is due to low intake of UMB which is affected by high amount of urea contents. The average daily weight gain values obtained from the this study in T1 and T3 diets were lower than the values of 72.88g/day and 74g/day reported by Tesfa *et al.* [15] for the Arsi-Bale sheep given UMB containing 3% and 8% respectively.

CONCLUSION AND RECOMMENDATION

Higher value of UMB intake was obtained from this study in goats supplemented T1 and T2. However, the lowest UMB intake was recorded for goats supplemented with T3 diet. The greater ADG was observed in goats supplemented with T2 diet and intermediate value was observed in goats supplemented with T1 diet. On the other hand, the lowest value of ADG was observed for goats supplemented T3. Based on the result of the current study, it concluded that supplementing goats T2 diet had resulted in better ADG performance than goats' supplemented with T1 and T3 diets which is indicating better fermentable nitrogen in the block which is sufficient to fulfill the protein requirements of rumen microbes. Thus, it is recommended that UMB containing 5% urea is the most promising protein supplement in terms of providing superior ADG to goats.

Furthermore, it has also been observed from the experiments that the supplementing UMB with low quality roughage based diet could increase feed intake and ADG

goats in pastoral area; it can be a replacement of concentrate supplement, which is not available in the study area.

If UMB is properly promoted in wider scale in the pastoral communities in South Omo, it will play a vigorous role in alleviating poverty and hunger among poor pastoralists' and agro pastoralist' communities.

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