Original article

Beneficial effect of camel milk in diabetic nephropathy

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Abstract. Diabetic nephropathy is originally microvascular in nature and is widely considered an important complication of diabetes. The present study was carried out to determine the efficacy of camel milk in controlling diabetic nephropathy. Twenty-four type-1 diabetic patients were randomly recruited from the outpatient diabetic clinic in PBM Hospital, Bikaner, India. All subjects gave their written consent before participation in the study. Patients with any acute metabolic complications were not included in the study. Eligible patients entered a run–in period of 1 month in which they were oriented to achieve the best possible glycemic control through standardized diet, standardized exercise regimen and insulin administration. During this period frequent monitoring of blood sugar was performed to maintain euglycemia. At the end of the run-in period, a base line evaluation was performed, then these patients were given camel milk in addition with usual care for six months. Urine microalbumin and blood sugar was measured twice a week before breakfast and dinner. There was a significant improvement in the microalbuminuria (119.48±1.68 to 22.52±2.68; $p<0.001$) after receiving camel milk for 6 months. A significant reduction in the mean dose of insulin for obtaining glycemic control was achieved (41.61±3.08 to 28.32±2.66; $p<0.01$). This study was performed to observe the role of camel milk in controlling microalbuminuria levels in type-1 diabetic patients. It was observed that after adding camel milk to the usual regimen an improvement in microalbuminuria was reached (119.48±1.68 to 22.52±2.68; $p<0.001$). This may be due to good glycemic control or to the direct effect of camel milk. The mechanism behind this effect is still unknown. (www.actabiomedica.it)

Key words: Diabetic nephropathy, camel milk, microalbuminuria

Introduction

Diabetes mellitus is a syndrome characterized by metabolism disorders and abnormally high blood sugar (hyperglycemia) resulting from a low level of the hormone insulin with or without abnormal resistance to insulin effects (1). Diabetic nephropathy is originally microvascular in nature and is widely considered an important complication of diabetes.

Microalbuminuria is defined by a rise in urinary albumin loss (between 30 and 300mg/day). To avoid a timed urine collection, a urinary albumin-creatinine ratio (ACR) >2.5 mg/mmol in men and >3.5 mg/mmol in women or a urinary albumin concentration >20 mg/l are adequate (2). This is the earliest sign of diabetic nephropathy and predicts increased total mortality, cardiovascular mortality and morbidity, and end-stage renal failure.

The cumulative incidence of microalbuminuria after 30 years of disease is approximately 40% (3-5). For microalbuminuric patients the relative risk of developing proteinuria is 9.3 compared to normoalbuminuric patients (6).

The majority of microalbuminuric type 1 diabetes mellitus patients will progress to develop proteinuria, although some of them may return to normoalbuminuria (7, 8). With aggressive anti-hypertensive therapy proteinuric type 1 diabetes mellitus pa-

tients lose glomerular filtration rate (GFR) at approximately 4 ml/min/year (9). When proteinuria and hypertension are present the standardised mortality ratio is increased 11-fold in men and 18-fold in women (10). Therefore preventing microalbuminuria might diminish progression to overt nephropathy.

The present study was carried out to determine the efficacy of camel milk in controlling diabetic nephropathy. In a previous study we observed that camel milk supplementation reduces the insulin requirement in type-1diabetic patients (11, 12). It was found that one of the camel milk proteins presents many characteristics similar to insulin (13) and does not form coagulum in acidic environment (14). This lack of coagulum formation allows camel milk to rapidly pass through the stomach together with the specific insulin like protein/insulin and remains available for absorption in the intestine. Radioimmunoassay of camel milk has revealed high concentration of insulin (i.e.. 52 units/lt) (15).

Materials and Methods

Twenty-four type 1 diabetic patients were randomly recruited from the outpatient diabetic clinic in PBM Hospital, Bikaner, India. The ethical committee of S.P. Medical College, Bikaner, approved the protocol and all subjects gave their written consent before participation in the study. Patients with any acute metabolic complications such as hypoglycemia, ketoacidosis, cardiovascular event, renal or acute infections were not included in the study. The eligible patients entered a run–in period of 1 month in which they were oriented to achieve the best possible glycemic control through standardized diet, standardized exercise regimen and insulin administration. During this period frequent monitoring of blood sugar was performe to maintain euglycemia. At the end of the run-in period, a base line evaluation was performed which included HbA1c dose of Insulin, mean plasma glucose, microalbuminuria, lipid profile, C-peptide and plasma insulin. These patients were also given camel milk (500 ml/day) in addition with usual care for six months.

Urine microalbumin was tested through micral test (16). Blood sugar was measured using the glucose oxidase method twice a week before breakfast and dinner. Plasma insulin and C-peptide were estimated by fully automated chemiilluminescence (CLIA) test. Anti-insulin antibodies were estimated by radioimmuno assay. HbA1c was measured by Ion exchange chromatography. Plasma total cholesterol, triglycerides, VLDL, HDL, LDL were estimated by fully automated biochemistry analyzer. Body mass index, waist hip ratio were also measured every week (17, 18). All the data were statistically analyzed by calculating mean value and applying 't' test for the same. $p<0.05$ was considered significant.

Results

A significant improvement of microalbuminuria (119.48±1.68 to 22.52±2.68; $p<0.001$) after receiving camel milk for 6 months was observed. Slight increase was also observed in mean BMI (18.52±0.73 to 19.43±0.81). The mean dose of insulin for obtaining glycemic control (41.61±3.08 to 28.32±2.66; $p<0.01$) was significantly reduced. A significant change in lipid profile i.e. cholesterol, HDL, LDL, VLDL and triglycerides was also observed. (Table 1, Fig 1). The daily insulin dose/kg before treatment of camel milk was 93.50 unit/kg and after camel milk supplementation it was 60.64 unit/kg.

Discussion

The present study was performed to observe the role of camel milk in controlling microalbuminuria levels in type 1 diabetic patients. It was observed that after adding camel milk to the usual regimen an improvement in microalbuminuria (119.48±1.68 to 22.52±2.68; $p<0.001$) was reached. This may be due to good glycemic control or to the direct effect of camel milk. The mechanism behind this effect is still unknown.

We also observed a slight increase in mean BMI (18.52±0.73 to 19.43±0.81) after camel milk supplementation. The positive effect in weight gain may be due to the good nutritive value of camel milk and good glycemic control.

Table 1. Effect of camel milk on biochemical parameters

Variables	Before camel milk supplementation Mean±SE	After camel milk supplementation Mean±SE	t	p
Age (years)	19.75±0.74	19.75±0.72	-	-
BMI (kg/m^2)	18.52±0.73	19.43±0.81	0.83	NS
HbA_1C (%)	9.54±0.44	8.65±0.38	0.62	NS
Dose of Insulin (u/day)	41.61±3.08	28.32±2.66	3.20	<0.01
Mean Plasma Glucose (mg/dl)	128.7±1.17	125.46±1.24	1.86	NS
Microalbuminuria (mg/dl)	119.48±1.68	22.52±2.68	30.68	<0.001
T. Cholesterol (mg/dl)	77.22±0.03	76.32±0.04	0.52	NS
HDL (mg/dl)	26.82±0.02	26.28±0.03	0.98	NS
LDL (mg/dl)	65.18±0.14	45.54±0.10	19.12	<0.001
VLDL (mg/dl)	6.84±0.02	6.3±0.02	1.00	NS
TG (mg/dl)	92.76±0.18	31.5±0.17	3.52	<0.001
C-Peptide (nmol/l)	0.18±0.14	0.24±0.17	0.75	NS
Plasma Insulin (pmol/l)	127.08±2.86	130.63±3.86	0.76	NS

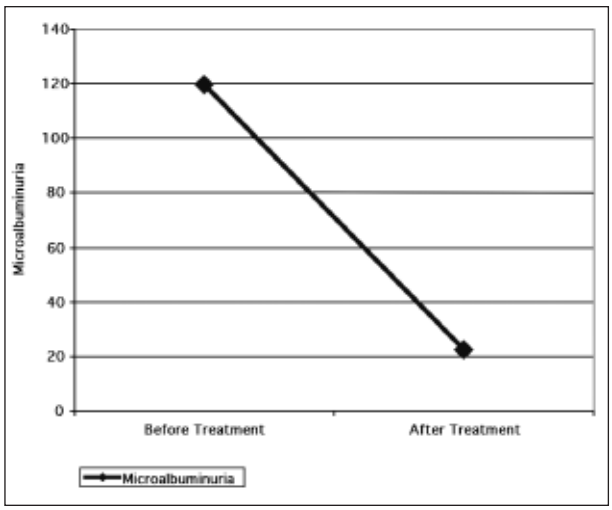

Figure 1. Effect of camel milk on Microalbuminuria

We also observed a significant reduction in insulin doses for obtaining glycemic control. Requirement of mean doses of insulin/day before treatment in patients was 41.61±3.08 which were reduced to 28.32±2.66 after camel milk addition to their treatment regimen. It may be the consequence of the high insulin/insulin like protein content in camel milk. In fact it has about 52 units/litre insulin (15). Moreover a significant change in lipid profile i.e. cholesterol, HDL, LDL, VLDL and triglycerides in patients after camel milk supplementation was observed and may be due to the low fat content of camel milk (2.49-3.1 gm% vs cow milk 3.79 gm%) (18). Till date we could not found any clear reference related to camel milk effect on diabetic nephropathy.

Conclusions

In conclusion the data of this study show a significant effect of camel milk on microalbuminuria when given as adjunctive therapy in type 1 diabetic patients but the reason behind this is still unknown. Therefore, further studies on camel milk are necessary to identify the components which are responsible for lowering microalbuminuria levels.

It was also concluded that camel milk shows its significant hypoglycemic effect when given alongwith conventional treatment. The action is presumed to be due to the presence of insulin/insulin like protein. Its therapeutic efficacy may be also due to the lack of coagulum formation in acidic media.

References

1. Tirerney LM, Mcphee SJ, Papadakis MA. Current medical diagnosis and treatment international edition. New York. *Lange Medical Book* 2002; 1203-1215.
2. Connell SJ, Hollis S, Tieszen KL, McMurray JR, Dornan TL. Gender and the clinical usefulness of the albumin: creatinine ratio. *Diabet Med* 1994; 11: 32-6.

3. Parving HH, Hommel E, Mathiesen E, et al. Prevalence of microalbuminuria, arterial hypertension, retinopathy and neuropathy in patients with insulin dependent diabetes. *Br Med J (Clin Res Ed)* 1988; 296: 156-60.
4. Orchard TJ, Dorman JS, Maser RE, et al. Prevalence of complications in IDDM by sex and duration. Pittsburgh Epidemiology of Diabetes Complications Study II. *Diabetes* 1990; 39: 1116-23.
5. Microvascular and acute complications in IDDM patients: the EURODIAB IDDM Complications Study. *Diabetologia* 1994; 37: 278-85.
6. Messent JW, Elliott TG, Hill RD, Jarrett RJ, Keen H, Viberti GC. Prognostic significance of microalbuminuria in insulin-dependent diabetes mellitus: a twenty-three year follow-up study. *Kidney Int* 1992; 41: 836-9.
7. Predictors of the development of microalbuminuria in patients with Type 1 diabetes mellitus: a seven-year prospective study. The Microalbuminuria Collaborative Study Group. *Diabet Med* 1999; 16: 918-25.
8. Effect of intensive therapy on the development and progression of diabetic nephropathy in the Diabetes Control and Complications Trial. The Diabetes Control and Complications Trial Research Group. *Kidney Int* 1995; 47: 1703-20.
9. Hovind P, Rossing P, Tarnow L, Smidt UM, Parving HH. Progression of diabetic nephropathy. *Kidney Int* 2001; 59: 702-9.
10. Wang SL, Head J, Stevens L, Fuller JH. Excess mortality and its relation to hypertension and proteinuria in diabetic patients. The world health organization multinational study of vascular disease in diabetes. *Diabetes Care* 1996; 19: 305-12.
11. Agrawal RP, Swami SC, Beniwal R, et al. Effect of camel milk on glycemic control risk factors and diabetes quality of life in type-1 diabetes: a randomised prospective controlled study. *J Camel Pract Res* 2003; 10: 45-50.
12. Agrawal RP, Swami SC, Beniwal R, et al. Effect of camel milk on glycemic control, lipid profile and diabetes quality of life in type-1 diabetes: a randomised prospective controlled cross over study. *Indian J Anim Sci* 2003; 73: 1105-110.
13. Beg OU, Von Bahr, Lindrom H, Zaidid ZH, Jornvall H. Characteristic of camel milk protein, rich in proline, identifies a new beta casein fragment. *Regul Pept* 1989; 15: 55-61.
14. Wangoh J. What steps towards camel milk technology? *Int J Anim Sci* 1993; 8: 9-11.
15. Singh R. Annual report of National Research Center on Camel, Bikaner, India 2001; p. 50, 2001.
16. Zheng YL, et al. Determination of Sensitivity and Specificity of the Micral-Test II Strip for Detection of Microalbuminuria in Diabetic and Nondiabetic Patients. *Nephron* 1999; 81: 455.
17. Shehadeh N, Gelertner L, Blazer S, Perlman R, Solovachik L, Etzioni A. Importance of insulin content in infant diet: suggestion for a new infant formula. *Acta Paediatr* 2002; 90: 93-5.
18. Surwit RS, Schneider MS, Feinglos MN. Stress and diabetes mellitus. *Diabetes Care* 1992; 15: 1413-22.
19. Singh Raghvendra. Senior Scientist. National Research Center on Camel, Bikaner, India. Personal Communication, 2001.

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