Effect of Heat Treatment on Some Mineral Status of Camel Milk

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ABSTRACT
The ability of milk to withstand relatively high processing temperature is very important from a technical view point. The present study was carried out to investigate the effect of heat treatment on mineral constituent of camel milk. Thirty raw and the same number of heat treated milk samples were tested for calcium (Ca), phosphorous (P), copper (Cu), sodium (Na), potassium (K), zinc (Zn) and ferrous (Fe). The heat treatment was performed at 60, 80 and 100°C. Results revealed significant increase in the concentration of copper and zinc at 100°C while the ferrous showed no effect with increasing heat treatment. The concentration of Na showed slight decrease with heat treatment at 80°C while the concentration of P, K and Ca showed no change.

Key words: Milk; camel, heat, minerals

INTRODUCTION
Camel is a multi-purpose animal with huge productive potential. It has been utilized by humans for transport, milk, meat and skin. Milk is an excellent source of most essential minerals required for human health. Camel milk has many properties that make it very useful choice as camel’s milk is used in some parts of the world to cure certain diseases (Yagil, 1982; Wernery, 2003). The milk composition of dromedary is excellent from a nutritional viewpoint, although it is often described as not easily fermented (Attia et al., 2001; Hassan, et al., 2009). Camel milk is used for the treatment of many diseases such as diabetes, jaundice tuberculosis, asthma, problems of spleen and anemia (Rao et al., 1970).

Camel milk is commercially produced in only few countries including Saudi Arabia, United Arab Emirates and Mauritania where the milk sold is pasteurized. The purpose of heat treatment of milk is either the partial destruction of micro-organism or the complete sterilization of milk to prolong its shelf life. Very limited information is available about pasteurization temperature and time. According to European regulations, for the short heat treatment of cow milk, a temperature between 72 and 75°C for 15 to 30 sec should be applied (Anonym, 2002). Wernery et al. (2003) reported that whey protein in camel’s milk is more heat resistant than those of cow’s milk, as the degree of denaturation varied in camel’s milk from 32 to 35% at 80°C for 5 min and pasteurization at 72°C for 5min revealed no losses in camel’s milk.

Although the cow milk in Sudan is the major source of milk for the people, yet an increasing demand of milk warrants study of milk from other species like camel. Average milk yield of camel ranged between 3.5-5.0 kg per animal per day with an average lactation yield of 4,575 to 20,675 kg (Sawaya et al., 1984).

Camel milk is much more nutritious than that from cow milk because it is low in fat and lactose content and higher in potassium iron and vitamin C (Anonymous, 1996). The purpose of this study was to compare the effect of different temperatures on the camel milk.

MATERIALS AND METHODS
Milk samples from 30 she camel at various stages of lactation were collected from Dr. Alaas Farm at Khartoum North region. Camels were grazed on sorghum and concentrates. Milk samples (500 ml each) were collected in clean and sterilized bottles and kept with ice bag and transferred to the laboratory for analysis. Sodium (Na), potassium (K), phosphorus (P), calcium (Ca), zinc (Zn), iron (Fe) and copper (Cu) concentration were determined. Minerals were extracted from the samples according to method of Barri (1993). Each sample was burnt in a muffle furnace at 550°C and then placed in water bath at temperature of 100°C for one hour after addition of 10 ml of 50% HCl and 5 ml of 33% NHO₃. Then the solution was carefully filtered with filter paper in a 100 ml volumetric flask and finally distilled water was added to complete the volume up to mark. The extracts were stored in bottles till further analysis. The K and Na content of each extracted sample were determined according to the method described by AOAC (1981) using flame photometer (Corning 400). Analysis of phosphorus was performed using UNICAM 8625 UV/Vis spectrometer. Ca, Zn, Cu and Fe were determined by Atomic Absorption Spectrophotometer (Phoenix-986).
Table 1: Effect of different heat treatment on some minerals concentration of camel milk

<table>
<thead>
<tr>
<th>Minerals (ppm)</th>
<th>Raw milk</th>
<th>60 °C for 30min.</th>
<th>80 °C for 30 min.</th>
<th>100 °C for 30 min.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu</td>
<td>0.985± 0.26a</td>
<td>1.155± 0.29b</td>
<td>1.168 ± 0.19b</td>
<td>2.427± 0.12a</td>
</tr>
<tr>
<td>Zn</td>
<td>1.625 ± 0.29a</td>
<td>1.833 ± 0.29b</td>
<td>1.982± 0.28a</td>
<td>2.427± 0.22a</td>
</tr>
<tr>
<td>Fe</td>
<td>2.159 ± 0.26a</td>
<td>2.205 ± 0.20a</td>
<td>2.260 ± 0.17a</td>
<td>2.042 ± 0.18a</td>
</tr>
<tr>
<td>Na</td>
<td>308 ± 34.37a</td>
<td>279 ± 18.28ab</td>
<td>257 ± 24.40b</td>
<td>266 ± 24.18ab</td>
</tr>
<tr>
<td>K</td>
<td>1380 ± 106.24a</td>
<td>1320 ± 86.66a</td>
<td>1520 ± 84.06a</td>
<td>1590 ± 15.47a</td>
</tr>
<tr>
<td>Ca</td>
<td>198.197 ± 22.01a</td>
<td>204.588 ± 15.50*</td>
<td>224.381 ± 17.54*</td>
<td>230.811 ± 17.51*</td>
</tr>
<tr>
<td>P</td>
<td>1003.5±7.56a</td>
<td>924.9±2.74a</td>
<td>898.0±6.08a</td>
<td>987.0±4.41a</td>
</tr>
</tbody>
</table>

Mean values in each row bearing the same superscripts are not significantly different (P>0.05)

Statistical analysis

The experimental data were analyzed by analysis of variance (Anova) according to the method of Snedecor and Cochran (1989). P value less than 0.5 was considered as statically significant.

RESULTS

The result of minerals concentration in raw and heat treated milk has been shown in Table 1. It was found that the concentration of Cu and Zn increased significantly with increasing heat treatment. The concentration Na decreased while Ca, P and Fe did not change significantly.

DISCUSSION

The most recent review of literature available lead to the fact that rapidly boiled milk store more calcium and phosphorus than the milk pasteurized for half an hour. Some authors reported that the major nutrients of milk were left unchanged by pasteurization (Elwell and Barbano, 2006). It was suggested that heat has detrimental effect on the nutritive value of milk.

Very little is known about the effect of heat on the mineral concentration of camel milk. The results showed that in general heat has very little effect on mineral content with exception of Cu and Zn. Our findings are similar to the result of Wernery et al. (2003) who tested 6 samples of camel milk and concluded that pasteurization does not destroy zinc, copper, iron and calcium in camel milk. Similarly, Löker et al. (2003) studied the effect of pasteurization in some minerals and vitamin C of camel milk and found that heat treatment decreases in some minerals contents. Study of the metabolism of nitrogen considered to be desirable to investigate the effect of heat on calcium and phosphorous (Gyorgy, 1923).

The current study indicated that temperature has a tremendous effect on the availability of heat treated milk particularly at higher temperature.

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