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Antidiabetic Activity of Coagulum from Camel Milk on Experimental Diabetes

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Abstract

This research was conducted to follow our previous research to evaluate the antidiabetic effect of coagulum from camel milk in alloxan diabetic dogs. Diabetes was induced by intravenous injection of alloxan (65 mg/kg bodyweight). The effects of camel milk on diabetic dogs were investigated by observing changes in the glycometabolic index (fasting blood glucose, IGTT test), the lipometabolic index (triglyceride, cholesterol), and total proteins and in the degree of injury of β-cells in the pancreatic islets. Diabetic dogs were divided into 2 groups getting respectively the coagulum obtained from 250 ml of camel milk and the whey gotten from the same quality of milk. For the group treated with coagulum from camel milk; a significant decrease in fasting plasma glucose (from 10 ± 1.02 mmol/l to 6.2 ± 0.48 mmol/l), cholesterol (from 7.46 ± 1.48 mmol/l to 4.76 ± 1.1 mmol/l) and total proteins (from 84.16 ± 7.18 g/l to 64.2 ± 7.41g/l) in blood sample and an improvement on the animal clinical state (increase of body weight, normal activity) were revealed. Treatment with coagulum from camel milk also induces the renewal of pancreatic b-cells. Treatment with whey from camel milk doesn't have any benefit effect on diabetic dogs. The curative effect of camel milk on diabetic dogs was approved in this study. This effect was observed using coagulum from camel milk as treatment.

Keywords

Coagulum, Camel Milk, Diabetes

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1. Introduction

Diabete mellitus is one of the endocrine glands diseases in Human and animal which involves the gland circulatory system. Several species were sensitive to alloxan toxicity such as rats, rabbit and dogs [13].

This metabolic disorder can be caused chemically using many components such as Alloxan and streptozotocin. Alloxanic diabetes is caused by the selective pancreatic beta cell toxicity of this composite [9].

Several species were sensitive to Alloxan toxicity such as rats, rabbit and dogs [13, 8].

Drugs used for diabetes treatment are expensive and have side effects; dietary interventions with the aim of prevention and control of diabetes as well as reduction in related costs could be highly effective [11] (Mahan, Escott Stump, & Raymond, 2012).

Recent research shows that camel milk has hypoglycaemic and hypocholesterolaemic effects, in addition to potential treatment effects for different diseases including cancers, hepatitis, allergies, and hypertension [2, 6, 3, 15]. Recent research shows that camel milk has hypoglycaemic and hypocholesterolaemic effects, in addition to potential treatment effects for different diseases including cancers, hepatitis, allergies, and hypertension.

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This study was conducted to assess the effects of coagulum from camel milk on alloxan - induced diabetic dogs.

2. Methods

2.1. Animals and Diet

Eight clinically normal adult mixed-breed dogs were prepared for this experiment (12 to 16 kg initially). These dogs were housed individually in the Tunisian Veterinary Medicine School, Sidi Thabet. Animals were fed once daily with 350-400 g of commercial dry chow (23% protein, 6% fat, 33% carbohydrates, 4% crude fiber and 3000 kcal/kg as energetic value; (DOGSY) from Tunisian Animal Nutrition Society) and 300- 400 g of beef.

2.2. Induction of Experimental Diabetes

The dogs were fasted for 24 h prior to the induction of diabetes mellitus. Diabetes was induced in dogs by intravenous injection of 65 mg/kg bodyweight: Fresh solution was prepared just prior to injection [5].

2.3. Experimental Design

Eight diabetic dogs were used and divided into 2 groups, each one containing 4 dogs, as follows:

Group 1: Diabetic dogs treated with coagulum obtained from 250 mL of raw camel milk;

Group 2: Diabetic dogs getting whey obtained from the same quantity of milk

The quantity of camel milk used (250 mL) was deduced from our previous research [14].

Day 7 of induction of diabetes was designated as day 1 for milk treatment in diabetic dogs.

After stopping the treatment with milk, all parameters were analyzed for two weeks to follow variations by the end of distribution of camel milk.

2.4. Blood Samples Collection and Biochemical Analysis

Blood samples were drawn two times per week, for seven weeks and samples were divided into two tubes: one for glycemic assay (enclose oxalate fluorure), other for cholesterol, Triglycerides (TG) and total proteins assays.

The blood glucose concentration was measured by a glucose oxidase method (Biomaghreb®) using a spectrophotometer at 505 nm. Cholesterol and triglycerides concentrations were determined by enzymatic methods (Biomaghreb®) using CECIL spectrophotometer (CE 2041, Cecil Instruments, England) at 505 nm. Total proteins concentrations were analyzed at 546 nm.

2.5. Milk Samples

Camel milk used during this study was obtained from a camel herd (Camelus dromedarius) belonging the Arid Land Institute (Medenine, Tunisia).

2.6. Statistical Analysis

The data were expressed as the mean ± SEM. These data were subjected to statistical analysis using SAS computer software (SAS institute, 1998)

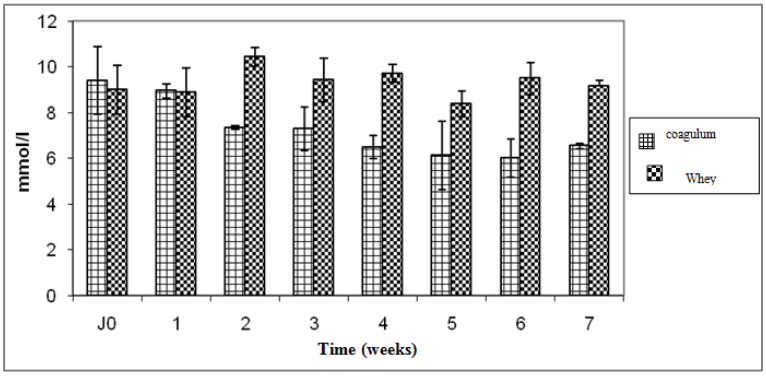

Figure 1. Blood glucose variations.

3. Results

3.1. Effect of Camel Milk Treatment on Fasting Blood Glucose

The treatment of diabetic dogs with coagulum significantly restored blood glucose levels (from 9.77 ± 0.19 to 5.4 ± 0.13 mmol/L); this significant decrease was observed since week 4 of treatment (figure 1).

3.2. Effect of Camel Milk Treatment on Blood Lipids and Proteins Levels

Cholesterol, TG and total proteins levels are presented as means ± SD in tables 1 and 2.

Diabetic dogs treated with whey from camel milk didn't show any significant variations of cholesterol and total protein levels during the experiment (tables 1 and 2).

Table 1. Total proteins, cholesterol and TG levels variations

	Camel milk Coagulum		Camel milk Whey	
	Cholesterol (mmol/l)	TG (mmol/l	Cholesterol (mmol/l)	TG (mmol/l
day 0	$7.46^{a} \pm 1.48$	$3.14^{a} \pm 1.28$	$7.68^{a} \pm 0.25$	$1.23^{a} \pm 0.12$
W1	$7.51^{a} \pm 1.82$	$2.2^{a} \pm 0.18$	$6.42^{a} \pm 0.31$	$1.3^{a} \pm 0.23$
W2	$6.86^{a} \pm 1.36$	$2,89^{a} \pm 0.74$	$6.92^{a} \pm 0.2$	$1.09^{a} \pm 0.56$
W3	$6.18^{a} \pm 1.69$	$3.01^{a} \pm 0.47$	$6^{a} \pm 1.02$	$0.93^{a} \pm 0.26$
W4	$5.66^{a,b} \pm 1.81$	$3.29^{a} \pm 0.02$	$5.84^{a} \pm 0.36$	$1.1^{a} \pm 0.45$
W5	$4.76^{b} \pm 1.1$	$2.97^{a} \pm 0.49$	$5.88^{a} \pm 2.3$	$0.86^{a} \pm 0.58$
W6	$4.06^{b} \pm 0,11$	$2.91^{a} \pm 0.125$	$5.98^{a} \pm 1.32$	$0.96^{a} \pm 0.97$
W7	$4.59^{b} \pm 0.62$	$2.9^{a} \pm 0.12$	$5.05^{a} \pm 0.63$	$0.97^{a} \pm 0.95$

Mean ± standard deviation. Values sharing same letters differ non-significantly ($p>0.05$)

Table 2. Total proteins variations.

Week	Coagulum	Whey
day 0	$84.16^{a} \pm 7.18$	$90.92^{a} \pm 4.23$
W1	$78.99^{a} \pm 10.42$	$98^{a} \pm 6.50$
W2	$72.32^{a} \pm 14.42$	$103.38^{a} \pm 3.21$
W3	$67.98^{a} \pm 8.44$	$97.56^{a} \pm 5.31$
W4	$65.13^{b} \pm 8.45$	$95.13^{a} \pm 6.32$
W5	$64.2^{b} \pm 7.41$	$99.2^{a} \pm 4.52$
W6	$65.51^{b} \pm 3.52$	$97.79^{a} \pm 3.14$
W7	$65.66^{b} \pm 4.61$	$95.97^{a} \pm 6.32$

Mean ± standard deviation. Values sharing same letters differ, non-significantly ($p>0.05$)

The administration of camel milk coagulum lowered cholesterol (from 7.46 ± 1.48 to 4.59 ± 0.62, $p<0.05$) (table 1) and total proteins levels (from 84.16 ± 7.18 to 65.66 ± 4.61 g/l, table 2). Triglycerides (TG) levels were not influenced by the diabetic state.

4. Discussion

Camel milk has attracted a lot of scientific interest due to its unique health effects, and an increasing number of scientific publications have focused on the medicinal potency of camel milk with its special components.

The effect of coagulum/ whey from camel milk on diabetes is not studied untill now. Therefore the antidiabetic effect of camel milk was reported in studies with various diabetic laboratory animals, camel milk consumption caused reduction of blood sugar [1, 3, 4, 8, 15].

Several underlying mechanisms have been proposed for improving blood sugar level by camel milk consumption; a high level of insulin (52 micro unit / mL) [3, 7], the high amount of polyunsaturated fatty acids (C18:1- C18: 3), and the high amount of vitamin B3 [7, 12] and also some particularities of camel immunoglobulin. Amino acid sequence in some camel milk proteins is rich with half-cysteine that is very similar to insulin family peptides and does not cause clotting in acidic stomach environment [2].

The antidiabetic effect of camel milk coagulum was similar to the effect of raw and pasteurized camel milk in diabetic dogs described by some previous studies [10, 11].

Diabetes causes huge changes in lipids, plasma triglycerides and lipoprotein profiles and also increases the risk of cardiovascular diseases. However, it has been documented that camel milk contains conjugated linoleic acid which reduces triglycerides, total cholesterol, LDL cholesterol, and ratio of LDL/HDL (Gizachew et al., 2014) and partially similar to our results, these effects have been shown in some studies [4, 8, 15]. Other researchers recently showed the hypocholesterolemic effect of Gariss (i.e., fermented camel milk) on the levels of lipid profile of rats [5].

Diabetes in dogs is generally associated, in addition to high blood glucose levels, with an increase of total proteins concentrations14 which was illustrated in our study in all dogs after injection of alloxan and especially in dogs from group 2 treated with cow milk during the trial. This may be due to the toxicity of alloxan on the proximal convoluted renal tube [14].

5. Conclusion

From the results presented in our study, a therapeutic efficacy of camel milk coagulum on alloxan-induced diabetic dogs was well shown. This may have an important implication for the clinical management of diabetes mellitus in humans.

Further pharmacological and histological investigations are necessary to identify this effect, as well as to confirm its mechanism of action and its antidiabetic potential.

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