Study on some heavy metal residues in milk and some dairy products
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SUMMARY

The present study was conducted to determine the contamination level of Pb, Cd, Cu, in different types of raw milk and milk products, and to assess their potential health hazards for people using target health quotients (THQ). Finally, to investigate the removal of cu from artificially contaminated raw milk by using the adsorption properties of a novel chelating ion exchange (CIE) resin.

For the previous purposes, a total of 120 random samples of raw milk of different species and other dairy products (20 samples for each of raw cows' milk, raw buffalos' milk, raw sheep's milk, raw goats' milk, UHT milk, and kariesh cheese samples) were collected from different outlets and vendors in Sharkia Governorate. All samples were digested and analyzed by Atomic Absorption Spectrophotometer for detection of Lead, Cadmium, and Copper.

Cupper residues in different examined samples :

The concentrations of Cu in different samples varied from 0.009 to 0.81 ppm. The highest mean value of Cu in our work was found in UHT milk samples, while the lowest value was found in raw cows' milk samples. On the other hand, the Cu residues were higher than the permissible limit (PL) of Cupper, where 65%, 75%, 65%, 75% and 80% of buffalos' milk, sheep's milk, goats' milk, UHT milk, and kariesh cheese respectively, were exceeded the PL, while no samples of cows' milk exceeded the permissible limit.

Concerning of Cu, it could be concluded that the average daily intake of Cu from the consumption of different examined samples were relatively low

and represents a low percentage of ADI recommended by The Food and Drug Administration. Also, our results showed that milk and dairy products can't contribute a great amount of the supply of Cu in the human diet.

lead residues in different examined samples

The results cleared that the average concentrations of Pb were 2.68, 2.04, 2.78, 1.94, 2.26 and 1.85ppm in raw cows' milk, raw buffalos' milk, raw sheep's milk, raw goats' milk, UHT milk and kariesh cheese, respectively. The levels of Pb in the examined samples were very high since 100% of the examined cows' milk, sheep's milk, and kariesh cheese samples were over the permissible level established by Egyptian Standard, while 90% of the buffalos', sheep's, UHT milk exceeded these limits.

The accepted daily intake (ADI) of Pb in the examined samples and their calculated daily intake resulted from the consumption of 200 ml of raw milk and UHT milk or 45 g kariesh cheese per day cleared that, the highest calculated daily intake for Pb was 0.556mg/day/person from the consumption of raw sheep's milk, while the least calculated value for it recorded 0.083mg/day/person from the consumption of kariesh cheese which represent about 111.2%, 16.6% of ADI recommended by Codex Alimentarius Commission, respectively.

Cadmium residues in different examined samples

In the present study, cadmium failed to be detected in all raw milk samples in different species, while it was detected in UHT milk samples, and kariesh cheese where it was recorded 0.02 ppm in each of them. Only 5% of

the contaminated UHT milk samples recorded Cd content higher than the PL according to The Egyptian Standard.

On the other hand, the results cleared that the average concentrations of Cd in the examined UHT milk and kariesh cheese samples gave a daily intake of about 0.004, 0.0009 mg/day/person from the consumption of 200 ml of UHT milk and 45 gm of kariesh cheese that contributed about 5.71%, 1.29% of ADI recommended by Codex Alimentarius Commission .

Target Hazard Quotients

The results cleared that, THQ value of (Pb) were more than one through the consumption of raw cows', buffaloes', sheep's and goats' milk, while they were less than one through the consumption of UHT milk, and kariesh cheese. These results are theoretically suggesting that the consumers in Sharkia Governorate will be exposed to a potential health hazard from consuming these products. Regarding THQ values of cadmium they were less than one through the consumption of all the examined samples except in UHT milk, where they were more than one. On the other hand, the THQ values of copper were less than one through the consumption of all examined samples.

The experimental part:

There are some parameters affect the quantitative uptake of the metal ions by resin, including resin amount, pH, initial metal concentration, and contact time. The amount of Cu adsorption on resin was evaluated by using various concentrations of IMAC HP resin (0.05–0.8 g), while the other parameters remained constant. It was apparent from the results that the adsorption

percentage of Cu ions increased with increasing resin concentration as the removal efficiency of 76.89% was achieved by using 0.8 g/L IMAC HP resin dose, and so we used it as the optimum amount for other experiments. On the other hand, there is no noticeable change in Ca ion concentration using different amounts of resin.

The results also, showed that the removal efficiency of metal ions was increased with increasing time and the highest percentage of Cu ions adsorption was reached after 45 min.

Finally, it was cleared from these results, the presence of contamination of different types of raw milk and milk products with heavy metals. Lead results in our work are responsible for exposing the population in this region to a potential health risk through the consumption of milk and milk products, while there are nearly no risks due to Cd and Cu, but bioaccumulation of these metals through the food chain should also be of concern. This investigation showed that we need further monitoring studies to follow up and to confirm food safety. Our results demonstrated the suitability of resin IMAC HP for adsorption of Cu ions from milk and also increasing the amount of adsorbent provides a higher removal for the contaminated metal without affecting calcium concentration.