A SIMPLIFIED TECHNIQUE FOR PERMANENT RUMEN FISTULATION OF CATTLE

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Summary

A single-stage technique for the establishment of permanent rumen fistulae in cattle is described.

I. INTRODUCTION

Techniques for the establishment of rumen fistulae in cattle have been described by Dougherty (1955), Schnautz (1957), Harrison (1961) and Balch and Cowie (1962). The last mentioned method was based on that of Schalk and Amadon (1928).

This note describes a technique for the establishment of a rumen fistula which appears to offer a number of advantages over previous techniques.

II. METHOD

Food, but not water, is withheld from the animal for about 24 h. The animal is then placed in a crush bail, and sedated a tranquillizer such as promazine* or ethyl isobutrazine†.

The hair of the left paralumbar fossa is clipped. The skin is washed with an antiseptic solution‡, and anaesthetised with 20 ml 2% lignocaine§ distributed in a horizontal line above and along the length of the proposed vertical incision with a 5 cm x 18 gauge needle.

For an adult beast an incision 1 l-l 2 cm long is made through the skin 4 cm posterior and parallel to the 13th rib and 5 cm ventral to the transverse processes of the lumbar vertebrae. The muscles of the abdominal wall are parted by blunt dissection and the peritoneum is incised with scissors. The rumen wall is grasped with Allis peritoneal forceps in a position anterior to the incision and pulled into the opening. Two sutures of No. 3 chromic cat-gut are inserted into the rumen wall to enable an assistant to hold it in position during suturing.

The rumen wall is sutured firstly to the muscles and peritoneum with three mattress sutures of No. 3 chromic cat-gut on each side of the incision, and then to the skin in a similar manner with 0.6 mm synthetic surgical suture material". These last mentioned sutures are placed as close to the edge of the incision in the skin as possible. To facilitate this last procedure, 2 mm holes are punched in the skin with leather-punch pliers.

On completion of suturing, the wall of the rumen is incised and the cannula¶ as designed by Balch and Johnson (1948) and modified by Balch . and Cowie

*Sparine, Wyeth Pharmaceuticals Pty. Ltd.

†Diquel, Jensen-Salsbery Laboratories.

‡Savlon, I.C.I.A.N.Z. Ltd., diluted 1 in 6 with industrial methylated spirits.

§Xylocaine, Astra Pharmaceuticals (Australia) Pty. Ltd.

¶Vetafil, Bengen & Co.

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administered once every 12 weeks (500,000 i.u. of each). There were two consecutive experimental periods, each of 15 weeks; the rations of ground and pelleted feed were designed to support a low rate of wool growth during period 1 (designated low nutrition) and a high rate of wool growth during period 2 (designated high nutrition). Initial body weight was used as the basis for calculating feed intake throughout the experiment. During period 1, the daily ration was 10 g/kg body weight of a diet of equal parts lucerne hay and oats grain. The diet contained 9.9 % crude protein; daily feed intakes were 410-560 g. During period 2, the daily ration was 25 g/kg body weight of a diet consisting of lucerne hay (35 %), oats grain (35%) and linseed meal (30%), plus sodium chloride (0.5%). The diet contained 18.7% crude protein; daily feed intakes were 1020-1390 g.

(b) Wool Growth

Wool was removed from an area on the midside (c. 10 x 10 cm), defined by tattooed lines, at intervals of three weeks with small animal clippers (Oster size 40); the samples were cleaned by the method of Reis (1967). The total amount of clean, dry wool grown by the sheep (g/day) was calculated as described by Reis and Schinckel (1964). Wool growth rate on each diet was calculated from the mean rate during the last six weeks of each feeding regime. Clean, dry wool growth (g/day) during a previous grazing period was derived from the results of Reis et *al.* *(1967).*

(c) Sulphur Content of Wool

Wool grown on the midside patch during the last two 3-week periods on each diet was analysed for sulphur by the method of Reis and Schinckel (1963). The sulphur content of the wool grown on each diet (percentage in clean, dry wool) was taken as the mean of these two values. Sulphur values for wool grown during periods of grazing are derived from data collected during previous studies (Reis and Williams 1965; Reis et *al.* 1967).

III. RESULTS

There were considerable differences between sheep in the sulphur content of the wool grown; while there were minor differences in ranking for this characteristic, the general pattern was similar at both levels of controlled nutrition and during grazing (Figure 1). The range of values for sulphur content of wool within the group was about 3.0-3.9% during the period of low nutrition, 3.4-4.2% during the period of high nutrition, and 3.1-3.9 % during grazing (Figure 1). The values during controlled feeding represented an increase of from 9-23 % (mean 18%) in sulphur content due to improved nutrition, concomitant with increases in wool growth rate of 42-161% (mean 110%).

There was an inverse relationship between sulphur content and growth rate of wool between sheep during the period of high nutrition; this relationship was indefinite during the period of low nutrition due to the compression of the range of wool growth rates (Figure ***2a).*** An inverse relationship was also obtained for these sheep during grazing (Figure ***2b);*** the range of values for wool growth and sulphur content within the group was intermediate between that obtained during the two controlled feeding periods. The substantial range in sulphur content and in rate of wool growth is also evident from this figure.

TABLE 2

Analysis of variance and expected mean square for faecal output of lambs (g/day)

(i) Analysis of Variance.

Source of Variation	d.f.	Mean Square in Relation to Mean Age of Lambs (weeks)					Expected Mean Square			
		2	9	12	15	21	V_s	V_d	V_{sd}	V_e
Between Sheep	12	33	505	541	1248	514	4	0	1	1
Between Days	3	1671	3080	3214	1930	6554	0	13	1	1
Sheep x Days	36	65	250	171	250	1224	0	0	1	1

NOTE: Because there is only one observation per subclass, V_{sd} and V_e cannot be distinguished. In the subsequent Table, it is assumed that V_{sd} denotes V_{sd} and V_e.

(ii) Estimates of Variance Components.

Source	Mean Age of Lambs (weeks)				
	2	9	12	15	21
Sheep V_s	Zero	64	93	250	Zero
Days V_d	124	218	234	129	410†
(d.f.)*	(11.1)	(10.1)	(10.7)	(9.0)	(7.8)
Error V_{sd}	65	250	171	250	1224†
(d.f.)	(36)	(36)	(36)	(36)	(36)

*The approximate degrees of freedom are calculated from Satterthwaite (1946).

†410 $\ngtr$ 124, 1224 > 65 ($P<0.01$)—Pearson and Hartley (1954) Table 31.

Variation between sheep varied in extent from period to period within the limits of the sheep by day source.

Table 3 shows for lambs of two ages, the standard deviation of the mean daily faecal output calculated from Table 2 on the basis of:

(a) measurements on the same sheep from each flock on each day,

(b) measurements on different (random) sheep from each flock on each day.

From Table 3, it is clear that to obtain the same order of accuracy with sheep of 21 weeks as compared with sheep of 2 weeks of age, a considerable increase in the number of measurements is necessary. However, a bias could arise

TABLE 3

Relationship of the standard deviation of means (from Table 2) to the number of sheep sampled and their age

No. of Sheep	No. of Days	2-week-old lambs		21-week-old lambs	
		(a)	(b)	(a)	(b)
1	1	8.056	13.726	34.986	40.426
	4	4.028	6.863	17.494	20.213
12	1	2.326	3.962	10.100	11.670
	4	1.163	1.991	5.050	5.835

(a) where the same sheep are sampled from day to day.

(b) where different sheep are sampled (at random) from day to day.

TABLE 1

Variation in Sulphur Content** of **Wool grown during Controlled Nutrition and during Grazing

Sheep	Percent Sulphur in Clean Dry Wool		
	Controlled Nutrition	Grazing Studies	
		1962-63	1964-65
773	3.18-3.86	3.00-3.74	—
621	3.14-3.85	3.23-3.78	—
628	3.21-3.98	3.26-3.86	—
641	3.26-4.05	3.48-3.88	—
714	2.94-3.63	3.10-3.66	—
823	3.52-4.16	3.72-3.92	3.68-3.94
627	2.97-3.42	2.93-3.45	3.00-3.38
748	3.14-3.57	—	3.06-3.44
754	3.06-3.78	—	2.96-3.54
517	3.37-4.13	—	3.56-3.94
614	3.82-4.28	—	3.87-4.02
36	3.45-4.22	—	3.89-4.04

Note: Values during controlled nutrition are extremes obtained in wool grown during periods of low and high nutrition. Values during grazing are extremes for wool collected at intervals of approximately six weeks over periods of one year. Sulphur is expressed as percentage in clean dry wool.

IV. DISCUSSION

This study has demonstrated that differences between sheep in ranking for wool sulphur content are reproducible under different nutritional regimes, and that sulphur content and growth rate of wool are inversely related between sheep under controlled feeding conditions. The substantial effect of nutrition on the sulphur content of wool has also been confirmed. The results substantiate the contention of Reis ***et al.*** (1967) that differences in sulphur content between wools grown by different sheep grazed together are mainly an expression of individuality.

The finding of an inverse relationship between wool growth rate and sulphur content of wool was not unexpected as these sheep were selected from a larger group studied by Reis ***et al.*** (1967), which had shown this relationship when grazed together. Nevertheless, it has now been demonstrated that this relationship can be obtained during controlled feeding, which eliminates the possibility that individual variation in dietary intake affects the relationship. To minimise the influence of body size on the amount of wool grown, the sheep were fed in proportion to their body weight. If efficiency of wool growth is expressed as wool grown per unit feed intake, sheep with the higher wool growth rates in this experiment are obviously the more efficient converters of feed to wool. Thus, as suggested by Reis ***et al.*** (1967), sheep with a high efficiency of conversion of feed to wool tend to grow wool with a low sulphur content.

It is apparent from the data in Table 1 that the substantial seasonal changes observed in the sulphur content of wool grown by Merino wethers in the field (Reis and Williams 1965) can be accounted for wholly by the effects of variable nutrition. This may not be so for pregnant or lactating sheep, or for breeds of sheep that exhibit a pronounced annual rhythm of wool growth.

Fig. 1.—Components of equipment showing rubber funnel (top right) metal flange that is inserted in the funnel (top left), rubber ring for holding collection bag over the flange (bottom left), and equipment assembled with cotton tapes.

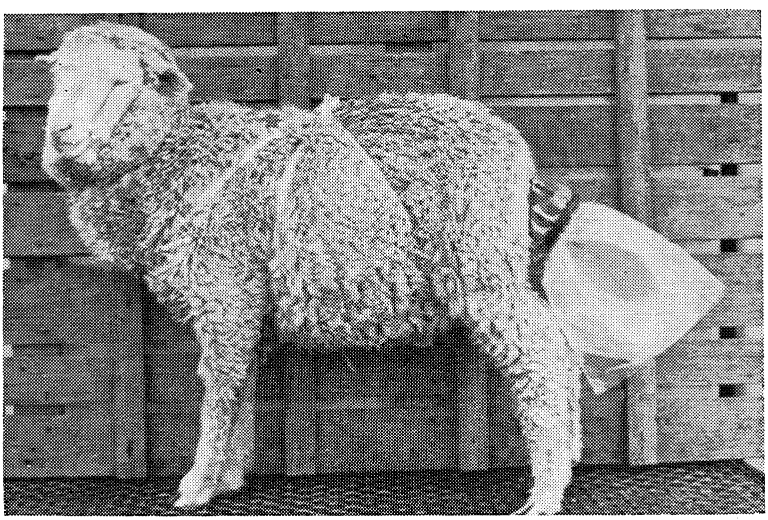

Fig. 2.—Sheep wearing harness and collection bag.