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EFFECT OF FEEDING FREQUENCY ON PRODUCTIVE PERFORMANCE OF FATTENING RAHMANY LAMBS.

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SUMMARY

Twenty four Rahmany lambs (average live weight: 34 kg and 8-9 months old) were used to evaluate the effect of feeding frequency on their growth performance. Animals were randomly allocated to one of three dietary experimental groups for 3 months, either feed offered once daily at 6.00 (G1) or twice daily at 6.00 and 18.00 (G2) or three times daily at 6.00, 14.00 and 22.00 (G3), respectively. Animals were fed by group feeding with total mixed ration (75% concentrate mixture and 25% clover hay) at the level of 4% of live body weight. Body weight was recorded weekly then daily weight gain and feed to gain ratio were calculated. At the end of the feeding trial, digestibility trials were carried out using three animals for each experimental group and the apparent digestibility of nutrients, nitrogen balance and some parameters of rumen fluid and blood were determined. Results showed that increased feeding frequency up to three times (G3) improved ($P<0.05$) both digestibility of nutrients, nutritive value (as TDN and DCP) and nitrogen balance as compared to groups G1 and G2. Increasing the feeding frequency improved the rumen fluid pH and increased the ammonia nitrogen concentration in the rumen fluid but decreased the concentration of total volatile fatty acids. Growth performance and economical efficiency were improved with increasing the feeding frequency up to twice or three times. According to the circumstances of this study increasing of the daily feeding frequency up to twice or three times resulted an improvement in both growth performance and economical efficiency of fattening lambs. Finally further research should be conducted to study the effect of increasing daily feeding frequency more than three times.

Keywords: feeding frequency, digestibility, performance, lamb

INTRODUCTION

The practical objective of manipulation of the feeding strategy is to stabilize the diurnal variation in rumen fermentation patterns. This stabilization should enhance fiber digestion, maintain the concentration of the microbial end-produets and maximize microbial yield. The intention of using continuous or very frequent feeding regimen for animals has been established steady-state conditions of rumen fermentation and flow of

nutrients (Goetsch and Galyean, 1983).

Subacute acidosis has been associated with fluctuation in feed intake when cattle are fed high concentrate rations (Fulton *et al.*, 1979). Feeding frequency had positive (Shabi *et al.*, 1999) or negative effect (Soto Navarro *et al.*, 2000) on feed intake and utilization of nutrients. Increasing feeding frequency seems minor effect on the fermentation of daily rations containing less than 35% concentrate. However, it may be improve fermentation and utilization of nutrients by increasing the proportion of concentrate in the rations (Ulyatt *et al.*, 1984 and Robinson and Sniffen, 1985). Also, Robinson and Sniffen (1985) and Cecava *et al.* (1990), indicated that feeding frequency had a minimal effect on site or extent of nutrients digestion. Increasing the feeding frequency improved organic matter (OM) and crude protein (CP) digestibility (Shabi *et al.*, 1999 and Soto-Navarro, 2000).

The objective of this study was to determine the effect of feeding frequency on performance of fattening lambs, apparent digestibility of nutrients, nitrogen balance and some parameters of rumen fluid and blood.

MATERIALS AND METHODS

The present study was carried out at the Experimental Station, Department of Animal Production, Faculty of Agriculture, Cairo University, Giza , Egypt.

Twenty-four male Rahmany lambs (average live weight 34 kg and ٨-٩ months old) were randomly divided according to their live body weight into 3 groups (8 for each). Animals in all groups were fed at the level of 4% of live weight with total mixed ration (TMR) for 90 days to cover the fattening requirements according to NRC, 1994 for sheep. The total mixed ration consists of 25% yellow corn, 16% wheat bran, 10.7% rice bran, 20% undecorticated cottonseed meal, 25% clover hay, 2% limestone, 1% salt and 0.3% mixture of minerals and vitamins. Ration was offered once daily at 600. (G1); twice daily at 6.00 and 18.00 (G2) ; and three times daily at 6.00, 14.00 and 22.00 (G3), respectively. Rations were adjusted weekly after recording body weight of animals. Fresh drinking water was available freely through the whole experimental period.

Daily feed intake, daily body weight gain, feed conversion (g DMI , TDNI or DCPI/g weight gain) and economical efficiency were calculated. At the end of the feeding trial, three animals of each group were used for a digestion trial. Each animal was fed 1200 g total mixed ration in the same order of feeding trial to cover the maintenance requirements according to NRC, 1994. Drinking water was freely available all the time. Feces and urine were collected daily for 7 days and were taken for analysis. Samples of feeds, feces and urine were analyzed according to AOAC (1995). Rumen fluid samples were collected every 4 hours (0, 4, 8, 12, 16 and 20 hrs) using stomach tube. Digital pH meter was used to determine pH immediately after taking the rumen fluid, its ammonia nitrogen (NH_3-N) concentration was determined according to Conway (1957). Total volatile fatty acids (TVFA's) were determined according to Warner (1964). Blood samples were collected from jugular vein at every 4 hours (0, 4, 8, 12, 16 and 20 hrs). Plasma urea-N and glucose were determined according to Patton and Crouch (1997) and Trinder (1969).

Data were statistically analyzed using the general liner model procedure, SAS (2000). Significant differences among means were tested by using Duncen's multiple range test (Duncen, 1955).

RESULTS AND DISCUSSION

Chemical composition of the experimental daily ration is shown in (Table 1).

Table (1): Composition and nutrient content of experimental total mixed ration.

Item	%
Yellow corn	25.00
Wheat bran	16.00
Rice bran	10.70
Undecorticated cottonseed meal	20.00
Clover hay	25.00
Lime stone	02.00
Common salt	01.00
Minerals & Vitamins mixture*	00.30
Nutrient content, % (DM basis)	
DM	91.98
OM	85.91
CP	15.75
CF	15.81
EE	03.57
NFE	50.78
Ash	14.09

* Minerals &vitamins mixture per kg contained Co 0.1g, Cu 8g, Fe 35g, I 0.5g, Mn 35g, Se 0.6g, Zn 35g, vitamin A 20,000,000 IU, vitamin D_3 2,000,000 IU and vitamin E 2g.

Nutrients digestibility and nutritive value:

Data concerning digestibility and nutritive value, presented in Table (2), indicated that increasing of the feeding frequency to twice daily (G2) slightly improved the apparent digestibility of all nutrients as compared to those fed once daily (G1). These data are in agreement with the findings of Cecava *et al.* (1990). However, increasing the feeding frequency to three times daily (G3) improved ($P<0.05$) the digestibility of nutrients compared to both G1 and G2 groups. The digestibility results are confirmed with the previous data of Shabi *et al.* (1998) and Soto-Navarro *et al.* (2000). The improvement of the apparent digestibility of crude fiber may be due to the stability of ruminal pH which avoid the negative effects of low pH on the cellulolytic bacteria (Hoover, 1986).

Besides, the nutritive value (as TDN and DCP) for G3, G2 and G1 detected the same trend of nutrients digestibility, being 67.51, 64.77 and 63.69 for TDN and 12.45, 11.95 and 11.94 % for DCP, respectively. These results may be due to the increase of the digestibility of all constituents (Bhar and Katiyar, 1999).

Nitrogen balance:

It is worth to notice that nitrogen balance, (Table 2) (either as g/head/day or percentage of nitrogen intake) was significantly ($P<0.05$) improved with the increase of feeding frequency, being 8.12 g and 26.85%; 9.52g and 31.48% and 10.80g and 35.71% for G1, G2 and G3, respectively. These results may be due to the improvement of the apparent digestibility of crude protein as a result of increasing feeding frequency (Bhar and Katiyar, 1999).

Table (2): Digestion coefficients, nutritive value and nitrogen balance of the experimental groups as influenced by feeding frequency.

Item	Experimental groups			±SE
	G1	G2	G3	
Apparent digestibility, %(DM basis)				
DM	68.53^{b}	69.14^{b}	72.35^{a}	0.63
OM	70.20^{b}	71.26^{b}	74.24^{a}	0.54
CP	75.80^{b}	75.87^{b}	79.07^{a}	0.78
CF	38.04^{b}	41.26^{b}	48.51^{a}	1.65
EE	79.63^{b}	81.64^{b}	83.91^{a}	0.47
NFE	77.48^{b}	78.26^{b}	80.04^{a}	0.48
Nutritive value, %(DM basis)				
Total digestible nutrients (TDN)	63.69^{b}	64.77^{b}	67.51^{a}	0.52
Digestible crude protein (DCP)	11.94^{b}	11.95^{b}	12.45^{a}	0.11
Nitrogen balance:				
Nitrogen intake, g/head/day	30.24	30.24	30.24	0.00
Feces nitrogen, g/head/day	07.32	07.30	06.33	0.58
Urine nitrogen, g/head/day	14.80	13.42	13.11	0.58
Nitrogen balance:				
g/head/day	08.12^{c}	09.52^{b}	10.80^{a}	1.15
% nitrogen intake	26.85^{c}	31.48^{b}	35.71^{a}	3.81

a,b,c means on the same row with different superscripts are significantly different (P<0.05).

Growth performance and economical efficiency:

Data in Table (3) indicated that increased feeding frequency did not affect significantly the daily dry matter intake. These results are in agreement with the findings of Klusmeyer *et al.* (1990); Macleod *et al.* (1994); Shabi *et al.* (1998) and Robles *et al.* (2007). Increasing the feeding frequency to two times (group G2) did not affect significantly the daily body weight gain, whereas it was higher by 7.8% as compared to group G1. Increase the feeding frequency to three times in group G3 significantly improved the daily body weight gain by 14.2% as compared to G1.These results may be due to the variation in the efficiency of feed conversion.

There was no significant difference in the feed conversion between groups G1 and G2, being 7.76 and 7.34 g DMI /g gain, respectively, but it was significantly ($p<0.05$) improved in groups G3 by 9.02% as compared to G1. These results are confirmed by those obtained by Bhar and Katiyar (1999), Shabi et al. (1999) and Soto-Navarro *et al.* (2000).

Data concerning the economical efficiency of the experimental groups are shown in Table (3). The results revealed that increasing the feeding frequency up to twice or three times reduced feeding cost, LE/kg weight gain as compare to G1. Therefore the respective relative feed cost, LE/ Kg weight gain was 95, 91 and 100%.

Table (3): Performance traits and economical efficiency of fattening lambs as affected by feeding frequency.

Item	Experimental groups			±SE
	G1	G2	G3	
Body weight changes:				
Initial live body weight, Kg	33.80	34.00	34.20	2.35
Final live body weight, Kg	52.20^{b}	53.77^{ab}	55.16^{a}	2.53
Total body weight gain, Kg	18.40^{b}	19.77^{ab}	20.96^{a}	0.93
Daily body weight gain, g	204^{b}	220^{ab}	233^{a}	10.40
Feed intake, g/head/day:				
DM	1582	1615	1644	88.3
TDN	1008	1046	1110	57.77
DCP	189	193	205	10.77
Feed conversion efficiency, g/g gain:				
DM	7.76^{a}	7.34^{b}	7.06^{b}	0.37
TDN	4.94^{a}	4.76^{b}	4.76^{b}	0.35
DCP	0.93^{a}	0.88^{b}	0.88^{b}	0.07
Economical efficiency:				
Daily feed cost, LE	2.75	2.81	2.86	
Feed cost, LE/kg weight gain	13.49	12.76	12.27	
Relative feed cost, LE/ Kg gain%*	100	95	91	

a,b, means on the same row with different superscripts are significantly different (P<0.05).
The price of one ton of the total mixed ration was 1600 LE.
*Relative feed cost, LE/ Kg weight gain% = Feed cost, LE/ Kg weight gain (G2 or G3) / G1

Ruminal and blood parameters :

Data in Table (4) indicated that there was no significant (P<0.05) difference among the groups in respect of rumen fluid pH, but at the same sampling time there was a trend for improving the rumen fluid pH with the increase of feeding frequency, causing more stable rumen environment (Soto-Navarro *et al.*, 2000; Robles *et al.*, 2007). The same trend was observed for rumen fluid ammonia concentration which was slightly increased with the increase of the feeding frequency. On the other hand the concentration of rumen fluid TVFA's content was not significantly decreased with increasing the feeding frequency. These results of the ruminal fermentation profile as affected by the feeding frequency are in agreement with the findings of Shabi *et* al., (1999); Bahar and Katiyar (1999) and Soto-Navarro *et al.* (2000). These results of ruminal fermentation may be due to that increasing the feeding frequency may reduce the negative effect of non-soluble carbohydrate fermentation in the rumen meanwhile, reducing the fluctuation of rumen pH, TVFA's and ammonia causing improve rumen microbe synthesis (Robinson, 1989).

Data in Table (4) also showed that there was significant decrease in plasma urea and glucose concentration by 14.6 and 9%, and 24.9 and 11%, for the groups G2 and G3 as compared to G1, respectively. Otherwise; these results of plasma urea and glucose are in normal range as described by Shabi *et al.* (1999).

According to the circumstances of this study increasing of feeding frequency up to twice or three times daily resulted in an improvement in both growth performance and economical efficiency of fattening lambs. Finally further research works should be conducted to study the effect of increasing daily feeding frequency more than three times.

Table (4): Mean values of some rumen fluid and blood plasma parameters of fattening lambs as affected by feeding frequency.

Item	Time (hours)	Experimental groups			±SE
		G1	G2	G3	
		Rumen fluid parameters			
pH	0	5.26	5.93	5.95	0.31
	4	5.99	6.17	6.12	0.30
	8	6.56	6.55	6.58	0.30
	12	6.65	6.58	6.81	0.29
	16	6.86	6.56	6.78	0.29
	20	6.45	6.26	6.42	0.29
	Overall mean	**6.30**	**6.40**	**6.44**	**0.29**
TVFA's (meq/100ml)	0	3.12	3.40	3.39	0.34
	4	4.03	4.05	4.03	0.33
	8	5.07	5.27	4.97	0.43
	12	6.57	5.07	4.57	0.42
	16	5.56	5.00	4.31	0.34
	20	4.04	3.19	3.15	0.32
		4.72	**4.33**	**4.07**	**0.30**
NH_3-N (mg/100ml)	0	12.56	13.22	13.88	0.60
	4	12.05	13.76	14.20	0.66
	8	13.53	14.61	15.04	0.61
	12	13.76	14.67	15.46	0.62
	16	14.30	13.96	15.41	0.61
	20	13.24	14.63	14.75	0.62
	Overall mean	**13.24**	**14.14**	**14.79**	**0.64**
		Blood plasma parameters			
Plasma urea, mg/dl	0	30^{a}	28^{a}	21^{b}	1.61
	4	35^{a}	31^{ab}	28^{b}	1.33
	8	34^{a}	22^{b}	25^{b}	2.00
	12	32^{a}	28^{a}	22^{b}	1.60
	16	27^{a}	25^{ab}	23^{b}	1.04
	20	27^{a}	24^{ab}	20^{b}	1.32
	Overall mean	**30.83^{a}**	**26.33^{ab}**	**23.17^{b}**	**1.60**
Plasma glucose, mg/dl	0	87^{a}	80^{b}	80^{b}	1.85
	4	93^{a}	82^{b}	80^{b}	2.48
	8	100^{a}	98^{a}	86^{b}	2.61
	12	92^{a}	80^{b}	80^{b}	2.46
	16	100^{a}	81^{c}	90^{b}	3.10
	20	85^{a}	86^{a}	80^{b}	1.71
	Overall mean	**92.83^{a}**	**84.50^{b}**	**82.67^{b}**	**2.13**

a,b,c means on the same row with different superscripts are significantly different ($P<0.05$).

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تأثير عدد مرات التغذية على الأداء الانتاجى للحملان الرحمانى المسمنة

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قسم الإنتاج الحيواني – كلية الزراعة – جامعة القاهرة – جيزة – مصر .

تم استخدام ٢٤ حولى رحماني (بمتوسط وزن حى ٣٤ كجم وعمر ٨- ٩ اشهر) لتقييم تأثير عدد مرات التغذية اليومية على كفاءة النمو . وزعت الحيوانات عشوائيا لثلاث مجموعات تجريبية فى تجربة تسمين لمدة ثلاثة اشهر .المجموعة الأولى : التغذية مرة واحدة يوميا الساعة ٦ صباحا ، المجموعة الثانية : التغذية مرتين يوميا الساعة ٦ صباحا و ٦ مساء ، المجموعة الثالثة : التغذية ثلاث مرات يوميا الساعة ٦ صباحا ، ٢ ظهرا ، ١٠ مساء . غذيت الحيوانات فى مجموعات على مخلوط عليقة متكاملة (٧٥٪ علف مركز + ٢٥٪ دريس البرسيم) بمعدل ٤٪ من وزن الحيوان الحى . وتم تسجيل وزن الجسم أسبوعيا ومن ثم حساب كل من الزيادة المكتسبة فى وزن الجسم وكفاءة معدل التحويل الغذائي . وعند نهاية تجربة التسمين أجريت تجارب الهضم باستخدام ثلاث حيوانات لكل مجموعة تجريبية وتم فيها تقدير معاملات هضم المركبات الغذائية المختلفة والقيمة الغذائية و ميزان الازوت وبعض قياسات الكرش والدم .

ويمكن تلخيص النتائج المتحصل عليها كما يلي :- زيادة عدد مرات التغذية اليومية حتى ثلاث مرات (المجموعة الثالثة) حسن معنويا كلا من معاملات هضم المركبات الغذائية المختلفة والقيمة الغذائية (فى صورة مركبات غذائية مهضومة كلية وبروتين خام مهضوم) وميزان الازوت مقارنه بالمجموعتين الأولى والثانية . كما أن زيادة عدد مرات التغذية حسن من ظروف بيئة الكرش من حيث درجة الحموضة وتركيز كل من الأمونيا والأحماض الدهنية الطيارة. كما تحسن الأداء الانتاجى والكفاءة الاقتصادية بزيادة عدد مرات التغذية اليومية الى مرتين أو ثلاثة .

وعلى ذلك يمكن استنتاج أن زيادة عدد مرات التغذية اليومية الى ثلاث مرات يكون له تأثيرا ايجابيا علي الاداء الانتاجي والكفاءة الاقتصادية للحملان الرحمانى المسمنه . ونوصى بمزيد من الأبحاث لدراسة تأثير زيادة عدد مرات التغذية لأكثر من ثلاث مرات يوميا .