Control of feed intake as affected by previous treatment

J.P. Pienaar, H.S. Hofmeyr and G.L. Whiteford

A.D.S.R.I., Private Bag X2, Irene 1675, Republic of South Africa

An experiment was conducted with eighteen rumen cannulated sheep fed on a chopped lucerne diet. Previous level of intake significantly influenced the level at which sheep initially established voluntary feed intake. This difference had disappeared after three weeks on an *ad lib.* intake.

Perturbation analysis of the results of the chopped lucerne diet and a high concentrate diet showed that sheep at low intakes, accommodated increased intakes mainly by increasing the rate constant which describes the fermentation and outflow of fermentable OM. This rate constant became less important as intake was increased and was progressively replaced by rumen fill, which accommodated 65% of increased intake at 1400 g OM intake.

'n Eksperiment is uitgevoer met agtien skape op 'n gekerfde lusern dieet. Vooraf behandeling het 'n betekenisvolle effek gehad op die vlak waarop die diere aanvanklik *ad lib* vrywillige voerinname gestabiliseer het. Hierdie verskille het egter verdwyn nadat die diere drie weke lank *ad lib* voer ontvang het.

Perturbasie analise van die resultate van 'n gekerfde lusern – en 'n hoë kragvoer dieet het gewys dat skape teen lae innames 'n verhoging in inname hoofsaaklik geakkomodeer het deur 'n verhoging van die tempokonstante wat die fermentasie en uitvloei van fermenteerbare OM gesamentlik beskryf. Hierdie tempokonstante het minder belangrik geword met verhoogde inname, en is progressief vervang deur rumen vulling, wat 65% van 'n verhoging in inname geakkomodeer het by 'n daaglikse inname van 1400 g OM.

Keywords: Sheep, intake, control, rumen

Introduction

Accurate prediction of voluntary feed intake is essential for an accurate feed evaluation system. It is perhaps the most difficult component of animal performance to predict. Earlier workers (Greenhalgh & Reid 1974) have shown that previous level of intake has a significant effect on the voluntary feed intake of sheep. Rumen dynamics is defined as the way in which an animal accommodates changes in intake in terms of changes in ruminal fill, outflow of unfermentable OM and in the combined rate constants for outflow and fermentation of fermentable OM. The aim of this study was firstly to determine if the rate at which an animal approaches *ad lib* intake from maintenance influences the level at which the animal will eventually control intake and secondly to investigate rumen dynamics at different levels of intake.

Methods

Two experiments were conducted using 18-cannulated sheep in each experiment. In the first experiment a pelleted high concentrate diet with an OM digestibility of 84% was used and in the second experiment a chopped high quality lucerne diet with an OM digestibility of 65% was fed. In both experiments all sheep were initially fed at a maintenance level for at least six weeks. They were then divided into three groups each, and a group's feed allowance was increased in daily increments so as to reach a calculated *ad lib* intake (= 2,5 × maintenance) in either seven days, 21 days or 90 days.

The mass of organic matter in the rumen was determined by emptying the rumen at 15h00 and 8h00 which represented the times at which maximum and minimum diurnal rumen fill were expected for these experiments. A combined estimate of the rate constants for outflow and fermentation of fermentable OM in the rumen, was obtained by dividing digestible OM intake by the mass of *in vitro* digestible OM in the rumen. The rate constant for the outflow of unfermentable OM from the rumen was determined as described by Pienaar, Roux, Morgan & Grattorola (1980).

The accommodation of increased intake through either increasing rumen fill (Z), outflow of unfermentable OM (γ_2) or fermentation and outflow of fermentable OM ($\gamma_1 + \gamma_0$) was obtained by perturbation analysis on the regressions obtained between OM intake and the changes in Z, ($\gamma_1 + \gamma_0$) and γ_2, using the equation for intake described by Pienaar *et al* (1980).

Perturbation analysis was done by keeping two of the variables constant and changing one of them by the increment associated with a change of 20 g in intake. This gave the relative fraction of intake that was accommodated by each of the variables at a specific level of intake.

Results and Discussion

The effect of previous level of intake on the level at which voluntary feed intake was established on the lucerne diet is shown in Figure 1.

Figure 1 shows intake from the first time sheep left 10% orts onwards. It is clear that the group which attained *ad lib* intake after one week did so at a much lower level than the groups which took three weeks and three months. This difference was statistically significant. After about three

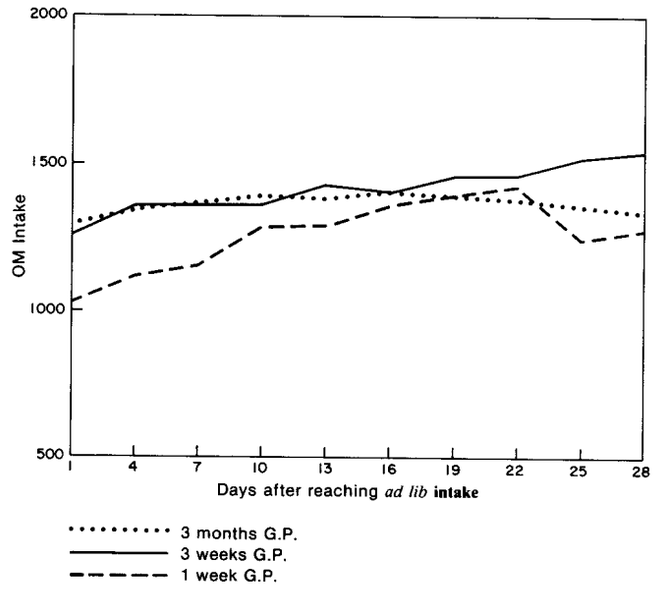

Figure 1 Patterns of voluntary intake after reaching *ad lib*, following either a one week, three week or three month period of increasing intake from maintenance to *ad lib*.

weeks this difference had disappeared completely and all three groups had approximately the same voluntary feed intake. The divergence in intake after the intakes had converged remains to be explained. The results of the high concentrate diets are not presented as two of the three groups did not attain *ad lib* intake because they developed rumen wall erosion caused by prolonged acidic conditions in the rumen.

The accommodation of increased voluntary intake at different levels of intake is presented in Table 1. The results of the three treatment groups in each diet have been pooled since all consistent variation between treatment groups within diets had disappeared when the results were expressed in terms of voluntary feed intake. The increase in OM intake given in Table 1 is well within the limits attained with both diets.

From Table 1 it can be seen that at low intakes the largest part of the increased intake (55 & 45% on the concentrate and roughage diet, respectively) was accommodated by increasing ($\gamma_1 + \gamma_0$). This component however, showed, a steadily declining effect on both the concentrate and roughage diets.

Increasing rumen fill (Z) accounted for a small part (35%) of the increased intake at low intakes, but became the major factor (65%) in both concentrate and roughage diets at higher intakes. The smallest part (10 & 20%) of increased intake at low intakes was accounted for by γ_2, but it showed a steady increase with increased intake. On the concentrate diet Z remained relatively unimportant (20%) even at high intakes but with the roughage diet it played an important role at high intakes (40%).

Table 1 The accommodation of increased voluntary intake at different levels of intake for a roughage and concentrate diet, determined using perturbation analysis and expressed as a percentage of increased intake.

	Concentrate diet		
OM Intake	Increased fill (Z)	Increased outflow (γ_2)	Increased fermentation & outflow ($\gamma_1 + \gamma_0$)
400	35	10	55
650	45	15	40
900	52	19	29
1150	60	20	20
1400	65	20	15
	Roughage diet		
OM Intake	Increased fill (Z)	Increased outflow (γ_2)	Increased fermentation & outflow ($\gamma_1 + \gamma_0$)
400	35	20	45
650	50	30	20
900	58	37	5
1150	62	38	0
1400	65	40	−5

Although the pretreatment of sheep significantly influenced the level at which they established voluntary intake in one group, this difference had disappeared within three weeks at *ad lib* intake and intakes were similar for all three groups at that stage.

The way in which sheep accommodated their increased intakes, showed that the different components of intake did not have the same relative importance at different levels of intake. Rumen fill (Z) was the most important at high intakes and ($\gamma_1 + \gamma_0$) was the most important at low intakes. Over the whole range of intakes with concentrate diets γ_2 was relatively unimportant, but increased in importance with roughage diets.

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