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BRIEF COMMUNICATION

Partitioning of milk accumulation between cisternal and alveolar compartments of the bovine udder: relationship to production loss on once-daily milking

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Keywords: mammary gland; milk; milking interval; once-daily milking.

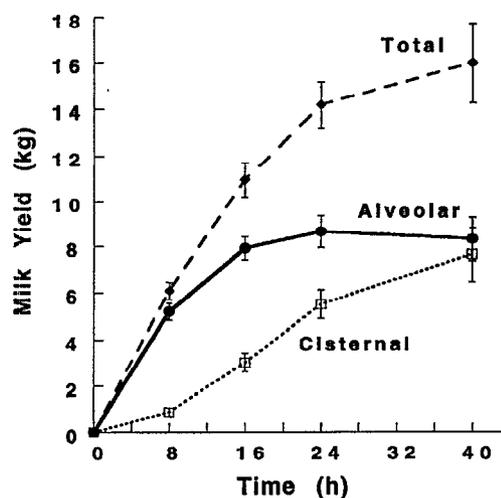
Accumulation of milk between milkings in the bovine udder can occur close to the site of secretion in the alveoli or, following drainage, in the large ducts and cisterns (Knight *et al.*, 1994). The purpose of the present study was to validate a simple method to measure milk volumes in cisternal and alveolar compartments (using adrenaline to block milk ejection); to use this method to assess cisternal and alveolar capacity in relation to production loss on once-daily milking and to determine the temporal pattern of milk accumulation in the cisternal and alveolar compartments.

Discrimination between cisternal and alveolar compartments may be achieved by avoidance of milk ejection through catheter drainage of cisternal milk (Knight *et al.*, 1994), or by blocking milk ejection with adrenaline (3 mg I.V.). In both approaches, alveolar milk may be determined following intravenous injection of oxytocin following removal of cisternal milk. Direct comparison of the methods gave similar values (kg \pm S.E.M.) for the cisternal (2.10 \pm 0.27 by drainage vs. 1.96 \pm 0.17 by adrenaline) and alveolar (1.78 \pm 0.24 by drainage vs. 1.81 \pm 0.33 by adrenaline) compartments using duplicate half udder measurements (two diagonally opposed glands), by each method, in a group of 6 cows after 20h of milk accumulation. Differences between methods were not statistically significant.

Temporal changes in the pattern of milk total accumulation and its distribution in cisternal and alveolar compartments were determined in 12 Friesian cows in mid-lactation using the adrenaline method at various intervals post-milking (see Fig. 1). Accumulation of milk in the alveolar compartment was relatively rapid and the alveolar compartment was full 16-18h post-milking. Filling of the cisternal compartment was much slower initially but increased rapidly after 8 h. At 40h the volume of milk contained in the cisternal and alveolar compartments were similar. Other data have indicated that udders of cows in New Zealand were full by 30h post-milking (Davis and Hughson, 1988), therefore, the capacity of the alveolar and cisternal compartments measured at 40h should be maximal.

To determine any relationship between the site of milk accumulation and yield loss on once-daily milking, a further 22 cows were studied (11 twin sets). After 3 weeks of twice-daily and 2 weeks of once-daily milking, the volume of milk contained in cisternal and alveolar compartments was deter-

FIGURE 1: Temporal changes in total milk yield and accumulation in alveolar and cisternal compartments. Measurements were made in a group of 12 cows at various intervals after milking using the adrenaline method. Error bars are standard errors of mean.



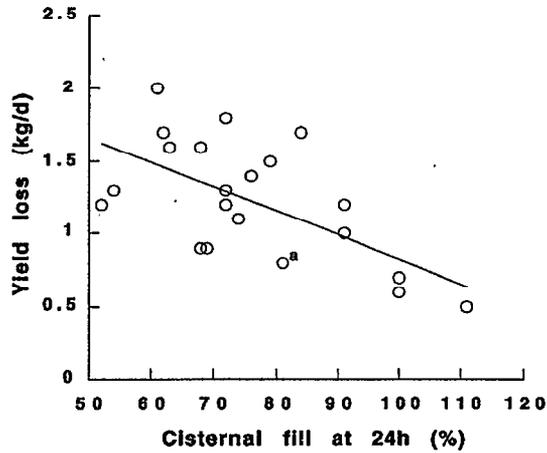
mined at 24 and 40h post-milking by the adrenaline method. Total milk in the udders increased (on average) by 1.4 kg to 11.7 kg from 24 to 40h post-milking, the proportion of milk in the alveolar fraction declining from 54 to 46% over the same period. There was no significant correlation within twin sets on milk yield loss with ODM. The yield loss on once-daily milking (ODM) was not significantly correlated with cisternal, alveolar or total capacity at 24 or 40h ($p > 0.1$). However, there was a significant ($p < 0.01$) negative relationship between the degree of cisternal filling at 24 h and the production loss on ODM (Fig. 2).

In conclusion, a straightforward method for the determination of cisternal and alveolar milk volumes was evaluated for use in dairy cattle. Filling of the alveolar compartment was complete 16-18h post-milking, while the cisternal compartment only began to fill a few hours after milking and was not full until >24 h post-milking. The correlation of cisternal filling and production loss on ODM (Fig. 2) suggests that the freedom of the alveoli to drain may be an important factor associated with production loss on ODM.

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FIGURE 2: Yield loss on once-daily milking of cows (11 twin-sets) in relation to the percentage fill of the cisterns at 24h. Cisternal fill (%) was calculated as the ratio of cisternal volumes at 24 and 40h (x100%). The equation describing the relationship was $Y = 2.5 - 0.017x$; $R^2 = 37\%$ ($p < 0.01$). *two cows with same value.



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