Ann Zootech (1995) 44, Suppl, 297

Effects of compensatory growth on muscle characteristics in 2 year-old beef steers

B Picard [1], D Micol [2], D Dozias [3], Y Geay [1]

[1]INRA, Croissance et métabolismes des herbivores ; [2]INRA, Adaptation des herbivores aux milieux, Theix, 63122 St-Genès-Champanelle ; [3]INRA, Domaine du Pin au Haras, 61310 Exmes, France

The effects of compensatory growth on performances and body composition are well documented in beef cattle (Hogg, 1991, Growth regulation in farm animals, Elsevier Sc Pub, 103-134). Only few data are available on muscle characteristic changes during compensatory period. These features have a determinant part in meat tenderness according to post mortem ageing of muscles (Valin, 1988, Reprod Nutr Dev, 28 (38), 845-856).

The aim of this study was to precise these effects during compensatory growth period between 20 and 27 months of age after a restricted feeding between 9 and 20 months in Charolais steers. During this rearing period on grass, animals were allocated to two groups : control (n = 13) and restricted (n = 19). At 20 months of age, control group reached 614 kg liveweight vs 525 kg for restricted group. During indoors feeding period in winter, the control group (C) was fed *ad libitum* and restricted animals were subdivided into two groups on the basis of weight and previous growth rate. Compensatory growth group (CG) (n = 10) was fed *ad libitum* during fattening period and always restricted group (RR) (n = 9) was fed in order to obtain the same growth rate as in the C group.

The three groups of animals were slaughtered approximately at the same live weight (695 kg) after 103, 114 and 168 days of finishing and 0.88, 1.27 and 0.97 g/d of ADG respectively for C, CG and RR.

Muscle characteristics : protein and DNA contents, oxidative activity (ICDH, isocitrate dehydrogenase), glycolytic activity (LDH, lactate dehydrogenase), percentages and areas of fiber types (I, IIA, IIB) (Jurie *et al*, Meat Sc, 1995, 39, 3, 415-427), total collagen, heat-soluble collagen and iron contents were evaluated at the beginning of the finishing period by biopsy on *Semitendinosus* muscle (ST) and at slaughter on ST and *Triceps brachii* muscles.

At 20 months of age, restricted animals were lighter (-90 kg LW) and leaner (9.8 % fat content in EBW vs 12.8 for C group). Their ST muscles contained less protein (173 vs 185 mg/g), had a less glycolytic metabolism (106 vs 115 nkat (= nmoles/s)/g for LDH) and a smaller area of the three fiber types (mean area 3700 μm^2 vs 4868 μm^2).

At slaughter at the end of finishing period, animals of C and CG groups (415 and 398 kg carcass weight respectively) reached the same body composition (16 % fat tissue in EBW and 67 % muscles in carcass). Their ST and TB muscles showed no significant difference in protein and DNA contents, in metabolic activities (138 and 133 nkat/g for LDH ; 0.155 and 0.147 nkat/g for ICDH in ST), in percentages of fiber types (15 and 16 % type I, 29 and 30 % type IIA, 56 and 54 % type IIB) and in fiber areas (4906 μm^2 and 4543 μm^2). Pigment and total collagen contents were also the same. Heat soluble collagen was higher ($P<0.05$) in ST of CG animals (33 vs 31 %) and the same in TB (34 %).

Fat content of RR animals was lower (14 % fat tissue in EBW, $P<0.05$) and muscle percentage in carcass (405 kg) was higher (69 %). ST and TB muscles in RR group were less glycolytic (119 nkat/g for LDH in ST). Fiber I proportion was higher (24 %), fiber IIB was lower (46 %) and similar for fiber IIA (29 %). Areas of fibers were in average lower (4444 μm^2). Heat soluble collagen content in the two muscles was lower (28 %, $P<0.01$).

These results demonstrate that restriction induces a decrease in areas of fibers and a more oxidative muscle metabolism. During compensatory growth, area of fibers increases, glycolytic metabolism increases in relation to the higher proportion of IIB fibers. After compensatory period animals present no difference in the body composition and muscle fibers characteristics relatively to control steers. However heat soluble collagen content is higher in compensating animals and lower in restricted animals. This suggests an important collagen neosynthesis during compensatory growth.