Indian Journal of Animal Sciences 75 (12): 1436–00, December 2005

Hypoglycemic activity of camel milk in straptozotocin induced hyperglycemia in rats

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Received: 20 May 2004; Accepted: 16 August 2005

Key words: Camel milk, Hyperglycemia, Milk, Rats

The camel milk is different from other ruminant milk: having low cholesterol, low sugar, high mineral (sodium, potassium, iron, copper, zinc and magnesium), high vitamin C (Knoess 1979), low protein and large concentrations of insulin. Gast *et al.* (1969) claim that the value of camel milk is to be found in the high concentrations of volatile fatty acids especially, linoleic acid and polyunsaturated acids, which are essential for human nutrition. Beneficial role of raw camel milk against chronic pulmonary tuberculosis patients had been observed by Mal *et al.* (2001). In repeated trials, Agarwal *et al.* (2003) reported 30–35% reduction in daily doses of insulin in patients of type-I diabetes drinking raw camel milk.

A controlled study of the oral hypoglycemic activity of camel milk was investigated in rats. Thirty-two white albino rats of approximately same age group having body weight ~150 g were acclimatized under laboratory conditions for a week by keeping them on diet of wheat *dalia* and water *ad lib.*, there fasting blood sugar level, by depriving food overnight but allowing free access to water, was estimated. The rats were divided into four groups (Gr.1, Gr.2, Gr.3 and Gr.4) of 8 rats each. Hyperglycemia was induced in rats of Gr.1, Gr.2 and Gr.3 by intraperitoneal administration of streptozotocin (50 mg/kg b.wt.). Whereas rats in Gr.4 were kept as untreated controls. Fasting blood sugar levels of all these animals were estimated after 3 days of treatment. These animals besides normal diet of wheat *dalia* were offered with raw camel milk (Gr.1), raw cattle milk (Gr.2), water (Gr.3) and normal diet (Gr.4). Rats of Gr.1 and Gr.2 were given 250 ml of milk daily through watering bottle, whereas animals in Gr. 3 and Gr. 4 were given tap water. The serum sugar levels of these rats were estimated at weekly interval for 3 consecutive weeks. Blood samples were drawn from cardiac puncture using tuberculin syringe from overnight fasted rats, serum samples were harvested and glucose level was determined spectrophotometrically employing glucose oxidase method.

Initial mean serum level of treated rats was 191.33±7.46 mg/dl whereas in sugar untreated controls it was 80.6±12.07 mg/dl. In Gr.1 after 1st, 2nd and 3rd week of trial mean blood sugar level was 98.0±3.37, 89.0±5.23 and 86.25±12.77 mg/dl, in Gr.2 it was 158.4±11.34, 132.8±23.49 and 110.0±9.97 mg/dl, whereas in Gr.3 it was 203.6±10.11, 132.8±23.49 and 124.5±24.21 mg/dl respectively. Every time mean blood sugar level in untreated group was within the normal range (70 to 90 mg/dl). During 3 weeks of trial three was a significant decrease in the mean blood sugar level of all the treated groups getting raw milk. But decline rate was higher in Gr.1 animals getting raw camel milk compared to raw cattle milk. The overall mean of three weeks trial showed a significant decrease in mean blood sugar level of Gr.1 rats

Table 1. Serum glucose (mean±SE) status in different groups of hyperglycemic rats

Mean serum glucose level (mg/dl)	Raw camel milk	Raw cattle milk	water	Untreated control
Before trial		191.33±7.46		80.6±12.07
7th day	98.0±3.37	158.4±11.34	203.6±10.11	77.6±8.68
14th day	89.0±5.23	132.8±23.49	132.8±23.49	86.2±12.41
21st day	86.25±12.77	110.0±9.97	124.5±24.21	80.0±10.81
Pooled	91.42±4.15	135.42±10.50	167.57±19.39	81.26±5.82
Drop in sugar level during three weeks trial	191/91=~210%	191/135=~141%	191/167=~114%	

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getting camel milk, as compared to Gr.2 rats getting raw cattle milk.

The positive effects may be because of high concentrations of insulin like protein of camel milk. Camel milk contains 48–128 units/litre insulin (Singh 2001). Oral insulin has been known since many years but the critical draw back is its coagulum formation in acidic media in stomach, which neutralizes its potency. One property of camel milk is that it does not form the coagulum in the stomach or the acidic media; thereby it prevents degradation of insulin in the stomach. Beg *et al.* (1986) found that amino acid sequence of some of the camel milk protein is rich in half cystine, which has superficial similarity with insulin family of peptides.

High mineral content (sodium, potassium, iron, zinc, copper and magnesium), as well as a high vitamin C intake may act as antioxidant thereby removing free radicals, which may provide a stress free situation to the animals (Gast *et al.* 1969, Knoess 1979). High concentrations of antioxidants and removal of fat from the body may make the insulin receptors to respond better to available insulin.

Unlike human immunoglobulin, which has a more complex structure, with 2 light chains bound to the heavier Y-shaped main chain, camel immunoglobulin has only the main Y-shaped heavy chain, without these additional parts (Hamers-Casterman *et al.* 1993). The camel antibodies find it easier to penetrate enzyme active sites than antibodies of other animal. This, and the relatively small size and weight of the immunoglobulin molecule, offer enormous potential. This action of camel immunoglobulins present in milk, might offer a better action of other proteins like insulin.

Since blood glucose level is controlled by endocrine, panacrine and autocrine interactions, there might be some other active principle in milk and that too more in camel milk compared to cattle milk. Baumrucker and Erondu (2000) reported insulin like growth factor system in the bovine mammary gland, having insulin receptors and binding proteins, concentrations of these changes at different stages of lactation. Further studies are warranted to fractionate the active principle and to find out its exact mode of action.

In conclusion overall mean of 3 weeks trial showed a significant decrease in mean blood sugar level of rats getting raw camel milk, as compared to rats getting raw cattle milk. Till now it is being thought that amount of insulin present in milk is playing this role. Its therapeutic efficacy may be due to lack of coagulum formation in the acidic media.

SUMMARY

A controlled study of the oral hypoglycemic activity of camel milk was investigated in rats. The 3-week trial study revealed that rats getting raw camel milk showed a significant decrease in mean blood sugar level compared to rats getting raw cattle milk.

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