

Camel Milk; A Superfood for Diabetic Patients

Taherah Mohammadabadi*

Professor, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University, Iran

***Corresponding Author:** Taherah Mohammadabadi, Professor, Faculty of Animal Science and Food Technology, Agricultural Sciences and Natural Resources University, Iran.

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Abstract

Camel milk contains insulin like proteins, which does not form coagulum in the acidic condition of stomach, can be absorbed from the intestine and may be an effective alternative for insulin to treat type 1 and 2 and gestational diabetes. Camel milk may prepare about 60% of the insulin in diabetic patients and reduce blood sugar and required insulin in type 1 diabetes patients. This milk is believed to be a suitable hypoglycemic agent in improving long-term glycemic control in experimental animals and diabetic patients. The incidence risk of diabetes in people who regularly consume camel milk, is much lower than those who don't use camel milk. Raw camel milk has immune-modulatory effects on beta-cells of the pancreas, increase insulin secretion, reduces required insulin and insulin resistance in type 1 diabetes patients. Lactoferrin of camel milk has immune-modulatory effects on pancreas beta-cells and reduces required insulin doses in diabetes 1 and 2 patients. Camel milk improves the diabetes complications such as obesity, inflammation, wounds and oxidative stress damages. The favorable effects of raw camel milk on diabetes confirmed in clinical trials which also improve risk factors such as liver and kidney failures and cardiovascular challenge derived from diabetes mellitus. It appears that more scientific studies are needed to confirm the efficacy of processed camel milk on diabetes.

Keywords: Camel Milk; Diabetes; Superfood

Introduction

Diabetes is a group of metabolic disorders associated with chronic hyperglycemia that linked with cardiovascular diseases and kidney and liver failures [1]. Three-quarters of the world's population cannot use allopathic medicines and therefore rely on drugs made from natural products of animals and plants [2].

Although the primary treatment for type 1 diabetes is insulin which must be resistant to enzymatic degradation and easily absorbed. Camel's milk plays a vital role in maintaining the pancreatic beta cell's function, as well as improving kidney and liver function during diabetes and enhancing the lipid metabolism associated with type 1 diabetes [1]. Consumers' interest in camel milk has been largely due to awareness of its unique benefits.

Raw camel milk has immune-modulatory effects on beta-cells of the pancreas, increases insulin secretion, reduces required insulin and insulin resistance, and improves glycemic control in type 1 diabetes patients [3,4]. Camel milk improves the diabetes complications such as obesity, inflammation, wounds, and oxidative stress damages [2].

Unique components of camel milk

The average fat content of camel milk was 3.82%, protein 3.35%, and lactose 4.12% [5]. The long-chain fatty acids, linoleic acid, and unsaturated fatty acids are high which are essential for health [6].

The size of immunoglobulins in camel milk is ten times smaller than human antibodies; which easily absorbed and transferred into the bloodstream and shows antiviral, antibacterial, and immunological effects [7]. Camel milk is a good source of iron and can support rapid growth in infants and prevent iron-induced anemia [8].

Compared to the amount of vitamin C in the milk of other species, camel milk contains 52 mg of vitamin C per liter [1]. Camel milk has no allergenicity due to a lack of beta-lactoglobulin. Higher concentrations of lactoferrin and lysozyme in camel's milk led to higher anti-microbial properties than cow's milk [3].

The saturated/unsaturated fatty acids ratio was 67.7% for camel milk and 69.9% for cow milk which unsaturated fatty acids are higher in camel milk. Due to the relatively high amount of conjugated linoleic acid in camel milk compared to human and cow milk, the tendency to camel milk is increasing [6].

Camel milk lactose is easily metabolized in lactose intolerance cases [2]. Camel milk contains 7 oligosaccharides, which inhibit the binding of pathogenic microorganisms in the Gut. It also stimulates the growth of colon bifidobacteria and acts as a nerve growth factor [6].

The action mechanism of camel milk on diabetes

Camel milk contains insulin-like proteins, which do not form coagulum in the acidic media of the stomach that can be an effective alternative for insulin [9]. Camel milk improves glycemic control and decreases insulin resistance and insulin requirements in diabetes patients [10,11]. This milk enhances obesity, inflammation, wounds, and oxidative stress damages as diabetes complications [12].

The anti-diabetic activity of camel milk may be due to its immune functions of pancreatic beta cells, anti-inflammatory effects, and antioxidants, which cause extensive changes in blood lipids and pressure and reduce the risk of cardiovascular disease [13].

The effects of camel milk on diabetes were included; effect on insulin synthesis and secretion and insulin receptor function, direct effects on insulin receptor function and glucose transport in the insulin-sensitive tissues, impact on insulin secretion by the pancreatic b-cells (Figure 1) [14]. These effects, together with the inhibitory effects on DPP-IV and the positive effects on GIP and GLP-1 receptors, may explain the cellular and molecular reasons for the beneficial effects of camel milk on the management of diabetes [15].

The bioactive proteins of camel milk are effective by direct or indirect action on specific pathways controlling insulin synthesis and secretion by the pancreatic b-cells (Figure 1). Finally, the indirect effects of camel milk may be known by its anti-inflammatory, anti-apoptotic, and antioxidant properties, which improve the secretory activity and overall function of pancreatic beta cells. The protective effects of small immunoglobulins of camel milk on pancreatic beta cells have also been suggested to explain the hypoglycemic effects of camel milk [14,16].

Iron-binding glycoproteins of camel milk whey like lactoferrin have an essential role on insulin function and signaling of insulin receptors (Figure 2) and insulin resistance that influence diabetes disorders such as inflammation and obesity [14].

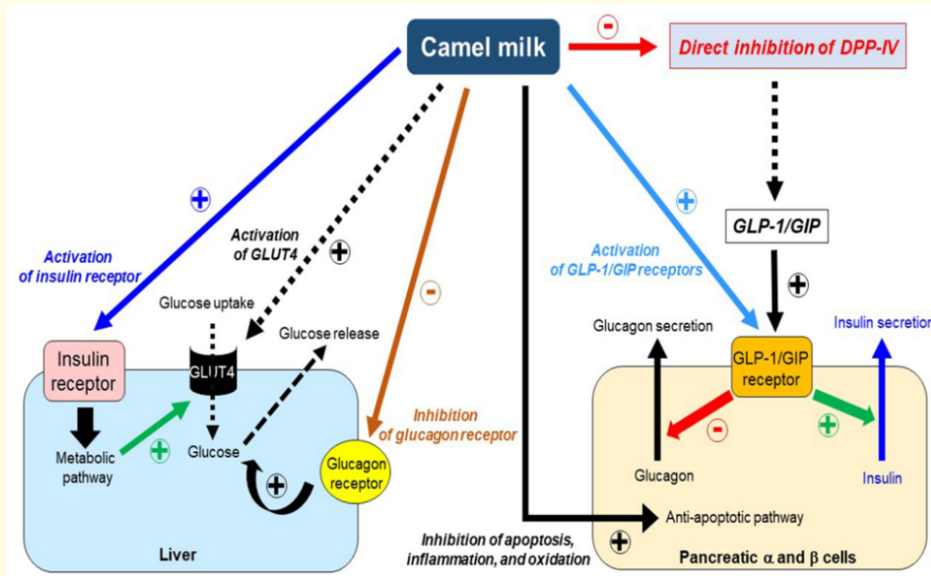


Figure 1: The mechanisms of anti-diabetic effects of camel milk. Adapted from Ayoub., et al. [14].

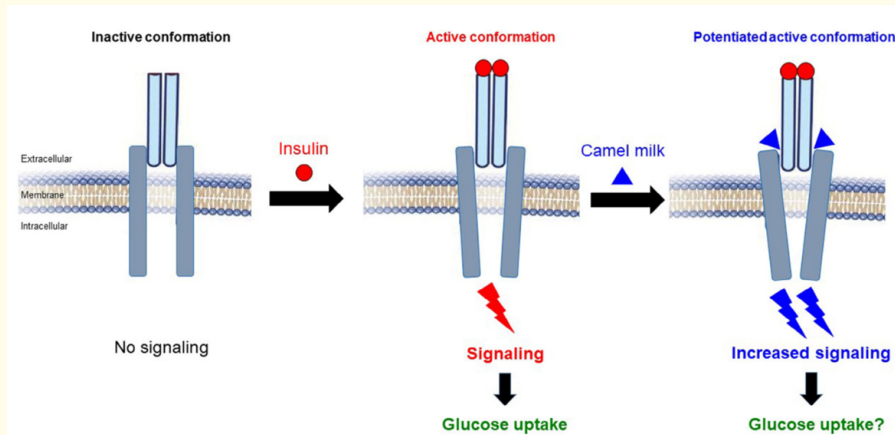


Figure 2: The effects of camel milk on signaling and glucose uptake into the cells. Adapted from Abdulrahman., et al. [17].

Camel milk and risk factors of diabetes

Chronic hyperglycemia causes chronic damage and dysfunction of various organs: eyes, renal, liver, nervous system, and heart. However, control of sugar metabolism through exercise, diet and drugs reduces the risk factors [16]. Camel milk improves wounds, hypercholesterolemia, oxidative stress, liver and kidney failures and obesity problems as main diabetes complications. The reducing oxidative

activity by whey proteins of camel milk enhances immune cell proliferation and diabetics wound healing by enhancing glutathione and the cellular antioxidant defense system [16].

The interaction between milk's bioactive peptides and cholesterol decreases cholesterol. Cholesterol-lowering peptides also prevent cholesterol absorption by electrostatic and hydrophobic reactions or through decreasing cholesterol solubility [2].

The anti-diabetic properties of camel milk

Consuming 500 ml camel milk daily reduced glucose and required insulin dose by 30 to 35%, without any effect on blood lipids. In addition, the anti-diabetic activity of camel milk may be due to its immune functions of pancreatic beta cells, anti-inflammatory and antioxidants effects [13].

Twenty-one patients with type 1 diabetes consumed 500 ml camel milk daily for six months. Triglycerides, LDL, required insulin dose and albuminuria were reduced [18].

In one experiment, diabetics cases (10 people per treatment) were given 500 ml pasteurized camel milk daily in the morning and evening. After two months, the results showed that camel milk reduced insulin requirements in diabetic patients [19].

Also, 500 ml raw camel milk was used for three months in type 1 diabetic patients, which reduced blood sugar from 115 to 100 and the required insulin from 41 to 30 units per day. LDL also decreased significantly, but total cholesterol and triglycerides reduced insignificant [11].

In another experiment, the effectiveness of camel milk on blood sugar and quality of life in patients with type 1 diabetes was evaluated. In this experiment, 24 patients with type 1 diabetes were randomly selected. Group 1 received routine or usual care (diet, exercise, and insulin), and group 2 received 500 mL camel milk daily in addition to regular care for three months. After three months of treatment with camel milk, the results showed a significant improvement in fasting blood sugar and a significant reduction in insulin requirements [11].

In another study, 50 newly diagnosed type 1 diabetic cases were divided into two groups. One group received standard routine treatment, and the other group consumed 500 mL fresh camel milk in addition to joint standard medical therapy for 12 months. Mean blood sugar decreased in the camel milk group. In addition, the need for an average daily dose of insulin in the camel milk group decreased [12].

Fifty-four type 1 diabetic patients (mean age 20 years) were divided into two groups. The first group was under regular treatment (diet, exercise, and insulin), and the second group, in addition to conventional therapy, were treated with 500 ml camel milk. After 16 weeks, they observed a significant difference between the control group and the camel milk group [9].

Decreased fasting blood sugar in type 1 diabetic patients treated with camel's milk and insulin together after approximately three months was 28% compared with 22% in patients treated with camel's milk alone or 11% in patients treated with insulin [9].

After three months of taking camel milk, blood cholesterol and triglyceride decreased as well as LDL in type 1 diabetic patients who received insulin injections. Also, a significant decrease in TG, cholesterol and LDL was reported in the diabetic patients fed insulin and camel milk compared with the control [9].

Conclusion

The favorable effects of raw camel milk on diabetes and risk factors such as liver and kidney failures and cardiovascular challenge due to diabetes confirmed. But it seems that more scientific studies are needed to confirm the efficacy of processed camel milk on diabetes subjects.

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