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Effect of Urea and Molasses Supplementation on Nutrient Intake and Digestibility of Sheep Fed with Straw

A. Can, [1]N. Denek and K. Yazgan
Department of Animal Science, Faculty of Agriculture, University of Harran, Sanliurfa, Turkey
[1]Faculty of Veterinary Medicine, University of Harran, Sanliurfa, Turkey

Abstract: This study is carried out to determine effect of different level of urea and molasses liquid supplementation on nutrient intake, digestibility and rumen parameters of wheat straw fed Awassi ram lambs. Total fifteen 2 years old Awassi ram lambs (44.40±2.0 kg) were allocated to five treatments (3 per treatment) at randqm within live weight. Treatments were wheat straw (Control; C), WS + 0.75% urea and 10% molasses (T1), WS+1.5% urea+ 10% molasses (T2), WS+0.75 %urea +20% molasses (T3), and WS+1.5 %urea +20% molasses (T3) as fed basis. Supplementing urea and molasses increased DMI and OMI of ram lambs ($P<0.05$). Increasing urea level from 0.75 to 1.50% and molases level from 10 to 20% did not change DMI or OMI ($P>0.05$). Dry matter and OM digestibility of wheat straw control diet (C) were found lower than urea and molasses supplemented treatment diets ($P<0.01$). Control diet consuming animals had a lower CP digestibility than urea and molasses supplemented animals ($P<0.05$). Increment both urea (T1-T3 vs T2-T4) and molasses (T1-T2 vs T3-T4) increased CP digestibility of diets. Control (WS) diet had a lower NDF digestibility than urea and molasses supplemented treatment diets ($P<0.01$). While increasing molasses level (T1-T2 vs T3-T4) did not affect NDF digestibility ($P>0.05$), increment of urea (T1-T3 vs T2-T4) improved NDF digestibility ($P<0.05$). ADF digestibilities of control (WS) and treatment diets were found similar ($P> 0.05$). Increment of molasses levels (T1-T2 vs T3-T4) and urea levels (T1-T3 vs T2-T4) increased ADF digestibilities of diets ($P<0.01$). Ruminal pH was similar for the different diets, while NH3-N (mg/100 ml) was higher ($P< 0.01$) for the treatment diets. As a conclusion, supplementation with urea and molasses improved rumen environment, feed intakes and digestibility in Awassi ram lambs fed with wheat straw.

Key words: Urea, Molasses, Wheat Straw, Digestion

Introduction

Sheep occupy a significant a role in rural economy of Turkey due to their ability to thrive even under harsh environment with low capital investment. It is very common practice to use cereal straw as a main feed source for sheep all year around. Straw is a roughage with low nutrient content and low digestibility. The first constraints its better utilization is the inbalance in the nutrients made available from the rumen fermantative digestion. Animals fed exclusively straw are in negative energy balance and supplement feeding with energy and nitrogen has been used for improving their nutritional status (Capper *et al.*, 1989). The effect of supplementing straw with nitrogen and various energy sources has been studied by many researchers (Andrews *et al.*, 1972; Preston and Leng, 1984; Capper *et al.*, 1989). They indicated that while small amounts of supplements may stimulate rumen functions, digestion, and intake of straw, high levels of supplements may lead to a depression of microbial activity, rumen digestibility, and straw intake. The principle cellulolytic bacteria species utilize ammonia as the main source of nitrogen (Byrant, 1973),whereas for microbes utilize sugars or starches there is an apparently high requirement for preformed amino acids and peptides (Leng, 1990). Supplementation of urea and molasses in the form of block or as liquid feed is often suggested for straw fed ruminants (Preston and Leng, 1984). During the block preparation, molasses was heated above 70 °C in the presence of urea which may lead to formation of 4-methyl imidazole causing hyperexcitability in cattle (Tillman *et al.*, 1957; Perdok and Leng, 1987) and unavailability of Ca and Mg to the animals due to chelate with the minerals (Vasloo, 1985). Moreover blocking of urea and molasses with other ingredients incurs cost of manufacturing.

The aim of this study is to determine effect of different level of urea and molasses liquid supplementation on nutrient intake, digestibility and rumen parameters of wheat straw fed to Awassi ram lambs.

Materials and Methods

Total fifteen 2 years old Awassi ram lambs (44.40±2.0 kg) were used as experimental animals in apparent digestion trial. They were allocated to five treatments (3 per treatment) at random within live weight. Treatments were wheat straw (Control; C), WS + 0.75% urea and 10% molasses (T1), WS + 1.5% urea+ 10% molasses (T2), WS + 0.75 %urea + 20% molasses (T3), and WS + 1.5 %urea + 20% molasses (T3) as fed basis. Also sulphur was added to diets at 10 % of the added urea. Ingredients and chemical composition of diets fed to ram lambs are presented in Table 1. Digestion trial was consist of a 10-day diet adaptation, 10-day feed intake

estimation, 4-day at 85% of *ad libitum* intake, with 7-day feces collection periods. During the collection period, the experimental animals were fed at a level of 85% of *ad libitum* intake at 8:00. They had free access to water at all times. Collection of feces was accomplished by housing the animals in creates and animals were fitted with specialized harnesses and bags which facilitate collection of feces. Feces were collected after excretion and bulked daily for total weight determination and then a 10% representative sample was taken to make running composite samples for individual animals. All the diet and faecal samples were preserved in sealed polyethylene bags stored in freezers until chemical analyses.

Rumen fluid pH values were measured immediately at 4 and 8 h post feedings by pH meter and NH3-N was analyzed according to AOAC (1980). Rumen fluid was filtered through four layer cheese cloth and 10 ml filtrate was stored at +4 C in refrigerator for NH3-N determinations. Feacal samples were dried in an oven at 65 °C for 48 h. Fecal and diet samples were ground to pass through 1mm screen for chemical analysis. Dry matter (DM), organic matter (OM) and crude protein (CP) contents of rations and faeces samples were determined (AOAC, 1990). Acid detergent fibre (ADF) and neutral detergent fibre (ADF) were determined as described by Goering and Van Soest, (1970). In vitro dry matter digestibilities (IVDMD) of diets were determined according to the procedure described by Tilley and Terry (1963) as modified by Marten and Barnes (1980). Ruminal fluid inoculum was obtained from two rumen fistulated ram lambs given alfalfa hay *ad-libitum.*

Statistical Analysis: Data for DMI, OMI , nutrient digestibilies and rumen parameters in this study were analyzed using a model for completely randomized design (CRD) using GLM procedure of SAS (1989). Orthogonal contrasts were used to compare treatments.

Results and Discustion

Effect of urea and molasses supplementation on DMI, OMI, nutrient digestibility, and rumen parameters of ram lambs fed with wheat straw are presented in Table 2. Supplementing urea and molasses increased DMI and OMI of ram lambs ($P < 0.05$). Increasing urea level from 0.75 to 1.50% and molasses level from 10 to 20% did not change DMI or OMI ($P > 0.05$). Similar results were reported for wheat straw by Dias-da-silva and Sunstol, (1986), rice straw by Djajanegera and Doyle (1989), and sorhum straw by Osman *et al.*, (1988). These increments are probably due to higher DM and OM digestibility of supplemented straw treatments with the consequent reduction in the retention time of solid digesta in the reticulo rumen (Chowdry and Huque, 1998). Wheat straw is very low in fermentable energy, protein and minerals, thus supplementation of these nutrients with molasses (fermentable energy source) and urea (protein source for microorganism) probably optimized rumen environment and improved intakes.

Dry matter and OM digestibility of unsupplemented wheat straw control diet (C) were found lower than urea and molasses supplemented treatment diets ($P < 0.01$). Increment of urea (T1-T3 vs T2-T4) and molasses (T1-T2 vs T3-T4) levels did not change DM and OM digestibility of diets ($P > 0.05$). This may be explained the increment of the microbial populations caused by the urea-molasses supplementation increased OM and DM digestibilities. Although low level of urea and molasses stimulated rumen functions, digestion, and intake, high levels did not have cumulative effects which supports former reports of Preston and Leng, (1984); Andrews *et al.*, (1972) and Capper *et al.*, (1989).

Exclusively straw consuming animals had a lower CP digestibility than urea and molasses supplemented animals ($P < 0.05$). Increment both urea (T1-T3 vs T2-T4) and molasses (T1-T2 vs T3-T4) increased CP digestibility of diets. This results is in agreement with observation of Van Niekerk and Jacobs (1985). In this present study, the higher CP digestibility in treatment diets was likely due to the high digestibility of urea and molasses N content. Control (WS) diet had a lower NDF digestibility than urea and molasses supplemented treatment diets ($P < 0.01$). While increasing molasses level (T1-T2 vs T3-T4) did not affect NDF digestibility ($P > 0.05$), increment of urea (T1-T3 vs T2-T4) improved NDF digestibility ($P < 0.05$). ADF digestibilities of control (WS) and treatment diets were found similar ($P > 0.05$). Increment of molasses levels (T1-T2 vs T3-T4) and urea levels (T1-T3 vs T2-T4) increased ADF digestibilities of diets ($P < 0.01$). Djajanegera and Doyle (1989) reported that urea pretreatment or supplementation with urea and sulfate increased digestibility of cell wall constituents of rice straw. Similar results were observed by Dias da silva and Doyle, (1989) for wheat straw. In contrast, Nuwanyakpa and Butterworth (1986) fed molasses-urea ad libitum to Ethiopian highland sheep and observed that teff straw fibre digestibility were negatively correlated with the intake of molasses –urea. The increase in cell wall constituents digestibility in present study may have been because of the low level of urea and molasses usage.

Ruminal pH was similar for the different diets, while NH3-N (mg/100 ml) was higher ($P < 0.01$) for the treatment diets. Increasing molasses level (T1-T2 vs T3-T4) increased NH3-N at 8 h post feeding and urea level (T1-T3 vs T2-T4) at 4 h post feeding. Djajanegera and Doyle (1989) had a similar observation that urea pretreatment or supplementation with urea and sulfate did not affect rumen pH value of rice straw fed sheep, but ammonia nitrogen concentration was increased from 12 mg/L on rice straw to 57 mg/L on urea pretreated rice straw, 104 mg/L on urea sulfate supplementation, 203 mg/L on urea pretreated and supplemented diet.

Table 1: Ingredients and chemical composition of diets consumed by ram lambs

Item	C	T1	T2	T3	T4
Ingredient Composition			% as fed basis		
Wheat straw	100	89.18	88.35	79.18	78.35
Urea	-	0.75	1.50	0.75	1.50
Molasses	-	10.00	10.00	20.00	20.00
Sulphur	-	0.070	0.15	0.070	0.15
Chemical Composition (DM basis, %)					
Organic matter	89.91	90.50	89.80	90.01	89.99
Crude protein	3.61	6.53	9.10	7.69	9.95
ADF	83.79	77.27	76.56	67.66	68.56
NDF	54.43	49.26	51.69	43.80	43.60

Table 2: Effect of urea and molasses supplementation on DMI, OMI, nutrient digestibility and rumen parameters of ram lambs fed wheat straw

	Treatments					Contrasts			
	C	T1	T2	T3	T4	SEM	C vs T1-4	T1 and T2 vs. T3 and T4 Significance level (P)	T1 and T3 vs. T2 and T4
Dry Matter Intake, Kg/day	531	743	744	715	737	79	0.043	0.823	0.888
Organic Matter Intake kg/day	478	673	668	644	664	71	0.042	0.820	0.917
In vivo digestibility %									
Dry Matter	40.08	47.50	50.99	51.32	51.97	2.14	0.001	0.288	0.356
Organic Matter	42.88	51.14	53.95	54.18	54.62	1.94	0.001	0.362	0.422
Crude Protein	15.71	45.66	62.90	54.89	65.50	2.58	0.001	0.045	0.003
NDF	41.40	46.80	49.50	43.07	47.84	1.24	0.002	0.054	0.012
ADF	37.04	33.27	39.79	39.00	43.71	1.33	0.232	0.004	0.002
Rumen pH 4 h-post feeding	6.97	7.40	7.20	7.10	6.83	0.21	0.510	0.158	0.310
Rumen pH 8 h-post feeding	7.17	7.10	7.17	7.27	7.03	0.19	0.910	0.933	0.676
NH3-N 4h post feeding mg/100ml	7.20	18.67	23.06	17.86	28.13	1.72	0.001	0.245	0.001
NH3-N 8h post feeding mg/100ml	7.37	18.13	15.73	18.93	30.40	2.71	0.001	0.017	0.125
In vitro DM digestibility %	35.91	39.15	45.47	46.42	46.06	1.45	0.001	0.022	0.067

Supplementation with urea and molasses improved rumen environment, feed intake and digestibility in Awassi ram lambs fed wheat straw. In terms of DM, OM intake and digestibilities, supplementing with 10% molasses and 0.75% urea seems to be enough supplementation for optimum utilization of wheat straw by ram lambs according to this study.

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