THE EFFECT OF PARTICLE SIZE ON THE ORGANIC MATTER DIGESTIBILITY OF SODIUM HYDROXIDE TREATED CHOPPED WHEATEN STRAW

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In a comparison of *in vivo* and *in vitro* digestibilities of NaOH-treated wheaten straw, it was found that the *in vitro* technique overestimated the *in vivo* digestibility to a greater extent than is normally the case with untreated materials (Hofmeyr – unpublished data). The most probable explanation for this may be found in the work of Morgan (1975, personal communication). He studied the effect of NaOH treatment on the mean retention time of organic matter (OM) of grass hay (Kikuyu) in the rumen. The mean retention time of this hay was found to be 50% shorter than that of the untreated hay. It was thus hypothesized that this increased rate of flow of OM from the rumen is probably the reason for the lower than expected *in vivo* digestibility values.

It was reasoned that the NaOH treated straw is not retained in the rumen long enough for maximum bacterial degradation. It is also well known that the retention time of OM in the rumen is dependant on the particle size of the OM. The coarser the particle, the longer the retention time (Weston & Hogan, 1967).

The purpose of the present investigation was to determine if increasing the particle size of the NaOH-treated straw, would increase the *in vivo* digestibility of OM as result of the longer mean retention time in the rumen.

Four mature S.A. Mutton Merino wethers received a diet consisting of 5% NaOH-treated chopped wheaten straw fed *ad libitum*. The straw was chopped to a mean 25 mm particle size (CH) prior to treatment. After NaOH-treatment, half of the straw was reduced in particle size to mean 6 mm (MH). Two groups of wethers were selected at random and each group was fed each of the treatments in a switch-over design. Because of the low nitrogen content of the straw, the diets were fortified with a 2:1 mixture of fishmeal and casein. This mixture was administered directly into the rumen *via* a rumen cannula and the amount administered was calculated to be 15% of the air dry intake of straw for the preceding 12 hours. Voluntary feed intake was determined at 12 hour intervals.

Table 1 indicates the effect of particle size on the various parameters related to digestibility. The 25% increase in retention time in the rumen of OM due to the larger particles shows that in this respect the experiment had succeeded. In the same instance, however, OM intake of the larger particle was 25% lower. Thus retention time of OM in the rumen has a definite effect on intake.

Initially it was hypothesized that OM digestibility of NaOH-treated straw would increase if the retention time of OM in the rumen was increased by feeding larger particles. Table 1 indicates that in this respect the contrary was obtained. Although the larger particle remained 25% longer in the rumen, the OM digestibility was 7% lower than that of the fine particle straw. This was probably due to a reduced surface area available for bacterial contact.

In conclusion it can be stated that although the increase in particle size of the straw caused an increase in the mean retention time of OM in the rumen, both OM digestibility and intake were markedly reduced. Thus no advantage was gained by increasing particle size to try and improve OM digestibility.

References

WESTON, R.H. & HOGAN, J.P. 1967. The digestion of chopped and ground roughages by sheep 1. The movement of digesta through the stomach. *Aust. J. agric. Res.* 18, 789.

Table 1

Parameters related to the digestibility of milled (6 mm) and chopped (25 mm) NaOH-treated wheaten straw

Parameters	Particle size (mm)	Sheep 1	Sheep 2	Sheep 3	Sheep 4	$\bar{x}$	S.D.
Ad libitum OM intake (g/day)	25	814	942	802	886	861	66
	6	1292	1012	1036	978	1080	144
Mean retention time of OM (h)	25	30,3	19,4	24,2	24,5	23,0	5,2
	6	21,2	17,0	16,3	20,4	18,4	2,2
OM digestibility	25	67,4	75,0	61,0	69,4	68,6	5,1
	6	77,0	70,0	73,7	80,6	73,7	5,4