

INSULIN CONTENT IN RAW DROMEDARY MILK AND SERUM MEASURED OVER ONE LACTATION PERIOD

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ABSTRACT

The insulin content was measured in raw milk and serum of individual dromedaries over a period of 310 days. The mean milk insulin concentration was 40.5 ± 10.7 $\mu\text{U/ml}$ and the mean serum insulin concentration was 12.77 ± 7.62 $\mu\text{U/ml}$.

Key words: Dromedary, insulin, lactation, milk

Over the past years camel milk is experiencing a novel awareness in the western world after it has been consumed for centuries by nomadic people for its nutritional and medicinal properties. According to Agrawal *et al* (2003) it contains high levels of insulin and can therefore be used to treat *Diabetes mellitus* (Agrawal *et al*, 2005). However, Wernery *et al* (2006) reported that the insulin content in camel milk is only slightly higher than in cow milk. In animals there are large discrepancies in reported insulin concentrations which may be explained by the stage of lactation and methodology used.

This paper therefore tries to clarify this point by testing insulin in camel milk of 7 dromedaries during one lactation period. Furthermore, it compares the values found in the milk with values in serum.

Materials and Methods

Milk samples were aseptically collected from 7 individual dromedaries immediately after parturition and then regularly over a period of 310 days. The dromedaries were milked by hand and the milk pooled from all 4 teats into sterile plastic containers. At the same time, when the dromedaries were milked, a blood sample was withdrawn from the jugular vein.

The camel received pelleted concentrate (2 kg/day), fresh alfalfa (4 kg/day) and hay *ad libitum*.

Camel insulin concentrations were measured by radio immune assay (RIA) using a commercially available human insulin kit (INS-Irma, KIP 1251 - KIP 2154, Biosource Europe S.A., Belgium) following the

manufacturer's recommendations. This kit detects insulin in human serum or plasma. According to the manufacturer, a strong cross reactivity with porcine and bovine insulin (100%) has been observed with this kit. Human serum was used as control.

The insulin values were calculated as mean with standard deviation from 7 dromedaries.

Results and Discussion

Insulin concentrations measured over a period of 310 days in camel milk and serum are shown in Figure 1 and 2.

The results show that the insulin content varies widely between the different camels as described before (Wernery *et al*, 2006). Marked variations also occur during the different lactation stages. The highest insulin content is reached after parturition with a mean of 286.5 $\mu\text{U/ml}$ during the first 48 hours. After 48 hours the insulin amount in dromedary's milk declines rapidly and reaches a plateau which last approximately 160 days. Before dry-off the insulin content increases again.

A similar insulin pattern has been described both in animals and human varying considerably depending on the stage of lactation (Ontsouka *et al*, 2003). The concentration is highest around parturition and declines rapidly within 14 days to reach a steady level. This process is fast in cows, more gradual in women and most prolonged in sows (Nowak and Nowak, 1989). Other factors than stage of lactation which have an influence on milk insulin concentrations include breed, quantity of

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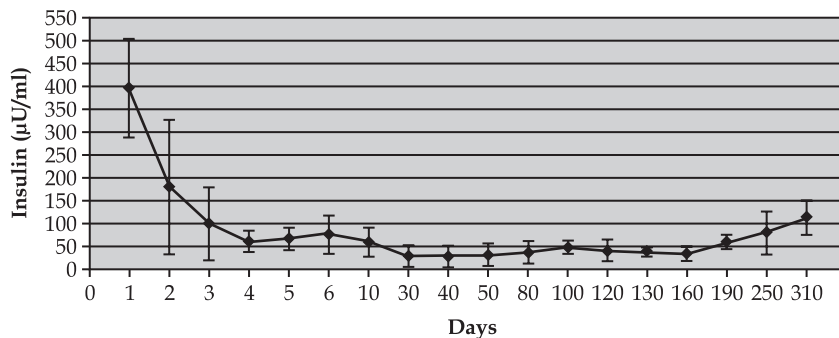


Fig 1. Insulin concentration measured in milk samples of 7 dromedaries with the RIA over a period of 310 days after parturition

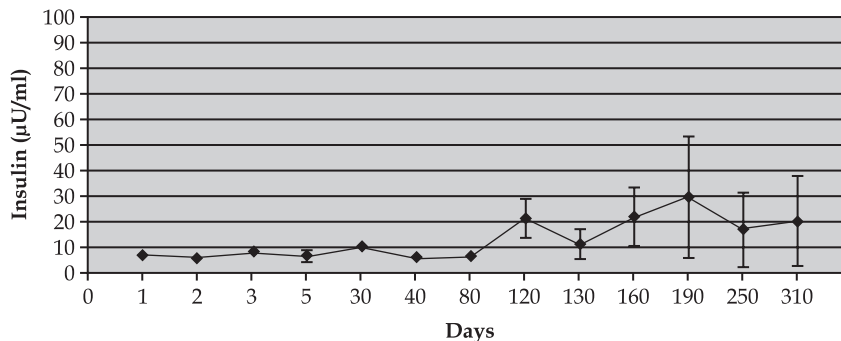


Fig 2. Insulin concentration measured in serum samples of 7 dromedaries with the RIA over a period of 310 days after parturition

milk produced, diet and methodology of testing. The relatively high insulin content at the end of the lactation period may reflect the reduced amount of milk produced at this lactation stage.

Our results show that insulin values are considerably high in milk compared to serum. Similar results are reported by Smith *et al* (1975) for bovines and by Westroem *et al* (1987) for sows. The origin of milk insulin is not known, but seems to be concentrating in the mammary gland. It is worth noting that the serum insulin was not increased after parturition like in milk, but increased steadily from day 80 after parturition. The reason for this is unknown.

Agrawal *et al* (2003) mentioned that camel milk possesses a higher concentration of insulin than cow milk ($52 \mu\text{U/ml}$ to $16.32 \pm 7.38 \mu\text{U/ml}$) and a similar concentration to human milk ($60.23 \pm 41.05 \mu\text{U/ml}$) without citing any references. Wernery *et al* (2006) found that the insulin content in dromedary raw milk is $41.9 \pm 7.38 \mu\text{U/ml}$. However, it is difficult to calculate a reference value for insulin in dromedary milk due to the great variations between the different camels and due to their lactation stage. However, the mean concentration of camel milk insulin was $40.5 \pm 10.7 \mu\text{U/ml}$, when the insulin content of the first 10 days and the last 2 months were not included in this figure. This amount is very similar to the one found earlier (Wernery *et al*, 2006). The mean serum insulin was $12.77 \pm 7.62 \mu\text{U/ml}$.

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