J. Agric. Sci. Mansoura Univ., 31 (1): 103 - 117, 2006

INFLUENCE OF PARTIAL REPLACEMENT OF CLOVER HAY BY AMMONIATED RICE STRAW IN BASAL DIETS OF LACTATING FRIESIAN COWS.

1- THE DIGESTION COEFFICIENTS, FERMENTATION IN THE RUMEN AND FEEDING VALUES OF THE RATIONS.

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ABSTRACT

Twelve lactating Friesian cows with body weights, ranging from of 480 to 600 kg were randomly distributed into four similar groups (three for each group). The experimental rations were formulated as follows ration 1 (R: 50 % concentrate feed)mixture (CFM) + 50 % clover hay CH, ration 2 (R2): 50 % CFM +10% CH+40 % ammoniated rice straw (ARS), ration 3 (R3): 50 % CFM + 20 % CH + 30 % ARS. and ration 4 (R4): 50 % CFM +50 % ARS . These proportions were chosen to achieve isonitrogenous rations containing about 12-15% CP necessary for optimal and fermentation of roughages in the rumen. The target of 12-15% CP in each experimental diets was achieved in all diets since the ingredients were analysed before formulating the experimental diets. The apparent digestibility of CF, NDF, ADF, cellulose, ADL and unavailable NDF (UNDF) were significantly ($p<0.05$) higher with feeding ammoniated rice straw as the only roughage or when combined with clover hay. than feeding on clover hay alone, the DCP% was significantly ($p<0.05$) higher when CH was used or supplemented with ARS than feeding on ARS alone. The relative feed value (RFV) was significantly ($p<0.05$) higher when feeding on 50% CH or 20% CH + 30% ARS than feeding on 50% ARS or 10% CH + 40% ARS, while the relative feed quality (RFQ) and quality index (QI) values were higher ($p<0.05$) when feeding on 50% CH than the other ones. The TDN/CP ratios were significantly ($p<0.05$) higher when feeding on ARS with or without CH.

The effective NDF (eNDF) values ranged from 42.44 to 49.67 with different rations. The highest value ($p<0.05$) was recorded when feeding on 10%CH + 40% ARS.

In general, the data indicated that the substitution of clover hay by ammoniated rice straw at a level of at least 10% (DM basis) would provide adequate fermentable N, as well as fermentable fiber, and above this level of clover hay may not be necessary. The increase in DM intake when feeding on CH alone might have affected fiber digestion because of an increase in the rate of passage of digesta.

Keywords: lactating Friesian cows, clover hay, ammoniated rice straw, effective NDF and unavailable NDF.

INTRODUCTION

The problems of feeding lactating cows have received considerable attention in the tropic and sub-tropics. Most of the work had focused on dietary supplementation during the late dry season when the quality of the feed from natural pastures is severely reduced.

Ruminant animals can maintain themselves and be productive on cellulose crops residues. Many techniques are on hand to improve the nutritive values of cereal straws.

In poor quality roughages, the cellulose is associated with lignin and other compounds which make it more or less unavailable for the microbes of the rumen. It has been known for many years that the digestibility and intake of highly lignified materials may be improved by physical(Chopping, grinding. etc,) and chemical treatment according to Davis *et al* (1983), of all the alkalis tested, ammonia is preferred because it provides both the alkali effect and a source of nitrogen. Forage legumes are rich in protein , both fermentable and undegradable protein (UDP), depending upon the tannin content (Said and Tolera, 1993). Since most tropical legumes have generally a high level of tannin and therefore better sources of UDP, other sources of fermentable N such as urea may be required (Preston and Leng, 1987).

Strategies for the utilization of crop residues should aim at establishing an efficient rumen ecosystem in order to maximize fiber digestion and optimize microbial protein synthesis. An efficient rumen ecosystem requires fermentable N, energy and minerals sufficient to support the rumen microbial population.

Early work on the use of forage supplements was mainly concerned with the need to improve the N content of diets based on poor quality roughages in order to overcome a deficiency of nitrogenous substrates for the rumen microorganisms. More recent evidence indicates that, other changes occur with this supplementation which enhance the intake and digestibility of the diet (Topps, 1995). These changes seem to be related to the level of supplementation, the quality of the basal diet, and the quality of the forage supplement.

The main objective of this project, therefore, was to study the influence of substituting clover hay by ammoniated rice straw feeding on digestion and fermentation in the lactating Friesian cows rations.

MATERIALS AND METHODS

The experimental work of this study was conducted at El-Karada Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture and Department of Animal Production, Fac. of Agric., Mansoura University during the years 2003 to 2005.

Twelve lactating Friesian cows from the station herd were randomly chosen out of the sixteen cows used for studying milk production (Maklad, 2006), with body weight ranging from of 480 to 600 kg were used. All animals were in the 2^{nd} to 4^{th} lactation season. Cows were randomly distributed into four similar groups (three each). All cows were individually fed according to Wheeler, (2003) recommendations, based on their live body weight and milk yield. He recommended that the maximum total DMI (from roughage and grain mixture) for milking cows with average body weight, 550 kg and milk yield between 20 to 30 kg/day can eat 4.2% of BW, while they can consume 1.8 to 2.2% of BW daily as DM from average quality dry roughage. Most cows increase in DMI gradually after calving and peak in DMI by 10 to 20 weeks of lactation season. The experimental period lasted for 140 days to study milk production and composition and some blood parameters (Maklad, 2006). The four experimental rations were evaluated through digestibility trails by the end of the tenth week of the experiment. For each digestibility trail, seven days were for collection period and then two days for sampling rumen liquor for fermentation parameters.

The four experimental rations were formulated as follows:

R 1: ration 1 : 50 % concentrate feed mixture (CFM) + 50 % Clover hay (CH).
R 2: ration 2 : 50 % CFM +10% CH+40 % ammoniated rice straw (ARS).
R 3: ration 3: 50 % CFM +20% CH+30 % ARS.
R 4: ration 4 : 50 % CFM +50 % ARS .

The experimental rations were formulated to be almost iso-nitrogenous and contained about 12-15% crude protein as recommended by Ørskov *et al.* (1972) to ensure maximal rate of fermentation in the rumen.

Bales of unshaped rice straw (30 tons) were arranged in three stacks, each consisting of three layers in cement pit. The stacks were covered with plastic sheets, leaving a free margin of fifty cm. plastic on each side to be covered with the soil. The stacks were injected by ammonia at the rate of 3% NH_3 on weight basis through a hold metal pipe, then each side of the plastic was well covered by the soil and left for three weeks to accomplish the reaction with ammonia. The stacks were opened and aerated for one week before starting the feeding trial.

The CFM used contained wheat bran, undecorticated cotton seed meal, yellow corn, molasses, rice bran , limestone, soybean meal and salt. The clover hay was obtained from the 3nd cut of clover, Egyptian.

Management of feeding

The CFM fed was offered to animals firstly at morning , while clover hay or treated rice straw was given after consumption of the CFM, Drinking fresh and clean water was available at all times.

Experimental animals and rations:

Four digestibility trials were conducted using three cows chosen randomly from each group to determine nutrients digestibility coefficients and nutritive values of the experimental rations. The digestibility trails were conducted at the tenth week from the beginning of lactation trials for each experimental rations. During the digestion trials, cows were fed their allowances according to the experimental assignment of each group. Acid insoluble ash (AIA) was used as a natural marker (Van Keulen and Young, 1977). Nutrients digestibility was calculated from the equations stated by Schneider and Flatt (1975).

Feces samples were taken from the rectum of each cow twice daily with 12 hours interval during the collection period of each trial and dried in a forced air oven at 65°C for 48 hours. Dried samples were composted for each cow and representative samples were taken, ground and kept for chemical analysis.

Samples of CFM, CH, ARS were taken at the beginning, middle and at the end of each trial. At the end of the collection period composite samples were dried in a forced air oven at 65°C for 48 hours, then ground and kept for chemical analysis.

Chemical analysis and rumen parameters :

Proximate chemical analysis of CFM, CH and ARS and feces were carried out according to the methods of AOAC (1990), fiber fractions (NDF,ADF ADL, Hemc. and Cell.) was determined according to method of Van Soset, (1982). Acid insoluble ash was determined according to method of VanKeulen and Young (1977).

Ruminal fluid samples were taken using rubber stomach tube at 3 hrs post- feeding from three animals in each treatment. The collected rumen fluid samples were filtered through three layers of gauze without squeezing for the determination of pH, buffering capacity (BC), ammonia-N and total volatile fatty acids (TVFAs) concentration. Ruminal pH was estimated by pH meter (Orion Research, model 201 digital pH meter). Buffering capacity was the milli-equivelaents of HCl required to bring the pH of100 ml rumen liquor to pH 4.5 (Nickolson *et al*, 1963) determined immediately after sampling. Ruminal NH_3-N was determined according to Conway (1957). The TVFA's were determined by the steam distillation method as described by Warner (1964).

Statistical analysis:.

The statistical analysis was performed using the least squares method described by Likelihood programme of SAS (1994). The obtained data for nutrient digestibility, nutritive value, effective NDF (eNDF), were subjected to one way analysis of variance according to the following model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where: Y = Observation of the tested factor

μ = Overall mean

T_i = Treatment effect

e_{ij} = Error

The data of rumen liquor parameters were subjected to tow way analysis of variance according to the following model:

$$Y_{ijk} = \mu + T_i + P_j + TP_{ij} + e_{ijk}$$

Where: Y = Observation of the tested factor

μ = Overall mean

T_i = Treatment effect

P_j = Time effect

TP_{ij} = Interaction effect of the treatment x time

e_{ijk} = Error

The differences among means were carried out according to Duncan's New Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

Chemical analysis (%) of concentrate feed mixture (CFM) , clover hay CH) and 3% ammoniated rice straw (3%ARS) used in the experiments are shown in Table (1).

The summative analysis of the ingredients (Table 1) used to formulate the experimental rations were within the normal published ranges (Cheva-Isarakul and Cheva-Isarakul,1984, Ibrahim,1987, Maklad and Mohmed, 2000 and Maklad *et al*, 2005).

Table (1): The chemical composition of the ingredients and experimental rations.

Item	DM	Chemical composition (% as DM)															
		OM	CP	EE	CF	NFE	Ash	NDF	ADF	Hemi.	Cellu.	ADL	NFC*	UNDF[1]	ANDF[2]	NDS[3]	RAC[4]
Ingredients																	
Concentrate feed mixture (CFM)	90.86	92.72	16.48	2.14	15.17	58.93	7.28	40.34	17.58	22.76	10.00	7.58	33.76	7.34	33.00	59.66	81.88
Clover hay (CH)	88.89	84.90	13.42	2.29	27.76	41.43	15.10	53.29	29.58	23.71	13.96	15.62	15.9	19.97	33.32	46.71	68.67
Ammoniated rice straw (3% ARS)	91.88	80.65	8.19	1.65	27.70	43.11	19.35	65.11	57.19	7.92	40.27	16.92	5.7	26.45	38.66	34.89	63.60
Experimental rations																	
50%CFM +50% CH	91.1	88.78	14.94	2.22	21.52	50.10	11.22	46.87	23.63	23.24	12.00	11.63	24.75	13.71	33.16	53.13	75.22
50%CFM+10% CH+40% ARS	91.05	87.24	12.95	1.97	21.32	51.00	12.76	51.28	34.20	17.09	22.17	12.02	21.04	16.05	35.23	48.68	73.44
50%CFM+20% CH+30% ARS	92.14	87.52	13.38	2.02	21.47	50.65	12.48	50.37	31.86	18.52	19.85	12.00	21.75	15.62	34.76	49.60	73.73
50%CFM+50% ARS	91.12	86.69	12.34	1.89	21.43	51.03	13.31	52.72	37.38	15.34	25.13	12.25	19.74	16.89	35.83	47.23	72.74

* Non fiberous carbohydrates%= OM% - (CP%+NDF%+EE%), (Calsamiglia *et al.*, 1995).

(1) UNDF : Unavailable NDF = NDF x 0.01 x ADL x 2.4 (Fox *et al.*, 2000) .

(2) ANDF : Available NDF = NDF – UNDF

(3) NDS : Neutral detergent solubles = 100 – NDF

(4) RAC: Rumen available carbohydrate = $\frac{[\,0.9\ (\text{NDS} - (\text{Protein} + \text{Lipid}) + (\text{NDF} \times \text{NDF availability}))\,]}{[\,(\text{NDS} - (\text{Protein} + \text{Lipid})) + \text{NDF}\,]}$ (Nocek and Russell, 1988)

The CP content is positively correlated with quality. Forage with high concentration of CP are considered high quality for two reasons. First if a high protein forage is fed , less supplemental protein will be needed. Secondly, CP is positively correlated to energy content of forages. High protein forages generally are more digestible and provide more energy per unit weight than low-protein forages (Weiss *et al*, 1982). Concentration of fiber is negatively related to quality because forages with high concentrations of fiber content had less available energy and are consumed in lesser amounts by cows than are forages with low amounts of fiber (Weiss *et al* 1982). They reported that, the mid bloom for legumes contain 13 to 16% CP and 47 to 51% NDF (36 to 41% ADF).

Maklad *et al*, (2005) showed that the crude protein content of ammoniated rice straw was practically doubled (8.19 vs 4.08% respectively) compared with the untreated rice straw. Ammonia treatment caused a reduction in neutral detergent fiber (NDF) content (65.5 vs 73.3 %) and increased neutral detergent soluble (NDS) (34.52 and 26.7%), compared with the untreated material. The proportion of fiber to cell soluble is a major determinant of energy availability in forages (Buxton and Redfearn, 1997).So, Maklad *et al*, (2005) showed that the rumen available carbohydrate (RAC) was higher in ammoniated rice straw than untreated rice straw (63.45 and 62.05 % , respectively). The energy contribution from structural and nonstructural carbohydrate have to be considered (Nocek and Rusell, 1988).

The clover hay was higher in neutral detergent soluble (NDS%) and rumen available carbohydrate (RAC%) than ammoniated rice straw (46.7 vs 34.89 and 68.67 vs 63.60% respectively), while CFM was higher in NDS% and RAC% than clover hay or ammoniated rice straw (59.66 and 81.88% respectively).

Ely (2002) showed that, minimum CF, ADF and NDF percentages in dairy cow rations should be 17, 22 and 33, respectively and at least 40% of total DM intake showed be covered from roughages.

The NRC (2001) recommended the concentration of NDF and NFC in lactation diets (% of diet DM) should never exceed 44% NFC or contain less than 25% total NDF or less than 15% forage NDF.

Table (2) showed the average daily dry matter intake from each experimental diet was in accordance with those of Wheeler (2003). The average daily intake of total concentrate (CFM) as % of body weight ranged from 1.8 to 2.25% while the roughage ranged from 1.81 to 2.29% of BW, so the total DM intake ranged from 3.60 to 4.54% of BW. Such differences among groups may be due to the differences in animals average body weight and average daily milk yield. When cow eats more clover hay, ammoniated rice straw consumption usually decreased.

Ørskov, (1995) found that the intake of diets based on crop residues supplemented with Ethiopian local forage was always less than that of unsupplemented control diet.

According to Topps (1992), the most practical alternative would be either to dilute the effect of tannins by feeding the legume at low levels in a suitable mixture or to feed two or more rather than one legume species. Addition of higher quality feeds such as legume forage to poor quality basal diet is more practicable. Since high quality feeds are available in small quantities, it is better to use them as supplements rather than as substitutes. In general, if the amount of supplement consumed was less than 30 to 40% of total intake there was an increase in the intake of the basal diet, (Kitalji and Owen, 1993). It is well known that. Forage legumes are relatively good sources of degradable N and fermentable energy so their inclusion in the diet is likely to increase the rumen population of cellulolytic microbes (Topps, 1995).

Table (2): Average daily dry matter intake of concentrate, clover hay, ammoniated rice straw by dairy cows

Items	Ration 1	Ration 2	Ration 3	Ration 4
Average body weight (kg)	500	600	483	553
Roughage : concentrate	50.4:49.6	49:51	50.2:49.82	50:50
Intake of DM from :				
Concentrate feed mixture (CFM) :				
Kg/h/d	11.25	11.29	9.3	9.99
As % BW	2.25	1.89	1.93	1.80
Clover hay (CH) :				
Kg/h/d	11.45	2.24	3.79	0
As % BW	2.53	0.41	0.87	0
3%Ammoniated rice straw (ARS) :				
Kg/h/d	0	8.62	5.58	9.99
As % BW	0	1.44	1.16	1.80
Total roughage:				
Kg/h/d	11.45	10.86	9.37	9.99
As % BW	2.29	1.81	1.94	1.81
Total dry matter intake:				
Kg/h/d	22.7	22.15	18.67	19.98
As % BW	4.54	3.70	3.88	3.60

Leng (1990), compiled a series of data on sheep and cattle fed on low-quality forage and supplemented with urea and / or bypass protein under different climatic conditions. Under tropical conditions, he reported that supplements which improved the protein : energy (P : E) ratio in nutrients absorbed by cattle fed on low-quality forage reduced metabolic heat production. Where metabolic heat production would increase body temperature the animal reduced its feed intake. Intake has been shown to be more sensitive to P : E ratio rather than VFA proportions, and legumes have the greatest potential to contents and often lower protein degradation rates caused by tannins (Poppi *et al*, 1990).

Table (3) shows the effect of the experimental rations on the digestion coefficients and feeding values.

There were no significant effect of feeding the experimental rations on the apparent digestibility coefficient of DM, OM, CP, NFC, ANDF, NDS, RAC, TDN, TDNI kg/d, ME (Mcal/kg DM feed), ME (MJ/kg) and NE (Mcal/kg DM feed).

There were higher significant effect ($p<0.05$) of feeding on 10% CH+40% ARS or 20% CH+30%ARS or 50% ARS from the total % DM on the apparent digestibility of CF, NDF, cellulose, ADL and UNDF than feeding on 50% CH of the total % DM.

These results are in agreement with Ørskov, (1995) who showed that where the supplemental forage in a straw-based diet given to sheep was of high digestibility, a boost to digestibility of the basal diet occurred even at relatively small levels of supplementation. The rate of digestibility of straw depends on the rate and extend of colonization of fiber and the biomass of adherent organisms (Cheng *et al* 1991).

Leng (1990) suggested that the beneficial effects of the incorporation of high digestibility forage to a low-digestibility forage diet could be that this exerts a large effect on digestibility by providing a highly colonized fiber source to "seed" bacteria onto the less digestible fiber. Supplementation with legume crop residues supplies fermentable energy to the rumen in the from of available cellulose which stimulates fiber digestion (Silva and Øroskov, 1985). According to Bauchop (1981), it is possible that offering such material prior to the daily feeding of straw may induce a greater degree of colonization of straw by rumen bacteria and by rumen fungi, which have been implicated in the breakdown of fiber.

Øroskov and Dolberg, (1984) stated that animals fed on untreated straws or poor quality roughages supplemented with substrates which increase the fermentation rate of cellulose, the rumen environments becomes similar to that animals receiving ammonia-treated straw.

Feeding value, palatability, and digestibility of low-quality cereal straws can be remarkably improved by treatment of the straw with ammonia (Manda *et al*, 1999). Ammoniation of straw has thus contributed to a considerable increase in livestock production in many countries. By treating rice straw with ammonia, the TDN content of rice straw increased from 40 to 60%. As a result, treated rice straw was similar to good quality grass hay while treated barley and wheat straws were similar to grass hay harvested at a slightly later stage (Manda *et al*, 1999).

Very few studies have been carried out in which changes in the rumen environment have been measured when legume forage are fed with poor quality basal diets (Topps, 1995). It is well known that poor quality forages provide insufficient degradable N and fermentable energy to sustain optimum digestion of fiber. Furthermore, rumen microbes require a source of fermentable N usually as NH3 although some microbial species require performed amino acids and peptides (Russell and Baldwin, 1978).

The nutritive value as DCP% was higher ($p<0.05$) when feeding on R1 than the feeding on R4. The DDM% was higher ($p<0.05$) when feeding on rations contain 10% CH+40% ARS or 20% CH + 30% ARS than the rations R1 or R4.

The relative feed values (RFV) were significantly ($p<0.05$) higher when feeding on 50% CH or 20% CH + 30% ARS than feeding on 50% ARS or 10% CH + 40% ARS rations, while the relative feeding quality (RFQ) and quality index values were higher ($p<0.05$) when feeding on 50% CH ration than the others.

The TDN/CP rations were significantly ($p<0.05$) higher when feeding on ARS with or without CH rations.

Table (3): Effect of feeding the experimental rations on the digestion coefficients and feeding values by cows.

Items	Ration 1	Ration 2	Ration 3	Ration 4
Nutrient digestibility (%):				
DM	73.68	77.89	78.23	74.34
OM	75.91	80.66	80.63	77.91
CP	73.13	77.27	77.68	73.69
EE	68.90^{b}	87.52^{a}	74.12^{b}	84.28^{a}
CF	62.83^{b}	72.09^{a}	72.54^{a}	72.77^{a}
NFE	79.02	82.52	82.30	78.53
NDF	63.77^{b}	74.32^{a}	73.55^{a}	70.28^{a}
ADF	41.88^{b}	67.65^{a}	67.08^{a}	64.26a
Hemi.	86.02	87.67	84.68	84.94
Cell.	56.65^{b}	82.02^{a}	83.60^{a}	77.76^{a}
ADL	26.66^{b}	41.14^{a}	39.78^{a}	36.55^{a}
NFC	93.83	91.88	92.92	94.33
UNDF	3.61^{b}	36.61^{a}	32.07^{a}	32.55^{a}
ANDF	88.63	91.45	92.19	88.07
NDS	82.43	81.61	82.96	78.84
RAC	86.27	86.59	87.77	83.76
Feeding value				
TDN%	67.48	71.33	71.03	68.35
DCP%	10.92^{a}	10.00^{b}	10.39^{ab}	9.09^{c}
TDNI kg/day	15.31	15.82	13.27	13.62
DCPI kg/day	2.48^{a}	2.22^{ab}	1.94^{bc}	1.81^{c}
ME(Mcal/kg)	2.44	2.54	2.54	2.43
ME(Mj/Kg)	10.05	10.62	10.57	10.17
NE(Mcal/Kg)	1.53	1.63	1.62	1.55
DDM%	65.19^{b}	69.94^{a}	70.01^{a}	67.03^{ab}
RFV	229.49^{a}	200.82^{b}	210.32^{ab}	187.2^{ab}
RFQ****	249.04^{a}	214.84^{b}	223.79^{c}	200.21^{b}
QI*****	3.21^{a}	2.78^{b}	2.89^{c}	2.60^{b}
TDN / CP	4.52^{b}	5.25^{a}	5.44^{a}	5.11^{a}

a, b and c : Means within the same row with different superscripts are significantly different (P<0.05).
* NE (Mcal / kg) = (TDN% x 0.0245) – 0.12 (NRC, 2001)
** DDM% of DM (Digested dry matter) = 88.9 - 0.779 x (ADF% of DM) (Schroeder , 1996)
*** RFV(Relative feeding value) = DMI x DDM / 1.29 (Schroeder , 1996)
****RFQ(Relative feeding quality) = (DMI% of BW) * (TDN% of DM) / 1.23 (Moore, 1994)
*****QI (Quality index) = 0.0125*RFQ + 0.097 (Moore, 1994)

Moore and Kunkle(1995) reported that supplements generally (but not always) improved animal performance. In many studies , performance was not increased as much as was expected from the amount of supplement fed. In a few studies, however, performance increased more than was expected. The reasons for the unexpected effects of supplements on animal performance are that forage intake and TDN may either be increased or decreased. The effects on intake and TDN depend on the quality and composition of the forage, as well as the composition and amount of the supplement. The negative associative effect was found when the concentrate was more than 50% of the total dry matter intake (Mehreze et al, 1983), so there were no significant effect on the TDN values of the presented study because of roughage : concentrate ratio among the rations did not increased than 1: 1

The TDN: CP ratio ranged from 4.52 to 5.44 for the experimental rations. Bohnert and Delcurto (2003) reported that the dietary ratio of TDN to CP (TDN : CP) is often used to evaluate the energy and protein balance of forage diets. A ratio of about 4: 1 is assumed to maximize forage intake. Most research suggest that protein supplementation may be needed when the TDN : CP ratio is greater than 6 : 1 to 8 : 1.

Table (4) shows that the mean value of ruminal pH was increased ($p<0.05$) when feeding on 10% CH + 40% ARS ration than feeding on 50% CH of the total % DM of the ration, while there were no significant effect when feeding on R2 or R3 or R4 and among rations R1 or R3 or R4. the mean values of the animal pH were within 7.22 to 7.53 of the experimental rations. The same trend was observed on the calculated effective neutral detergent fiber (eNDF) values. The eNDF values ranged from 42.44 to 49.67 with different rations. The lowest value was recorded in ration 1 compared with the other rations. Effective NDF (eNDF) is the percentage of the NDF effective in stimulating chewng and salivation, rumination as rumen motility (Russel *et al*, 1992). Pitt *et al* (1996) described the relationship between eNDF values, rumen pH and structural carbohydrate (SC) digestion. Total microbial yield, and SC growth rate rapidly declines below a pH of 6.2, which relates to a diet eNDF content of 20%.

Øroskov (1987) reported that the supplements fed with either untreated or treated straw diets are very important, since rumen bacteria which ferment or digest cellulolosic feed are very sensitive to low rumen pH caused by supplementation. The pH values obtained in the present study were within a normal range of 6-7. Such range is suitable for the growth and activity of cellulolytic bacteria (Prasad *et al* 1972).

Topps (1995), stated that forage legumes increase the total concentration of VFA without affecting the relative proportion and the rumen pH, indicating that forage legumes are likely to maintain a stable fermentation pattern. Ndlovu and Buchaman-Smith (1985) found that feeding of a Lucerne supplement increased the proportion of branched chain VFA and suggested that this increase may stimulate the growth of cellulotic microorganisms.

The mean value of the NH_3-N concentrations were not significantly affected by the clover hay replacement. The ideal N concentration in the rumen for maximum microbial protein synthesis per unit of substrate fermented has been variously stimulated at 5 – 7 mg/100 ml (Satter and Slyter, 1974) and at 15 – 20 mg/100ml (Krebs and Leng, 1984) for maximal rate of fermentation in the rumen. Forage legume are relatively good sources of degradable N and fermentable energy so their inclusion in the diet is likely to increase the rumen population of cellulolytic microbes (Topps, 1995). Concentrations of rumen NH_3 have been increased following supplementation with forage legumes (Kimambo *et al*, 1991), the increased being a function of the degradability of the N in the forage legume.

Table (4) : Effect of feeding experimental rations on some rumen liquor parameters at different times after feeding.

Items		Ration 1	Ration 2	Ration 3	Ration 4	Means
Parameters	Hours					
pH-Values	0	7.73	7.60	7.50	7.53	7.59[a]
	2	7.38	7.16	7.35	6.84	7.18[b]
	4	7.65	7.29	7.36	7.50	7.45[a]
	8	7.35	7.40	7.08	7.00	7.20[b]
	Means	7.53[a]	7.36[ab]	7.32[ab]	7.22[b]	
Buffering capacity BC (ml eq/100ml)	0	9.90	8.83	8.93	9.60	9.31[a]
	2	8.93	11.67	8.83	9.36	9.70[a]
	4	8.80	8.30	8.82	8.36	8.52[b]
	8	7.73	8.00	8.48	8.16	8.10[b]
	Means	8.84	9.20	8.72	8.88	
Total VFA's (ml eq/100ml)	0	7.68	5.48	10.82	6.56	7.64[b]
	2	13.32	10.58	10.837	9.01	10.94[a]
	4	9.07	9.30	10.68	9.81	9.72[ab]
	8	9.453	8.72	11.083	10.05	9.82[ab]
	Means	9.88	8.52	10.85	8.86	
NH_3-N (mg/100ml)	0	15.88	17.17	12.69	17.26	15.70
	2	14.75	20.164	14.09	14.18	15.80
	4	20.25	18.95	18.99	17.08	18.82
	8	19.79	19.13	19.98	16.61	18.88
	Means	17.62	18.85	16.44	16.29	
%eNDF*		42.44[b]	49.67[a]	45.81[ab]	44.89[ab]	

a, b and c : Means within the same raw with different superscripts are significantly different ($P<0.05$).
* % eNDF = (pH - 5.425) / 0.04229 (Fox *et al.*, 2000)

Conclusion:

Substitution of clover hay by ammoniated rice straw at a level of at least 10% (DM basis) would provide adequate fermentable N, as well as fermentable fiber, and above this level of clover hay may not be necessary. The increase in DM intake when feeding on CH alone might have affected fiber digestion because of an increase in the rate of passage of digesta. The eNDF was higher when feeding on 10% clover hay + 40% ARS than the other ones.

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تأثير احلال دريس البرسيم الــى قــش الأرز المعامــل بالأمونيــا فــى علائــق ابقارالفريزيان الحلابة:
١ – معاملات الهضم والتخمرات فى الكرش والقيم الغذائية للعلائق

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اجرى هذا البحث بهدف دراسة تأثير احلال نسب مختلفة من دريس البرسيم بواسطة قش الأرز المعامل بالأمونيا على كل من معاملات الهضم والقيمة الغذائية وبعض مقاييس التخمر فى الكرش حيث استخدم ستة عشرة بقرة فريزيان فى الموسم من الثانى الى الرابع وزعت فى اربع مجموعات تتغذي على احدى العلائق الأتية :

(عليقة اولى) ٥٠ % علف مصنع +٥٠% دريس برسيم.
(عليقة ثانية) ٥٠ % علف مصنع + ١٠% دريس برسيم.+٤٠% قش أرز معامل بـ ٣% أمونيا.
(عليقة ثالثة) ٥٠ % علف مصنع+ ٢٠% دريس برسيم.+٣٠% قش أرز معامل بـ ٣% أمونيا.
(عليقة رابعة) ٥٠ % علف مصنع +٥٠ % قش أرز معامل بـ ٣% أمونيا

وقد تم تكوين الخلطات حتى تكون متماثلة تقريبا فى محتواها من البروتين الخام (١٢ – ١٥ %) وهى النسبة التى تلبى إحتياجات الحيوانات الحلابة تحت الظروف المصرية وتم تقييم العلائق المختبرة كما تم اخذ عينات من سائل الكرش بواسطة اللى المعدى وذلك قبل التغذية مباشرة وبعدها بـ ٢، ٤، ٨ ساعات اثناء اجراء تجارب الهضم لتقدير تركيز ايون الهيدروجين (pH) وتركيز الامونيا (NH3-N) والسعة التنظيمية للكرش (BC) وتركيز الاحماض الدهنية الطيارة (VFA).

وكانت أهم النتائج المتحصل عليها كما يلى:

١.تحسنت معنويا معاملات هضم الأليـاف الخـام (CF) ومستخلص الأليـاف المتعـادل (NDF) ، مستخلص الألياف الحامضى(ADF) والسليلوز ومستخلص اللجنين (ADL) ومستخلص الأليـاف المتعادل الغير قابل للتخمر (UNDF) فى العلائق التى تحتوى على قش الأرز المعامل بالأمونيا سواء مع اضافة او بدون اضافة دريس البرسيم مقارنة بالتغذية على دريس البرسيم فقط بينما زادت نسبة البروتين المضموم عند اضافة دريس البرسيم الى القش المعامل مقارنة بالتغذية على دريس البرسيم فقط. .
٢.تحسنت معنويا القيمة الغذائية للعليقة (RFV) مع العليقة التى تحتوى على دريس برسيم فقط العليقة التى تحتوى على ٢٠% دريس برسيم+ ٣٠% قش أرز معامل بلأمونيا مقارنة بالعلائق الأخرى بينما القيمة النوعية (RFQ) و (QI) زادت عند التغذية على دريس البرسيم فقط مقارنة بالعلائق الأخرى.
٣.تحسنت معنويا قيمة مجموع المركبات الغذائية المهضومة (TDN) / البروتين الخام (CP) مع العلائق التى تحتوى على قش معامل بالامونيا مع اضافة او بدون اضافة دريس البرسيم.
٤.إزدادت قيمة الألياف القابلة للتخمر (eNDF%) معنويا عند التغذية على عليقة المجموعة التى تحتوى على ١٠% دريس برسيم + ٤٠% قش ارز معامل بالامونيا مقارنة بالعليقة التى تحتوى على ٥٠% دريس برسيم وقد تراوحت قيمته فى العلائق المختلفة بين ٤٢,٤٤ – ٤٩,٦٧ %.

يستخلص من هذه الدراسة انه يمكن فى الظروف المماثلة لهذه التجربة استبدال دريس البرسيم فى علائق أبقار الفريزيان الحلابه بواسطة قش الارز المعامل بالامونيا (بنسبة ١٠٠%) من المادة الجافة المأكولة وانها كانت كافية للحصول على نيتروجين والياف متخمرة حيث ان اعلى من هذه النسبة لم تكن مفيدة لعمليات الهضم والتخمر فى الكرش.