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THE EFFECT OF LEVEL AND SOURCE OF NITROGEN ON GROWTH AND NITROGEN METABOLISM IN THE RUMEN OF GROWING EWES

By

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Fifteen growing Ossimi ewes were distributed into three groups to study the effect of the level and source of nitrogen in ration on the nitrogen fractions in the rumen liquors and on the rate of body gain. The results indicate that high level of nitrogen in ration was accompanied by an increase in the total nitrogen in rumen filtrate. The minimum figures of different nitrogen fractions was noticed after 6 hours of feeding, when the main source of nitrogen was the protein of hay. The presence of soluble carbohydrate (corn) in ration was resulted in better feed conversion, nitrogen effeciency and higher rate of gain.

The theoretical bases of the non-protein nitrogen (NPN) utilization by ruminants was proved 70 to 75 to years ago. Later on during the last 25 years the urea and other NPN were widly used in ruminant nutrition. The most common nitrogen suplement in ration is the urea. It contains 42—46% nitrogen and relativly poor in energy (about 250 k cal/100 gm. urea). This means that the caloric value of urea epuals 50% of that obtained from true proteins.

The most important factors affecting the utilization of NPN in rumen are: *a*) The presence of soulble crabohydrates, which are used as a source of energy needed for the microbial activity; *b*) The level and properties of the proteni in ration, the lower the level of protein the higher the utilization and retention of the NPN.

The results obtained in vitro showed that the protein concentration in the artificial rumen affected the protein synthesis from urean nitrogen through the microorganisms (wegeer N.I. *et al.*, 1940). Johonson *et al.*, 1942, stated, that the suplementation of rations for sheep containing not more than 12% protein by urea caused increase in N retention.

Reid, (1955), stated that the rate of urea utilization was low When the suplemented ration was rich in protein. Better results were obtained on rations containing 9—12% or less protein.

The source and proparities of the proteins in rations also affect the rate of urea utilization. Pearson *et al.*, 1943, revealed that the less the solubility of proteins consumed the higher the convrsion rate on NPN through the rumen microbial agency. It was not so effective to supplement rations, comprised, of fresh young grass by urea, such rations is characterized by its high content of soluble proteins.

No significant difference was noticed in the microorganism number, when the level of nitrogen increased in pation difficient in starch (Williams

et al., 1953). Other workers stated that the increase of nitrogen in rations rich in soluble carbohydrate caused a remarkable increase of the microbes number (Tommi *et al.*, 1963).

Different investigators demonstrated, that the microbial nitrogen may cover the essential amino acids needed for both maintenance and production. Moir *et al.*, 1950, reported that 50% of the protein in ration is resynthesized into microbal proteins. The bacterial nitrogen was found to be 11% of the total nitrogen in Rumen, whereas the corresponding figures of the infuzoria nitrogen ranged from 10—20% (Tommi M. F. & Madianov A.B., 1963).

Th objectives of this work were to study the effect of different levels (normal and high) and sources (plant protins and urea) of nitrogen in ration on : *a*) the dynamic of nitrogen fractions in Rumen liquors ; *b*) and how much it could be reflected on the rate of growth.

Materials and Methods

Fifteen growing Ossimi ewe lambs (8 months age of 28 kg live weight), were used in this study. Animals were distributed according to their live weight and date of birth in three groups, 5 head in each. The experiment was carried out on the experimental farm of the Faculty of Agric. Ain Shams University and extended for 98 day. Before the experiment started all animals were maintained on the farm ration. The experimental rations shown in (Table 1) were fed randomly to the different groups. Ration I being the control while II and III were the experinmental ones.

TABLE 1.—THE AVERAGE DAILY INTAKE OF THE GROUPS DURING THE EXPERIMENTAL PERIOD (PER HEAD)

Groups Ingridient	I			II			III		
	amount	S.V.	D.P.	amount	S.V.	D.P.	amount	S.V.	D.P.
		kg.	gm.		kg.	gm.		kg.	gm.
Hay kg.*	1.00	0.32	80	1.00	0.32	80.	1.00	0.32	80
Corn kg.**	0.300	0.24	18	0.300	0.24	18	—	—	—
Co-op feed mixture kg.† . .	—	—	—	—	—	—	0.600	0.30	60
Urea gm. in Ration†† . . .	—	—	—	16	42	42	—	—	—
		62	98		0.56	140		62	140
dig nitrogen % of D.P.of the control			15.68 100%			22.40 142%			22.4 142%

* Hay contain 32% S.V. and 8% D.P.

** Corn contain 80% S.V. and 6% D.P.

† Co-op feed contain 50% S.V. and 12% D.P.

†† Urea feed contain 43% nitrogin

The animals were fed twice daily at 8.30 A.M. and at 3.00 P.M. samples of rumen content were obtained by using the stomach tube method. The frequancy of sampling were at 2 hours before morning feeding, 2, 4 and 6 hours after feeding. The dynamics of different nitrogen fractions in the rumen fluid were studied. The total, and non protein nitrogen were determined in the filtrate of the rumen content using micro Kjeldahl method, while the protein nitrogen was calculated by the difference between the total and non protein nitrogen. Animals were weighed biweekly.

Results and Discussion

The data of the dynamic changes of the nitrogen fractions in rumen liquor which is presented in (table 2) shows that the lowest figures of the total nitrogen in different analysis (after and before feeding) were observed in the first group (control). The other two experimental groups however showed the maximum figures of the total nitrogen after different periods of feeding.

Fig. 1, however, illustrates the total nitrogen behaviour in the rumen of the experimental animals. The third group showed the highest level after 2 hours of feeding, whereas the maximum concentration was obtained in the second group at 2 hours before, 4 and 6 hours after feeding.

There was a marked difference between the groups with regards to N in rumen liquor. A carrelation between the concentration of total N in rumen liquor and the level of digestable protein in ration was noticed. These results are in accordance with those obtained by El-Ashry, (1963), Belanshouk (1966). Mean while the differances between the concentration of the total N in rumen in relation o the nitrogen intake are not constant at differant periods of feeding. This is largely due to many factors, which may stimulate or depress the degradation and resynthesis of the nitrogenous compuonds of ration into microbial protein.

The increase noticed in total nitrogen in the second analys of the third group could be explained as a result of the presence of fine particles of the grind concentrate mixture rich in crude protein in the rumen fluid. The relative values of the nitrogen fractions however are not significantly different from those obtained before feeding.

On the other hand the highest concentration of the total nitrogen obtained from the second group was that of 4 hours after feeding. This was accompanied by the maximum microbial activity as a result of the presence of soluble carbohydrate, which supplied microorganisms by energy needed to attack the hay tissues. This was associated with the liberation of a large amount of nitrogenous compounds with some increase in the NPN formed in the processes of protein degradation (fig II).

TABLE 2.—THE DAYNAMIC OF DIFFERANT NITROGEN FRACTIONS IN RUMEN FLUIDES

Groups	total N mg. %	% of the control	N.P.N. mg.%	$\frac{\text{N.P.N.}}{\text{total}} \times 100$	Protein N mg.	Percentage of P.N.
First analys.—2 hours before feeding						
I	173.0	100	75.6	43.4	98	56.5
II	222.0	128.3	53.2	23.9	178.0	76.1
III	182.0	105.2	53.2	28.9	128.8	71.1
Second analys.—2 hours after feeding						
I	126	100	39.2	31.1	86.8	68.9
II	184.6	146.8	44.8	24.2	140.0	75.8
III	252.0	200	70.4	27.9	181.6	72.1
Third analys.—4 hours after feeding						
I	64.4	100	50.4	76.7	14	23.29
II	280.0	434.7	75.6	27.0	204.4	73.00
III	140.0	217.3	42.0	30.0	98.0	70.00
Forth analys.—6 hours of feeding						
I	67.2	100	39.2	57.75	28.0	42.27
II	84.0	125.3	30.8	36.79	35.2	63.21
III	78.4	116.6	28.0	35.72	40.4	64.28

The lowest concentration of the total nitrogen in all groups were evident after 6 hours of feeding. Also the minimum difference between groups were observed in the same analys.

The main source of the increased nitrogen in rumen filtrate in all groups before feeding was the hay proteins which were liberated from the lignified plant tissues after 15 hours of feeding.

It is suggested that the relative figures of different N fractions can be used as an indicator of the rate of synthesis and protein degradation. The highest percentage of NPN of the total N (76.7%) was observed in the first group after 4 hours of feeding. This demonstrates that the protein degradation predominat protein synthesis specially after a noticeable increase in the absolute value of the NPN (from 39.2 to 50.4 mg.% after 2 and 4 hours of feeding respectively).

In spite of the fact that about 25% of the N-intake was urea nitrogen, the minimum percentage of NPN was noticed after 2 hours of feeding in the second group (24.2%). These figures lead to the conclusion that due to the presence of enough supply of nitrogen and soluble carbohydrate, high rate of protein synthesis was obtained.

A noticeable increase in the NPN percentage in the forth analysis of the same group can be explained by the fact that as time passes there is a marked decrease in the avalaible energy needed for protein sysnthesis through microbial activity, over all this was reflected on the concentration of the total nitrogen and particularly on the ratio between different nitrogen fractions.

Although the highest level of NPN in ration was offered to animals of the second group, the protein, nitrogen in rumen fluid in three sucessive analysis (2 hours before feeding and 2, 4 hours after Feeding) were the maximum values obtained from different groups. This reveals that the protein synthesis predominantes its degradation. The presence of soluble Carbohyderate (easy fermented corn starch) as a source of energy required for the microbial activity was responsible for the highest efficiency of nitrogen utilization from its simple form into microbial protein.

The drop in protein nitrogen percentage of the second group (from 73 to 63% after 6 hours of feeding) is largely due to the fact that the quickly fermented carbohydrate was used as a source of energy during a short period after feeding. Later on the main source of enegy for microflora activity are usually the other fractions of carbohydrates (hardly fermented) which need longer period to be fermented.

The low concentration of the absolute and relative figures of the protein nitrogen in the first group after 4 hours of feeding inspite of the presence of enough quantity of soluble carbohydrate in Ration could be due to the defficiency in soluble nitrogenous compounds needed to be utilized into protein.

The increase in absolute and relative values of the protein nitrogen of the same group in the following periods of analysis (after 15 hours of feeding)' demonestrated that it was required longer time for the hay N to be liberated and utilized by microflora. The same trend was naticed in the other groups, a significant increase in the absolute values of all studied fraction and in the relative values of protein nitrogen (56.1, 76.1 and 71.1% for the first, second and third groups respectively).

Body gain during the experimental period :

It was reported by Badr El-Din-(1951) that, the average daily gain was 164, 132, 52 gm. for Ossimi males and 146, 137 13, 19 gm. for Ossimi females in the first, 94, 184 and 274 days of age respectively. Such trend in the daily gain was noticed by Ragab *et al.*, (1953). El Khishin (1938) reported an average of 32.9 and 31.9 gk for Ossimi males and females respectively at 12 months of age. The body weight for the yearling ewes was 35.9, 35.1 anr 34.39 kgs as it was reported by Ghoneim *et al.*, (1961). El labban *et al.* (1963), and aboul Naga (1966), respectively.

The body gain obtained in this experiment for the ossimi single females is shown in Table, No 3 :

TABLE 3.—THE DAILY GAIN DURING THE EXPERIMENTAL PERIOD

Groups	avorage initial weight	average final weight	total gain	daily gain	% or gain of the control
	kg.	kg.	kg.	kg.	
I	29.4	34.5	5.1	51.2	100
II	28.6	36.8	8.2	83.6	143
III	27.3	34.8	7.5	76.5	147

The average daily gain of the control animals was about 51 gm., however markedly lower figures was obtained by Badr -l-Din (1951). The highest gain recorded for ossimi females in the same age was reported by Aboul-Naga (1966) (56 gm daily).

The difference in Body gain between the control and experimental animals was statistically significant. The percentage of daily gain was 143 and 147% of the control for the second and third group respectively.

This means that the increase in the daily intake of the digested nitrogen in such rations was accompanid by increase in the rate of gain in the experimental animals. The highest nitrogen efficiency was noticed in the second group, while the lowest was recorded in the control one.

A significant differance in feed efficiency was obtained in different groups (table 4). The highest feed conversion was in the second group while the lowest was in the first one.

TABLE 4.—THE FEED CONVERSION

Groups	total gain during the experiment kg.	average daily gain gm.	average intake (starch eq. kg.	S.V. kg. required for kg. gain	average daily intake D.P gm.	daily N digested gm.	N required for 1 kg. gain gm.
I	5.1	51.2	0.62	12.5	98	15.68	306.2
II	8.2	83.6	0.56	6.69	140	22.4	276.9
III	2.5	76.5	0.62	8.1	140	22.4	292.9

These Figures of feed efficiency obtained from the second and third group are close to those found by Ghoneim *et al.* (1959). The difference between the experimental groups (II & III) in feed conversion and nitrogen intake needed for the unit of gain may be due to the presence of soluble carbohydrate in the second ration.

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تأثير مستوى ومصدر نيتروجين العليقة على النمو وتمثيل النيتروجين فى كرش الحوليات النامية

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الملخص

استخدمت فى التجربة خمسة عشر حولية أوسيمى قسمت الى ثلاثة مجاميع لدراسة تأثير مستوى ومصدر نيتروجين العليقة على تركيز بعض المركبات النيتروجينية فى سوائل الكرش كما درس ايضا اثرها على معدل النمو لهذه الحيوانات . وقد أوضحت النتائج أن رفع مستوى النيتروجين فى العليقة صحبة زيادة فى النيتروجين الكلى فى محتويات الكرش . وقد لوحظ أن أقل مستوى للمركبات النتروجينية المختلفة ــ عندما كان الدريس هو مصدر الجزء الأكبر من أزوت العليقة ــ هو ٦٧ ملليجرام فى المائة فى العينات المأخوذة بعد ست ساعات . كذلك وجد أن توفر الكربوايدرات الذائبة بكميات مناسبة (فى عليقة المجموعة الثانية) أدى الى تحسن فى معدلات التحويل الغذائى وخفض كميات الأزوت فى العليقة اللازمة لانتاج وحدة الوزن (كجم) كما ارتفع معدل الزيادة اليومية .

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