COLD-INDUCED DECREASES IN HUMAN, CIRCULATING LEPTIN, AND IN THE SUBCUTANEOUS ADIPOSE LEPTIN SECRETION RATE

A. Zeyl, J.M. Stocks, N.A.S. Taylor and A.B. Jenkins, Department of Biomedical Science and Metabolic Research Centre, University of Wollongong, Wollongong, Australia.

Leptin is secreted primarily by adipocytes, and is associated with regulating energy expenditure and appetite. Studies have shown cold-induced decreases in both circulating leptin and *ob* gene expression, and an apparent protective effect on body temperature of exogenous leptin during acute cold stress. In this study, we investigated the effects of acute cold-water immersion (*in vivo*) on human plasma leptin concentration, and the effects of incubation temperature (*in vitro*) on leptin secretion from human, subcutaneous adipose tissue fragments. Twelve males underwent daily, 60-90-min chest-deep immersions in 18°C water, for 15 days. Blood samples were collected to determine plasma leptin concentration, while regional body temperatures were continuously recorded. In the *in vitro* study, adipose tissue fragments were incubated at three temperatures (27°, 32° and 37°C), with leptin secretion into the culture medium being determined. Acute cold immersion significantly decreased plasma leptin concentration (-14% at 25 min, -22% at 60 min, both $P<0.05$). A significant positive relationship was found between plasma leptin concentration and the decrease in rectal temperature during immersion ($P<0.05$). Incubation temperature significantly affected leptin secretion rate ($P<0.05$). Leptin secretion (*in vitro*) increased 3.7-fold over the temperature range 27-37°C. A simple modelling approach predicted that, during cold-water immersion, plasma leptin concentration would decrease by 45%, due to the local effects of reduced subcutaneous adipose tissue temperature alone. We suggest that low subcutaneous fat temperatures directly reduce leptin secretion in cold-exposed humans. Given the role of leptin in the regulation of both energy intake and energy expenditure, this would make insulating, colder adipose tissue less ‘visible’ to central mechanisms regulating energy balance, and hence body composition.

arthur_jenkins@uow.edu.au