

# Camel Milk; a Superfood as Adjunctive Therapy for Diabetes

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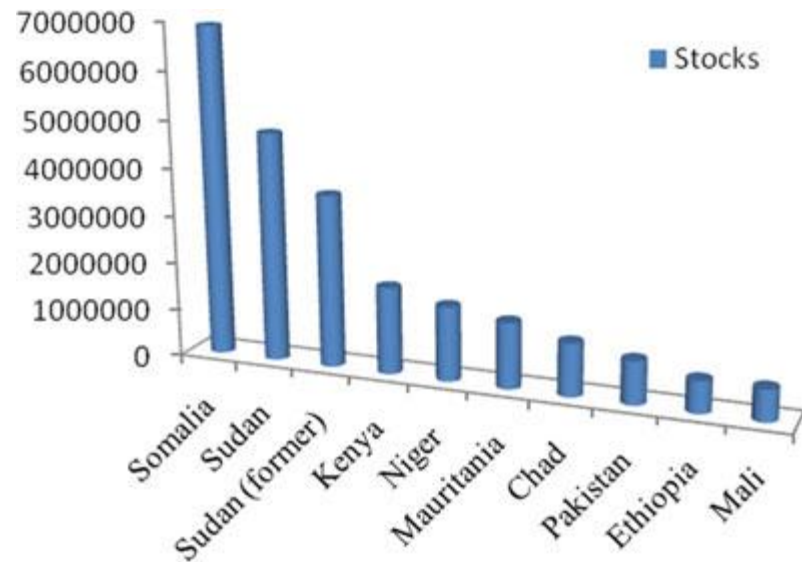
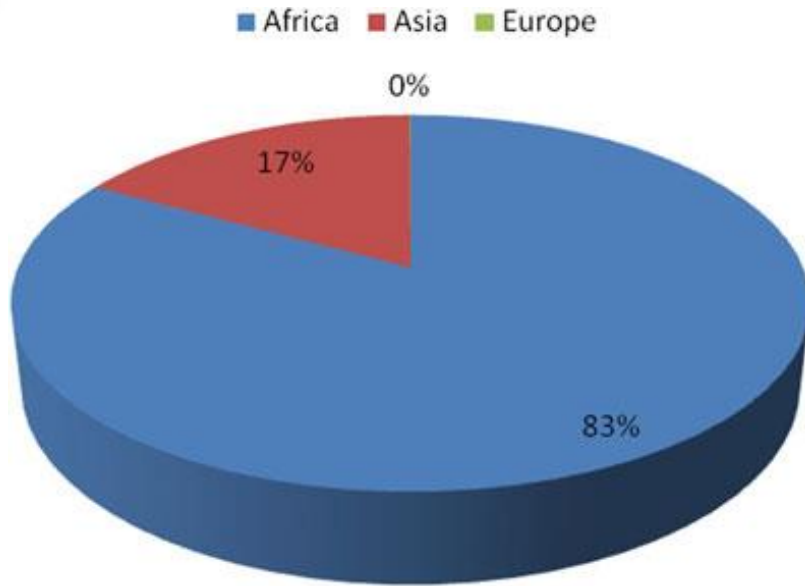


# 22 June

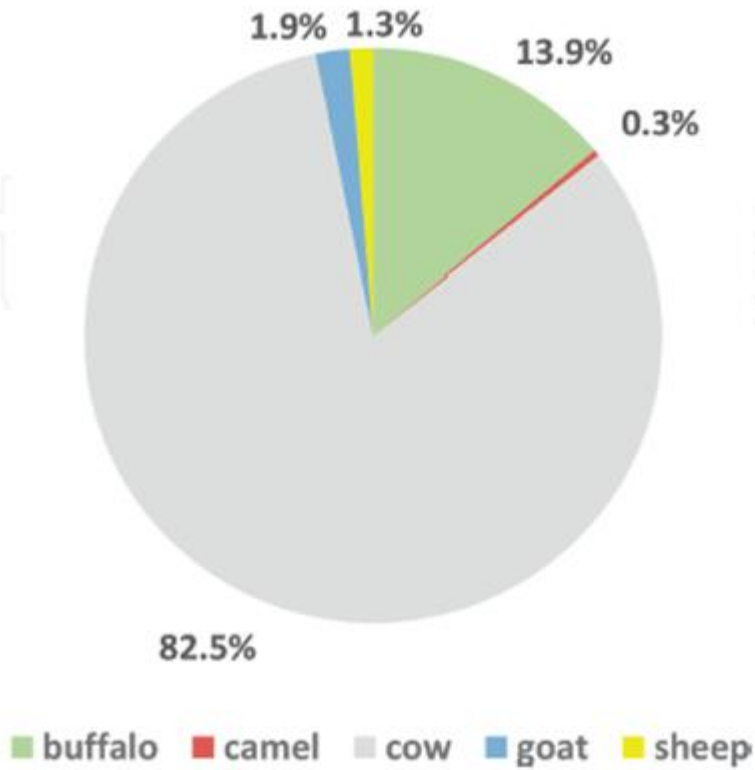
# World Camel Day



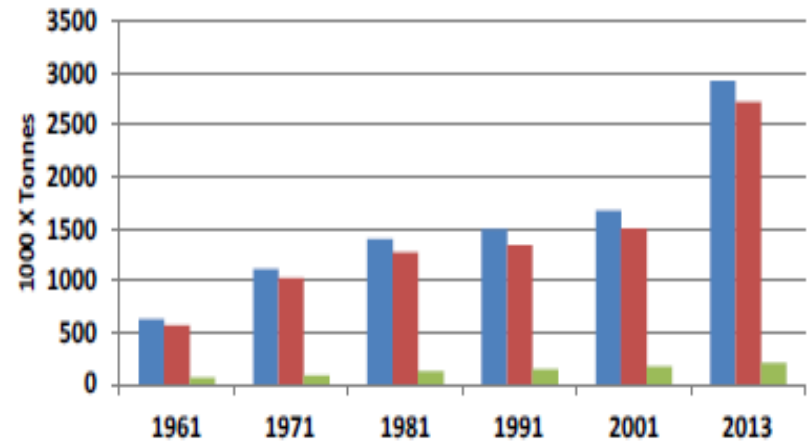
# Camel populations



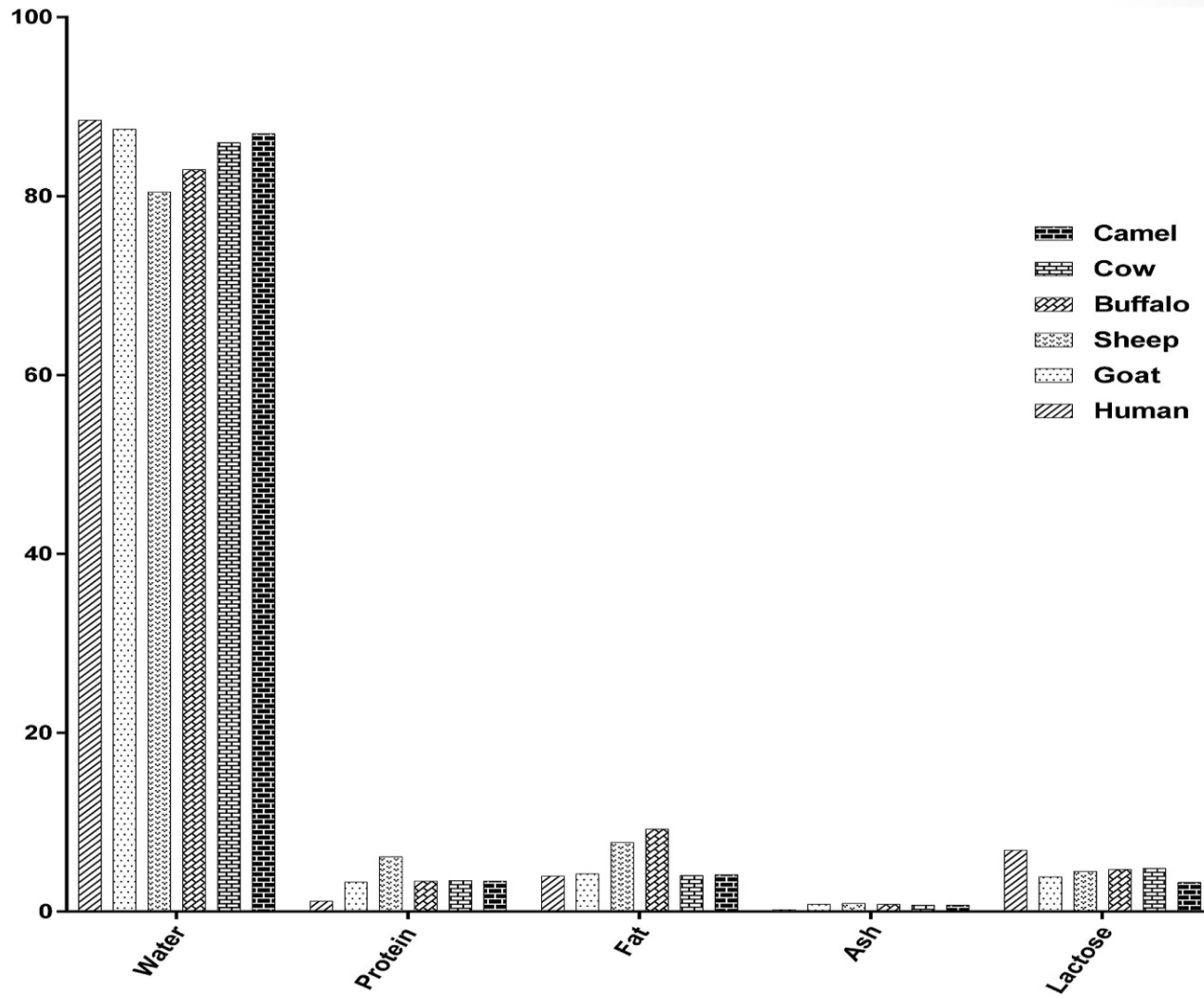
Top 10 camel producers' country (Average 1994–2016)



Percentage of total quantity of milk produced by different species in the world



Growth of global camel milk production



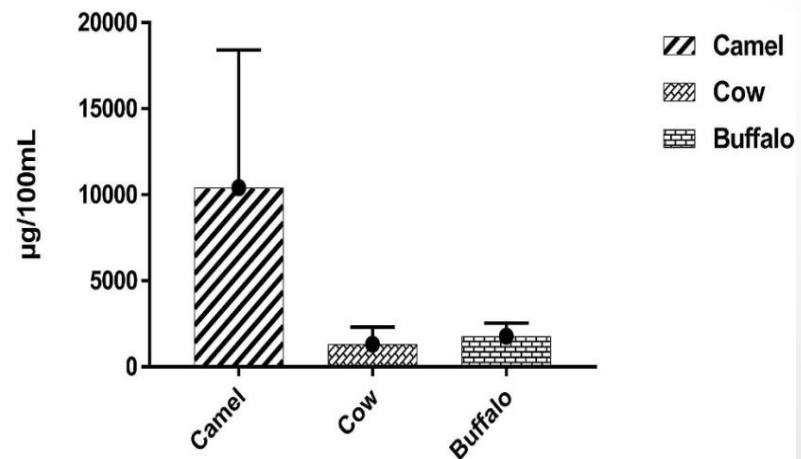
Comparison between **camel milk composition** with other dairy species milk, Aqiba et al. 2019

## Why camel milk is Superfood?

- ❖ Camel milk is **rich in vitamin C, B3, Mg, iron, Cu and Zn** than cow milk
- ❖ Higher amount of **zinc** is important in the development and maintenance of **normal function of immune system**
- ❖ Camel milk is a suitable alternative for kids with allergy to cow milk due to **lack of  $\beta$ -lacto globulin and low  $\beta$ -casein** as allergic proteins
- ❖ **Lactose** of camel milk is **more digestible** than cow milk for **lactose intolerance cases**
- ❖ The **ratio of whey protein to casein** in the camel milk is higher than cow milk
- ❖ **Fat globules** of camel milk are smaller in size
- ❖ These may explain why the coagulum of camel milk is softer and **more digestible** than cow milk

## Why Camel milk is Superfood?

- ❖ Camel milk has **high amount of mono-and polyunsaturated fatty acids** that **have beneficial effects on the human health**
- ❖ Camel milk is a **rich source of insulin** (**52 units of insulin per liter**), that it helps to treat **type 1 and 2 and gestational diabetes**
- ❖ Camel milk whey has an **acidic protein** that is **protease inhibitor** and may cause to **longer storage of raw camel milk** as compared with raw cow milk
- Camel milk is **richer in vitamin C** than other milks, about **52 mg/L** versus 27, 22, 29, 16, 35, 49, and 61 mg/L for cow, buffalo, sheep, goat, human, donkey, and mares' milk, respectively



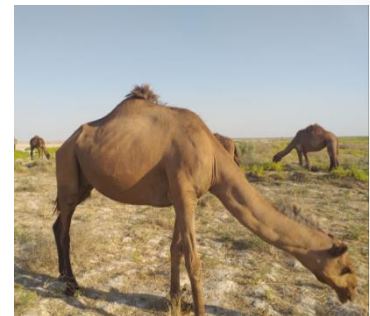
## Why Camel milk is **Superfood**?

- ❖ The **lactoferrin** in camel milk has medicinal values such as anti-bacterial, anti-viral and anti-inflammatory properties
- ❖ Camel milk has **higher activity of lactoferrin, higher content of lysozyme, high peptidoglycan recognition protein and lactoperoxidase**
- ❖ **Lactoperoxidase** protects udder from microbial infections and its alternative method for the **preservation of raw camel milk**, under high temperature and low hygienic conditions when a cooling process is not possible
- ❖ Camel milk contains **small size immunoglobulins** which allowing penetration of antigens, and **boost the immune system**
- ❖ The **highest level of IgG** (1.64 mg/mL) is for camel milk versus 0.67, 0.63, 0.70, 0.55, and 0.86 for cow, buffalo, goat, sheep, and human milk, respectively
- ❖ **Lactic acid bacteria** were isolated from camel milk as **probiotic** are important for the **gut and colon health**

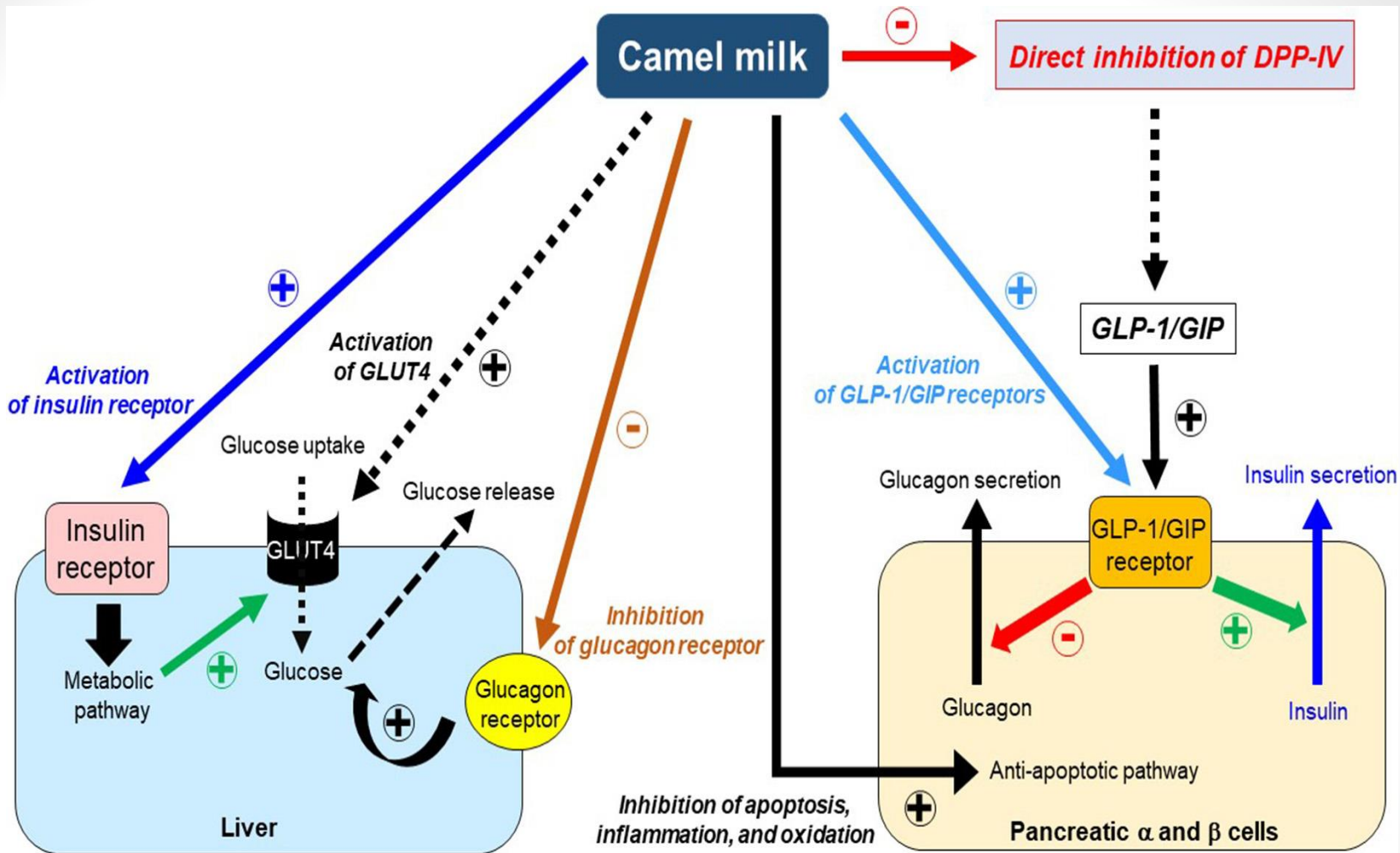


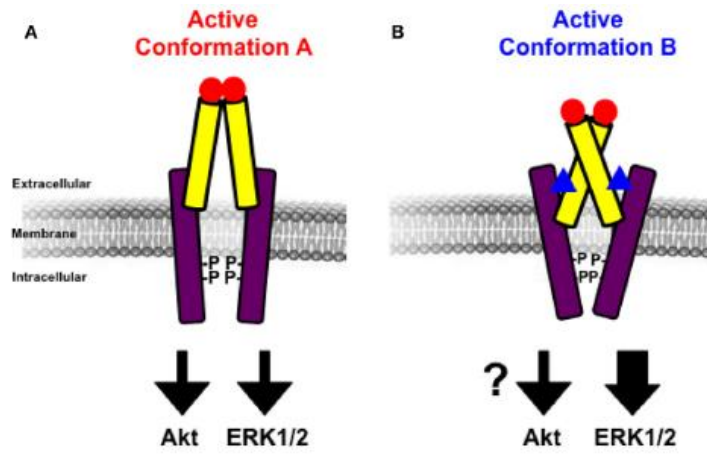
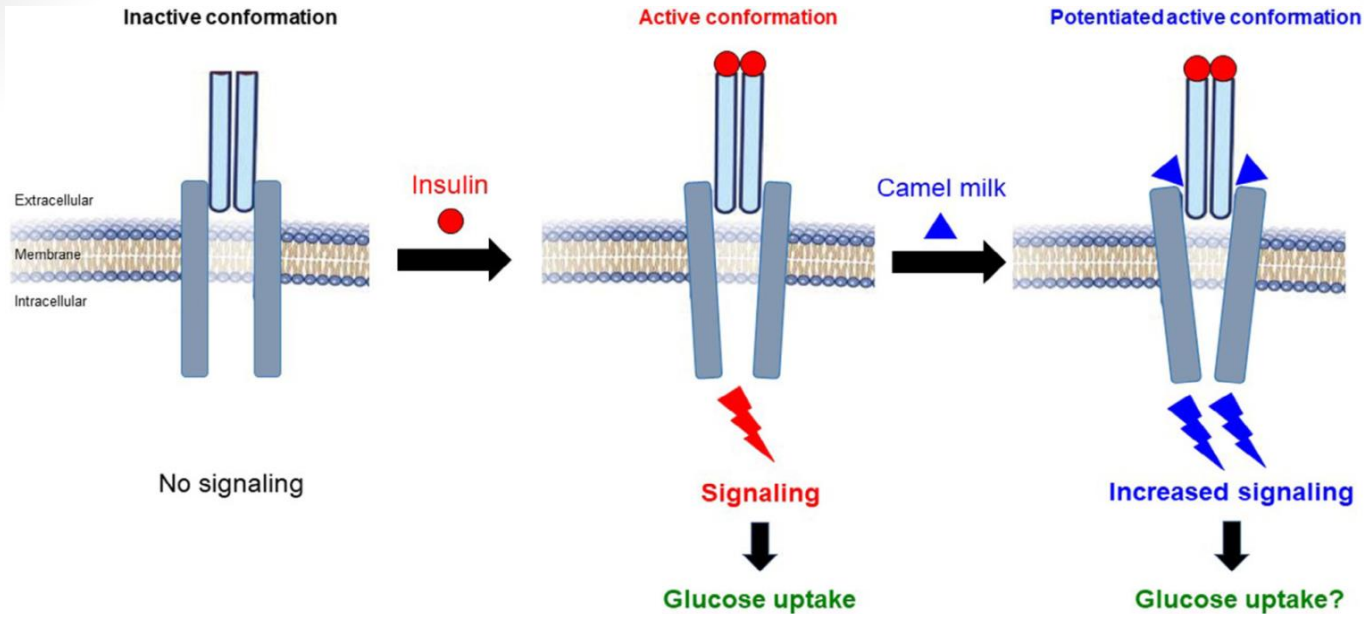
## Why Camel milk is **Anti-Diabetes?**

- Nowadays, the people looking for natural healings for diabetes
- Camel milk contains **insulin like protein** that covered by fat micelles, is not destroyed in the stomach
- **Lactoferrin, immunoglobulin's and antioxidants agents** in the camel milk lead to;
  - Regulatory and immune-modulatory effects on the pancreas beta-cells
  - Normal function of beta-cells
  - Reduce required insulin doses in type 1 and 2 diabetes patients



- **How camel milk regulate the blood glucose?**
- Effect on insulin receptors activity
- Increasing of the signaling in the insulin-sensitive tissues
- The effect on the pancreatic beta-cells function
- The inhibition of glucagon receptors
- The activation of GLUT4 in the cells
- Inhibition of DPP-IV enzyme and activating of GIP/GLP-1 and increase insulin secretions





● Insulin  
▲ Camel milk

## How camel milk influences **diabetes complications**

- The anti-oxidative activity of camel milk whey proteins;
  - Enhances the proliferation of immune cells
  - Improve the wound healing process during diabetes
- Anti-microbial properties and high vitamin C of camel milk help to heal diabetes wounds
- Camel milk improves kidney and liver function in nephropathy; proteinuria and cardiovascular challenges in diabetes



- **Some researches on diabetic's cases by using camel milk**
- 500 mL raw camel milk for 16 weeks in type 1 diabetic patients decreased daily insulin doses and blood sugar
- Pasteurized camel milk in type 2 diabetic patients for 2 months;
  - **Significantly increased serum insulin content**
  - **Decreased blood glucose and the required insulin doses**

➤ **Camel milk** with insulin on type 1 diabetic patients for 12 weeks indicated;

The daily dose of insulin may be reduced by 66%

➤ **Raw camel milk** in type 1 diabetic cases for 52 weeks;

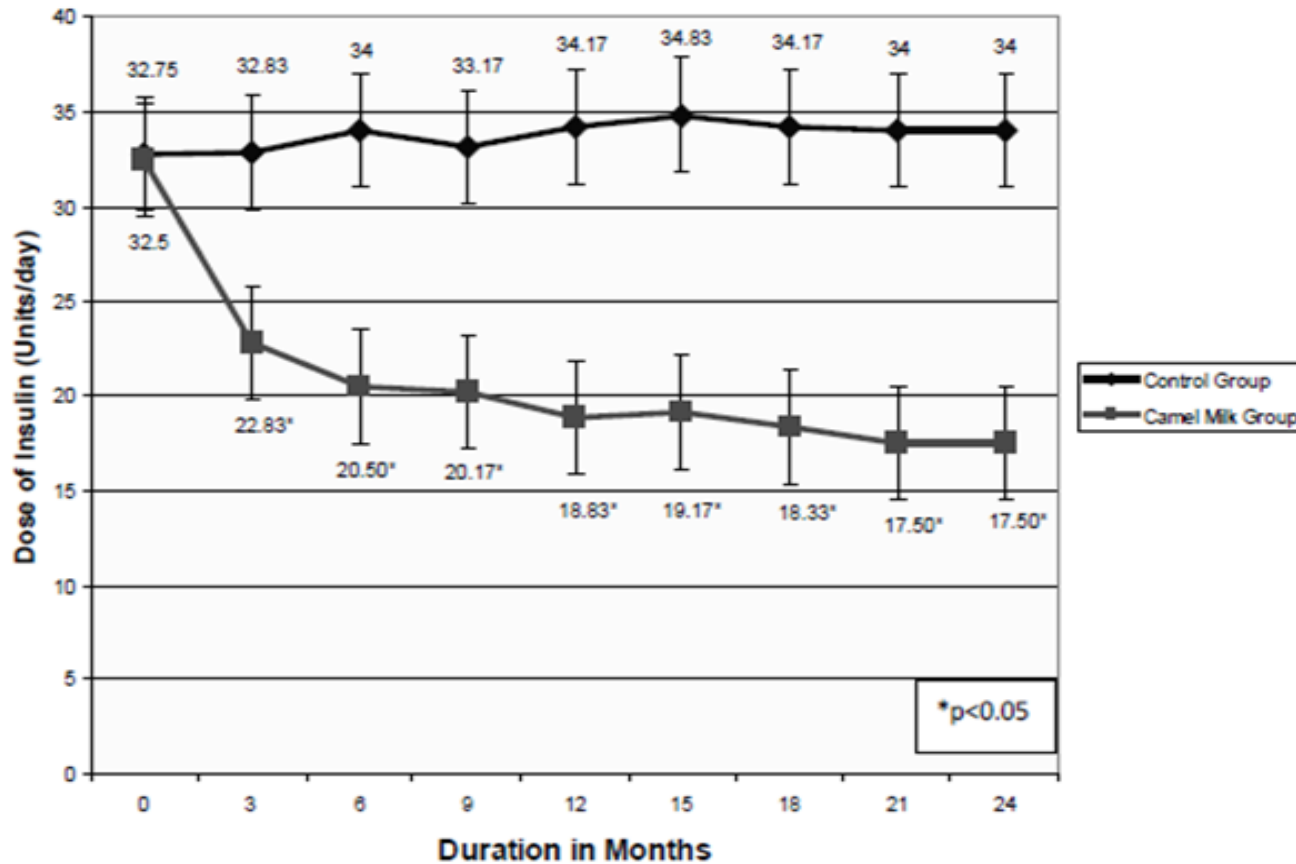
Reduced HbA1c, mean blood glucose and required insulin doses by 30%

➤ **Fermented camel milk** significantly

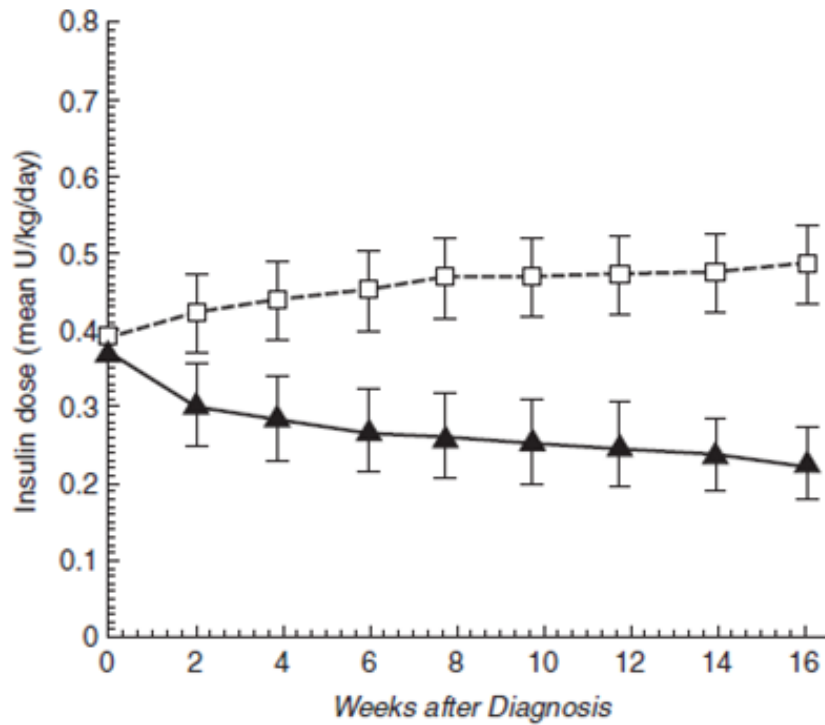
Reduced fasting blood sugar, postprandial glucose and HbA1c in type 2 diabetes patients

- **Consuming of 500 ml camel milk (two times daily) in type 1 diabetes cases, for 3 months resulted in;**
- Increase blood insulin, reduction of fasting blood sugar and HbA1c, Reduce the insulin requirement with better glycemic control
- **Raw camel milk in type 1 diabetic patients caused to;**
- Increase insulin secretion and reduce blood sugar
- Reduce required insulin (about 30–35% )
- Prepare about 60% of insulin in the diabetic patients
- Reduce insulin resistance
- Improve the glycemic control





Significant reduction in insulin requirement (46.15%) at the end of two years in patients taking camel milk



Mean insulin requirement during the entire period of treatment (up to 16 weeks). In the follow-up period after 4 weeks no remission was observed in patients receiving insulin alone ( $\square$ ), whereas partial remission occurred in patients receiving camel milk and insulin ( $\blacktriangle$ ).

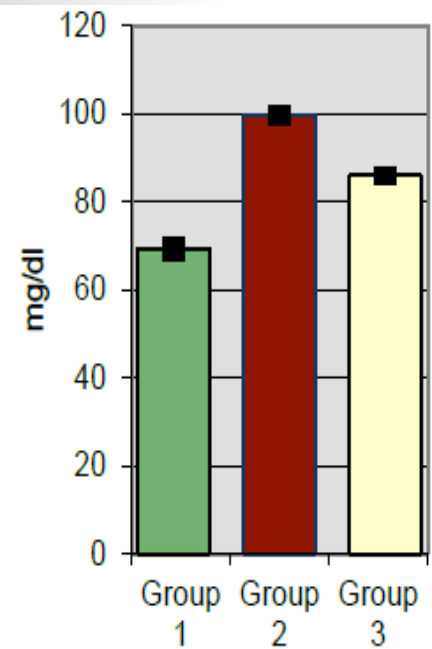


Fig 4: Total cholesterol (mg/dl) in studied groups

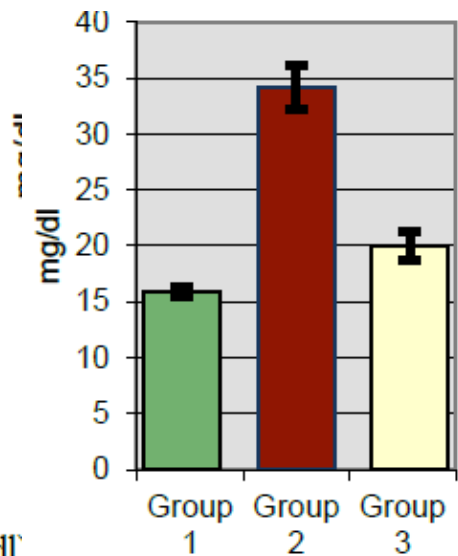


Fig 7: LDL (mg/dl) in studied groups

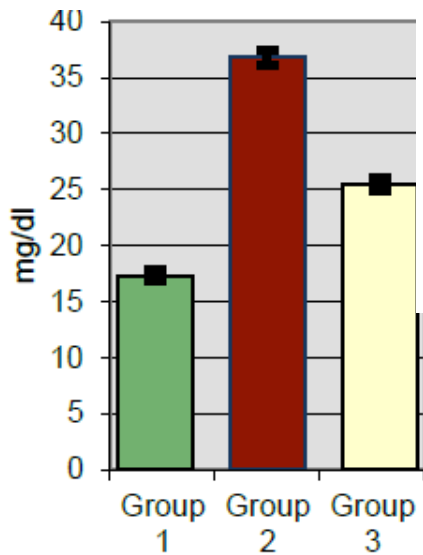


Fig 8: VLDL (mg/dl) in studied groups

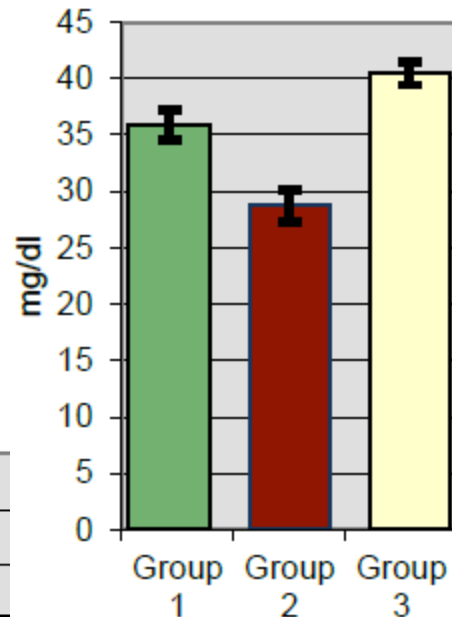


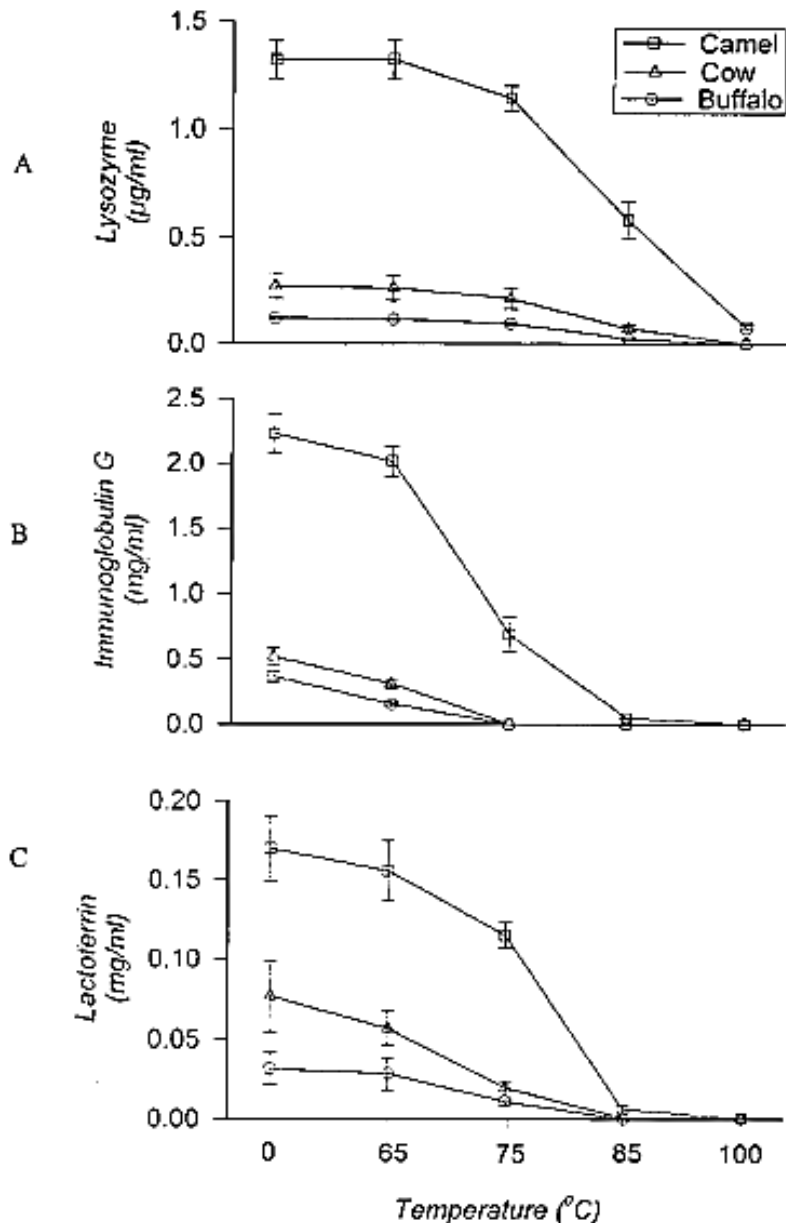
Fig 6: HDL (mg/dl) in studied groups

## How heating can change therapeutic efficacy of camel milk?

- **Raw camel milk is best option for diabetes**, but it is a threat for health due to possible contamination with bacteria **So, camel milk should be heated**
- Pasteurization (71-74C/15-40s or HTST pasteurization) and Sterilization (110-120C/10-20 min), UHT (135-140C/6-10s for indirect and 140-150C/2-4s for direct UHT) destroy all micro-organisms of the milk
- Heat treatment in high temperature destroys vitamin C, casein, whey proteins, IgG, lysozyme, lactoferrin, Insulin like protein, anti-diabetic properties and peptidoglycan recognition protein of camel milk
- **The protective enzymes and proteins, xanthine oxidase, alkaline phosphatase, lipoprotein lipase, bacteriocins and lactic acid bacteria growth** are inactivated by pasteurization, UHT treatment or sterilization and their activity is limited at refrigeration

Heat treatment	Camel		Cow	
	mg/kg	% loss	mg/kg	% loss
Raw milk	24.9 ± 2.75	0	14.3 ± 1.12	0
63°C/30 min (LTLT)	18.2 ± 2.15	27	11.7 ± 1.51	18
73°C/15 s (HTST)	21.2 ± 1.61	15	12.9 ± 1.71	10
80°C/30 min	14.6 ± 1.62	41	10.6 ± 1.05	26
90°C/10 min	13.8 ± 1.20	45	10.4 ± 1.21	27
90°C/30 min	11.7 ± 2.20	53	9.1 ± 1.60	36
100°C/30 min	8.3 ± 1.69	67	7.5 ± 1.21	48

Loss of vitamin C by heating, Mehaia, 1994



**Important point:**

Pasteurizing of camel's milk in the mild temperature is very important to save its protective proteins

**72 C for 15 s**

**63 or 65 C for 30 min**

## Conclusion

- **Raw camel milk is more beneficial for treatment and heating of camel milk in high temperature may destroy its medicinal effects**
- But without heating, storage at high temperature with low hygienic conditions may spoil camel milk
- Although the clinical trials reported, the raw camel milk by 500 mL/day improved diabetes, liver and kidney failures and diabetic wounds
- But pasteurization in high temperature, sterilization, boiling, cooling, freezing and freeze drying of camel milk may be decrease the insulin concentration and anti-diabetes effects of camel milk
- So more scientific researches are needed to study the effectiveness of pasteurized, cooled, freeze dried and camel milk powder for diabetes
- **Applying the indirect and mild temperature for camel milk is necessary to save its therapeutic efficacy**



- Thankful to Dr Tanveer Hossain
- VU of Pakistan



**Thanks for your attention**