

LEAD LEVELS IN TISSUES OF ANIMALS SLAUGHTERED IN ISMAILIA SLAUGHTERHOUSE

SOHAIR Y. MOHAMED; INSHRAH, K. MIRA and EL-KHAWAS K. M.

Animal Health Research Institute, Dokki, Egypt.

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SUMMARY

Liver, kidney and muscle samples from a total number of 246 animals of cattle (73), buffaloes (74), camels (37), sheep and goats (62) aging from one to 7 years old were collected and analysed using atomic absorption spectrophotometer for estimation of lead residues. According to the Egyptian Standards (ES) (2360/2007), lead concentrations in buffalo and cow muscles were generally low and far away from the maximum residual limit. On the other hand, 18.75% of both kidneys and livers, 68.75% of muscles of slaughtered ole camels and 52.4% of young camel muscles contained residual lead more than the permissible limit. Meanwhile, most of the examined samples of old sheep and goats and half of sheep and goats under three years contained residual lead more than the permissible limit in their tissues. There was a significant ($P<0.05$) increase in lead concentration in relation to the age in case of

all of the examined animals except for female buffaloes. Also there was a significant ($P<0.05$) linear relationship between the concentrations of lead in livers and kidneys for the same animal.

INTRODUCTION

Heavy metals are natural components of the environment, Industrial, agricultural and zootechnic development has been responsible for the diffusion of these substances in the environment, causing pollution of water, soil and atmosphere. These elements are accumulated in soils and edible plants, and when animals are fed with these plants they accumulate high levels of toxic metals in their organism (Miranda et al., 2000).

Knowledge of toxic metals concentrations in livestock is important for assessing the effects of pollutants on domestic animals and contaminant in-

takes by humans (López et al., 2000). Lead is a wide spread environmental contamination with largely airborne sources, such as combustion of fuel containing lead additives, and industrial emission that include smelters (Salisbury et al., 1991). It is used in many industrial processes. Paint, gasoline and fruit trees sprays contain significant quantities of lead and are possible sources of lead (Diab et al., 2000).

Concentrations of lead residues in animal tissues are significantly affected with several factors. In industrial areas, the level is usually higher than in urban and rural areas. Animal tissues collected from farms of heavy industrial pollution area have greatly elevated levels of lead (Avram et al., 1995). Many authors reported the significant elevated lead residues in blood and tissues of animals reared in the vicinity of the metal industrial zone specially lead-zinc smelting, aluminum processing and steel processing factories than in rural areas (Abou-Arab, 2001; Swarup et al., 2005; Patra et al., 2007). Mass-nyi et al. (2003) reported that the median concentration of lead in liver as well as in kidney in relation to the season is the highest in winter period in comparison with spring, and summer period ($p < 0.001$). Also they found significantly higher ($p < 0.05$) concentrations of lead in the liver of males than in females.

Lead accumulates and concentrates in certain target organs and tissues which are mainly liver, kidneys, spleen and bone (Fox, 1987 and Avram

et al., 2000). But usually liver contains higher accumulation of lead in comparison with other organs (Kram-rov et al., 2005). The animal breed affects the accumulation of lead in liver. López et al. (2003) noticed that dairy cattle accumulated significantly higher lead residues in liver than did beef cattle, which could be related not only to higher dietary intake, but also to the higher hepatic metabolism associated with milk production. Nevertheless there is significant correlation ($P < 0.01$) between lead concentrations in different organs (Swarup et al., 2005).

Egyptian standards (2360/2007) stated that the concentration of lead in animal tissues must not exceed 500 ppb in internal organs (liver and kidney) and 100 ppb in muscles (ES, 2360/2007).

Elevated lead residues in the surrounding habitat of animals constitute a probable danger on animals and human health. Lead inhibits the activity of the enzymes dependent upon the presence of sulfhydryl groups for their activity and this inhibition is clearly demonstrated in the disturbances which occur in the biosynthesis of heme (Diab et al., 2000). Lead poisoning in animals is characterized by head pressing violent movement, blindness and salivation (Dwivedi et al., 2001). While in human cause kidney damage, liver cirrhosis, cancer, renal failure, testicular atrophy, hypertension, neuropathy, gastroenteritis, diabetes mellitus, anemia and osteomalacia, irritability, visual disturbances, vomiting, coma, convulsions and

death (Ehle and Mckee, 1990; Klopov, 1998; Santiago et al., 1998).

The aim of this study was to investigate lead concentrations in tissues of animals slaughtered in Ismailia governorate slaughterhouse.

MATERIALS AND METHODS

A total number of 246 animals of both sexes (male and female) ranging from one year to 7 years, slaughtered in Ismailia slaughterhouse were used to determine the lead level in their tissues. Liver, kidney and muscles were collected from cattle (73), buffaloes (74), camels (37), sheep and goats (62). The samples were collected at the time of slaughtering, then transported immediately on icebox to the laboratory and kept in

deep freezer at -18 o C until preparation for digestion.

One gram portion of each sample was digested by wet ashing as described by Valentine et al. (1987) using a mixture of nitric and perchloric acids (1:1 v/v) on hot plate until digestion of the organic matter and evaporation to dryness, then 15 ml of 6 N HCl were added. The prepared samples were analyzed for lead concentration using atomic absorption spectrophotometer, Thermo MQZ-environment (graphite + hydride) with detection limit as low as 0.05 ppb. Results were statistically analyzed according to Selvin (1996) using SPSS for Windows program.

RESULTS

Table (1): Mean concentration (ppb) of lead in tissues of slaughtered animals in Ismailia slaughterhouse

Specie	Tissue *	Female		Male	
		1-3	>3	1-3	>3
Buffalo	Kidney	19.6	17.4	47.9 A	65.3 a
	Liver	19.1	7.6	43.2 A	60.8 a
	Muscle	7.4	5.4	2.7 A	8.9 a
Cow	Kidney	42.3 A	70.0 a	84.2 B	120.6 b
	Liver	40.1 A	53.3 a	108.5	110.2
	Muscle	19.5 A	43.4 a	32.6 B	65.0 b
Camel**	Kidney	ND	ND	310.3 A	395.1 a
	Liver	ND	ND	215.5 A	389.2 a
	Muscle	ND	ND	101.8 A	145.7 a
Sheep & Goat	Kidney	510 A	663.8 a	46.4	ND
	Liver	480 A	650.2 a	46.1	ND
	Muscle	133 A	410 a	25.2	ND

* There is a linear correlation between kidney and liver for the same animal

** camels were categorized as less than 4.5 and more than 4.5 years old ND: not done
There is significance difference between cells having the same capital and small letter in the same raw

Table (2): Percentage of animals exceeded the maximum residual limit according to ES (2007)

Specie	Tissue	Female		Male	
		1-3	>3	1-3	>3
Buffalo	Kidney	0	0	0	0
	Liver	0	0	0	0
	Muscle	0	0	0	0
Cow	Kidney	0	0	0	0
	Liver	0	0	0	0
	Muscle	0	0	0	0
Camel	Kidney	ND	ND	0	18.75
	Liver	ND	ND	0	18.75
	Muscle	ND	ND	52.4	68.75
Sheep & Goat	Kidney	41.7	91.7	0	ND
	Liver	50	91.7	0	ND
	Muscle	66.7	100	0	ND

DISCUSSION

In recent years much attention has been paid to the possible danger of metal poisoning in human. It has been reported that lead and other heavy metals are concentrated mostly in the kidney and liver leading to kidney damage and liver cirrhosis. They constitute severe threat to human health due to their cumulative nature resulting in cancer, renal failure, human hypertension, neuropathy, gastroenteritis, diabetes mellitus, anemia and osteomalacia (Eife et al., 1999).

Because of the significant relation between the nature of the breeding area and the accumulation of lead in tissues of animals, this study was designed to investigate the concentration of lead in tissues of slaughtered animals in Ismailia governorate. The aim was to know the effect of this gov-

ernorate environment on the accumulation of lead in animal tissues living in.

This study included both sexes of buffaloes, cow, camel (male only), sheep and goats with age of 1-7 years. For buffaloes and cow not only none of the examined samples exceeded the permissible limit according to ES (2007) (Table, 2) but also the mean concentrations of residual lead in their tissues were generally low and far away from the maximum residual limit stated by the ES (2007) (Table, 1). These results agree with that obtained by Vos et al. (1986); Jorhem et al. (1991) and LÚpez et al. (2000). Meanwhile slightly higher values were reported by Aranha et al. (1994); Doganoc (1996) and Mass-nyi et al. (2003). On the other hand, Daoud et al. (1998); Diab et al. (2000) and Thabet (2004) reported very high values in Egypt. The reported values ranged between

930 ppb in cow liver (Diab et al., 2000) to 1868 and 2329 ppb in liver of buffaloes and cow, respectively (Thabet, 2004). Also Daoud et al. (1998) reported similar high values in cow (1102, 1284 and 881 ppb for liver, kidney and muscle, respectively).

These low figures may be attributed to the fact that Ismailia governorate is mostly touristic. The industrial area is still growing and mainly outside the governorate away from the breeding area. Also buffaloes and cow are mainly kept in farms for fattening but not rear in the surrounding so they are less in contact with the polluted environment. On the other hand, the high values reported by other research in Egypt may be attributed to the highly polluted environment in other governorates (Cairo and Giza).

The examined samples of camel and sheep and goats showed higher concentration of lead than that recorded for cow and buffaloes on both categories of age. This may be attributed to the nature of breeding of these animals, as they mainly grazing. Especially sheep and goats grass around the polluted areas and garbage. Table (2) revealed that 18.75 of both kidney and liver and 68.75 of muscles of slaughtered old camels (more than 4.5 years) exceeded the limit of residual lead according to ES (2007). Meanwhile, 52.4% of the slaughtered camels under 4.5 years old contained residual lead more than the permissible limit in their muscles. On the other hand, most of the ex-

amined samples of sheep and goats aged more than three years exceeded the permissible limit of lead according to ES (2007). Meanwhile, half the slaughtered sheep and goats under three years contained residual lead more than the permissible limit in their kidney, liver and muscles.

The obtained results in this study for sheep and goats were generally agreed with that obtained by Vos et al. (1988). On the contrary these results were highly larger than that recorded by Gonzalez-Weller (2006) who recorded 1.35 ppb lead in mutton.

Table (1) revealed the significant ($P < 0.05$) increase in lead concentration in relation to the age in case of all of the examined animals except for female buffaloes. This result indicates the cumulative nature of lead residues in the tissues as stated by Eife et al. (1999). Also from the same table it was obvious that there was a significant linear relation (positive correlation coefficient) between the concentrations of lead in livers and kidneys for the same animal. The same result was reported by Vos et al. (1987). On the other hand, the highest concentrations were present in kidneys then in livers. This result agrees with that obtained by El-Dayem (2000) and confirms the hypothesis of lead accumulation and concentration in certain target organs and tissues which is mainly liver, kidneys, spleen and bone stated by Fox (1987); Avram et al. (2000) and Kram-rov et al. (2005).

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مستوى عنصر الرصاص فى أنسجة الحيوانات المذبوحة فى مجزر الإسماعيلية

سهير يوسف محمد انشراح خليل ميرة خالد محمد الخواص

معهد بحوث صحة الحيوان - الدقى - الجيزة

تم تحليل عينات من الكبد والكلى والعضلات من أجمالى ٢٤٦ حيوانا من البقر (٧٣) والجاموس (٧٤) والجمال (٣٧) والأغنام والماعز (٦٢) ذبحت فى مجزر الإسماعيلية بأعمار تتراوح بين سنة واحدة وسبع سنين لتحديد بقايا عنصر الرصاص بواسطة جهاز الإمتصاص الذرى. بمقارنة النتائج بالمواصفات القياسية المصرية ثبت أن بقايا عنصر الرصاص فى أنسجة البقر والجاموس كانت منخفضة وبعيدة عن الحدود القصوى المسموح بها، بينما كان ١٨,٧٥% من عينات كل من الكبد والكلى و ٦٨,٧٥% من عينات العضلات للجمال كبيرة السن المذبوحة و ٥٢,٤% من عينات العضلات للجمال صغيرة السن تحتوى على نسبة من هذا العنصر أعلى من الحد الأقصى المسموح به. وبالنسبة للأغنام والماعز فقد كانت معظم عينات أنسجة الحيوانات كبيرة السن ونصف الحيوانات صغيرة السن تحتوى نسبة من الرصاص أعلى من الحد الأقصى المسموح به.

وقد ثبت من التحليل الإحصائى للنتائج أن هناك تأثير معنوى للعمر على زيادة تركيز عنصر الرصاص فى أنسجة الحيوانات المفحوصة فى كل الحيوانات عدا إناث الجاموس. وكذلك ثبت وجود علاقة خطية (طرديّة) بين تركيز عنصر الرصاص فى الكبد والكلى لنفس الحيوان.