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EFFECTS OF SEAWEED SUPPLEMENTATION TO FATTENING FRIESIAN STEERS RATIONS ON: 1-THE NUTRITIVE VALUE AND RUMEN FERMENTATION

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ABSTRACT

Three digestibility trials were conducted using three steers for each; which were with average body weight 392 ± 3.3 kg and 18 month of age. The experimental rations were formulated as follows: ration 1 (R1) 81.8% concentrate feed mixture (CFM) + 18.2% clover hay (CH) (control), ration 2 (R2): 81.55% CFM + 18.05% CH + 0.40% seaweed (S) and ration 3 (R3): 81.23% CFM + 17.87% CH + 0.90% S.

The results showed that there were no significant effect of feeding the experimental rations on the digestion coefficients for all nutrients and feeding values, but the digestion coefficients of OM, NFE, ADF, cellulose, ADL, NFC, TDN%, ME (Mcal/kg DM) and NE (Mcal/kg DM) were higher when feeding on R2 or R3 than R1.

The predicted values using net carbohydrate and protein system (CNCPS) showed that the sugar and starch fermentation were 276.6 and 729.4 g / d, respectively with feeding R1, 277 and 731.4 g / d, respectively for R2 and 277.6 and 737.2 g/d, respectively for R3. The total microbial protein was 1006, 1008.4 and 1014.8 g/d when feeding on R1, R2 and R3, respectively.

The mean values of ruminal pH, buffering capacity (BC), VFA’s were not significant affected by the different dietary treatments, while the concentration of NH_3-N (mg/100 ml RL) tended to increase ($p<0.05$) when animals were fed on R2 or R3 (13.74 and 14.20 mg/100 ml RL, respectively) than R1 (11.82 mg/100 ml RL).

The present study showed that, the dry matter intake and nutrients digestibility were improved by supplemented seaweed but the total VFA's was higher with feeding on 81.55% CFM + 18.05% CH + 0.40 % seaweed (S) than the other rations.

Keywords: Friesian steers, seaweed, digestion coefficients and fermentation**.**

INTRODUCTION

The risk of acidosis is increased when cattle are fed forages high in non-structural carbohydrates (sugars and starches) with low effective fiber content, such as clovers and young Lucerne (alfalfa) and possibly ryegrass that may not stimulate adequate rumination and salivation, especially when fed in combination with concentrate feeding (Kolver and de Veth, 2002) .

In ruminants, acidosis is defined as the biochemical and physiological stress caused by rapid production and absorption of ruminal organic acids (volatile fatty acids (VFA) and lactic acid) that arise the over consumption of readily fermentable carbohydrates (Britton and Stock, 1986).

The rapid ingestion of high grain diets include a dramatic reduction of ruminal pH (5.2 or less) (Cooper and Klopfenstein, 1996), increased concentration of VFA's and lactic acid in the rumen (Huntington, 1988) and a significant decline in total protozoa (Hristov *et al*, 2001).

In severely acute cases, death may occur within 24 to 72 hours following grain engorgement (Glock and DeGroot, 1998).

For the rumen to work efficiency and effectively the rumen microbes need a steady supply of fermentable energy and degradable protein and most importantly they need a stable rumen pH between 6.0 and 7.0 pH (Russell and Hino, 1985). Within this pH range the rumen is at its most efficient.

Buffer supplementation of high concentrate diets has been shown to improve or stabilize feed intake and increase animal performance in some studies (Solorzano *et al,* 1989; Zinn, 1991), but not in others (Coppock *et al*, 1986).

Aga *et al* (2000) were used a calcified seaweed as a buffer in continuous culture of rumen contents.

The chemical composition of ordinary seaweed, as from *Ascophyllum nodosum*, immediately characterizes the material as of low energy content. According to the analytical data the value of seaweed meal must primarily be sought in its content of vitamins, and minerals, among which β-carotene, tocopherols, some B vitamins, iodine, zinc and potassium are the more important (Scott, 1990). The rational way of using seaweed meal in rations would be to let this component supply the above active substances according to the analytical data and to add the factors lactating to obtain a balanced diet.

Sykes (2009) reported that the seaweed is a totally natural multi-mineral supplement. Seaweed contains all minerals and trace elements an animal requires for a normal healthy life. The feeding recommendation for finishing cattle is from 100-120 g per day.

On the other hand, Scott (1990) reported that for ration proves equal the normal balanced ration, economic considerations should decide diet is to be preferred.

The objective of this study was to evaluate the effect of supplementing different levels of seaweed concentration in finishing phase of Friesian steers rations on nutrient digestibility and ruminal fermentations.

MATERIALS AND METHODS

This study was conducted at El-Karada Animal Production Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture in Egypt and Department of Animal Production, Fac. of Agric., Mansoura University.

Three Experimental Rations Were Formulated as Follows:

R1: ration 1: 81.8% concentrate feed mixture (CFM) + 18.2% clover hay (CH) (as a control ration).

R 2: ration 2: 81.55% CFM + 18.05% CH + 0.40% seaweed (S)

R 3: ration 3: 81.23% CFM + 17.87% CH + 0.90% S.

The CP concentration of tested rations were ranged from 16 to 17% according to Hunter *et al* (1999). Steers were individually fed the experimental rations.

The concentrate feed mixture (CFM) used contained 44% yellow corn , 23% soybean meal (44% protein), 14% wheat bran, 11.5% rice bran , 4.5% molasses, 2%, limestone and 1% salt.

The clover hay was made from the 3rd cut of Egyptian clover.
The supplement seaweed meal as from *Ascophyllum nodosum* manufactured by Acadian Sea plants Limited, Canada . The approximate label analysis showed that it contains protein, fiber, carbohydrates, vitamins and minerals.

Management of feeding:

The intake of tested ration by steers was fixed and calculated as the percentage of roughage to concentrate ratio to satisfy their maintenance and production requirements (Ghoneim, 1967).

The CFM fed with or without seaweed was offered to steers at morning. While clover hay (CH) given after consumption of the concentrate. Drinking fresh and clean water was available at all times

Digestibility Trails:

Three digestibility trials were conducted using three steers to determine nutrients digestibility coefficients and nutritive values of the experimental rations. Animals were fed to cover the requirements of fattening steers. Steers were with average body weight 392 ± 3.3 kg and 18 month of age. Animals were fed their allowances according to the experimental to 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 steer twice daily with 12 hours interval during the collection period of each trial (5 days) and dried in a forced air oven at 65°C for 48 hours. Dried samples were composted for each animal and representative's samples were taken, ground and kept for chemical analysis.

Chemical Analysis:

Samples of CFM, CH, S 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 animal 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 steer and representative samples were taken, ground and kept for chemical analysis.
Chemical analysis of CFM, CH and S 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 Soest, (1982).

At the end of each collection period ruminal fluid samples were taken using rubber stomach tube before offering the morning feed and at 2, 4 and 8 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).

The Nutritive Analysis:

The mechanist sub models as published by Russell *et al* (1992) was applied on the experimental rations to predict microbial growth from their carbohydrate and protein fractions and their digestion and passage rate using the net carbohydrate and protein system (CNCPS) programmed version 3.0.

Statistical Analysis:

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

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

Where:

Yij = Observation of the tested factor
μ = Overall mean
T_i = Treatment effect
e_{ij} = Error

The data of rumen liquor parameters were subjected to two- ways analysis of variance according to the following model:

$Y_{ijk} = \mu + T_i + p_j + tp_{ij} + e_{ijk}$

Where :

Yij = Observation of the tested factor
μ = Overall mean
T_i = Treatment effect
p_j = time effect
tp_{ij} = interaction effect of the treatment) × time
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), clover hay (CH) and seaweed (S) 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).

The cell wall fraction plants have 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.

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%. 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. 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 (1): 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*
Ingredients													
Concentrate feed mixture (CFM)	90.86	93.07	16.54	2.14	15.17	59.22	6.93	40.34	17.58	22.76	10.00	7.58	34.05
Clover hay (CH)	88.89	87.71	16.61	2.29	27.76	41.03	12.29	53.29	29.58	23.71	13.96	15.62	15.52
Seaweed (S)	88.00	75.00	6.80	2.30	6.80	59.10	25.00	36.52	20.06	16.46	15.72	4.34	29.38
Experimental rations													
R1	93.92	92.10	16.55	2.17	17.45	55.93	7.90	42.68	19.75	22.93	10.71	9.04	30.70
R2	93.75	92.02	16.51	2.17	17.40	55.94	6.25	42.65	19.75	22.90	10.73	9.02	30.70
R3	93.72	91.96	16.47	2.17	17.36	55.96	6.28	42.64	19.76	22.88	10.76	9.00	30.68

R1: (ration 1): 81.8% CFM + 18.2% CH (control), R2 (ration 2): 81.55% CFM + 18.05% CH + 0.40% S
R3 (ration 3) : 81.23% CFM + 17-87% CH + 0.90% S.
*** Non fibrous carbohydrates%= OM% - (CP%+NDF%+EE %), (Calsamiglia *et al.,* 1995).**

Table (2) showed the effect of feeding the experimental rations on average daily dry matter intake. The total daily dry matter intake was as% body weight (BW) 2.54, 2.52 and 2.59 when feeding on R1, R2 and R3, respectively. The average daily intake of CFM was ranged from 2.06 and 2.11% BW. The CH was about 0.45% BW. Rapidly growing cattle, such as steers can be safely fed up to 2.0 to 2.25% of their weight in concentrates. Feeding roughage at least 1.8 to 2.2 kg of hay daily. However neither should be fed at over 20% of the diet (Schreder, 2002).

The voluntary intake of feed depends essentially on the rate of degradation of its digestible matter into particles of a size small enough to enable their passage from the reticulo-rumen to the lower gut. This degradation is achieved by means of the microbial fermentations which takes place in the reticulo-rumen. The cell wall content and the magnitude and nature of lignifications of these cell walls are amongst the most important factors which govern the digestibility and the rate of passage of forage (Preston and Leng, 1987).

Table (2): Average daily dry matter intake of concentrate, clover hay and seaweed by Friesian steers during the digestion trials.

Items	R 1	R 2	R 3
Average body weight (kg)	393	396	388
Concentrate : Roughage	81.8 : 18.2	81.5 : 18.5	81.2 : 18.8
Intake of DM from :			
Concentrate feed mixture (CFM) :			
Kg/h/d	8.18	8.18	8.18
As % BW	2.08	2.06	2.11
Clover hay :			
Kg/h/d	1.81	1.81	1.80
As % BW	0.46	0.45	0.46
Seaweed :			
Kg/h/d	0	0.04	0.09
As % BW	0	0.01	0.02
Total dry matter intake:			
Kg/h/d	9.99	10.03	10.07
As % BW	2.54	2.52	2.59

Scott (1990) reported that the *Ascohpyllum nodusum* contains, as well as some 18 amino acids, 60 minerals and trace elements, kelp meal rich in nitrogen, carbohydrates and also contains considerable amounts of β carotene (the precursor of vitamin A), as well as vitamins E, D and K and some B vitamins. Among the trace elements found in kelp are magnesium, fluorine, manganese, molybdenum, tellurium, thallium, vanadium, tungsten, zinc and zirconium. Deficiencies of these elements are known to cause a variety of disorders in man and animals.

Nutrient Digestibility and Feeding Values of Tested Rations:

Table (3) shows the nutrient digestion coefficients and feeding values of tested rations. There were no significant effect of feeding the experimental rations on the digestion coefficients of all nutrients and feeding values. But the digestion coefficient of OM, NFE, ADF, cellulose, ADL, NFC, TDN%, ME (Mcal/kg) and NE (Mcal/kg) were slightly higher when feeding on R2 or R3 than R1.

Aga *et al* (2000) were used calcified seaweed to study the effect of buffer on pH and microbial metabolism in continuous culture of rumen contents. They found that there no differences ($p<0.05$) among treatments were observed for digestion of DM, OM, CP, NDF or ADF.

On the other hand, the kelp meal contains, as well as some 18 amino acids, 60 minerals and trace elements (Scott, 1990). Biologists believe that the amino acids, when absorbed by the animal's rumen, enhance the microbial action within the rumen and hence increase the total digestible nutrients (TDN) available from the test of the feed.

The basic reason for the use of organic forms of trace minerals is the reported increased bioavailability of organic vs. inorganic source of the mineral (Clark *et al*, 1993).

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

Items	R 1	R 2	R 3	±SEM	*p*
Nutrient digestibility (%):					
DM	88.31	87.73	90.36	1.37	0.421
OM	89.95	90.39	92.30	1.61	0.5819
CP	87.55	86.84	89.54	1.35	0.3988
EE	98.39	94.24	92.52	2.52	0.3109
CF	90.41	84.60	88.94	2.03	0.1916
NFE	89.14	92.42	93.34	1.93	0.3408
NDF	85.86	84.24	87.82	2.41	0.5995
ADF	77.30	78.76	84.50	2.06	0.1037
Hemi.	93.24	88.91	90.68	3.12	0.6378
Cell.	95.66	96.99	98.95	0.87	0.0959
ADL	55.51	57.04	67.21	4.51	0.2176
NFC	94.43	99.41	98.52	1.57	0.1366
Feeding value (%)					
TDN	84.93	85.36	86.93	1.61	0.6707
DCP	14.49	14.34	14.74	0.22	0.4749
ME(Mcal/kg)	12.64	12.70	12.94	0.23	0.6641
ME(Mj/Kg)	3.02	3.04	3.09	0.05	0.7082
NE(Mcal/Kg)*	1.96	1.97	2.01	0.03	0.6835
DDM%**	78.06	77.57	79.89	1.21	0.4178
RFV***	153.7	152.2	161.1	3.82	0.2919

*** 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)**

Both the macro and microelements affect the processes that proceed in the animal's organism in the different way and through their presence in the digestion tract. Thus, for example, cellulose degradation in suspension of rumen bacteria cells is accelerated by the following elements : P, Mg, Ca, K, Na, Fe, Mn, Co, and Mo (Durand and Kawashima, 1980).

Table (4) showed that there were no significant effect when feeding the experimental rations on the (BC) of the ruminal liquor at different times of sampling from 0 hr up to 8 hr of feeding. The mean values of BC was 8.83, 9.17 and 9.27ml eq/100 ml RL for R1, R2 and R3 respectively. There was no significant effect of the experimental rations on the pH of the rumen liquor at different times of sampling from 0 hr up to 8 hr of feeding, although the pH tended to decrease after 8 hrs after feeding on R1, while it was decreased after 4 hrs after feeding on R2 or R3. The mean values were 7.3, 7.3 and 7.35 for R1, R2 and R3, respectively.

The results also showed that there was no significant effect on the VFA of the ruminal liquor at different times of sampling from 0 hr up to 8 hr of feeding on R1, R2 and R3. The mean values were 9.95, 10.47 and 9.78 eq/100 ml RL when feeding on R1, R2 and R3, respectively.

Table (4) showed that there was significant effect of feeding the experimental rations on the NH_3-N concentration in the rumen at different times of sampling. The NH_3-N concentration was higher ($p<0.05$) at 0 hr when feeding on R2 than R1 or R3 and R1 was higher ($p<0.05$) than R3, and then NH_3-N values were higher ($p<0.05$) when feeding on R1 or R2 than R3 from 2 hr up to 4 hr after feeding. The NH_3-N concentration tended to increased ($p<0.05$) when feeding on R1 or R3 than R2, but the NH_3-N concentration was higher ($p<0.05$) when feeding on R3 than R1 after 8 hrs of feeding. The mean values were higher ($p<0.05$) when feeding on R2 or R3 (13.74 and 14.20 mg/100 ml RL respectively), than R1 (11.82 mg/100 ml RL).

As shown in table (4) there was no significant effect on the eNDF values. The values for eNDF were 44.1, 44.06 and 45.42% when feeding on R1, R2 and R3 respectively.

Westwood and Lean (2001) reported that rumen pH fluctuates throughout the day depending on diet, time of feeding of concentrates and the supplementation of fiber sources such as hay. Daily mean ruminal pH will not adequately represent the highly variable characteristics of ruminal pH. The nadir of rumen pH when feeding concentrates separately from forages is between tow and four hours after feeding (Kolver and Veth , 2002), with optimal pH being above 5.8 (Kolver, 1998) to 6.0 (Van Soest, 1994) for fiber digestion.

As shown in table (4) the pH value did not decreased than 7.3, because the samples of ruminal fluid token by stomach tube have a higher pH than there optimal through a rumen canula (Erdman, 1988). Because cattle fed forage secrete more saliva and have a higher ruminal pH than cattle fed grain. The impact of fiber on ruminal pH is explained by its effect on fluid dilution rate. When cattle are fed forage, ruminant and saliva flow are stimulated, the fluid dilution rate is high (as high as 20% per h), and the large amounts of acid are washed out the rumen to the abomasums where the pH is lower, a greater fraction of the acid is undissociated and the absorption rate is faster (Crichlow and Chaplin, 1985).

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

Items		Ration 1	Ration 2	Ration 3	±SEM	*p*
Parameters	**Hours**					
pH-Values	0	7.78	7.69	7.79	0.102	0.2850
	2	7.36	7.52	7.34		
	4	7.08	6.91	7.01		
	8	6.94	7.03	7.25		
	Means	7.29	7.29	7.35	0.051	0.6656
Buffering capacity BC (ml eq/100ml)	0	10.23	11.7	10.77	0.394	0.1686
	2	9.10	8.30	9.20		
	4	7.97	8.16	8.67		
	8	8.03	8.50	8.44		
	Means	8.83	9.17	9.27	0.196	0.2821
Total VFA's (ml eq/100ml)	0	7.28	8.10	8.32	1.488	0.9245
	2	11.46	11.43	12.23		
	4	10.57	10.65	9.45		
	8	10.48	11.68	9.13		
	Means	9.95	10.47	9.78	0.944	0.7964
NH_3-N (mg/100ml)	0	11.00	13.31	9.30	0.935	0.0003
	2	13.25	15.38	14.49		
	4	8.77	13.05	13.42		
	8	14.27	13.21	19.61		
	Means	11.82	13.74	14.20	0.467	0.0034
%eNDF*		44.10	44.06	45.42	1.23	0.6911

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)**

On the other hand, Van Soest, (1994) reported that Lucerne hay provides greater buffering capacity compared to Bermuda grass hay for several reasons. First, Lucerne contains higher levels of protein and calcium, both which buffer gastric acid. Also, Lucerne fiber has a higher cation exchange capacity compared to graminaceous plants due largely to its higher content of lignin and other polyphenotics.

Generally, Bramly ,(2004) showed that the cow was consistent with acidosis, being characterized by high concentration of valerate and propionate and low concentrations of ammonia.

The specific attributes of fibrous components in the forage that contribute most to its function as roughage are comprised in the term " effective fiber ", specifically effective neutral detergent fiber or eNDF. This term describes the properties of forage that stimulate chewing, regurgitation on rumination. The eNDF of forage not only represents its particular functionally in promoting digestive function, but also represents the character of the forage that can limit energy intake, and thus have a negative influence on performance (Jeffries, 1990).

Table (5): Effect of experimental ration on sugar and starch fermentation (g/d), total microbial protein (g/d) and total amino acids (AA) % of requirement.

Item	R1	R2	R3
Sugar fermentation (g/d)	276.6	277	277.6
Starch fermentation (g/d)	729.4	731.4	737.2
Total microbial protein (g/d)	1006	1008.4	1014.8
Total AA % of requirement	77.61	76.65	77.98

In general as shown in Table (5) the predicted values using CNCPS showed that, the sugar, starch and total microbial protein were tended to increase when feeding on R2 or R3 than R1. The total amino acids % of the requirement were 77.61, 76.65 and 77.98 when was feeding on R1, R2 and R3, respectively.

The presented study, may lead to concluded that the seaweed supplementation may enhance the immune response, but more information is needed on its mode of action and method of administration. The total VFA was higher with feeding on 81.55% CFM + 18.05% CH + 0.40 % seaweed (S) than the other rations.

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تأثير إضافة الطحالب البحرية لعلائق تسمين عجول الفريزيان على : 1- القيمة الغذائية وتخمرات الكرش.

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أجرى هذا البحث بهدف دراسة تأثير إضافة نسب مختلفة من الطحالب البحرية (صفر , 0,4, 0,9) من المادة الجافة المأكولة على كل من معاملات الهضم والقيمة الغذائية وبعض المعايير لسائل الكرش

وتم تكوين ثلاث علائق على النحو التالى:
(عليقة أولى) 81,8 % علف مصنع + 18,2 % دريس برسيم (عليقة مقارنة)
(عليقة ثانية) 81,55 % علف مصنع + 18,05 % دريس برسيم + 0,4 % طحالب بحرية
(عليقة ثالثة) 81,23 % علف مصنع + 17,87 % دريس برسيم + 0,9 % طحالب بحرية

وكانت الخلطات الثلاثة متماثلة من حيث نسبة البروتين حيث تراوحت بين (16,47 – 16,55 %) ,مستخلص الألياف المتعادلة (42,64 – 42,68 %) .

أستخدم 9 عجول فريزيان متوسط وزن 392 كجم, عند متوسط عمر 18 شهر وموزعة فى ثلاث مجاميع (ثلاثة عجول فى كل مجموعة) وتم أخذ عينات الروث لاجراء التحاليل المطلوبة

لتجارب الهضم وأخذ عينات سائل الكرش بواسطة اللى المعدى قبل الأكل وبعد الأكل بـ 2, 4, 8 ساعات لتقدير تركيز أيون الهيدروجين (pH) , السعة التنظيمية للكرش , تركيز الأحماض الدهنية الطيارة وتركيز الأمونيا.

وقد استخدم برنامج CNCPS لتقييم الخلطات العلفية من حيث درجة تخمرات ميكروبات الكرش للمركبات الكربوهيدراتية ومعدل نموها خلال اليوم وضبط الاحتياجات الغذائية وذلك لتفسير النتائج المتحصل عليها.

وكانت أهم النتائج المتحصل عليها كما يلى :

1- لم تظهر فروق معنوية على معاملات هضم المكونات الغذائية والقيمة الغذائية بالرغم من تحسن معاملات هضم المادة العضوية ومستخلص الخالى من الازوت ومستخلص الألياف الحامضى والسليولوز والمركبات الكربوهيدراتية غير الليفية ومجموع المركبات الغذائية المهضومة عند إضافة الطحالب البحرية مقارنة بالعليقة المقارنة وقد أشارت نتائج التحليل الغذائى الى أن السكريات والنشا المتخمرة (جم / يوم) كانت (276,6 , 729,4) للعليقة الأولى على التوالى , (277 , 731,4) للعليقة الثانية على التوالى , (277,6 , 737,2) للعليقة الثالثة على التوالى كما أن البروتين الميكروبى المتكون كان 1006 , 1008,4 , 1014,8جم / يوم عند التغذية على العليقة الأولى والثانية والثالثة على التوالى.

2- لم تظهر فروق معنوية عند التغذية على العلائق المختبرة على كل من خصائص سائل الكرش (درجة الحموضة , السعة التنظيمية , الأحماض الدهنية الطيارة) فى حين زاد تركيز الأمونيا معنويا (0,05) عند التغذية على العليقة الثانية والثالثة (13,74 , 14,2 مللجم / 100 مل سائل كرش) على التوالى مقارنة بالتغذية على العليقة الأولى 11,82 مللجم / 100 مل سائل كرش.

مما سبق يتضح أن إضافة الطحالب البحرية أدى الى تحسن فى معاملات الهضم والقيمة الغذائية ولكن زادت الأحماض الدهنية الطيارة بصفة عامة عند التغذية على العليقة الثانيةبالمقانة بالتغذية على العلائق الأخرى.

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