BRIEF COMMUNICATION

Differences in the extent of mammary development between Jersey cows of high or low genetic merit

S. R. DAVIS, G. A. HUGHSON and A. M. BRYANT

Ruakura Agricultural Research Centre
Ministry of Agriculture and Fisheries, Hamilton

The value of genetic selection of cattle for milk and milkfat yield has been demonstrated by the greater productivity of high breeding index (HBI) cows over that of cows of low breeding index (LBI) (Bryant and Trigg, 1981). HBI Jersey cows outproduce their LBI herdmates by 20 to 30% and show a greater gross efficiency of feed conversion into milk (Bryant, 1981).

Milk production is essentially determined by the number of secretory cells in the udder and their activity. The productivity of mammary tissue is relatively constant both across and within species at a rate of 1.9 ml/g tissue/d (Linzell, 1972). Thus, indices of secretory cell number such as post milking udder weight or volume may be expected to vary proportionally with milk production. That this occurs has been demonstrated in goats (Linzell, 1966) and ewes (Davis *et al.*, 1980) udder size being measured by water displacement in both cases.

The current study used a method for calculating udder volume by measuring post milking udder height (rear quarter to base of rear teat), width (average width measured approximately 8 cm above front and rear teats) and length (from base of rear teat to anterior junction of udder with abdomen). Half the product of these measurements was taken as an estimate of udder volume. The accuracy of udder volume determination using this method is dependent upon how closely the udder approximates a wedge shape. Thus cows with pendulous or asymmetric udders are not suitable for this type of study.

The validity of the measurement principles was assessed by measuring the change in udder volume following removal of a known volume of milk from 10 Jersey cows at morning and evening milking. The mean change in udder volume was similar to the mean milk yield at both milkings (Table 1). Post milking udder volume did not differ significantly with time of milking.

TABLE 1 Validation of measurement procedures (n = 10).

Time of milking	Post milking udder volume	Change in udder volume	Milk yield	Difference ± S.E.
	litres	litres	litres	
Afternoon	6.8	2.0	2.2	-0.2 ± 0.5
Morning	7.4	6.1	5.8	0.3 ± 0.7
Difference ± S.E.	0.5 ± 0.4			

The results of using this technique to measure udder volume in HBI and LBI Jersey cows at peak lactation is shown in Table 2. Measurements were made after afternoon milking when the residual milk volume was at a minimum. HBI cows produced significantly more milk and had significantly larger udders than LBI cows of similar maturity. While the udder volume of heifers was less than that of mature cows this difference was largely a function of live weight, milk

TABLE 2 Differences in live weight, milk yield and udder volume between cows of high (HBI) and low (LBI) breeding index.

	Heifers			Mature cows		
	HBI n = 7	LBI n = 6	Sig. of difference	HBI n = 17	LBI n = 25	Sig. of difference
Live weight (kg)	336	295	*	376	340	**
Udder volume (l)	9.1	7.3	$P < 0.1$	10.3	8.5	**
Milk yield (l/d)	16.2	12.7	***	18.0	14.8	**
Udder volume (ml/kg$^{0.75}$)	115	103	ns	120	108	*
Milk yield (ml/kg$^{0.75}$)	205	180	*	211	187	**
Milk yield/udder volume (l/l)	1.85	1.76	ns	1.80	1.75	ns

yield and udder volume expressed per $kg^{0.75}$ being similar for all animals within breeding index groups. However, although HBI cows were significantly heavier than LBI cows their udder volume per $kg^{0.75}$ was also greater, suggesting that the live-weight difference was insufficient to account for the difference in udder volume between BI groups.

Within the HBI and LBI groups there was a significant linear relationship between milk yield (MY,l) and udder volume (UV,l). The slopes and intercepts of these relationships did not differ significantly. The relationship for all cows was:

$$MY = 0.93\ UV + 7.33 \quad r = 0.66^{***} \quad n = 55$$

The difference in milk yield between HBI and LBI Jersey cows may be explained by the difference in udder volume which, by inference, is a reflection of differences in secretory cell number. While part of this difference can be attributed to the greater live weight of the HBI cows used in this study the remainder must arise as a consequence either of increased mammary growth during pregnancy in the HBI cows or an enhanced rate of secretory cell regression during lactation in the LBI cows.

The management requirements to promote mammary growth and prevent cell regression are fundamental to improving the efficiency of feed utilisation for milk production and the persistency of lactation.

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