Dept. Animal Medicine (Toxicology),
Faculty Vet. Med., Assiut University,
Head of Dept. Prof. Dr. M.F. Raghib.

LEAD CONTENT IN MILK OF LACTATING ANIMALS AT ASSIUT GOVERNORATE

(With 3 Tables)

By

A. SHEHATA and NAGAH M. SAAD*

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قياس مستويات الرصاص في ألبان الحيوانات الحلوب في محافظة أسيوط

عادل شحاتة ، نجاح سعد

يعد التلوث البيئي من أهم المشاكل المعاصرة لتأثيره علي صحة الحيوان والانسان مما يجعل البحث عن الملوثات البيئية وتحديد مستوياتها دوريا هدفا هاما ، ويعد التسمم بالرصاص من أهم الملوثات البيئية بمحافظة أسيوط ويهدف هذا البحث إلي قياس معدلات الرصاص في ألبان الحيوانات الحلوب لذا قد تم أخذ عينات عشوائية من الأبقار (٥٥) ، الجاموس (٥٠) ، الأغنام (٤٠) والماعز (٣٠) عينة وتم أجراء الفحوص الطبيعية وقياس معدلات الرصاص بالاضافة الي العناصر الآتية (الحديد ، النحاس ، الكالسيوم ، الفوسفور) في جميع عينات الألبان المفحوصة وأظهرت النتائج أن معدل الرصاص (جزء في المليون) في الألبان المفحوصة كان ٠١٩ر٠ في الأبقار ، ٢٤٥ر٠ في الجاموس ، ٤ر٠ في الأغنام ، ١٩٧ر٠ في الماعز ٠ كما دلت النتائج على وجود علاقة واضحة من ارتفاع معدل الرصاص في ألبان الحيوانات المختلفة ، وزيادة معدل الحديد ونقص في معدلات كل من عنصري الكالسيوم والنحاس ٠ مما سبق يتضح مدي خطورة ارتفاع مستويات الرصاص في ألبان الجاموس ، الأغنام والماعز حيث فاقت معدلات المستويات المسموح بها عالميا ، كما أن نقص العناصرالهامة (النحاس ، الكالسيوم) في هذه الألبان يؤدي الي الاقلال بقيمتها الغذائية ٠ لذلك يجب التحذير من استخدام هذه الألبان لمالها من خطورة واضحة على صحة الانسان والحيوانات الرضع ٠

SUMMARY

The present study estimate the levels of lead in 175 milk samples from lactating cows, buffaloes, sheep and goats in Assiut governorate. Related elements, iron, copper, calcium and phosphorus were also investigated.

* Dept. Food Hygiene, Faculty of Vet. Med., Assiut University.

The analytical results revealed that lead levels in milk of investigated animals were 0.019, 0.245, 0.4 and 0.197 ppm in cows, buffaloes, sheep and goats respectively. Also a significant changes were recorded in calcium, copper, and iron in relation to lead levels of examined milk.

INTRODUCTION

Environmental pollutants are the most deleterious agents to the biological life. Lead is considered one of the most important pollutants in our environment and distributed widely in classes of natural foods. Investigations on lead content of milk have screened mainly on whether it was present in toxic amounts, rather than on its occurrance as normal constituent.

Lead affects both centeral and peripheral nervous system of man. Children with overt lead poisoning usually have central nervous symptoms. These vary from ataxia to stupor, comma and convulsions. The most prominent pathological changes noted in the brain are cerebral oedema associated with an increase in cereprospinal fluid pressure, focal necrosis and neuronal degeneration (PENTSCHEW, 1965).

The average lead content in cows milk is 0.04 ppm (KASAHARA et al. 1936). Uncontaminated milk from cow showing no clinical signs of lead toxicity containing from 0.006 to 0.013 ppm lead with average of 0.009 ppm (HAMOND and ARONSON, 1964). Normal milk lead levels in cattle (0.028-0.030 ppm) my be raised to as high as 2.26 ppm in severly poisoned cows (BLOOD, et al. 1983). Hygienic standards of the contents of foreign substances in food, state that 0.1 ppm is the maximum lead content in milk (BARTIK and PISKAC, 1981).

On the other hand, milk from two cows surviving near lethal doses of lead oxide contained 2.26 and 0.15 ppm after 12 days. After 122 days, these parameters had droped to 0.03 ppm (KEHOE, et al. 1940). Milk from cows fed up to 12.95 mg lead / 45.5 kg body weight for 126 days contained less than 0.05 mg/liter (MARSHALL, et al. 1963). Holstein cows given 11 mg lead carbonate per kg body weight for two weeks secreted milk containing 5.9 ppm lead (LYNCH, et al. 1974). Lead content in fresh uncontaminated milk from lead intoxicated cows was 0.23 to 0.7 ppm (BARTIK and PISKAC, 1981).

In subsequent studies, normal levels of calcium and phosphorus were 1.369, 0.843 g/l. in cow milk and 1.173, 0.872 g/l. in buffaloe milk (SHEHATA, et al. 1984). IBRAHIM, et al. (1984) recorded copper levels of 0.136 and 0.132 ppm in cow and buffaloe milk respectively in Assiut Governorate.

No available literatures concerning lead levels in milk of goat, sheep and buffaloe were obtained. Because data on lead content of milk produced in Assiut governorate are lacking, the present investigation was undertaken.

MATERIAL and METHODS

A total number of 175 dairy animals at Assiut governorate were investigated in this study. Milk samples (20 ml each) were collected randomly from 55 cows, 50 buffaloes, 40 sheep and 30 goats. The samples were examined physically for colour and flavour.

Lead concentrations of examined milk samples were estimated by using lead electrod model 94-82, according to the method of COMPIGLIO (1979), which attached to expandable ion analyzer EA 920, orion research.

Calcium and phosphorus levels in examined milk samples were estimated after the methods of GINDLER and KING (1972) and VOGLER (1965) respectively. Iron and copper were determined using test kits after the methods of TRINDER (1956) and GUBLER, et al. (1952) respectively.

Milk samples of each species were divided into five groups according to lead level. Mean values of related elements (iron, copper, calcium and phosphorus) were statistically calculated in relation to lead levels according to KALTON (1967).

RESULTS

The physical examination (colour and flavour) revealed that all examined milk samples were within the normal limits.

Results of chemical analysis, of milk samples for lead, iron, copper, calcium and phosphorus were recorded in table 1, 2 and 3.

DISCUSSION

Lead is one of the most hazardous pollutants to animal and human beings health status. Several enzootic lead poisoning in domestic animals have been recorded throughout the world, where the source of the metal contaminate pasture or crops (ARONSON, 1972). The previous toxicological studies in Assiut governorate, revealed a high level of lead in all examined water sources and plants (EL-SHREIF, 1991).

The results of the present study revealed that milk lead levels were 0.019±0.002 ppm in cow, 0.245±0.016 ppm in buffaloe, 0.4±0.06 ppm in sheep and 0.197±0.028 ppm in goat (table 1). The previous studies recorded the average content of lead in cows milk as 0.04 ppm (KASAHARA, et al. 1936). Un contaminated milk from cow showing no clinical signs of lead toxicity contained from 0.006 to 0.013 ppm lead with average of 0.009 ppm (HAMOND and ARONSON, 1964). Normal milk levels of lead in cattle (0.028-0.030 ppm) may be raised to as high as 2.26 ppm in severly poisoned cows (BLOOD,

et al. 1983). Therefore, the obtained lead level in our investigation considered within the normal range.

On the other hand, a higher lead levels were recorded in other lactating animals as 0.245 ppm, 0.4 ppm, and 0.197 ppm for milk of buffaloe, sheep and goat respectively. The high lead levels recorded in our results specially in sheep and goat may be attributed to rearing of this animals in roads and direct exposure to polluted air. Through the years a considerable amounts of lead have been mobilized into the environment, industrial smelters, burning of garbage, petrol additives are the main sources of environmental lead.

The hygienic standards of the contents of foreign substances in food state that, 0.1 ppm is the maximum lead content in milk (BARTIK and PISKAC, 1981). According to PARTIK and PISKAC (1981) for the maximum lead content in milk (0.1 ppm), 55 samples (100%), 7 samples (14%), 10 samples (25%) and 10 samples (33.3%) of cows, buffaloes, sheep and goats respectively concede the permissable limit, while zero %, 86% 75% and 66.6% of the examined samples respectively contain higher content.

Therefore, the high lead levels recorded in buffaloe, sheep and goat milk in this investigation ensure the contamination of our enveronment.

The recorded calcium, and copper levels in the present investigation are in the same range with that of SHEHATA, et al. (1984) and IBRAHIM, et al. (1984) in both buffaloe and cow milk.

The analytical results of elemental content of milk in relation to lead levels (table 3) showed no significant change in phosphorus and calcium levels, except in buffaloe's milk calcium was significantly decreased in the IV and V groups which showed a higher level of lead (0.303 and 0.414 ppm). It has been reported that, lead might have adverse effects on the formations of 1, 25 dihydroxy-chalecalciferol by renal tubular cells and thus causes a decreased intestinal absorption of calcium (SOBEL, et al. 1940). This suggestion is suported by the known injurious effect of lead on the proximal renal tubular cells (GOYER and RHYNE, 1973).

Iron levels were significantly increased in relation to higher lead levels in milk of buffaloe, sheep and goat. The same relation between lead and iron was observed by FRANGENBERG (1986), SELL (1987) and EL-SHREIF (1991), who found a positive carrelation between lead and iron in blood and different tissues. Lead inhibits amino levulinic acid dehydratase enzyme of the haem synthesis pathway which is a zinc dependant enzyme, so that inhibition of this enzyme by lead, leads to accumulation of iron in blood and other tissues (FINNELLI, et al. 1975). Inversely copper levels in examined milk samples were significantly decreased in relation to increase lead levels. The copper dificiency increase the toxic effects of lead and increase its accumulation in liver and kidneys (PETERING, 1973).

In conclusion, the high lead levels recorded in investigated milk of buffaloe, sheep and goat, constitute a possible hazardous effect of newly born animals and human consumers, in addition to other environmental sources of lead (air, water, and plants) in Assiut governorate. Thus a veterinary medically orinted practitiones must do careful periodical evaluation of the animal health and the status of its products.

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Table 1: Levels of lead (ppm) in examined milk samples

Animal	No. of samples	Min.	Max.	Mean	S.E.
Cow	55	0.003	0.060	0.019	0.002
Buffaloe	50	0.066	0.550	0.245	0.016
Sheep	40	0.050	1.900	0.400	0.060
Goat	30	0.060	0.500	0.197	0.028

LEAD IN MILK

Table 2: Levels of lead and related elements (mean ± S.E) in milk

Animal	No. of samples	Lead (ppm)	Iron (ppm)	Copper (ppm)	Calcium gm/l.	Phosphorus gm/l.
Cow	55	0.019±0.002	0.053±0.034	0.101±0.012	1.154±0.061	1.112±0.027
Buffaloe	50	0.245±0.016	0.077±0.003	0.105±0.014	1.205±0.050	1.302±0.037
Sheep	40	0.400±0.060	0.099±0.005	0.134±0.013	1.159±0.053	1.456±0.044
Goat	30	0.197±0.028	0.127±0.006	0.057±0.005	1.149±0.059	1.161±0.033

Table 3: Iron, coper, calcium and phosphorus levels in relation to different levels of lead in investigated milk samples

Animal	Group	No. of samples	Lead (ppm)	Iron (ppm)	Copper (ppm)	Calcium (gm/l.)	Phosphorus (gm/l.)
Cow	I	11	0.007±0.0006	0.636±0.032	0.143±0.002	1.157±0.162	1.072±0.035
	II	11	0.012±0.0002	0.559±0.023	0.129±0.014	1.523±0.086	1.267±0.004
	III	11	0.016±0.0004	0.587±0.042	0.228±0.025**	1.050±0.071	1.090±0.016
	IV	11	0.022±0.0006	0.354±0.077	0.044±0.008**	1.127±0.055	1.075±0.042
	V	11	0.038±0.003	0.508±0.068	0.106±0.033	0.942±0.033	1.038±0.055
Buffaloe	I	10	0.093±0.006	0.057±0.006	0.128±0.009	1.456±0.087	1.355±0.053
	II	10	0.173±0.009	0.055±0.001	0.096±0.022	1.334±0.050	1.206±0.074
	III	10	0.244±0.007	0.082±0.005**	0.088±0.016*	1.262±0.166	1.574±0.039
	IV	10	0.303±0.005	0.092±0.003**	0.061±0.006**	1.09 ±0.107**	1.114±0.105
	V	10	0.414±0.029	0.096±0.004**	0.054±0.0059**	0.918±0.072**	1.260±0.051
Sheep	I	8	0.072±0.005	0.083±0.002	0.206±0.026	1.185±0.065	1.366±0.122
	II	8	0.114±0.007	0.088±0.006	0.181±0.036	1.030±0.121	1.350±0.072
	III	8	0.210±0.022	0.105±0.016*	0.133±0.022*	1.457±0.139	1.426±0.100
	IV	8	0.552±0.027	0.089±0.010	0.071±0.005**	1.129±0.123	1.586±0.062
	V	8	1.015±0.130	0.118±0.016*	0.076±0.010**	1.121±0.096	1.596±0.163
Goat	I	6	0.053±0.013	0.090±0.003	0.083±0.008	1.176±0.148	1.03 ±0.058
	II	6	0.103±0.006	0.143±0.009**	0.042±0.006**	1.015±0.103	1.056±0.058
	III	6	0.176±0.012	0.128±0.014*	0.050±0.009*	1.465±0.168	1.22 ±0.100
	IV	6	0.238±0.003	0.150±0.012**	0.058±0.011*	0.988±0.110	1.193±0.052
	V	6	0.413±0.029	0.122±0.010**	0.025±0.002**	1.102±0.136	1.273±0.102

* Significant at P/ 0.05

** Significant at P/ 0.01