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Sheep

Adaptation of Lambs to Biuret as a Nitrogen Source When Fed High Concentrate Rations

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Story in Brief

It had previously been shown in this laboratory that rumen microorganisms in both sheep and cattle required considerable periods of time varying from 20 to 40 days of exposure to biuret in the feed before significant ability to utilize biuret as a source of nitrogen could be shown.

In the experiment reported here, the ability of the microorganisms to adapt to biuret when the animals were fed high concentrate rations was studied. In contrast to the relatively long adaptation period required when biuret was fed with high roughage rations, with rations containing 60 percent concentrate, adaptation was complete by 10 days after the start of biuret feeding. Similar to the results with high roughage rations, however, when biuret was removed from the high concentrate ration the biuretolytic activity was lost by 4 days after removal.

Introduction

Biuret is being tested as a source of supplemental nitrogen to ruminants, primarily in relation to protein supplements being fed to ruminants

on low quality roughage regimes. In experiments conducted at Oklahoma, we have shown that a period varying from 20 to over 40 days of exposure to the biuret in the supplement may be required before the rumen microorganisms can fully utilize the biuret or can break it down to a useful form of nitrogen (biuretolytic activity). This period required to develop biuretolytic activity on high roughage rations appears to be related to the level of natural protein in the rations as well as to the level of concentrate that might be added to the roughage. Biuret has also been proposed as a source of supplementary nitrogen for ruminants consuming high concentrate rations. Therefore, the objectives of the present experiment were to investigate the adaptation to biuret as a source of nitrogen by lambs consuming high concentrate rations.

Materials and Methods

Trial 1. Eight rumen fistulated sheep were divided into four lots of two animals each and fed the rations shown in Table 1. These rations consisted of approximately 60 percent concentrate type feeds and cottonseed meal was compared to urea, biuret and a combination of urea and biuret as nitrogen sources. The rations were fed free choice daily for a period of 75 days. On days 10, 17, 31, 45, 59 and 75 after the initiation of biuret feeding, the ability of rumen microorganism to hydrolyze biuret in a laboratory flask (biuretolytic activity) was determined on all lambs on all rations. At the end of the 75 days, the two lambs on each of the biuret and the urea + biuret rations (rations 2 and 4) were given ration 1 which had no biuret and the biuretolytic activity was measured on days 1, 2, 4 and 7 after the switchover.

Trial 2. Twenty four spring lambs from the station flock were divided into four groups of 6 lambs each and fed the same rations as

Table 1. Composition of Rations for High Concentrate Trial 1 and 2

Ingredient	Percentage composition, as is basis			
	1 CSM ¹	2 U	3 B	4 U+B
Ground corn	40.3	54.1	53.5	53.7
Cottonseed hulls	38.0	38.0	38.0	38.0
Molasses	5.0	5.0	5.0	5.0
Cottonseed meal	15.7	-	-	-
Urea	-	1.83	-	0.92
Biuret, pure	-	-	2.35	1.18
Limestone	0.4	0.4	0.5	0.5
Dicalcium phosphate	-	0.07	0.05	0.1
T.M. salt	0.6	0.6	0.6	0.6
Vit A & D	+	+	+	+

¹ Abbreviations Refer to Cottonseed meal-CSM, U-Urea, B-Biuret.

shown in Table 1. This trial was designed as both a growth and performance trial as well as a digestion study. Seven day feces collection periods were conducted starting at days 20 and 60 after the initiation of feeding for purposes of determining digestibility of the ration constituents. Rations were fed free choice and the animals were weighed at two week intervals.

Results and Discussion

Figure 1 illustrates the biuretolytic activity of the rumen contents from the fistulated sheep fed these rations over the entire experiment. A

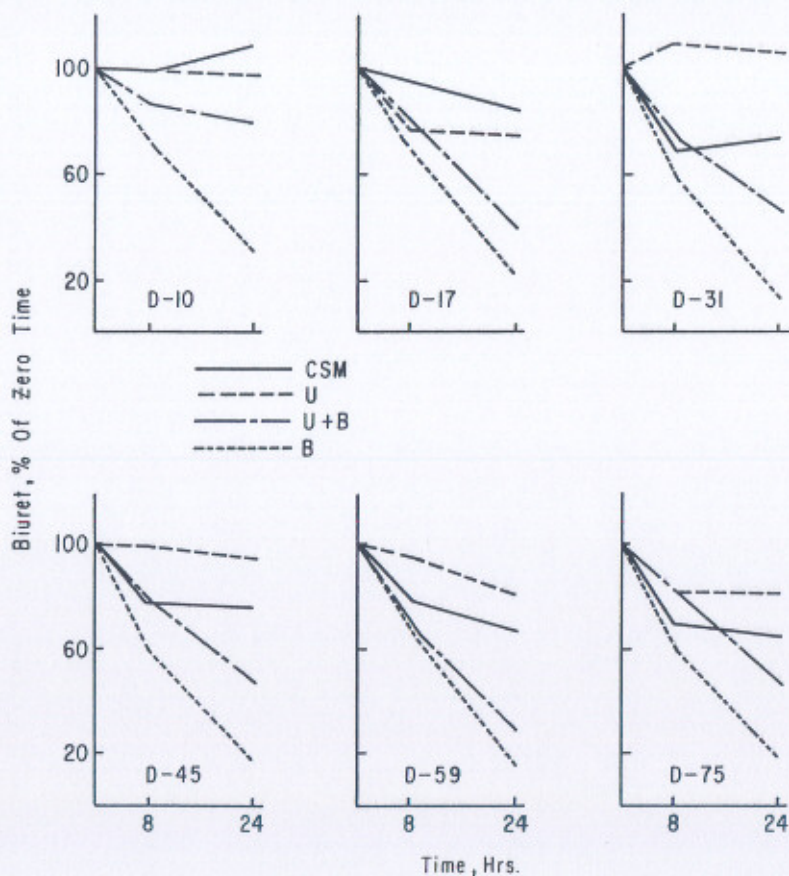


Figure 1. Biuretolytic activity of rumen contents for animals fed high concentrate rations. Each line represents average of two animals.

rapidly decreasing line indicates significant biuretolytic activity or the ability to break this form of nitrogen down to a useful form. It can be seen that on day 10 the rumen microorganisms in the animals fed the biuret ration had already adapted to this nitrogen source and there was little improvement for the remainder of the experiment in their ability to hydrolyze the biuret. The animals consuming the urea plus biuret ration were not fully adapted until day 17 and at no time was their adaptation equal that shown by the animals consuming the biuret ration.

Although there were some traces of biuretolytic activity in rumen contents from the animals on the other two rations which did not contain biuret, these are considered to be artifacts since most of this activity was in the first 8 hours of incubation, with little activity shown between 8 and 24 hours. When the biuret was removed from the ration for those animals that had been adapted to the biuret, the loss of biuretolytic activity was very rapid as shown in Figure 2. Biuretolytic activity had essentially disappeared by two days after the removal. This is very similar to the loss of biuretolytic activity shown in previous studies when high roughage rations were being utilized.

Table 2 presents the performance results for the lambs fed the high concentrate rations supplemented with biuret. During the course of this trial, considerable difficulty was encountered with several of the lambs

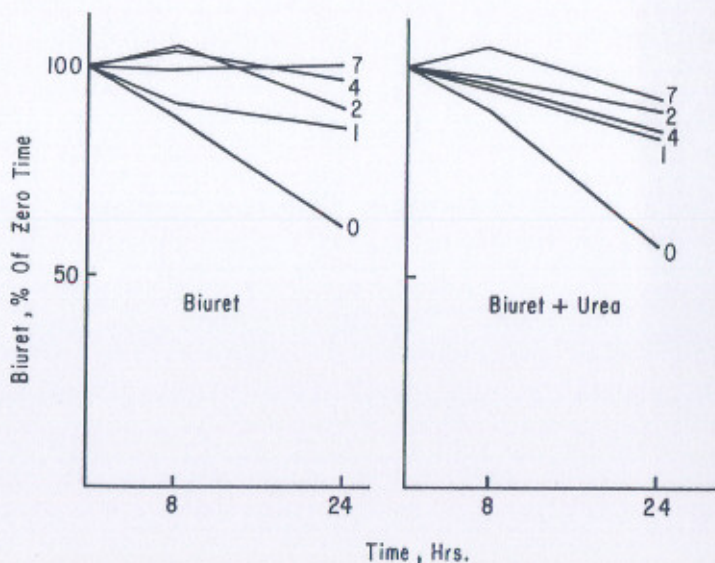


Figure 2. Disappearance of biuretolytic activity in vitro in Trial 1 following removal of biuret from the ration.

and five lambs had to be removed from the experiment either through death or other causes. Therefore, the performance data should be considered in this light. The fastest rate of gain was shown by the animals consuming biuret supplemented rations followed closely by those on the cottonseed meal ration. Those on the urea and biuret or urea were still lower. Since only three animals finished the experiment on the cottonseed meal control ration, it is difficult to draw any conclusions from these results. The biuret ration was consumed as well as any of the other rations and apparently better than some, although feed efficiency was actually best for the control ration containing cottonseed meal. Little more can be said about these results without repeating these experiments.

The apparent digestibilities determined for these animals for the two periods starting at day 20 and day 60 are shown in Table 3. There

Table 2. Performance of Lambs On High Concentrate Rations (Trial 2)

	1 CSM	2 U	3 B	4 U+B
No. animals	3 ¹	5	6	5
Initial wt. lb.,	43.8	52.1	49.7	51.3
Final wt., lb.	90.6	95.9	100.3	95.5
Ave., daily gain, lb.	0.312	0.279	0.323	0.285
Ave. daily feed, lb	2.26	2.58	2.76	2.52
Feed per lb. gain, lb.	7.24	9.25	8.54	8.84

¹ Three of the heavier lambs from this group were removed from this treatment for health reasons which probably affected the average.

Table 3. Apparent Coefficients of Digestibility-High Concentrate-Trial 2

Period ¹	Ration			
	1 CSM	2 U	3 B	4 U+B
	<i>Dry matter digestibility, %</i>			
1 (20)	60.5	56.7	52.2	54.0
2 (60)	64.5	62.1	58.5	59.4
	<i>Organic matter digestibility, %</i>			
1 (20)	60.1	56.7	52.1	53.9
2 (60)	64.3	61.7	58.3	59.9
	<i>Cellulose digestibility, %</i>			
1 (20)	22.9	17.2	10.7	24.8
2 (60)	42.6	12.3	19.9	11.1
	<i>Nitrogen digestibility, %</i>			
1 (20)	52.8	58.5	54.3	54.9
2 (60)	56.7	65.4	61.8	64.0

¹ Period effect significant ($P < .05$ or less) for all rations for DMD, OMD and ND. Periods refer to 7 day collection periods starting 20 and 60 days after initiating study.

was an apparent increase in digestibility of dry matter and organic matter from day 20 to day 60 but this was not associated with nitrogen source since it occurred in all rations. Cellulose digestibility was extremely low in all cases. Although nitrogen digestibilities were not greatly different in the early period, these values appeared to be greater for the rations containing non protein nitrogen sources during the last period. This may be an indication of an adaption phenomena toward the utilization of non protein nitrogen.

Conclusions

Adaptation to biuret by the microorganisms in the rumen of sheep occurs much more rapidly on the high concentrate rations tested here than on the high roughage rations tested earlier. Nevertheless, the adaptation was lost just as rapidly as with the high roughage ration when biuret was removed from the ration. The utilization of biuret in performance studies with ruminants on high concentrate rations should be studied further before drawing any conclusions on this aspect. Further studies are presently underway to determine the effects of different levels of concentrate on the adaptation and utilization of biuret in comparison to other sources of nitrogen.
