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Camel Milk an Alternative Therapeutic for Diabetes

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COLUMN ARTICLE

More than 300 million people in the world have diabetes which is expected to reach to 500 million in next decade. Insulin is an anabolic hormone, protein in nature having 51 amino acids arranged in α and β chains and is produced by pancreas and functions metabolically for carbohydrates, proteins and lipids in human body [1]. Type1 diabetes (TD1M) previously known as juvenile diabetes is immune mediated diabetes present in 5 - 10% of cases. It is insulin dependent and caused by immune destruction of β-cells of islets of Langerhans, which is indicated by autoantibodies to insulin, autoantibodies to GAD, autoantibodies to tyrosine phosphatases IA-2 and IA-2β [2]. Type 2 diabetes (T2DM) present in 90-95% of cases is adult-onset diabetes and is caused due to either insulin deficiency or insulin resistance in individuals. It is also referred as non-insulin dependent diabetes [2]. T2DM is caused either by impaired glucose tolerance or insulin resistance, initiated by insulin receptors and other related cells [3]. Tumor necrosis factor-α (TNF-α), abundantly found in adipose tissues, causes insulin resistance in type 2 diabetes by blocking synthesis of many adipocyte specific proteins which metabolize body energy and cause insulin sensitivity [4]. The risk of cardiovascular complications is twice in hyperglycemic patients in addition to nephropathies and retinopathies.

At present, several anti-diabetic drugs are used but they are doing more harm than cure and causing serious health issues. Such therapeutics are not cost effective rather hard to use for patients living below the poverty line [5]. It is dire need to find economical but effective alternate treatments. Camel is one of the animals mentioned in Quran and Hadith, the Holy Scripts of Muslims. The camel milk is acknowledged with statement "The food for hungry and treatment for the sick". Camel is mostly found in Asia and Africa serving as good source of food and transportation. The interest about camel production and its products are growing in the world as studies about them are advancing [6]. Literature shows antiradical, anti-diabetic, anti-inflammatory, anti-allergic, anti-autism and hepato protective activitities of camel milk [7]. Camel milk is rich in manganese, selenium and iron hence may be used in cases

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where minor deficiencies of these elements are used. Camel milk has 7-20 times more manganese and 4-10 times more iron in comparison to human and cow milk [8]. Experiments on type 1 diabetic humans show significant reduction in parenteral insulin requirement when they are subjected to camel milk consumption along with management (diet and exercise) [9,10]. Another research shows a significant improvement in fasting blood glucose level and reduction in insulin dosage in patients of type 1 diabetes, having camel milk [9,11].

Insulin attached to glycoprotein receptor present at cell surface and starts its action. α-subunit of this receptor molecule binds the hormone (insulin) and β-subunit, tyrosine specific protein kinase, produces signals which stimulate insulin's action on metabolism of glucose, lipid and proteins [12]. Pancreatic β-cells have more affinity towards insulin like growth factor-1 than that of insulin, resulting in reduced action of insulin [13]. Glucose modulates growth and survival of pancreatic beta cells which is achieved by electrifying certain proteins in insulin signaling pathway. Insulin stimulates insulin receptor (βIRKO) and insulin receptor substrate 2 (βIRS2KO), they activate phosphatidylinositol-3-kinase and Akt-kinase that glucose fails to do alone [14]. In T2DM the function of glucagon like peptide-1 (GLP-1) an incretin hormone, secreted from enteroendocrine L cells in lower intestine [15] and metabolized by dipeptide peptidase-IV enzyme (DPP-IV), is conserved and treatment involves its activation [16]. Due to insulinotropic nature of GLP-1, it suppresses glucagon and stimulate insulin synthesis along with other actions [17]. GLP-1 when given exogenously shows effects on insulin secretion and makes β-cells sensitive to glucose and helps in treating DM [18,19]. An experiment on diabetic rats' shows enhanced glucose stimulated insulin secretion, regulate secretion and effect of incretin and anti-inflammatory effect when given camel milk [20].

In summary, the mechanisms involved in treatment of diabetes by camel milk insulin included its a) direct effect on functioning of insulin receptor, and glucose transport in insulin sensitive tissue, b) direct or indirect effects on insulin section by pancreatic beta cells, c) effects on survival and, growth, and overall activity of pancreatic cells. Camel milk directly activates GIP/GLP-1 or indirectly by inhibiting DPP-IV that in turn increases GIP/GLP-1 which acts on GIP/GLP-1 receptor to inhibit glucagon and to increase insulin secretions. The anti-apoptotic activity, antioxidant activity, and anti-inflammatory activity of camel milk save both alpha and beta cells of pancreases. The inhibition of glucagon receptor by camel milk also helps in diabetes treatment. The activation of GLUT4 makes utilization of glucose (lactoferrin is supposed to do this). Moreover, camel milk directly activates insulin receptors.

Camel milk proved to be effective in reversing pathological changes of kidney and liver occurred due to diabetes [21]. Due to presence of monosaturated and poly-saturated fatty acids, immunoglobulin's, lactoferrin, serum albumin, vitamin C and E, lysozymes and insulin hormone camel milk is used to control diabetes and blood cholesterol level [22]. Due to all these constituents it is considered as immune stimulator [23]. Peptides in camel milk provide insulin secretion and stimulate activity of insulin receptors and make it an anti-diabetic agent [24]. Insulin content is much higher in camel milk (58.67 ± 2.01 U/L) than cow (17.01 ± 0.96 U/L) and buffalo milk (16.21 ± 0.95 U/L) [21]. Several experiments and documentations also suggests that camel milk does not react with the gastric acid and pass as such to intestines [25]. Camel milk have protected insulin, enclosed by micelles, which by pass the stomach acid and gastric digestion and degradation, absorbed from intestines to blood stream and provides antidiabetic effect [26]. Diabetes mellitus is a metabolic disease and antioxidants present in camel milk helps to combat metabolic symptoms and complications associated with this like nephropathy, retinopathy and cardiovascular disorders [27]. Fermented camel milk showed hypoglycemic and anti-inflammatory effect when experimented on human adolescent host [28]. In a study, 92% of diabetic patients showed decreased requirement of parenteral insulin administration up to 30% , when given 0.5 liter camel milk daily along with the regular care (diet and exercise) [9]. Further studies are required to explore its therapeutic efficacy and its marketing [29-34].

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