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METABOLIC AND HORMONAL ADAPTATION OF RUMINANTS TO UNDERNUTRITION

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In ruminants, short-term adaptations to undernutrition are more pronounced for splanchnic organs than for other tissues. For the latter, the long-term response involves a sequential mobilization with relative priorities differing among anatomical sites. The body lipids are extensively used in underfed animals, especially during lactation, or in fat animals. The fat tail depot of some sheep breeds of the Middle-East regions seems to play a particular role in the adaptation to undernutrition, linked to its smaller adipocytes and high sensitivity to the lipolytic effect of catecholamines. The decrease in energy expenditure during undernutrition is mostly due to a short- and medium-term decrease in the cost of feeding activity, and in the mass and activity of splanchnic tissues.

Numerous hormones are involved in the adaptation to undernutrition in order to maintain the constancy of the internal environment (homeostasis) and/or to sustain productive functions (teleophoresis). The *in vivo* beta-adrenergic lipolytic potential is primarily related to energy balance, whereas basal postprandial plasma non-esterified fatty acids (NEFA) concentration is related to body fatness, and preprandial plasma NEFA is the best predictor of the actual body lipid loss. The yield of leptin is positively related to body fatness, decreased by underfeeding and beta-adrenergic stimulation, and increased by insulin and glucocorticoids. This suggests that the leptin decrease in underfed ruminants is a signal for adaptations aimed to maintain homeostasis, especially when teleophoretic regulations linked to reproduction, pregnancy and lactation are challenging the constancy of the internal environment and increasing the risks of metabolic or infectious diseases.

A minimum of 15-20 % fat in the body seems to be needed to allow animal to reproduce when underfed, but too much fat (more than 30-35 %) could have negative effects on animal productive efficiency (excessive weight) and health (excessive fat mobilization). Hence, the practical challenge of breeders in harsh environment is to adopt feeding strategies that allow animal's physiological regulations to occur within a range that would allow both survival (homeostasis) and efficient production (teleophoresis)

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