Proceedings of the Nutrition Society (2008), **67 (OCE)**, E164 doi:10.1017/S0029665108007969

Joint meeting of the Société Française de Nutrition and The Nutrition Society, 6–7 December 2007

Casein limits the loss of fat-free mass during food restriction in obese rats

S. Adéchian[1], C. Sornet[1], C. Bos[2], C. Gaudichon[2], D. Dardevet[1] and L. Mosoni[1]
[1]*INRA, Clermont-Ferrand–Theix, France and* [2]*INRA and AgroParisTech, Paris, France*

Treatment of obese patients with restrictive diets induces not only a loss of fat mass but also of fat-free mass[(1)]. A sufficient amount of protein in the diet is necessary to limit this loss, but for the same level of protein, the kinetics of amino acid delivery to the organism could play a role[(2,3)]. The objective of the present study was to limit food restriction-induced loss of fat-free mass by varying the nature of ingested proteins. Casein (slowly digested), milk soluble proteins (MSP; rapidly digested), and a mixture of casein–MSP (50/50, w/w) were tested.

Obesity was induced in four groups of male Wistar rats weighing 324.3 (SE 9.9) g by feeding them *ad libitum* for 5 weeks with a semi-liquid diet containing (% energy) 14 protein (PR), 40 carbohydrates (CHO) and 45 lipids (LIP). One of these groups was killed (obese rats, *n* 9) and the three other groups were then fed a restricted amount of a diet containing casein (*n* 19), MSP (*n* 18) or the casein–MSP mixture (*n* 18) as the only source of protein for 3 weeks (% energy; 37 PR, 35 CHO and 28 LIP). A control group (*n* 10) was fed a diet with (% energy) 19 PR, 69 CHO and 10 LIP *ad libitum* for 5 weeks. Weight and food intake were recorded. *In vivo* fractional protein synthesis rates (FSR) were measured in *extensor digitorum longus* muscle in the fed state using the flooding-dose method and [1-^{13}C]valine as the tracer. Body composition was measured in restricted rats by dual-energy X-ray absorptiometry at the beginning and at the end of the restricted diet. Rats were killed and tissue weights were measured (hind-limb muscles, kidney, intestine, liver, spleen).

Only body weight (+8%; $P<0.01$) and peri-renal (+41%; $P<0.05$) and peri-genital (+28%; $P<0.05$) fat masses were significantly increased in obese rats compared with controls. Muscle FSR were unchanged. During food restriction, intake was similar for casein-, MSP- or mixture-fed rats and averaged 45% energy intake of control rats. The lower energy intake induced a significant decrease in weight (−12%; $P<0.01$), fat mass (−39%; $P<0.01$) and muscle FSR (−26%; $P<0.01$). Casein-fed rats maintained a higher weight (+7%; $P<0.01$), fat-free mass (+6%; $P<0.005$), liver weight (+10%; $P<0.01$) and intestine weight (+18%; $P<0.01$) than MSP- or mixture-fed rats, while only their muscle weight tended to be higher ($P=0.06$). Muscle FSR (%/d) were not different between rats fed casein (3.8 (SE 0.1)), MSP (4.4 (SE 0.3)) or mixture (3.3 (SE 1.0)) diet (but it was higher in MSP-fed rats than in mixture-fed rats).

Casein allows a sparing of fat-free mass during food restriction in obese rats. This result is not explained by a higher muscle FSR in the fed state, but it could result from: (a) the maintenance of a high muscle FSR for a longer period of time; (b) a higher muscle FSR in the post-absorptive state; (c) a greater inhibition of muscle protein degradation. Further studies are necessary to answer these questions.

1. Chaston TB, Dixon JB & O'Brien PE (2007) *Int J Obes (Lond)* **31**, 743–750.
2. Boirie Y, Dangin M, Gachon P, Vasson MP, Maubois JL & Beaufrère B (1997) *Proc Natl Acad Sci U S A* **94**, 14930–14935.
3. Lacroix M, Bos C, Léonil J *et al*. (2006) *Am J Clin Nutr* **84**, 1070–1079.