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Exploring the Therapeutic Potential of Camel Milk in Diabetes Management: A Comprehensive Investigation

Dr. Sachin Gupta[1]*, Ajay Kumar[2], A Kannagi[3]

*[1]Chancellor, Department of Management, Sanskriti University, Mathura, Uttar Pradesh, India, Email Id- chancellor@sanskriti.edu.in, Orcid Id- 0000-0002-4900-0082

[2]Assistant Professor, Department of Computer Science & Engineering, Vivekananda Global University, Jaipur, India, Email Id- Kumar.ajay@vgu.ac.in, Orcid Id- 0000-0002-9134-054X

[3]Associate Professor, Department of Computer Sceince and Information Technology, Jain (Deemed to be University), Bangalore, India, Email Id- a.kannagi@jainuniversity.ac.in, Orcid Id- 0000-0003-3810-7500

Abstract

Chronic metabolic disease known as diabetes mellitus is becoming more and more common, which presents a worldwide health concern. As possible supplements to conventional treatments, complementary and standard treatments are receiving more attention. Due to its distinct composition and stated health advantages, camel milk has emerged as one of the most promising approaches. There is a conflict regarding how consuming camel milk (CM) affects glycemic control in diabetic people. This systematic review was carried out to compile data on how CM consumption affected glucose homeostasis markers in individuals, the two forms of diabetes mellitus. Tests were performed on the following parameters: insulin resistance levels, insulin dosage (ID) obtained serum insulin antibody (IA), "fasting blood glucose" (FBG), "postprandial glucose" (PPG) and fasting serum insulin (FI). FBG can regulate blood sugar, after an extended period without food intake. PPG refers to the term of glucose in the bloodstream after consuming a meal; it is a crucial aspect of glucose metabolism. Meanwhile, camel milk is becoming more and more popular as a possible natural insulin replacement due to the presence of special proteins that share fundamental similarities with human insulin. One-way ANOVA was used to detect camel milk. Of the 450 articles gathered, sub-group analysis was deemed suitable for inclusion. The ability to reduce HbA1c was helpful for fresh and processed CM. In conclusion, long-term CM usage by diabetic patients can be a helpful adjuvant therapy in addition to traditional medicine, particularly in reducing the needed dose of insulin and HbA1c. Interference variables were included in the examined publications because of the significant level of heterogeneity seen in the included research.

Keywords: Diabetics, Blood glucose, Camel milk, Patients, Insulin, Mineral

INTRODUCTION

Camel milk (CM) has a multiple wellness that contains a source of nutrients and proteins, 30 percent of calories in pastoral communities of dietary. CM consists of fats, cholesterol and lactose in milk was less as compared with the bovine milk (1). CM contains a high-power source of minerals like calcium, magnesium, iron, copper, zinc along with vitamins A and C. Additionally has a greater concentration of zinc, which is critical for the growth and upkeep of the immune responses' regular functioning (2). Researchers' analyzed CM antibodies can be useful in the fight against viral infections such as AIDS, dementia and cancerous cells. Features of regulation and immune-modulating affecting cell populations in the digestive tract. Moreover, CM contains tumor-fighting antithrombotic and inflammatory characteristics (3, 4). At present, the antibacterial properties of lactic acid from camel milk are thoroughly studied. A type of pro such as the acid-producing bacteria found in CM is crucial for gut health. The immunity of camel stands apart from the rest of mammals and it is more robust (5, 6). The potent of antioxidants found in camel's milk include a high concentration of vitamin C with beneficial effects on cellular collagen that repairs creases as well as roughness and protects the skin from damage caused by free radicals (7, 8). Vitamin C has a crucial role in the creation of collagen, the expansion of artery walls, tissues and fortifying skin rigidity. Research revealed that continuous liver condition patients' CM recovered more quickly and recovered to normal (9). CM lactic acid has been shown to have a more beneficial antiviral effect over lactoferrins from humans and milk from cows. Because of their ability to suppress kinase enzymes and increase

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RNA production, CM antibodies, lactoferrins and iron-binding protease have been shown to have anticancer properties (10). Additionally, CM lactoperoxidase has anticancer properties. The condition known as diabetes is a major worldwide disease. It's a long-term metabolism illness marked by increased plasma glucose concentrations. The demand for novel and practical methods of managing diabetes is increasing while the disease's incidence rises (11). Investigating supplementary and alternative treatments, particularly the possible benefits of CM, received more attention in the past few decades. Increased levels of CM lactic acid help individuals with arthritis by removing unprocessed iron from their bones (12). The objective of the study is to give an in-depth knowledge of the effects of milk from camels on blood sugar, diabetic resistance and various other relevant variables. Furthermore, investigates plausible pathways for action that underlie the effects and evaluates the general practicability and obstacles are linked for integrating camel milk through diabetic therapy approaches.

The study (13) explored the globe's hottest and most arid areas, the milk of camels CM is an essential supply of nutrition. Heterogeneous mixtures comprising non-nutritional (chemicals, growth-promoting inflammatory substances, antibodies) exosomes and nutritive (amino acids, sugars, lipids, nutrients and metals) constituents make up CM. This article has endeavoured to share their opinion on the curative value of the dietary or non-nutritional parts of complementary medicine as well as a peek at the present developments in CM development attempts. The research (14) examined the anti-cancer, anti-inflammatory, anticoagulant, hypoglycemic, antibacterial, non-allergenic and anti-Crohn's illness qualities of milk from camels among other possible health advantages, besides the discovered practical benefits of milk from camels. The article (15) illustrated that the human's obesity was a major threat to health. Currently, the treatment plan for this disease includes a variety of hypoglycemia medications, such as glinides, a medication that improves the balance of blood sugar but has several adverse impacts on patients. Traditional insulin administration was linked to several problems including a high level of unease and soreness. The study (16) presented that camel's milk was an essential part of the food that humans eat, particularly for those who live in semi-arid, arid regions of the globe. In contrast to the cow's dairy products, CM has an entirely distinct composition since it has more medium-chain lipids, less lactate and greater amounts of sunshine as well as proteins. The research (17) discovered the benefits of CM for human wellness and nutrition are well documented. This has to do with the low blood sugar level in which multiple in vivo and vitro experiments are showed. By providing its cells basis, the utilization of infrared-absorbing substances produced by CM sheds more light on the diabetes-fighting abilities of CM that can provide compelling evidence for the development of new diabetic devices made of CM-derived particles and an utilize of CM in the medical management that is overweight. The article (18) assessed contrast that benefits the effects on lymphocytes used in liver cancer research on milk from camel exosomes included obtained from colostrums and promptly, the middle and postpartum phases. On a healthy adult liver function. These extracellular particles demonstrated neurotoxicity but were less harmful. The study (19) demonstrated that there are special medicinal advantages to milk from camels. The primary ingredient that provides milk from camels its distinctive characteristics and affects its dietary content is proteins. The absence of β-lactoglobulin in CM makes it a suitable substitute in human milk. Iron is manganese and the antioxidant vitamin C are abundant in CM. CM contains large levels of antibodies, insulin-like proteins, polyunsaturated fats and protecting proteins including lysozyme & lactic acid. The research (20) presented the impact of frequent goat milk intake on the glycaemic condition of diabetic individuals and experimental animals, using direct evidence concerning the low incidence of diabetics in the community consuming the CM.

MATERIALS AND METHODS

The analysis paper and systematic review were considered as well as reported regarding the items of analysis paper and systematic review of PRISMA.

Inclusion criteria

The research articles are published in scholarly journals following a peer-review process. Research shows the investigation of camel milk's potential function as a medicinal treatment to treat diabetics. Research using different types of milk from camels unprocessed, sterilized, condensed, etc. we have used the following insulin

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for camel milk therapeutic prediction as fast blood glucose (FBG), postprandial glucose variation (PPG), alanine transaminase (ALT), C-peptide (CP), fasting serum insulin (FI), aspartate transaminase (AST).

Exclusion criteria

People having diseases besides diabetes should not be included in the investigation since they might affect the evaluation of camel milk's impact on diabetes and skew the findings. Exclude women who are nursing or about to become mothers, as CM can exert different effects on those individuals as well as pose risks to unborn or nursing camel kids. Having an allergy or intolerance to milk from camels, could cause unfavourable responses and complicate the assessment of overall medicinal advantages. People who have chronic nerve damage, kidney disease, or retinopathy severe diabetic complications should not be included in the current research because they are likely to require special healthcare that might affect the results.

Database search

A comprehensive search strategy was employed, utilizing renowned academic databases including Google Scholar, PubMed, JSTOR, Web of Science and Scopus. This approach ensured a thorough exploration of scholarly literature on the therapeutic potential of camel milk in diabetes management, encompassing diverse research perspectives and publications.

Statistical analysis

A one-way ANOVA with repeated measures is a crucial technique for inquiry and definitive analysis of information. To determine the significance of the chosen metallic ions, the approach employs an uncertainty ratio. The null hypothesis is tested and depicted in equation (1);

$$\begin{cases} Z_0: \mu_1 = \mu_2 = \cdots . = \mu_o \\ Z_1: \mu_1 \neq \mu_2 \neq \cdots . \neq \mu_o \end{cases} \quad (1)$$

The variance of the observations (SST) is split into within-group and between-group variance (SSW and SSB, respectively) using the one-way ANOVA as shown in Equation (2-5).

$$SST = SSB + SSW \quad (2)$$

SSB Is calculated by,

$$SSB = \frac{1}{o-1} \sum_{Z=1}^{O} v_z (\bar{y}_z - \bar{y})^2 \quad (3)$$

Where v_z was the number of samples in z_{th}group; $\bar{y}_z$ was the mean of the z_{th} group and $\bar{y}$ was the mean of all samples. SSW Is calculated by:

$$SSW = \frac{1}{(o-1)u} \sum_{z=1}^{o} \left(\sum_{s=1}^{u} \left(y_{z,s} - \bar{y}_z \right)^2 \right) \quad (4)$$

Here, $y_{z,s}$ represents the s_{th}sample of z_{th} group. The F-statistic is constructed to test the hypothesis, which is evaluated by equation (5).

$$L = \frac{SSB}{SSW} \quad (5)$$

The significant threshold is set at P 0.04 and the data are presented as mean Standard deviation (SD). A statistical software program was used to conduct the statistical analysis.

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RESULTS

Study selection

In the primary research, we have identified 450 articles on the therapeutic potential of camel milk in diabetes management. Duplicate analyzing leads to exclude the 300 articles (has been done before screening), remaining 150 articles were included in it. After screening 110 articles were excluded and 40 articles were prepared for eligibility. At last, 10 articles were taken as final reports as shown in Figure (1).

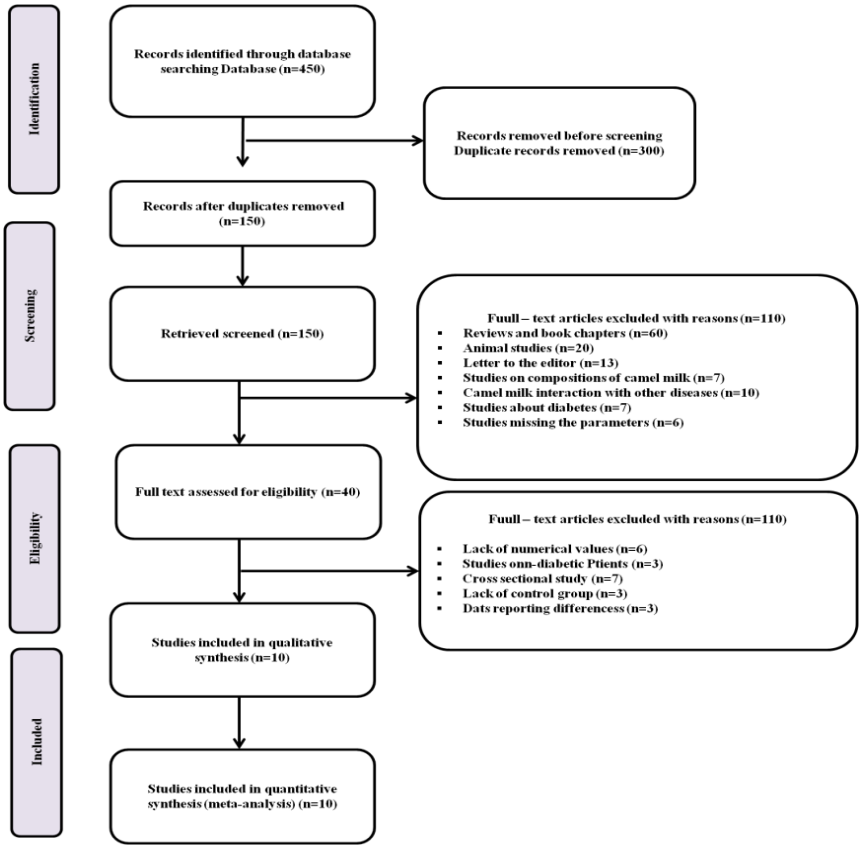

Figure (1). PRISMA flow diagram for study selection (Source: Author)

Fast blood glucose as the therapeutic potential for camel milk in diabetes management

Fast blood glucose (FBG) is a vital component of tracking and treating obesity, as a disease marked with increased insulin stages, involves determining rapid insulin concentrations. When determining someone's probability of developing diabetes or the efficacy of treatment techniques, this variable acts as an essential diagnostics instrument. The importance of quick glucose tests, whether to read them in conjunction with obesity and how important these tests are for maintaining general wellness. Commonly called blood sugar, plasma glucose was an essential part of the physique's power control mechanism. It serves as the principal source of electricity over cell and tissue membranes, yet its concentrations have been carefully monitored to preserve ideal performance. Considering an emphasis on diabetes, glucose monitoring was essential to manage the symptoms of numerous medical disorders. Quick tests for blood glucose give quick information on the amount of sugar in the blood at any given moment. FBG measurements assist in determining the right dose for diabetics who utilize hormone or alternative medications to control blood sugar levels. A key instrument for managing diabetes as well as additional medical disorders involves a rapid glucose test. Thus, it can quickly and accurately collect data giving people the capacity to make informed choices regarding their general state of health, habits and course of therapy. Sustaining ideal levels of insulin and avoiding the problems related to sugar instability need ongoing surveillance in conjunction using the right therapies.

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Postprandial glucose (PPG)

The blood amount of sugar increases following the consumption of food. Monitoring blood sugar levels following dinner is crucial for treating diabetes mellitus as it provides insight into how the body utilizes and regulates the food that is ingested. A crucial part of managing diabetes is to manage glucose levels after eating to reduce the possibility of chronic issues and avoid hypoglycemia during brief periods. The amounts of glucose in the blood recorded following consuming food are referred as the long-term or short-term. Sustaining ideal postoperative insulin levels is crucial to long-term metabolic management in diabetics. Increases in post-meal glucose levels are capable of causing elevated diabetes, which can result in consequences including glaucoma nerve damage and heart attack. To maximize glucose control, healthcare clinicians utilize this data to modify drugs and diabetes doses, including suggested diets. As shown in Figure (2) and Table (1), therapeutic potential in camel milk for diabetes management has been rated in FBG and PPG insulin.

Table (1). Numerical outcomes of FBG and PPG insulin (Source: Author)

	FBG	PPG
t0	9	8
t20	7	6
t40	5	7
t60	6	8
t80	5	5
t100	6	8

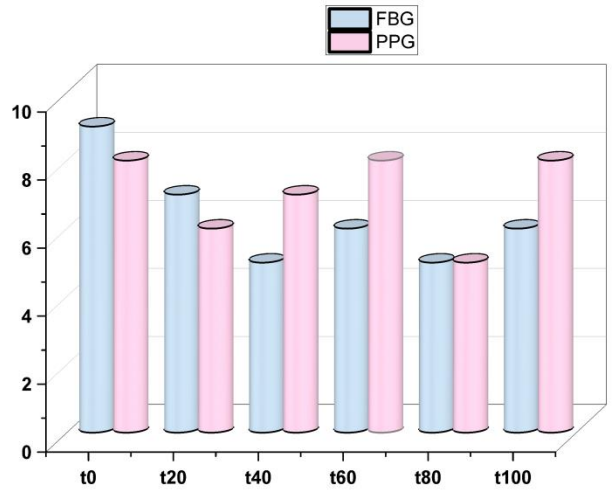

Figure (2). FBG and PPG insulin in camel milk diabetic management (Source: Author)

Alanine transaminase (ALT)

Alanine transaminase (ALT) is termed as a serum glutamate pyruvate transaminase (SGPT). It refers to a chemical that is present in the cells of the liver. It is employed in medical laboratories to evaluate the liver's functioning and wellness due to the necessity of many bodily functions. The enzyme known as ALT plays a role in the movement of amino acids from the amino acid alpha to alanines. The enzymatic event was an important phase in the procedure of cell respiration, which turns amino compounds into power. While ALT is present in numerous systems, the stomach contains the highest concentration of the enzymes. Increased ALT levels in the circulatory system can signify malfunction or injury in the hepatic. Another liver enzyme that is tested in blood samples to evaluate liver function is ALT. This condition, cirrhosis and fatty liver condition could be diagnosed and tracked with the use of ALT levels of measurement. It is feasible to monitor ALT levels over time to assess

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the treatment approach for liver problems. While high amounts might indicate protracted damage to the hepatocytes decreasing ALT values could indicate healing. In addition to additional enzymatic measures, ALT values appear in the test for liver function (LFTs) which is utilized by medical professionals to gauge the overall wellness of the liver. Unusual amounts of ALT might necessitate more research to find the root reason.

Aspartate transaminase (AST)

Aspartate transaminase (AST) known as a serum glutamic oxaloacetic transaminase (SGOT) is a living thing that is present in the organism cells, especially its liver and hearts, where it becomes concentrated. This enzymatic process helps the presence of alpha to transmit amino acids to one another. The following enzyme response contributes to cell respiration by a component of the mechanism that turns the amino acids into power. This can be evaluated as an element for heart enzyme slabs including tests for liver function. Increased concentrations of AST could be indicators of cardiac problems, hepatic ailments, muscular deterioration, or additional conditions involving the tissues that contain AST. While the median value for the amount of AST in plasma varies from laboratory to laboratory, typically ranges from eight to forty-eight units each litre (U/L). The fundamental cause might need to be investigated in cases with elevated AST values. AST remains a significant measure indicating liver problems. One way to find out more about potential causes underlying liver damage is to find out the AST-to-ALT ratios. A myocardial infarction called as coronary or coronary artery disease is one cardiac ailment that can be linked to increased AST values. Elevated amounts of AST can be caused by liver illnesses, cardiac problems, trauma, muscular varieties, with some drugs. The damaged organs can be identified using a specific type with elevated enzyme levels. For assessing the health of organs to identify anomalies, AST is utilized as an indicator in combination with additional hepatic functions. The compound known that breaks down aspartate is found in a variety of organs, most notably the cardiac and liver systems. The detection of this substance in blood samples offers important insights into the state of those systems, helping to track and assess diseases related with the cardiovascular system, liver and the various organs that contain AST. Figure (3) and Table (2) depict the applicability of ALT and AST insulin in camel milk diabetic management.

Table (2). Numerical outcomes of ALT and AST insulin (Source: Author)

	ALT	AST
No treatment	60	80
Milk	65	85
Diabetic	120	140
Diabetic+drug	70	100
Diabetic+Milk	80	120

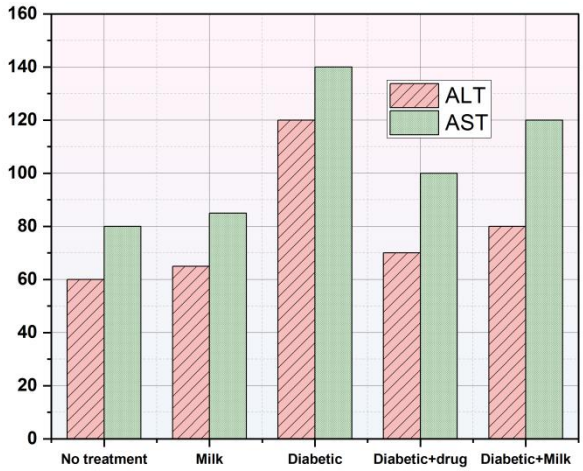

Figure (3). ALT and AST insulin in camel milk diabetic management (Source: Author)

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A one-way ANOVA

It serves as a methodology for the different groups in a two-factor authentication investigation to vary from one another. Stated differently, it facilitates the evaluation of the impact of a pair of distinct variables on an underlying variable at the same time. Two separate variables called factors are present. There might be two or more tiers for every component with respect to the variables under investigation, there's no apparent distinction between the set of averages. The CM was more effective within 8.00 seconds of 30min. It describes how two variables work together to affect the variable of interest. The applicability of one-way ANOVA is shown in Figure (4) and Table (3).

Table (3). Numerical outcome of one-way ANOVA (Source: Author)

Minutes	Control	Camel Milk	Aspirin
0	2	1	1
30	2	8	5
60	2	6	6
90	2	7	6
120	2	5	9
150	2	5	6
180	2	5	3
210	2	4	2.5

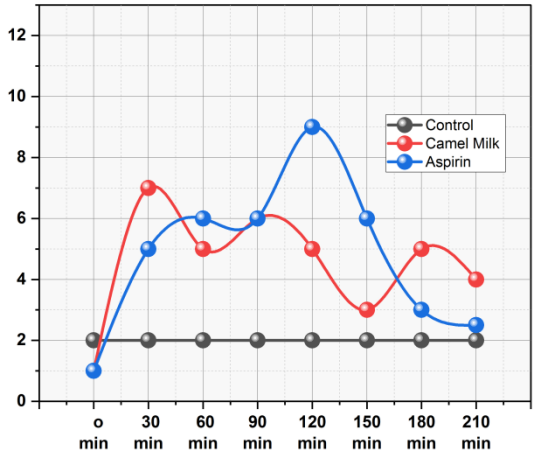

Figure (4). ANOVA in the camel milk (Source: Author)

CONCLUSION

The substance in CM that has hypoglycemic effects in it and proteins resembles glucose which might help with the better control of glucose levels. Consuming CM was linked in specific research to increases in insulin tolerance in addition to a decrease in FBG ranges. The distinct nature of CM has been linked to the elevated concentrations of particular minerals, among them zinc as well as magnesium, that are essential for the proper functioning of glucagon and the breakdown of sugar. Such dietary components could help to explain the various general beneficial outcomes. Given its distinct makeup and possible hypoglycemic qualities, it would be a worthwhile topic for more research. But rather than being the primary therapy for obesity, it deserves to be seen as a supplementary strategy while more proof is obtained.

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Limitation

- Limited sample sizes can compromise the statistical power of the findings and make it challenging to generalize results to broader populations.
- CM composition can vary based on factors such as the camel's diet, geographical location and health status. This variability can lead to inconsistencies in the observed therapeutic effects, as the composition of CM used in studies could differ.
- Many studies might focus on specific demographic groups or populations, limiting the generated findings to a broader range of individuals with diabetes.
- This lack of diversity can impact the applicability of CM as a therapeutic option for a more varied patient population.

Future scope

- Conduct more rigorous and well-designed clinical trials to assess the long-term effects of CM consumption on diabetes management.
- To develop personalized treatment plans that incorporate CM based on patient-specific characteristics.
- Promote awareness and education about the therapeutic potential of CM in diabetes management.

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