# Milk composition in the Kohi camel of mountainous Balochistan, Pakistan

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## Abstract

Livestock provides food and livelihood for livestock keeping communities and tribes in the arid and semi-arid lands of Balochistan. Camel milk is famous for its nutritional qualities and health properties. More than 40% of the Pakistani camel population (379,528 head) is kept in Balochistan, but facts about milk production and composition are, to a large extent, unknown. The present study was performed to acquire knowledge about the milk composition of the high producing Balochistani Kohi camel. It is of great importance to evaluate and discuss scientific findings on camel milk in the context of the production systems. Camels in pastoral herds under ordinary grazing conditions provide a field for science and can contribute to food security and sovereignty.

In this study, milk samples from six camels during initial and late stage of lactation were analysed for fat, protein, lactose, ash, sodium, magnesium, iron, manganese, copper and zinc. The study demonstrated that Kohi camel milk contains high levels of protein, iron and zinc, and low levels of fat and lactose. Average contents were 4.01%, 0.55 mg/100 g milk, 1.42 mg/100 g milk, 2.63% and 3.11% respectively.

**Keywords**: camel, dairy, livestock, milk, pastoral.

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## Introduction

North-eastern Balochistan is the home of nomadic and semi-nomadic herders, who use the camel for transportation of goods, family luggage and other daily needs. Camel milk is a very important food item for them; it is used as drink, in tea and converted into yoghurt, shalombey, kurth and other valuable food items (Figure 1). The camel milk is very much liked in Balochistan and appreciated for its nutrient richness and therapeutic peculiarities. The herders regard camel milk as a remedy for several diseases, e.g. liver dysfunction, arthritis and 'long bone pain', and also as an aphrodisiac.

**Figure 1.** Kurth made of camel milk. Photo: Abdul Raziq

The Kohi camel is found in the Suleiman Mountains, Balochistan. It is well adapted to the mountainous ecology of the region. Brief physiological features of the Kohi camel are summarised in Table 1.

The Kohi camel is praised for its milk production. Under ordinary pastoral grazing conditions the mean daily yield is 10.2±0.43 kg with a lactation length of 259 days (Raziq and Younas, 2008). The milk production varies with the stage of lactation, and in June and November the mean daily yields are 11.2±0.31 and 10.1±0.33 kg respectively (Raziq and Younas, 2008).

**Table 1.** Reproductive performance of Kohi camel

| **Reproductive traits** | **Performance** |
|---|---|
| Age at puberty | 4 year (male), 3 year (female) |
| Gestation period | 375-385 days |
| Calving interval | 2 year |
| Calving rate | 80% |
| Conception rate | 85% |
| Reproductive life | 25-35 year |

Modified from Raziq and Younas (2008)

Very little scientific work has been done on the Pakistani camel, especially on milk composition (Khan and Iqbal, 2001; Konuspayeva et al., 2009). This study was performed to acquire knowledge about milk composition in the Kohi camel breed of Balochistan.

## Materials and methods

### *Camels*

This study was conducted on six Kohi camels, representing parity 1-6. All the selected camels belonged to pastoral herds and calved in April 2007. Due to practical reasons it is extremely difficult to study a large number of camels on a regular basis, given the remoteness of the area, lack of transportation, poor civic amenities, lack of sufficient camel numbers at one place and the continuous movement of herds. Therefore, this study was conducted on six camels and sampling was performed on two occasions during the lactation period. The first sampling was done in the initial stage, i.e. 2$^{nd}$ month of lactation in the first week of June, and the next sampling was done in the late stage, i.e.7$^{th}$ month of lactation in the first week of November.

### *Study area*

The study area in north-eastern Balochistan is known as the Suleiman mountainous region (Figure 2). The region is categorised as semi-arid, receiving 200-500 mm precipitation bimodal. The region is situated from 29º–37' to 31º, 70' at North latitudes and from 68º, 06' to 70º, 20' at East longitudes; the climate is arid to semi arid, with a warm summer and cool winter. The average temperature in the summer is 21–32°C and winter temperatures below 0ºC have been reported (GOB, 1999). There are two wet seasons: spring rains in March and April (*Pasarlai*) and monsoons rains in July and August (*Wasa*).

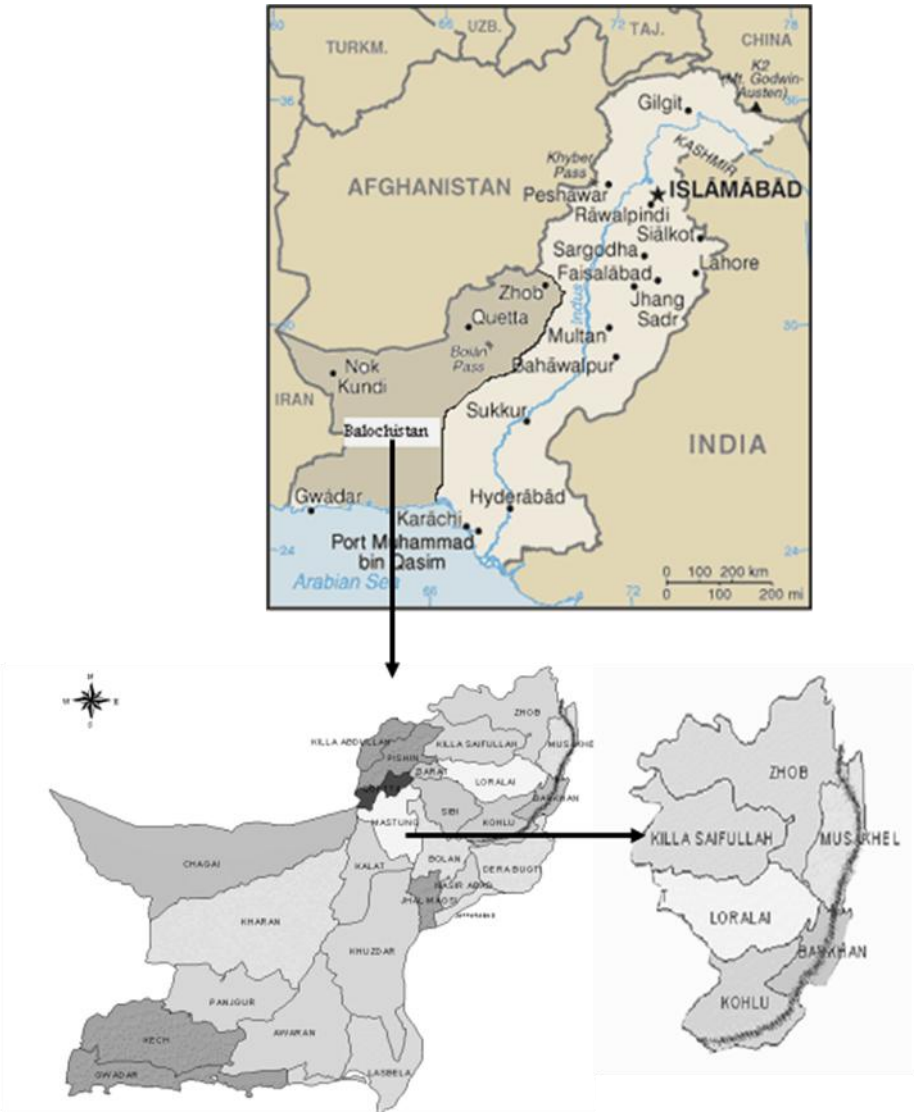


**Figure 2.** Map of the Suleiman mountainous region of Balochistan, Pakistan.

Source: Geological Survey of Pakistan.

*Grazing management*

The camels used in this study belonged to pastoral herders and were grazing on natural vegetation. The animals were allowed to move freely in the grazing area from dawn to evening. They were given water three times per day: morning before grazing, noon, and evening when returning from the rangelands.

The area is rich in vegetation in June as well as in November, especially in the mountainous region. The vegetation is composed of Palosa *(Aacia modesta),* Showan *(Olea ferrugina),* Gorgula *(Reptonia buxifolia),* Makhie *(Caragina ambigua),* Bararr (*Periploca aphylla),* Shorie *(Haloxilon griffithii) and* Barwazi (*Heteropogon contrutus).*

*Milking practice and sampling*

All six camels were milked twice a day, morning and evening. The calves were allowed to suckle to stimulate milk letdown. While the calves were suckling, simultaneously the dams were milked completely for all quarters. One handler was controlling the calf to ensure equal suckling of all quarters. Milk was collected from all four quarters in a clean utensil, and the milk foam was allowed to liquefy for 30 minutes. The milk was stirred and a homogenous sample was collected. Morning and evening milk samples (100 ml of each) from each camel were mixed. The samples were stored on ice and transported to the laboratory within 24 hours. At the laboratory, the samples were stored in freezer (-20ºC) until they were analysed.

*Fat, protein, lactose and ash analysis*

The milk samples were analysed for fat, protein, lactose and ash. For fat, protein and lactose, an ultrasonic milk analyser was used (Model Ekomilk Total Ultrasonic Milk Analyzer, Bulltek 2000, Stara Zaqora, Bulgaria) at the Department of Livestock Management, KPK Agricultural University in Peshawar. The method was used according to the operating instructions of the manufacturer. The Ekomilk cow milk protocol was used, since camel milk protocol wasn´t available in the Ekomilk system and camel milk is more similar to cow´s milk than other species (Knoess, 1984). For ash, the standard method (AOAC, 1999) was used.

Data collected were coded, entered into data files and analysed using a Microsoft Excel program.

*Mineral analysis*

One milk sample from the initial stage of lactation was chosen from each camel (n=6). The levels of sodium (Na), magnesium (Mg), iron (Fe), manganese (Mn), copper (Cu) and zinc (Zn) were analysed in the milk samples (n=6) by atomic absorption spectrophotometer (Varian AA-240) at the Institute of Food Science and Technology, University of Agriculture, Faisalabad.

## Results and discussion

A study comprising only six camels may seem like a very minor study. These camels represent, of course, not the whole Baluchistani camel population but only themselves. The reason for this low number was the practical difficulties inherent in studying animals owned by pastoralists who are constantly on the move in remote locations. Perhaps only those who have completed such a study can fully understand these difficulties.

*Fat, protein, lactose and ash*

The results and mean values for fat, protein, lactose and ash in the milk samples are presented in Table 2.

**Table 2.** Milk composition of Kohi camels (n=6, representing parity 1-6) at initial (1st) and late (2nd) stage of lactation

| Contents | Stage of lactation | Parity | | | | | | Mean |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | |
| Fat | 1st | 2.70 | 2.50 | 2.50 | 2.60 | 2.60 | 2.50 | 2.57 |
| | 2nd | 2.80 | 2.60 | 2.60 | 2.70 | 2.70 | 2.80 | 2.70 |
| | *Mean* | *2.75* | *2.55* | *2.55* | *2.65* | *2.65* | *2.65* | *2.63* |
| Protein | 1st | 4.10 | 3.70 | 4.30 | 4.30 | 4.30 | 4.20 | 4.15 |
| | 2nd | 3.60 | 3.40 | 3.10 | 4.40 | 4.30 | 4.40 | 3.87 |
| | *Mean* | *3.85* | *3.55* | *3.70* | *4.37* | *4.30* | *4.30* | *4.01* |
| Lactose | 1st | 3.77 | 3.50 | 3.80 | 3.45 | 3.92 | 3.62 | 3.67 |
| | 2nd | 2.50 | 2.44 | 2.70 | 2.54 | 2.70 | 2.43 | 2.55 |
| | *Mean* | *3.13* | *2.97* | *3.25* | *2.99* | *3.31* | *3.02* | *3.11* |
| Ash | 1st | 0.66 | 0.68 | 0.68 | 0.70 | 0.66 | 0.70 | 0.68 |
| | 2nd | 0.72 | 0.76 | 0.72 | 0.78 | 0.70 | 0.72 | 0.73 |
| | *Mean* | *0.69* | *0.72* | *0.70* | *0.74* | *0.68* | *0.71* | *0.70* |

*Fat*

The fat content ranged from 2.50% to 2.80% with an average of 2.63%. Konuspayeva et al., (2009) reported an average 3.82 g fat/100 ml in a meta-analysis of the literature data on the composition of milk from dromedary camels, Bactrian and hybrids. The findings of our study are in line with 2.47% from Ethiopia (Zeleke, 2007), 2.5% from Sub-Saharan Africa (Bengoumi et al., 2005), 2.7% from Morocco (Kouniba et al., 2005), 2.90% from Egypt (El-Agamy, 1983) and 2.9% from India (Bhakat and Sahani, 2006). The fat findings of our study are lower compared with 3.08% from India (Khan and Appanna, 1964), 3.1% from India (Sahani et al., 1998), 3.15% from Kenya (Farah and Ruegg, 1989) and Saudi Arabia (El-Amin and Wilcox, 1992), 3.16% from India (Dukwal et al., 2007), 3.22% from Saudi Arabia (Mehaia et al., 1995), 3.28% from Saudi Arabia (Ali-Gorban and Izzeldin, 1997), 3.3% from Libya (Gnan and Sheriha, 1986), 3.39% from Israel (Guliye et al., 2000), 3.45% from UAE (Ahmed, 1989), 3.5% and 3.57% from Pakistan (Mehaia, 1994; Iqbal et al., 2001), 3.6% from Saudi Arabia

(Sawaya et al., 1984), 3.78% from India (Ohri and Joshi, 1961), 3.8% from Egypt (El-Bahay, 1962), 3.9% from Egypt (Farag and Kebary, 1992), 4,3% from Israel (Yagil and Etzion (1983), 4.33% from Ethiopia (Mukasa Mugerwa, 1981), 5.4% and 5.5% from Ethiopia and Somalia (Knoess, 1976; Hjort and Dahl, 1984). A wide variation in camel milk fat has been reported in different parts of the world (Konuspayeva et al., 2009). This difference may be due to the available vegetation, topography of the area, frequency of milking, stage of lactation, climate (hot, cold, dry, wet), camel breed and methodology of the analyses (El-Amin, 1979; Rodriguez et al., 1985; Knoess et al., 1986; Mehaia et al., 1995 and Zia-ur-Rahman et al., 1998; Kouniba et al., 2005).

There is a negative correlation between the fat content in camel milk and the milk yield (Sheriba, 1986). Studies in Pakistan and India on experimental camels with high milk production and optimal nutrition reported low fat contents; 1.5-3.1% (Knoess et al., 1986) and 2.2% (Raghvendar et al., 2003). The high mean daily milk yield (10.22 kg) in the Kohi camel most likely affects the fat content.

In our study, the mean fat content was higher in the late stage of lactation ($7^{th}$ month) than in the initial stage of lactation ($2^{nd}$ month). This is supported by Bekele et al. (2002); however, other scientists found no significant effect (Al-Shaikh and Salah, 1994; Guliye et al., 2000) or the reverse association (El-Hatmi et al., 2004). Higher fat content in the late stage of lactation might be due to many factors, e.g. lower average milk yield and mild ambient temperature. Fat content is reduced when the water content is high in milk from camels living in hot climate zones (Wernery, 2006). Milk is an important source of water for camel calves in hot weather, thus the need of the young calves dictates the quality of the milk (Yagil and Etizion, 1983). Our study was conducted during the wet season, when the milk yield was optimal. At the first sampling ($2^{nd}$ month of lactation, daily milk yield 11.00 kg), the weather was hotter compared to the second sampling ($7^{th}$ month of lactation, 10.00 kg). Lakosa and Shokin (1964), Knoess et al. (1986) and Zeleke (2007) reported that the season of the year (and milk yield) affects the fat content. The vegetation of the study area differs from March to August, which might affect camel milk composition (Al-Shaikh and Salah, 1994).

Some scientists found no correlation between camel milk fat content and parity (Al-Sultan and Muhammad, 2007; Al-Shaikh and Salah, 1994), but Zeleke (2007) reported that milk fat was significantly higher in parity 3 as compared to other parities. In our study the fat content was highest in the parity 4 camel. Differences between studies on fat and parity might be due to different age of maturation of camels. Kohi camels are 12 years old and completely mature when they are in parity 4, compared to the African camels which reach mature body size in earlier parities. A mature body completes the nutrient shift to the

milk, which results in higher fat content.

*Protein*

The protein content ranged from 3.10% to 4.40% with an average of 4.01%. Konuspayeva et al. (2009) reported an average 3.35 g protein/100 ml in a meta-analysis of the literature data on the composition of milk from dromedary camels, Bactrian and hybrids.

Our findings are well in the range of 3.50% (Kheraskov, 1953), 3.50% (El-Bahay, 1962), 3.70% (El-Agamy, 1983), 3.76% (Khan and Appanna, 1964), 3.90% (Dukwal et al., 2007), 3.95% (Ohri and Joshi, 1961), 4.02% (Mukasa-Mugerwa, 1981), 4.50% (Knoess, 1976), 3.50–4.50% (Bengoumi et al., 2005), 3.5–4.6% (Bhakat and Sahani, 2006) and 4.60% (Yagil and Etzion, 1983).

Other studies reported lower values: 3.00% (Hjort and Dahl, 1984; Sawaya, 1984; Ahmed, 1989), 3.10% (Farag and Kebary, 1992), 3.11% (Farah and Ruegg, 1989), 3.27% (Ali-Gorban and Izzeldin (1997), and 3.30% (Gnan and Sheriha, 1986; Kouniba et al., 2005).

Some scientists reported considerably lower values, e.g. 2.1–2.5% (Raghvendar et al., 2005), 2.20–2.59% (Knoess et al., 1986), 2.67% (Zeleke, 2007), 2.79% (Guliye et al., 2000), 2.80% (Mehaia, 1994), 2.81% (El-Amin and Wilcox, 1992) and 2.85% (Iqbal et al., 2001).

The protein content in our study might be correlated with the quality of the available vegetation in the study area, predominantly leguminous flora-like *Acacia* (15.31% crude protein (CP) and *Caragana* (11.00% CP).

The protein content was higher in the initial stage of lactation than in the late, which supports the findings of Bekele et al. (2002), Zeleke (2007) and El-Hatmi et al. (2004). Many factors can contribute to this phenomenon, e.g. nutritional variation (Al-Shaikh and Salah, 1994). The vegetation changes in nature during the lactation period and is not always available in the same quantity. The change in the milk quantity, advancement in the lactation and the physiological and hormonal changes might also be factors of importance. The need of the calf can also dictate the milk quality (Yagil and Etizion, 1983). The neonatal calf needs high protein content in the milk. With advancement in age, the calf starts to browse and gets some of the protein requirement from the vegetation; therefore the milk protein requirement decreases with calf age. Detailed studies are needed to evaluate the protein variation in Kohi camel milk.

Zeleke (2007) reported that parity had significant effects on daily composition of protein and milk protein was significantly higher in parity 3, as compared to other parities. Al-Sultan and Muhammad (2007) reported that parity had no effect on protein content. Al-Shaikh and Salah (1994) claimed that milk composition was not affected by parity, rather variations in milk protein were due to nutritional management.

The Kohi camel matures early. In our study, the milk protein content

from the three camels in parity 1-3 was lower than that from the camels in parity 4-6.

*Lactose*

The lactose content ranged from 2.43% to 3.92% with an average of 3.11%. Konuspayeva et al. (2009) reported an average 4.46 g lactose/100 ml in a meta-analysis of the literature data on the composition of milk from dromedary camels, Bactrian and hybrids.

Our findings are well in the range of 3.30% (Hjort and Dahl, 1984), 3.36% (Barthe, 1905), 3.4% (Knoess, 1976; Bengoumi et el., 2005), 3.8% (Raghvendar et al., 2005) and 3.9% (El-Bahay, 1962).

Higher lactose contents were reported: 4.1% (Kouniba et al., 2005), 4.16% (El-Amin and Wilcox, 1992), 4.17% (Ahmed, 1989), 4.21% (Mukasa-Mugerwa, 1981), 4.4% (Sawaya, 1984; Bhakat and Sahani, 2006), 4.47% (Farag and Kebary, 1992), 4.6% (Yagil and Etzion, 1983; Mehaia, 1994), 4.67% (Zeleke, 2007), 4.81% (Guliye et al., 2000), 4.88% (Ohri and Joshi, 1961), 5.0% (Kheraskov, 1953), 5.24% (Farah and Ruegg, 1989), 5.43% (Khan and Appanna, 1964), 5.61% (Gnan and Sheriha, 1986), 5.8% (El-Agamy, 1983), and 4.59–5.33% (Knoess et el., 1986).

Only one study reported lower lactose content: 2.56% (Ali-Gorban and Izzeldin, 1997).

The lactose content in our study was higher in the initial stage than in the late stage of lactation. The conclusion from Abdoun et al. (2007), that nutritional scarcity during dry season depressed the milk lactose content, was not valid for our study, which was conducted during the wet season. Al-Sultan and Muhammad (2007) from Saudi Arabia reported that parity had no affect on lactose content.

*Ash*

The ash content ranged from 0.66% to 0.78% with an average of 0.70%. Konuspayeva et al. (2009) reported an average 0.79 g ash/100 ml in a meta-analysis of the literature data on the composition of milk from dromedary camels, Bactrian and hybrids.

Our findings are in line with 0.60% (Yagil and Etzion, 1983), 0.70% (Kheraskov, 1953; El-Agamy, 1983; Hjort and Dahl, 1984; Dukwal et al., 2007), 0.73% (Khan and Appanna, 1964), 0.76% (El-Bahay, 1962), 0.77% (Ali-Gorban and Izzeldin, 1997; Guliye et al., 2000), 0.70-0.90% (Bhakat and Sahani, 2006) and 0.79-0.90% (Bengoumi et al., 2005).

Other studies reported higher ash content: 0.79% (Mukasa-Mugerwa, 1981; Mehaia, 1994), 0.8% (Sawaya et al., 1984; Farah and Ruegg, 1989; Farag and Kebary, 1992), 0.82% (Gnan and Sheriha, 1986; Ahmed, 1989), 0.83% (El-Amin and Wilcox, 1992; Kouniba et al., 2005), 0.90% (Knoess, 1976) and 0.95% (Ohri and Joshi, 1961).

The ash content in our study was lower in the initial stage compared to the late stage of lactation. This agrees with the findings of El-Hatmi et al., (2004), who reported that the ash content increased during lactation and reached to its peak (1%) at week 40 of lactation.

The higher ash contents of the Kohi camel milk in the late stage of lactation might be correlated with the milk yield. The milk production is lower in the late stage, which increases the ash content. Another factor might be the change in the nature of the available vegetation during the both stages. In the late stage the camels in the study area graze mainly on salty bushes because the other vegetation decreases in the autumn months in the region.

**Mineral contents**

The mineral (Na, Mg, Fe, Mn, Cu and Zn) contents are presented in Table 3.

**Table 3.** Mineral composition of camel milk (mg/100g)

| Parity | Na | Mg | Fe | Mn | Cu | Zn |
|---|---|---|---|---|---|---|
| 1 | 40.53 | 15.36 | 0.55 | 0.067 | 0.24 | 1.12 |
| 2 | 61.07 | 14.84 | 0.58 | 0.062 | 0.19 | 1.27 |
| 3 | 43.62 | 14.98 | 0.51 | 0.065 | 0.26 | 1.20 |
| 4 | 39.89 | 14.52 | 0.52 | 0.06 | 0.19 | 1.68 |
| 5 | 68.90 | 15.81 | 0.55 | 0.073 | 0.22 | 1.93 |
| 6 | 42.52 | 14.75 | 0.56 | 0.073 | 0.27 | 1.34 |
| Average | 49.42 | 15.04 | 0.55 | 0.066 | 0.22 | 1.42 |

*Sodium (Na)*

Sodium in our study varied from 40.53 to 68.90 mg/100 g milk with an average of 49.42 mg/100 g. These results are well in the range of 43.10 mg/100 g reported by El-Amin and Wilcox (1992). The findings of our study are higher than 23 mg/100 g (Yagil and Etzion, 1980) and 31.2 mg/100 g (Farag and Kebary, 1992), but lower than 58.8 mg/100 g (Abu-Lehia, 1987), 63.86 mg/100 g (Dukwal, 2007), 67.7 mg/100 g (Sawaya et al., 1984), 69 mg/100 g (El-Hatmi et al., 2004; Mehaia et al., 2005). The levels of sodium can be affected by seasonal heat and water intake (Yagil and Etzion, 1980). The levels of sodium in our study probably reflect the nature of the topography of the habitat where the camels live. The area is mountainous with good quantity and quality of vegetation.

*Magnesium (Mg)*

Magnesium in our study varied from 14.52 to 15.81 mg/100 g milk with an average of 15.04 mg/100 g. These findings are well in range with the finding of 12 mg/100 g (Sawaya et al., 1984), 12.3 mg/100 g (Mehaia et al., 1995), 13.5 mg/100 g (Abu-Lehia, 1987) and 18.1 mg/100 g (Khan and Appanna, 1964), but higher than 4.50 mg/100 g (El-Amin and Wilcox, 1992), 8.3 mg/100 g (Farah and Ruegg, 1989), 8.8 mg/100 g (Farag and Kebary, 1992) and 10 mg/100 g (Yagil and Etzion, 1980). The results reported by Ahmed et al, 1977 are much higher (21.0 mg/100 g) than ours findings.

*Iron (Fe)*

Iron in our study varied from 0.51 to 0.58 mg/100 g milk with an average of 0.55 mg/100 g. These findings are in line with the findings of 0.5 mg/100 g (Knoess, 1976), but higher than 0.21 mg/100 g; Abu-Lehia, 1987), 0.26 mg/100 g (Sawaya et al., 1984), 0.28 mg/100 g (El-Amin and Wilcox, 1992) in Saudi Arabia, 0.32 mg/100 g in India (Khan and Appanna, 1964), 0.37 mg/100 g in Egypt (Ahmed et al., 1977) and 0.44 mg/100 g in Jordanian (Haddadin et al., 2008).

The differences in iron level may be due to camel breed (Ali-Gorban and Izzeldin, 1997) and also to the nature of vegetation and the topography of the habitat. The mountainous regions have higher iron content in the soil than the deserts. Most of the studies reported on camel milk relate to the desert camel.

*Manganese (Mn)*

Manganese in our study varied from 0.060 to 0.073 mg/100 g milk with an average of 0.066 mg/100 g. These findings are very close to 0.050 mg/100 g (Haddadin et al., 2008), but higher than 0.018 mg/100 g (Abu-Lehia, 1987).

*Copper (Cu)*

Copper in our study varied from 0.19 to 0.27 mg/100 g milk with an average of 0.22 mg/100 g. These findings are in the range of 0.14 mg/100 g (Mehaia et al., 1995), 0.15 mg/100 g (Abu-Lehia, 1987) and 0.22 mg/100 g (Ahmed et al., 1977).

*Zinc (Zn)*

Zinc in our study varied from 1.12-1.93 mg/100 g with an average of 1.42 mg/100 g. These findings are higher than 0.44 mg/100 g (Abu-Lehia, 1987), 0.58 mg/100 g (Haddadin et al., 2008) and 0.59 mg/100 g (Mehaia et al., 1995). The higher zinc content in our findings could be related to the composition of the soil. Further studies are needed to evaluate the correlation of the nature of the soil and the zinc content of camel milk.

## Conclusion

The Kohi camel is a high producing dairy animal under the ordinary grazing conditions of the Suleiman mountainous region. Milk quality was evaluated in the present study and proved to be excellent, containing high protein, iron and zinc levels and low levels of fat and lactose.

The most interesting finding in our study was the high content of iron and

zinc. Most likely, the soil in the mountains and the camel breed together contribute to high levels in the milk of these important minerals. The low lactose content makes Kohi camel milk an alternative for consumption by children when breast milk is not available. The low level of fat makes it a good choice for people with arteriosclerosis, high blood pressure and heart diseases.

Protein and mineral deficiency are major problems for people in Pakistan. Malnutrition especially strikes people in remote areas. The first author has personally observed that camels in peak milk production are milked only to empty the udder, and the milk is thrown away. The remoteness of the herds and the fact that they are continuously moving makes it difficult to take care of surplus milk. If safe and sound storage for milk could be made available especially in the peak period, camel milk could become a source of income for poor camel herders and also assist food security on a country level. The waste of camel milk is not only the wastage of food but also a loss of the milk as a natural medicine without any side effects.

Camel production can be a profitable production system, based on marketable products from the camel keeping areas. Value adding to camel milk to obtain common consumer products (e.g. kulfi, ice cream and flavored milk) could be advantageous for farmers and represent the introduction of new quality food in the food chain of several countries. It is strongly recommended to inform the masses about the value and importance of camel milk and to remove taboos related to it.

Internationally, studies on camel milk composition are scarce. Available data are limited and often originate from camels on stations. In Pakistan, studies on camel milk in general are rare and especially on the Balochistani mountainous camel breeds such as Kohi. Milk studies on camels in pastoral herds are scarce indeed. Here is an urgent field of science, to contribute to food security and sovereignty.

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