INSULIN IN MILK – A COMPARATIVE STUDY

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ABSTRACT
As drinking camel milk for treatment of diabetes is common practice and as it was previously found that camel milk has large concentrations of insulin, a project was carried out to examine this phenomenon. Colostrum and milk of various mammals were examined for insulin and the effect of camel milk on blood sugar levels of laboratory rats was examined. It was found that colostrums contained much higher levels of insulin than milk. In all mammalian milk examined there were relatively high concentrations of insulin. It was further found that in starved laboratory animals who were fasted and thirsted for 24hr, causing endogenous insulin to be low, camel milk cause a decline in blood sugar. This decline was temporary as lactose was converted to glucose and the absorbed, pushing blood glucose up to normal. It is concluded that although all milks had insulin, the fact that only camel milk is unaffected by gastric acid allows it to pass into the intestines where it is apparently absorbed.

INTRODUCTION

In the article "type 1 diabetes and the milk hypothesis" the question that was raised was: "is there a role for the insulin in mother's milk?" (Kontanko, 1997). All mammals have "mothers" including camels. However, there appears to be a connection between camel milk and diabetes; it is common practice in Africa, Asia, and the Middle East to drink camel milk for treating diabetes mellitus, without defining which type there is (Yagil *et al*. 1994). Using milk for treatment is itself a point of contention as insulin, being a protein, is normally destroyed in the stomach (Vander *et al*, 1994). Camel milk has been noted to have other medicinal properties, among others: treating tuberculosis (Urazakov and Bainazarov. 1974), ulcers, respiratory ailments (Rao et *al*, 1970) and hepatitis (Sharmonov *et al*, 1978). Concerning the latter, a child suffering from biliary atresia was kept alive on camel milk until a liver transplant was carried out (Yagil *et al*, 1984). Camel milk dies have special properties not found in milk of other mammals (Yagil, 1987). Among the pertinent properties are a high acid content ascorbic acid (Farah *et al*. 1992); fat dispersed as small micelles in the milk instead of a layer of fat; non-reaction to acid (Abu-Lehia, 1989) and antibacterial and antiviral properties (El-Agamy *et al*., 1992).

As antibodies, and presumably protein-like hormones if they are present, do not pass the placental barrier in non-primate mammals, colostrums is of vital importance for the new-born and for a short period relatively large proteins are absorbed. Insulin would, therefore, become available if not destroyed in the "true stomach".

As diabetics drinking camel milk is a widely spread phenomenon, a project was initiated to examine the scientific validity of the stories. At a first stage possible appearance of insulin in camel milk was examined and it was found that indeed relatively large concentrations are present in the milk (Yagil *et al*., 1994)

The questions that now arose were: Is the presence of insulin in milk specific to camels or do other mammals have insulin in the milk? Is there a difference in hormone concentration in colostrum compared with milk? If the insulin passes to the small intestine, is it absorbed and functional? The present communication examines these questions.

MATERIALS AND METHODS

A. Presence of Insulin in Milk of Mammals

Colostrum and full milk are milked from camels, cows, goats and sheep. Colostrum was collected from women in the first tow days after birth at the Soroka Teaching hospital as part of the normal routine examinations. All samples were frozen until examinations. In addition samples of store milk (cows) and camel-milk ice cream were frozen. Insulin's concentrations in milk were determined by specific RIA (Coat-a-Count, USA).

B. Effect of Camel Milk on Blood Glucose

White laboratory rats (Rattus norvegicus) were starved and thirsted for 24h. Blood was examined for glucose from the tail veil using a glucose meter. Then the animals were given free access to camel milk and every 2 min blood was checked for glucose for 10 min. Results are given as mean + SEM.

RESULTS

A. Insulin in Milk

Insulin contents of the milks are presented in Fig. 1. Colostrum levels of all the ruminating mammals were higher than those of their milk. Woman colostrums contained insulin but in levels similar to those of milk of the other animals. Cow milk had the lowest insulin levels. Camel-milk ice-cream had the same insulin as in the animals' milk. Store milk had the lowest milk of all the samples.

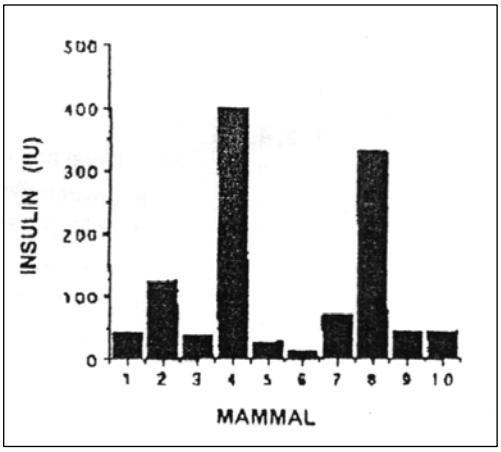

Fig. 1. Concentrations of insulin in milks of mammals.

1 = Colostrum women
2 = Colostrum camels
3 = Milk camels
4 = Colostrum cows
5 = Milk cows
6 = Store milk
7 = Colostrum goat
8 = Colostrum sheep
9 = Milk sheep
10 = Ice-cream camel

B. The Effect of Camel Milk on Blood Glucose in Fasted Animals

After 6 min the blood glucose started to decline ($P<0.001$) and by 8 min had declined by 24% and then rose again to beginning levels by 10min (table 1).

Minutes after drinking	Blood glucose (mg/dl)
0	97±0.2
2	98±0.3
4	97±0.2
6	80±0.6
8	74±0.8
10	98±0.3

Table 1: Blood glucose levels in fasted rats receiving camel milk

DISCUSSION

Insulin was found in all the samples of milk. Colostrum of the non-primates contained higher concentrations of insulin that in the whole milk a few months later. Although the insulin concentration in human colostrum is considered high (Slebodzinski *et al*., 1986), they are relatively low compared to the ruminating animals. The low concentrations in human milk could be associated with the fact that transfer of antibodies, and presumably of hormones, is carried out via the placental blood flow (Lawrence, 1980). In the mammals that were examined in the present work, there is no transfer via the placenta and so the colostrum becomes of vital importance for the new-born. Camels-calves, kids and lambs are born in the coldest months, in rain, sleet and often snow, and are often exposed to the elements. Cellular glucose would be vital in metabolic heat production (Vander et al., 1994) and insulin would, therefore, be required. Presumably the new-born's endocrine functions will be inferior to adult's and, therefore, an extraneal source would aid in regulation of cellular glucose for formation of metabolic heat. The only source will be in the colostrum for the first few days until the neo-natal endocrine system is fully operational. Intestinal absorption of large proteins and, therefore, insulin is only possible in the first few days of life (Lawrence, 1980). After this period proteins are destroyed in the stomach by acid and pepsin, especially in milk, which forms a coagulum in the stomach. However, camel milk does not react to the acid (Abu-Lehia, 1989) and so will pass into the intestines ready for absorption of insulin. This was proven valid as after the initial decline in glucose blood levels rose again. The decline validates the observation that camel milk acts on regulating cellular sugar in the absence of endogenous insulin.

Even if camel milk passes into the small intestine without forming cheese it is not known how insulin, a protein, is absorbed by humans with diabetes mellitus.

The question of specificity of the RIA is interesting. On one hand, it can be theorized that the results are not specific for insulin but merely for insulin-like activity. On the other hand if the specific receptors for insulin react in the same way as those of the RIA then whatever is in the milk it will give rise to the specific response of the second messenger in cells i.e. insulin response.

It can be concluded that from the data presented above there is a strong indication that there is a scientific justification for drinking camel milk by certain diabetic patients. However, more research is necessary before a final conclusion can be made.

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