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UTILIZATION OF CORN STALKS IN RUMINANT FEEDING: 2- EFFECT OF SOURCE OF ENERGY ON UTILIZATION OF TREATED CORN STALKS BY GROWING LAMBS.

By

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ABSTRACT

Twenty four growing crossbred male lambs, weighing about 22.95 ± 0.57 kg were divided into four similar groups, six lambs of each, to study the effect of replacement of corn with barley grains (0, 33.3, 66.7 and 100 %) in the concentrate feed mixture (CFM,s) when fed with corn stalks treated with urea (5%) plus berseem hay at the ratio of (2:1) on the digestibility coefficients, nutritive values, nitrogen utilization, some blood traits and productive performance of growing lambs. Animal were fed on (CFM,s) at the level of 2.25 % of live body weight plus corn stalks treated with 5 % urea and berseem hay (2:1) *ad libitum*. Results revealed that diet 3 obtained the highest digestibility coefficients of DM, OM, CP, CF, EE and NDF. The differences in TDN values were not significant, while the differences in DCP % and nitrogen balance values were significant . There were no significant differences in the concentrations of total protein, albumin, globulin, creatinine and ALT among the experimental diets at zero time. While, at 3hrs after feeding the differences were significant in the concentration of AST in blood. Average daily gains (ADG) were significant among the four diets , while diet (3) obtained the highest ADG and diet (4) obtained the lowest value. Feed conversion ratio (kg DM, or TDN /kg gain) indicated that group (3) was more efficient than other groups, (2) and (4), with significant differences. This data showed that diet (3) was more efficient

followed by diets (1), (2) and (4) at the entire experimental period.

Key word: Corn stalks, Urea treatment, Ruminants, Growing lambs, Barley and corn grains.

INTRODUCTION

In Egypt, animals are suffering from feed shortage, particularly during summer, and perhaps surplus or just enough feed resources during winter. The balance between nutrient requirements of livestock and traditional feed resources was negative. The annual nutritional population in Egypt was calculated to be 12.86 million tons of TDN and 1.73 million tons of DCP per year (Abou-Akkada, 1984). Also, there is a wide gab between the available feeds and animals requirements. It was estimated as a shortage of 3.1 million tons of TDN per year (Abou-Akkada, 1988). At the same time, livestock numbers need to be doubled to safe the minimum amount of animal protein required for the Egyptian population. To increase the cultivated land and livestock populations, Egyptian government started a great reclamation project in Upper Egypt (Wady El-Saaida, east Ewinat and Toshka). These projects included animal production, which indeed, should increase the problem of shortage of feedstuffs in Egypt, especially in summer. The number of animal units in Upper Egypt is 21.6% of the total number of animal units in Egypt, while, the production of concentrate feed mixture (CFM) in Upper Egypt is only 11% of the total production of Egypt. Then, there are shortages of about 50% in (CFM) in Upper Egypt (Lashien, *et al*., 2001). Lashien, *et al*., (2001) conducted to find a suitable feeding system for the newly reclaimed land in Upper Egypt, depending on the available crops found in these lands such as: barley grains, chopped barley straw treated with 4% urea and conserving the surplus of berseem as a hay to be used in summer feeding.

The present work aimed to study the effect of replacement of corn grains with barley grains as a source of energy on the utilization of corn stalks treated with 5% urea (TCS) plus berseem hay (2:1) on digestibility coefficients, nitrogen utilization, soe blood traits and productive performance of growing lambs.

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MATERIALS AND METHODS

This experiment was carried out at the Experimental Station of Faculty of Agriculture (Damanhour) , Alexandria University, during 2005-2006. Twenty four growing crossbred lambs, weighing 22.95 ± 0.57 kg were used. Animals were divided into four similar groups, six of lambs each. Each group was housed in a separate pen to study the effect of replacement of corn with barley grains (0, 33.3, 66.7 and 100 %) on the utilization of treated corn stalks with (5%) urea (TCS) plus berseem hay (2:1) on the productive performance of lambs. Animal were fed on 2.25 % of live body weight on concentrate feed mixtures (CFM) plus TCS and berseem hay (2:1) *ad lib*. Ingredients Composition of CFM's are presented in Table (1). Animals were fed in groups. CFM's were given twice daily at 9 a.m and 3 p.m. The offered and the orts of feed were weighed daily and recorded. Water was offered freely. Amount of offered concentrate feed mixtures were adjusted according to the changing of body weight every two weeks. Animals were weighed in the morning before drinking or feeding at the beginning of the trial and biweekly. At the end of the growing experiment three animals of each treatment were used to determine the digestibility coefficients and nutritive value of the experimental diets.

Digestibility coefficients, nutritive values and nitrogen balance were estimated throughout digestibility and nitrogen balance trials according to the official methods . Samples of blood were taken using three animals from each treatment, 15 ml blood from the jugular vein at 0 and 3 hrs after feeding were withdrown. Blood samples were centrifuged at 4000 r.p.m for 15 min to separate serum and kept frozen to determine Total protein, Albumin, Globulin, A/G ratio, Creatinine, Urea, AST and ALT.

Chemical analysis:

Treated corn stalks, berseem hay, CFM's, orts and feces were chemically analyzed according to the official methods of AOAC (1995). Cell wall constituents were estimated according to the methods described by Van Soest and Wine (1967). Blood total protein, albumin, urea, creatinine, ALT and AST in blood serum were estimated using kits and the methods described by Biomerieux (Biochemistry Laboratory Reagents and Products).

Statistical analysis:

Data were statistically analyzed by (GLM) general linear model procedures (SAS, 2000) to study the fixed effect of treatment, time of sampling and the interaction between them. Differences between mean values were compared by Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Ingredient composition and chemical analysis of CFM's, TCS and berseem hay are shown in Table (1). Concentrate feed mixtures used contained similar CP, however, CF, EE, Ash, NDF and hemicellulose increased and NFE and ADF decreased with increasing proportion of barley grains instead of corn grains.

The results of dry matter intake, digestibility coefficients, nitrogen balance and nutritive values of the experimental diets are shown in Table (2). The results indicated that dry matter intake from roughage and total dry matter intake significantly decreased ($P<0.05$) with increasing barley grains on CFM instead of corn grains. Also, total dry matter intake as percentage of live body weight significantly decreased ($P<0.05$) from 3.27 to 2.93, to 2.87 and 2.62 when sheep fed on CFM 1, 2, 3 and 4, respectively. These results are in agreement with those reported by Galina *et al*.(2004) and Wambui *et al*. (2006). The results of digestibility trials indicated that increasing the proportion of barley grains replacement of corn grains increased digestibility coefficients of OM, CP, CF, EE, and NDF. These results were similar with those reported by Saadullah and Mozammal (1981) they reported that urea treatment increased digestibility of DM and CF. Mohamed (1988) found that treated rice straw with 5% urea increased CP digestibility. The differences in nutritive values among the experimental diets were not significant for (TDN%), while the differences in DCP % values were significant ($P<0.05$). These results are in agreement with those reported by Ismaiel (2006) who showed that urea treatment increased significantly ($P< 0.05$) the digestible protein (DP) and gross energy (GE) for ureated corn stalks. On the

Table (1): Ingredient and chemical composition of concentrate feed mixture, ureated corn stalks and berseem hay used during growth trial.

Ingredient %	Concentrate feed mixtures				Ureated corn stalks	Berseem hay
	1	2	3	4	-	-
Barley grain	0.00	20.00	40.00	60.00	-	-
Corn grain	60.00	40.00	20.00	0.00	-	-
Cotton seed meal	34.10	33.10	32.60	31.40	-	-
Sun flower oil	0.00	1.00	1.50	2.70	-	-
Molasses	3.00	3.00	3.00	3.00	-	-
Sodium chloride	1.00	1.00	1.00	1.00	-	-
Lime stone	1.50	1.50	1.50	1.50	-	-
Sodium bicarbonate	0.20	0.20	0.20	0.20	-	-
Mineral mixture *	0.20	0.20	0.20	0.20	-	-
Total %	100	100	100	100	-	-
Chemical composition (%)						
DM	94.92	95.62	94.47	95.21	96.49	95.36
CP	15.69	15.74	15.89	15.84	9.17	12.51
CF	8.95	10.98	10.05	11.02	31.09	28.69
EE	6.14	6.74	7.29	7.47	2.21	2.86
NFE	61.91	58.28	57.46	55.00	48.68	44.44
Ash	7.31	8.26	9.31	10.67	8.85	11.50
Cell wall constituents (%)						
NDF	31.44	32.12	35.99	42.01	69.43	51.38
ADF	20.01	20.91	21.17	18.90	42.49	37.75
Hemicellulose	11.43	11.21	14.82	23.11	26.94	13.63

- Mineral mixture (Vigomex): each 1 kg contained : potassium sulphate (40 gm), magnesium sulphate (30 gm), iron sulphate (4 gm), zinc sulphate (0.4 gm), manganese sulphate (0.24 gm), potassium iodide (0.4 gm), sodium borate (0.24 gm), cobalt chloride (0.008 gm), sodium florate (0.008 gm), sodium selinite (0.004 gm), molybdenum oxide (0.008 gm), **Vigomex**, product of Vigora Pharmaceutical Industries, Sadat City, Egypt.

other hand, it tended to increase TDN, SE, DE and ME; however the differences were not significant.

The data of nitrogen utilization by sheep fed on the experimental diets indicated that the highest ($P<0.05$) values of nitrogen intake was observed with diet (1) followed by diet (3) while the lowest nitrogen

Table (2): Dry matter intake, digestibility coefficients, nutritive values and nitrogen balance of the experimental diets during digestibility trials.

Items	Diets				SEM	Significancy
	1	2	3	4		
No. of animals	3	3	3	3		
Live body weight, kg	43.00	43.33	45.00	37.66	1.38	NS
DM intake, gm/h/d						
Concentrate	875.10	887.92	932.00	778.24	28.53	NS
Roughage**	528.71^{a}	381.76^{b}	358.67^{b}	208.43^{c}	42.69	*
Total	1403.80^{a}	1269.70^{a}	1290.70^{a}	986.67^{b}	61.33	*
DM intake % of LBW	3.27^{a}	2.93^{a}	2.87^{ab}	2.62^{b}	0.26	*
Digestibility coefficients (%)						
DM	61.84	63.33	65.86	63.30	0.66	NS
OM	65.14^{b}	67.53^{ab}	69.50^{a}	67.51^{ab}	0.64	*
CP	62.16^{b}	63.36^{b}	70.97^{a}	63.32^{b}	1.26	*
CF	61.84^{b}	65.87^{ab}	73.18^{a}	61.00^{b}	1.90	*
EE	72.87^{c}	76.63^{b}	80.83^{a}	77.31^{b}	0.90	*
NFE	66.17	67.19	66.49	69.21	0.59	NS
NDF	56.60^{ab}	54.39^{b}	60.89^{a}	57.72^{ab}	0.94	*
ADF	52.22	47.61	51.00	42.79	1.82	NS
Nutritive values (%)						
TDN %	63.88	65.91	66.49	66.61	0.79	NS
DCP %	8.55^{c}	8.98^{c}	10.25^{a}	9.50^{b}	0.20	*
Nitrogen balance (g/h/d)						
Nitrogen intake (g/h/d)	30.96^{a}	28.79^{ab}	29.86^{a}	23.71^{b}	1.17	*
Fecal nitrogen (g/h/d)	11.74	10.62	8.66	8.69	0.56	NS
Urinary nitrogen (g/h/d)	12.40^{a}	11.48^{a}	12.86^{a}	9.33^{b}	0.64	*
Nitrogen balance (g/h/d)	6.82^{ab}	6.69^{ab}	8.33^{a}	5.68^{b}	0.33	*
NB as % Nitrogen intake	25.27	25.62	29.28	26.06	1.16	NS
NB as % Digested nitrogen	34.96	37.00	39.38	37.78	1.52	NS

a,b,c, means with different letters in the same raw are significantly different (P< 0.05).
* Significant at (P < 0.05), NS = Not significant. SEM = Standard error of means.
Diets: 1= CFM_1(60% corn : 0% barley) + roughage (UTCS+BH 2:1), 2= CFM_2 (40% corn : 20% barley)+ roughage, 3= CFM_3 (20% corn : 40% barley) + roughage and 4= CFM_4 (0% corn : 60% barley) + roughage.

intake was recorded with diet (4), The differences were significant (P<0.05). The results of nitrogen balance indicated that the highest values (P<0.05) was for diet (3), while the lowest (P<0.05) values obtained by diet (4) and diets (1) and (2) recorded the middle values, the differences were significant. These results were in agreement with the results reported by El-Ashry *et al*., (1997). Salem (1996) reported that nitrogen balance was higher with diet contained berseem fiberous residues plus ammoniated corn stalks 93.54 g|h|d) followed by treated corn stalks with ammonia (3.19 g|h|d) with significant differences. Sultan and Loerch (1992) found that nitrogen retention decreased with diets low in protein and energy.

The results in Table (3) of blood traits of sheep fed on the experimental diets at 0 and 3 hrs after feeding indicated that at zero time, there were no significant differences in the concentrations of total protein, albumin, globulin, creatinine and ALT among the experimental diets except A/G ratio, urea and AST. On the other hand, at 3hrs after feeding the differences were significant in the concentrations of AST. These results may be attributed to increasing the level of barley grains instead of corn , and were similar to the results reported by Gomaa *et al.*(1989); El-Ashry *et al.*(1997); Abd El-Malik *et al.*(2003) and Ismaiel, (2006). Generally, blood parameters were within the normal values as recorded by Stanek *et al*., (1992).

Dry matter intake (DMI), average daily gain and feed conversion ratio of growing lambs fed on the experimental diets are shown in Table (4). It was noticed that diet (1) and (3) had higher DMI from concentrate feed mixture. Concerning DMI from roughages which contained (TCS and BH (2:1). These results were in accordance with the findings of Hadjipanayiotou, (2004) who studied the effects of replacement of barley grain for corn in concentrate diets fed to dairy Damascus goats at different frequencies. It is concluded that concentrate mixtures of corn or barley grain can attain similar milk yields and milk composition when fed to dairy goats, and that at high concentrate diets, barley, but not corn grain, may result in digestive upsets.

Average daily gain of growing lambs fed on the experimental diets are presented in Table (4). The results indicated that total gain was recorded higher values (p<0.05) with diet (3) which obtained (17.25 kg), followed by diet (1) which obtained (15.75 kg) while diet

Table (3): Blood traits of sheep fed on the experimental diets during digestibility trials.

Items	Time after feeding (hrs)	Diets				SEM	Significancy
		1	2	3	4		
Total protein (gm/ 100 ml)	**0**	6.44	7.55	7.55	6.44	0.33	NS
	3	6.99	6.77	8.55	7.66	0.31	NS
Albumin (gm/ 100 ml)	**0**	4.28	3.95	3.90	4.66	0.13	NS
	3	4.75	4.66	4.56	4.28	0.10	NS
Globulin (gm/ 100 ml)	**0**	2.16	3.6	3.65	1.97	0.35	NS
	3	2.24	2.11	3.98	3.38	0.37	NS
A/G ratio	**0**	2.12 ^{ab}	1.37 ^{ab}	1.09 ^{b}	2.42 ^{a}	0.22	*
	3	2.33	2.15	1.15	1.46	0.24	NS
Creatinine (mg/ dl)	**0**	1.55	1.33	1.10	0.88	0.11	NS
	3	1.03	0.77	1.21	1.10	0.11	NS
Urea (mg/dl)	**0**	36.81 ^{ab}	47.31 ^{a}	32.55 ^{b}	30.61 ^{b}	2.48	*
	3	44.57	44.18	43.71	46.89	1.49	NS
AST GOT(u/l)	**0**	37.60 ^{a}	19.66 ^{b}	14.00 ^{b}	12.10 ^{b}	3.34	*
	3	47.53 ^{a}	40.20 ^{ab}	29.66 ^{b}	27.00 ^{b}	3.03	*
ALT GPT(u/l)	**0**	3.73	7.70	8.00	6.40	0.77	NS
	3	17.60	11.73	10.83	8.00	1.64	NS

a,b, means with different letters in the same raw are significantly different (P< 0.05).
* Significant at (P < 0.05), NS = Not significant, SEM = Standard error of means.

(2) and (4) had the lowest total gain (13.33 and 13.50 kg, respectively). The values of average daily gain at the entire experiment period were (115.81, 98.03, 126.84 and 99.27 gm) for diet (1), (2),(3) and (4) respectively, these results were significant at (P< 0.05).These results are inagreament with the findings of Hadjipanayiotou (2004) , Ismaiel (2006) and Askar *et al.(2006).* The results of feed conversion ratio (kg DMI and kg TDN / kg gain) indicated that groups (1) and (3) were more efficient in converting DM and TDN to gain than group (2) and (4).

Under the circumstances of this study it could be concluded that: corn stalks can be used in feeding sheep after chopping and treating with 5 % urea. Barley grains could be used instead of 66.7 % corn grains in feed concentrate mixtures , as a source of energy, and fed to growing lambs at 2.25 % of live body weight plus ureated corn stalks and berseem hay (2:1) *ad libitum*.

Table (4): Dry matter intake (DMI), average daily gain (ADG) and feed conversion ratio (FCR) of growing lambs fed on the experimental diets.

Items	Diets				SEM	Significancy
	1	2	3	4		
No. of animals	6	6	6	6		
Experimental period, day	136	136	136	136		
Initial body weight, kg	23.08	22.50	23.08	23.16	0.57	NS
Final body weight, kg	38.83	35.83	40.33	36.66	0.94	NS
Total gain, kg	15.75 ^{ab}	13.33 ^{b}	17.25^{a}	13.50^{b}	0.59	*
DMI, (g/h/d)						
Concentrate	617	583	634	605	-	-
Roughage	483	400	546	396	-	-
Total	1100	983	1180	1001	-	-
ADG gm/h/day total	115.81 ^{ab}	98.03 ^{b}	126.84 ^{a}	99.27 ^{b}	4.40	*
FCR (Kg DMI/ kg gain)	9.49	10.02	9.30	10.08	-	-
FCR (Kg TDN/ kg gain)	6.06	6.60	6.18	6.71	-	-

a, b means with different letters in the same raw are significantly different (P< 0.05).
* Significant at (P < 0.05), NS = Not significant, SEM = Standard error of means.
Diets: 1= CFM_1(60% corn:0% barley) + roughage (UTCS+BH 2:1), 2= CFM_2 (40% corn: 20% barley)+ roughage, 3= CFM_3 (20% corn:40% barley) + roughage and 4= CFM_4 (0% corn:60% barley) + roughage.

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الملخص العربي

الاستفادة من حطب الذرة فى تغذية المجترات : 2- تاثير مصدر الطاقة على الاستفادة من حطب الذرة المعامل باليوريا على آداء الحملان النامية .

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أجريت هذه الدراسة بمزرعة قسم الإنتاج الحيواني الداجني– كلية الزراعة بدمنهور- جامعه الإسكندرية خلال عامي 2005م – 2006 م. واستخدم في هذه الدراسة 24 حولي ذكر خليط بمتوسط أوزانها 22.95كجم وزعت عشوائيا لأربعة مجاميع بكل مجموعة ستة حملان،وذلك لدراسة تأثير استبدال حبوب الذرة بحبوب الشعير بنسب (صفر، 33.3، 66.7، 100 %) على الاستفادة من مخلوط حطب الذرة المعامل باليوريا (5%) ودريس البرسيم بنسبة (1:2) على أداء الحملان النامية. تم تغذية الحيوانات على مخلوط العلف المركز بنسبة 2.25 % من وزن الحيوان الحي بالإضافة إلى مخلوط حطب الذرة المعامل باليوريا(5%) ودريس البرسيم بنسبة 1:2 حتى الشبع، غذيت الحيوانات فى مجاميع كما يلي: غذيت المجموعة الأولى على مخلوط (1) ،والمجموعة الثانية غذيت على مخلوط مركز(2) ، والمجموعة الثالثة غذيت على مخلوط مركز(3) ، والمجموعة الرابعة غذيت على مخلوط مركز(4) هذا بالإضافة إلى مخلوط حطب الذرة المعامل باليوريا (5%) ودريس البرسيم بنسبة (1:2) حتى الشبع بكل المجاميع.

أوضحت اهم النتائج ما يلى :

- أعطت العليقة الثالثة أعلى قيم لمعاملات هضم المادة الجافة والمادة العضوية والبروتين الخام والألياف الخام والمستخلص الايثيرى ومستخلص المحلول المتعادل.
- أوضحت القيم الغذائية للعلائق التجريبية معبراً عنها كمجموع مواد غذائية مهضومة كلية (TDN) وبروتين خام مهضوم (DCP) أنه لاتوجد فروق جوهرية بالنسبة لل TDN بينما كانت الفروق جوهرية لل DCP بين العلائق التجريبية ، وكذلك كانت هناك فروق جوهرية بين العلائق التجريبية بالنسبة للإتزان الأآزوتى.

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- لا توجد فروق جوهرية قبل التغذية فى تركيز كل من البروتين الكلى والالبيومين والجلوبيولين و الكرياتينين وإنزيم (ALT) فى دم الأغنام المغذاة على العلائق التجريبية بينما فى النسبة بين الالبيومين والجلوبيولين و تركيز اليوريا وإنزيم (AST) كانت الفروق جوهرية. بينما عند وقت 3 ساعات بعد التغذية كانت الفروق جوهرية فى تركيز وإنزيم (AST).
- سجلت العليقة الثالثة اعلى زيادة كلية فى وزن الجسم تليها العليقة الأولى ثم العليقة الثانية والرابعة. بينما أعطت العليقة الثالثة أفضل القيم بالنسبة للكفاءة التحويلية للغذاء عن العلائق التجريبية.

من هذه النتائج يمكن استخدام حبوب الشعير بنسبة 66.7 % بدلا من حبوب الذرة كمصدر للطاقة بنسبة فى مخاليط الأعلاف المركزة فى تغذية الحملان النامية المغذاة على حطب الذرة المعامل باليوريا (5%) مع دريس البرسيم بنسبة (1:2) على التوالى.