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INFLUENCE OF FEEDING DIFFERENT LEVELS OF SOYBEAN MEAL IN GROWING FRIESIAN CALVES RATIONS ON:
2- PRODUCTIVE PERFORMANCE IN FINISHING PHASE.

Ead, H, M. E.
Animal Production Research Institute, Agriculture Research Center, Dokki, Giza, Egypt.

ABSTRACT

Fifteen male Friesian calves with average body weight of 270 ± 24 kg and 13.3 ± 0.94 month of age were used in this study. Calves were distributed into three groups similar in number. The experimental rations were formulated as follows: ration 1 (R1): 82% concentrate feed mixture (CFM)+18 % clover hay (CH) (control), ration 2 (R2): 76% CFM+5% soybean meal (SBM)+19% CH and ration 3 (R3): 73% CFM+10% SBM+17% CH.

Replacement of CFM by SBM resulted in increasing the CP% from 14% for R1 to 15.4 and 17% for R2 and R3 rations, respectively. Digestibility coefficients of DM, CF, NFE, NDF, ADF, cellulose and NFC were significantly higher ($p<0.05$) for R2 ration than feeding R3, while there were no significant differences between R2 and R1 were observed, except for CF and NDF which were higher ($p<0.05$) when feeding on R2 than R1. The TDN% was higher ($p<0.05$) with feeding R2 than R3, while there was no significant difference between R1 and R2 or R1 and R3 was noticed. The DCP% was higher ($p<0.05$) when feeding R1 or R2 than R3. The CPI g/ME Mcal was higher ($p<0.05$) when animals were fed on R3 than on R1 or R2 (55.24, 59.17 and 68.70% for R1, R2 and R3, respectively). The TDN: CP ratio was higher ($p<0.05$) when feeding on R1 than R2 or R3.

The mean values of ruminal pH, VFA and NH3-N were significantly affected ($p<0.05$) by the different diatery treatments. The concentration of urea-N in blood serum was higher ($p<0.05$) for calves fed R2 or R3 than R1.

The ADG were 1.01, 0.98 and 1.00 kg/d for calves fed on rations R1, R2 and R3 respectively. The production efficiency was higher when feeding on R1 than feeding on R2 or R3 (36.7, 34.3 and 35.5%, respectively), and the economic efficiency, was higher when feeding on R1 than feeding on R2 or R3 being 40.13, 35.29 and 26.15% respectively.

In general, the data indicated that feeding ration at a level 14.0% CP (% DM basis) for growing Friesian calves was successfully and economically improved animals performance compared with rations which are high in CP levels.

Keywords: Friesian calves, soybean meal, daily gain and non fibrous carbohydrates (NFC).

INTRODUCTION

Beef production is a large and important segment of animal production and one of the largest industries in the world. The percentage of roughage and concentrate in beef cattle rations depends on the type of animal being fed.

For example, feedlot calves are fed mostly grains and little roughage. Cattle usually weight 270 to 310 kg before they are placed on high grains (high-energy) ration. This diet is fed until slaughter weight is achieved. An animal that is gaining weight at a moderate rate needs about 1.5% of their body weight in concentrates per day.

Rapidly growing cattle, such as calves 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)

Dietary fiber levels (neutral and acid detergent fibers) increased while available energy decreased as roughage in the diet increased from 8 to 32% (schreder, 2002)

The 90% corn diet was formulated to contain the lowest amount of dietry fiber and the highest amount of dietary energy. Finishing cattle in the terminal stage of fattening are often fed diets with low concentrations of roughage to maintain performance and achieve targeted backfat finish and marbling that are desired by the beef industry. High energy fattening rations have over 70% TDN and 9% to 15% CF (Mandell *et al* 2001).

Two needs must be considered when formulating the protein requirements of finishing cattle. One is the requirement by the animal for metabolizable protein (amino acids) and the second is the requirement by the microorganisms for available nitrogen in the rumen If metabolizable protein is inadequate, growth of the animal will be limited. If nitrogen available to the microorganisms is inadequate, growth of the microbes will be reduce, presumably limiting digestion in the rumen and reducing the supply of metabolizable protein from the microorganisms (Trenkle and Barrett, 2003)..

In an experiment conducted at Kansas state university indicated a linear increase in average daily gain as protein level increased from 14 to 20% of the diet (Hunter *et al*, 1999). Soybean meal is a common source of protein in finishing cattle diet because of its high rumen digestibility (Drouillard *et al*, 1999).

On the other hand, the protein requirement of cattle declines with maturity because of a decrease in protein content of tissue growth. Based on this change, cattle in the feedlot can be program-fed decreasing quantities of supplemental protein to reduce nitrogen lost in the manure (Trenkle and Barrett, 2005).

The objective of this study was to evaluate the effects of feeding different levels of dietary protein concentration in growing Friesian calves on performance, ruminal fermentation and nutrients digestibility.

MATERIALS AND METHODS

The experimental work of study is continuation of the first part presented by Ead and Maklad (2006), since the effects of the same tested rations used herein on nutrient digestibility coefficients, rumen parameters and growth performance of growing Friesian calves up to 150 days of weaning (stoker phase) were studied. Herein, the effects of the same tested rations, but at higher concentrate : roughage ratio (82: 12), during the following 90 days from day (151) on growing performance of Friesian calves were investigated.

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 2004.

Experimental animals:

The same fifteen male Friesian calves which were distributed into three similar groups (five for each) in the first part of study were used herein. The average live body weight (initial body weight) was 266 $\pm$ 13.0, 255 $\pm$ 23.2 and 290 $\pm$ 20.2 kg and the average age was 13.6 $\pm$ 1.02, 12.8 $\pm$ 0.7 and 13.6 $\pm$ 0.8 month for groups R1, R2 and R3, respectively.

Experimental rations :

Calves assigned for the three experimental rations as follows:

Ration 1: R1: 82% concentrate feed mixture (CFM) + 18% Clover hay (CH)(control).

Ration 2: R2: 76.0% CFM + 5% soybean meal (SBM) + 19% CH.

Ration 3: R3: 73% CFM + 10% SBM + 17% CH.

The SBM was used to replace CFM in tested ration to elevate the CP level in R2 and R3. The CP concentration of the tested rations was ranged from 14 to 17% according to Hunter *et al*, (1999). Calves were individually fed the experimental rations. Animals were fed to cover the requirements of fattening calves and were adjusted monthly according to their body weight changes.

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

Management of feeding

The CFM was fed with or without SBM and were offered to calves at morning , while clover hay (CH) given after consumption of the concentrates. Minerals-vitamins blocks were available for animals free choice. Drinking fresh and clean water was available at all times.

Weighing procedure:

Animals were weighed in the morning before drinking and feeding at the beginning of the trial and monthly thereafter to the nearest kg for each animal.

Digestibility trials:

Three digestibility trials were conducted using three animals chosen randomly from each group to determine nutrients digestibility coefficients and nutritive values of the experimental rations. The digestibility trials were conducted after about two months from the beginning trials. During the digestion trials, animals 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 calve twice daily with 12 hours interval during the collection period of each trial and dried in a forced air oven at 65ºC for 48 hours. Dried samples were composted for each animal and representative samples were taken, ground and kept for chemical analysis.

Samples of CFM, CH and SBM 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 65ºC for 48 hours, then ground and kept for chemical analysis.

Chemical analysis, rumen parameters and blood parameters:

Proximate chemical analysis of CFM, CH, SBM and feces were carried out according to the methods of AOAC (1990). Fiber fractions (NDF,ADF and ADL) while hem. and cell. were calculated by deference (NDF- ADF)% and (ADF- ADL%), respectively according to method of Van Soset, (1982). Acid insoluble ash was determined according to method of Van Keulen and Young (1977).

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, ammonia-N and total volatile fatty acids (TVFA's) concentration. Ruminal pH was estimated by pH meter (Orion Research, model 201 digital pH meter). 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).

Blood samples were taken from the jugular vein of calves at 3 hrs post-morning feeding. Blood samples were separated by centrifugation at 4000 r.p.m for 10 minutes. The serum samples were frozen at –20ºC until analysis for total proteins, (Doumas *et al*., 1981); albumin, (Hill and Wells, 1983); globulin, (calculated by differences between the total protein and albumin concentrations); urea, (Freidman *et al*., 1980); creatinine, (Ullmann, 1976); Glucose, (Teuscher and Richterich, 1971) and GOT and GPT, (Reitman and Frankel, 1957).

Production efficiency :

The ME can be converted to an NEm requirement with an efficiency of 0.576 (NRC, 1996), and NEp will be equal (ME – NEm)..

The retained energy (RE, Mcal/d) = (live weight $^{0.2955}$ * 0.544) * $(ADG)^{1.262}$

Where ADG is in kilograms (Overton, 1999).

Production efficiency = RE/NE_p * 100

Economic evaluation.

Economic efficiency was calculated according to the following formula:

$$\text{Economic efficiency} = \frac{\text{(price of daily gain – daily feed cost)}}{\text{daily feed cost}}$$

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, blood parameters, average monthly body weight and average monthly daily gain, 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:

The summative analysis of the tested ingredients (Table 1) used to formulate the experimental rations were previously presented and discussed by Ead and Maklad, (2006).

The chemical composition of the tested (Table 1) rations was similar except for CP, which was increased with replace partially CFM by SBM. The CP contents for R1, R2 and R3 were 14.0, 15.42 and 17% respectively. Dietary fiber levels (CF, NDF and ADF) in the experimental rations were within the normal published ranges when feeding fattening cattle as described by Mandell *et al*, (2001), while CP levels were in accordance with the recommendations of Hunter *et al*, (1999).

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	ADL	Hemi	Cellu	NFC*
Ingredients													
CFM	88.43	93.7	14.3	3.17	6.76	69.4	6.3	36.9	16.9	2.25	20.0	14.6	39.2
SBM	88.99	94.1	43.1	1.65	5.24	44.1	5.85	25.1	6.02	1.78	19.0	4.24	24.2
CH	85.35	88.8	12.3	1.17	20.0	55.2	11.1	49.1	35.2	9.27	13.9	25.9	26.1
Experimental rations													
R1	87.86	92.82	14.00	2.80	9.19	66.83	7.18	39.15	20.25	3.54	18.90	16.71	36.87
R2	87.88	92.82	15.42	2.72	9.16	65.52	7.18	38.61	19.77	3.54	18.84	16.23	36.07
R3	87.95	92.92	17.00	2.67	8.89	64.36	7.08	37.79	18.92	3.41	18.87	15.51	35.46

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

Dry matter intake of tested rations:

Data in Table (2) showed the average concentrate: roughage ratio which was about 82: 18 for the tested rations. Finishing cattle in the terminal stages of fattening are fed diets with low concentrations of roughage to maintain performance and achieve targeted backfat finish and marbling that are desired by beef industry (Mandell *et al*, 2001). The average daily dry matter intake from each experimental ration was in accordance with those of Schreder, (2002). The average daily intake of total concentrate as % of body weight ranged from 2.20 to 2.37%, while the roughage portion ranged from 0.48 to 0.52% of BW, so the total DM intake ranged from 2.70 to 2.85% of BW. Such differences among groups may be due to differences in animals average body weight. In this respect, roughages are included in a low concentration in feedlot diets to help prevent digestive upsets and to maximize NEg intake by cattle (Defoor *et al*, 2002). The effectiveness of roughage for promoting NEg intake might be a useful index and a suitable definition of roughage value in beef cattle finishing diets (Defoor *et al*, 2002). Biologically, it is well recognized that cattle fed high grain rations are very efficient. Moreover, studies have shown that limit feeding of high concentrate diets further increases ration digestibility because of slower feed passage through the digestive tract allowing digestion to be more complete. In addition, high energy rations avoid the "negative associative effect" of starch on fiber digestibility when grains is added to high roughage diets. Restricting intake further reduces the negative impact of grain feeding on fiber utilization (Loerch, 1990). Cattlemen are a ware that the two most important nutritional factors controlling the performance of growing calves are voluntary feed intake and the available energy a NEg content of the ration. Limit feeding a high concentrate diet provides less protein from basal energy ingredients, which may increase the importance of source of supplemental protein (Loarch, 1990).

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

Items	Ration 1	Ration 2	Ration 3
Average body weight (kg)	329	336	354
Concentrate : Roughage	81.8 : 18.2	81.2 : 18.8	82.8 : 17.2
Intake of DM from :			
Concentrate feed mixture (CFM) :			
Kg/h/d	7.66	6.93	7.22
As % BW	2.33	2.05	2.04
Soybean meal (SBM) :			
Kg/h/d	0	0.44	1.04
As % BW	0	0.15	0.33
Total concentrate :			
Kg/h/d	7.66	7.37	8.26
As % BW	2.33	2.20	2.37
Clover hay (CH) :			
Kg/h/d	1.71	1.71	1.71
As % BW	0.52	0.50	0.48
Total dry matter intake:			
Kg/h/d	9.37	9.08	9.97
As % BW	2.85	2.70	2.85

Soybean meal are clearly a more concentrate source of digestible amino acids which is especially advantages when formulating dense, high performance diets. Expression of nutrients on this basis allows formulation and production of diets more closely related to real physiological requirements (Dudley-Cash, 2001). The protein requirement of cattle declines with maturity because of a decrease in protein content of tissue growth. Based on this change, cattle in feedlot can be programmed decreasing quantities of supplemental protein to reduce over feeding of protein and there by reduce N lost in the manure (Trenkle and Barrett, 2005).

Soybean meal can be supplemented to stoker cattle and a rate of approximately 0.3% of body weight is recommended is the upper limit.

Nutrient digestabilities and feeding values of tested rations:

Table (3) shows the nutrient digestion coefficients and feeding values of tested rations. The digestibility of DM, CF, NFE, NDF, ADF, cellulose and NFC was significantly higher ($p<0.05$) for R2 than R3, while there was no significant difference between R2 and R1, except for CF, NDF and ADL which were higher ($p<0.05$) when feeding R2 than R1.

The TDN was increased ($p<0.05$) when feeding on R2 compared with R3, while there was no significant difference between R1 and R2 or between R1 and R3 was observed. The DCP% was higher ($p<0.05$) when feeding calves on R1 or R2 than R3. The CPI kg/day was higher ($p<0.05$) when calves fed R3 than R1 or R2.

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

Items	Ration 1	Ration 2	Ration 3	± SE
DMI kg/day	9.37	9.08	9.97	0.51
CPI kg/day	1.31^{b}	1.40^{b}	1.70^{a}	0.83
Nutrient digestibility (%):				
DM	70.93^{ab}	73.30^{a}	69.25^{b}	0.82
OM	72.94	75.61	71.67	0.82
CP	69.77^{a}	72.24^{ab}	68.18^{b}	0.82
EE	86.30	86.36	82.92	1.55
CF	33.57^{b}	43.61^{a}	34.72^{b}	3.04
NFE	79.22^{ab}	80.56^{a}	77.51^{b}	0.79
NDF	58.28^{b}	61.67^{a}	58.57^{b}	0.81
ADF	38.32^{ab}	39.96^{a}	31.22^{b}	2.36
Hemi.	79.66	84.41	85.97	1.81
Cell.	44.20^{a}	44.89^{a}	29.29^{b}	2.57
ADL	10.69^{c}	17.51^{b}	40.14^{a}	1.94
NFC	90.06^{ab}	91.42^{a}	86.98^{c}	1.07
Feeding value				
TDN%	71.23^{ab}	73.21^{a}	69.54^{b}	0.88
DCP%	9.77b	11.14a	11.59a	0.20
TDNI kg/day	6.67	6.64	6.93	0.36
ME(Mcal/kg)	2.54^{ab}	2.61^{a}	2.48^{b}	0.03
MEI (Mcal/day)	23.76	23.64	24.66	1.28
ME(Mj/Kg)	10.60^{ab}	10.90^{a}	10.35^{b}	0.12
NE(Mcal/Kg)*	1.63^{ab}	1.67^{a}	1.58^{b}	0.02
TDN / CP	5.09^{a}	4.75^{b}	4.10^{c}	0.08
CP / ME	55.24^{b}	59.17^{b}	68.70^{a}	1.27
DDM%**	62.32^{ab}	64.41^{a}	60.91^{b}	0.73
RFV***	137.5	134.2	132.8	2.12
RFQ****	164.7	160.1	159.0	2.74
QI*****	2.16	2.10	2.09	0.03

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 (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)**

The nitrogen requirement of bacteria fermenting starch is more complex than the requirement of bacteria fermenting fiber. The starch – digesting bacteria require amino acids as well as ammonia (Trenkle, 2002). The present results showed that the 14.0 or 15.4% protein diet (R1 and R2, respectively) have provide adequate amino acids and NH3 for change concentration of protein in diets of finishing cattle as they mature. The requirement for metabolizble protein (MP) is related to rate and composition of gain and decreases as the animal matures, because rate of gain declines and composition of gain contains less protein and more fat (Trenkle and Barrett, 2005).

Table (3) shows that ME (Mcal/kg) was higher ($p<0.05$) when feeding R2 than R1 than R3, while the NE (Mcal/kg) and digested dry matter (DDM%) were higher when feeding on R2 than R3. The CP g to ME Mcal was higher ($p<0.05$) when feeding on R3 than feeding on R1 or R2 (55.24, 59.17 and 68.70 for R1, R2 and R3 respectively).

The TDN/CP ratio was higher ($p<0.05$) when feeding R1 than R2 and R3, while it was higher ($p<0.05$) when feeding R2 than R3. 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 my be needed when the TDN/CP ratio is greater than 6:1 to 8:1 (Bohnert and Delcurto, 2003). These results were affected positively on RFQ and QI values with the same trend.

Rumen fermentation:

The effects of feeding the three tested rations on some rumen liquor (RL) parameters are presented in Table (4) and figures (1, 2 and 3).

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

Items / Parameters	Hours	Ration 1	Ration 2	Ration 3	± SEM	Means
pH-Values	0	7.13	7.28	7.24	0.19	7.22^{a}
	2	6.34	6.34	6.46		6.38^{b}
	4	5.80	5.94	6.29		6.01^{c}
	8	5.65	5.91	6.56		6.04^{c}
	± SEM		0.11			0.11
	Means	6.23^{b}	6.37^{ab}	6.64^{a}	0.10	
Total VFA's (ml eq/100ml)	0	16.37	16.43	16.83	1.38	16.54^{c}
	2	23.20	20.07	25.70		22.99^{b}
	4	23.07	20.77	22.07		21.97^{b}
	8	21.13	29.70	27.63		26.16^{a}
	± SEM		0.80			0.80
	Means	20.94^{b}	21.74^{ab}	23.06^{a}	0.69	
NH_3-N (mg/100ml)	0	6.69	8.37	6.23	0.47	7.10^{b}
	2	7.08	10.44	12.75		10.10^{a}
	4	8.41	7.21	6.8		7.48^{b}
	8	6.27	6.61	5.79		6.22^{c}
	± SEM		0.27			0.27
	Means	7.12^{b}	8.16^{a}	7.89^{a}	0.23	

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

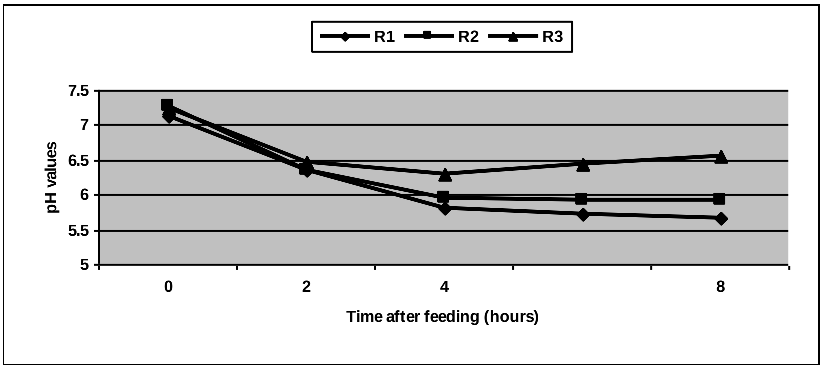

Fig. (1): Effect of feeding on tested rations on ruminal pH values.

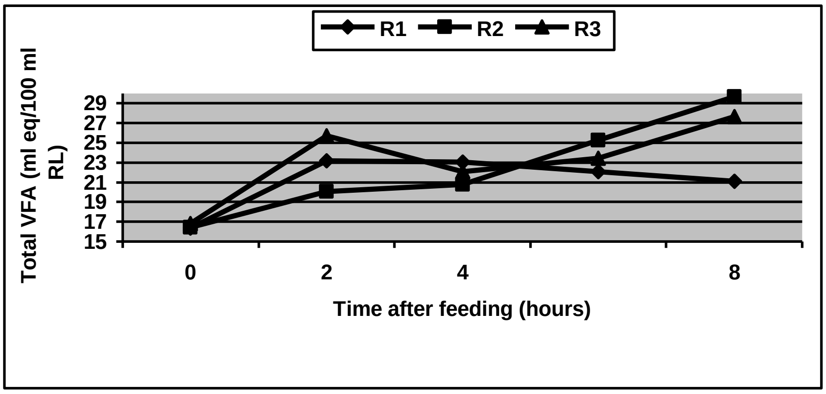

Fig.(2): Effect of feeding on tested rations on ruminal total VFA (ml. eq. /100 ml RL) values.

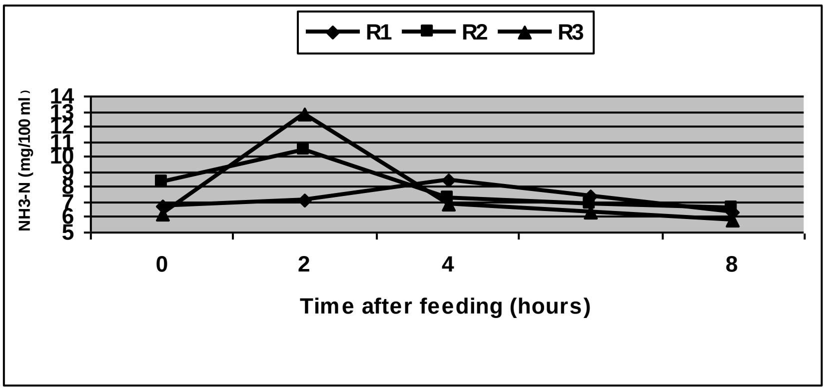

Fig.(3): Effectof feeding on tested rations on ruminal NH_3-N (mg /100 ml RL) concentrations.

Ruminal pH values were significantly affected by dietary treatments, sampling time and their interactions (Table 4).

Based on the mean values, the maximum (p<0.05) pH values were observed at 0 time, while the minimum values (p<0.05) occurred at 4 hrs postfeeding as shown in fig 1. However, most of pH values obtained herein at all measuring times were within the range of 6-7 given by Prasad *et al*, (1972) for optimum cellulolytic bacteria activity.

The highest total VFA concentrations ($p<0.05$) occurred in RL of animals fed SBM rations (R2 and R3), while R1 showed the lowest ($p<0.05$) VFA,s concentration at 8 hrs postfeeding and the lowest values ($p<0.05$) were occurred at 0 time prefeeding. Topps (1964) found that both digestibility and protein content of the ration had a significant effect on the concentration of VFA in the rumen liquor. Also, 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.

The ideal N-concentration in the rumen for microbial protein synthesis per unit of substrate fermented has been variously stimulated at 6- 7 mg/100 ml (Satter and Slyter, 1974). Forage legume are relatively good sources of degradable N and rumen population of cellulolytic microbes (Topps, 1995). If N, as any other nutrient, is lacking then the amount of microbial protein synthesized will be limited (Slyter *et al,* 1979) and rate of fermentation in the rumen will be slow (Mehrez *et al*, 1977).

Devant *et al* (2000) reported that the average ruminal pH was 6.28 in spite of the high concentrate intake, there was no indication of ruminal acidosis. The absorption capacity of VFA across the rumen wall seems to increase with advancing maturity (Anderson *et al*, 1987), however, in last period of growing heifers, factors (e. g. chewing) other than total VFA were possibly becoming more important in ruminal pH regulation.

Blood parameters:

Concerning blood metabolites, data in Table (5) shows that the values obtained were in the normal range as described by Mohamed and Selim (1999) except that for glucose concentration in the blood serum, which was higher than the range (35-55 mg/100 ml). Fouad (2002) and Fouad *et al.* (2002) found that the increase in serum glucose may be attributed to the increase of carbohydrate metabolism and the increase in the rate of intestinal glucose absorption.

Table (5): Effect of experimental rations on some blood parameters

Iems	Experimental rations			
	Ration 1	Ration 2	Ration 3	± SE
Total protein g/100ml	6.81	7.47	6.77	0.63
Albumin g/100 ml	3.62	3.78	3.71	0.27
Globulin g/100 ml	3.19	3.69	3.06	0.63
Creatinine mg/100 ml	1.43	1.66	1.69	0.14
Urea-n mg/100 ml	17.57^{b}	21.97^{a}	24.23^{a}	1.26
GOT IU/L	65.67	64.00	62.00	2.06
GPT IU/L	26.00	23.33	24.00	1.22
GOT/GPT ratio	2.53	2.74	2.58	0.30
Glucose (mg/100 mL)	76.47	72.53	75.53	1.44

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

There were no significant differences among blood metabolites concentrations, except of urea-N which was higher (P<0.05) when feeding R2 and R3 (21.97 and 24.23 mg/100 ml respectively) than feeding on R1 (17.57 mg/100 ml).

The concentration of urea-N in blood is affected not only by dietary intake of digestible crude protein in the rumen but also by balance between energy and protein in the diet ((Hoffman and Steinhofel, 1990). Increasing the intake of digestible CP or digestible CP/MJ of metabolizable energy increases the urea content in blood (Hoffman and Steinhofel, 1990 and Grings *et al*, 1991).

Table (6) shows the effect of feeding tested rations on the ABW, DMI kg/d and DMI kg/kg daily gain. It should be point out that the significant difference appeard among tested groups in average initial body weight (IBW) of calves was mainly due to that the IBW of animals used herein was the final body weight of the same animals used in the first part of this study (Ead and Maklad, 2006). However, the average dialy gain (ADG) from 13 to 16 month was not significantly affected by dietary treatments (1.01, 0.98 and 1.00 kg/d for R1, R2 and R3, respectively).

The protein requirement of cattle declines with maturity because of a decrease in protein content of tissue growth. Cattle in the feedlot can be program-fed decreasing quantities of supplemental protein to reduce overfeeding of protein and thereby reduce nitrogen lost in the manure (Trenkle and Barrett, 2005).

Excess MP is metabolized in the body and converted to urea, which is recycled to the digestive tract or excreted in the urine (Trenkle and Barrett, 2005).

Table (6) shows that there was no significant difference among tested groups on DMI kg/d, while the DMI kg/kg daily gain was higher (P<0.05) when feeding R3 than R1 and R2.

Table (6): The effect of feeding tested rations on the average body weight kg, average daily gain kg, dry matter intake kg/kg daily gain of the growing Friesian calves.

Age month	BW				ADG				DMI kg/d				DMI kg/kg daily gain			
	R1	R2	R3	± SE	R1	R2	R3	± SE	R1	R2	R3	± SE	R1	R2	R3	± SE
Initial BW (13 mo)	266^{ab}	255^{b}	290^{a}	9.66	-	-	-	-	-	-	-	-	-	-	-	-
13.14 m.	288	279	308	10.93	0.73^{ab}	0.79^{a}	0.61^{b}	0.05	7.15	7.32	7.84	0.31	9.80^{b}	9.27^{b}	12.85^{a}	0.56
14-15 m	318	316	346	12.88	1.01	1.23	1.27	0.09	7.73	7.56	7.92	0.30	7.65^{a}	6.14^{b}	6.23^{b}	0.43
Final BW (15-16 m.)	356	343	380	14.38	1.27^{a}	0.91^{b}	1.12^{ab}	0.08	8.78	8.61	9.26	0.43	6.91^{b}	9.46^{a}	8.27^{ab}	0.59
13-16 m.	-	-	-	-	1.01	0.98	1.00	0.06	7.89	7.83	8.34	0.36	7.81^{b}	7.98^{b}	8.34^{a}	0.27

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

As shown in Table (7), the production efficiency was higher when feeding R1 than R2 and R3. .

Table (7): Production efficiency of growing calves fed the experimental rations.

Item	Ration 1	Ration 2	Ration 3
DM intake	7.89	7.83	8.34
ME Mcal/kg	2.54	2.61	2.48
MEI Mcal/d	20.04	20.44	20.68
NEm Mcal/day	11.54	11.77	11.91
NEp Mcal/day	8.50	8.66	8.77
Live weight kg	356	343	380
ADG kg/day	1.01	0.98	1.00
Retained energy Mcal/d	3.13	2.98	3.15
Production efficiency	36.79	34.35	35.89

Economic efficiency of calves fed the experimental rations.

The economic efficiency as shown in Table (8) was higher when feeding R1 than feeding on R2 and R3, being 40.13, 35.29 and 26.15%, respectively.

Energetic efficiency might be depressed directly by excessive protein intake (NRC, 1984). Added protein may increase maintenance requirements. Higher protein levels early in the feeding period, may increase protein of growing calves. Tissue protein is more costly to maintain than tissue fat. Higher protein levels , also may increase the size of certain high-maintenance organs (liver, intestine). This adverse effect of the higher protein level was more pronounced in the finishing phase, presumably because protein deposition rate had decreased so that the surplus of protein was greater. Perhaps decreasing the protein levels to 12.5% late in the feeding period for rapidly growing feedlot cattle would increase feed intake and improve energetic efficiency. Wanger (1993) and Hutcheson (1990) proposed that a receiving diet should contain 12.5 to 14.5% protein (DM basis) to meet the needs of newly received cattle. This was in agreement with the obtained results.

Table (8): Economic efficiency of calves fed the experimental rations.

Item	Ration 1	Ration 2	Ration 3
*Price / kg DM (LE)	1.10	1.11	1.14
DMI / kg / d	7.89	7.83	8.34
Total cost (LE) day	8.65	8.69	9.51
Average daily gain kg / d	1.01	0.98	1.00
Price of daily gain (LE)	12.12	11.76	12.00
Profit (LE) as total feed / cow	3.47	3.07	2.49
Economic efficiency %	40.13	35.29	26.15

Market price Pt./kg fresh of: Concentrate feed mixture= 107.5; SBM = 150; clover hay = 50; kg body weight gain = 1200.

*** Was calculated according to the DMI from all ingredients during the digestion trials, the price/kg DMI (LE) was calculated to be 1.10, 1.11 and 1.14 for R1, R2 and R3, respectively.**

Conclusion :

It could be concluded from the previous data that, feeding on 82% concentrate feed mixture (CFM) & 18% clover hay (CH), which contains 14.0% CP (DM basis) in ration of fattening Friesian calves, successfully and economically improved animal performance, compared with ration contained higher CP levels.

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تأثير التغذية على مستويات مختلفة من كسب فول الصويا فى علائق عجول الفريزيان النامية على :
٢- الأداء الانتاجى في المرحلة النهائية.

حسين محمد الشافعى عيد

معهد بحوث الانتاج الحيوانى ، مركز البحوث الزراعية

اجرى هذا البحث استمرارا للبحث الأول كمرحلة ثانية على نفس مجاميع الحيوانات بهدف دراسة تأثير احلال نسب مختلفة من كسب فول الصويا محل جزء من مخلوط العلف المصنع (٥، ١٠%) من المادة

الجافة المأكولة الكلية على كل من معاملات الهضم والقيمة الغذائية وبعض المعايير لسائل الكرش وبعض قياسات الدم ومعدل النمو فى تسمين عجول الفريزيان والاستفادة الغذائية والكفاءة الاقتصادية. وتم تكوين ثلاث علائق على النحو التالى:

(عليقة اولى) ٨٢ % علف مصنع +١٨% دريس برسيم.

(عليقة ثانية) ٧٦ % علف مصنع + ٥ % كسب فول صويا + ١٩ % دريس برسيم.

(عليقة ثالثة) ٧٣ % علف مصنع+ ١٠ % كسب فول صويا + ١٧ % دريس برسيم.

وقد تم تكوين الخلطات على اساس زيادة نسبة البروتين الخام باحلال جزء من مخلوط العلف المصنع بكسب فول الصويا وتراوحت نسبة البروتين بين ١٤-١٧ % بالعلائق التجريبية.

استخدمت الخمسة عشرة عجل فريزيان بمتوسط وزن ٢٧٠ كجم عند متوسط عمر حوالى ١٣ شهر والموزعة فى ثلاث مجاميع (خمسة عجول لكل مجموعة). وتم اخذ عينات الروث بعد بدء التجارب بحوالى شهرين لاجراء التحاليل المطلوبة لتجارب الهضم واخذ عينات سائل كرش بواسطة اللى المعدى قبل الاكل وبعد الاكل بـ ٢، ٤، ٨ ساعات لتقدير تركيز ايون الهيدروجين (pH) وتركيز الامونيا (NH3) وتركيز الاحماض الدهنية الطيارة (VFA) وتم تسجيل اوزان الحيوانات شهريا لتقدير معدل الزيادة اليومية عند التغذية على العلائق المختبرة وحساب الكفاءة الاقتصادية لكل منها.

وكانت أهم النتائج المتحصل عليها كما يلى:

١- تحسنت معنويا معاملات هضم المكونات الغذائية على مستوى (٠,٠٥) لكل من المادة الجافة والألياف الخام والمستخلص الخالى من الأزوت ومستخلص الألياف المتعادل ومستخلص الألياف الحامضى والسليلوز والكربوهيدرات الغير ليفية عند التغذية على العلف المصنع + ٥% كسب فول الصويا (العليقة الثانية) مقارنة بالتغذية على العلف المصنع + ١٠% كسب فول صويا (العليقة الثالثة) ولكن لم تظهر فروق معنوية بين العليقة الثانية والكنترول الا فى زيادة هضم الألياف الخام ومستخلص الألياف المتعادل حيث زادت معنويا (٠,٠٥) عند التغذية مع العليقة الثانية مقارنة بالكنترول.

٢- ظهر تحسن فى مجموع المركبات الغذائية المهضومة % (TDN%) معنويا (٠,٠٥) عند التغذية على العليقة الثانية مقارنة بالعليقة الثالثة ولم تظهر فروق معنوية بين العليقة الأولى والثانية او بين الأولى والثالثة .

٣- زاد البروتين المهضوم % معنويا (٠,٠٥) بالتغذية على العلائق التى تحتوى على كسب الفول الصويا مقارنة بالكنترول.

٤- ارتفعت كمية البروتين المأكولة بالجم بالنسبه لوحدة الطاقة الممثلة معنويا (٠,٠٥) عند التغذية على العليقة الثالثة مقارنة بالعليقة الاولى أو الثانية بينما زادت نسبة المركبات الغذائية المهضومة / البروتين الخام معنويا (٠,٠٥) عند التغذية على العليقة الاولى مقارنة بالتغذية على الثانية أوالثالثة.

٥- لوحظ زيادة فى درجة حموضة الكرش معنويا (٠,٠٥) عند التغذية على العليقة الثالثة مقارنة بالتغذية على العليقة الأولى كما زادت ايضا كمية الاحماض الدهنية الطيارة الكلية على مستوى (٠,٠٥) عند التغذية على العلائقة الثالثة مقارنة بالعليقة الاولى.

٦- لم تتأثر اوزان الحيوانات معنويا نتيجة المعاملات وكذلك معدل النمو اليومى(كجم/يوم) خلال فترة التجربة من ١٣-١٦ شهر من عمر الحيوانات. وكان متوسط معل النمو اليومى للحيوانات خلال التجربة (١,٠١، ٠,٨٩ ، ١,٠ كجم/يوم عند التغذية على العليقة الأولى والثانية والثالثة على التوالى)

٧- زادت الكفاءة الانتاجية عند التغذية على العليقة الاولى مقارنة بالعلائق الأخرى (٣٦,٧ ، ٣٤,٣ ، ٣٥,٨% لكل من العليقة الأولى والثانية والثالثة على التوالى) كما زادت الكفاءة الأقتصادية لنفس العلائق حيث كانت القيم (٤٠,١٣ ، ٣٥,٢٩ ، ٢٦,١٥% على الترتيب)

مما سبق يستنتج إنه بالتغذية على علائق تحتوى على ١٤% بروتين على اساس المادة الجافة كانت الافضل انتاجيا واقتصاديا مقارنة بالتغذية على علائق مرتفعة فى نسبة البروتين خلال فترة تسمين العجول.