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EVALUATION OF ALFALFA HAY AND SILAGE IN COMPLETE DIETS FOR LACTATING GOATS

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SUMMARY

Third and fourth cuts of alfalfa forage were conserved as hay or ensiled either untreated or treated with 1.3 g of HCHO/100g of CP and fed to lactating Zariabi goats (three groups, 6 each group).

The obtained results indicated that silage treated with HCHO had the lowest pH and concentrations of NPN, NH_3, butyric acid and protein solubility, while acetic acid concentration increased. The improvements in the digestibilities of nutrients reflected better feeding values in terms of TDN, DCP and NEl for diet containing treated-AS than AH or AS. Rumen pH and concentration of VFA were similar for all diets.

Although dry matter intake was comparable, yields of milk, 4% FCM and its component were higher when treated silage were fed. Milk NPN concentration and rumen NH_3-N concentration were lower on treated-silage diet. On the other hand, yields of true protein-N, CN, NCN and whey-N in milk were higher for goats fed treated-silage diet. This indicated efficiency of the protection and/or better synchronization between availability of energy and release of NH_3-N. Plasma concentration urea-N was decreased when the HCHO-treated silage, whereas, concentrations total protein and albumin were increased.

It could be concluded that formaldehyde treatment effectively improved utilization of nutrients in alfalfa silage by lactating goats based on better fermentation characteristics during ensiling and in the rumen and improved feeding values. In addition, formaldehyde treatment could be recommended for the alfalfa silage to improve milk production and its components.

Keywords: Alfalfa, hay, silage, goats, milk production, milk composition, milk protein fractions

INTRODUCTION

Alfalfa forage, conserved as hay or silage, is a major dietary component for lactating animals. As much as 75 to 87% of the total N present in alfalfa silage may be NPN (Muck, 1987 and Broderick *et al*., 1990). Moreover, alfalfa protein is subjected to extensive degradation during ensiling, particularly that in alfalfa silage (AS), is poorly utilized because of its extensive degradation in the rumen (Merchen and Satter, 1983) and Hristov *et al*., 2001), solubility *in vitro* (Nagel and Broderick, 1992), and excessive production of NH_3 in the rumen (Vagnoni and Broderick, 1997), which suggest that conservation of alfalfa as silage may reduce ruminal protein escape, synthesis of ruminal microbial CP, or both, relative to conservation of alfalfa as hay. The NRC (1989) and Beauchemin *et al*. (1997) reported that the rumen undergradable protein (RUP) content of alfalfa hay (AH) was 18% greater than that of its silage (AS).

Formaldehyde reduces protein degradability by forming cross-links between protein chains and has antimicrobial properties that may alter the bacterial population and fermentation pattern of silage (Woolford, 1975).

Post ruminal infusion of protein (as casein) in lactating cows fed a diet containing 98% of DM from AS increased milk and protein yields by 5.5 and 0.18 K/d, respectively and infusion of energy (as glucose) did not increase yield (Dhiman *et al*., 1993). These results indicated that protein, but not energy, was the first limiting nutrient for milk yield in cows fed diets high in AS. For lactating dairy cows fed AH or AS as the sole forage, addition of 3% fish meal, a high source of RUP, increased milk protein yield by 30 and 100 g/d, respectively (Broderick, 1995).

Poor performance on diets high in AS might result from inadequate capture of dietary N as absorbable protein. Also, lactating cows fed formaldehyde-treated AS or formic acid-treated AS as the sole forage, increased milk yield and milk protein yield by 3.3, 0.06, 3.40, 0.11 kg/d, respectively than those fed untreated silage (Nagel and Broderick, 1992).

Increased dry matter intake and N retention have been reported in sheep (Barry *et al*., 1978), dairy heifers (Waldo *et al*., 1971), and dairy cows (Nagel and Broderick, 1992) fed treated-AS.

The objective of this work was to study the effect of different forms of alfalfa as hay, untreated silage and formaldehyde-treated silage in lactating goat's ration on milk yield, milk components yield, milk protein fractions, nutrients digestibility, some rumen liquor parameters and plasma metabolite concentrations. In addition, the effect of formaldehyde on silage fermentation and protein solubility were determined.

MATERIALS AND METHODS

The current investigation was carried out at El-Serw Experimental Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

1. Preparation of Experimental diets:

Alfalfa was grown at El-Serw Agriculture Research Station. Third and fourth cuts in second year before bloom were used in this experiment. The harvested plants were divided into two parts. One part was wilted to approximately 85% DM, chopped to a length of 5 cm and conserved in a stack and stored under shelter. The other part of alfalfa was allowed to wilt to approximately 33% DM and then ensiled in double plastic bags (130 x 80 cm). Forage was ensiled untreated or treated with formaldehyde (1.3 g of HCHO / 100 g of CP).

2. Experimental animals and their management:

Eighteen lactating Zaraibi goats in mid-lactation were balanced for body weight, milk yield, days after calving and parity. The animals were divided into 3 groups and received one of 3 experimental diets. Diets were formulated to contain (% of DM) 50% alfalfa hay or silage (Table 1). The diets were prepared once daily as a total mixed ration and the animals were fed twice daily. The experimental diets were formulated and offered in quantities to cover their requirements calculated according to NRC (1981). Diets were calculated every two weeks based on the average milk production and body weight. Animals of each group were housed in stalls (3 x 3 m) and fed in groups. Fresh and clean drinking water was available all times. The experiment began after 10 days of adaptation to the different rations and lasted 12 weeks.

Table 1. Formulation of the experimental diets (% of DM)

	Experimental diets*		
Ingredients	**AH**	**AS**	**FAS**
Alfalfa as:			
Hay (Chopped)	50	--	--
Untreated silage	--	50	--
Formaldehyde-treated silage	--	--	50
Yellow corn	22.50	22.50	22.50
Undecorticated cotton seed meal	11.00	11.00	11.00
Wheat bran	14.0	14.00	14.00
Limestone	1.25	1.25	1.25
Salt	0.75	0.75	0.75
Minerals and vitamins mixture**	0.50	0.50	0.50

* AH: Alfalfa hay, AS: Untreated alfalfa silage
FAS: Alfalfa silage treated with formaldehyde.
** Each Kg contained P, 40 g, Ca, 50 g, Mg. 50 g, Mn, 4.5 g, S, 12 g, Fe, 7 g, Cu, 2 g, Se, 12 mg, Co, 50 mg, vitamin A, 2000000 IU, vitamin D, 20000 IU and vitamin E, 20 mg (Biomix 33, Produced by Biochema, A.R.E., Cairo).

Animals were hand milked twice daily and milk yield of individual animals was recorded at each milking. Fat corrected milk (4% FCM) for each animal was calculated using the formula of Gaines and Overman (1938). Milk was sampled biweekly form two consecutive milkings, and composited according to milk yield. Composite milk samples were analyzed for contents of total solids (TS), ash, fat, total nitrogen (TN), non-casein nitrogen (NCN), and non-protein nitrogen (NPN).

Total solids in milk were determined by drying at 105°C for 4 hours to a constant weight, milk fat was analyzed following the Gerber method (British Standard Institution's Method, 1955), and protein was analyzed using the Kjeldahl method (N x 6.38). Lactose was determined by difference after ashing in a muffle furnace (Model RHF, 1200, England) at 750°C for 4 hours.

Solids-not fat (SNF) were calculated as the difference between TS and fat. Non-casein nitrogen (NCN) was determined by Kjeldahl analysis of the filtrate by using Whatman paper No. 42 after precipitation with 10% acetic acid and 1 N sodium acetate (Ling, 1963). Non-protein nitrogen (NPN) was determined by Kjeldahl analysis of the filtrate by using Whatman paper No. 42 after precipitation with 15% trichloroacetic acid, TCA (Ling, 1963).

Casein-N was calculated as the difference between TN and NCN, true protein-N was calculated as the difference between TN and NPN. Whey N was calculated as the difference between true protein-N and casein-N. Formaldehyde in the produced milk was assessed using Nash's reagent according to Naiem (1999).

3. Metabolism trail:

Metabolism trials were carried out at the end of the feeding experiment using the 3 animals of each group to determine the digestion coefficients and nutritive values of the tested rations used in the feeding trial. Fecal samples were gripped from the rectum of each animal twice daily during the collection period (5 days). Acid insoluble ash (AIA) was used as a natural marker (Van Keulen and Young, 1977).

Samples of alfalfa silage, chopped alfalfa hay and concentrate mixture were collected weekly throughout the experiment. Dry matter was assayed after the samples were ground through a 1 mm screen hammer mill and dried at 105°C for 3 hours except those of silages and feces were first dried at 60°C for 48 hours and analyzed for ash, crude fiber, crude protein, ether extract according to AOAC (1980).

4. Alfalfa silage quality determination:

Samples of alfalfa silage were taken during the experimental period (4 samples within 12 weeks) and kept frozen at -20°C until analysis. Silage samples were thawed, then extracted with distilled water and pH was measured immediately using battery operated pH meter. Water extracts were analyzed for organic acids fractions by gas liquid chromatograph (GLC). Extract (20 ml) was deproteinized using 5 ml of 25% (wt/vol) TCA. The TCA extracts were analyzed for NH_3-N (Conway and O'Mally, 1957) and NPN (Muck, 1987).

5. Rumen fluid parameters:

During the last week of the experimental period, rumen fluid samples were taken from four animals in each group just before offering morning meal and 4 hours post-feeding using stomach tube. Rumen-fluid pH was measured immediately on a fresh aliquot using battery operated pH meter, then samples were filtered through two layers of surgical gauze, acidified with 1.0 ml of H_2SO_4 (50% v/v) to retard ammonia and kept frozen at -20°C until analysis of NH_3-N (Conway and O'Mally, 1957) and total volatile fatty acids (Warner, 1964). Twenty milliliters of strained rumen fluid were prepared for volatile fatty acids fractions analysis by GLC.

6. Blood parameters:

During the last week of the experimental period, blood samples were collected in heparinized test tubes from the jugular vein from three animals of each group before morning feeding and 4 hours post-feeding. Blood samples were centrifuged immediately at 3500 revolution per minute (rpm) for 15 minutes to separate blood plasma and stored at -20°C until further analysis. Blood plasma was analyzed for urea-N (Patton and Crouch, 1977), total protein (Peters, 1968), and albumin (Webster, 1974). Globulin concentration was calculated by difference (Total protein-albumin).

7. Statistical analysis:

Data were subjected to statistical analysis by the computer program of SAS (1996) using the General Linear Model (GLM). Means were compared according to Duncan/s Multiple Range Test at 0.05 level (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical composition:

Formulation of the experimental diets and the chemical composition of the ingredients used to formulate the total mixed rations are presented in Tables 1 and 2. The chemical composition of the ingredients were within the normal published ranges (Abu-Raya, 1967 and Broderick, 1995). However, OM, CF, and NFE content of alfalfa silage were relatively greater than those of alfalfa hay (AH).

Table 2. Chemical composition of the tested ingredients and the experimental diets

Items	DM (%)	Chemical composition on DM basis (%)					
		OM	CP	EE	CF	NFE	Ash
Alfalfa as:							
Hay	88.14	86.15	18.00	2.57	25.65	39.93	13.85
Untreated silage	33.78	88.70	18.23	2.96	23.55	43.96	11.30
Formaldehyde-treated silage	33.53	88.47	18.36	3.03	22.73	44.35	11.53
Yellow corn	88.29	98.06	9.04	2.86	2.91	83.25	1.94
Undecorticated cotton seed meal	90.05	94.30	24.43	5.35	28.72	38.80	5.70
Wheat bran	88.06	94.76	13.31	3.76	9.72	67.97	5.24
Calculated chemical composition of the tested diets							
AH	100	88.77	15.58	3.04	17.99	52.16	11.23
AS	100	90.05	15.69	3.24	16.95	54.17	9.95
FAS	100	89.93	15.76	3.27	16.53	54.37	10.07

Fermentation characteristics and N solubility:

The results in Table 3 indicated that the treatment of alfalfa silage with formaldehyde tended to cause a high desirable fermentation as indicated by the lower pH and butyric acid and higher lactic acid content compared to untreated silage. The results are in agreement with previous reports (McDonald and Edwards, 1976, Nagel and Broderick, 1992). Treated silage with formaldehyde was most effective in preventing protein solubility, probably by rapidly decreased pH and inhibiting plant proteases. Reduced protein solubility was demonstrated by the lower NPN, NH_3 in FAS versus AS. Similar results have been reported (Barry *et al*., 1978).

Formaldehyde treatment of silage tended to decrease NPN and NH_3 by 20 and 50%, respectively compared with those of untreated silage. Broderick *et al*. (1990) reported that alfalfa ensiled with 30 to 55% DM contained 62 to 76% NPN, mean NPN in the present trial was 39% of total N. Messman *et al*. (1994) observed that drying fresh alfalfa to AH reduced the amount of total soluble protein that was identifiable electrophoretically by about 25% and ensiling reduced it by more than 90%.

Digestion coefficients and nutritive values:

The results of digestibility and feeding values are presented in Table 4. It was clear that there were significant differences ($P< 0.05$) among means of nutrients digestibility except EE digestibility of all the tested diets. The highest values for all nutrient digestibility was those of diet FAS and the lowest values were of diet AH. The FAS diet was higher by about 4.2% or 2.9% for CP digestibility than diets AS or AH, respectively. The improvement in CP digestibility may be related to formaldehyde treatment as a protection method of protein, hence, reducing protein solubility (Table 1) and degradability in the rumen and there for provided more dietary protein for digestion and absorption in the small intestine, which is probably is better than of microbial protein (Nagel and Broderick, 1992, Atwal *et al*., 1995 and El-Shabrawy, 2000).

Table 3. Fermentation characteristics and *in vitro* N solubility of alfalfa silage

Item	Silage		Hay
	Untreated	**HCHO-treated**	
No. of sample	4	4	--
DM (%)	33.78	33.53	--
pH	4.11	3.88	--
Total N (TN), % DM	2.92	2.94	--
NPN, % TN	43.11	34.60	--
NH_3-N, % TN	7.20	5.20	--
Organic acids (%):			
Lactic	40.33	44.82	--
Acetic	35.37	36.78	--
Propionic	14.13	14.83	--
Isobutyric	2.36	0.26	--
Butyric	6.56	2.61	--
Isovaleric	0.66	0.16	--
Valeric	0.59	0.54	--
Soluble N (% Total N*)	72.1	30.15	46.17

* In borate phosphate buffer solution (El-Shabrawy, 1996).

Table 4. Effect of the experimental diets on digestion coefficients (%) and nutritive values

Item	Experimental diets			± SE
	AH	**AS**	**FAS**	
Digestibility coefficients (%):				
DM	64.60^c	67.66^b	72.31^a	0.43
OM	66.59^c	69.20^b	74.29^a	0.43
CP	76.31^b	75.07^b	79.26^a	0.44
EE	66.31	67.06	66.18	0.36
CF	62.43^b	66.17^a	67.47^a	0.52
NFE	69.35^c	71.23^b	73.18^a	0.43
Feeding values (%):				
TDN	63.81^c	66.45^b	68.28^a	0.14
DCP	11.89^b	11.78^b	12.49^a	0.07
NEl*	1.44^c	1.50^b	1.55^a	0.01

* Net energy for lactation calculated according to NRC (1981).
Means within the same row having different superscripts are significantly different ($P< 0.05$).

The feeding values expressed as TDN, DCP and NEl followed the same trend of digestibility coefficients. The DCP values were higher ($P< 0.05$) in diet FAS than diets AH and AS. The higher DCP with the protection of protein was probably because of higher CP digestibility.

Certainly the influences on the digestibility of nutrients along the whole alimentary tract are mainly reflections of fermentation in the rumen in terms of availability of N for rumen microbes as a result of protein protection.

Ruminal parameters:

The results in Table 5 indicate that the ruminal pH and total VFA's values did not differ among the tested diets. In contrast, NH_3-N concentration was higher ($P< 0.05$) in diet AS than diet AH. The extensive conversion of protein to NPN that occurs during silage fermentation, results in excessive production of NH_3-N in the rumen, which suggested that conservation of alfalfa as silage may reduce ruminal protein escape, synthesis of microbial CP, or both, relative to conservation of alfalfa hay (Peltekova and Broderick, 1996 and Vagnoni and Broderick, 1997). Ruminal NH_3-N concentration tended to be lower ($P< 0.05$) when goats were fed treated silage with formaldehyde than those fed untreated silage diets.

This indicates that dietary rumen undegradable protein (RUP) could be increased without affecting microbial fermentation in the rumen and additional RUP was utilized efficiently (Nagel and Broderick, 1992, Baker *et al*., 1996 and El-Fadaly *et al*., 2003). The ruminal pH of goats fed the tested diets was above 6.0, which was identified as critical pH for maintaining ruminal fiber digestion (Hungate, 1966).

Table 5. Mean effect of feeding the experimental diets on some rumen parameters of Zaraibi goats

Items	Experimental diets			±SE	Sampling time (hr)		±SE
	AH	AS	FAS		0	4	
pH	6.17	6.32	6.20	0.06	6.47^a	5.99^b	0.05
NH_3-N (mg/100 ml RL)	19.97^b	21.94^a	17.79^c	0.26	18.19^b	21.61^a	0.22
VFA (meq./100 ml RL)	6.49	6.61	6.55	0.22	5.90^b	7.20^a	0.18
Individual volatile fatty acid (mol/100 mol)							
Acetic acid	55.00^c	57.00^b	60.00^a	0.41	54.33^b	60.33^a	0.33
Propionic acid	23.00^b	24.00^a	22.00^c	0.15	21.67^b	24.33^a	0.12
Butyric acid	14.00^a	14.00^a	11.00^b	0.18	12.40^b	13.60^a	0.14
Acetate / Propionate	2.39^b	2.37^b	2.73^a	0.02	2.52	2.48	0.02
Act. + But. / propionate	3.00^b	2.96^b	3.23^a	0.03	3.09	3.04	0.02

Means within the same row having different superscripts are significantly different ($P< 0.05$).

The highest pH value (6.47) before feeding, and decreased significantly ($P< 0.05$) to be 5.99 at 4 hours post-feeding. Robinson and McQueen (1994) observed a similar reduction in pH after feeding, which might have been due to increasing availability of fermentable substrate after feeding. In contrast, the highest ($P< 0.05$) NH_3-N and VFA's values (21.61 mg/100 ml and 7.20 meq./100 ml) were obtained after feeding. The pattern of VFA's and NH_3-N values followed the reverse trend of the obtained pH values at all times (Shafie and Ashour, 1997 and El-Ayek *et al*., 1999), and reflecting the pattern of fermentation in the rumen. Acetate and propionate concentrations were higher (P< 0.05) on diet AS than diet AH, but butyrate, acetate to propionate and acetate plus butyrate to propionate were not different (P> 0.05). Treatment of alfalfa silage with HCHO led to increase acetate and tended to decrease propionate concentrations, therefore, the ratio of acetate to propionate (A : P) and acetate plus butyrate, to propionate were higher in goats fed FAS than those fed AH or AS. These results are in harmony with the findings of Pires *et al*. (1997).

Milk yield and its component:

The results in Table 6 indicated that dry matter intake and body weight gain were similar for all diets. Higher responses for milk and 4% FCM yields by 12.5 and 14.2% were found, respectively for goats fed FAS than for goats fed AS, however, the differences were not significant. Nagel and Broderick (1992) showed that milk yield improved by 11.3 for cows fed HCHO-treated alfalfa silage than those fed untreated. Fat, protein, lactose, SNF and TS productions were greater (P< 0.05) on diet FAS than on diet AS. There were no significant differences in yields of milk, protein, lactose, SNF and TS for goats fed AS and AH. On the other hand, 4% FCM, milk fat yield and fat, TS percentages were higher significantly. The improvement in the milk yield and its components associated with feeding HCHO-treated alfalfa silage might be due to the decreased protein solubility and degradability in the rumen, consequently more ruminal undegradable protein for digestion and absorption in the small intestine was available, thus increased the availability of amino acids in the small intestine (Nagel and Broderick, 1992, El-Ayek *et al*., 1999 and El-Shabrawy, 2000).

Vagnoni and Broderick (1997) reported that the response of milk protein secretion to RUP was greater for cows fed AS diets than for cows fed AH diets, which partly may explain the higher milk yield and its component of goats fed FAS than those fed AH in the present study.

The increase of milk fat % of goats fed FAS may be due to the improvement in ruminal fermentation particularly crude fiber digestibility (Table 4), producing more acetic acid (Table 5), which is the main precursor for milk fat synthesis. Overton *et al*. (1996) reported that microorganisms might benefit from the increase of ruminal acetate fermentation stimulating synthesis of lipids.

Table 7 presents the effect of feeding the experimental diets on fractions of milk nitrogen. Total nitrogen (TN) content of milk increased when goats were fed HCHO-treated diet. True protein nitrogen, casein nitrogen (CN) and whey-N values took the same trend of TN. On the contrary, using of HCHO to protect dietary protein decreased non-protein nitrogen (NPN) content of milk, which reflects dietary differences in RUP (Akayezu *et al*., 1997).

No significant effects (P> 0.05) on TN, true protein-N, NCN, CN, and whey-N contents were found between animals fed AS and those fed AH, but NCN % and NPN yield were significantly higher with animals fed AS.

The increase in milk protein content corresponded to an increase in true protein content as the NCN, CN and whey-N contents in milk increased. Milk NPN concentration has been used as an indicator relative protein to energy intake and efficiency of ruminal N capture (Barry *et al*., 1978 and Oltner and Wiktorsson, 1983).

Table 6. Mean effect of feeding the experimental diets on dry matter intake, body weight change, production of milk and milk components

Item	Experimental diets			± SE
	AH	AS	FAS	
Number of Goats	6	6	6	--
DMI (kg/head/day)	1.700	1.700	1.700	--
BW changes (Kg/head/day)*	+1.17	+1.33	+1.33	0.49
Milk yield (g/day)	894[b]	1038[ab]	1168[a]	59.21
FCM (g/day)	831[b]	1022[a]	1167[a]	52.75
Fat				
%	3.55[b]	3.90[a]	4.00[a]	0.08
g/day	32[c]	40[b]	47[a]	1.99
Protein				
%	3.43[b]	3.40[b]	3.58[a]	0.04
g/day	31[b]	35[b]	42[a]	2.17
Lactose				
%	4.61	4.63	4.82	0.11
g/day	41[b]	48[b]	56[a]	3.36
SNF				
%	8.79[b]	8.78[b]	9.14[a]	0.10
g/day	79[b]	91[b]	107[a]	5.83
TS				
%	12.34[c]	12.68[b]	13.14[a]	0.08
g/day	110[b]	132[b]	153[a]	7.68
Ash (%)	0.76	0.76	0.75	0.01

* During the experimental period.
Means within the same row having different superscripts are significantly different (P< 0.05).

Decreasing of NPN and increasing of CN of goat's milk as a result of feeding HCHO treated diet will improve the yield and properties of cheese made from it. Milk containing high casein ratio produces suitable firm curd and so cheese with good body and texture and raise the yield, while increasing of NPN content in milk retard the rennet action and made weak curd and the resultant cheese has low yield and bad properties (Davis, 1965).

In the present study, residual formaldehyde concentrations in milk from goats fed FAS diet have been found to be negligible (1.6 ppm).

Concentrations of some plasma metabolites are present in Table 8. Plasma urea-N was lower (P< 0.05) when HCHO-treated silage was fed, whereas plasma total protein and albumin were higher. Plasma globulin concentration and albumin to globulin ratio were unaffected significantly (P> 0.05) among diets. Plasma urea-N concentration in this present study followed a pattern similar to milk NPN concentration (Table 7).

The lower in blood urea-N and higher total protein and its fractions for goats given diet containing protected protein (FAS) may be due to the increase in RUP, consequently decreased NH_3-N concentration (Table 5) in rumen liquor, which consequently utilized efficiency (Bremmer *et al*., 1997, Titgameyer and Shirley, 1997 and El-Shabrawy, 2000). Generally, all values were within the normal ranges for healthy goats.

Table 7. Mean effect of feeding the experimental diets on fractions of milk nitrogen

Item	Experimental diets			± SE
	AH	AS	FAS	
Total-N				
%	0.537^{b}	0.532^{b}	0.561^{a}	0.006
g/day	4.80^{b}	5.52^{ab}	6.,55^{a}	0.339
True protein-N				
%	0.495	0.489	0.531	0.010
g/day	4.43^{b}	5.08^{b}	6.20^{a}	0.287
% of total-N	92.19	91.92	94.66	1.560
Non-protein-N				
%	0.042^{a}	0.043^{a}	0.030^{b}	0.001
g/day	0.38^{b}	0.45^{a}	0.35^{b}	0.026
% of total-N	7.81^{a}	8.07^{a}	5.34^{b}	0.265
Non-casein-N				
%	0.117^{a}	0.101^{b}	0.108^{b}	0.003
g/day	1.046	1.048	1.261	0.067
Casein-N				
%	0.420^{b}	0.431^{b}	0.458^{a}	0.007
g/day	3.75^{b}	4.47^{b}	5.29^{a}	0.280
% of total-N	78.21^{b}	81.02^{a}	80.75^{a}	0.722
% of true protein-N	84.84^{a}	88.14^{a}	85.31^{a}	2.012
Whey-N				
%	0.075^{a}	0.058^{b}	0.073^{a}	0.006
g/day	0.671^{b}	0.602^{b}	0.911^{a}	0.062
% of total-N	13.98^{a}	10.90^{b}	13.90^{ab}	0.760
% of true protein-N	15.16^{a}	11.86^{b}	14.69^{ab}	0.790

Means within the same row having different superscripts are significantly different ($P< 0.05$).

Table 8. Mean values of blood constituents concentrations of goats fed the different experimental diets

Items	Experimental diets			±SE	Sampling time (hr)		±SE
	AH	AS	FAS		0	4	
Urea-N (mg/100 ml)	23.72^{a}	22.60^{b}	20.16^{c}	0.17	22.49^{a}	21.82^{b}	0.14
Total protein (g/100 ml)	6.62^{b}	7.06^{b}	7.68^{a}	0.16	7.10	7.14	0.13
Albumin (g/100 ml)	3.78^{b}	4.00^{b}	4.39^{a}	0.08	4.04	4.07	0.07
Globulin (g/100 ml)	3.01	3.06	3.29	0.11	3.05	3.18	0.09
A / G ratio	1.26	1.31	1.34	0.04	1.33	1.28	0.03

Means within the same row having different superscripts are significantly different ($P< 0.05$).

It could be concluded that formaldehyde treatment effectively improved utilization of nutrients in alfalfa silage by lactating goats based on better fermentation characteristics during ensiling and in the rumen and improved feeding values. In addition, formaldehyde treatment could be recommended for the alfalfa silage to improve milk production and its components.

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تقييم دريس وسيلاج البرسيم الحجازى فى العلائق المتكاملة للماعز الحلاب

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تم حفظ الحشة الثالثة والرابعة للبرسيم الحجازى فى صورة دريس أو سيلاج غير معامل أو معامل بالفورمالدهيد (١.٣ جم فورمالدهيد / ١٠٠ جرام بروتين خام) وتم تغذية الماعز الزرايبى عليها (٣ مجموعات بكل مجموعة ٦ حيوانات). أوضحت النتائج المتحصل عليها أن السيلاج المعامل بالفورمالدهيد إنخفض محتواه من المواد الآزوتية غير البروتينية – الأمونيا – حامض البيوتريك – البروتين الذائب ، كما إنخفضت درجة pH ، بينما إزداد تركيز حامض الخليك. عكس التحسن فى معاملات هضم المادة الغذائية قيمة غذائية أعلى فى صورة المواد الكلية المهضومة والبروتين الخام المهضوم والطاقة الصافية لإنتاج اللبن. سجل pH الكرش وتركيز الأحماض الدهنية الطيارة قيماً متماثلة مع كل العلائق المختبرة. على الرغم من أنه كان هناك تشابه فى المادة الجافة المأكولة فقد كان محصول اللبن ، اللبن معدل الدهن (٤%) ، مكونات اللبن مرتفعة عندما تم التغذية على السيلاج المعامل.

كانت تركيزات المواد الأزوتية غير البروتينية فى اللبن ونتروجين الأمونيا فى سائل الكرش منخفضة بالتغذية على السيلاج المعامل. وعلى الجانب الآخر كان محصول نتروجين البروتين الحقيقى ، النتروجين الكازين ، النتروجين غير الكازين ، نتروجين الشرش فى اللبن مرتفعة للماعز المغذاه على السيلاج المعامل. مما يتضح كفاءة عملية الحماية و / أو التزامن بين الطاقة المتاحة وإنطلاق الأمونيا. قد إنخفض تركيز يوريا الدم عند التغذية على السيلاج المعامل بينما إزداد تركيز كلا من البروتين الكلى والألبيومين. من هذه الدراسة يمكن إستنتاج أن المعاملة بالفورمالدهيد لسيلاج البرسيم الحجازى حسنت كلا من خصائص تخمر السيلاج ، تخمر الكرش ، القيم الغذائية بالإضافة إلى أن المعاملة أدت إلى تحسن واضح فى ناتج اللبن ومكوناته.