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Nutritional Aspects of Recycling Plants By-Products and Crop Residues (Corn Stalk) in Sheep

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Abstract: An experiment was conducted to study the effect of long term feeding of sheep with ureated corn stalk with or without addition of molasses on feed intake, ration digestibility (dry matter, crude protein, ether extract, Ash, crude fiber, neutral detergent fiber and acid detergent fiber) and ruminal parameters which including PH, ruminal TVFA`S and ammonia-nitrogen concentration. The effect of these treatments also on some blood metabolites as (glucose, total protein, total cholesterol, triglycerides, HLD-cholesterol, LDL-cholesterol, VLDL-cholesterol, total protein, albumin, globulin and BUN (Blood urea Nitrogen). The methods of preparation and storage of corn by-products (green corn and corn stalk) when fed as silage which enriched by urea also by yeast with addition of molasses on the same parameters. One year old six healthy Baladi rams, were used in this work (initial average body weight of 30 kg). They were divided into 3 similar groups (2 rams per each group). Crude protein content of treated corn stalk by 4%urea and /or 5% molasses was increased 75.4% and 113.2% respectively due to increase nitrogen content. Feed intake, EE, Ash, crude fiber, ADF and NDF were also significantly decreased. Total digestible nutrients and Digestion Coefficient of DM, OM, EE , NFE and CP did not show any significant difference. Digestion Coefficient of crude fiber fractions (CF, ADF and NDF) were significantly increased. The ruminal Total VFA values were significantly decreased whereas the ruminal Ammonia nitrogen concentration was significantly increased. Moreover, blood glucose, total protein, albumin, globulin and BUN were increased but total lipids, total cholesterol and triglycerides were decreased in treated groups compared with the control.

Key words: Corn stalk, corn stover, recycling of agricultural by products, urea treatment

INTRODUCTION

Recycling of plants by-products and crop residues to be used as animal feed help food processor to save money and also decrease the environmental pollution. In Egypt, among these crop residues left in field after harvesting is the corn crop resides which include (green corn, corn Stover, corn stalk and corn cobs, there are about 21 million tons of plant by-products produced annually (El-Shahat *et al*., 2006), about 13600 thousands tons of them are from corn (El-Shaer, 2004). Therefore, this work was carried out to study the effect of the chemical treatments of corn by-products (corn stalk) by non protein nitrogenous source as urea alone or supplemented with molasses as a source of soluble carbohydrates and to determine there nutritive value through digestibility trials and ruminal parameters (pH, TVFA`S and ammonia-nitrogen concentration). Moreover, the effect of feeding the experimental diets on some blood metabolites as (glucose, total protein, albumin, globulin, total lipids, triglycerides, cholesterol and BUN).

MATERIALS AND METHODS

This work was conducted at the farm of animal production in faculty of veterinary medicine, Zagazig University. Feedstuffs used in formulation of experimental diets were analyzed for moisture, crude protein, ether extract, Ash and crude fiber according to standard procedures of the AOAC (1980) as shown in Table 1. 96 kg of corn stalks were chopped using harvester chopper machine to about (1.5-2 cm length), and chemically treated with 4 kg urea by spraying chopped corn stalks with urea solution into layers, black plastic sheet was placed under treated corn stalks to minimize soil contamination (Prasad *et al*., 1998). Anther one air tight polyethylene sheets was placed over the layers leaving a free margin of about 0.5 m of plastic on each side corresponding to that under sheet. The upper and lower plastic edges fitted together by heavy load, then kept in for 21 days. During this period with adequate moisture content and suitable temperature urea could be decomposed into ammonia by presence of endogenous urease enzyme in the corn stalks. Sheets opened and the treated corn stalk was aerated for 24 h prior to feeding (to reduce the smell of ammonia). Other 100 kg of chemically treated corn stalk (4% urea) prepared by addition of 5% molasses (Attia-Ismail *et al*., 2002; Fouad and Deraz, 2002) as 91 kg of chopped corn stalks were chemically treated with 4 kg urea with addition of 5 kg molasses.

Six healthy Baladi rams, were used in this work. They were about 9 month old with initial average body weight ranged from 30-40 kg. They were divided into 3 equal

Table 1: Chemical analysis of feedstuffs used (on 100% DM basis) in formulation of experimental diets

	Nutrients composition (%)										
Ingredients	DM	OM	CP	CF	ADF	NDF	EE	Ash	Ca*	P*	NFE
Hay	91.020	90.990	15.998	29.992	38.010	49.994	2.4	9.01	1.27	0.25	42.6
Corn Stalk (CS)	89.995	93.001	5.004	35.008	44.007	70.001	1.3	6.999	0.35	0.19	51.689
Corn Fodder (CF)	37.020	93.007	8.995	25.030	29.001	48.002	2.4	6.993	0.5	0.25	56.582
Yeast*	94	93	48	3	-	-	1	7	0.1	1.56	41
Molasses*	77	86	6	-	-	-	0.8	14	0.9	0.08	79.2
Urea (46% Nitrogen)*	99	100	288	-	-	-	-	-	-	-	-
Yellow Corn	87.970	97.997	8.97	1.93	2.997	8.97	4.3	2.1	0.02	0.3	82.7
Wheat Bran	89.2	93.01	17.2	11.4	13.01	46.2	4.5	6.990	0.13	1.29	59.91
SBM	91.002	93.005	49.002	6.10	10.005	15.003	1.6	6.998	0.38	0.71	36.30
Dicalcium phosphate*	96	6	-	-	-	-	-	94	22	18.65	-

• According to typical composition feeds tables for cattle and sheep (2008)

groups (2 rams per each group). Each group was housed separately in shaded pen 4*4 meter. All rams were examined for parasitic infestation and prophylacticly dosed against internal parasites. Each ram was fastened in order to limit its movement. Voluntary feed intake by each ram is recorded daily. Fresh water was available twice daily for all experimental groups with application of water-proof bag for the fecal collection The rams were offered 60% concentrate mixture of yellow ground corn, soybean meal, wheat bran, dicalcium phosphate, salt (NaCl) and 40% roughages (hay or treated corn stalk (Table 2), twice a day in equal parts at 8 a.m and 5 p.m. as follow:

Group (A): Fed on concentrates mixture and (berseem hay).

Group (B): Fed on concentrates mixture and 4% ureated corn stalk.

Group (C): Fed on concentrates mixture and corn stalk treated with 4% urea and 5% molasses.

Three digestibility trails were carried out to determine the feeding value of experimental rations. Each digestibility trail included two sub-period, the preliminary period of 21 days (3 weeks) in which the experimental diet was offered to rams at regular time 8 am, 5pm, daily feed intake was recorded. And collections period (7 days) in which experimental diet was offered daily and also daily fecal out put was collected each 24 h (at 8 a.m) in collecting bags (having a polyethylene inner side and an outer water proof one) from each ram during the collection period, however, directly before collecting the feaces, the remaining food from previous day was collected and weighed to determine the actual amount of food consumed. The moisture content of daily fresh sample of food and feaces was determined in order to calculate the daily feed intake and fecal out put on dry matter basis.

A representative sample 25% of fresh feaces was taken every 24 h just after collection. The facal sample of each animal was dried for 48 h at 65°C for 48 h in hot air oven, thoroughly mixed, weighed and ground and kept in suitable bags to be used in chemical analysis. At the end of experimental period rumen fluid sample were taken individually from two animals of each group before feeding and at 0, 3 and 6 hours post feeding for 2 successive days through rubber tube with a suction pump. Each sample was strained through four fold of gauze and divided in two portions: the first portion was used immediately for the estimation of rumen PH and ammonia nitrogen concentration. The second portion was preserved by addition of 2 ml N/10 HCl and 1 ml orthophosphoric acid to each 2ml of ruminal juice for determination of total volatile fatty acids.

At the end of each digestibility trail, blood samples were collected from jugular vein of rams at 4 h post feeding, in evacuated centrifuge glass tubes, left for 2 h at room temperature then centrifuge for 10 min at 3000 rpm. Sera were carefully aspirated by pasture pipette and transferred into dry, clean and sterile labeled glass vials, then kept in deep freeze until analysis.

RESULTS AND DISCUSSION

Chemical composition of corn stalk, corn fodder: The chemical compositions of corn stalk, corn fodder are shown in Table 1. The nutrients composition % of corn stalk on DM basis were DM; 90, OM; ,93, CP; 5, CF; 35, EE; 1.3, Ash; 7 while the fiber fraction were CF; 35, NDF; 44, ADF; 70. and for the corn fodder on DM basis were DM; 37, OM; 93, CP; 9, EE; 2.4, Ash; 7 while the fiber fraction were CF; 25, NDF; 29, ADF; 48. These composition were in agreement with those of El-Shinnawy (1974) for corn stalk and Eweedah (2007) for corn fodder. It is clear that corn stalk contain relatively high level of DM, CF with low protein therefore corn stalk of low nutritive value. On other hand the corn fodder contain high amount of OM, CP and lower fiber than corn stalk so it has relatively high potential nutritive value.

Effect of addition of urea and molasses on chemical composition of corn stalk: The chemical compositions of ureated corn stalk and ureated corn stalks with molasses are shown in Table 3. These results revealed an increase in C P and ADF and decrease in EE, Ash,

Table 2: Physical composition and calculated analysis of the diets

Ingredients	Groups (A) control	(B) 4% ureated corn stalk	(C) 4% ureated corn stalk + 5% molasses
Yellow corn, ground	46.75	46.75	46.75
Wheat bran	7	7	7
Soybean meal	5.2	5.2	5.2
Dicalcium phosphate	0.25	0.25	0.25
NaCl	0.5	0.5	0.5
Vitamin. mineral premix**	0.3	0.3	0.3
Clover hay	40	-	-
4% ureated Corn stalk	-	40	-
4% ureated Corn stalk + 5%molasses	-	-	40
Total	100	100	100
Calculated analysis			
DM (%)	88.74	88.49	88.23
OM (%)	94.38	95.29	95.15
TDN (%)	71.61	73.06	73.38
CP (%)	14.35	11.45	12.21
CF (%)	14.02	15.46	14.76
ADF (%)	18.03	19.73	18.85
NDF (%)	28.21	35.09	33.69
EE (%)	3.37	2.92	2.91
Ash (%)	5.62	4.71	4.85
Ca (%)	0.6	0.23	0.24
P (%)	0.41	0.39	0.39
NFE	62.64	65.44	65.27

**Each one kgm of ASU Minreral mix powder contain Na 0.14%, (Ca) 1.10%, (P) 0.82%, (Mag) 0.30%, (K) .029%, (I) 0.03%, (Fe) 0.20%, (Cu) 0.03 %, (Co) 0.005%, (Mn) 0.20%, (Zn) 0.03% and (Se) 1.1%. Silver zinc vit mix contain 200.00000 IU Vit A, 200.00000 IU Vit D3, 10000 IU Vit E and 500 gm bastracen

Table 3: Chemical analysis of feedstuffs mixtures (on 100% DM basis)

Ingredients	Nutrients composition (%) DM	OM	CP	CF	ADF	NDF	EE	Ash	Ca	P	NFE
96% CS + 4% Urea	90.36	93.28	8.77	33.6	42.24	67.2	1.28	6.72	0.34	0.34	49.63
91% CS + 4%Urea + 5% Molasses	89.71	92.93	10.66	31.85	40.04	63.7	1.25	7.07	0.36	0.36	49.17

Table 4: Chemical analysis of fecal matter of experimental animals (on 100% DM basis)

Groups	Nutrients composition (%) DM	OM	CP	EE	CF	NDF	ADF	Ash	NFE
Control	50.25	83.5	14	2	20	40	25	16.5	47.5
4% ureated corn stalk	48.65	89.67	12	2	16	36	20	10.33	59.67
4% ureated corn stalk + 5% molasses.	46.75	89.68	13	2	16	36	20	10.32	58.68

NDF and NFE for 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses. Khadr (1990) reported similar result due to ammonization. Also, Borhami *et al.* (1999) mentioned that ammonization of corn stalks was proved to increase its CP content (3.5 vs., 8.3%) and the chemical analysis of corn stalks treated with 3% ammonia was as following: (as DM%) OM: 90.79, CP: 8.30, EE: 0.84, CF: 35.18, NFE: 45.95.

Effect of addition of urea and molasses on feed intake of corn stalk: The averages feed intake of diet containing ureated corn stalk alone and diet containing ureated corn stalk with molasses are shown in Table 5. The results revealed significant ($p<0.05$) decrease in feed intake diet containing ureated corn stalk and diet containing ureated corn stalk with molasses compared with the control. These results agreed with Ibrahim-Khalil (1994). The authors found that ammonia treatment of rice straw tended to increase feed intake where as supplementation of rice straw with El-Muffed appeared to decrease feed intake.

Digestion coefficient of ureated corn stalk and ureated corn stalk with addition of molasses: The digestion coefficient of different nutrients as affected by adding urea and urea with molasses on corn stalk are shown in Table 6. The results revealed that digestion coefficient values for DM did not show any significant difference in

Table 5: Average of daily feed intake (kg/day) of rams fed on diet containing ureated corn stalk and diet containing ureated corn stalk with molasses according to the body weight

	Groups		
Items	(A) Control	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk + molasses)
Average daily feed intake of concentrates (kg/day)	0.9[a]	0.8[b]	0.8[b]
Average daily feed intake of roughages (kg/day)	0.426± 0.01[a]	0.392±0.01[b]	0.339± 0.01[c]
The Average of total daily feed intake (kg/day)	1.33± 0.01[a]	1.20± 0.02[b]	1.14±0.02[c]

[Abc]Mean in the same row with different superscripts are different at ($p<0.05$)

Table 6: The effect of treatment of corn stalk by urea and by urea with molasses on digestion coefficients (Mean±SE), total digestible nutrients and digestible crude protein

	Groups		
Items	(A) (Control)	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk + molasses)
DM	69.23±0.45[b]	70.33±0.43[b]	72.89±0.45[a]
OM	72.86±0.39[b]	71.70±0.45[b]	74.26±0.45[a]
CP	69.43±0.47[b]	69.85±0.44[b]	71.26±0.43[a]
EE	82.20±0.25[a]	81.26±0.26[b]	82.54±0.25[a]
CF	50.56±1.38[c]	56.25±0.76[b]	62.74±0.63[a]
NFE	77.36±0.32[a]	74.08±0.49[b]	76.50±0.55[a]
NDF	52.83±1.05[c]	60.58±0.68[b]	65.45±0.55[a]
ADF	52.15±1.31[c]	59.59±0.78[b]	64.79±0.53[a]
Nutritive value %			
TDN*	72.55±0.37[b]	71.99±0.44[b]	74.06±0.38[a]
DCP	9.88±7.5[a]	8.43±5.60[c]	8.85±5.43[b]

[Abc]Mean in the same row with different superscripts are different at ($p<0.05$). TDN* = DCP + DCF + DNFE +DEE x 2.25 according to AOAC (1980)

urea treated corn stalk group. Significantly ($p<0.05$) increased in ureated corn stalk with molasses groups compared with the control .These values were 70.33±0.43, 72.89±0.45 and 69.23±0.45 respectively.

The same results with OM as the digestion coefficient values for it did not show any significant ($p>0.05$) difference in urea treated corn stalk group but significantly ($p<0.05$) increased in ureated corn stalk group with molasses compared with the control . On the other hand the digestibility % of DM and OM for hay with concentrates was higher (73.68 and 75.91 respectively). These results are consistent with those previously obtained (Maklad and Eman, 2006). Who mentioned that digestibility of DM and OM for corn stalk was improved by urea treatment. Also, these results were supported by Abd-El-Aziz (1986), who found that treatment of rice straw or corn stalk by anhydrous ammonia or urea solution (3-5%) increased ($p<0.05$) the apparent digestibility of dry matter and organic matter of rations containing rice straw or corn stalk for sheep. Moreover, Ghebrehiwet *et al*. (1988) found that urea treated rice straw (4%W/W) improved digestibility of organic matter. These results disagreed with Owen *et al*. (1971), who stated that in high concentrated steer finishing diets, the addition of 5% or 10% cane molasses did not significantly affect the digestibility of dry matter or fiber.

The digestion coefficient values for CP did not show any significant difference in group containing urea alone, whereas, it was significantly ($p<0.05$) increased in group containing urea with molasses (69.85±0.44 and 71.26±0.43 respectively) compared with the control (69.43±0.47). The previous results are fit with those of Nour (1986), who recorded that addition of 2% urea and 5% molasses to rice straw slightly increase digestibility coefficient (DM%: 56.81, CP: 33.60, EE: 75.84, CF: 48.93, NFE: 58.36). Nutritive value was also improved (the total digestible nutrients were 44.28 and digestible crude protein was 3.77). On the other hand Khadr (1995) reported that ammonia treatment did not significantly ($p<0.05$) increase the digestion coefficient of CP.

The digestibility coefficient values of EE and NFE did not show any significant difference for urea with molasses treated corn stalk groups compared with the control and they were significantly decreased in urea treated corn stalk alone.

The digestibility coefficient values of crude fiber fraction (CF, ADF and NDF) significantly ($p<0.05$) increased for ureated corn stalk and ureated corn stalk with molasses groups (56.25±0.76 and 62.74±0.63 respectively for CF, 60.58±0.68 and 65.45±0.55 respectively for NDF and 59.59±0.78 and 64.79±0.53 respectively for ADF) compared with the control (50.56±1.38 for CF, 52.83±1.05 for NDF and 52.15±1.31 for ADF). These results are compatible with those obtained by Oji *et al*. (2007), who reported that treatment of rice straw with 4% urea improved crude fiber, NDF and ADF digestibility (9.24 and 7.67 respectively). Additionally, the digestion coefficient of DM and NDF were improved. These results

may be explained as intermolecular bonds that cement cellulose and hemicellulose was ruptured by ammonization (Campling *et al*., 1962; Tarkow and Feist, 1969). Also, Saenger *et al*. (1982) stated that ammonization improved accessibility to microbial enzymes and increased the total nitrogen which lead to stimulation of cellulytic bacteria in the rumen.

Total digestible nutrients of ureated corn stalk and ureated corn stalk with addition of molasses: The results of total digestible nutrients revealed that the TDN values of ureated corn stalk with molasses was significantly ($p<0.05$) higher while the ureated corn stalk alone did not show any significant difference compared with the control (74.06±0.38, 71.99±0.44 and 72.55±0.37 respectively) (Table 6). Higher TDN values of urea and urea with molasses treated corn stalk may be explained by higher digestible nutrients of them. These results are in accordance with that of El-Shaer (2004) who mentioned that addition of molasses to rice straw improved the nutritive value (DCP% and TDN%).

Digestible crude protein of ureated corn stalk group and ureated corn stalk with molasses group: The results of digestible crude protein revealed significant improvement in the digestibility of crude protein in ureated corn stalk group and ureated corn stalk group with molasses compared with the control (Table 6). These results are in agreement with those of Maklad and Eman (2006), who found that feeding of lactating Friesian cows on concentrate feed mixture and ammoniated rice straw (3%) increases ($p<0.05$) DCP. Moreover, El-Shaer (2004) mentioned that addition of molasses to rice straw slightly increased the digestibility and improved the nutritive value (DCP% TDN%).

Rumen fermentation parameters: The pH is one of the most important factors affecting the fermentation in the rumen and influences its functions. It varies in regular manner depending on the nature of the diet and on the time that it is measured after feeding and reflecting changes of organic acids quantities in the ingesta. Rumen pH value is not constant; it fluctuates throughout the timer of sampling, which reflects the changes of organic acids concentration in the rumen acid and absorption across the rumen wall and neutralization by salivary buffers (Salem, 1976).

Table 7 revealed that pH values were above 6 at different sampling times and at zero time. There no significant difference in pH values between all groups except a significant ($p<0.05$) decreased in ureated corn stalk with molasses group, at 3 and 6 hours post feeding compared with the control. These results agreed with Van Soest (1983) who mentioned that the optimum pH value for growth of cellulytic organisms is 6.7 and the range for normal condition is about ±0.5 pH units. The results of the present study also showed that the lower pH values were at 3 h post feeding (6.23±0.02, 6.38±0.06 and 6.23±0.05 for control, 4% ureated CS and 4% ureated CS with 5% molasses groups respectively). Then it slightly increased at 6 h after feeding for all diets (6.68±0.08, 6.63±0.02 and 6.50±0.04 for control, 4% ureated CS and 4% ureated CS with 5% molasses groups respectively). The previous results agreed with Sutton (1969), who reported that the infusion of simple sugars into rumen of cow fed either a hay or flaked corn diet increased the total VFA concentration and reduced the pH. Allam (2008) reported also that, ruminal pH values of rice straw treated with 4% urea decreased at 3 hours after feeding, then slightly increased at 6 h after feeding. Also total VFA concentration increased after feeding reaching their peak at 3 h, then decreased at 6h post feeding. These results disagreed with Jain *et al*. (2005) reported that pH was slightly higher in goats fed urea molasses mineral granules and it was 7.22. They also reported that the TVFA concentration was significantly higher ($p<0.05$) (10.55 meq/100 ml).

Ammonia nitrogen concentration: The ammonia nitrogen concentration was significantly increased in ureated corn stalk and ureated corn stalk with molasses at zero time, 3 h and 6 h post-feeding compared with the control, the maximum values of ammonia- N were found 3 h after feeding as it being significantly ($p<0.05$) increased (30.98±0.60, 26.85±0.69 for 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses groups respectively versus 12.25±0.67 for the control). Ammonia-N concentration after 6 h started to decline but still significantly higher than the control, recording 23.10±0.40, 19.25±0.67 for 4% ureated corn stalk and 4% ureated corn stalk +5% molasses respectively versus 10.50±0.40 for the control group (Table 8). These results agreed with Farghly (1993) who found that the ruminal ammonia concentration increased by the addition of urea to rice straw as a source of nitrogen all over the sampling period. He also reported that the ruminal ammonia concentration was low at zero time and increased with time to reach maximum value at 3 h, then decreased at 6 h after feeding. Furthermore, This high level of ammonia may be due to higher crude protein intake, deaminaition of amino acids and increased availability of free ammonia in rumen urea treated feed (Khadr, 1990).

Total VFA: The results shown in Table 9 revealed that at zero time the total VFA values significantly decreased in ureated corn stalk and ureated corn stalk with molasses compared with the control. At 3 h post feeding, the total VFA values were significantly increased. At 6 h post-feeding, these values were non significantly changed among groups. The lowest total VFA values were

Table 7: Effect of addition of ureated corn stalk and ureated corn stalk with molasses in the diets on ruminal pH (Mean±SE) of rams compared with control diet

	Groups		
Time post Feeding (h)	(A) (Control)	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk + molasses)
0	7.30±0.04[a]	7.05±0.03[a]	6.85±0.10[b]
3	6.23±0.02[a]	6.38±0.06[a]	6.23±0.05[a]
6	6.68±0.08[ab]	6.63±0.02[ab]	6.50±0.04[b]

[Abc]Mean in the row with different superscripts are different at (p<0.05).

Table 8: Effect of addition of ureated corn stalk and ureated corn stalk with molasses in the diets on ruminal ammonia nitrogen concentration (Mean±SE) (mg/100 ml) of rams, compared with control diet

	Groups		
Time post Feeding (h)	(A) (Control)	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk + molasses)
0	8.50±0.58[c]	18.9±0.40[a]	16.10±0.40[b]
3	12.25±0.67[c]	30.98±0.60[a]	26.85±0.69[b]
6	10.50±0.40[c]	23.10±0.40[a]	19.25±0.67[b]

[Abc]Mean in the row with different superscripts are different at (p<0.05)

Table 9: Effect of addition of ureated corn stalk and ureated corn stalk with molasses in the diets on ruminal total VFA concentration (Mean±SE) (meq/100 ml) of rams, compared with control diet

	Groups		
Time post Feeding (h)	(A) (Control)	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk+ molasses)
0	5.98±0.08[a]	5.30±0.15[b]	4.30±0.21[c]
3	7.75±0.17[c]	8.37±0.08[b]	9.15±0.16[a]
6	6.53±0.25[b]	6.35±0.02[b]	6.73±0.16[ab]

[Abc]Mean in the row with different superscripts are different at (p<0.05)

recorded before feeding (at zero time) for all treatments (5.98±0.08, 5.30±0.15 and 4.30±.0.21 for control, 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses respectively). At 3 h after feeding the sheep on 4% ureated CS +5% molasses, it was significantly increased (p<0.05) reaching its peak (9.15±0.15) followed by 4% ureated corn stalk group (8.37±0.08) than the control (7.75±0.17). After 6 h post feeding VFA values decreased. The previous results agreed with Preston (2008), who suggested that the total VFA concentration in the rumen would be higher for cattle fed high molasses diets than for cattle fed forage or grain based diets. Borhami *et al.* (1999) mentioned that feeding of barki female sheep on treated corn stalk (3% ammonia) increased total volatile fatty acids values (ml eq/100 ml), it was be maximized after 3 h (7.72 before feeding, 9.88, 13.23 and 11.29 after 1, 6 and 3 h respectively). Allam (2008) reported total VFA concentration increased after feeding reaching their peak at 3 h, then decreased at 6 hour post feeding.

Blood parameters: The present results showed that feeding of rams on ureated corn stalk increased the blood glucose level (Table 10). Blood glucose level of rams fed on 4% ureated corn stalk + 5% molasses was the highest level (64 mg/dl), than rams fed on 4% ureated corn stalk (62 mg/dl)compared with the control (59 mg/dl). These results agreed with Briggs (1967) who reported that supplementation of readily available carbohydrates with NPN to the basal diet increased the level of blood glucose.

Total protein, albumin and globulin: The results revealed that rams fed on 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses has the highest blood Total protein, albumin and globulin level compared with control group (Table 10), but they still within the normal range. Theses results agreed with Farghly (1993) who recorded that the normal blood total protein, albumin and globulin level of rams (6.67, 3.27 and 4.30 g/100 ml respectively).

Total lipids, cholesterol and triglycerides: It was found that, rams fed on 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses groups had normal blood total lipids, cholesterol and triglycerides. Lower values were seen in groups fed 4% ureated corn stalk and 4% ureated corn stalk with 5% molasses compared with control (Table 10). The previous results agreed with Kubesy (1987) who found that the levels of serum total lipids, total cholesterol were not significantly affected by urea supplementation for rahmani sheep.

Blood urea nitrogen: Urea is produced in the liver from catabolism of protein in the ornithine, citrulline, and arginine cycle.

Table 10: Concentration of some blood metabolites of rams fed on diets containing ureated corn stalk and diet containing ureated corn stalk with molasses, compared with control one

	Groups		
Parameters	(A) (Control)	(B) (Fed on diet containing ureated corn stalk)	(C) (Fed on diet containing ureated corn stalk + molasses)
Glucose (mg/dl)	59	62	64
Total protein (g/dl)	6.3	7.00	7.2
Albumin (g/dl)	2.7	2.8	2.9
Globulin (g/dl)	3.6	4.1	4.3
Total lipids (mg/dl)	250	190	192
Cholesterol (mg/dl)	117	76	78
Triglycerides (g/dl)	35.56	32.50	33.40
Blood urea nitrogen (mg/dl)	30	31	33

The results revealed that rams fed on 4% ureated corn stalk with 5% molasses groups have blood urea nitrogen within normal range or may be slightly higher (Table 10). These results agreed with Lewis (1957), who mentioned that ammonia level in portal blood parallel to the changes occurs in rumen ammonia. Ortigues *et al.* (1989) reported that no treatment differences were recorded in the level of blood-urea-nitrogen of cattle fed hay alone or with ureated molasses (32% CP) injected in the ball or as liquid supplement (self-fed in lick tanks); or soybean meal. Additionally, El-Khadrawy (1991) found that the mean value of plasma urea-N in untreated and treated straw fed bulls were 15.83 and 15.84 mg percent, respectively and there was no statically significant difference due to different dietary treatments observed for plasma urea-N. Also, Taghizadeh *et al.* (2007) reported that the blood urea-n concentration in corn silage treated with 1% urea was (19.5 mg dl) which is higher due high releasing of ammonia in rumen resulting of high absorption of ammonia from the rumen to the blood.

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