The ruminal ratio of *trans*-10/*trans*-11 fatty acids obtained *in vitro* reflects *in vivo* values and strongly depends on the diet of the donor cow

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Introduction :

Trans-10 and *trans*-11 fatty acids (FA), originating in ruminal biohydrogenation of unsaturated dietary FA, would have negative and positive effects on human health, respectively (Tricon et al., 2004). A large variability in the ratio of *trans*-10 to *trans*-11 isomers (t10/t11) has been observed in milk fat (Shingfield et al., 2006). Some dietary factors shifting from t11 to t10 have been identified, like the proportion of concentrate (Griinari et al., 1998), or the addition of oil (Roy et al., 2006).

The aim of the present study was to investigate if the ruminal fluid of a cow having the t11 to t10 deviation results in the same deviation during *in vitro* batch incubation and if the pathway of biohydrogenation *in vitro* depends mainly on the donor cow or on the fermentative substrate.

Material et methods :

Four Holstein dry cows were fed four different diets (12 kg DM) based on corn silage during two successive periods : a control diet (**C**, 20% of starch, <3% of crude fat, 15% of crude protein), a starch diet (**S**, 40% of starch) with barley and wheat, anoil diet (**O**) supplemented with 5% of sunflower oil and a starch plus oil diet (**SO**) was rich in both starch and. Each period consisted of 3 weeks with the C diet, followed by 2 weeks with C, S, O or SO diet. Cows were assigned to different diets during periods 1 and 2. On the last day of each period, ruminal fluid of each donor cow was incubated for 5 hours with the four diets used as substrates, replacing sunflower oil by pure linoleic acid. Five hours after the morning meal, rumen fluid was taken from each cow (*in vivo* data). FA of *in vivo* and *in vitro* samples were analysed by gas chromatography. The t10/t11 ratios observed *in vivo* were compared to the ratios obtained *in vitro* with the same donor cow and the same diet by a paired Student's t test. Effects of cow's diets and culture substrates were analysed by the GLM procedure of Systat.

Results :

In vivo, the t10/t11 ratio was much higher when the diet was supplemented with both starch and sunflower oil. There was no significant (P = 0.34) difference in the t10/t11 ratio of the ruminal fluid between *in vivo* samples and samples from *in vitro* incubations (Fig.1). There was no effect (P = 0.29) of the *in vitro* substrates on the t10/t11 ratio (Fig. 2), but the *in vitro* ratio was strongly affected by the diet of the donor cow (P < 0.001).

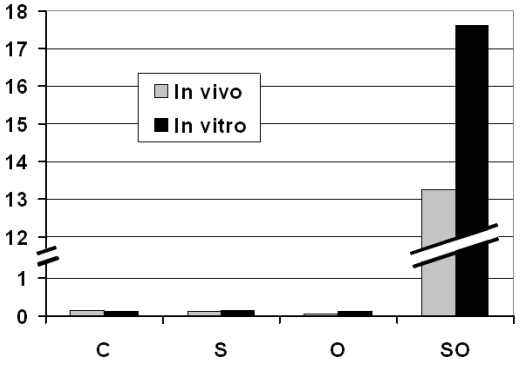

Figure 1. Comparison of *in vivo* and *in vitro* t10/t11 ratios obtained with control (C), added starch (S), added oil (O) and added starch + oil (SO) diet or substrate.

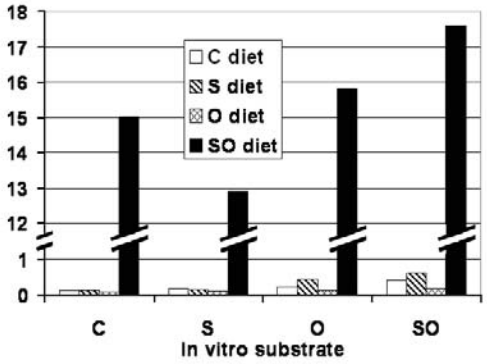

Figure 2. Effect of the diet of donor cow on the t10/t11 ratio obtained *in vitro* with control (C), added starch (S), added oil (O) and added starch + oil (SO) substrate.

Conclusions :

This study showed that the t10/t11 ratio of the ruminal fluid after 5 hours *in vitro* incubation reflects the *in vivo* values. This ratio *in vitro* did not depend on cultures substrates, but related to the diet of the donor cows, suggesting a major importance of the ruminal inoculum on the biohydrogenation pathway. This might be due to the short incubation time preventing the bacterial communities to evolve according to the *in vitro* substrate. As a consequence, short duration batch *in vitro* cultures cannot be used to study the dietary conditions of the t11 to t10 shift. Nevertheless, they could possibly be used for the study of the effects of feed additives on the t10/t11 ratio.

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