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Effects of feed restriction and re-feeding on body condition, plasma metabolites and intestinal brush border enzymes activity in rainbow trout *O. mykiss*

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Recovery of body weight and condition as a consequence of liberal feeding after periods of fasting or feed shortage, is a well-known phenomenon in salmonid fish species. To what extent the adoption of culture protocols, alternating liberal feeding to severe feed restriction to exploit compensatory growth, could be a challenge in terms of metabolic adaptation and welfare, still remains questionable. In this context, the present study was aimed at evaluating some physiological responses of rainbow trout subjected to 3 weeks fasting or restricted feed ration and re-feeding over the following 2 weeks. Ninety-nine trout (body weight 109.1 ± 3.5 g) were randomly distributed among 3 tanks (0.5 m^3) each supplied with 8 L min^{-1} of well water at a temperature of $12.7 \pm 0.1^\circ\text{C}$. Fish groups were subjected to one of the following treatments: C, continuous feeding with a commercial trout diet at 1% body weight over 5 weeks; R, restricted ration (30% of C ration) over 3 weeks followed by 2 weeks feeding to visual satiety; F, fasting over 3 weeks followed by 2 weeks feeding to visual satiety. Three fish per group were euthanized at time 0 and after 1, 2, 4, 7, and 14 days during the re-feeding period and sampled for viscera, liver and mesenteric fat to calculate carcass yield, visceral organ or tissue weight and somatic indices. Blood and gut samples were also collected and analysed for plasma metabolites (glucose, lipid and protein levels) and the activity of intestinal brush border membrane (BBM) enzymes (disaccharases, alkaline phosphatase, γ -glutamyl transaminase) in different sections (pyloric caeca, foregut, hindgut). In comparison to the control group, i.e. continuously fed fish, a feed restriction or fasting over 3 weeks resulted in significantly reduced body and visceral to body weight ratio and in diminished activity of the intestinal BBM enzymes. Among plasma metabolites, only cholesterol was reduced. During the re-feeding period, liver and viscera weight increased more rapidly in groups R and F than in group C, resulting in significantly higher organ to body scores. The pattern of the activity of the intestinal BBM enzymes varied among the different tracts in a specific manner, but no differences were observed among treatments after 2 weeks of re-feeding. In conclusion, a period of 14 days of liberal feeding seems to be able to restore the metabolic status in rainbow trout previously subjected to fasting or restricted feed ration over 3 weeks.

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