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Proceeding Paper

The Use of a Natural Product "Camel Milk" as a Regulator of Glycemia †

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Abstract: In many countries around the world, camel milk is a healthy food used to treat many health issues including diabetes. Thus, it has been demonstrated from several studies in vivo that the consumption of camel milk either fresh or fermented could have a positive effect on certain diseases and metabolic disorders such as hypercholesterolemia and hypertension. Furthermore, lactic cultures from camel milk have also been tested for the action of some active proteins or probiotic and have shown encouraging results. The objective of this work is to synthesize the data related to the benefits of camel milk and its effect on the regulation of glycemia. More in-depth studies should be carried out on humans, in order to confirm the effect of camel milk on glycemia.

Keywords: milk; camel; diabetes; proteins; probiotics; health

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1. Introduction

In recent decades, diabetes has been a major public health problem worldwide, with a prevalence that could reach 700 million by 2045 [1]. In addition, type 2 diabetes, which accounts for approximately 90% of diabetes cases, can lead to serious damage to the heart, eyes, kidneys, blood vessels and nerves [2]. As a result, many studies have focused on the development of anti-diabetic drugs and functional foods to cure or minimize this damage [3,4]. In the arid regions of Africa and Asia, camel milk can provide to the nutritional needs of these minor populations. Furthermore, it is recommended in these regions to consume this milk in a fresh or fermented state for the treatment of diabetes [5]. Indeed, it has been recently reported that camel milk may have medicinal properties [6], such as anticarcinogenic, antimicrobial, antioxidant, angiotensin I converting enzyme inhibitory activities, as well as cholesterol-lowering, hypoglycemic and hypoallergenic effects due to the presence of bioactive compounds [5]. In addition, the fermentation of camel milk by beneficial microorganisms offers consumers, in addition to good nutritional value, prevention against diabetes because they can reduce the absorption of glucose in the intestines. They are therefore considered one of the best ways to manage high blood sugar [7]. The objective of this work is to demonstrate the involvement of camel milk, active proteins or probiotics isolated from it, in the regulation of blood sugar and its possible use in the control of diabetes.

2. Materials and Methods

A search for articles was carried out using both Google Scholar and NCBI PubMed databases. All the articles uploaded focused on the regulation glycemia effect of camel milk and active proteins or probiotics derived from it.

3. Results and Discussion

Table 1 represents the analysis of data carried out from some selected papers and relating to the hypoglycemic effect of camel milk.

The effect of camel milk and its derivative products on the various parameters of diabetes has been reported by numerous studies cited in the table below. Zheng et al. [8] reported that the hypoglycemic effect of this milk is due to an insulin-like protein. Further, Kilari et al [9] demonstrated that a camel milk protein hydrolysates, source of bioactive peptides, could activate the insulin receptor and prevent hyperglycemia and diabetes complications. On the other hand, some authors such as Manaer et al. [10] and Chouikhi et al. [5] have suggested that the hypoglycemic effect of camel milk is mainly linked to its richness in probiotics. Overall, however, the number of these studies using probiotics isolated from camel milk remains relatively low compared to studies that used either raw or fermented milk.

Table 1. Summary of results.

References	Model of Study	Diabetogenic	Products and Dose/Day	Duration	Strains of Probiotic	Benefic Effect on Diabetes Parameters
Agrawal et al. [1]	Rats	Streptozotocin	Fresh camel milk (250 mL)	3 weeks	N.D	↓ Glycemia
El-Said et al. [7]	Rabbits	Alloxan	Fresh camel milk (7 mL/kg)	4 weeks	N.D	↓ Glycemia + ↑ Insulinemia
Alharbi et al. [2]	Rats	Streptozotocin	Fermented camel milk (5 mL)	28 days	N.D	↓ Glycemia + Hepatoporotector effect
Fallah et al. [11]	Patients	-	Fermented camel milk (250 mL)	8 weeks	N.D	↑ Insulinemia
Xu et al. [12]	Mice	LPS/D-GalN	Probiotic isolated from Mongolian camel milk	7 weeks	*Lactobacillus Paracasei* subsp. *paracasei* WXD5	↓ lipopolysacharids + ↓ IL6
Chouikhi et al. [5]	Rats	Alloxan	Probiotic isolated from Tunisian camel milk (10^9 cfu/mL)	14 days	*Lactiplantibacillus plantarum* LC38	Hepatoprotector effect
Manaer et al. [10]	Mice	*db/db mice*	Traditional fermented cheese whey (10^8–10^{10} cfu/mL)	6 weeks	*Lactobacillus Kefiranofaciens* + *Issatchenkia orientalis*	↓ Glycemia, OGTT, HbAlc

↑: Increase; ↓: decrease; N.D: no determined; OGTT: oral glucose tolerance test; HBAlc: Hemoglobin A1c; IL6: Interleukin 6.

4. Conclusions

Most of the results of in vivo tests searching the effect of camel milk, have shown that this animal product could have preventive and/or curative effects against diabetes, due to the action of some active proteins. Moreover, very little research have been done, on the strains of probiotics isolated from this milk and their effects on diabetes. Thus, other trials on the different strains isolated from camel milk and tested on several animal species as well as on humans, should be considered.

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