Detection of Some Heavy Metal Residues in Camel Milk in Sharkia Governorate

Neveen H. Abo El-Enaen ; Enas, M. Sami and Amal, Raslan*
Food Hygiene Dept., Animal Health Research Institute, Zagazig
*The Hospital of Fac. of Vet. Med. Zag. Univ.

ABSTRACT

A total of 25 camel milk samples were collected from markets in Sharkia Governorate for detection and determination of some heavy metal residues. The mean resides of cadmium, lead, mercury, copper, zinc and manganese were 0.1643 ±0.0049, 0.426 ±0.00876, 0.00015 ±0.000015, 0.6182 ±0.044, 3.8089 ±0.4674 and 0.2126 ±0.0187 ppm respectively, cobalt residues was not detected in all the examined samples. The obtained results showed that all the cadmium, lead, copper and manganese residues were exceed the recommended permissible limits in all the examined samples except one sample had manganese within the permissible limit, while; zinc residues were above the permissible limits in 13 (52%) samples. On contrast, all the examined camel milk samples had mercury residues within the permissible limits. Although, the most of the tested heavy metals exceeded the permissible limits in the examined samples, the calculated daily intake from the consumption of 200 ml gave a daily intake below the acceptable daily intake from each metal.

INTRODUCTION

Camel milk is a principal source of food in nomad peoples, they think that it is the better type of milk in the world *(1)*, and they usually drink camel milk in fresh form. Camel milk is used for drinking only and is not sold as it is utilized for other purposes *(2)*.

Since the last quarter of 20th century, many studies were conducted for analysis the chemical composition of camel's milk. These investigations concluded that the camel milk contained a very valuable source of nutritive materials for human. Water in camel milk ranged between 84-90%, the average fat content was 5.4%, protein level was nearly 3% and lactose sugar concentration was 3.4%, the element contents as iron, calcium, phosphorus, manganese, potassium and magnesium were 0.7%. On the other hand, camel milk contained the volatile fatty acids especially linolic acid and unsaturated fatty acids which are important for cardiac patients, furthermore, cholesterol levels in camel milk is lower than those in cow s milk by 40%, casein in the camel milk reach to 70%, thus it easy for digestion. On the other aspect, vitamin C level in the camel milk is three duplicate than those in the cow's milk especially if camels fed on the green ration. Also, vitamin B1, B2, A and carotene were found in adequate amounts in the camel milk *(1)*.

Several studies in Egypt recorded considerable levels of different heavy metals in cow and buffalo s milk *(3,4)*. As the other types of milk, the milk of camels may be exposed to different heavy metal pollutants, which express the serious hazardous risks on the public health.

Because the data about the heavy metal levels in the camel milk in Egypt is scanty, the aim of this study is to estimate the different heavy metal levels in camel milk from markets in Sharkia Governorate, Egypt.

MATERIAL AND METHODS

Collection of samples

A total of 25 camel milk samples were collected from markets in Sharkia Governorate, these sold in bottles 1 or 0.5 liter, bottles were identified and kept frozen until the analysis was conducted.

Preparation of samples

Each of 5 ml of the examined samples were digested *(5).* 10 ml solution of concentrated nitric acid and perchloric acid (1:1) were added to each sample. The samples were cold digested over night followed by mild increase in temperature till heating at 100 °C in water bath for 3-4 hours, 4-5 drops of H_2O_2 30% were added and heating continued till the brown nitrous gases were expelled and specimens become clear. After cooling, each digest was diluted to 30 ml with deionized water and filtered through Whatman filter paper No. 42. the clear filtered of each sample was kept in refrigerator to avoid evaporation.

Preparation of blank solution

Ten ml. of digestion solution (nitric/ perchloric acid 1:1) in screw capped glass bottle was subjected to digestion, dilution, and filtration as the examined samples to detect any traces of the studied metals in acids or deionized water.

Quantitative determination of metals in the examined samples

Quantitative determination of cadmium, copper, zinc, manganese and cobalt residues were conducted using UNICAM 969 Atomic Absorption Spectrophotometer. Lead residues were conducted using Atomic Absorption Spectrophotometer (Buck – MODEL 220 GF-Graphic Furance). Meanwhile, mercury was determined using Perkin- Elmer mod. 2830, USA, Spectrophotometer. The concentrations of metals were calculated according to the following equation: ppm metal in samples = A×B÷V where, A= ppm metal in prepared samples from the digital scale reading of A.A.S., B= final volume of prepared samples in ml. and V = Volume of samples in ml.

RESULTS

The obtained results of cadmium, lead, mercury, copper, zinc and manganese are outlined in Table 1, while; cobalt residues could not be detected in all the examined samples. The frequency distribution of heavy metal residues in the examined camel milk samples is showed in Table 2. Meanwhile, the comparison of acceptable daily intake (ADI) values of the detected heavy metals with calculated daily intake from the examined camel milk is tabulated in Table 3.

Table 1. Heavy metal concentrations (ppm) in the examined camel milk (n=25)

Metal	Minimum	Maximum	Mean ±S.E.
Cadmium	0.124	0.205	0.1643 ±0.0049
Lead	0.355	0.509	0.426 ±0.00876
Mercury	0.0001	0.0003	0.00015 ±0.000015
Copper	0.217	0.945	0.6182 ±0.044
Zinc	0.05	7.70	3.8089 ±0.4674
Manganese	0.041	0.389	0.2126 ±0.0187

Table 2. Frequency distribution of heavy metal concentrations in the examined camel milk with the maximal permissible limit (n=25)

Metal	Permissible Limits (ppm)	Not detected		Within P.L.*		Over P.L.	
		No.	%	No.	%	No.	%
Cadmium	0.05 *(6)*	0.0	0.0	0.0	0.0	25	100
Lead	0.2 *(6)*	0.0	0.0	0.0	0.0	25	100
Mercury	0.005 *(7)*	0.0	0.0	25	100	0.0	0.0
Copper	0.2 *(8)*	0.0	0.0	0.0	0.0	25	100
Zinc	4.3 *(9)*	3	12	9	36	13	52
Manganese	0.05 *(10)*	0.0	0.0	1	4	24	96

Table 3. Consumption of acceptable daily intake (ADI) values of the detected heavy metals with calculated daily intake from the examined camel milk.

Metal	ADI* mg/70kg person *(11)*	Mean conc. of the metals in the present study (mg/kg)	Calculated daily intake from consumption of 200 ml milk daily *(12)*	
			mg/day/person	%
Cadmium	0.07	0.1643 ±0.0049	0.0328	46.85
Lead	0.5	0.426 ±0.00876	0.0852	17.04
Mercury	0.05	0.00015 ±0.000015	0.00003	0.06
Copper	35.00	0.6182 ±0.044	0.1236	0.353
Zinc	70.00	3.8089 ±0.4674	0.7617	1.0871
Manganese	5.0	0.2126 ±0.0187	0.04252	0.85

DISCUSSION

The obtained results (Table1) revealed that the mean concentrations of cadmium residues in the examined camel milk samples was 0.1643 ±0.0049 ppm, this result agreed with those previously recorded in an Egyptian study *(3)*. On the other hand, our figures were lower than obtained in another Egyptian studies *(4,13)*. On contrast, lower levels of cadmium residues than our estimations were detected in cow milk in Brazil *(14)*, Croatia *(15)* and Italy *(16)*.

Concerning lead residues, were detected in the examined camel milk with a mean value of 0.426 ±0.00876 ppm, this value coincide with those previously reported in cow milk *(3,4,13,15)*. On the other hand, lower lead levels than those obtained in the current study were reported in cow milk *(14,17,18)*. Meanwhile, higher lead residues than our

figures were recorded in cow milk in Italy *(16)*.

Mercury residues were detected in the examined camel milk with the mean value of 0.00015 ±0.000015 ppm, this level is nearly similar with those detected in breast milk *(19-21)*. Meanwhile, in Turkish study mercury could not detect in cow ´s milk *(17)*.

The mean concentrations of copper and zinc in camel milk samples were 0.6182 ±0.044 and 3.8089 ±0.4674 ppm respectively. The obtained results were lower than those detected previously in breast milk in Bangladesh *(22)* and Indian *(23)* .

The average of manganese levels in the examined samples was 0.2126 ±0.0187 ppm, these findings coincide with those detected in raw cow milk *(24, 4)*. Meanwhile, lower levels than our figures were reported in another investigations (0.024ppm) *(25)*, and (0.043 – 0.048 ppm) *(18)*. On the other side, higher levels of manganese values were detected *(26,27)*.

Cobalt residues could not be detected in all the examined samples.

Concerning the comparison among the estimated element levels in the examined camel milk and the recommended permissible limits, Table 2 showed that all the cadmium, lead, copper and manganese residues were exceed the recommended permissible limits in all the examined samples except one sample had manganese within the permissible limit, while; zinc residues were above the permissible limits in 13 (52%) samples. On contrast, all the examined camel milk samples had mercury residues within the permissible limits.

The results showed in Table 3 indicat that the average concentrations of cadmium, lead, mercury, copper, zinc and manganese residues were 0.1643 ±0.0049, 0.426 ±0.00876, 0.00015 ±0.000015, 0.6182 ±0.044, 3.8089 ±0.4674 and 0.2126 ±0.0187 ppm respectively as previously mentioned, which gave a daily intake of about 0.0328, 0.0852, 0.00003, 0.1236, 0.7617 and 0.04252 mg/ person respectively for milk consumer (200 ml/ person/ day) *(12)* and this contributed to about 46.85%, 17.04%, 0.06%, 0.353%, 1.0871% and 0.85%. The calculated daily intake in the present study is lower than those detected in cow ´s milk in Egypt *(4)*.

It is evident that, in spite of, camel life usually in desert areas far from the traditional sources of heavy metal pollution, the examined camel milk suffered from considerable levels of cadmium, lead, copper, zinc and manganese. Otherwise, mercury residues were at low safety levels and cobalt was not detected. These results may be explained by the contaminations of camel ´s feed and water with heavy metals. Moreover, we can be concluded that it is difficult to avoid the environmental pollution in our foods. Also, under the present environmental conditions, all kinds of organisms exposed to metal pollution wheresoever its life.

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الملخص العربي

الكشف عن بقايا بعض المعادن الثقيلة في ألبان الجمال في محافظة الشرقية

*نيفين حسن إسماعيل أبو العينين – إيناس محمود سامي – أمل رسلان عبد العزيز**

معهد بحوث صحة الحيوان – معمل الزقازيق الفرعى (وحدة صحة الأغذية)

• *مستشفي كلية الطب البيطري- جامعة الزقازيق*

أجريت هذه الدراسة لاستبيان مدي تواجد بعض المعادن الثقيلة في ألبان الجمال بمحافظة الشرقية، تم تجميع عدد ٢٥ عينة من ألبان الجمال من الأسواق و قد تم هضم العينات و قياسها بجهاز الإمتصاص الذري و أسفرت الدراسة عن النتائج التالية.

وجد أن متوسط تركيزات الكادميوم، الرصاص، الزئبق، النحاس، الزنك و المنجنيز كانت ٠,١٦٤٣، ٠,٤٢٦، ٠,٠٠٠١٥، ٠,٦١٨٢، ٣,٨٠٨٩، ٠,٢١٢٦ جزء في المليون علي التوالي. ولم يتواجد الكوبالت في كل العينات المختبرة.

و قد وجد أن جميع العينات احتوت علي الكادميوم، الرصاص، النحاس، االمنجنيز بمستويات أعلي من الحدود المسموح بها عدا عينة واحدة كان بها المنجنيز في حدود المسموح به ، أما متبقيات الزنك فقد تعدت الحدود المسموح بها في ١٣ عينة (٥٢%)، في حين كانت مستويات الزئبق أقل من الحدود المسموح بها في كل العينات

و قد وجد أن المأخوذ اليومي من المعادن المختبرة الناتج عن استهلاك الألبان لا يتعدي الحد الأقصي المسموح به من كل المصادر الغذائية، من هذه الدراسة نستنتج أن المعادن الثقيلة تتواجد بنسب عالية في ألبان الجمال لا تتناسب مع كون الجمل حيوان صحراوي يعيش بعيدا عن مصادر التلوث مما يستلزم المزيد من الدراسة حول المصادر المحتملة لذلك التلوث.