

THE INFLUENCE OF LIVE WEIGHT ON THE VOLUNTARY INTAKE OF LOW QUALITY ROUGHAGE BY MERINO SHEEP AND ITS IMPLICATIONS FOR SUCCESSFUL OVERWINTERING ON GRASS VELD

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OPSOMMING: DIE INVLOED VAN LIGGAAMSGEWIG OP DIE VRYWILLIGE INNAME VAN SWAK KWALITEIT RUVOER DEUR MERINOSKAPE EN DIE INVLOED DAARVAN OP SUKSESVOLLE OORWINTERING OP GRASVELD.

In verterings- en voerproewe met volwasse Merinohamels, waarin koringstrooi met 'n ureumbevattende mengsel aangevul is, is die volgende gevind: (a) Swak kwaliteit ruvoer mag die liggaamsgewig van Merinoskape onderhou as hul organiese materiaal verteerbaarheid nie minder is as 45%. (b) 'n Organiese materiaal verteerbaarheidsvlak van 45% mag verkry word wanneer ureumbevattende lekkie aangevul word tot swak kwaliteit ruvoere wat soortgelyk is aan koringstrooi. (c) 'n Onderhoudsrantsoen, wat hoofsaaklik uit swak kwaliteit ruvoer bestaan, kan liggaamsgewig onderhou maar kan dit nie verhoog nie as gevolg van die nou verwantskap wat daar bestaan tussen vrywillige voerinname en metaboliese liggaamsgrootte. (d) Verteringsstimulerende lekkie behoort aan diere voorsien te word vanaf die stadium wanneer die voedingswaarde van die weidings begin afneem en die diere nog in goeie kondisie is. Dit sal verseker dat die somerkondisie van diere beter gehandhaaf word gedurende die winter as gevolg van 'n tydige voorkoming van 'n te vinnige afname in ruvoerverteerbaarheid en -inname. Die beter kondisie van die diere sal op sy beurt weer 'n groter daaglikse voerinname verseker as gevolg van die verwantskap tussen laasgenoemde faktor en die metaboliese grootte van die dier.

SUMMARY:

In experiments with adult Merino wethers, where wheat straw was supplemented with an urea-containing mixture, the following was found: (a) Poor quality roughage may maintain the body weight of Merino sheep provided that the organic matter digestibility is not lower than 45%. (b) An organic matter digestibility level of 45% can be attained by supplementing low quality roughages similar to wheat straw with urea-containing licks. (c) A maintenance ration consisting mainly of low quality roughage can maintain live weight, but will not increase it due to the close relationship that exists between voluntary feed intake and metabolic body size. (d) Digestion stimulatory licks should be made available to ruminants from the stage when the nutritional value of pastures begins to decrease and the animals are still in a good condition. This will ensure that the summer condition of the animals is maintained to a greater degree as a result of a timely prevention of a sudden decrease in the intake and digestibility of roughage. The better condition of the animals will, in turn, ensure a greater feed intake as a result of the relationships between the latter factor and the metabolic body size of the animal.

Introduction

Maximum digestibility and crude protein content of grass veld occurs only for an exceptionally short period during summer and decrease rapidly towards minimal values during winter (Van Schalkwyk, Lombard & Vorster, 1968; Louw, Steenkamp & van der Merwe, unpublished data). Voluntary feed intake by grazing animals decreases proportionately with decreasing nutritional value, as indicated by Milford & Minson (1965), and in this way accelerate the decrease in productivity of the animals.

According to Bishop, Grobler & Smith (1966) cattle may lose 20 per cent of their live weight during winter, while wool production may be decreased by 22% (Swart, van Schalkwyk, Hugo & Venter, 1963). The importance of maintaining live weight was demonstrated by Harwin, Lamb and Bisschop (1967) who found that the weight of Afrikaner heifers at commencement of the breeding season had a significant influence on the subsequent birth rate and the interval from exposure to conception. The same principle applies to Angora ewes (Marais, 1968) and apparently to all ruminants.

Since voluntary feed intake by ruminants is related to apparent digestibility of the food (Blaxter, 1963), as well as metabolic body size (Blaxter, Wainman & Wilson, 1961),

the question arose what effect a drop in roughage digestibility would have on the feed intake of sheep when they are either in good or poor condition. The practical implication is whether supplementary feeding of digestion stimulatory licks should commence at an early stage when the nutritional value of veld is only starting to decrease, but the animals are still in a good condition, or at a much later stage when both digestibility of the grazing and the metabolic live weights of the animals have decreased to some extent.

The ideal would be to feed veld grass like *Themeda triandra* in these experiments. However, it is often found (Louw & Steenkamp, unpublished) that when veld grasses are dried and milled, the straw breaks into fine needles which damage the sheep's intestines. For this reason wheat straw was fed instead. The digestibility of wheat straw was determined with and without the supplementation of an urea-containing stimulatory lick. The first ration was subsequently fed on an *ad lib.* basis to sheep with average live weights of 54,5 kg and 36,4 kg in order to determine the relationship between metabolic live weight and voluntary feed intake.

Digestibility trial Procedure

Sheep: Twelve full-grown Merino wethers with live

Table 1

Composition of rations (formulation on air dry basis) and chemical analysis on an absolute dry basis.

Constituent		Contents	
		Control	Experimental
Wheat straw	%	97,75	89
Urea	%	—	0,75
Maize Meal	%	—	3
Molasses Distrillers' Dried Solubles	%	—	5
Mineral-vitamin mixture*	%	2,2	2,25
Crude protein	%	2,1	5,5
Crude fibre	%	41,8	36,4
Ether extract	%	1,9	1,4
Ash	%	6,2	6,9
N.F.E.	%	48,0	49,8
Gross energy	kcal/g	4,20	4,31

*Composition of mineral-vitamin mixture (25 kg):

NaCl	11,5 kg
Ca(H ₂ PO ₄) ₂ H ₂ O	11,5 kg
FeSO ₄ .6H ₂ O	283 g
MnSO ₄ .4H ₂ O	185 g
CoSO ₄	0,5 g
CuSO ₄ .H ₂ O	90 g
Vitamin A	2,75 mil. I.U.
Vitamin E	6 g
Vitamin D	5 g

weights varying from 40 to 45 kg were divided into two groups of six animals each.

Rations: Wheat straw was milled by hammer mill fitted with a 6 mm screen. Both rations were pelleted and were constituted as in Table 1.

Data collection: Standard procedures for digestibility trials were followed. The adaptation period lasted 21 days and the collection period seven days.

Experimental design: Randomized block.

Feed intake trial

Sheep: Fifteen full-grown Merino wethers were specially fattened to an average live weight of 54,5 kg.

Ration: The experimental ration tested in the digestibility trial was fed.

Feeding programme

The sheep were fed according to the following schedule:

- 54 days *ad libitum*,
- 40 days 200 g/sheep/day,
- 40 days *ad libitum*.

Fresh food was supplied every morning after refusals from the previous day were weighed.

Data collection: Daily feed intake was determined during the *ad libitum* feeding periods. During these periods the sheep were weighed every second morning before feeding.

Results

The data obtained from the metabolic trial are given in Table 2. The over-all improvement of the nutritional value of wheat straw as a result of the supplement is obvious. According to Blaxter (1962) a roughage should have a digestibility of approximately 44% to ensure maintenance of sheep. The nutritional value of the control ration was considered to be too low to maintain the sheep and was not tested in the intake trial.

Table 2

Digestibility data (on a dry basis)

		Ration		
		Control	Experimental	F Calculated
Daily intake	g	340	772	24,75**
Organic matter digestibility	%	38,3	45,1	4,31
Apparent protein digestibility	%	— 75,0	36,6	70,72**
Apparent digestible energy	Mcal/kg	1,38	1,84	11,30*
Nitrogen retention	g/day	— 2,51	— 0,53	19,50**

F required * P 0,05 = 6,61
** P 0,01 = 16,26

The average live weights and daily feed intake values of the sheep in the intake trial are given in Fig. 1.

The data in Fig. 1 indicate that the sheep, when fat, lost live weight gradually during the first 30 days of the trial. From then onwards their average live weight remained more or less constant at about 50 kg. Although their average daily feed intakes fluctuated considerably the general trend was constant.

During the second period of *ad lib.* feeding the average live weight of the sheep remained constant at approximately 36,4 kg. However, their average daily feed intake remained at a relatively lower level for 20 days and then suddenly shifted upwards. This apparent adaptation period was not taken into account when the intakes per metabolic live weight unit were calculated.

The daily feed intakes during the two periods of *ad lib.* feeding were:

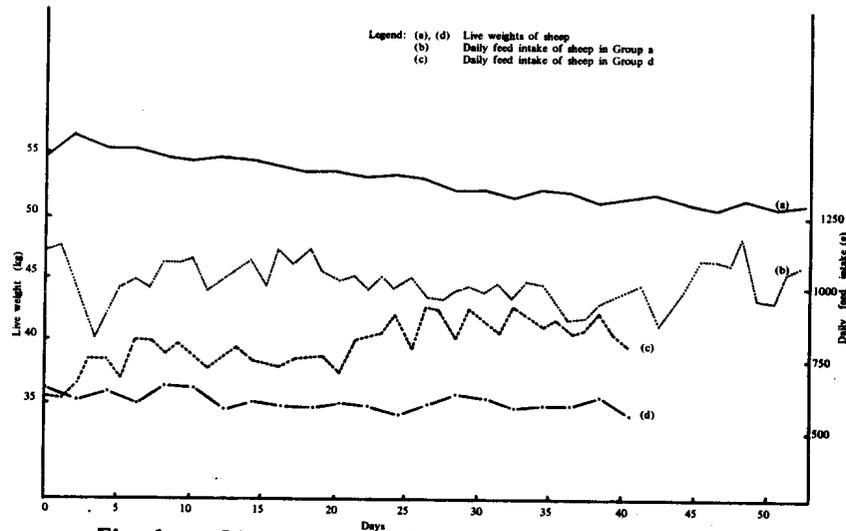


Fig. 1. - Live weights and daily feed intakes of sheep.

(a) *Fat sheep:*

Dry matter, $53,8 \pm 10,6 \text{ g/Wkg}^{0,73}$

Apparent digestible energy, $99,1 \text{ kcal/Wkg}^{0,73}$

(b) *Lean sheep:*

Dry matter, $55,3 \pm 18,6 \text{ g/Wkg}^{0,73}$

Apparent digestible energy, $101,7 \text{ kcal/Wkg}^{0,73}$

These results indicate that sheep apparently eat slightly more per unit metabolic live weight when lean than when they are fat.

Discussion

The gradual decrease in average live weight of the fat sheep during the first 30 days may partly be due to a decrease in weight of the intestinal contents. The maintenance of average live weights at approximately 50 kg and 36 kg during the first and second periods of *ad lib.* feeding, respectively, supports the finding of Blaxter (1962) that a digestibility of approximately 44% is the minimum value required for maintenance of sheep. The fact that the sheep could be maintained at live weights of both 50 and 36 kg, may be ascribed to the difference in metabolic size resulting in corresponding proportional feed intakes.

The relatively low level of feed intake by the sheep when lean during the first 20 days of the second *ad lib.* feeding period is in accordance with the results obtained by Blaxter, Wainman & Wilson (1961). These workers found that maximal intake of poor quality roughage only occurred subsequent to the twelfth day of feeding.

The finding that the sheep, when fat, ingested on an average $2,6 \text{ kcal/Wkg}^{0,73}$ less than when they were lean supports a conclusion of Campling (1964) in this connection. The daily digestible energy intake of $101,7 \text{ kcal/Wkg}^{0,73}$ by the lean sheep agrees with the value of $101,9 \pm 12,8 \text{ kcal/Wkg}^{0,73}$ obtained by Blaxter et al. (1961) for poor quality hay.

The practical implications of these results are, that the live weights of animals may be maintained at a fairly high level during winter, provided that the digestibility of the roughage diet, such as veld grass, can be increased to 45% by stimulation of ruminal digestion. A ration consisting mainly of poor quality roughage, will maintain live weight but will not increase it on account of the close relationship between roughage digestibility, voluntary feed intake and metabolic body size.

Referring to the results obtained by Van Schaikwyk et al. (1968) it would therefore be advantageous to start supplementing grass veld with digestion stimulatory licks as soon as its nutritional value starts to decrease. Relatively heavy live weights obtained during the period of active vegetational growth may be maintained more successfully. If on the other hand conditions are such that the animals break down, lost body weight may not be regained economically and productivity such as wool production and fertility may be affected adversely.

Conclusions

- (a) Low quality roughages may maintain the live weight of Merino sheep if their organic matter digestibility is not less than approximately 45%.
- (b) An organic matter digestibility level of 45% may be achieved by supplementing low quality roughages, equivalent to wheat straw, with urea-containing licks.
- (c) A ration, consisting mainly of poor quality roughage, can maintain live weight but can not increase it on account of the close relationship between voluntary feed intake and metabolic body size.
- (d) Digestion stimulatory licks should be supplied from the stage when the nutritional value of the grass starts to decrease, and when the animals are still in good condition. This will ensure that the summer condition of animals will be maintained much better during winter as a result of a timely prevention of too fast a

retrogression of roughage digestibility and intake. The better condition of the animal will, in turn, ensure a bigger daily feed intake due to the relationship between the latter factor and metabolic size of the animal.

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