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Effect of breed and diet on *de novo* synthesis of fatty acids by mammary gland tissue of Friesian and Jersey dairy cows

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INTRODUCTION

Differences exist in the fatty acid (FA) composition of milkfat of Jersey and Friesian cows. Milkfat triglycerides are produced in mammary epithelial cells using FAs taken up from circulation as well as FAs synthesised *de novo* by the gland. The aim of the present experiments was to determine whether mammary metabolism is responsible for milkfat differences between breeds and to determine effects of diet on these.

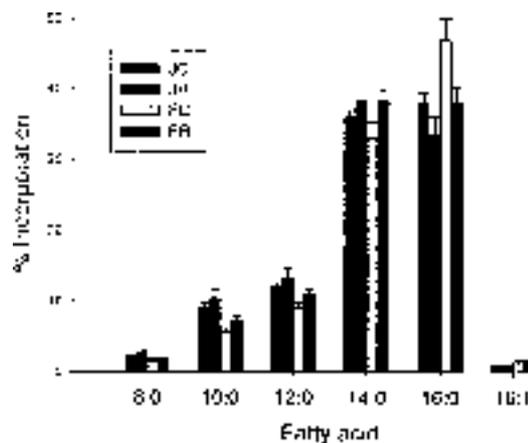
MATERIALS AND METHODS

A 2x2 factorial design was set up to compare effects of breed and diet on FA composition of milkfat. Control cows (5 of each breed) were fed pasture *ad libitum* and alfalfa pellet supplement. Treatment diet was the same plus 2.0 kg RumentekTM (rumen protected canola seed) per cow per day. After 30 days of treatment, tissue was collected after morning milking using the biopsy method of Farr *et al.*, 1996. We studied *de novo* synthesis of FAs by incubating fresh mammary gland slices for 2 hr in Medium 199 containing 10 mM glucose, using 10 mM [1-¹⁴C]acetate as substrate. FAs were extracted using the method of Bligh & Dyer. Nitrophenylhydrazide derivatives of FA were separated using reversed phase HPLC (Miwa *et al.*, 1990). The *de novo* synthesis of each FA was calculated as the percentage of the total amount of incorporated radioactivity. Statistical analyses were done using SAS.

RESULTS

Mammary tissue slices from Jersey cows incorporated a significantly higher proportion of [1-¹⁴C] acetate into caprylic (C8:0; P<0.05), capric (C10:0; P<0.01) and lauric acid (C12:0; P<0.01) compared to those from Friesian cows (Figure 1). Slices from Friesians incorporated a significantly higher proportion of acetate into palmitic (C16:0, P<0.01) and palmitoleic acid (C16:1, P<0.05). The ratio of monounsaturated to saturated FA ((C14:1 + C16:1)/(C14:0 + C16:0)) also tended to be greater in Friesians (P<0.10).

FIGURE 1: *De novo* synthesis of fatty acids by mammary gland tissue slices of Jersey (J) vs Friesian (F) cows fed control (C) or Rumentek (R) diet.



In both breeds the rumen protected diet significantly increased the *de novo* synthesis of myristic acid (C14:0, P<0.05) and decreased palmitic (C16:0, P<0.01) and oleic acid (C18:1, P<0.05). Overall, *de novo* synthesis of FA longer than C16 was less than 1% of total incorporation.

CONCLUSIONS

These differences in *de novo* FA synthesis suggest these breeds differ in regulating milkfat FA chain length at the level of the mammary gland. Diet also changed the profile of *de novo* synthesised FAs. Differences in ratio of monounsaturated to saturated FAs suggest that breeds may differ in mammary desaturase activity. Such mechanisms may provide a means to manipulate FA composition of milkfat to increase yield of spreadable butter or produce a "healthier" milkfat.

REFERENCES

- Farr *et al.* (1996) *Journal of Dairy Science* **79**: 543-549.
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