Assessment of Cadmium and Lead in Buffalo’s Raw Milk and its Rural Products in some villages of Sohag and Qena Governorates, Egypt

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Abstract:

Raw buffalo’s milk and house-made rural milk products including, Laban Rayeb, Cream, Samna, Kareish cheese and Mish cheese (252 samples) were collected from 14 villages of Sohag and Qena Governorates. These samples were applied to assess Cadmium and Lead. It was found that the average contents of Cadmium and Lead were 0.023 ppm and 0.09 ppm in Buffalo’s milk; 0.022 ppm and 0.065 ppm in Laban rayeb; 0.025 ppm and 0.09 ppm in Cream; 0.024 ppm and 0.088 ppm in Samna; 0.061 ppm and 1.841 ppm in Kareish cheese, and 0.049 ppm and 2.104 ppm in Mish cheese, respectively.

Statistical analysis showed that the variations among investigated villages were highly significant except of Cadmium values in Laban Rayeb were significant. These variations may be due to the different environmental condition of each village.

Key word (milk-laban rayeb-Samna-cream- Kareish cheese- Mish cheese - Cadmium - Lead)

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Introduction

Milk is considered as a nearly complete food since it is a good source for protein, fat and major minerals. Also milk and milk products are main constituents of the daily diet, especially for vulnerable groups such as infants, school age children and old age (Davies, et al., 1986).

In recent years, risks of heavy metals that may pollute different foods have been receiving increased attention. Heavy metal contamination of milk is now considered to be a greater problem than that of pesticides (IDF, 1992 and FAO/WHO, 1997).

Pollution of the environment with heavy metals such as lead and cadmium are world-wide problem. Lead alkyl as additives in petrol are combusted and emitted into the atmosphere and can be responsible for the high concentration of lead in some vegetation, roadside, soil, air, water and plants (Burguera and Rondon, 1987). Cadmium was presumed to be a possible source of environmental pollution through galvanized pipes and effluents from electroplating works and geological deposits (Dwivedi, et al., 1997) and (Melgar, et al., 1997).

Maximum limit admitted for Cadmium by Romanian regulation for milk and cheese is 0.05 ppm, the maximal limit for Lead in milk and cheese in Romania is 0.02 ppm (Florea et al., 2006). (Codex Alimentarius Commission 2007) established a limit for Pb in milk 0.02 ppm.

Cream is concentrated emulsion of milk lipid globules in skim milk. It is prepared commercially by centrifugal separation of the less-dense lipid phase from skim milk, while ghee is a complex lipid. (Tamime, 2009).

Laban rayeb is a type of fermented milks manufactured by Egyptian farmers. Fresh raw milk is placed in an earthenware pot (Matared) and left un-disturbed in a warm place until the cream rises which is churned into butter. The remain coagulated lower part milk is called labanrayeb (El-Gendy, 1983).

Kariesh cheese is a soft acid cheese made from skimmed milk or butter milk obtained from churning of sour cream or by-product called Laban Khad with high protein and low fat contents; apparently it is made only on farmsteads. It is considered to be one of the most important traditional Egyptian dairy products, commonly made in the Egyptian countryside, especially in small villages (Aldo, et al., 2013)
the chemical composition of Mish cheese (fat, protein, total solids, ash and acidity) was investigated by (Abdalla and Ahmed, 2010) in three plants and they found that the variations were significantly.

The aim of this work was to throw some light on levels of lead and cadmium as toxic heavy metals in buffalo’s milk and its rural products produced in some villages of Sohag and Qena Governorates

Material and methods

1. Materials:-

Investigated samples

Raw buffalos milk and house - made rural milk products including, Laban Rayeb, Cream, Samna, Kareish cheese and Mish cheese (252 sample) were collected from 14 villages of Sohag and Qena Governorates. The villages of Sohag are: Nza El-hesh, Enibes, Bnawett, Basona, Abar El-waqf, El-hwaweash, Arab El-sabha, Awlad Salem, El-mgabra and Mzata, while that of Qena are: AzbitHwo, Bahjora, Hgaza and El-masead. All investigated raw milk Samples as well as the rural milk products were of buffalo’s milk. The above samples were kept under cooling till the application for analysis to determine Cd and Pb contents.

2. Determination of Pb and Cd elements

The occurrence of Pb and Cd elements in samples had been estimated (ppm) according to the method of (James 1995). The obtained ash was dissolved in 5 ml HCL (36.6%) and the volume was completed to 50.0 ml by distilled water. The dilutions were applied to the ICAP6200 (ICP - OES) device to estimate the levels of Cd and Pb in Central laboratory for Chemical Analysis, Faculty of Agriculture, Assiut University.

Statistical Analysis:

The obtained data were subjected to statistical analyses. Data were performed in computer using the SAS package. The significant different among milk and investigated dairy products as well as their heavy metals content were compared using F-test.
Results and discussions:

1. Cadmium element (Cd) contents:

Results listed in Table (1) and Fig (1) revealed that the mean value of Cd level in raw buffaloes milk was 0.023 ppm.

**Table (1): Cadmium concentrations of different raw milk and milk products collected from some villages of Sohag and Qena Governorates**

<table>
<thead>
<tr>
<th>Village</th>
<th>Raw milk</th>
<th>Laban Rayeb</th>
<th>Cream</th>
<th>Samna</th>
<th>kariesh cheese</th>
<th>Mish cheese</th>
</tr>
</thead>
<tbody>
<tr>
<td>NzaElhesh</td>
<td>0.036</td>
<td>0.02</td>
<td>0.015</td>
<td>0.018</td>
<td>0.047</td>
<td>0.072</td>
</tr>
<tr>
<td>Enibes</td>
<td>0.018</td>
<td>0.018</td>
<td>0.021</td>
<td>0.018</td>
<td>0.064</td>
<td>0.068</td>
</tr>
<tr>
<td>Bnawett</td>
<td>0.017</td>
<td>0.018</td>
<td>0.018</td>
<td>0.017</td>
<td>0.045</td>
<td>0.022</td>
</tr>
<tr>
<td>Basona</td>
<td>0.025</td>
<td>0.02</td>
<td>0.017</td>
<td>0.032</td>
<td>0.077</td>
<td>0.081</td>
</tr>
<tr>
<td>Abar El-waqf</td>
<td>0.019</td>
<td>0.017</td>
<td>0.022</td>
<td>0.018</td>
<td>0.069</td>
<td>0.044</td>
</tr>
<tr>
<td>El-hwaweash</td>
<td>0.017</td>
<td>0.024</td>
<td>0.021</td>
<td>0.019</td>
<td>0.020</td>
<td>0.018</td>
</tr>
<tr>
<td>Arab El-sabha</td>
<td>0.017</td>
<td>0.019</td>
<td>0.017</td>
<td>0.017</td>
<td>0.049</td>
<td>0.07</td>
</tr>
<tr>
<td>Awlad Salem</td>
<td>0.017</td>
<td>0.021</td>
<td>0.02</td>
<td>0.02</td>
<td>0.076</td>
<td>0.018</td>
</tr>
<tr>
<td>El-mgabra</td>
<td>0.025</td>
<td>0.02</td>
<td>0.024</td>
<td>0.027</td>
<td>0.046</td>
<td>0.07</td>
</tr>
<tr>
<td>Mzata</td>
<td>0.025</td>
<td>0.03</td>
<td>0.028</td>
<td>0.025</td>
<td>0.065</td>
<td>0.053</td>
</tr>
<tr>
<td>AzbitHwo</td>
<td>0.024</td>
<td>0.026</td>
<td>0.025</td>
<td>0.032</td>
<td>0.027</td>
<td>0.025</td>
</tr>
<tr>
<td>Bahjora</td>
<td>0.034</td>
<td>0.03</td>
<td>0.033</td>
<td>0.027</td>
<td>0.101</td>
<td>0.053</td>
</tr>
<tr>
<td>Hgaza</td>
<td>0.027</td>
<td>0.028</td>
<td>0.064</td>
<td>0.034</td>
<td>0.116</td>
<td>0.055</td>
</tr>
<tr>
<td>El-masead</td>
<td>0.017</td>
<td>0.013</td>
<td>0.022</td>
<td>0.035</td>
<td>0.054</td>
<td>0.037</td>
</tr>
<tr>
<td>Average</td>
<td>0.023</td>
<td>0.022</td>
<td>0.025</td>
<td>0.024</td>
<td>0.061</td>
<td>0.049</td>
</tr>
</tbody>
</table>

* Values are average of three samples.

The obtained results were similar to those obtained by (El-Gendy et al., 2007) who found that the Cd levels in Assiut Governorate were 0.027 ppm at Arab El-Madabigh region and 0.020±0.013 ppm at Assiut University station, while it was lower than Cd values that obtained by (Sharkawy and Hussein, 2002) 0.174 ppm, (Amer, et al., 2005) 0.353 ppm and (Enb et al., 2009) 0.118 ppm.
On the other hand data obtained by (El-prince and Sharkawy 1999) 0.019 ppm was lower than the present level.

As shown in the mentioned Table, data represents the level of Cd in Laban rayeb with an average of 0.022 ppm. The obtained results ranged between 0.013 for samples from El-masead village to 0.03 ppm for samples of both Bahjora and Mzata villages respectively.

The mean value of Cd levels in traditional cream samples was ranged from 0.015 ppm for samples of NzaElhesh village to 0.064 ppm for that of Hgaza village, with an average of 0.025 ppm, which was lower than values obtained by (Amer, et al; 2005) who stated that the Cd contents in Cream was 0.088 ppm.

Generally, the variation of Cd levels in cream samples regarded to various investigated villages may be due to the environmental conditions related to each village.

Data presents in Table (1) represents the mean value of Cd concentrations samples of Samna ranged from 0.017 ppm for Samples obtained from both of Bnawett and Arab el-sabha villages to 0.035 ppm for that from El-masead village, with an average of 0.024 ppm.

The average value of Cd contents of Kariesh cheese samples was 0.061ppm, which ranged from 0.020 to 0.116 ppm sample for El-hwaweash and Hgaza village respectively. The present mean value of Cd level in Kareish cheese was lower than that obtained by (El-Malt 2001), (Mohran et al., 2010), (Mohamed, 2008) and (Bakry, 2012), while Abdou and (Korashy, 2001) had not detected Cd in Karieish cheese collected randomly from different localities of Upper Egypt.

The determined values of Cd contents in Mish cheese samples obtained from various villages listed in Table (1). It was found that, Mish cheese samples collected from Basona village recorded the highest value with 0.081ppm, while the lowest one was found in samples of both El-hwaweash and Awlad Salem with 0.018 ppm. The various values of all samples gave 0.049 as a general average.
Fig (1). The averages of cadmium concentration in raw milk and its rural products.

2. Lead element (Pb) contents:

The lead concentrations of raw milk samples obtained from various villages related to Sohag and Qena Governorates are presented in Table (2). Both Arab El-sabha and El-mgabra villages showed the lowest values with 0.01 and 0.013 ppm respectively, while the highest one was given by raw milk samples of NzaElhesh village with 0.484 ppm. The obtained data of Pb concentration was nearly similar to those obtained by (Enb, et al., 2009) 0.084 ppm, while it was higher than results reported by (Sreedhar, et al., 2009) 0.015 ppm. On the other hand it was lower than those reported by (El-Prince and Sharkawy, 1999) 0.119 to 0.730 ppm, (Sharkawy and Hussein 2002) 0.49 ppm, (Amer, et al; 2005) 1.97 ppm and (El-Gendy, et al., 2007) 0.156 to 0.264 ppm.

The mean value of lead contents in samples of Laban rayeb, lied between 0.015 and 0.205 ppm for samples obtained from Basona and NzaElhesh villages respectively, with an average of 0.065 ppm.
As indicated in Table (2), the mean values of Pb levels in traditional cream samples ranged from 0.023 ppm for samples of El-hwaweash village to 0.215 ppm for that of Enibes village, with an average of 0.09 ppm, which was lower than values obtained by (Amer, et al; 2005) who stated that the Pb contents in Cream was 0.492 ppm.

Results listed in Table (2), it could be noticed that the mean value of lead concentrations of Samna was nearly similar to that of Cream (0.088 and 0.09) ppm respectively. The value obtained from samples of Bnawett village was the highest with 0.183 ppm, while the lowest concentration was given by sample belonged to Mzata village with 0.025 ppm.

As shown in Table (2) the average of Pb contents in Kareish cheese samples was 1.841 ppm, which varied from 0.159 ppm that given by samples obtained from El-hwaweash village to 3.701 ppm.
3.701 ppm for samples of Bahjora village. It was observed that the values of sample from Awlad Salem and Enibes villages showed nearly the same levels of 1.872 and 1.855 ppm respectively. The present mean value of Pb content of Kareish cheese samples was higher than that obtained by (El-Malt, 2001), (Mohamed, 2008) and (Bakry, 2012), while it was lower than that obtained by (Mohran, et al., 2010).

The Pb values in Mish cheese samples collected from different villages related to Sohag and Qena Governorates were listed in Table (2). It was found that, the average level of Pb contents was 2.104 ppm.

The variations of Cadmium and Lead values among investigated villages were highly significant except of Cadmium values of Laban Rayeb were significant only.

**Fig (2) The averages of lead concentrations in raw milk and its rural products.**

![Pb ppm concentration graph](image)

**Conclusion:**

Compared to the average levels of Cd and Pb in Buffalos milk and its different products it was found that Mish cheese and Kareish cheese were obviously high. The variations of Cadmium and Lead values among investigated villages were highly significant except of Cadmium values of Laban Rayeb were significant.
The general average of Cadmium concentrations in milk and rural products was lower than maximum limit except in the case of Kariesh cheese, while the average of Lead concentrations in milk and all its rural products was higher than maximum limit

References


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