

Regulation of blood glucose in red deer stags (*Cervus elaphus*)

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The metabolic demands of male red deer (*Cervus elaphus*) vary with season. During spring and summer stags partition nutrients into muscle and fat. In autumn and winter appetite is reduced and live weight is lost as fat reserves are mobilised to meet energy demands. Regulation of blood glucose levels may alter to cope with these two opposing metabolic states.

Twelve red deer stags were maintained indoors from 6 to 15 months of age. At four-week intervals each stag was given an i.v. bolus injection of glucose (200 mg/kg). Blood samples were collected for glucose and insulin determinations at -30, -20, -10, 0, 10, 20, 30, 45, 60, 90, 120, 150 and 180 minutes with respect to glucose at time 0. Liveweight and dry matter intake were recorded weekly. In a second experiment, growth hormone (GH) was measured at 15-minute intervals for 24 hours in 12 stags in the fed state and following a 48-hour fast during winter. A third experiment examined the effect of acute hyperglycaemia and hypoglycaemia, produced by 12-hour infusions of glucose (150 mg/kg/hr) or insulin (30 mU/kg/hr), on GH secretion in six stags.

There was a seasonal change in the stags ability to remove glucose from the blood. Glucose

clearance rate in summer was 175% higher than that in winter. This was in part due to the increased capacity of insulin to remove glucose from the blood during summer as demonstrated by a 78% increase in insulin response to glucose from winter to summer. A 48-hour fast in winter reduced glucose levels (s.e.) from 6.1 to 5.6 (0.15) mmol/l ($P<0.05$) and increased the number of GH pulses/day from 7.8 to 12.4 ($P<0.001$). Glucose and insulin infusions both decreased mean GH levels ($P<0.05$). In the case of glucose, this decrease was associated with a tendency for fewer GH pulses. Insulin infusions were associated with a reduced mean GH pulse width ($P<0.05$).

The regulation of blood glucose changes with season and responds to metabolic changes in such a way that may partly explain the seasonal growth pattern in red deer stags. Increased glucose clearance may enhance spring growth. GH may enhance mobilisation of tissue reserves to maintain glucose homeostasis during the autumn rut and in winter. GH may also have a role, albeit a lesser one, in short-term regulation of blood glucose levels.