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ABSENCE OF DE-ADAPTATION TO BIURET AFTER A THREE-DAY BREAK IN FEEDING IT TO SHEEP

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OPSOMMING: INVLOED VAN ONDERBROKE VOEDING VAN BIURET OP DIE BENUTTING DAARVAN DEUR SKAPE

Merino hamels is gebruik om aanpassing by biuretvoeding te bestudeer asook die invloed van drie-daagse onderbreking van biuretvoeding by aangepaste skape te bepaal. N-retensie en urine biuretkonsentrasie is as maatstawwe gebruik. Wanneer 7g biuret per dag saam met 'n basiese rantsoen gevoer is, was aanpassing na ongeveer 3 weke voltooi. Wanneer 10,5g biuret per dag saam met 'n groeirantsoen aan aangepaste skape gevoer is, het die weglating van biuret 3 agtereenvolgende dae geen meetbare verlies van aanpassing veroorsaak nie.

SUMMARY

Merino wethers were used to study adaptation to biuret and the effect of a 3-day interruption in feeding biuret to fully adapted sheep. N-retention and urinary biuret concentration were used as criteria. When fed 7g biuret daily in addition to a basal ration, adaptation was complete by about 3 weeks. When fed a growth ration supplying 10,5g biuret per day, the exclusion of biuret from the ration of fully adapted sheep for 3 successive days did not result in any measureable deadaptation.

Schröder & Gilchrist (1969) found that when biuret was withdrawn from the diet of fully adapted sheep the biuretolytic activity of the ruminal ingesta fell to low values within a few days. The fall in activity, as revealed by *in vitro* tests, was quite large, of the order of 75% after 3 days without biuret. Return to the normal level took some weeks. Since it is difficult to avoid an occasional interruption in feeding supplements to livestock, these results raise an important practical question: does a short break in feeding biuret reduce the amount subsequently utilized, and if so for how long?

Decomposition of the amounts of biuret usually added to rations need not be directly affected by a fall in biuretolytic activity. Clearly, if the activity is just sufficient to decompose a practical ration in 24 hours, then any fall must reduce the amount decomposed. But if there is surplus activity it will do so only when the fall exceeds the surplus. What happens in any particular conditions is therefore a matter for investigation.

In the present experiment fully adapted lambs received 10,5 g biuret daily as part of a growth ration. Whether they utilized less biuret after a 3-day interruption was found by measuring nitrogen retention and urinary biuret excretion. Nitrogen retention would be expected to drop after a fall in biuret decomposition, for this reduces the available nitrogen. Urinary biuret would be expected to rise, for Schröder (1970) has shown that all undecomposed biuret is excreted, mainly in the urine.

Procedure

Experimental animals

Ten Merino wethers were used, aged about 10 months and weighing 18–23 kg (mean 21 kg). They were shorn halfway through the experiment, in September 1971.

Experimental design and treatments

The animals were kept in individual pens and fed a basal ration of hay, maize meal, and minerals (Table 1) for 14 days. They were then placed in metabolism cages for a preliminary period of 7 days before the first N-retention test took place. This was followed by 9 further tests at fortnightly intervals. Each N-retention test lasted 5 days. During the remaining 9 days of each fortnight the animals spent 7 days in the pens and the final 2 days in the cages, remaining on ration throughout. Test 1 was carried out on the basal ration, Tests 2–4 on the adaptation ration, Tests 5–9 on the growth ration, and Test 10 on the growth ration with biuret reduced by 25% (Table 1). Rations were changed while animals were in the pens. Between Tests 6 and 7, and again, between Tests 8 and 9, biuret was omitted from the ration for 3 days. It was resumed 4 days before the next test began.

Table 1
Experimental rations

	Basal ration	Adaptation ration	Growth ration
Tests in which used	1	2–4	5–9
Offered (g/day)			
Teff hay (4,6% CP)	700	700	–
Teff hay (8% CP)	–	–	700
Maize meal (9% CP)	150	150	200
Prosup (70% biuret)	–	10	15
Starch	–	–	100
Minerals*	20	20	20
Consumed			
CP% (DM basis)	6,1	10,0	12,3
Estimated NE (Mcal)	0,54	0,56	0,99
DCP/NE ratio	34	74	66
% DCP from biuret	–	36	34

*10 g dicalcium phosphate, 10 g salt.

Urine biuret was determined in 5 of the 10 sheep during all N-retention tests except the tenth. It was also determined, in the same 5 sheep, on the second and third days without biuret and the first 3 days after resumption; on these occasions the sheep were returned to the cages earlier than usual.

Biuret was supplied as Prosup*, which according to specification contains 70% biuret and 25% other sources of NPN (9% urea, 9% cyanuric acid, 7% triuret). It was included in the maize meal and mineral mixture and fed at 0930h each day. Hay was fed in 2 roughly equal lots at 1030h and 1500h each day.

The adaptation ration was low in both protein and energy; the growth ration was at the recommended level in these respects (van Niekerk, 1969).

Analytical methods

Urinary biuret was determined by the method of Gilchrist, Potgieter & Vos (1968), except that copper sulphate was used in place of nickel sulphate. Nitrogen was determined by the Kjeldahl method with selenium as catalyst.

Discussion of Results

N retention from the adaptation ration

When NPN (Prosup) was added to the basal ration, N retention first rose slightly and then fell to a negative value by the sixth week (Table 2, Tests 1–4). Balch (1967) has pointed out that the effect of adding nitrogen to an energy-deficient ration may well be a decline, instead of a rise, in N retention, and this appears to be a case in point. Energy intake at 0,56 Mcal/day was well below the optimum for lambs of this size, and the DCP/NE ratio of 74 was above the optimum of about 61. N retention rose immediately when extra energy, mainly as starch, was added to the ration (Table 2, Test 5 onwards).

Decomposition of biuret during the adaptation period

In Test 2, on days 6–10 after starting biuret, the average daily excretion of biuret in urine was 3,6 g (Table 2). The intake was 7 g/day, and if none had been decomposed about 84% of this (5,9 g) would be expected to appear in urine (Schröder, 1970). The difference (5,9–3,6) is 2,3g which is 39% of the 5,9 g expected if no decomposition had taken place. Thus by about the eighth day after starting biuret some 39% of the intake was being decomposed. Similar calculations for Test 3, centred on the 22nd day, show that by then about 73% was being decomposed. This is approximately the maximum (Gray & Clark, 1964; Whiteside, unpublished results). If full adaptation is defined as maximum decomposition of biuret, then these sheep took about 3 weeks to become fully adapted. Three weeks is quite a normal period for adaptation to biuret in sheep (e.g., Clark, Barrett & Kellerman, 1963; Schröder & Gilchrist, 1969); thus, adaptation was not slowed down even with a ration so poorly balanced that N retention became negative after adding biuret.

Effect of 3-day interruption of biuret on N retention

Tests 7 and 9 were each carried out after a 3-day break in feeding biuret at 10,5 g/day (Table 1), and took place on days 4–8 after resumption. In both cases N retention was insignificantly higher after the break than before; that is, no effect was detected (Table 2).Deadaptation either did not occur or, if it did, was of short duration. A third possibility is that slight deadaptation did occur but is not detectable by these means. It is known from other experiments that complete removal of biuret,

Table 2

Results of N-retention tests and corresponding urine biuret determinations (g/day unless otherwise shown)

	Test no.									
	1	2	3	4	5	6	7*	8	9*	10
Ration**	B	A	A	A	G	G	G	G	G	Gx
N retention	0,42	1,76	1,07	−1,34	4,74	4,19	4,40	4,08	4,46	3,97
S.E.	0,22	0,17	0,27	0,36	0,26	0,32	0,26	0,20	0,21	0,27
N intake	5,16	9,83	9,58	9,09	14,46	14,88	14,35	14,96	15,11	13,69
% retained	8	18	11	−15	33	28	31	27	29	29
Urine biuret	0	3,60	1,60	2,00	2,46	3,96	2,56	3,75	3,12	–
S.E.	–	0,42	0,35	0,24	0,12	0,58	0,14	0,23	0,19	–

* Biuret withdrawn for 3 days before these tests.

** B – basal, A – adaptation, G – growth, Gx – growth less 25% of biuret, see Table 1.

*Registered trade mark, AE & CI Ltd.

Table 3

Urine biuret (g/day) during withdrawal and resumption of biuret and in preceding and succeeding 5-day tests

		Mean, days 4–8 before withdrawal	Days during withdrawal 2	3	Days after resumption 1	2	3	Mean, days 4–8 after resumption
A*	Urine biuret	3,96	0,36	0,18	3,62	3,46	2,36	2,56
	S.E.	0,58	0,10	0,07	0,60	0,39	0,29	0,14
B	Urine biuret	3,75	0,17	0,22	4,38	3,46	2,18	3,12
	S.E.	0,23	0,10	0,08	0,12	0,52	0,29	0,18

*A – withdrawal between tests 6 and 7, B – withdrawal between Tests 8 and 9.

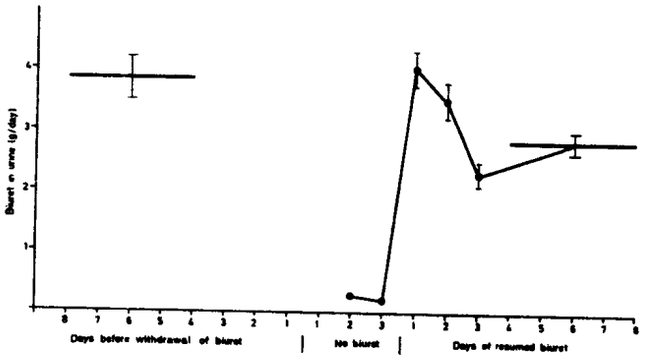

Fig. 1. – *Biuret in urine of sheep before, during, and after a 3-day interruption in feeding biuret at 10,5 g/day. Circles, 1-day means; horizontal lines, 5-day means; vertical lines, one S.E. above and below mean.*

equivalent to complete deadaptation, is at once followed by a significant drop in N retention. Test 10 of the present series was intended to find whether a 25% removal of biuret, equivalent to 25% deadaptation, would produce a corresponding drop in N retention. It did so (Table 2, Tests 9 & 10); the values 4,46 and 3,97 are each 29% of the corresponding intakes. But the variances were too great for the difference between these means to be statistically significant ($\underline{P} = 0{,}15$). Clearly, larger groups of sheep than 10 must be used if changes in biuret decomposition are to be detected by means of N retention.

It appears that N retention does in fact follow changes in biuret decomposition quite closely. Values for N retention and biuret decomposition (calculated from urine biuret) are available for each of Tests 5–9. The correlation between these 2 sets of data is +0,85 and is highly significant ($P < 0{,}01$).

Effect of 3-day interruption on urine biuret excretion

The 2 sets of results obtained are shown in Table 3. Values for urine biuret on the second and third days without biuret show that there was little carry-over from delayed excretion. Those for the first 3 days of resumed biuret are no higher, with one exception, than the values before withdrawal. The exception is not significantly different from the corresponding value before withdrawal. Since any reduction in the amount of biuret decomposed must be followed by higher amounts excreted, these results provide evidence that no deadaptation occurred on the first 3 days after the interruption.

There is, in fact, some evidence that the immediate effect of a 3-day break was *increased* decomposition of biuret fading away over the next week or two. This is illustrated in Fig. 1, which shows the means of the 2 sets of results in Table 3. The 2 sets can legitimately be combined because each datum of one set is insignificantly different from the corresponding datum of the other. It is apparent from Fig. 1 that on days 1 and 2 of resumed biuret the amount excreted in urine was insignificantly different from that before the interruption. But on day 3 it was significantly lower, and on days 4–8 it was again significantly lower, though beginning to rise. On days 18–22, not shown in Fig. 1 because only one observation is available, it had returned to the original level. This curious sequence needs confirmation before it can be regarded as the normal effect of a 3-day break in feeding biuret. If true, it is difficult to explain. Perhaps the reduced nitrogen intake for 3 days affected the rumen microbes adversely, and the biuretolytic organisms were at a temporary advantage when their substrate reappeared in the rumen.

Conclusions

Ten Merino wethers averaging 21 kg livemass were used to follow the course of adaptation to biuret and to

find the effects of a 3-day interruption in feeding this compound to the fully adapted animals. Nitrogen retention and urinary biuret excretion were measured for 5 days on a basal ration, and then for the same period at fortnightly intervals after adding a commercial biuret product. Urinary biuret was also measured on the second 2 days of withdrawal and the first 3 days of resumption of biuret. During adaptation the ration contained 10,0% CP and 0,54 Mcal NE, and consisted of poor teff hay, maize meal, minerals, and 7 g/day biuret. This ration eventually gave rise to a negative nitrogen balance, probably because it was deficient in energy. Nevertheless, the rate of adaptation to biuret was normal.

When adaptation was complete the ration was raised to 12,3% CP and 0,99 Mcal NE by providing better hay, more maize meal, starch, and 10,5 g/day biuret. Biuret was twice withheld for 3 days between fortnightly tests. No drop in nitrogen retention followed on either occasion, and there was no rise in urine biuret even immediately after resumption. Thus there was no evidence that a 3-day interruption depressed the assimilation of 10,5 g biuret daily.

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