Egyptian J. Anim. Prod., Vol.31,Supplement Issue, Nov.(1994):105-119.

EFFECT OF LEVELS OF CONCENTRATE WITH LICK BLOCK ON NUTRITIVE VALUE OF SOME ROUGHAGES

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SUMMARY

Rice straw and corn stalks were compared when supplemented with urea molasses blocks and varying levels of concentrates (0, 250, 500 and 750 gm/h/d). Twelve mature rams were used in 16 metabolism trials. total dry matter intake increased as the level of concentrates increased. Both roughage intake and block intake decreased in a proportional way to increasing levels of concentrates. Digestibilities of DM, OM, CP, NFE and hemicellulose increased with increasing levels of concentrates. Cellulose digestibility (62.33, 51.72, 46.91 and 42.49%) and ADL digestibility (32.79, 32.19, 30.71 and 25.88%) decreased as concentrate levels increased from 0 to 750 g/h/d in order. Therefore, feeding value in terms of TDN(46.54, 52.28, 57.22 and 62.97%), DCP(6.84, 6.97, 8.34 and 10.30%) and DE(2.04, 2.36, 2.51 and 2.87 Mcal/Kg) increased with increasing levels of concentrates. Comparisons between rice straw and corn stalks as supplemented with lick block revealed that corn stalks had better quality than rice straw. Intake of DM (i.e. TDMI) was better for non supplemented corn stalks (702.15 gm/h/d) versus rice straw (660.21 gm/h/d).

Digestibilities of nutrients were better for corn stalks either supplemented with blocks or not than for

Keywords: Urea molasses block, concentrate, roughage, feed value, sheep

rice straw. Nitrogen balance was positive for all levels of concentrates and for both kinds of roughages, supplemented or not, and so were mineral balances. The conclusion drawn out of the results was that corn stalks was of better quality than rice straw either supplemented or not.

INTRODUCTION

The summer period in Egypt is characterized by severe animal feed shortage. The crop residues may contribute in summer feeding (Hathout, 1984). Summer TDN shortage reached 69%, while DCP shortage was about 54% (Abou-Akkada, 1988). The use of ammonia or urea to raise the crude protein contents of roughages has another advantage; that is improving nutrient digestibilities of roughages (Fick et al., 1973 and Horton, 1979) by loosening the lignocellulosic linkage. Also the use of molasses was intended to make available the soluble carbohydrates in the rumen of animals. There has been a thought to get both additives together (i.e. urea and molasses) in one supplement; namely solid block or mufeed liquid. Several workers have found increased intakes of basal ration as a result of urea molasses supplementation (Ernest et al., 1975; Losada et al., 1979 and Sudana,1985). Others,however, found no increase in intakes from the basal rations (Chicco et al., 1972; Dixon, 1984 and Neric et al., 1985). Effects of lick block supplementation on digestibility are still inconclusive (Schiere et al., 1989). Some investigators showed no positive effects of urea molasses supplementation on nutrient digestibilities (Ernest et al., 1975 and Church and Santos, 1981). Soetanto et al. (1988) showed a positive effect of lick block on rate of degradation of DM and cell wall contents. Pearce (1973) observed that the effects of lick blocks were more effective when the quality of the basal ration was poorer. Fouad (1991), found that the supplementation of roughages with urea molasses blocks showed better digestibility of CP, while the digestibilities of ADF, ADL and cellulose decreases. When protein levels are adequate, further increases in digestibility and intake occurred when diets based on crop residues were supplemented with additional energy in the form of grains (Crabtree and Williams, 1971 and Andrews et al.,

1972). A survey of mineral contents of feeds in Egypt including forages and residues showed levels below NRC recommended allowances particularly in CA, P, Zn and Mn (Shalaby et al., 1984). The solid block supplements have mineral premix in their contents.

This investigation was conducted to evaluate the effects of urea molasses lick block fed with different levels of concentrates on nutritive values of either corn stalks or rice straw as a source of roughage for sheep.

MATERIALS AND METHODS

1- Animals and management

Twelve mature Rahmani (an Egyption local breed) x Finnish crossbred rams were divided into four groups according to body weight and age then used repeatedly to make sixteen metabolic trials of three animals each. Animals were individually kept in metabolic cages fitted with stainless steel separators. Weights of animals at the beginning and at the end of experiments were recorded. Each experimental period consisted of a ten day preliminary period and a seven day collection period. Two week rest and adaptation intervals were given to animals between experiments. Measures and sampling of feed, water, feces and urine were made daily at 0700 h.

2-Experimental rations

Corn stalks (C.S.) and rice straw (R.S.) were chopped to 3-cm in length using a locally assembled machine (chopper). Diets offered to animals were control (C.S. or R.S.) alone or along with lick block (ad. lib. for both). There were also four levels of concentrates (0, 250, 500,and 750 gm/h/d) with each roughage. Therefore, there were 16 rations under test. The control ration fed animals were offered 10 gm urea +150 gm corn starch/h/d. Refusals were then weighed out. Diets were given twice daily at 0800 and 1500 hrs. Chemical compositions of feed components are presented in Table 1.

3-Analytical Methods

Samples of feeds, feces and urine as well as mineral

contents were analyzed according to A.O.A.C. (1984). analysis of fiber fractions was according to Goering and Van Soest procedures (1970). Statististical analysis was performed according to Snedecor and Cochran (1980). Significance of differences among means was estimated buy multiple test of Duncan (1955).

Table 1. Chemical compositions of the ingredients of rations fed to sheep

Item	CS	RS	Block*	Concentrates
DM	78.25	84.87	81.62	88.60
	----------DM basis (%) ----------			
OM	90.94	84.13	65.80	87.76
CP	3.99	4.04	39.05	17.13
NFE	47.33	40.99	21.63	52.50
Ash	9.06	15.86	34.21	12.24
CF	38.46	37.86	2.88	14.06
ADL	11.46	7.95	4.11	4.79
Cellulose	45.45	51.47	7.22	11.43
Hemicellulose	27.54	27.56	23.70	60.03
GE (Kcal/Kg)	4035	3686	3535	4232
	----------Mineral content mg% -------			
Ca	185.27	200.89	848.08	1041.79
P	79.38	94.56	409.91	407.79
Zn	9.49	10.33	87.13	39.69
Mn	8.27	16.89	90.09	117.26

* Block composed of: can molasses 43%, wheat bran 16%, rice bran 16%, sodium chloride 5%, minerals premix 2%, Binding agent 8% and urea 10%.

** Concentrates composed of: 30% undecorticated cotton seed cake, 38% wheat bran, 23% yellow corn, 3% rice bran, 3% molasses, 2%, limestone and 1% common.

RESULTS AND DISCUSSION

1-Dry matter intake(DMI)

Table 2 shows the effect of level of concentrates on some nutritional parameters. Absolute values of daily total DMI as well as relative values on basis of metabolic body size showed increasing trend as the level of concentrates increased ($P<0.05$). Values of total

DMI/Kg $W^{0.75}$/day were 50.40, 64.02, 73.30 and 84.94 gm for zero, 250, 500 and 750 g/h/d of concentrates increased. The difference in roughage DMI was not significant in relation to increased concentrate level from zero to 250 gm (411.03 and 409.55 gm in order). When the level of concentrates was highly leveled to above 250 gm/day, the roughage intake decreased significantly (325.62 and 281.31 gm for the 500 and 750 gm of concentrates in order). This was an expected behavior of the animals. The unit decrement, calculated as [(intake at higher level of concentrates minus intake at lower level of concentrates)/ intake at lower level of concentrates]%, in roughage intake corresponding to zero and 250 gm levels of concentrates was trivial whereas those of lick block showed greater unit decrements of intake (0.36% vs 19.53% for roughages versus block). The greater decrement in block intake was a direct reflection of adding concentrates to the basal ration. Therefore, animals may have preferred concentrates over lick block. The situation was reversed as the concentrates level was elevated from 250 to 500 g/h/d. The unit decrement of roughages (20.42%) was greater than that of lick block (3.05%). For the zero level of concentrates, the intake of block was high enough to compensate for the low intake of energy and protein from roughage only. The animals balanced themselves at the 250 and 500 gm levels of concentrates; that is the absolute intake of block was similar (189.82 and 182.02 gm of block in order for both levels of concentrates). At the higher level of concentrates, animals were in a welfare state that they significantly decreased the level of block intake (Table 2). In concern with total DMI as affected by the two kinds of roughages either alone or supplemented with block (Table 3), there was a significant difference ($P<0.05$) with rice straw (672.20 vs 869.49 gm for control vs block). The same was applicable for corn stalks (702.15 vs 890.28 gm for control vs block). dry matter intakes of either concentrates or roughages as affected by the treatment (block) were necessarily the same for control and lick block supplemented rice straw (330.30 or 341.9 gm) or corn stalks (330.30 vs 371.85 gh).

2- Digestibilities

Table 2 shows the effect of level of concentrates on

the nutrient digestion coefficients. There was a tendency to increase digestibilities of nutrients when levels of concentrates increased. The highest coefficients of digestion were attained by the nitrogen free extract (NFE) fraction (54.21, 63.59, 69.35 and 76.78% for zero, 250, 500 and 750 gm levels of concentrates respectively). Crude protein digestibility (CPD) had a low value (49.06%) at the zero level of concentrates, yet it increased as the levels of concentrates were elevated to reach 69.56% at the highest level of concentrates. The difference in digestibility of NFE and organic matter (OMD) as well as those of dry matter digestibility (DMD) were significant among the four levels of concentrates ($P<0.05$). Both of cellulose and acid detergent lignin (ADL) digestibilities decreased with increasing levels of concentrates, yet the decrease (from 62.33 to 51.72%) in cellulose digestibility was significant ($P<0.05$) when the 250 g/h/d level of concentrates was offered to animals. The ADL digestibility remained the same (32.79 to 32.19%) for the same change in concentrates levels, though. Whereas, the decrease in cellulose digestibility was greater (from 51.72 to 46.91%) when the 500 gm concentrates level was introduced to animals than the decrease (from 32.19 to 30.71%) in ADL digestibility (nonsignificant). At the higher levels of concentrates, both decrements in cellulose an ADL digestibilities were significant ($P<0.05$). The reducing effect of these higher levels of concentrates (500 and 750 g/h/d) on rumen pH could account for the variations in cellulose and ADL digestibilities (Ørskov, 1987). The digestibility of hemicellulose fraction was different where it increased as the level of concentrates increased. For the effect of both roughages and block supplement on digestibilities of nutrients, (Table 3) shows that with either kinds of roughages the block had a significant ($P<0.05$) effect on DMD (55.72 vs 58.22% for control versus block for rice straw and 58.17 vs 60.67% for corn stalks). The effect of block supplement on DMD of both rice straw and corn stalks was equal (+2.5% unit for either roughage). Values for OMD of corn stalks either supplemented or not were higher than those of rice straws (63.71 or 62.78% vs 60.98 or 58.69% for supplemented C.S. or not vs the same for R.S. resp.). The effect of block supplement versus control on CPD

(66.71 vs 51.94 for rice straw and 69.23 vs 52.71% for corn stalks) was significant (P<0.05). Again the effect of block with corn stalks on CPD was greater than that of rice straw (69.23 vs 66.71%) for C.S. vs R.S.). The effect of lick block on both cellulose and ADL digestibilities was clear as they decreased though. The unit decrement of cellulose digestibility as a result of supplementing R.S. with lick block was almost twice as much as that of C.S. (-12.6% vs -7.3% respectively). The unit decrement s of ADL as a result of using lick block were 35.8 for R.S. and -26.5% for C.S. The increase in hemicellulose digestibility as an effect of lick block was less than that occurred with concentrates.

Table 2. Effect of levels of concentrates on nutritional parameters

Item	Level of concentrates 0	250	500	750
Intake: (gm/h/d)				
TDM (gm)	646.16^{d}	820.76^{c}	0939.67^{b}	1088.99^{a}
TDM/Kg$^{0.75}$	50.40^{d}	64.02^{c}	64.02^{c}	64.02^{c}
Concentrates	0.00^{a}	0.00^{a}	0.00^{a}	0.00^{a}
Roughages	411.03^{a}	411.03^{a}	411.03^{a}	411.03^{a}
Block	235.13^{a}	235.13^{a}	235.13^{a}	235.13^{a}
Digestibilities:(%)				
DM	50.51^{a}	50.51^{a}	50.51^{a}	50.51^{a}
OM	54.26^{d}	54.26^{d}	54.26^{d}	54.26^{d}
CP	49.06^{c}	49.06^{c}	49.06^{c}	49.06^{c}
NEF	54.21^{c}	54.21^{c}	54.21^{c}	54.21^{c}
CF	54.91^{a}	54.91^{a}	54.91^{a}	54.91^{a}
Cellulose	62.33^{a}	62.33^{a}	62.33^{a}	62.33^{a}
Hemicellulose	62.89^{d}	62.89^{d}	62.89^{d}	62.89^{d}
ADL	32.79^{a}	32.79^{a}	32.79^{a}	32.79^{a}
Feed value: (%)				
DE	2.04^{d}	2.04^{d}	2.04^{d}	2.04^{d}
TDN	46.54^{d}	46.54^{d}	46.54^{d}	46.54^{d}
DCP	6.84^{b}	6.84^{b}	6.84^{b}	6.84^{b}
N. Balance(g/h/d)	1.48^{d}	1.48^{d}	1.48^{d}	1.48^{d}
Mineral balance:(gm/h/d)				
Ca	1090.73^{c}	1090.73^{c}	1090.73^{c}	1090.73^{c}
P	22.38^{c}	22.38^{c}	22.38^{c}	22.38^{c}
Mn	- 32.40^{d}	- 32.40^{d}	- 32.40^{d}	- 32.40^{d}
Zn	62.79^{d}	62.79^{d}	62.79^{d}	62.79^{d}

a,b,c and d Values in the same row bearing different superscripts differ significantly (P<0.05).

Table 3. Effect of kinds of roughages and urea-molasses lick block on nutritional parameters

	Level of concentrates			
	Rice straw		Corn stalks	
Roughages item	Control	Block	Control	Block
Intake: (gm/h/d)				
TDM (gm)	672.20^{b}	869.49^{a}	702.15^{b}	890.28^{a}
$TDM/Kg^{0.75}$	51.50^{a}	66.89^{a}	54.77^{b}	669.44^{a}
Concentrates	330.30	330.30	330.30	330.30
Roughages	341.90	341.90	371.85	371.85
Block	---	197.29^{a}	---	188.13^{b}
Digestibilities:(%)				
DM	55.72^{b}	58.22^{ab}	58.17^{ab}	60.67^{a}
OM	58.69^{c}	60.98^{bc}	62.72^{ab}	63.71^{a}
CP	51.94^{b}	66.71^{a}	52.71^{b}	69.23^{a}
NEF	63.83	64.38	68.53	67.20
CF	55.02^{b}	48.41^{a}	57.06^{a}	51.55^{c}
Cellulose	53.93^{a}	47.16^{b}	53.12^{a}	49.24^{b}
Hemicellulose	70.77^{b}	71.46^{ab}	73.45^{ab}	74.06^{a}
ADL	32.21^{b}	20.68^{c}	40.11^{a}	29.49^{b}
Feed value: (%)				
DE	2.31^{b}	2.40^{b}	2.51^{a}	2.56^{a}
TDN	53.88^{bc}	51.87^{b}	57.50^{a}	55.77^{ab}
DCP	4.70^{b}	11.30^{a}	5.06^{b}	11.39^{a}
N. Balance(g/h/d)	1.96^{d}	3.81^{a}	2.28^{b}	4.03^{a}
Mineral balance:(gm/h/d)				
Ca	1436.29^{b}	2965.73^{a}	1725.74^{b}	3264.05^{a}
P	420.50^{c}	690.89^{ab}	596.35^{b}	923.18^{a}
Mn	109.54^{c}	267.33^{b}	140.65^{c}	355.99^{a}
Zn	43.75^{c}	215.46^{a}	65.98^{b}	223.61^{a}

a,b,c and d Values in the same row bearing different superscripts differ significantly ($P<0.05$).

3- Feeding values

As might be expected, digestible energy (DE) contents (Table 2) of diets increased as the levels of concentrates increased (2.04, 2.36, 2.51 and 2.87 Mcal/Kg DM for the four levels of concentrates in order) and so was the total digestible nutrients (TDN) (46.54, 52.28, 57.22 and 62.97% respectively). The same was applicable for DCP and nitrogen balance. Supplementing blocks to rice straw increased DE content from 2.31 to 2.40 Mcal/Kg DM (Table 3), but not significantly. The

increase in energy contents (from 2.51 to 2.56 Mcal/Kg DM) of corn stalks was less than that of rice straw. This might be attributed to the higher gross energy content of corn stalks (4.035 Mcal) than that of rice straw (3.686 Mcal). The results obtained from this study agreed with those of Saad, 1993; Prasad and Pradhan, 1990; tag-El-Din et al., 1989. Shehata and Nour, 1986 and Arndt et al., 1980 observed higher values of digestibility of DM, OM and CP as well as TDN and DCP, but lower values of cellulose digestibilities with increasing levels of concentrates in sheep, cattle and buffaloes than those reported in this study. They also found that N. balance increased with increasing levels of concentrates.

4-Mineral balances:

Apparent availability of minerals increased with increasing levels of concentrates (Table 2). Animals were in positive balances for Ca, P, Zn but were in a negative Mn balance. This negative balance of Mn at the zero level of concentrates included ration was possibly because of the inadequacy of Mn in this ration. The positive mineral balances obtained in this study were similar to those obtained by Tiwari et al., 1989; Fouad,1991 and Abdel-Aziz et al., 1993. They reported that supplementing diets with urea molasses block enhanced mineral balances especially Ca and P. This is in agreement with the results reported in this study when either roughages was supplemented with urea molasses block. This emphasizes the importance of lick blocks as a source of mineral premix.

GENERAL DISCUSSION

Orthogonal contrasts were made for the four levels of concentrates for some selected variables (DM, OM, CP, CF and NFE digstibilities). Also, contrasts were made for both kinds of roughages and lick block. When corn stalks was contrasted against rice straw, only CPD was non significant ($P<0.07$) and when level zero of concentrates was contrasted against level 250 gm of concentrates, only CFD was non significant ($P<0.13$). The rest of contrasts were highly significant ($P<0.0001$).

The decreased DMI of roughages corresponding to the increasing levels of concentrates is a logic conclusion

and an expected tendency of the animals. The percentage of block intake to the total DMI at the highest level of concentrates was about 18% and was similar to that obtained by Lashin et al., 1993; Hafez, 1992; Soetanto et al., 1988 and Sudana and Leng, 1986, when concentrates were offered at more than 500 g/h/d.

All the results obtained in this study agreed upon that with lick block supplementation increases in the apparent digestibility of roughages may take place (Lashin et al., 1993; Kunju, 1986 and Leng, 1984), as well as TDN and DCP (El-Faramawy,1991; ElKhidir et al.,1989). Corn stalks seems to be of higher quality than rice straw since its DM, OM, CP, CF, and ADL digestibilities had higher values either supplemented or not. Consequently, the feeding values of corn stalks were higher than those of rice straw.

Abdel-Aziz et al., 1993 reported that the supplementation of corn stalks with block increased Ca, P, Zn and Mn retention than for control diet. Tiwari et al., 1989 found that wherever animals were offered urea molasses minerals block, Ca and P balances were significantly higher ($P<0.01$) than that of control ration. This is in accordance with the results obtained in this study.

IMPLICATIONS

Rice straw is a kind of roughage used commonly in Egypt as a basic feedstuff component especially in summer. Corn stalks, on the other hand is less frequently used in spite of being more quantitavely present than rice straw. Corn stalks has been used as a fuel. This study is an attempt to compare both roughages especially when their feeding values were improved by supplementation of urea molasses block along with different levels of concentrates. This study revealed that even in control ration the corn stalks was of better quality than rice straw. The differences between the two roughages either with increasing levels of concentrates or when supplemented with lick block or not supplemented were in the side of corn stalks. Although the differences between the two roughages were not such great to get corn stalks superior over rice straw, but it is still better than rice straw. So, the negligence of corn stalks for rice straw is impractical. Therefore, the use of corn stalks side by side with rice straw must

be a widespread practice especially in periods of feed shortage. That is in order to make use of all available resources to relief the problem of feed shortage in Egypt.

ACKNOWLEDGEMENT

The authors would like to thank late DR. F.A. Abdel-Kareem for his efforts to make this work available.

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تـأثير مستوى العلـف المركـز مـع قوالـب المـولاس واليوريـا علـى القيمـة الغذائية لبعض المواد المنشفة

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فى هذه الدراسة تمت مقارنـة قش الارز وحطـب الذرة عند استخدام قوالب المولاس واليوريا مع مستويات مختلفة من العلف المركز (صفر- ٢٥٠-٥٠٠-٧٥٠جم/ راس/ يوم) وجد ان المأكول الكلى من المادة الجافة قد زاد بزيادة مستوى العلف المركز مع ملاحظة إنخفاض المأكول من المادة الخشنة وقوالب المولاس بطريقة طردية مع زيادة مستوى المركزات. وقد انخفض معامل هضم السليولوز (٦٢,٣٣٪، ٥١,٧٢٪، ٤٦,٩١، ٤٢,٤٩٪) وكـذا اللجنيـن (٣٢,٤٩٪، ٣٢,١٩٪، ٣٠,٧١٪، ٢٥,٨٨٪) بزيـادة نسـبة العلف المركز فى العليقة٠ ولوحظ زيادة المركبات الكليـة المهضومـة بزيـادة نسبة العلف المركز (٤٦,٥٤٪، ٥٢,٢٨ ٪، ٥٧,٢٢٪، ٦٢,٩٧٪) وكذلـك البروتين الخام المهضوم (٦,٨٤٪، ٦,٩٧٪، ٦,٩٧ ٪، ٨,٣٤٪، ١٠,٣٠٪) ٠

وقد اوضحت المقارنات بين قش الارز وحطب الذرة. أن حطب الذرة كـان افضل قيمة من قش الارز حيث زاد المـأكول الكلـى مـع حطـب الـذرة بـدون قوالـب المـولاس (٧٠٢,١٥جـم/راس/يـوم) وذلـك عـن قـش الارز (٦٦٠,٢١جم/ رأس/يوم)٠ مع زيادة معاملات الهضم لحطب الذرة عن قـش الارز سواء مع قوالب المولاس او بدونهـا٠ لوحظ ايجابيـة ميزان الازوت لكل مستويات العلف المركز وكذلك لنوعى المادة الخشـنة مـع القوالـب المولاسية او بدونها مع ملاحظة ايجابية ميزان المعادن ٠٠ ويستنتج من ذلك ان حطب الذرة افضل من قش الارز سواء استخدم معه القوالب المولاسية او لم تستخدم٠