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EFFECT OF PARTIAL REPLACEMENT OF CONCENTRATE FEED MIXTURE BY CORN GRAINS IN RICE STRAW RATIONS FOR LACTATING FRIESIAN COWS ON : 1- NUTRIENTS DIGESTIBILITY, NUTRITIVE VALUE AND SOME RUMEN LIQUOR PARAMETERS.

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ABSTRACT

Three digestibility trails were conducted using three cows (in each) with on average BW 480 kg. In the present study, the experimental rations were formulated as follows: R 1: ration 1: 69 % concentrate feed mixture (CFM) + 31 % rice straw (RS) as a control. R 2: ration 2: 62 % CFM +7 % ground corn grains (GCG)+31% (RS). R 3: ration 3: : 55 % CFM +14 % (GCG) + 31 % (RS). These proportions were chosen to achieve iso-nitrogenous diet containing about 12.2-13.0 % crude protein necessary for optimal utilization and fermentation of roughages of in the rumen Ørskov *et al.* (1972). The target of 12-13% CP in each experimental diets were achieved in all diets since the ingredients were analysis before formulating the experimental diets. The apparent digestibility of crude fiber (CF) was significantly (P<0.05) higher with R3 than the other ones, while the nitrogen free extract (NFE) and available neutral detergent fiber (ANDF) were significantly (P<0.05) higher with R1 than the others. The cellulose digestibility was increased (P<0.05) with R1 than R2, but there were no significant effect between R1 and R3 or R2 and R3, while acid detergent lignin (ADL) digestibility was increased with R3 (P<0.05) than R1, and there was no significant effect between R1 and R2 or R2 and R3. The total digestible nutrient (TDN) to crude protein (CP) ratio (TDN: CP) was higher (P<0.05) with R3 than R1 or R2 (5.1, 4.71 and 4.78 respectively). The mean values of the ruminal pH was increased (P<0.05) with R1 or R2 than R3. the mean values of the ruminal pH were 6.33, 6.3 and 6.13 respectively. The same trend was observed on the effective neutral detergent fiber (eNDF) values (21.48, 20.89 and 16.75% for R1, R2 and R3 respectively). The mean values of the buffering capacity (BC) was the lowest (P<0.05) with R1 or R3 than R2. While the mean values of the total VFA concentration was significantly (P<0.05) higher with R3 than R1 or R2. The mean values for TVFA' s were 12.5, 13.0 and 27.87 ml eq / 100ml with R1, R2 and R3 respectively. The ruminal NH_3-N concentrations were ranged from 5.87 to 7.47 mg / 100 ml RL with different rations, but without significant effect.

Keywords:lactating Friesian cows, corn grains, rice straw, effective NDF and unavailable NDF.

INTRODUCTION

Wiedmeier *et al* (2001) showed that most low-quality forages should be supplemented with high quality feed. Feeding cows large amounts of low-quality forages, for extended periods of time, without proper supplementation, will result the following negative effects:

- Cows will loose a more of weight, over 0.9 kg per day.
- A relatively high percentage of the cows could develop abomasal impaction, which is generally fatal (up to 25%).

Deficiencies in most nutrients, including protein and energy, are imposed on pregnant cows when they are fed low-quality forages. Since energy is the most costly nutrient requirement, it would be logical to rectify that deficiency first.

In ruminant animals, like cattle protein and energy utilization are strongly linked. This is particularly true with diets compared mainly of low-quality forages. When feeding low-quality forages, particular attention must be paid to the requirements of the microorganisms. Those that ferment forage fiber are very critical (Wiedmeier *et al*, 2001).

The effects of feeding increasing amounts of corn to cows offered low-quality forage diets would be a slight increase in low-quality forage intake and digestibility when a small amount of corn is fed. However, as the high level of corn results in adequate DDM intake with most of the DDM from the corn (Wiedmeier *et al*, 2001). Starch is the primary energy component of grains, and is considered the primary driver of microbial protein synthesis in the rumen. In ruminant , the majority of starch in the diet is fermented to volatile fatty acids in the rumen.

Rumen fermentation varies with type of grains as well as conservation at processing method, and this variation can greatly affect animal performance. Optimal levels of starch in the diet, and rumen fermintability of that starch depend on animal and dietary factors.

In addition, the feeding of low-quality forage can decrease cost of production, however, attention to feeding properly balanced rations is critical for success.

The main objective of this study was to evaluate the effect of partially substituting of concentrate feed mixture (CFM) by ground corn grain fed together with rice straw on the digestion and fermentation of lactating Friesian cows.

MATERIALS AND METHODS

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 year 2003.

Five lactating Friesian cows were used in "swing-over" design as described by Lucas (1956), and Abou Hussein (1958). The average body weight was about 480, all animals were in the 2nd to 4th lactation season, to study milk production and composition and some blood parameters (Maklad et al 2006b). The animals were individually fed according to NRC (2001) recommendations, based on their live body weight and milk yield (requirements for maintenance were 1% of live body wight LBW concentrate +1% of LBW roughage and requirement for lactation was ½ Kg concentrate per 1Kg milk yield).

The experimental rations were formulated as follows:

R 1: ration 1: 69 % concentrate feed mixture (CFM) + 31 % rice straw (RS), (as a control ration).

R 2: ration 2 : 62 % CFM +7 % ground corn grains (GCG) + 31 % (RS).

R 3: ration 3: : 56 % CFM +14 % (GCG) + 30 % (RS).

The experimental rations were formulated to be almost iso-nitrogenous and contained about 12.2-13.0 % crude protein as recommended by Ørskov *et al.* (1972) to ensure maximal rate of fermentation in the rumen.

The intake of tested ration by cows was fixed and calculated as the percentage of roughage to concentrate ratio to satisfy their maintenance and production requirements (Ghoneim, 1967). The concentrate feed mixture (CFM) used contained wheat bran, undecorticated cotton seed meal, yellow corn, molasses, rice bran , limestone, soybean meal and salt.

The supplemented yellow corn grains was coarsely ground. The CFM with or without ground corn grain was offered firstly at morning, while rice straw was offered after consumption of the CFM. Mineral and vitamins blocks (biomix-333) (5kg weight) were available for all animals free choice at all times. Drinking fresh and clean water was available at all times also.

Experimental animals and rations:

Three digestibility trials were conducted using three cows chosen randomly from each animals group to determine nutrients digestibility coefficients and nutritive values of the experimental rations. Each digestibility trial was running at the last 7 days as a collection period for each experiment. During the digestion trials, cows were fed their allowances according to the experimental assignment of the group. The CFM fed with a without ground corn grains was offered firstly at the morning. While rice straw was offered after consumption of the CFM. 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).

Chemical analysis:

Samples of CFM, GCG, RS were taken at the beginning of the trials. The composite samples were dried in a forced air oven at 65°C for 48 hours, then ground and running the chemical analysis for each. 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.
Chemical analysis of CFM, GCG and RS 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).

At the end of each collection period 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 (TVFA s) 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 of 100 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 nutrients digestibility, nutritive value, effective NDF (eNDF) and rumen parameters, 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 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), corn grains (CG) and rice straw (RS) which were used in the experimental diets are shown in Table (1). It was clear that, the ingredients were within the normal published ranges (Wiedmeier *et al* 2001 and Maklad *et al* 2005). They reported that the characteristics of a low-quality roughages are:

1- low in crude protein, less than 6% crude protein (CP).
2- high in fiber, greater than 70% neutral detergent fiber (NDF).
3- Low in energy, less than 45% total digestible nutrients (TDN).

Concentration of fiber is negatively related to quality because forages with high fiber content has less available energy and are consumed in lesser amounts by cows than are forages with low amount of fiber (Weiss *et al*, 1982).

In the case of low-quality forage diets, the energy released from the forage by the fermentation of fiber may have to account for 70 to 90% of the total energy requirement of the cows (Wiedmeier *et al*, 2001). If follows, then that the most practical feeds that a producer would consider as supplements for cows fed low-quality forage diets would be protein supplements, such as soybean meal or cottonseed meal, or energy supplements such as cereal grains like corn, barley or oats.

National research council (NRC, 2001) reported that, diets consumed by high producing dairy cows in the United states contain high levels of starchy grains. Understanding starch digestion is the key to optimizing protein utilization and improving the efficiency and effectiveness of high grains diets.

On the other hand, rice straw is characterized by a relatively low digestibility and that high portion of its ash is silica which can lead to a depressing effect on digestibility and inhibiting the digestion of carbohydrates. Wanapat *et al* (1982) found that the content of silica in rice straw ranged from 5 to 8%, whereas Roxas *et al* (1984) reported that silica content is ranging from 14 to 23%.

The cell wall fraction plants has been implicated as a control mechanism for forage intake by ruminants (Waldo, 1986). Lignin is the major component of the cell wall that is recognized as limiting digestion of the wall polysaccharides in the rumen (Jung and Deetz, 1993). Lignin seems to exert its negative effect on cell wall polysaccharide digestibility by shielding the polysaccharides from enzymatic hydrolysis.

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)	88.36	94.84	16.77	2.24	10.90	64.93	5.16	42.00	18.47	23.53	10 35	8.12	33.83	8.19	33.82	58.00	80.90
Corn grains (CG)	88.58	97.33	9.54	2.61	2.21	82.97	2.67	30.30	4.63	25.67	3.08	1.55	54.88	1.13	29.17	69.70	88.85
Rice straw (RS)	90.63	80.47	4.88	0.22	29.31	46.06	19.53	73.75	56.63	17.12	39.85	16.78	1.62	29.70	44.05	26.25	61.83
Experimental rations																	
69% CFM+31% RS	89.07	90.36	13.06	1.61	16.64	59.05	9.64	55.84	30.36	25.48	19.54	10.82	19.85	14.50	41.34	44.16	74.71
62% CFM + 7% CG + 31% RS	89.08	90.54	12.55	1.64	16.01	60.34	9.46	55.00	29.37	25.63	19.02	10.35	21.35	13.66	41.34	45.00	75.68
56% CFM + 14% CG + 30% RS	89.07	90.87	12.23	1.68	15.24	61.72	9.13	53.73	28.04	25.69	18.21	9.83	23.23	12.67	41.05	46.27	76.75

* 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 soluble = 100 – NDF

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

Wheeler (2003) recommended the concentrations of non-fiber carbohydrate (NFC) in lactation diets (% of diet DM) should not fall bellow 20 to 25%, or not go above 40 to 45%. The NRC (2001), also recommended the concentrations of NDF and NFC in lactation diets (% of diet DM). Diet should never exceed 44% NFC or contain less than 25% total NDF or less than 15% forage NDF. The starch in dry ground corn is less digestible in the rumen than many other starch sources, therefore, ruminal acid production is lower with dry corn than some other feeds. The CP content about 12- 13% as recommended by (Ørskove *et al* 1972), to ensure maximal rate of fermentation in the rumen. Balancing dietary carbohydrates for maximum energy intake, while supplying adequate fiber for rumen health, is an art as much as a science. While starch is the major non structural carbohydrate (NSC), the energy contribution from structural carbohydrates can be (and should be) significant (Nocek and Russell, 1988). they developed the rumen available carbohydrate (RAC) equation to account for both structural and nonstructural carbohydrate digestion in the rumen. Formulation of rations based on NDF, although achieving one of the most important objectives of ration balancing, which is to define the upper limit for the forage : concentrate (F:C), does not account for the more subtle differences in fiber that are associated with the kinetics of digestion and passage or with physical characteristics (Mertens, 1994).

Table (2) shows the average daily dry matter intake of each experimental diets in accordance with those of Hagemeister *et al*, (1981) The average daily intake of total concentrate (CFM+GCG)) as the % of body weight (BW) was ranged from 3.0 to 3.25, and the RS was 1.53% of BW so the total DM intake ranged from 4.46 to 4.65 % of BW. In most feeding trails using forage and grain, DMI from roughage is usually under 2% of BW (Wheeler , 2003) .

Table (2): Average daily dry matter intake of concentrate, rice straw and corn grains by dairy cows.

Items	Ration 1	Ration 2	Ration 3
Average body weight (kg)	480	480	480
Roughage : concentrate	31 : 69	31 : 69	30 : 70
Intake of DM from :			
Concentrate feed mixture (CFM) :			
Kg/h/d	14.73	13.2	12.61
As % BW	3.07	2.75	2.64
Corn grains:			
Kg/h/d	0	1.53	3.01
As % BW	0	0.36	0.71
Total concentrate:			
Kg/h/d	14.73	14.73	15.62
As % BW	3.07	3.07	3.25
Rice straw (RS) :			
Kg/h/d	6.65	6.65	6.53
As % BW	1.53	1.53	1.53
Total dry matter intake:			
Kg/h/d	21.37	21.38	22.26
As % BW	4.46	4.46	4.65

The response by lambs was similar to previous research with steers fed low-quality hay and similar supplements (Sanson et al, 1990), except the decrease in intake did not occur until the level of corn in the supplement reached, 0.75% of BW. This implies a positive association effect due to correcting a N deficiency in the rumen and indicates the importance of differentiating the type of concentrate fed as a supplement with low quality roughages. The substitution rate of corn with low-quality forages varies with the amount of corn fed and is supported by the quadratic response of forage intake by lambs consuming low quality hay to increasing levels of corn supplementation. According to 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.

Mixture of forage and concentrate fed to cows should result in greater and more efficient microbial growth than either concentrate or forage alone, possibiy because of optimizing the availability of fermentable substrate and increase rate of passage of digestion from the rumen. Adding forage or structural carbohydrate to a diet may allow minimal bacteria to utilize the energy for growth more efficiency because the energy is released in a more uniform pattern throughout the day.

Table (3) show the effect of feeding the experimental rations on the digestion coefficients and feeding values. There were no significant effect on the apparent digestibility of the nutrients and the nutritive values except for CF, NFE, cell, ADL, and TDN/CP ratios. The apparent digestibility of CF was significant ($p<0.05$) higher with feeding on R3 than the other treatments, while the digestibility of NFE and ANDF were significant ($p<0.05$) higher with feeding on R1 than the other treatments. The cell. digestibility increased ($p<0.05$) when feeding on R1 than R2, but there were no significant effect between R1 and R3 or R2 and R3, while ADL digestibility was increased when feeding on R3 ($p<0.05$) than R1, while there was no significant effect between R1 and R2 or R2 and R3.

Mehrez (1995) reported that the addition of quantities of readily available substrates (in the form of cereals) to poor quality roughage increased its rate of digestion and fermentation of rumen bacteria, Maklad *et al* (2005) found that the CF, cell., ADL digestibility improved with increasing the replacement of corn grains in rations, since these were the highest with 0.7% corn grains of BW.

Matejovesky and Sanson (1995) reported that there was large variation associated with the effect of cereal grain supplementation on digestion of the NDF fraction, with no apparent trend within forage . In general, there is more variation associated with the digestion coefficients for NDF than DM . Plascencia and Zinn (1996) indicated that 1 to nearly 5 kg of starch may disappear postruminally in cows fed high starch diets. 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 unclear. Grinding has been shown to increase the rate of passage of grain from the rumen as well as rate of digestion within the rumen (Ewing *et al*, 1986). Rate of passage and rate of digestion have opposing effects on ruminal starch digestion.

The effect of the grinding process on grain on *in vivo* starch digestion in the rumen may, therefore be less than expected in animals with high intakes and high rates of passage such as high producing cows.Most published reports on the site of starch digestion in lactating cows have involved duodenally but not ilealy canulated cows. Some of the very high postruminally starch disappearances was observed when dry grains were fed (Oliveira *et al.*, 1995) might have been more associated with fermentation in the large intestine than digestion in the small intestine .

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

Items	Ration 1	Ration 2	Ration 3
Nutrient digestibility (%):			
DM	60.33	58.97	60.96
OM	68.16	66.09	67.11
CP	59.67	58.53	60.26
EE	67.33	66.82	64.96
CF	44.95^{b}	46.95^{b}	59.63^{a}
NFE	73.43^{a}	67.96^{b}	67.79^{b}
NDF	58.63	55.17	56.96
ADF	48.07	45.04	50.04
Hemi.	71.23	66.78	64.50
Cell.	71.07^{a}	63.33^{b}	69.66^{ab}
ADL	6.51^{b}	11.39^{ab}	13.63^{a}
NFC	91.13	85.06	87.92
UNDF	2.56	3.10	4.74
ANDF	78.29^{a}	72.37^{b}	73.09^{b}
NDS	62.47	63.61	65.60
RAC	71.11	68.12	69.97
Feeding value (%)			
TDN	61.07	58.33	60.57
DCP	7.80	7.93	7.37
TDN:CP (ratio)	4.68^{b}	4.65^{b}	4.95^{a}
ME(Mcal/kg)	2.17	2.08	2.16
ME(Mj/Kg)	9.09	8.68	9.02
NE(Mcal/Kg)*	1.38	1.31	1.36
DDM%**	53.74	52.54	54.30
RFV***	185.8	181.8	196.2
RFQ****	221.5	211.9	229.5
QI*****	2.87	2.75	2.97

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)**

******RFQ = (DMI% of BW) * (TDN% of DM) / 1.23 (Moore, 1994)**

*******QI = 0.0125*RFQ + 0.097 (Moore, 1994)**

Digestion of starch in the large intestine (as much as 11% of starch intake) has been reported in steers fed on 80% corn diet. Knowlton *et al.* (1998) reported that 23%of the starch consumed from GC diet was digested in the large intestine. Fermentation of starch in the large intestine result in a loss of microbial N in feces, although the VFA produced are available for absorption and use by the cow.

Oldham (1984) states the interrelationship between protein and energy yielding nutrients within the rumen and within the ruminant body can have tremendous effects on the overall pattern of nutrient use. Consequently, the relative amount of protein energy yielding nutrients supplied to the animal is likely to determine net efficiency of the absorbed nutrients. Nocek and Russell (1988) supports this conclusion through this explation, if there is a deficiency of CP, the digestibility of carbohydrates can decrease. If there are insufficient carbohydrates to match CP, N can be lost as rumen ammonia. It is apparent that a synergistic relationship exists between protein, protein fractions, and energy yielding nutrients that must be recognized.

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 protein supplementation may be needed when the TDN: CP ratio is greater than 6: 1 to 8: 1. The results in Table (4) show the mean value of ruminal pH was increased ($p<0.05$) when animals were feeding on R1 or R2 than feeding on R3. The mean values were 6.33, 6.3 and 6.13 respectively. The same trend was observed on the calculated effective neutral detergent fiber (eNDF) values (21.18, 20.89 and 16.75%) respectively.

Øroskov(1987)reported that the supplements fed with either untreated or 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). Fouad (2002) reported that if the diet contains grains at relatively high proportions, the roughage part will be depressed mainly because of lowered rumen pH as a results of acids produced and less saliva presented during chewing and syndication. Effective NDF (eNDF) is the percentage of the NDF effective in stimulating chewng and salivation, rumination as rumen motility (Russel *et al*, 1992). Effective NDF (eNDF) was calculated to estimate adjustments in ruminal pH useful only when eNDF was below 30% . Fiber digestion is at normal levels (pH about 6.2 optimal) when eNDF is at least 20%. In addition, to predicate ruminal pH and eNDF were used to adjust passage rate.

The mean values of the buffering capacity (BC) was shown in Table 4, was the lower ($P<0.05$) when feeding on R1 or R3 than R2. Because VFA absorption is a passive process, and only un-dissociated acids or readily absorbed, VFA absorption rates do not increase until VFA accumulate and the pH declines (Deaville, 1990). So, in that case when feeding on corn diets the total amount of fermentation acids produced in rumen is lower and more importantly, the rate of fermentation acids produced could be considerably slower (Maekawa *et al.*, 2002). Data presented in Table (4) showed that ruminal TVFA's concentrations was significantly ($P<0.05$) higher when feeding on R 3 than R1 followed by R2. The pattern of TVFA's concentrations followed the reverse trend of pH values. Fouad (2002) and Fouad *et al.* (2002) reported that ruminal liquor of TVFA's concentration were higher with rations containing yellow corn grains. In general, Krause *et al.* (2002) showed that the quantity of organic matter fermented in the rumen drives VFA production. Rumen concentration of VFA are measured in attempt to characterize the general nature of the rumen fermentation .

As shown in Table 4, The ruminal NH_3-N concentration, were ranged from 5.87 to 7.47 mg/100 ml rumen liquor with deferent treatments, but without significant effects.

Elizalde *et al.* (1999) added fermentable carbohydrate to a diet of fresh alfalfa that contained large amounts of rapidly available N; this decreased ruminal NH3 levels and increased duodenal supply of AA in steers. Similarly, adding starch to a low-quality hay supplemented casein decreased ruminal NH3 levels but it also reduced fiber digestion (Olson *et al.*, 1999). Many of the cellulolytic bacteria prefer or require N in the from of NH3 (Russell et al, 1992), thus forming a link between transformation of N sources to NH3 and fermentation of fiber. Ruminal bacteria have a high affinity for NH3 and can survive on concentrations below 50 µ M (Schaefer et al, 1980), which means that fiber fermentation system is designed to survive episodes of low N supply yet function at NH3 concentrations ≥ mM.

Table (4) : Effect of feeding experimental rations on some rumen liquor parameters at 3 hr after feeding.

Items	Ration 1	Ration 2	Ration 3
Parameters			
PH-Values	6.33^{a}	6.3^{a}	6.13^{b}
Buffering capacity BC (ml eq/100ml)	9.0^{b}	16.2^{a}	10.8^{b}
Total VFA's (ml eq/100ml)	12.5^{b}	13.0^{b}	27.87^{a}
NH_3-N (mg/100ml)	7.13	7.47	5.87
%eNDF*	21.48^{a}	20.69^{a}	16.75^{b}

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.

Carbohydrates are the major components of ruminant diets and they differ widely in the rate and extent of fermentability in the rumen . In concentrate based diets the storage polysaccharides (starch and sugars) provide most of the energy requirements. Soluble polysaccharides are more highly fermentable and diets of dairy cattle are often supplemented with grains to meet the energy demands associated with higher milk production . From the foregoing results it could be concluded that the replacement of amounts of the concentrate feed mixture in lactating cow rations at 14% of total DMI/day by corn grains with rice straw was the best than the other rations .

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تأثير إحلال حبوب الأذرة جزئيا محل مخلوط العلف المصنع عند التغذية على علائق قش الأرز لأبقار الفريزيان الحلابة على:

١- معاملات الهضم ، القيمة الغذائية وبعض قياسات سائل الكرش

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اجرى هذا البحث بهدف دراسة تأثير احلال حبوب الأذرة محل جزء من مخلوط العلف المصنع (٧ ، ١٤ %)من المادة الجافة الماكولة الكلية على كل من معاملات الهضم والقيمة الغذائية وبعض ا لمعـايو لسوائل الكرش فى ابقار الفريزيان الحلابة وتم تكوين ثلاث علائق على النحو التالى :

(عليقة اولى) ٦٩ % علف مصنع + ٣١% قش أرز .

(عليقة ثانية) ٦٢ % علف مصنع+ ٧% حبوب اذرة مجروشة +٣١% قش أرز .

(عليقة ثالثة) ٥٥ % علف مصنع + ١٤% حبوب أذره مجروشة +٣١% قش أرز.

وقد تم تكوين الخلطات حتى تكون متماثلة تقريبا فى محتواها من البروتين الخام (١٢—١٣ %) والطاقة وهى التى تلبى إحتياجات البكتريا وتوفير الظروف المناسبة لتخمر المواد الخشنة بالكرش

واستخدمت طريقة العودة الى زى بدء فكانت كل تجربة تستغرق مدة ٣١ يوم (١٦ يوم دور تمهيدى ، ١٥ يوم دور رئيسى) ويتم اخذ عينات الروث فى الاسبوع الاخير من كل تجربة لاجراء التحليلات المطلوبة لتجربة الهضم. ثم اخذ عينات سائل كرش بواسطة اللى المعدى بعد ٣ ساعات من التغذية لتقدير بعض قياسات الكرش .

وكانت أهم النتائج المتحصل عليها كما يلى:

١. زاد معامل هضم الألياف الخام (CF) معنويا على مستوى (٠,٠٥) عند التغذية على العليقة الثالثة (١٤% اذرة صفراء) مقارنة بالعلائق الاخرى بينما زاد معامل هضم المستخلص خالى الاذوت(NFE) ومستخلص الالياف المتعادل القابل للتخمر (ANDF) على مستوى (٠,٠٥) عند التغذية على العليقة الأولى.

٢. زاد معامل هضم السليلوز معنويا على مستوى (٠,٠٥) عند التغذية على العليقة الاولى مقارنة بالعليقة الثانية ولكن لم تظهر فروق معنوية مع العليقة الثالثة أو بين العليقة الثانية والثالثة وزاد معامل هضم مستخلص اللجنين الحامضى (ADL) معنويا على مستوى (٠,٠٥) عند التغذية على العليقة الثالثة مقارنة بالعليقة الاولى ولم تظهر فروق معنوية مع العليقة الاولى والثانية او العلائق الثانية والثالثة.

٣. تحسنت قيمة مجموع المركبات الغذائية المهضومة الى البروتين الخام (TDN: CP) معنويا على مستوى (٠,٠٥) عند التغذية على العليقة الثالثة مقارنة بالعلئق الاولى او الثانية وكانت النسب (٥,١، ٤,٧١ ، ٤,٧٨ على الترتيب).

٤. انخفضت قيم الـ (pH) لسائل الكرش بالتغذية على العليقة الثلثة (١٤% ادرة صفراء مجروشة) مقارنة بالعلائق الاولى والثانية وكانت القيم ٦,٣٣ ، ٦,٣ ، ٦,١٣ للعلائق الاولى والثانية والثالثة على الترتيب وكانت قيم مستخلص الألياف القابلة للتخمر (eNDF%) متطابقة مع قيم (pH) حيث كانت ٢١,٤٨ ، ٢٠,٨ ، ١٦,٧٥ % على الترتيب.

٥. زاد تركيز الأحماض الدهنية الطيارة (TVFA`s) معنويا على مستوى (٠,٠٥) عند التغذية على العليقة الثالثة مقارنة بالاولى والثانية وكانت القيم هى ١٢,٥ ، ١٣,٠ ، ٢٧,٨٧ مليمكافىء / ١٠٠ مل سائل كرش مع العلائق الاولى والثانية والثالثة على الترتيب.

٦. تراوح تركيز ازوت الأمونيا(NH_3-N) بالكرش بين ٥,٨٧ – ٧,٤٧ ملليجم / ١٠٠ مل سائل كرش بالتغذية على العلائق المختلفة ولم تظهر فروق معنوية بينهم.

يستخلص من هذه الدراسة إن الكربوهيدرات تعتبر الجزء الاعظم فى علائق المجترات ويختلف معدل درجة تخمرها بالكرش. وعند التغذية على علائق تحتوى على نسبة عالية من المركزات الغنية بالنشا والسكريات فانها تمد الحيوان بمصدر طاقة على صورة احماض دهنية طيارة (VFA) وعند اضافة الحبوب تكون المركبات الكربوهيدراتية عالية فى درجة تخمرها فتلبى احتياجات الحيوانات المنتجة للبن وخاصة عالية الانتاج ونستنتج من ذلك انه باحلال حبوب الأذره المجروشة بنسبة ١٤% من المادة الجافة الكليه المأكولة بجانب العلف المصنع وذلك عند التغذية على قش الارز فانها تعتبر الأفضل غذائيا وصحيا مقارنة بالعلائق الاخرى التى استخدمت فى هذه التجربة.