BRIEF UPDATE ON RESEARCH IN NUTRITION OF DAIRY SHEEP

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Dairy sheep may take advantages from all aspects of research conducted in the field of animal science and biology. There are, however, laboratories that specifically work in that field and have a direct objective of improvement of dairy sheep breeding. In the field of nutrition, an important body of work has been done in a collaborative EEC project involving France (INRA ; Barillet and Bocquier, 1993), Spain (UA-Barcelona), and Italy (IZCS-Sardegna). Agricultural EEC policy is oriented toward research that may improve the sustainability of a Mediterranean dairy sheep population of more than 70 million ewes.

These teams worked mainly with western Mediterranean dairy sheep production systems, and systems in which controlled feeding phases are strategically important. Compared to other ruminant production systems there is a specific need for knowledge of the effects of nutrition and management practices on both milk yield and milk composition. We proved that lactating ewes use dietary energy with the same efficiency as dairy cows. This allows the use of the net energy system established for dairy ruminants in diet formulations for dairy ewes. Furthermore, in case of underfeeding, the mobilized body energy is used with an efficiency of transformation into milk which is close to 80 %. During full lactation, milk energy output is linearly related to dietary energy supply. In ewes in negative energy balance, the body energy mobilization, assessed by dilution technique (Bocquier et al., 1999), can account for almost 50 % of milk energy output (Agus and Bocquier, 1995). Voluntary food intake is negatively affected by body fatness at lambing, while ambient temperature doesn't seem to affect significantly the voluntary food intake of Manchega sheep in the range of 5 to 25 ºC (Prió et al., 1994, 1995). An important work has been done on main factors that affect voluntary food intake of both forage and concentrate at different physiological stages (dry, pregnant and lactating), evaluating its significance in dairy ewes (Ferret et al., 1998) and providing reliable equations for the maximization of forage intake (Caja et al., 1997bc; Bocquier et al., 1997). Effect of genetic merit of ewes by the comparison of two lines of Lacaune ewes obtained by divergent selection (Marie et al., 1996) or between breed comparisons Manchega vs Lacaune on the relationship between milk yield, food intake and variations of body energy has been studied. Effect of using protected fat for dairy ewes also has been analyzed, for it may increase milk fat content and modify fatty acid composition of milk and cheese (Pérez Alba et al., 1997; Osuna et al., 1998; Casals et al., 1999).

As ewe milk is processed into cheese, manipulation of its composition is of great interest (see Bocquier and Caja ibid). We also isolated strong positive influence of long photoperiod (16h/d), compared to short photoperiod (8h/d), on milk yield (+25%), food intake (+16 %) and negative effects on milk fat (-14 g/l) and protein (-11 g/l) content (Bocquier et al., 1997). More recently we showed that leptin, an hormone secreted by adipose tissue and involved in regulation of food intake, is increased (Figure 1) by long daylength in the sheep (Bocquier et al., 1998). These results, altogether, illustrate that the sheep which is a seasonal breeder may have conserved a mechanism that may operate and enhance its adaptation to seasonal fluctuations of food resource (Chilliard and Bocquier, 1999).

In on-farm situation, it is of importance to take into account individual variability of milk performance because it may limit feed efficiency of the flock. In these situations, we analyzed the interest of group-feeding of ewes (Bocquier et al., 1995).

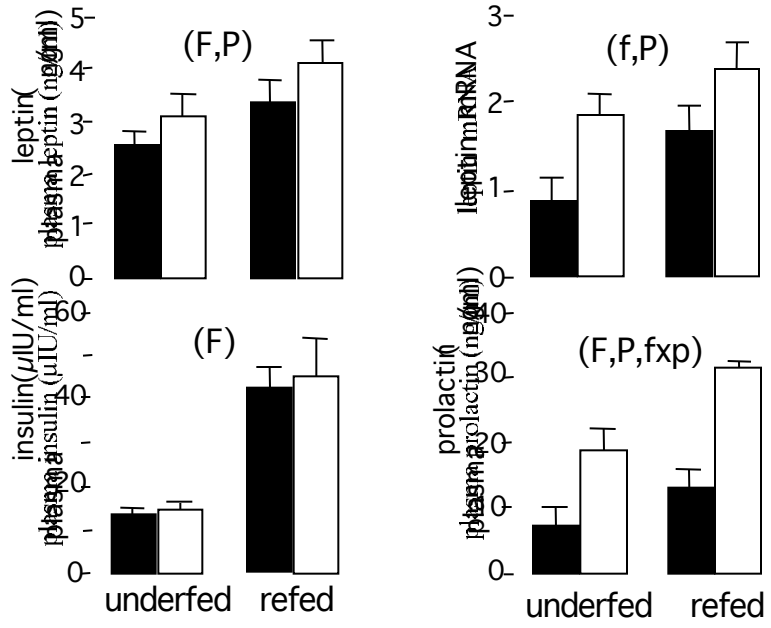

Figure 1. Effects of daylength (shaded bars: short days (8h/d) and open bars: long days (16h/d)) and nutritional status (underfed (22%) or refed (190% of energy requirements)) on (A) plasma leptin, (B) adipose tissue leptin mRNA (in arbitrary units), (C) plasma insulin and (D) overall mean plasma prolactin (5 ewes per group, mean + SEM). F, P or f, p: significant effect of feeding level and photoperiod ($P<0.05$ or $P<0.10$, respectively); f x p: significant interaction ($P<0.10$) (from Bocquier et al., 1998)

Although dairy sheep production is an important industry in the Mediterranean countries of EEC, only few flocks are under true feeding control. There is now a better knowledge on dairy sheep nutrition, even if specific research is still needed. Current need of knowledge on nutrition of dairy sheep is focused on milk composition, because of an industrial demand for cheese making from raw milk. Furthermore some important effects of nutrition on milk composition (composition of fatty acids) are still imperfectly known and should be studied. Feed intake capacity and substitution rates in lactating dairy ewes are now better known but they should be tested on a larger set of group feeding conditions. They should be adapted to different production systems encountered with the Mediterranean dairy breeds. There is no doubt that this will help to better adjust the concentrate supply to high producing ewes.

We showed that the flock structure affects the annual milk composition (Fraysse et al., 1995). These analyses of flock structure (dynamics of lambing and dry-off policy) and possibly the mean genetic level is a necessary step before analyzing the effect of feeding practices on milk composition. At the farm level, the perspective to use electronic devices (Caja et al., 1997a) will greatly help in a better adjustment of food to ewe requirements, thus insuring a higher milk quality.

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