

EVALUATION OF A WHEY BASED PRODUCT  
INCORPORATED IN DIETS FOR THE LIVE SHEEP TRADE

B. BOGDANOVIC\*, N. GUIRGUIS\*\* and R.W. HODGE\*

**SUMMARY**

The value of a product prepared from whey effluent to replace the hay component of a pelleted feed used in the live export of sheep was investigated with adult Merino wethers in an experiment lasting four weeks. None, 100% and approximately 33 and 67% of the hay was replaced with the whey based product. After gradual adaptation from hay to pellets over the first 7 days, all diets were offered at the rate of 1.1 kg/hd/d for an additional period of 21 days. The results show that, nutritionally the whey based product can adequately replace the hay in the pellet, either wholly or in part. However, pellets with large amounts of whey product were eaten more slowly. This could have an effect, either positively or negatively on the incidence of sheep with low-feed intake syndrome.

**INTRODUCTION**

Whey as a by-product of the cheese and casein manufacturing industry, contains valuable nutrients, namely lactose, proteins, some fat and minerals. Of 1.65 m tonnes of whey produced in Australia annually over 60% is wasted (Zadow, 1987) and disposal is a growing problem. One of the ways to reduce this problem would be to process more whey into useful products such as stock feed. Recently, technology has been developed (Guirguis, 1988) which extracts nutrients from the whey to produce a product which may be suitable as a component of pelleted feed produced for the live sheep export trade. The estimated energy (8 MJ/kg DM) and crude protein (11%) content of this product compares favourably with the pasture hay available in Victoria (Saul and Flinn, 1983) for manufacture of pellets for the live sheep export trade. The objective of our experiment was to determine the effect on rate of feeding and liveweight change of progressively replacing the roughage component of a commercial pellet used in the live sheep trade with the whey based product.

**MATERIALS AND METHODS**

*Animals*

One hundred and twenty mature Merino wethers previously grazing annual pastures were allocated by stratified randomization on live weight (mean = 52.3, s.d. = 3.3 kg) to one of 4 diets and to one of 5 replicates each of 6 animals in a fully randomised design. Animals familiar with pens and pelleted feed were used in order to minimize the problem of shy feeders. Animals were housed in partly shaded outside pens (4.5 x 8.0 m). Clean water was freely available. The sheep were fed for a period of four weeks, simulating a feeding regime similar to that employed in the trade.

*Diets and feeding*

The diets were mixed and pelleted at the Heywood Stockfeeds mill using the ration ingredients and composition currently fed to sheep during the assembly phase and on board ship. One tonne of each diet was prepared and the amount of

---

\* Animal Research Institute and \*\*Food Research Institute, Department of Agriculture and Rural Affairs, Werribee, Vic. 3030.

when based product required to replace 33, 67 and 100% of the hay in the ration was pre-weighed (diets 2, 3 and 4 respectively). However, the amount of hay and grain included in the diets was based on that delivered by conveyor belt or auger per unit time (calculated by mill operator) and hence only an approximate estimate of the composition was possible. The composition of the commercial diet (diet 1, control) was approximately 55% pasture hay, 43% concentrates (mixture of grains) and 2% mineral mix. The whey based product contained 6.6% moisture, 1.3% fat, 5.3% whey protein, 1.0% urea, 27.6% acid detergent fibre, 40.4% nitrogen free extract (lactose) and 17.8% ash (approximately 8% bentonite). All diets were pelleted through a 9 mm die after the roughage had been tubground through a 100 mm screen and hammermilled through a 9 mm screen. The chemical composition of the diets is set out in Table 1.

Table 1 Chemical composition (% dry matter)

Ingredient	Diet			
	1	2	3	4
Dry matter	90.5	92.2	91.7	91.4
Crude protein (N x 6.25)	11.1	9.5	11.1	13.2
Acid detergent fibre	28.6	32.4	28.1	22.5
Ash	8.1	8.8	10.9	12.2

Diets 1,2,3 and 4 contained respectively, none and approximately 18, 37 and 55% as fed of the whey based product.

The sheep were initially offered 1 kg/hd of pasture hay which was progressively replaced by one of the four pelleted diets so that by day 7 only pellets were fed. The pellets were offered at the industry recommended rate of 1.1 kg/hd/d in covered galvanized troughs, providing 0.3 m of trough space per sheep.

#### Measurements

Fasted live weight (24 h: fast without water) and condition score (on the scale 1-5) were determined at the beginning and end of the experiment.

During the second week daily visual estimates were made of the feed remaining at 2.5 and 7.5 hours after the rations were fed.

At the end of the four week period, 6 sheep of similar live weight were selected from each treatment and housed in metabolism cages for 17 days to determine digestibility. The amount fed was 1.1 kg/hd/d. Faeces were collected over the last 7 days and 5% of the fresh faeces dried at 100°C for 24 hours. Dry faeces were bulked, ground through a 0.5 mm screen and ashed to determine organic matter digestibility,

#### Statistical analyses

Results from individual animals were averaged and replicate means used as data for the analysis of variance. Individual results were used for the analysis of digestibility data.

### RESULTS

The change in live weight and condition score of the sheep, the digestibility of the diets and the visually estimated rate of consumption are set out in Table 2.

There was a trend for less liveweight loss (linear trend on % whey,  $P < 0.1$ ) and less condition score loss (linear trend of  $P < 0.01$ ) in the diets with more whey

based product. The organic matter digestibilities did not closely reflect this trend although diet 4 had the greatest digestibility and smallest losses in live weight and condition score.

Each ration (1.1 kg/hd/d) was consumed over a 24 h period throughout the experiment but diet 4 was consumed at a slower rate than the other diets.

Table 2 Live weight and condition score, digestibility and feed residues

Attribute	Diet				s.e.d.
	1	2	3	4	
Liveweight change (kg)	-3.0	-3.4	-2.7	-2.4	0.36
Condition score change	-0.2	-0.2	-0.1	-0.1	0.05
Digestibility (DOM%)	59.2	54.6	55.5	64.3	1.05
Feed residues*					
2.5 h	14	5	19	47	5
7.5 h	5	0	5	13	4

\* Estimated % of pellets left in feed troughs 2.5 and 7.5 h after feeding (second week)

#### DISCUSSION

The small difference between diets in live weight and condition score loss is of little practical importance (Table 2). The mean liveweight loss experienced by the sheep offered the commercial diet is similar to that reported by Round (1986) for sheep fed restricted rations and held in conditions simulating the assembly and transport of sheep to the Middle East. Replacement of the hay portion of the ration in part or in whole with the whey based product had no detrimental effect on the performance of the sheep (Table 2). Maintenance of liveweight of adult Merino sheep undergoing transport by ship and offered rations of this quality would probably be achieved only if more than 1.1 kg/hd/d was made available.

Complete replacement of the pasture hay component of the commercial diet with the whey based product resulted in a very hard pellet which was consumed more slowly than the other diets (Table 2). This slow rate of eating may be beneficial when feed is restricted because it should reduce competition for feed and perhaps allow shy feeders longer access to the pellets. On the other hand the hardness of the pellets containing the whey based product may influence the incidence of sheep exhibiting the failure to eat syndrome - a major cause of mortality and morbidity of sheep during ship transport (Beers and Kelly, 1988; Richards et al. 1989). This remains to be evaluated. On nutritional grounds there seems no reason why the whey based product cannot be incorporated into pelleted feed prepared for the live sheep trade.

#### ACKNOWLEDGMENTS

This work was made possible through support from the Australian Dairy Research Council and the Rural Credit Development Fund (Reserve Bank). Bentonite was donated by Commercial Minerals Ltd. The authors are grateful to Mr. Brian Leyonhjelm, Manager of Heywood Stockfeeds Pty.Ltd., Heywood, Victoria for pelleting the diets and Mr. Kym Butler, Biometrician, for assistance in statistical analyses and preparation of the paper.

REFERENCES

- BEERS, P.T. and KELLY, A.P. (1988). In "Proc. No.3, S.C.A. Workshop on Livestock Export Research" p.35. (Moorabbin Printing Sales: Victoria).
- GUIRGUIS, N. (1988). Patent Application No. P.I. 7341.
- RICHARDS, R.B., NORRIS, R.T., DUNLOP, R.H. and McQUADE, N.C. (1989). Aust. Vet. J. 66 : 33.
- ROUND, M.H. (1986). Proc. Aust. Soc. Anim. Prod. 16 : 339.
- SAUL, G.R. and FLINN, P.C. (1983). In "Feed Composition and Animal Production", p.303, editors, G.E. Robards and R. G. Packham. (Commonwealth Agricultural Bureaux: Farnham Royal, U.K.)
- ZADOW, J.G. (1987). Aust J. Dairy Tech. 42 : 71