STUDIES ON THE OCCURRENCE OF SOME HEAVY METALS IN MILK IN LOCAL MARKETS AT PORT- SAID PROVINCE

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SUMMARY

The present study aimed to estimate the levels of some heavy metals in 50 raw milk samples collected from several supermarkets in different localities at Port Said Governorates . The samples were analyzed for the detection of lead ,cadmium and mercury using Atomic Absorption Spectrophotometer The analytical results revealed that the mean values of lead ,cadmium and mercury in the examined raw milk samples were 1.078 ,0.060 and 0.091 ppm (mg /kg) respectively. The analyzed samples contained lead, cadmium and mercury above the permissible limits. the serious health hazard for people who could consume such milk were discussed . A regular monitoring of heavy metals contamination of milk is recommended to establish the true contribution of milk to the dietary intake of heavy metals.

INTRODUCTION

Milk contain most of the nutrients necessary for healthy food and in some groups such as children and elderly ,it may constitute the main food or even the only one **(Lawrance and Friedman, 1995 and Tripathi et al.,1999)**. Heavy metal residues are highly toxic but many of them (e.g. Copper and zinc) are essential activators for certain enzymes, vitamins and hormones, only at low concentrations. They are able to accumulate in the living tissues and organs leading to toxicity in man and animals.

Contamination of milk and milk products by chemical pollutants is one of the major problems confronting public health. Heavy metals make up one of the most important of pollutant in food supply **(Protasowicki, 1992)**. From this group, lead, cadmium and mercury have received increasing attention. This attention has been focused due to adverse toxic effects caused by lead **(Subramanian, 1988)**, cadmium **(Friberg et al., 1986)** and mercury **(Manahan, 1989)**. They are widely distributed in air, agricultural lands, water, effluents from heavy industries, drainage, fertilizer ,sludge applied in the fields and stainless steel used in dairy equipment. **(USEPA, 1993; Miner et al., 1997 and Nareah et al., 1999)**. Lead and cadmium are often deposited in lakes

and streams from the air and considered as main source of water pollution that may be utilized by dairy animals or used for washing dairy utensils **(Wesiland et al.,1990 and Walker, 1999)**. Animal reeeived heavy metals by means of air ,water and feeds **(Antoniou et al. ,1989)**. Ingested contaminated feeding stuffs has been considered as the main source of metal residues in secreted milk. Moreover, lead contamination from soldered cans is one of post secretory contamination of milk products **(Carl, 1991)**.

In recent years, much attention has paid to the possible danger of metal poisoning in human. It has been reported that lead, eadmium and mercury are concentrated mostly in the kidney and liver leading to kidney damage and liver cirrhosis. They constitute sever threat to human health due to their cumulative nature resulting in cancer, renal failure, human hypertension, neuropathy of both central and peripheral nervous system, gastroenteritis, diabetes mellitus ,anemia and osteomalacia **(Muller and Johnsen,1992; Klopov, 1998 and Elfe et al., 1999)**. Because of the high risk associated with the eonsumption of milk with such toxic pollutants,

The present study aimed to determine the concentration of lead (Pb), cadmium (Cd) and mercury (Hg) in marketed raw milk samples and to set alarm for the public about their hazard effects.

MATERIAL AND METHODS

Collection of samples: Fifty random samples of market raw milk were collected from different dairy shops from several localities in Port Said Governorates. The collected samples were transferred to the laboratory to be examined for heavy metals residues. Market raw milk samples were subjected to storch test to exclude all samples proved to be heat treated according to **Schonberg (1956)**.

Preparation of samples: All samples were prepared according to the method described by **Hankinson (1975)**. 50 ml of milk samples were placed in 250 ml flask. An equal volume of 20 Trichloroacetic acid were added. The samples was shaken for about 30 minutes with intervals of five minutes and filtered through a 0.45 u membrane filter. Lead, cadmium and mercury in filtered samples were identified and quantified by using Perkin Elmer 2380 Atomic Absorption Spectrophotometer. The analytical detection limits for lead, cadmium and mercury were 0.05, 0.003 and 0.001ppb, respectively .

RESULTS AND DISCUSSION

From the obtained results, it was clear that , the mean value of lead, cadmium and mercury

concentrations in examined raw marketed milk samples were 1.078 ± 0.002 & 0.060 ± 0.014 and 0.091 ± 0.02 ppm; respectively (table 1). Hygienic standards of the contents of foreign substances in food, state that 0.1ppm is the maximum lead content in milk **(Bartic and Piskac, 1981)**. Hence, all examined milk samples were above this maximum recommended limits. Lead is considered one of the most important pollutants in our environment and distributed widely in classes of natural Foods (**Shehata and Nagah, 1992**). It is accumulated poison ,inhibit haemoglobin synthesis **(Carl, 1991)**. and affecting neurological and psychromotor **(Ukhun et al., 1990)**. Moreover, lead reduce or complete breakdown the function of kidney, liver and brain **(Forstner and Wittman, 1983)**. The mean value of cadmium in examined raw milk samples were 0.060 ppm ± 0.014.The results of cadmium were similar with those reported by **(Murthy and Rhea, 1968)**. The levels of cadmium in the examined raw milk samples were above the permissible limit (0.005ppm) for milk recommended in some countries as Netherland, Hungary and Germany **(Carl, 1991)**.

Cadmium is one of the most toxic metals and everyday new data on its toxicity are coming up **(Antoniou et al., 1989)**. It acts on sulfydryle groups of essential enzymes and binds to phospholipids and nucleic acids, also it has been shown to interfere with oxidative phosphorylation and replace zinc in metal enzymes which changes its activity **(Carl, 1991)**. Cadmium is a possible cause of hypertension, kidneyailment and testicular atrophy **(Lovett et al., 1972)**. Moreover, cadmium may induce prostate cancer and functional and morphological changes in many body organs **(Lawuerys, 1978)**. The average of mercury in examined raw milk samples were 0.091±0.02 ppm. Similar result were reported by **(Gomez and Markakis , 1974), Matvijcuk et al., (1987) and Riolfatti and Veronese (1990)**. The concentration of mercury in examined raw milk samples exceeded the guide line level (0.01ppm) for milk established by Netherland , Hungary and Germany **(Carl, 1991)**. Mercury is not essential for man due to its affinity to sulfydryle group in protein , mercury compounds are potent enzyme poison **(Rossi and Santaroni, 1976)**. It causes neurological effects and embryotoxicity **(Carl, 1991)**. Moreover, it causes sever kidney damage in both man and animal **(Manahan, 1989)**. The obtained results declared that, the concentration of heavy metals in market raw milk samples considerably high, this may be due to the different sources of milk samples which depend on the surrounding circumstances (**Saad et al., 2001**). The most probable explanation for the high level of heavy metals in raw market milk samples may occur during milk transportation specially in polluted air, bad storage, contact with equipment employed as mechanical milkers, cadmium plated containers and Tanker lorries. The transferred metals from equipment may exceed those originally present in the dairy farm milk **(Coni et al., 1999)**. Based on chronic toxicity studies, the Provisional Tolerable Weekly Intake (PTWI) of heavy metals in food for adults (60 kg b.w) established by the joint FAO/

WHO Expert Committee on Food Additives, was 0.05mg/kg b.w. for lead,0.007 mg/kg b.w. for cadmium and 0.005mg/kg b.w. for mercury. And according to the maximum permissible limits (M R L) of human daily intake recorded in Egyptian Organization for Standardization and Quality Control (**E O S Q C, 1993**). The level of lead, cadmium and mercury in the examined raw milk samples represents high percent from the acceptable dietary intake of heavy metals.

Continuous consumption of milk with such pollutants may lead to chronic toxicity including nervous system damage, mental retardation, kidney dysfunction, nausea, severe colic, diarrhea, persistent restlessness and long lasting rashes (**Walting & Rehm, 1994 and Walker, 1999**). So consumption of such milk particularly from polluted envtronment may cause human health hazards (**Annon,1996 and Zetterstrom,1999**).

CONCLUSION

The high lead, cadmium and mereury recorded in examined raw milk samples constitute a possible health hazardous effect for man and animal. To safeguard human health, a number of factors are taken into account for controlling heavy metal residues in milk starting from crop production by application good manufacturing practice, personal training and minimizing use of sludge for land fertilization until periodical monitoring of heavy metals in different types of milk. In addition to a veterinary medically oriented practitiones must be careful periodical evaluation of the animal health and the status of its products.

Table (1) : Concentrations of Some Heavy Metals residues (p.p.m = mg/kg) in raw market milk samples .

Type	Min.	Max.	Mean	±S. E.
Lead	**0.983**	**1.160**	**1.078**	**0.002**
Cadmium	**0.048**	**0.068**	**0.060**	**0.0 14**
Mercury	**0.081**	**0.099**	**0.091**	**0.02**

p.p.m : part per million., Min : Minimum values

Max : Maximum values., S.E. : Standard Error.

Table (2) : Recommended Levels of Lead, Cadmium and Mercury in food

Heavy metals residues mg/kg (p.m.m) in all examined samples			Heavy metals residues all examined samples consumed daily by human	FAO/WHO (1972) Cadmium in food	WHO (1972) human weekly intake of Lead	Casarett and Doull (1975) human daily intake of Lead, Cadmium and Mercury	E.O.S.Q.C. (1993) human daily and weekly intake	E.O.S.Q.C. (1993) permissible limits mg/kg in examined samples
Metal	examined samples	X: mg/kg (p.m.m)	X:(mg/100g)					
Lead (Pb)	Market raw milk	1.078	0.1078	....	3 mg / person or 0.05 mg /Kg b.w	0.3 mg	Weekly intake 0.05mg/kg body weight	0.5mg/kg 0.5mg/kg 0.1mg/kg
Cadmium (Cd)	Market raw milk	0.060	0.006	Not exceed 0.007 mg/kg b.w.	Not exceed 0.04-0.05 mg/kg b.w	0.018-0.20 mg	Weekly intake 0.0067-0.0083mg/kg body weight	.... 0.1mg/kg
Mercury	Market raw milk	0.091	0.0091	0.005mg/kg b.w	....		Daily intake 0.05-mg/kg body weight	.... 0.5mg/kg ....

FAO : Food and Agriculture Organization.
WHO : World Health Organization.
E.O.S.Q.C. : Egyptian Organization for Standardization and Quality Control.
X : mean value.
N.B. : p.p.m = mg/kg. The human body weight is considered as 70kg.

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الملخص العربى

دراسات على تواجد العناصر الثقيله فى الألبان فى الأسواق المحلية بمحافظة بورسعيد

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معهد بحوث صحة الحيوان - معمل فرعى بورسعيد* و الاسماعيلية**

يعد التلوث البيئي من أهم المشاكل المعاصرة لتأثيره على صحة الإنسان مما يجعل البحث عن الملوثات البيئية وتحديد مستوياتها دوريا هدفا هاما . أجرى هذا البحث لتحديد مستوى الرصاص والكادميوم والزئبق في اللبن الخام . تم تجميع ٥٠ عينة عشوائية من اللبن الخام من محلات بيع الألبان من مناطق مختلفة في محافظة بورسعيد وتجهيزها للقياس بواسطة جهاز الامتصاص الذرى الطيفي . وقد أسفر تحليل العينات عن تواجد الرصاص والكادميوم والزئبق في عينات اللبن الخام بتركيزات أعلى من الحدود المسموح بها في اللبن بمتوسط قدره ٠,٧٨ ، ١ و٠,٦٠ ، ٠ ، ٠ و ٠,٩١ ، ٠ جزء فى المليون (مج /كجم) على التوالى . هذا وقد تم مناقشة مدى تأثير وجود تلك المعادن بتركيزات عالية على الصحة العامة وكذلك الإجراءات والتوصيات اللازمة للمحافظة على صحة الإنسان.