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EFFECT OF SUBSTITUTING CONCENTRATE FEED MIXTURE BY CORN GRAINS FED WITH AMMONIATED RICE STRAW AND BENTONITE SUPPLEMENT ON:
1- FEED INTAKE, DIGESTION COEFFICIENTS AND SOME RUMEN PARAMETERS OF LACTATING FRIESIAN COWS.

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ABSTRACT

Twenty lactating Friesian cows with average live body weight ranging from 450 to 620 kg were used. All animals were in the 2^{nd} to 4^{th} lactation season. Animals were randomly distributed into five similar groups(G) (four animals each), to be fed formulated experimental rations which were as follows :G 1 : Control : 70 % concentrate feed mixture (CFM) + 30 % rice straw (RS), G 2 : ration 1 : 70 % CFM + 30 % ammoniated rice straw (ARS) + bentonite (B) , G 3 : ration 2: 65 % CFM +5% ground corn grain (GCG) + 30 % ARS +B, G 4 : ration 3 : 60 % CFM +10% GCG + 30 % ARS +B and G 5: ration 4 : 55 % CFM +15% GCG + 30 % ARS + B .These proportions were chosen to achieve approximately isonitrogenous rations containing about 12-13% CP. The results obtained showed that digestibility of DM was significantly ($P<0.05$) higher with control and ration 4 than the other ones, while OM digestibility was significantly ($p<0.05$) higher with ration 4 than the other rations. The digestibility of CP, NFE, NDF, hemi. and cell. were significantly ($p<0.05$) higher when animals were fed the control and ration 4 than the other rations, while the CF was significantly ($p<0.05$) improved with increasing the replacement of corn grains to the highest level with ration 4. Nutritive values as total digestible nutrients (TDN), metabolizable energy (ME), net energy (NE) and relative feeding value RFV were significantly ($p<0.05$) higher with ration 4 than the other rations . Based on the mean value of ruminal pH, buffering capacity (BC), NH_3-N concentration, the results showed that ruminal pH was decreased ($p<0.05$) when feeding ration 4 compared with ration 1 (7.09 and 7.38 ,respectively) .The BC was higher ($p<0.05$) when feeding ration 2 , 3 and 4 than the control or ration 1 . The NH_3-N concentration was significantly ($p<0.05$) increased by the replacement with corn grains. The VFA concentration was significantly ($p<0.05$) lower by increasing the replacement with corn grain in ration 3 and ration 4 than the other rations. The calculated effective neutral detergent fiber (eNDF) values ranged from 39.41 to 46.15 with different rations. The lowest eNDF value was recorded ($p<0.05$) for ration 4 compared with the other ones .

Keywords: Cows, ammoniated rice straw, effective NDF, relative feeding values, rumen fermentation.

INTRODUCTION

Fiber-rich, low protein forages and crop residues are the most abundant and appropriate feeds for ruminants in the tropics. Strategies to improve the utilization of these feeds should aim to provide supplements to rumen microbs by selective feeding or chemical treatment usually with urea (Manda *et al.* 1999).

In ruminant nutrition it has long been recognized that the structural carbohydrates are essential to proper functioning of that the rumen and its microbs fermentation. Furthermore developments have been characterized as neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) .Nowadays non-fibrous carbohydrates (NFC) receive attention and are divided and characterized in terms of soluble sugars and starches of different origin that differing in rumen degradation rates and hence, also in rumen resistance. It was also realized that the microbial population in the foregut may have requirements for nutrient and energy different from that of host animal. Until now, our knowledge of how we can stimulate a beneficial microflora in the gastro intestinal tract is very limited. It can be expected that some carbohydrates are the primary sources of propriotics as alternatives to antibiotics (Williams *et al.* 2001).

Nutritionists often go beyond and the measures of carbohydrates nutrition to include nutrients such as non-fiber carbohydrates (NFC), starch, effective NDF (eNDF), (Mertens,1997). Each of these nutrients look at a slightly aspect of carbohydrates nutrition. The total intake of rapidly fermentable carbohydrates is probably more important than the percentage of the carbohydrates (Oetzel and Nordlund, 1998). Ruminal adaptation to diets high in fermentable carbohydrates apparently has two key aspects-microbial adaptation (particularly the lactate-producing bacteria) and ruminal papillae length (longer papillae probate greater VFA absorption and thus lower ruminal pH) (Dirksen *et al.*, 1985).

Although it is clear that increased starch digestion in the total tract improves performance (Nocek and Tamminga, 1991), the optimal site of starch digestion is still unclear. Much of the work on alteration of the site of starch digestion has been done to compare different grain sources. Although this information is useful and practical, more specific questions about starch digestion in those studies are difficult to address because of confounding factors, such as protein and fiber concentration and their levels and source.

The main objective of this study was to evaluate, the effect of partially substituting of concentrate feed mixture (CFM) by yellow corn grains fed together with ammoniated rice straw supplemented with bentonite on nutrient or grains digestibility coefficients, nutritive values and rumen liquor parameters in lactating Friesian cows.

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 2003-2005.

Twenty lactating Friesian cows from the herd station with body weight ranging from 450 to 620 kg were used. All animals were in the 2^{nd} to 4^{th} lactation season. Cows were randomly distributed into five similar groups (four each) . All groups were individually fed according to NRC (1984) recommendations, based on their live body weight and milk yield (requirements for maintenance were 1% of LBW concentrate +1% of LBW roughage and requirements for lactation were ½ Kg concentrate per 1Kg milk yield). The experimental period lasted for 140 days (20 weeks).

The five experimental rations were formulated as follows:

G 1 : Control : 70 % concentrate feed mixture CFM + 30 % rice straw RS.
G 2 : ration 1 : 70 % CFM + 30 % ammoniated rice straw ARS +3%bentonite B.
G 3 : ration 2: 65 % CFM +5% ground corn grain GCG + 30 % ARS +3%B.
G 4 : ration 3 : 60 % CFM +10% GCG + 30 % ARS +3%B.
G 5: ration 4 : 55 % CFM +15% GCG + 30 % ARS +3% B.

The experimental rations were formulated to be almost iso-nitrogenous and contained about 12.5-13.5% crude protein as recommended by Ørskov *et al.* (1972) to ensure maximal rate of fermentation in the rumen.

Bales of unchopped rice straw (30 tons) were arranged in three stacks, each consisting of three layers in cement pit. The stacks were covered with plastic sheet, 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 weight basis through a hold metal pipe, then good covered each side of the plastic by the soil and left for three weeks to accomplish the reaction with ammonia. Then the stacks were opened and aerated 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 yellow corn grains were spread to dry in the sun, it was coarsely ground using a local chopper usually available in the villages for grinding wheat grain.

Bentonite was obtained from El-Fayoum governorate, Egypt. It was added at the rate of 30 g/kg DMI according to Abd El-Baki *et al.* (1988) recommendation .

Management of feeding

The CFM was fed with or without ground corn grain (GCG) was offered to animals firstly at morning , while untreated or treated rice straw was given after consumption of the CFM + GCG mixture. Drinking fresh and clean water was available at all times.

Experimental animals and rations:

Five digestibility trials were conducted using three cows chosen randomly from each group to determine nutrients digestibility coefficients and nutritive values of the experimental rations. Each digestibility trial consisted of 15 days preliminary period followed by 7 days collection period. 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) according to the following formula :

$$\text{Nutrient digestibility \%} = 100 - \frac{\text{AIA \% in feed}}{\text{AIA \% in feces}} \times \frac{\text{nutrient \% in feces}}{\text{nutrient \% in feed}} \times 100$$

Where: AIA is acid insoluble ash.

Feces samples were taken from the rectum of each cow twice daily with 12 hours interval at 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, GCG, RS, ARS were taken at the beginning, middle and 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, GCG, RS, and ARS and feces were carried out as well as fiber fractions (NDF,ADF ADL, Hemc. and Cell.) according to the methods of AOAC (1990). Acid insoluble ash was determined according to method of VanKeulen and Young (1977).

Ruminal fluid samples were taken using rubber stomach tube before morning feeding and at 2, 4 and 8 hrs post- feeding from three animals of each treatment. The collected rumen fluid samples were filtered through three layers of gause without squeezing for the determination of pH, buffering capacity, ammonia-N and total volatile fatty acids (TVFA's) concentration. Ruminal pH was estimated by pH meter (Orion Research, model 201 digital pH meter). Rumen liquor buffering capacity was determined according to Nicholson *et al.* (1963). Ruminal ammonia-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

The CP content of ARS was practically doubled (8.19 vs 4.08 % respectively) compared with the untreated RS (Table 1). Generally, the summative proximate chemical analysis of the CFM, RS, ARS and GCG (Table 1) used to formulate the experimental rations were within the normal published ranges (Toykawa *et al*, 1982; Yoon *et a*l, 1983; Cheva-Isarakul *et al*., 1984, Ibrahim, 1987, Maklad, 1996 and Sayed-Ahmed, 2001). The CP of rice straw was marginal to deficient and not adequate for ruminal microbial breakdown of ingested forage. Ammonia treatment caused a reduction in neutral detergent fiber (NDF) content (65.5 Vs 73.3 %) and increased in 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). Also the energy contribution from structural and nonstructural carbohydrate must be considered (Nocek and Russell, 1988).

Corn grain was higher in neutral detergent soluble (NDS) % and rumen available carbohydrate (RAC) % than CFM (82.63 vs 59.66% and 89.38 vs 81.88% respectively).

The average daily dry matter intake by cows (Table 2) of each roughage and concentrate were in accordance with those of Hagemeister *et al*, (1981) who reported that the greatest utilization of energy for microbial protein synthesis has been suggested when diets contained approximately 30 % roughage and 70 % concentrate. The average daily intake of total concentrate (concentrate feed mixture +corn grains) as the % of body weight (BW) was ranged from 2.6 to 3.29 of BW, while the roughage ranged was from 1.16 to 1.41% of BW. The total DM intake ranged from 3.82 to 4.70 % 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 corn grains, ammoniated rice straw consumption was tended to be usually under 2% of BW (Wheeler , 2003) .

Concerning nutrient digestibility coefficients, the digestibility of DM was significantly ($P<0.05$) the highest with control and ration 4, but the differences among control, R1 and R2 were not significant while OM digestibility was significantly ($p<0.05$) the highest ration 4 composed with the other rations (Table 3) without significant difference among control , R1, R2 and R3 rations. These results are in agreement with those recorded by Fouad (2002) when feeding ammoniated rice straw with corn grain .

The highest CP digestibility was noticed for control ration and it did not significantly differ when compared with ration 1, 2 and 4, but the lowest value ($p<0.05$) was recorded with ration 3. The highest NFE digestibility ($p<0.05$) was with R4, compared with R1, 2 and 3 , but the differences were not significant among control , R1, R2 and R3 in this respect . Ration 4 showed the highest ($p<0.05$) CF digestibility compared with control, R1 and R3, but the differences among latter rations were not significant. The NDF digestibility was significantly ($p<0.05$) highest in R4 ration, compared with R1, R2 and R3, but the differences among latter rations were not significant. Likewise, 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	20.65	19.69	13.07	7.58	33.76	7.33	33.01	59.66	81.88
Corn grain (CG)	90.43	98.30	11.53	3.77	2.50	80.50	1.70	17.37	3.55	13.82	2.14	1.41	65.63	0.58	16.79	82.63	89.38
Rice straw (RS)	91.56	82.38	4.08	1.82	28.48	48.00	17.62	73.32	56.06	17.26	39.45	16.61	3.14	29.22	44.1	26.68	62.05
Ammoniated rice straw (3% ARS)	91.89	80.65	8.19	1.65	27.70	43.11	19.35	65.48	57.19	8.29	40.27	16.92	5.33	26.59	38.89	34.52	63.45
Experimental rations																	
30% RS+70%CFM	89.04	89.61	12.74	2.04	19.19	55.64	10.39	50.30	31.34	18.96	21.03	10.31	24.53	12.44	37.86	49.70	76.86
30%ARS+B+70%CFM	89.45	89.07	13.97	1.99	18.96	54.15	10.93	47.93	31.68	16.25	21.28	10.40	25.18	11.96	35.97	52.07	77.19
30%ARS+B+65%CFM+5%CG	89.46	89.35	13.73	2.08	18.40	55.14	10.65	46.79	30.84	15.95	20.74	10.10	26.75	11.34	35.45	53.21	77.87
30%ARS+B+60%CFM+ 10%CG	89.48	89.62	13.58	2.20	17.85	55.99	10.38	45.66	30.00	5.66	20.21	9.79	28.23	10.72	34.94	54.34	78.54
30%ARS+B+55%CFM+ 15%CG	89.49	89.96	13.27	2.24	17.50	56.95	10.04	44.42	29.02	15.40	19.57	9.45	30.03	10.07	34.35	55.58	79.27

*** 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)**

ration 4 showed the highest hemicellulose and cellulose digestibility coefficients, compared with R1, R2 and R3 rations. Similar result was found by Hill and West (1991).

In this respect, Mehrez (1995) reported that the addition of readily available substrates (in the from of cereals) to poor quality roughage, increased its rate of fermentation in the rumen through more colonization of rumen bacteria.

The nutritive values expressed as TDN, ME, NE and RFV were significantly ($p<0.05$) the highest with ration 4, compared with the other rations. Higher starch intakes may promote rapid rates of passage from the rumen, causing a "washout" of grain from the rumen to the lower tract. The highest DCP values ($p<0.05$) were noticed with ration 1, 2 and 4, without significant difference among them, compared with the values of control and R3 rations

Table (2): Average daily dry matter intake of concentrate, rice straw, ammoniated rice straw with or without bentonite supplementation by dairy cows

Items	Control	Ration 1	Ration 2	Ration	Ration
Average body weight	476.7	530.0	606.7	540.0	513.3
Roughage : concentrate	30 : 70	30 : 70	30 : 70	30 : 70	30 : 70
Bentonite g/h/d	0.00	630	690	700	740
Intake of DM from :					
Concentrate feed mixture (CFM) :					
Kg/h/d	13.30	14.56	15.03	13.77	13.24
As % BW	2.79	2.75	2.48	2.55	2.58
Corn grains (CG) :					
Kg/h/d	0.0	0.0	1.15	2.29	3.60
As % BW	0.0	0.0	0.19	0.43	0.71
Total concentrate :					
Kg/h/d	13.30	14.56	16.18	16.05	16.84
As %BW	2.79	2.76	2.67	2.99	3.29
Untreated rice straw (RS) :					
Kg/h/d	5.75	0.0	0.0	0.0	0.0
As % BW	1.21	0.0	0.0	0.0	0.0
3%Ammoniated rice straw (ARS) :					
Kg/h/d	0.0	6.30	7.01	6.95	7.20
As % BW	0.0	1.19	1.16	1.29	1.41
Total dry matter intake:					
Kg/h/d	19.05	20.87	23.18	23.01	24.04
As % BW	4.00	3.95	3.82	4.28	4.70

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

Items	Control	Ration 1	Ration 2	Ration 3	Ration 4
Nutrient digestibility (%):					
DM	$76.59^{ab} \pm 0.93$	$72.24^{bc} \pm 0.68$	$76.07^{bc} \pm 2.69$	$71.93^{c} \pm 1.31$	$80.86^{a} \pm 0.76$
OM	$79.91^{b} \pm 1.25$	$75.88^{b} \pm 0.72$	$79.32^{b} \pm 2.77$	$75.93^{b} \pm 1.20$	$85.06^{a} \pm 0.57$
CP	$85.56^{a} \pm 0.65$	$83.49^{a} \pm 0.68$	$83.47^{a} \pm 2.23$	$77.05^{b} \pm 1.75$	$85.05^{a} \pm 0.66$
EE	86.71 ± 0.28	83.46 ± 3.07	80.04 ± 2.04	80.90 ± 2.11	84.65 ± 1.13
CF	$70.67^{b} \pm 0.98$	$71.71^{b} \pm 1.25$	$74.88^{ab} \pm 1.52$	$71.31^{b} \pm 2.03$	$77.78^{a} \pm 1.08$
NFE	$81.56^{ab} \pm 1.85$	$75.10^{b} \pm 0.87$	$79.67^{b} \pm 3.49$	$76.78^{b} \pm 1.92$	$87.12^{a} \pm 1.07$
NDF	$69.50^{ab} \pm 2.09$	$61.28^{c} \pm 1.20$	$67.08^{bc} \pm 4.61$	$61.11^{c} \pm 1.86$	$75.57^{a} \pm 1.08$
ADF	63.92 ± 1.38	59.70 ± 0.88	62.00 ± 4.41	60.46 ± 1.69	68.83 ± 1.36
Hemi.	$78.71^{ab} \pm 3.28$	$64.36^{c} \pm 3.14$	$76.89^{b} \pm 5.05$	$62.34^{c} \pm 3.35$	$88.27^{a} \pm 1.97$
Cell.	$85.44^{ab} \pm 0.46$	$75.50^{c} \pm 1.43$	$78.40^{bc} \pm 4.82$	$76.67^{c} \pm 1.37$	$86.19^{a} \pm 0.91$
ADL	20.01 ± 3.24	27.37 ± 1.81	28.32 ± 3.92	27.00 ± 3.13	32.88 ± 2.27
NFC	97.79 ± 0.69	98.87 ± 0.56	98.55 ± 0.23	98.92 ± 0.10	99.14 ± 0.13
Feeding value (%)					
TDN	$73.81^{b} \pm 1.13$	$69.67^{b} \pm 0.65$	$72.78^{b} \pm 2.49$	$69.89^{b} \pm 1.10$	$78.36^{a} \pm 0.47$
DCP	$10.90^{bc} \pm 0.08$	$11.67^{a} \pm 0.10$	$11.46^{ab} \pm 0.30$	$10.39^{c} \pm 0.24$	$11.27^{ab} \pm 0.08$
NFCI/DCPI	$2.66^{b} \pm 0.02$	$2.46^{c} \pm 0.02$	$2.69^{b} \pm 0.09$	$3.07^{a} \pm 0.07$	$2.97^{a} \pm 0.02$
ME(Mcal/k	$2.63^{b} \pm 0.04$	$2.48^{b} \pm 0.02$	$2.59^{b} \pm 0.09$	$2.49^{b} \pm 0.04$	$2.79^{a} \pm 0.01$
ME(Mj/Kg)	$10.99^{b} \pm 0.16$	$10.37^{b} \pm 0.10$	$10.83^{b} \pm 0.36$	$10.41^{b} \pm 0.15$	$11.67^{a} \pm 0.08$
gDCP/ME	$41.53^{c} \pm 0.79$	$47.08^{a} \pm 0.77$	$43.84^{b} \pm 1.14$	$41.74^{bc} \pm 0.36$	$40.40^{c} \pm 0.23$
NE(Mcal/K*	$1.69^{b} \pm 0.03$	$1.59^{b} \pm 0.02$	$1.66^{b} \pm 0.06$	$1.59^{b} \pm 0.03$	$1.80^{a} \pm 0.02$
DDM%**	$68.20^{ab} \pm 0.83$	$64.62^{b} \pm 0.61$	$68.06^{b} \pm 2.41$	$64.36^{b} \pm 1.17$	$72.35^{a} \pm 0.69$
RFV***	$211.58^{b} \pm 6.43$	$197.96^{b} \pm 5.91$	$201.63^{b} \pm 7.46$	$213.45^{b} \pm 6.47$	$264.02^{a} \pm 12.4$

a, b and c : Means within the same raw with different superscripts are significantly different (P<0.05).

* NE (Mcal / kg) = (TDN% x 0.0245) – 0.12 (NRC, 2001)

** DDM% of DM = 88.9 - 0.779 x (ADF% of DM) (Schroeder , 1996)

*** RFV = DMI x DDM / 1.29 (Schroeder , 1996)

The NFCI/DCPI ratio was significantly (p<0.05) higher with ration 3 and 4 than the other rations, but the difference was not significant between the former rations in this respect. The DDM% was higher (p<0.05) with ration 4 than R1, R2 and R3 rations. In this field, Knowlton *et al* (1998) reported that nitrogen digestibility in total tract was lower for diets containing dry corn than for diets containing higher moisture corn. Increasing in microbial N flow in feces and in microbial N produced in the large intestine for dry ground corn diets support the observation that starch digestion in the large intestine increases for dry ground corn diets. The increase in N lost as starch fermentation increased in the large intestine. Also, N from urea recycled from the blood to the large intestine may be incorporated into microbial N and excreted (Ørskov, 1982). Recent studies with lactating dairy cows indicate that from 1 kg to nearly 5 kg of starch may disappear post ruminally in cows on high starch diets (Knowlton *et al* , 1998).

In general, increased flow of starch to the small intestine increased the quantity of starch digested. The grinding of corn may be decreased fecal starch flow and increased starch digestion in the total tract because of increased starch disappearance from the large intestine (Oliveira *et al*, 1995).

McAllister *et al* (1992) suggested that increasing the supply of starch post-ruminally to the small intestine may improve the feed efficiency by reducing the loss of energy through methane or heat . This would support the suggest of an advantage to increasing the availability of starch present in the small intestine . However , this may be offset by decreases in efficiency of starch digestion and absorption of glucose in the small intestine with increasing post ruminal starch passage (Owens *et al* 1986) .

Regarded rumen parameters, based on the mean value of ruminal pH (Table 4) the obtained results showed that it was decreased ($p<0.05$) when feeding ration 4 compared with ration 1 (7.09 and 7.38 ,respectively). In this field, 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 present study were within a normal range of 6-7 . Such range is suitable for the growth and activity of cellulytic bacteria (Prasad *et al* 1972).

The mean value of BC was higher ($p<0.05$) when feeding ration 2 , 3 and 4 than the control or ration 1. Maekawa *et al* (2002) showed that when feeding corn diets the total amount of fermentated acids produced in rumen is lower and more importantly, the rate of fermentation of acids produced could be considerably slower .

The mean values of the NH_3-N concentrations was significantly ($p<0.05$) increased by the replacement corn grains. In this respect, Bunting *et al* (1989) showed the amount ranging from non to over 80% of NH_3 from urea degradation is incorporated into bacteria N and the availability of energy is the major determinant of that percentage.

The mean values of the VFA concentrations, showed that the concentration was significantly ($p<0.05$) decreased by increasing the replacement of corn grain in ration 3 and ration 4 than the other ones. Krause *et al* (2002) showed that the quantity of organic matter fermented in the rumen drives VFA production.

Nocek and Tamminga (1991) showed that the starch degradability in the rumen, rate and extent of VFA production, post-ruminal starch flow as digestion of starch can vary in response of the physiological status of the cow, grains type, growing conditions and both physical and chemical processing methods . The starch in similarly processed wheat, oats and barley is generally more degradable than the starch in corn. Most published reports on the site of starch digestion in lactating cows have involved duodenally but not ilealy cannulated cows. Some of the very high post-ruminal starch disappearances were observed when dry grains were fed (Oliveira *et al* 1995) might have been more associated with fermentations of starch in the large intestine than digestion in the small intestine. Fermentation of starch in the large intestine result in loss of microbial N in feces, although the VFA produced are available for absorption and use by the cow.

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

Items		Control	Ration 1	Ration 2	Ration 3	Ration 4
Parameters	Hours					
PH-Values	0	7.39 ± 0.04	7.78 ± 0.13	7.63 ± 0.14	7.38 ± 0.06	7.49 ± 0.13
	2	7.22 ± 0.11	7.47 ± 0.18	7.40 ± 0.26	6.97 ± 0.19	6.81 ± 0.13
	4	7.20 ± 0.13	7.20 ± 0.10	7.35 ± 0.30	7.23 ± 0.09	7.31 ± 0.38
	8	7.49 ± 0.19	7.06 ± 0.15	6.88 ± 0.18	7.67 ± 0.30	6.76 ± 0.19
	Means	7.32^{ab} ± 0.07	7.38^{a} ± 0.10	7.32^{ab} ± 0.13	7.32^{ab} ± 0.11	7.09^{b} ± 0.14
Buffering capacity BC (ml eq/100ml)	0	9.23 ± 0.29	10.70 ± 0.06	14.87 ± 0.69	14.07 ± 0.90	12.50 ± 1.00
	2	11.43 ± 0.35	11.43 ± 0.30	14.03 ± 0.32	13.23 ± 0.97	12.47 ± 1.98
	4	9.23 ± 0.07	8.23 ± 0.38	12.47 ± 1.03	10.97 ± 0.89	11.47 ± 0.44
	8	7.80 ± 0.26	8.37 ± 0.44	10.83 ± 0.55	11.37 ± 1.49	10.03 ± 0.61
	Means	9.43^{c} ± 0.41	9.68^{c} ± 0.45	13.05^{a} ± 0.55	12.41^{ab} ± 0.61	11.62^{b} ± 0.58
NH_3-N (mg/100ml)	0	14.00 ± 1.01	12.04 ± 1.64	15.12 ± 2.80	17.27 ± 2.05	11.39 ± 3.09
	2	14.93 ± 0.81	15.68 ± 2.39	17.73 ± 1.31	17.17 ± 1.73	15.96 ± 0.97
	4	19.00 ± 0.73	18.67 ± 1.08	21.28 ± 1.32	23.80 ± 1.70	24.27 ± 1.82
	8	20.65 ± 1.46	18.67 ± 0.67	21.28 ± 2.26	21.75 ± 3.67	24.92 ± 1.54
	Means	17.14^{bc} ± 0.94	16.26^{c} ± 1.06	18.85^{abc} ± 1.17	20.00^{a} ± 1.35	19.13^{ab} ± 1.9
Total VFA's (ml eq/100ml)	0	9.68 ± 0.04	7.03 ± 0.43	8.52 ± 0.20	7.05 ± 1.08	5.35 ± 1.24
	2	8.95 ± 0.10	7.62 ± 0.72	8.22 ± 1.61	7.37 ± 0.88	7.75 ± 1.08
	4	7.88 ± 1.01	8.18 ± 0.89	7.95 ± 1.20	7.72 ± 0.86	6.07 ± 0.16
	8	8.67 ± 0.84	6.50 ± 0.35	7.67 ± 0.98	5.52 ± 1.04	7.42 ± 0.10
	Means	8.80^{a} ± 0.34	7.33^{bc} ± 0.33	8.09^{ab} ± 0.49	6.91^{bc} ± 0.48	6.65^{c} ± 0.57
%eNDF*		44.91 ± 0.57	46.15 ± 0.72	44.71 ± 1.66	44.69 ± 3.46	39.41 ± 1.81

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)

The calculated effective neutral detergent fiber eNDF values ranged from 39.41 to 46.15 with different rations. The lowest eNDF value was recorded (P<0.05) in ration 4 compared with the other rations. Effective NDF (eNDF) is the percentage of the NDF effective in stimulating chewing and salivation, rumination as rumen motility (Russell *et al*, 1992).

From the foregoing results, it could be concluded that corn grains can be replaced at the rate of 0.7% of body weight would supply adequate amounts of both digested dry matter (DDM) and CP. Therefore, corn would be the preferred supplement if the low quality forage supply was limited in diets of lactating cows. This replacement showed appropriate similar results in terms of nutrient digestibility coefficients, feeding values and rumen parameters as that obtained with the control ration

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تأثير إحلال الأذرة جزئيا محل مخلوط العلف المصنع مع التغذية على قش الأرز المعامل بالأمونيا وإضافة البنتونيت على ١- الهضم وبعض قياسات الكرش فى ابقار الفريزيان الحلابة

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اجرى هذا البحث بهدف دراسة تأثير زيادة الطاقة المتاحةفى كرش الابقار الحلابة بتغذيتها على حبوب الأذرة المجروشة باحلالها بنسب مختلفة (٥ ، ١٠ ، ١٥ %) محل مخلوط العلف المصنع على كل من معاملات الهضم والقيمة الغذائية وبعض مقاييس الكرش حيث استخدم عشرون بقرة فريزيان تراوح موسم حليبها بين الثانى والرابع وزعت فى خمس مجموعات لتغذي على احدى العلائق الأتية :

(مجموعة المقارنة) ٧٠ % علف مصنع + ٣٠% قش أرز غير معامل.

(عليقة اولى) ٧٠ % علف مصنع +٣٠% قش أرز معامل بـــ ٣% أمونيا+٣% بنتونايت.

(عليقة ثانية) ٦٥ % علف مصنع + ٥% حبوب أذره مجروشة +٣٠% قش أرز معامل بـــ ٣% أمونيا + ٣% بنتونايت.

(عليقة ثالثة) ٦٠ % علف مصنع+ ١٠% حبوب أذره مجروشة +٣٠% قش أرز معامل بـــ ٣% أمونيا + ٣% بنتونايت.

(عليقة رابعة) ٥٥ % علف مصنع + ١٥% حبوب أذره مجروشة +٣٠% قش أرز معامل بـــ ٣% أمونيا + ٣% بنتونايت.

وقد تم تكوين الخلطات حتى تكون متماثلة تقريبا فى محتواها من البروتين الخـــام (١٢,٥-١٣,٥%) وهـــى النسبة التى تلبى إحتياجات البكتريا وتوفير الظروف المناسبة لتخمر المواد الخشنة بالكرش

وكانت أهم النتائج المتحصل عليها كما يلى:

١. أشارة نتائج التحليل الكيماوى لحبوب الأذره مقارنة بمخلوط العلف المصنع إلى إرتفاع محتواه مـــن المركبات الكربوهيدراتيه غير الليفيه (NFC) الكربوهيدرات المتاحة بالكرش(RAC) ، المركبات الذائبة (NDS) (٦٥,٦٣ ، ٨٩,٣٨ ، ٨٢,٦٣%) ، (٣٣,٧٦ ، ٨١,٨٨ ، ٥٩,٦٦) لكل مـــن الأذرة ومخلوط العلف المصنع على التوالى ، و كان محتوى العلف المصنع من كلا" من البروتين الخام (CP) ، مستخلص الألياف المتعادل المستفاد منه(ANDF) مرتفع مقارنة" بحبوب الأذره حيث كـــان فـــى العلف المصنع ١٦,٤٨ ، ٣٣,٠١% بينما كان فى حبوب الأذره ١١,٥٣ ، ١٦,٧٩% على التوالى، و أيضا" تشير نتائج التحليل الكيماوى إلى زيادة نسبة كلا" من CP , NDS , RAC و إنخفاض نسبة الألياف الخام (CF) فى قش الأرز بعد معاملته بالأمونيا ٣% .

٢. كان متوسط المأكول اليومى من المادة الجافة كنسبة مئويه مـــن وزن الجســـم الحـــى يختلـــف بـــين المجموعات المختلفة حيث كان ٤ ، ٣,٩٥ ، ٣,٨٢ ، ٤,٢٨ ، ٤,٧٠% لكل من عليقة المقارنة وعليقة ١ و ٢ و ٣ و ٤ على الترتيب .

٣. تحسنت معنويا معاملات هضم المادة العضوية CF , NFC فى العلائق التى تحتوى على نســـب مختلفة من حبوب الأذره وخاصة" مع العليقة الأخيره (١٥%حبوب أذره) وبالنسبة لمعاملات هضـــم البروتين الخام فلم يكن هناك فروق معنويه بإستثناء المجموعة الرابعـــة (١٠% حبـــوب أذره) فلقـــد إنخفض بها بالمقارنة بالمجموعات الأخرى ، وبالنسبة لمعاملات هضم الهيميسيليلوز والـــدهن الخـــام واللجنين فلم يظهر معها تحسن معنوى مقارنة" بالمجموعات الأخرى.

٤. تحسنت معنويا قيمة مجموع المركبات الغذائية المهضومة (TDN) مع العليقة الأخيره (١٥%حبوب أذره) بالمقارنة بباقى المجموعات الأخرى.

٥. تحسنت قيم البروتين الخام المهضوم DCP (معنويا على مستوى ٥%) مع المجموعه الأولى بالمقارنة بمجموعة المقارنه بينما إنخفضت معنويا مع المجموعه الثالثه بالمقارنه بباقى المجموعات الأخرى ،

وكذلك فإن الطاقة الممثلة والطاقة الصافية و الطاقة المتاحة (RFV) تزداد معنويا مع العليقة الأخيره (١٥%حبوب أذره) بالمقارنة بباقى المجموعات الأخرى.

٦. ازدادت قيمة المهضوم من المادة الجافة (DDM) مع العليقة الأخيره (١٥%حبوب أذره) أو مجموعة المقارنه بالمقارنة بباقى المجموعات الأخرى .

٧. كانت متوسطات قيم تركيز أيون الأيدروجين(pH) فى سائل الكرش فى الحدود المناسبة لنشاط البكتريا وتأثرت معنويا عند الأوقات المختلفة (قبل التغذية مباشرة" وبعدها بـ ٢و٤و٨ساعات) ولقد نقصت قيمة (pH) بالتقدم فى الوقت حتى وصلت لأقل قيمة عند الساعة الرابعة ثم إرتفعت مرة أخرى عند الساعة الثامنة مع كل المجموعات.

٨. وجد أن تركيز الأمونيا(NH_3-N) كان متشابها بين كل المجموعات وذلك قبل الأكل مباشرة ثم بعد ذلك وبمرور الوقت زاد التركيز حتى وصل إلى ذروته فى الساعة الثامنه مع كل المجموعات ،وكان المتوسط العام لتركيز الأمونيا (NH_3-N) يزداد معنويا مع العلائق التى تحتوى على نسب مختلفة من حبوب الأذره بالمقارنة بباقى المجموعات الأخرى.

٩. إنخفض تركيز الأحماض الدهنية الطيارة (TVFA`s) معنويا مع مجموعات إحلال الأذره وعلى وجه الخصوص مع العليقة الأخيره (١٥%حبوب أذره) بالمقارنة بباقى المجموعات الأخرى.

١٠. كانت متوسطات قيم السعة التنظيمية للكرش (BC) منخفضه معنويا مع مجموعة المقارنه و السحموعه الأولى مقارنة" بالمجموعات الأخرى .

١١. إزدادت قيمة الألياف القابلة للتخمر (eNDF%) معنويا عند التغذية على عليقة المجموعة الأولى بالمقارنة بالمجموعة الرابعة وكانت القيم ٤٦,١٥ ، ٣٩,٤١% على الترتيب .

يستخلص من هذه الدراسة إنه يمكن فى الظروف المماثلة لهذه التجربة تغذية أبقار الفريزيان الحلابه على علائق تحتوى على حبوب الأذره المجروشة بنسبة ١٥% من المادة الجافة الكليه المأكولة بجانب العلف المصنع وذلك عند التغذية على القش المعامل بالأمونيا مع إضافة البنتونايت أثناء التغذية حيث أن هذه الخلطات كانت الأفضل غذائيا فىصورة تحسن ملحوظ فى معاملات الهضم والقيمة الغذائية وقياسات الكرش.