

Effects of underfeeding on body reserves variations and on energy efficiency of lactating Charolais cows

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During winter beef cows mobilize their body reserves which are mainly composed of lipids (1984, Wright and Russel, Anim Prod, 38, 23-32). In French beef breeds, in usual management systems, lipids may account for 7 % of the body mass in the thinnest cows, (scored 1.0 on 5) and 22 % of the body mass in the fattest (scored 4.5 on 5).

In addition, adaptation of energy metabolism to undernutrition can reduce maintenance requirement of the lactating cow by 13 to 20 % (Ortigue, 1991, Repr Nutr Dev, 31, 593-616). The objective of the present experiment was to measure the quantity and the composition of body reserves mobilized by lactating Charolais cows fed either a high (H) or a low (L) level of food supply, then to estimate their energy maintenance requirements by calculating energy balance.

Nine multiparous cows aged 4 to 9 years, in good initial body condition (rated 3.0 over 5), and fed individually in tying stalls, were allocated randomly to the high (n = 4) or the low (n = 5) energy level, for a 16 week experimental period, 2 weeks after calving. Diets consisted of 85 % hay (first cut and second cut) and 15 % concentrate (barley and soybean meal). Rations were individually adjusted to requirements (INRA 1988) plus 1 LFU for H cows or minus 2.5 LFU for L cows. Digestibility of diets were obtained on each cow by total faecal collection during 10 days.

All the cows were fitted with rumen canulae, which made it possible to remove their rumen contents in order to estimate their body mass (live weight - rumen content/0.75). Body composition was estimated from diameter of

subcutaneous adipocytes (ACD : Robelin, 1982, Anim Prod, 34, 347-350) at the beginning and the end of the experimental period. Body condition score (BCS) was rated by palpation (Agabriel et al, 1986, Bull Tech CRZV Theix INRA, 66, 43-50).

On average H and L cows weighted initially 630 kg and their body mass (515 kg) included 79 kg lipids (15.3 %). During experimental period, rumen content of H cows increased from 88 to 99 kg (10.4 to 11.4 % dry matter DM) while remaining near 85 kg in L cows with a significative decrease of DM content (12 to 9.4 % P<0.01). L cows lost 62 kg of body mass (P<0.01), 1.5 point of BCS (P<0.01) and 53 kg of lipids (P<0.01). Corresponding values for H cows were 18 kg (NS), 0.1 point and 18 kg. So lipids accounted respectively for 85 and 100 % of the loss of body mass. At the end of the experiment, lipid content of the body mass of L cows was estimated to 5.5 %.

The cows produced on average 7.2 (H) and 5.3 (L) kg of milk/day (P<0.05), milk fat content was estimated three times after hand milking half a udder while the calf sucked the other half : 44g/kg (H) and 40g/kg (L) of fat per kg of milk (P<0.05).

Maintenance requirements were defined as the difference between the net energy supplies by the food (computed from the digestibility of organic matter measured in each cow) and by the body mass loss (with a 85 % efficiency), and the net energy used for milk secretion. They were 7.3 and 5.9 LFU/day for H and L cows equivalent to 24 % less in the latter group. This can represent the increase of efficiency induced by adaptation to undernutrition.

	Initial LW (kg)	Initial EBW (kg)	Initial ACD (μ)	EBW Change (kg)	BCS Change	ACD Change (%)
Low	631	517	66	-62	-1.5	-38
High	629	513	73	-18	-0.1	-15
	Milk (kg/d)	OM digestib. %	NE L supplies LFU/d (1)	NE L from tissues LFU/d (2)	NE for milk LFU/d (3)	1 + 2 - 3
Low	5.3	69.6	5.6	2.5	2.2	5.9
High	7.2	69.0	9.9	0.7	3.3	7.3