

Effect of induced hyperglycemia on insulin secretion in *Camelus dromedarius*

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Priority role of insulin is to regulate blood glucose levels by increasing the uptake of glucose into tissues and storage as glycogen or lipids (Squires 2003). The various actions of glucose have been investigated intensively, when compared to other energy substrates due to the major role of glucose on the regulation of insulin secretions by β cells in the islets of Langerhans in the pancreas (Martin and Crump 2003). In monogastric animals, intestinal absorption of glucose is the main supply for the glucose pool (except during starvation). In ruminants, on the other hand, little glucose is absorbed due to extensive microbial degradation of carbohydrates to short-chain fatty acids in the forestomach system. It has been assumed that due to this metabolic peculiarity, blood glucose levels are lower in domestic ruminants (2.5–3.5 mmol/l) than in monogastric animals (4.5–5.5 mmol/l) (Kaske *et al.* 2001). However, in camels, also ruminating herbivores with an extensive forestomach, the level of blood glucose is much higher than in most monogastrics (Al-Ali *et al.* 1988) and small ruminants (Chandrasena *et al.* 1979). The intravenous glucose tolerance tests suggested this high level of blood glucose could be caused by insulin resistance (Elmahdi *et al.* 1997). However, no other relevant comparative findings are available so far.

Plasma insulin concentration of many species has a characteristic early or acute-phase response minutes after intravenous administration of glucose. The camel is important for its ability to perform in harsh arid and semi-arid environments. They can survive under severe feeding conditions with very poor roughage diet during extreme scarcity or starvation (Wensvoort *et al.* 1996). However, very little information is available regarding levels of

insulin in camel and about the insulin response of camels soon after the i.v. administration of glucose. This article describes effect of glucose infusion on insulin levels in *Camelus dromedarius*.

Adult camels (2), weighing between 730 and 756 kg, were fasted overnight. Earlier Rai and Khanna (1993) had found that blood glucose concentration rose from 70.56 mg/dl to 402.82 mg/dl immediately after infusion of 20% dextrose @0.4 g/kg b.wt the same dose used in the present experiment.

In the morning a blood sample was drawn from both the camels and then each animal was injected with 20% dextrose solution i.v. @ 0.4 g/kg b.wt. within 15 min. The blood samples were collected from the jugular vein on the contralateral side of infusion at 4 min after infusion and then at an interval of 15 min up to 2 h. Thereafter the time interval between samples was increased to 1 h and sampling was continued up to 8 h. The sera was separated in a refrigerated centrifuge and stored at -30°C until assayed.

The binding region of insulin has been identified as a largely invariant region on the surface of the insulin monomer (Pullen *et al.* 1976). Further, the respective amino acids in the A- and B-chain representing the major receptor binding determinants are identical in porcine, equine, ovine and camel insulin (Danho 1972, Trenkle 1972). Kaske *et al.* (2001) used a commercial radio-immunoassay (RIA) kit using human recombinant insulin as a standard and ^{125}I label, for insulin assay in camel, sheep, ponies and pigs. The sample standard curve was reported to be almost identical when bovine insulin was used as standard and basal concentrations measured were in accordance with values cited in the literature for animals which had been starved for about 12 h. In the present study also the insulin was estimated using commercially available Coat-A-Count RIA kit for human insulin.

The pre-infusion values of insulin ranged between 6 and 8 mIU/ml. Similar basal insulin level (5 ± 1 $\mu\text{IU/ml}$) in camel was reported earlier (Kaske *et al.* 2001) The levels reached 12.0 and 12.5 $\mu\text{IU/ml}$ within 4 minutes of the glucose infusion and registered an ascending trend up to 2 h in both camels. The peak levels in the 2 camels at 2 h of the infusion were 23.5 and 18.0 $\mu\text{IU/ml}$ respectively. The values started

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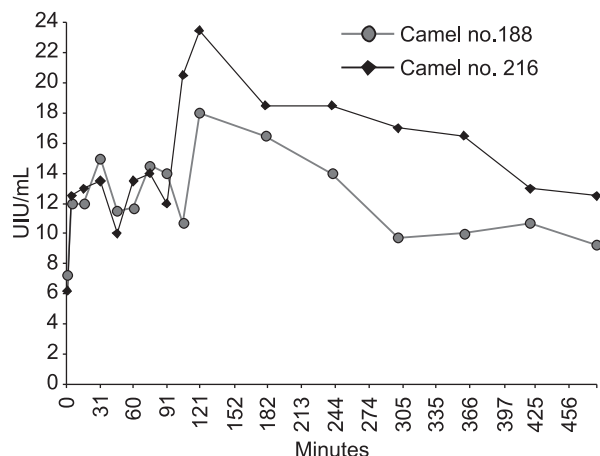


Fig. 1. Insulin response to glucose infusion @400 mg/kg wt. in *Camelus dromedarius*

declining 2 h onwards up to 8 h attaining values almost similar to 0 h (Fig. 1). The results suggest that camel responded to glucose infusion by elaborating insulin release from the islets of Langerhans cells in the pancreas. This is in contrast to acute insulin response in ponies and sheep (Elmahdi *et al.* 1997). This discrepancy may be due to species difference in the response of pancreatic cells. The low insulin responsiveness in camel could be advantageous to minimize glucose consumption and seems to be an important factor in the ability of camels to cope with poor feeding conditions and longer starvation period.

SUMMARY

The serum insulin level in *Camelus dromedarius* (n=2) were investigated at different intervals after infusion of 20% dextrose solution i.v. @ 0.4 g/kg b.wt. within a period of 15 min. The insulin level rose from 6–8 mIU/ml to 12.0 and 12.5 mIU/ml within four min of the glucose infusion, then rose to the peak level of 23.5 and 18.5 μ IU/ml respectively at 2 h of infusion and then declined attaining values similar to 0 h and 8 h after infusion. The results suggest that camel respond to glucose infusion by elaborating insulin release from the islets of Langerhans cells in the pancreas.

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