Protected Canola Meal Increases Milk Protein Concentration in Dairy Cows Fed a Silage-Based Diet

C. L. White1, M. F.J. van Houtert2, N. Phillips1, P. Young1, R. Taylor1, F. Coupar3, J. R. Ashes3 and S.K. Gulati3

1CSIRO Animal Production, Private Bag PO Wembley, WA, 6014, 2Agriculture Western Australia, PO Box 1231, Bunbury, WA, 6231, 3CSIRO Animal Production, Prospect, NSW, Australia 2148.

Milk from dairy cows in Western Australia (WA) shows a marked seasonality in true protein (TP) concentration, with typical values in spring of 3.1-3.2 % w/w and in autumn of 2.7-2.9 % w/w (DIA 1998). Since the processing value of milk is determined by its protein and fat content, a low protein content represents a revenue loss to the dairy farmer. In addition, a penalty of 4 c/l for milk containing less than 2.7% w/w TP has been introduced by processors in anticipation of higher costs associated with meeting the proposed Australian-New Zealand Food Authority (ANZFA) standards for market milk of 2.9% w/w TP.

The low milk protein syndrome occurs at a time when annual pastures have senesced and cows are fed conserved forage and concentrates. The summer diet is typically 60-70% annual ryegrass/clover pasture hay or silage with 30-40% grain concentrates. The concentrates are usually a mixture of lupin and cereal grain, such as barley.

The concentration of protein in milk is a function of the quality and quantity of amino acids absorbed from the intestine (metabolisable amino acids, MAAs). Modelling a typical WA summer diet using AFRC (1993) equations modified to include amino acids, indicated that while total MAA supply was just meeting requirements, the supply of histidine and methionine was likely to be deficient. These theoretical deficiencies were overcome when rumen-protected canola meal replaced part of the lupins in the diet. The following experiment was designed to test the hypothesis that substituting 2.4 kg of lupins with 2.4 kg of formaldehyde-treated canola meal would increase milk protein concentration in dairy cows fed pasture silage and concentrates.

Sixty Friesian cows in mid lactation (mean 83 days in milk on 20/4/99; day 0) were allocated to two equal-sized treatment groups: control or protected canola meal (PCM). The cows were run as a single herd and at the start of the experiment there was no detectable pasture in the paddocks. The basal diet consisted of 6 kg of concentrate (lupins:barley 4.8:1.2) fed individually during milking plus 16 kg DM silage/head offered in the paddock. Individual intake of silage was not recorded, but herd residues were minimal. Silage was 29% DM and contained 11.6% CP and 10.4 MJ ME/kg. For the PCM group, 2.4 kg of lupins was replaced with PCM. The CP content of the lupin/barley concentrate was 31.7%, and that of the lupin/barley/canola concentrate was 33.6%. The in sacco degradability of the treated canola meal was 27% at a fractional rumen outflow of 0.08/h. The treatment lasted 54 days. Statistical analysis was by repeated measures ANOVA using pretreatment values as covariates.

Milk protein content increased over time. This was considered due to the appearance of green pasture following the start of winter rains as well as the natural increase that occurs as stage of lactation progresses. Protected canola meal increased TP in milk by up to 0.15 percentage units (Fig.1, P = 0.01). It also increased liveweight (598 ± 3.5 vs 586 ± 3.5 kg, P = 0.002) but had no significant effect on fat concentration (3.94 vs 4.01% w/w) or milk output (22.4 vs 22.0 l/d) (P > 0.1).

Fig 1. Effect of formaldehyde-treated canola meal on milk protein concentration (mean ± SE, n=30). Symbols are (λ) control and (O) PCM.

The results support the hypothesis that the supply of one or more MAA is limiting under a feeding regimen typical of WA dairy cows in summer, and point to one possible strategy to increase milk protein content.


Email: c.white@ccmar.csiro.au