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COMPARISON AMONG THE EFFECTS OF CLOVER HAY AND CORN SILAGES AS FEED INGREDIENTS ON PERFORMANCE OF LACTATING GOATS

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ABSTRACT

The effects of clover hay (CH), corn silage with ears (CS) and corn silage without ears (S) as roughage ingredients of lactating goats on their performance for milk yield and composition were investigated. Eighteen female Zaraibi goats in the 3rd season of lactation with average body weight of 38 Kg were divided randomly into three equal groups. All groups fed on restricted amount of concentrate feed mixture (CFM) and bean straw (BS) (800 and 300 g/h/d, respectively) along with CH, CS and S (*ad lib.*) in group 1 (control), 2 and 3, respectively. Average daily milk yield of goats fed CH or CS diets (0.769, 0.798 Kg, respectively) were higher ($P<0.01$) than those fed S diet (0.650 Kg). Milk fat % was not significantly affected by the treatments, but protein, lactose and total solids % were significantly ($P<0.05$) higher of goats fed CS than those fed CH or S diets. On the other hand, the average milk protein and solids non fat (g/h/d) were significantly higher ($P<0.01$) of goats fed CS than those fed CH or S diets. The milk lactose (g/h/d) was significantly ($P<0.05$) higher of goats fed CS than those fed CH or S diets. The fat corrected milk (4% FCM) and energy corrected milk (Kg/h/d) were significantly higher ($P<0.05$) of goats fed CH or CS than those fed S diets. Total DM intake as Kg/h/d was increased when feeding on CH followed by that feeding on S diets. Economic efficiency data showed that the CS ration was economically superior to the CH, followed by that containing S diets.

Keywords: Clover hay, corn silage, lactating goats, milk yield and composition.

INTRODUCTION

Although much research on fiber has been done, the precise amount of fiber needed in diets remains unclear, primarily because many variables must be considered. Although forages are the major source of fiber, their energy content is low, especially for low quality forages (Harmison *et al.*, 1997). Mertens (1983) reported that, although fat corrected milk (FCM) yield was greatest at a similar NDF content (35%) for cows fed several forages, the FCM yield differed according to forage source. Yield of FCM was greatest for cows fed alfalfa hay, intermediate for cows fed corn silage and least for cows fed bermudagrass hay.

The main objective of this study, therefore, was to evaluate the effects of feeding clover hay versus corn silages as roughage ingredients on milk yield and its components by lactating goats.

MATERIALS AND METHODS

This study was conducted at El-Serw Experimental Station, belonging to Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt.

Eighteen lactating female Zaraibi goats in the 3rd season of lactation aging about 2 years and weighing on average 38 Kg were selected from the herd station and divided randomly according to their live body weight into three equal groups (six animals each). All the experimental animals were fed two weeks pre-kidding as a preliminary period and continued for three months post-kidding as the main experimental period. All groups were fed on restricted amounts of commercial concentrate feed mixture (CFM) which formulated from undecorticated cottonseed, wheat bran, yellow corn, salt and limestone, and bean straw (BS), 800 and 300 g/h/d, respectively to cover 50% of crude protein (CP) requirements recommended by NRC (1981) for lactating goats to produce one kg of milk (4% fat). The other three tested roughages being clover hay (CH), corn silage with ears (CS) and corn silage without ears (S) in rations 1, 2 and 3, respectively, were given *ad lib*. The bean straw was chopped to length of about 5 cm, but the clover hay was at the 3rd cut and was harvested from the experimental field belonging to the station, and corn stover with ears or without ears were harvested for silage at the early head stage of maturity at a DM concentration of 270 g/kg (Nadean *et al.*, 1996).

Fresh amounts of roughages (CH, CS and S) were always offered during feeding and any refusals were collected and weighed to estimate the *ad libitum* intake. The animals were weighed biweekly in two successive days. Drinking water was available at all times. The daily milk yield was recorded for each goat for all tested groups. Milk samples about 0.5% of total milk produced were taken once biweekly from each goat, from the morning and evening milking of the same day. Then the samples composted and analyzed for total solids (TS), fat, protein and solids not fat (SNF) according to Ling (1963), while milk lactose was calculated by difference. The chemical analysis of tested materials was determined according to the official methods of the A.O.A.C. (1984).

The 4% fat corrected milk (4% FCM) was calculated from milk yield and the percentage of milk fat using the following equation

4% FCM= A*0.4+15*B

where A, milk yield (kg); B, fat yield (kg).

Data were statistically analyzed by one-way analysis of variance according to Snedecor and Cochran (1980). The differences among means were tested using Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The chemical analysis of tested materials, the composition of experimental rations, the digestion coefficients, the feeding values, the degradable (a+b) of ADF and mean values of some rumen liquor parameters are presented in Tables (1, 2, 3 and 4), respectively, and previously studied and presented by Maklad and Mohamed (2000).

Table 1: The chemical composition of clover hay, corn silage with and without ears, bean straw and concentrate feed mixture (CFM).

Items	Clover hay	Corn silage with ears	Corn silage without ears	Bean straw	CFM
DM %	87.46	88.56*	89.37*	87.27	89.29
Composition of DM %:					
OM	87.05	87.61	85.34	86.39	93.36
CP	10.61	9.16	7.78	11.36	18.87
EE	1.45	2.03	1.82	1.08	4.64
CF	34.70	27.77	31.30	35.13	9.51
NFE	40.29	48.65	44.44	38.82	60.34
Ash	12.95	12.39	14.66	13.61	6.64
NDF	60.65	62.47	66.10	61.68	37.33
ADF	46.34	34.29	39.62	44.64	14.87
Hemicellulose	14.31	28.18	26.48	17.07	22.46
Cellulose	30.38	28.53	28.45	22.91	8.70
ADL	15.96	5.76	11.17	21.70	6.17
NFC	14.34	13.95	9.94	12.27	32.52

*** Air dried**

Table 2: Average daily feed intake Kg/head with lactating goats fed the experimental diets.

Ingredients	Ration (1)		Ration (2)		Ration (3)	
	As fed	DM	As fed	DM	As fed	DM
Clover hay, kg/h	1.00	0.875	-	-	-	-
Corn silage with ears, kg/h	-	-	1.500	0.335	-	-
Corn silage without ears, kg/h	-	-	-	-	2.00	0.450
Bean straw, kg/h	0.300	0.260	0.300	0.260	0.300	0.260
Concentrate feed mixture	0.800	0.710	0.800	0.710	0.800	0.710
Total daily feed intake (Kg/h)	2.100	1.845	2.600	1.290	3.100	1.420
Roughage : Concentrate ratio (On DM basis)						
CH : BS : CFM	48 : 14 : 38		-		-	
CS : BS : CFM	-		25 : 20 : 55		-	
S : BS : CFM	-		-		32 : 18 : 50	
Total R : C	62 : 38		45 : 55		50 : 50	

Table 3: The chemical composition of the experimental rations.

Items	Ration (1)	Ration (2)	Ration (3)
DM %	88.13	88.70	88.95
Composition of DM %:			
OM	89.36	90.53	89.54
CP	13.85	14.94	13.97
EE	2.61	3.28	3.10
CF	25.19	19.20	21.09
NFE	47.70	53.11	51.38
Ash	10.64	9.47	10.46
NDF	51.93	48.49	50.92
ADF	34.14	25.68	28.15
Hemicellulose	17.79	22.81	22.78
Cellulose	21.10	16.50	17.58
ADL	13.04	9.17	10.57
NFC	20.96	23.83	21.65

Table 4: The digestion coefficients, feeding value, degradable (a+b) of ADF and mean values of some rumen liquor parameters of the tested rations with goats.

Items	Ration (1)	Ration (2)	Ration (3)
Nutrient digestibility (%):			
DM	64.41^{A}	62.37^{A}	43.19^{B}
OM	65.59^{A}	65.92^{A}	48.54^{B}
CP	66.59	68.37	58.43
EE	68.71^{b}	87.47^{a}	78.66^{ab}
CF	43.67^{A}	32.87^{B}	18.21^{C}
NFE	76.62^{A}	74.77^{A}	56.11^{B}
Cellulose	64.36^{A}	37.50^{B}	4.98^{C}
NFC	89.81^{C}	97.82^{A}	92.94^{B}
Feeding value as DM(%):			
TDN	60.67^{A}	62.67^{A}	47.06^{B}
TDN intake (g/h/d)	1119.30^{A}	808.40^{B}	668.20^{C}
ME (MJ/Kg DM)	9.06^{A}	9.33^{A}	7.01^{B}
DCP	9.25^{ab}	10.19^{a}	8.16^{b}
Degradable (a+b) of ADF:	46.63^{A}	32.76^{C}	41.31^{B}
Rumen liquor parameters:			
NH_3 (mg/100 ml RL)	17.78^{A}	19.50^{A}	15.41^{B}
VFA (meq./100 ml RL)	9.42^{A}	8.20^{B}	7.08^{C}

A, B: Values with different superscripts in the same row significantly differed at P<0.01.
a, b: Values with different superscripts in the same row significantly differed at P<0.05.

As for milk yield and its composition the results in Table (5) show that daily milk yield of goats fed CH or CS rations were significantly higher (P<0.01) than those fed S rations by about 14.8 and 17.92%, respectively. This could be associated with the higher DM intake accordingly TDN intake by goats fed on these rations.

Table 5: Average daily milk yield its composition and milk nutrients yield by goats fed the experimental rations.

Items	Ration (1)	Ration (2)	Ration (3)
Average milk yield, Kg	0.769^{A}	0.798^{A}	0.655^{B}
Fat %	4.18	4.08	4.13
Protein %	2.70^{b}	3.57^{a}	2.54^{b}
Lactose %	4.45^{b}	5.31^{a}	4.71^{ab}
Total solids (TS%)	12.14^{b}	13.67^{a}	12.08^{b}
Solids not fat (SNF%)	7.84^{B}	9.83^{A}	7.98^{B}
Average fat yield (g/h/d)	32.14	32.56	27.05
Average protein yield (g/h/d)	20.76^{B}	28.48^{A}	16.63^{B}
Average lactose yield (g/h/d)	34.22^{b}	42.37^{a}	30.85^{b}
Average TS yield (g/h/d)	93.36^{AB}	109.08^{A}	79.12^{B}
Average SNF yield (g/h/d)	60.29^{B}	78.44^{A}	52.26^{B}
4% FCM (Kg/d)	0.789^{a}	0.808^{a}	0.672^{b}
ECM (Kg/d)*	0.861^{a}	0.936^{a}	0.719^{b}

*** Energy-corrected milk (ECM) was calculated according to Tyrrell and Reid (1965) using the following equation:**
ECM = [7.2 x protein (kg/d) + (12.95 x fat (kg/d)] + [0.37 x milk (kg/d)].

Milk fat % was not significantly affected by the tested rations. This could be as a result of increasing EE digestibility (P<0.05) when feeding on CS or S than feeding on CH and increasing cellulose digestibility (P<0.01) when feeding on CH than CS or S (Patton, 1994), which compensate each other in this respect. The protein content % was significantly higher (P<0.05) with diet contained CS which was higher in DCP% than that diet contained CH or S. Lactose % was higher with CS or S than CH ration, especially when fed CS, it was higher (P<0.05) than in case of CH. This could be associated with increasing NFC digestibility (P<0.01) when feeding CS or S than CH diets. The total solids content % was higher (P<0.05) with CS than CH or S diets, but solids not fat % was increased (P<0.01) in this respect (Cecava *et al.*, 1988).

The average of milk fat (MF) yield presented as g/h/d of goats was not significantly affected by the tested rations. The average milk protein (MP) and SNF yield as g/h/d were significantly higher (P<0.01) by goats fed CS diet than those fed CH or S diets, but the average total solids yield was higher (P<0.01) when fed CS than S diets without significant effect when fed CS or CH diets. The average lactose yield as g/h/d was higher (P<0.05) when fed CS than CH or S diets. The FCM and ECM were higher (P<0.05) when fed on CH or CS than S diets. This could be associated with the solubilization of S diet hemicellulose during fermentation might have caused the remaining fiber to be less digestible, potentially contributing to reduced digestion of dietary fiber (West *et al.*, 1998). So, as shown in Table (4), the OM, CF, cellulose digestibility, TDN%, NH_3- concentration (mg/100 ml RL) and VFA (meq./100 ml RL) were decreased (P<0.01) when fed on S than CH or CS rations.

The obtained values for milk yield and its composition are in agreement with those reported by Mertens (1983), Ashmawy (1997), Mehana *et al.* (1998), El-Feel and Marzouk (1998) and Gabr *et al.* (1999).

The results of economic efficiency in Table (6) showed that the feed cost of the experimental group which received the CS diet to produce one Kg milk was lower (68.0 pt/Kg milk) followed by the S diet (81.0 pt/Kg milk), whereas the CH diet came last because it had the highest cost (95.0 pt/Kg milk).

Table (6): Economic efficiency with lactating goats fed the experimental rations.

Items	Ration (1)	Ration (2)	Ration (3)
Feed cost/d (pt.)	73	55	53
Price of milk produced (pt.)	77	80	65
Feed cost/Kg milk (pt)	95	68	81
The economic efficiency*	1.05	1.45	1.22
Economic efficiency improvement %	-	38.09	16.19

*** Price (LE) of one ton of (CH = 300; CS = 80; S = 50; BS = 100, CFM = 500 and price of milk = 1000).**

CONCLUSION

It could be concluded that feeding lactating goats on ration containing CS gave more milk yield as well as more profitability, compared with other tested rations. Therefore, the source of forages according to the quality of fermentation and the stage of the performance should put in our consideration when formulating farm animal rations. The 4% FCM yield differed according to forage source being fed. Yield of FCM was greatest for goats fed CH or CS than S diets.

REFERENCES

Ashmawy, T.A.M. (1997). Studies on some factors affecting yield, chemical and technological properties of milk on Baladi goats and their crosses. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt.

A.O.A.C. (1984). *Official Methods of Analysis*. 13th ed. Association of Official Analytical Chemists. Washington, D.C.

Cecava, M.J.; Merchen, N.R.; Berger, L.L. and Fahey, G.C.Jr. (1988). Effects of dietary energy level and protein source on site of digestion and doudenal nitrogen and amino acids flows in steers. J. Anim. Sci., 66: 961-974.

Duncan, D.B. (1955). Multiple range and multiple f-test. Biometrics, 11. 1.

El-Feel, F.M. and Marzouk, K.M. (1998). Goats milk yield and composition in Egypt. J. Agric. Sci. Mansoura Univ., 23 (11): 4761-4771.

Gabr, A.A.; Mehrez, A.Z.; Soliman, E.S.M. and El-Kholany, M.E. (1999). Response of lactating goats to diets containing Reeds grass (*Arundo domax*, L.) versus sorghum plants. Egypt. J. Nutr. and Feeds, 2 (Speciall Issue): 297-307.

Harmison, B.; Eastridge, M.L. and Firkins, J.L. (1997). Effect of percentage of dietary forage neutral detergent fiber and source of starch on performance of lactating Jersey cows. J. Dairy Sci., 80: 905-911.

Ling, E.R. (1963). *A Text Book of Dairy Chemistry*. 3rd Ed. Chapman and Hall Ltd., London.

Maklad, Eman H.M. and Mohamed, Bahira K. (2000). Comparison among the effects of clover hay and corn silages as feed ingredients on the nutritive value, bacterial strains and fermentation in the rumen of sheep. 3rd All Africa Conf. On Anim. Agric. and 11th Conf. of the Egypt. Soc. of Anim. Prod., Alexandria, Egypt, 6-9 November. (In press)

Mehana, M.T.; El-Shazly, A.A.; Nasr, M.M.A. and Ayyad, M.K. (1998). Studies on Domiati cheese. I. Yield, gross chemical composition and physical properties of curd of goats milk as affected by feeding rations. J. Agric. Sci. Mansoura Univ., 23 (11): 4949-4957.

Mertens, D.R. (1983). Using neutral detergent fiber to formulate dairy rations and estimate the net energy content of forages. Pages 60-68 in Proc. Cornell Nutr. Conf., Syracuse, NY Cornell Univ., Ithaca, NY.

NRC (1981). Nutrient Requirements of Domestic animals. 15. Nutrient Requirements of Goats. National Research Councils. Washington D.C., USA.

Nadeau, E.M.G.; Burton, D.R.; LinDgren, E. and Lingvall, P. (1996). Kinetics of cell wall digestion of orchardgrass and alfalfa silages treated with cellulose and formic acid. J. Dairy Sci., 79: 2207-2216.

Patton, R.S. (1994). Complexities of soluble carbohydrate metabolism in ruminants examined. Feedstuffs, February 14, 66, 7.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical Methods. 7th Ed. Iowa State Univ. Press, Ames Iowa, USA.

Tyrrell, H.F. and Reid, J.T. (1965). Prediction of the energy value of cows milk. J. Dairy Sci., 48: 1215.

West, J.W.; Mandebvu, P.; Hill, G.M. and Gates, R.N. (1998). Intake, milk yield and digestion by dairy cows fed diets with increasing fiber content from Bermudagrass hay or silage. J. Dairy Sci., 81: 1599-1607.

مقارنة بين تأثير التغذية على علائق تحتوى على دريس برسيم أو سيلاج أذرة بكيزان أو سيلاج أذرة بدون كيزان على إنتاج الماعز الحلابة

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أجريت هذه الدراسة لبحث تأثير التغذية على علائق تحتوى على دريس برسيم أو سيلاج أذرة بكيزان أو سيلاج أذرة بدون كيزان على أداء الماعز الحلابة من حيث إنتاج اللبن وتركيبه. وقد تم استخدام ١٨ ماعز زرايبى حلابة فى موسم الحليب الثالث وبمتوسط وزن ٣٨ كجم حيث وزعت عشوائياً فى ثلاث مجموعات متساوية العدد (٦ حيوانات فى كل مجموعة).

أعطى العلف المركز وتبن الفول بمعدل ٨٠٠ جم ، ٣٠٠ جم للرأس فى اليوم ، بينما كانت التغذية على دريس البرسيم أو سيلاج الأذرة بكيزان أو سيلاج الأذرة بدون كيزان للشبع. واستمرت التجربة لمدة ٣ شهور.

وأوضحت النتائج المتحصل عليها ما يلى:

١- كان متوسط إنتاج اللبن اليومى للماعز المغذاة على دريس البرسيم أو سيلاج الأذرة بكيزان أعلى معنوياً (٠,٠١) (٠,٧٦٩ ، ٠,٧٩٨ كجم/رأس/يوم على التوالى) عن التغذية على سيلاج الأذرة بدون كيزان (٠,٦٥٥ كجم/رأس/يوم).

٢- لم تتأثر نسبة الدهن فى اللبن معنوياً نتيجة التغذية على دريس البرسيم أو سيلاج الأذرة بكيزان أو سيلاج الأذرة بدون كيزان ، بينما زادت نسبة البروتين وسكر اللاكتوز والمواد الصلبة الكلية (٠,٠٥) والمواد الصلبة غير الدهنية (٠,٠١) عند التغذية على سيلاج الأذرة بكيزان مقارنة بالتغذية سواء على دريس البرسيم أو سيلاج الأذرة بدون كيزان. وظهر هذا التأثير أيضاً على المنتج (جم/رأس/يوم) من الدهن والبروتين واللاكتوز والمواد الصلبة الكلية والمواد الصلبة غير الدهنية.

٣- كان متوسط إنتاج اللبن المعدل ، وطاقة اللبن المعدل (كجم/يوم) أعلى معنوياً (٠,٠٥) عند التغذية على دريس البرسيم أو سيلاج الأذرة بكيزان مقارنة بالتغذية على سيلاج الأذرة بدون كيزان.

يستخلص من هذه الدراسة أن إنتاج اللبن المعدل وطاقته تتأثر بدرجة تخمر المادة الخشنة والتى يتوقف عليها معامل هضم المادة الجافة والقيمة الغذائية للعليقة حيث لوحظ أن التغذية على علائق تحتوى على دريس البرسيم أو سيلاج الذرة بكيزان أدت إلى زيادة إنتاج اللبن المعدل وطاقته مقارنة بالتغذية على عليقة تحتوى على سيلاج الأذرة بدون كيزان. ومن ناحية أخرى فإن التغذية على عليقة تحتوى على سيلاج الأذرة بكيزان كانت أفضل من الناحية الاقتصادية مقارنة بالتغذية على علائق تحتوى على دريس البرسيم.