

EFFECT OF PLANE OF NUTRITION ON  
FEED INTAKE AND DAILY GAIN OF GROWING LAMBS

By

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Twenty one Rahmany lambs just after weaning (about 4 months old) were divided into three equal groups (average weight of each was about 17 kg.) were used in this study. Lambs were fed on rations containing 13 % crude protein in the 1st period with 35% wheat straw as a roughage for 6 weeks and in the 2nd period, no roughage was offered and consequently the crude protein was 17% for another 10 weeks. The Co-op feed mixture (FM) was used for performed protein supplementation for group 1 or to be partially substituted by dried poultry manure (DPM) or urea-molasses mixture (UM) at the level of 50% for 2nd and 3rd groups, respectively. Yellow corr. was given in the 2nd period of nutrition to increase the daily energy intake.

Lambs lost about  $1\frac{1}{2}$  Kg. live weight during the 1st period because of the low intake. During the 2nd period the daily feed intake increased and the lambs compensated for their growth within 2-3 weeks in the 2nd period. The NPN source did not affect the growth rate either during the low and/or high plane of nutrition compared with the control rations which contained no NPN sources.

Overall results showed that using 35% roughages during the low plane of nutrition (in the 1st period) did not allow the lambs to cover their requirements in the early age after weaning. Using concentrate rations during the high plane of nutrition (in the 2nd period) covered the lambs requirements with reasonable daily gain. Feeding DPM and UM as protein supplements for growing lambs were comparable to the commercial concentrate feed mixture (co-op feed).

## INTRODUCTION

Fast and efficient lamb growth to heavier market weights is basic to an improvement in sheep production efficiency. This requires improved breeding, nutrition and management programs. Voluntary feed intake is affected by energy and roughage levels in the diet (Glimp, 1971). Feeds excessively high in fiber may restrict nutrient intake. This is particularly a problem during late gestation, early weaned lambs and finishing lambs fed for maximum gain (NRC 1985). The growth response by lambs of different breeds to varying nutritional regimes has not been adequately investigated (Glimp, 1971).

Many investigators have shown that urea and dried poultry manure could be fed as cheap sources of nitrogen for ruminants (Fontenot and Webb, 1975, Gihad, 1976 and Allam et al., 1976).

In addition, under the unstable nutritional conditions in Egypt, growing lambs may suffer from feed shortage depending upon the location and time of the year. The main problem is the unavailability of the concentrates all over the year, whereas roughages are easily available. So, growing lambs may be sometimes obliged to eat roughages only. Then, when concentrates are available again, concentrates could be offered. Growing lambs might compensate for any losses during the concentrate deprivation period when concentrates are offered.

The objectives of this study are (a) to investigate the effect of plane of nutrition (two levels of protein and energy) with different nitrogen sources on feed intake and daily gain of growing lambs.

(b) The ability of lambs to compensate for any slow growth rate or any losses during concentrate shortage periods.

## MATERIALS and METHODS

Twenty one Rahmany lambs after weaning (having average age of about 120 days) and initial weight of about 17 kg were divided into three equal groups were used in this study. The trial lasted for 16 weeks with two phases. The 1st phase lasted for 6 weeks and the 2nd phase lasted for another 10 weeks. The experimental rations were randomly distributed over the groups. Each group was kept in a separate part-shaded pen. Rice straw was used as bedding (Ciszuk, 1974 and Oliphant, 1974).

Lambs were fed on rations containing 13% crude protein in the 1st period with 35% wheat straw as a roughage for 6 weeks and in the 2nd period, no roughages were offered and consequently the crude protein was increased up to 17% for another 10 weeks. The co-op feed mixture (FM) was used for performed protein supplementation for group 1 or to be partially substituted by dried poultry manure (DPM) or urea-molasses mixture (UM) at the level of 50% for 2nd and 3rd groups, respectively. Yellow corn was given in the 2nd period of nutrition to increase the daily energy intake.

The formulation and chemical composition of the experimental rations are shown in table (1). The experimental rations were offered ad libitum and the animals were allowed free access to water. Feed consumption was recorded, and the lambs were weighed before the morning meal at the beginning of the trial and at 14-day intervals till the end of the trial.

The data were statistically analyzed by analysis of variance (Steel and Torrie, 1960). A summary of the analysis is shown in tables 3 and 4).

## RESULTS and DISCUSSION

Composition of different rations and the percentage of different ingredients could be shown in table (1). Chemical composition of different rations either in the 1st period or in the 2nd period is illustrated in table (1). Crude

protein (CP) content of the three rations was lower, but the crude fiber (CF) was higher during the 1st period as compared with the rations during the 2nd period. This variation may be due to the wheat straw content of the rations during the 1st period. The higher content of CF due to the wheat straw addition to the diet is similar to that happens practically, where farmers find a difficulty in the concentrate availability they are obliged to add any roughage to the animal.

The average daily intake and average daily gain per lamb for the three experimental rations during the two successive periods were estimated. Data are summarized in table (2). The average daily intake of DM was lower in the 1st period for the three experimental rations as compared with the 2nd period. Consequently, TDN and DCP intake were lower in the 1st period than that in the 2nd period for the three groups.

The average of live body weight changes during the whole experimental period are shown in table (1) and figure (1). Lambs live body weight decreased during the 1st period. The losses in the live weight were 1.71, 1.93 and 2.5 kg per lamb during the 1st period for the FM, DPM and UM groups, respectively. During the 2nd period, there were increases in the live weight. The average daily gains were 134, 146 and 142 g for FM, DPM and UM groups, respectively. The differences among the three groups in daily gain and feed efficiency (kg DM/kg gain) lack for any significant differences (tables 3 and 4). These results are in agreement with those obtained by Simith and Calvert (1972) and Cooper et al. (1974).

During the 1st period, feed consumption for all groups was very low that lambs could not cover their maintenance requirements from the TDN or the DCP. The TDN and DCP consumed were lower than the lambs maintenance requirements. Therefore, the lambs lost about 2 kg live weight per lamb during the first 6 weeks (1st period). During the 2nd period, the TDN and DCP consumptions were quite enough to cover the

lambs requirements that the lambs showed reasonable daily gain for the three experimental groups.

The low feed intake during the 1st period may be due to the diet unpalatability and the high fiber content because of wheat straw especially during the period after weaning. On the other hand, the weaned lambs probably had not completely adapted with this type of rations which had high crude fiber content.

The NRC (1985) showed that, conversely, feeds excessively high in fiber or water may restrict nutrient intake. This is a particular problem during late gestation in twin and triplet - bearing ewes, early weaned lambs and finishing lambs fed for maximum gain. Glimp (1971) reported that feed efficiency (kg feed/kg gain) was improved as the energy concentration in the ration increased.

It is interesting to compare the results of this study with nutrient requirements of lambs published by Ghoneim (1964), ARC (1965) and NRC (1985). Ghoneim (1964) reported that total requirements for Rahmany lambs (at 16-28 weeks of age) are 350 - 400 g SE (= 370 - 420 g TDN) and 60 - 70 g DCP/lamb/day. The requirements of growing lambs according to the ARC (1965) are 561 g TDN/day and 57 g DCP/day for lambs gaining 100 g/day. The maintenance requirements are 277 g TDN/day and 22 g DCP/day for lambs averaging 20 kg live weight. In other words, the maintenance requirements are 29 g TDN and 2.33 g DCP/kg  $W^{0.75}$ /day.

In the present study, the average daily intake was 1.8, 1.92 and 2.4 g DCP and 11.5, 10.36 and 17.32 g TDN/kg  $W^{0.75}$ /day in the 1st period. The corresponding values were 7.76, 7.76 and 7.96 g DCP and 46.25, 41.04 and 47.06 g TDN for the 2nd period. Comparing these results with those previously published, it is obvious that values of the 1st period are lower than those recommended. Therefore, lambs lost about 2 kg/lamb during 6 weeks. Whereas during the 2nd period lambs received comparable DCP and TDN as compared with the recommended values by the Ghoneim (1964),

therefore lambs could compensate for the losses in the 1st period within 2-3 weeks in the 2nd period.

Effect of nitrogen source :

Ration consumption and daily gain data as affected by nitrogen source are presented in table (2). The DM, TDN and DCP intakes were similar for FM and DPM groups, while the UM group was higher than the other 2 groups in the 1st period only. During the high plane of nutrition the three groups had similar feed intake. The feed intake during the 2nd period was higher than that during the 1st period. The higher feed intake during the 2nd phase might be due to the higher digestibility and low CF content which usually stays longer in the digestive tract and reduces the need of the animal to refill its rumen. Excluding wheat straw in the 2nd period was accompanied by higher intakes. In this connection, intake of DM in the 2nd phase was 2.90 as much as that in the 1st phase with FM, while values for DPM and UM were 1.14 and 2.18, respectively. Corresponding values for TDN were 4.02, 4.02 and 2.72 for FM, DPM and UM and for DCP were 4.19, 4.04 and 3.29, respectively. These results indicate that adding performed true protein to the rations of growing lambs to compensate for any weight losses is better than NPN sources (Figure, 1).

The average daily gain of the group which received FM ration was lower than those of the other two groups which showed similar daily gains during the 2nd period.

Although there were remarkable differences in the daily intakes, the daily gain varied insignificantly. The duration of the experiment should have been prolonged with carcass analysis after relative longer two phases. The average daily gains obtained were similar with the findings of Abbas (1978) and Abd-ElKhabir (1978) using Rahmany sheep fed different rations.

During the low plane of nutrition the lambs lost 1.71, 1.93 and 2.5 kg live body weight for FM, DPM and UM groups

respectively. The lambs received UM ration showed higher loss than the other two groups which might be due to the higher efficiency of lambs to utilize the true protein (from FM) more than the NPN sources (both DPM and UM groups). NPN sources should be offered with energy source which was not available when wheat straw was offered and resulted in higher rate of losses in the live body weight and also the total losses.

Also, the differences in average daily gains observed during the 1st period between the urea group and the control group, may indicate an adaptation response of lambs to urea supplementation. Using urea in rations of growing lambs may need longer time for gradual adaptation which will be reflected on the daily gain. Previous experiments have shown that daily gain and efficiencies are reduced during the first 2-4 weeks after urea is introduced into the ration of lambs (McLaren et al. 1965, Ludwick et al. 1971, Allam et al. 1976 and Phillips 1986).

Overall results showed that using 35% roughage during the low plane of nutrition (in the 1st period) did not allow the lambs to cover their requirements in the early age after weaning. Using concentrate rations during the high plane of nutrition (in the 2nd period) covered the lambs requirements with reasonable daily gain. Feeding DPM and UM as protein supplements for growing lambs were comparable to the commercial concentrate feed mixture.

Further investigations are required to know the most suitable portion of roughage which could be perfectly and safely used in growing animals rations without any undesirable effects on the daily gain and feed efficiency of these animals. Different periods for compensation are also required to be studied.

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Table 1. FORMULATION AND DRY MATTER COMPOSITION OF THE EXPERIMENTAL RATIONS.

Item	Rations					
	1st period			2nd period		
	FM	DPM	UM	FM	DPM	UM
- Formulation %						
Wheat straw	50	51.23	49.26	--	--	--
Co-op feed mixture	50	25.61	24.63	42.	21.5	21.1
Yellow corn	--	--	--	58.	59.0	58.1
Dried poultry manure	--	23.16	--	--	19.5	--
Urea	--	--	2.09	--	--	1.7
Sugarcane molasses	--	--	24.02	--	--	19.1
- DM Composition %						
Organic matter	91.59	84.05	91.12	96.1	90.0	95.8
Crude protein	12.83	13.20	12.82	17.2	17.7	17.8
Crude fiber	29.25	29.05	25.59	10.8	10.3	7.4
Ether extract	4.35	3.89	2.71	6.0	5.6	4.6
N. free extract	45.16	37.91	50.00	62.1	56.4	66.0
Ash	8.41	15.95	8.88	3.9	10.0	4.2
- Feeding value (DM basis), %						
Total digestible nutrients (TDN) <sup>a</sup>	55.96	50.36	58.01	77.49	71.13	80.00
Digestible crude protein (DCP) <sup>b</sup>	8.99	9.33	8.93	13.00	13.45	13.54

<sup>a</sup> Harris and Asplund (1969) equations.

<sup>b</sup> Knight and Harris (1966) equations.

Table 2. EFFECT OF PLANE OF NUTRITION ON FEED INTAKE AND DAILY GAIN.

Item	Ratios					
	1st period			2nd period		
	FM	DPM	UM	FM	DPM	UM
Days of trial	42	42	42	70	70	70
No. lambs	7	7	7	7	7	7
Initial weight, kg.	17.71	17.29	17.71	16.00	15.36	15.21
Final weight, kg.	16.00	15.36	15.21	25.36	25.57	25.14
Average weight, <sup>a</sup> kg.	16.86	16.33	16.46	20.68	20.47	20.18
Average weight kg W <sup>.75</sup>	8.32	8.12	8.17	9.70	9.62	9.52
Total gain, kg	-1.71	-1.93	-2.5	9.36	10.21	9.93
Daily gain, g	- 41	- 46	- 60	134	146	142
Daily intake :						
Feed g/lamb	186	181	244	629	603	622
DM, g/lamb	171	167	220	579	555	560
DM, g/Kg W <sup>.75</sup>	20.55	20.57	26.93	59.69	57.69	58.82
TDN, g/lamb	95.69	84.10	141.54	448.67	394.77	448.00
TDN, g/kg W <sup>.75</sup>	11.50	10.36	17.32	46.25	41.04	47.06
DCP, g/lamb	15.37	16.58	19.76	75.27	74.65	75.82
DCP, g/kg W <sup>.75</sup>	1.85	1.92	2.42	7.76	7.76	7.96
Crude protein g/lamb	21.94	22.04	28.20	99.59	98.24	99.68
Feed efficiency (kg DM/kg gain)	--	--	--	4.32	3.80	3.94

<sup>a</sup> Average weight =  $\frac{\text{Initial weight} + \text{Final weight}}{2}$

Table 3. THE STATISTICAL ANALYSIS OF BODY DAILY GAIN DURING 2<sup>nd</sup> PERIOD.

S.V	d.f	SS	MS	F
Between treatments	2	640.6671	320.3333	0.197 NS
Residual	18	29265.134	1625.8413	
Total	20	29905.81		

Table 4. THE STATISTICAL ANALYSIS OF FEED EFFICIENCY (Kg feed /Kg gain DURING 2<sup>nd</sup> PERIOD.

S.V	d.f	SS	MS	F
Between treatments	2	1.70212	0.85106	0.458 NS
Residual	18	33.44900	1.858278	
Total	20			

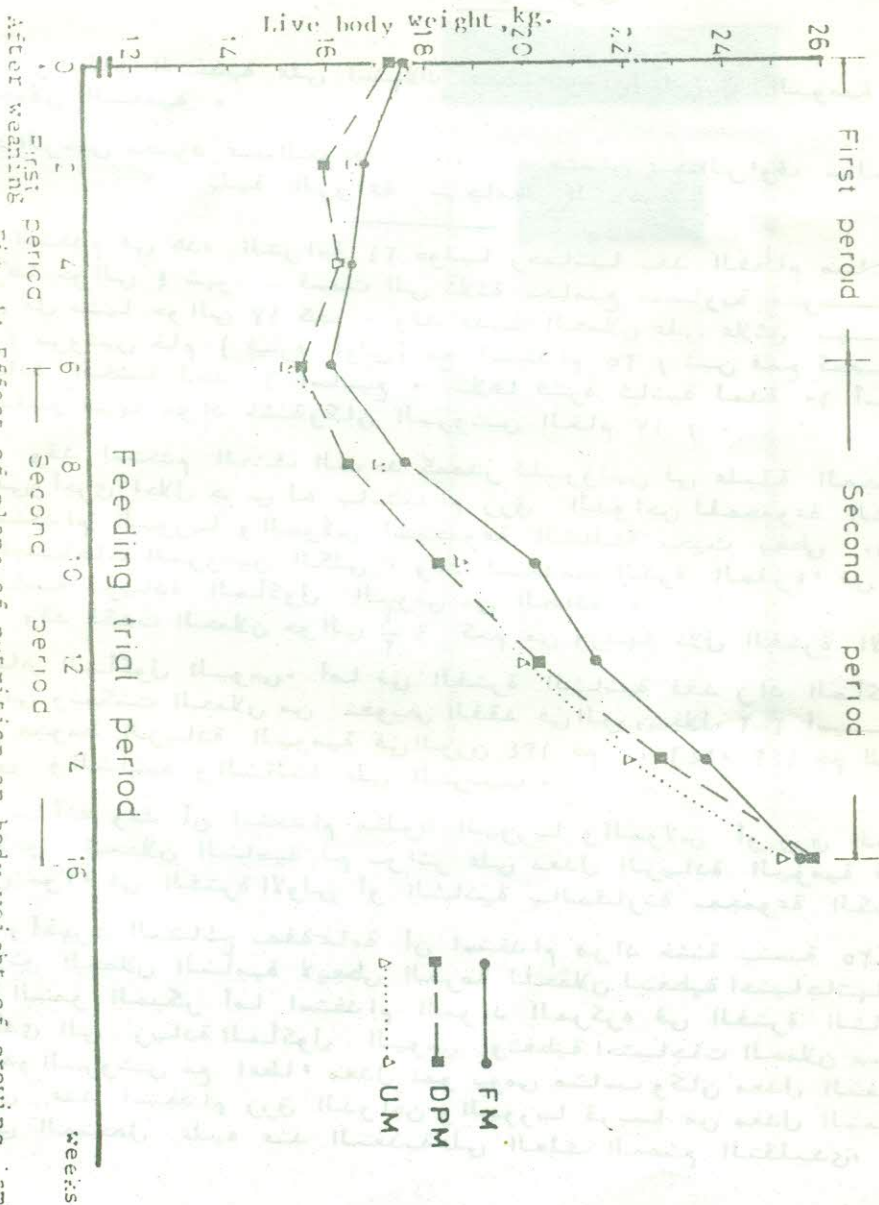


Fig. 1: Effect of plane of nutrition on body weight of growing lambs.

## الملخص العربي

تأثير نظام التغذية على استهلاك الغذاء ومعدل الزيادة اليومية فى الحملان النامية .

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استخدم فى هذه الدراسة ٢١ حوليا رحمانيا بعد الفطام مباشرة عمرها حوالى ٤ شهور - قسمت الى ثلاثة مجاميع متساوية متوسط وزن كل منها حوالى ١٧ كجم . وقد غذيت الحملان على علائق بها ١٣ / بروتين خام ( فترة أولى ) مع استخدام ٣٥ / تبين قمح كمصدر للمادة الخشنة لمدة ٦ أسابيع . تلاها فترة ثانية لمدة ١٠ أسابيع لم يقدم فيها مواد خشنة وكان البروتين الخام ١٧ / .

وقد استخدم الحاف الموحد كمصدر للبروتين فى عليقة المجموعة الأولى وأجرى احلال جزى له باستخدام زرق الدواجن للمجموعة الثانية وباستخدام اليوريا والمولاس للمجموعة الثالثة بحيث يغطى ٥٠ / من احتياجات البروتين الكلى . وقد استخدمت الذرة الصفراء فى الفترة الثانية لزيادة الماكول اليومى من الطاقة .

وقد فقدت الحملان حوالى ١ ٣ / كجم من وزنها خلال الفترة الأولى لانخفاض الماكول اليومى . أما فى الفترة الثانية فقد زاد الماكول اليومى وتمكنت الحملان من تعويض الفقد فى الوزن خلال ٢-٣ أسابيع وكان متوسط الزيادة اليومية فى الوزن ١٣٤ جم ، ١٤٦ ، ١٤٢ جم للمجاميع الأولى والثانية والثالثة على الترتيب .

كما أنه وجد أن استخدام مخلوط اليوريا والمولاس أو زرق الدواجن فى علائق الحملان النامية لم يؤثر على معدل الزيادة اليومية فى الوزن سواء فى الفترة الأولى أو الثانية بالمقارنة بمجموعة الكنترول

وأظهرت النتائج بصفة عامة أن استخدام مواد خشنة بنسبة ٣٥ / فى علائق الحملان النامية لايعطى الفرصة للحملان لتغطية احتياجاتها فى مرحلة النمو المبكر أما استخدام المواد المركزة فى الفترة الثانية فقد أدى الى زيادة الماكول اليومى وتغطية احتياجات الحملان من الطاقة والبروتين مع اعطاء معدل نمو يومى مناسب وكان معدل النمو اليومى عند استخدام زرق الدواجن واليوريا قريبا من معدل النمو اليومى المتحصل عليه عند التغذية على العلف المصنع التقليدى .