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Letter to the Editor

Camel milk as an adjunct to insulin therapy improves long-term glycemic control and reduction in doses of insulin in patients with type-1 diabetes. A 1 year randomized controlled trial

In earlier studies we had observed that camel milk supplementation reduces the insulin requirement in type 1 diabetic patients [1,2]. It is found that one of the camel milk protein has many characteristics similar to insulin [3] and it does not form coagulum in acidic environment [4]. This lack of coagulum formation allows the camel milk to pass rapidly through the stomach together with the specific insulin like protein/insulin and remains available for absorption in intestine. Radioimmunoassay of camel milk has revealed high concentration of insulin, i.e. 52 units/l [5]. The aim of the present study was to determine the long-term efficacy and safety of camel milk as an adjunct to insulin therapy in patients with type 1 diabetes.

In a 52 weeks, randomized controlled study, 24 patients with type 1 diabetes were divided into two groups with mean age (13 7.5 versus 15 ± 9.4), BMI (17 ± 5.2 versus 17 ± 4.4) HbA_1c (7.54 ± 1.38 versus 7.8 ± 1.38). Plasma insulin (7.73 ± 2.42 versus 6.91 ± 2.13), C-peptide (0.22 ± 0.03 versus 0.18 ± 0.04) and mean dose of insulin required (33 ± 11 versus 32 ± 12). Group 1 ($n = 12$) received usual care and group 2 ($n = 12$) received 500 ml camel milk in addition to usual care for 1 year. Frequent blood sugar monitoring was done to maintain euglycemia by titrating the doses of insulin. Anti insulin antibodies were measured every 3 months. Changes from base line to end point were analysed using MANCOVA. After 1 year of treatment there was statistically significant increase in body mass index (17 ± 4.4 to 19.7 ± 2.97, $p < 0.001$), improvement in fasting blood sugar (119 ± 19 to 95.42 ± 15.70 $p < 0.003$) and in HbA_1c (7.8 ± 1.38 to 6 ± 0.96, $p < 0.001$). There was a significant reduction in the mean doses of insulin (32 ± 12 to 17.83 ± 12.40, $p < 0.005$) in patients receiving camel milk. Fasting plasma insulin and C-peptide levels did not reveal any significant change in either group, (Table 1). No significant treatment-emergent adverse events were reported in either group. Anti insulin antibody titers were less than 10% even after 1 year.

The important observation of this study was the significant reduction in insulin doses to obtain glycemic control at the end of 1 year in patients taking camel milk. Breitling [6] suggested that camel milk is having anti diabetic activity possibly because of: Insulin like activity, regulatory and immuno modulatory functions on β cells. El Agamy et al. [7] found good amounts of lysozyme, lactoferrin, lactoperoxidase, immunoglobulin G and secretory immunoglobulin A in camel milk. Beg et al. [8] has found that amino acid sequence of some of the camel milk proteins, is rich in half-cystine, which has superficial similarity with insulin family of peptides.

In conclusion, camel milk as an adjunct to insulin therapy appears to be safe and efficacious in improving long-term glycemic control and helps in reduction in the doses of insulin in patients with type 1 diabetes.

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Table 1
Effect of camel milk on glycemic control and insulin requirement in type 1 diabetes

Variables	Before treatment	After treatment	*p*-value
Group 1: control group			
BMI (kg/m^2)	17 ± 5.2	18.2 ± 3.8	NS
HbA_1c (%)	7.54 ± 1.38	7.63 ± 1.03	NS
Dose of insulin (units/day)	33 ± 11	30.16 ± 8.54	NS
Mean blood sugar (mg/dl)	121 ± 17.3	105.25 ± 14.50	0.041
Plasma insulin (μIU/ml)	7.73 ± 2.42	$19.54 \pm .43$	0.041
C-peptide (ng/ml)	0.22 ± 0.03	0.21 ± 0.06	NS
Group 2: camel milk group			
BMI (kg/m^2)	17 ± 4.4	19.7 ± 2.97	0.001
HbA_1c (%)	7.8 ± 1.38	6 ± 0.96	0.001
Dose of insulin (units/day)	32 ± 12	17.83 ± 12.40	0.005
Mean blood sugar (mg/dl)	119 ± 19	95.42 ± 15.70	0.001
Plasma insulin (μIU/ml)	6.91 ± 2.13	18.17 ± 7.12	0.03
C-peptide (ng/ml)	0.18 ± 0.04	0.24 ± 0.07	NS

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