SOME HEAVY METALS RESIDUE IN EDIBLE OFFALS AND MEAT OF NATIVE CATTLE AT ALEXANDRIA GOVERNORATE

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ABSTRACT

Heavy metal residues are considered among the most important chemical pollutants in food especially meat and offals which leads to several public health hazards .

This study was conducted to determine the levels of some heavy metals residue as lead (Pb), cadmium (Cd), copper (Cu), zinc (Zn), chromium (Cr) and mercury (Hg)

The residues were determined in 120 samples of meat and offal samples (20) of each (meat, liver, kidney , heart, spleen and lung) of cattle, the samples were collected from retail stores and butchers at Alexandria governorate. These samples were analyzed far levels of lead, Cadmium, Copper, zinc, Chromium and mercury by using Atomic Absorption Spectro photometer .

Our results showed that the mean values of lead (Pb) were 0.110 , 0.320,0.223, 0.150, 0.040 and 0.004 p.p.m respectively in meat , kidney, liver, heart , spleen and lung. in case of cadmium (Cd), the concentration of mean values were 0.022 , 0.038, 0.022, 0.056 , 0.048 and 0.066 p.p.m respectively in the examined samples. Concerning copper (Cu), the mean values were 1.590 , 2.580, 2.100, 1.910, 2.080, and 1.300 p.p.m respectively which in case of zinc (Zn) the mean values were ranged from 0.854 to 10.060 p.p.m respectively in the examined samples while the mean values of chromium (Cr) were 0.006, 0.023, 0.030, 0.040, 0.002, and 0.032 p.p.m respectively in the examined samples but in case of mercury (Hg),the mean values ranged from 0.081 to 0.340 p.p.m respectively.

From the pervious results , it was reported that most of this studied samples had levels of heavy metals within the maximum permisible limits with the Egyptian standard except the mean concentration of cadmium (Cd) with exceeded the limit in case of heart and lung samples (0.056 , 0.066 ug/g) p.p.m respectively .

The public health importance and toxic effect of these heavy metals as well as suggestive recommendations to minimize pollution with these heavy metals were discussed .

INTRODUCTION

Nowadays, environmental pollution is considered one of the most important problem affecting meat production capacity of grazing animal. Metal of environmental interest include elements that are macronutrients in the biosphere (Na.K.Ca) or micronutrients (Fe,Cu, Zn,ete) and some that have uoknown biological function e.g. (Pb,Cd) and that are generally regards as toxic elements. Metalic elements are cumulative toxicant because they are excreted slowly and their toxicity depends on their dosage the route. frequency and duration of administration **(Under wood 1977 and JECFA2005)**.

Heavy metals liberated into the environment through the air, drinking water, food or countless human made chemieal and products. Heavy metals enter and accumulate in body tissues via inhalation, ingestion and skin absorption **(Pouls,2005)**.

Toxic elements cadmium. lead and mercury are widely distributed in the environment since the industrial revolution in the last 50 years. They are frequently found in minute amounts in food **(Pouls 2005)**. Their toxicity depends on their classical form, the dosage, the route, frequency and duration of administration **(Underwood 1977 & JECFA, 2005)**. Cadmium is used extensively in the mining and electroplating industries and is form bone meal fertilizers and fungicides. Cadmium accumulates in body over many years because the body have homeostatic mechanism to keep cadmium at a constant level **(Nasri A (2006)** sources of lead exposure are air pollution, batteries, chemical fertilizers, dust, foods grown around industrial areas. gasoline, paints. pesticides, soil and tapwater **(Osumex, 2006)**.

Sources of mercury exposure are air pollution, diuretics (mercurial, fungicides, insecticides, pesticides and tapwater, the high amount of mereury entering the food from industrial sources **(FAO/WHO 2005)**. the major sources of heavy metals come from agrieultural, industrial and sewage wastes which may aceumulated in animal tissues and organs causing severe healthy problem to the consumers. Environmental pollution represent a major problem in the world especially in the less developed eountries and Egypt is one of these countries which suffer from biosphere pollution (air, soil, and water) **(Magouz et al 1996)**.

Cattle offal (liver, kidney, heart, spleen and lung) have a nutritive values as regard of its constituents. So in Egypt, offal represent on the main foods of large part of populations and these offals can be contaminated by heavy metal as mercury, cadmium, lead, chromium, copper, iron and zinc directly or indirectly through agricultural compound as fertilizer, pesticides, etc. Industrially through polluted water with wastes discharges of factories and/or environmentally by gases from mining or the motor vehicles **(WHO, 1994)**.

Water is a very critical environmental problem facing public health offieial, the greatest volume of waste diseharged the water course is sewage. sewage contains debris wastes, sanitary from domestics baths **(Omer et al 2004)**. chemical analysis of water significant increase in heavy metal especially lead, Cadmium, Zinc and Copper and increase than other trace elements **(Radwan and Ali 2003)**.

Heavy metals and other trace elements have been considered as a dangerous substanee causing serious health hazards to human and other living organisms through progressive irreversible accumulation in their bodies as a result of a repeat consuming of small amount of these elements **(wheaton and Lawson1985)**.

The concentration of toxic elements in animal tissue and organs depends mainly on the dietary concentration of the elements, absorption of this element, thomeostatic control mechanism of the body for the element and the species of animal involved **(Under wood 1977)**.

Heavy metals toxicity represent an uncommon yet clinically significant medical condition. If unrecognized or inappropriately treated, heavy metal, toxicity can result in significant morbidity and mortality. the most common heavy metals implicated in acute and for chronie conditions include lead, arsenic, cadmium and mereury in non-industrial situations, the major souree exposure of human and animal to toxic element occurs principally through their food supply **(Sunderman, 1998)**.

So, the present study was to determine the levels of some heavy metals especially cadmium, eopper, lead, zine, chromium and mercury in meat and offals of cattle at Alexandria provinces with their relation to public health and to deteet the safety to human eonsumption through comparing with the permissible limits and discussed this because there is a few reports were explain the hygienic quality of these offals , and some studies tries to focus some light on the relationship between heavy metal pollution (Hg , Cd , Cu , Zn , Cr , etc) in the offals and meat **(Mansour et al, 1988)**.

Therefore the objective of the present investigation was initiated to estimations of chemical quality of meat and native cattle offal (liver, kidney, heart, spleen and lung) with special reference to some heavy metals residue .

MATERIAL AND METHODS

1- Collection and preparation of samples:

A total of one hundred and twenty samples (20 each of meat, kidney, liver, heart, spleen and lung) were collected from butcher shops in Alexandria governorate. The collected samples were washed with deionized water and separately wrapped in acid washed polyethylene bags. Such samples were transferred without delay to the laboratory and then stored in frozen condition at -20°C until analysis was carried out .

2- Analysis of samples :

a- Digestion procedure :

Each sample was thoroughly minced and digested aecording to the technique recommended by khan et al 1995).

b- Heavy metal analysis :

Heavy metals including cadmium, lead, copper, zinc, and chromium were determine in using atomic absorption spectrophotometer (PERKIN ELMER 2380) according to **Richard and Rubin Shapiro (1986)**. In ease of mercury, the analysis was conducted according to **Honway and Donny (1985)** using flameless atomic absorption spectrophotometer .

Statistical analysis :

The obtained data were analyzed statistically according to the method recommended by **Petrie and Watson (1999)**.

RESULTS

The heavy metals concentrations in meat and offals were statistically analyzed and summarized in table (1) with the recommend permissible limits and with figures (1,2,3, 4,5,6) to detect which was highly meat or edible offals in the monitoring of the heavy metals residues, also, there, was a table (2) to evaluate the correlation coefficient between different organs according to the levels of the examined heavy metals .

DISCUSSION

It has become important to determine the content of heavy metals in meat and offals as an essential part in human diet, and this elements make up one of the serious groups of pollutants and this come from various sources as a result of modern industerization so, it is necessary to monitor the levels of this metals residue to evaluate the acceptability to human consumption .

Heavy metals or toxic elements are trace elements with density at least five times that of water . as such they are stable elements, they cannot be serious health hazards to human and other living organism (**Wheaton and Lawson 1985**). These include cadmium (Cd), lead (Pb), mercury (Hg), copper (Cu), zinc (Zn)and chromium (Cr). Human exposure to heavy metals has risen dramatically in the last fifteen years and from daily or weekly diet of human is from meat or offals so, a topic of public health concern because metals may be concentrated with along time and lead to be a dangerous level by meat and offals in the human chain (**Albert 2002, Smith and Tichochine 2002**) .

The statical analytical results of heavy metals in cattle meat and its offals illustrated in table (1) and revealed that the mean values of all samples not exceed the permissible limit which recommended by FAO / WHO (1989) and Egyptian organization standardization (1993) except in two samples of heart and lung, we found that the mean values of cadmium (Cd) were (0.056, 0.66 ug/g)p.p.m respectively. these results were nearly similar to these reported by **Rabiee A. E. (2001)** who found that cadmium (Cd) residues in liver, heart of cattle were 0.081, 0.063 ug/g ppm respectively and also similar to **Khan et al (1998)** while they were lower than those obtained by Abdel-Rahman (2004) which the reported result of cd residues in liver, kidney were 6.180 and 5.355 ug/g p.p.m respectively and also lower than those recorded by **EL-Atabany (1995)** who found that cadmium (Cd) residues in muscles, liver and kidney of cattle were 0.11, 0.024 and 0.38 ug/g p.p.m respectively .

Mean while the obtained results were higher than those recorded by **Omima et al (2000)** which found that (Cd) residues of liver of cattle was 0.022 ug/g p.p.m respectively and also the results reported here, lower than that were recorded in livers of Canadian slaughtered cattle and sheep (**Sallsubry et al 1991**).

Lead Pb :

The resulted presented in table (1) and figure (1) pointed out that the mean values of lead (Pb) in all examined samples were within P.P.L but was in high average and within permissible limit in kidney sample (0.32) ug/g p.p.m respectively and the lowest average was in the lung sample (0.004 ug/g p.pm) respectively and this result was similar to those which obtained by **Alaa M. Morshdy et al (2006)** found the pb residue mean value 0.032 ug/g p.p.m in kidney of camel carcasses and lower than the result obtained by **Hassouba and Omima (2007)** found lead (Pb) mean value was 0.70 ug/g p.p.m respectively in meat sample and not agreed with **Hala (2004)** reported the concentration of pb in muscle of cattle was 1.39 p.p.m respectively. Mean while, **Mousa and Samha (1993)** recorded higher lead (Pb) residues in cattle meat. The exposure to lead (Pb) of concern mainly because of possible detrimental effect on intelligence. Studies on exposure to lead and intelligence have indicated an adverse effect of low level lead exposure on new physiological development **(WHO, 1994)**. Food is one of the major sources of lead exposure, the other are air (mainly lead dust originating from petrol) and drinking water **(Ysart at al 2000)**. Exposure from these three sources should be reduced and can be demonstrated through following up the blood levels of different Egyptian population. Although industrial and agricultural discharges are the primary source of lead poisoning in Egypt **(EL-Nabawi et al. 1987)** lead is used in many industrial process. lead paint, lead gasoline and lead arsenate quantities and chronic lead poisoning is characterized by anemia, muscular pain, lead nephropathy and neuropathy of both central and peripheral nervous system **(Daoud and Rashed 2002)**.

Cadmium (Cd) :

At the same table (1) and figure (2) we can demonstrated that mean value of cadmium was higher in heart and lung samples (0.056 and 0.066) p.p.m respectively and exceeded the permsible limit, this may be due to higher heavy metal environmental pollution which resulting from various industrial activities in Alexandria .

This result was agreed with J. **Lee et al (2007)** which detect the accumulation of Cd in organs of cattle carcasses (0.058, 0.060 p.p.m respectively) (in kidney and liver samples) **Daoud et al, (1998)** determined Cd in 20 cattle slaughtered in Zagazig city, the obtained results revealed that the mean values of Cd residues in muscles were 0.309 p.p.m wet weight and also the recorded mean concentration of cd were stated by **Doganoc (1996)** which estimated the concentration in bovine meat was 0.004 mg / kg wet weight . **Koh et al (1998)** recorded that a survey to assess the extend of Cd accumulation in south Australian cattle. None of 262 muscle samples assayed contained cd levels above the maximum permitted concentration of 0.2 mg/kg wet weight. **Avram et al., (2000)** reported that 44 a samples of various organs and tissues were collected from 8 cows older than 5 years in an area of heavy industrial pollution with lead and cadmium in particular. the results evidenced the (Pb) and (Cd) accumulation and concentration markedly exceed maximum admitted limits characterization cumulative chronic intoxication in this area . **Miranda et al (2004)** determined the levels of (Cd). in calves from Asturias. the average. concentration in meat was 2.03 ug/ g. **Korenckova et al. (2002)** determined the occurrence of heavy metals in 21 cattle slaughtered on agricultural farms. the highest mean level of (Cd). in the muscle 0.126 mg / kg. Cadmium inhibits essential enzymes in the Krebs energy cycle, directly damages nerve cells resulting in hyperactivity of the nervous system affects on bones and joints by altering calcium and phosphorous metabolism contributes to arthritis, accumulates in the kidneys resulting in high blood pressure and kidney disease **(Zakrzewiska et al 2002)**.

The hazards of cadmium as a food contaminant, this referred to the use of Cd. for several decades in many industrial fields, especially in the production of the paint, plastic and special alloys **(Lucisano, 1989)**.

Copper (Cu) :

Concerning in the table (1) and figure (3) showed that the mean values of Copper (Cu) coneentrations of all samples was within the permissible limit and the highest copper concentration was dated in kidney (2.58ug/g p.p.m) respectively and the lowest was detected in lung (1.30 ug/g p.p.m) respectively. These results are inagreement with those obtained by **Pouls (2005)** which found copper concentration in kidney and muscles (2.50 and 1.50 p.p.m respectively and also was nearly agreement with **Lars Johem (1992)** while the resulted recorded in this study were lower than the results obtained by **EL-Sherif (1991)**. Copper is an essential trace element for man and animal. In addition to its role in promoting haematopoiesis. it is also required for normal activity for many enzymes, and copper is normally present in sufficient amounts in forage and feed stuffs but may be used as food supplement where levels in soil are low .

Zinc(Zn) :

Zinc is an essential element for human, as being involved in protein synthesis and as a constituent of many metaloenzemes . Relativity low toxicity of zinc coupled with efficient homeostatic control mechanisms make chronic zinc toxicity from dietary sources as unlikely hazard to men. From table (1) and figure (4) showed that the mean value of examined samples within the permissible limit of Zn and the highest concentration found in kidney sample (10.06ppm)and the lowest concentration found in spleen sample is (0.85ppm) respectively and this was similar with the obtained results by **Thanae A. (1999)** which found the mean value concentration of zinc is highest in kidney sample (13.78 p.p.m) while lower result in were reported by **Salisbury et al (1991)**.

Zinc is neeessary for normal growth and development in animal and birds, Oral toxication by zinc leads to bloody watery diarrhea. Intense abdominal pain. central nervous system depression and tremors **Falandyz (1993)**.

Chromium (Cr) :

Chromium is an essential nutrient required for sugar and fat metabolism . Insufficient dietary intake of (Cr) leads to signs and symptoms that are similar to those observed for diabetes and cardiovascular diseases **(Anderson R. 1997)**. Food is a major source to chromium and found in meat. fish. sea foods and cereals were rich sources but fruits, milk, oils, fats and sugar were poor sources of chromium **(Brata kos et al, 2002)**.

At the same table (1) and figure (6) which demonstrated that the lowest mean valve com centration of chromium (Cr) was found in meat sample (0.006 ug/g p.p.m respectively and the highest concentration present in heart sample (0.030 ug/g p.p.m) respectively followed by lung sample (0.032 ug/g p.p.m) respectively and in liver and kidney mean values were (0.030 and 0.023 ug/g p.p.m) respectively and this obtained results were nearly similar wilt those recorded with Thanae. A. (1999) which gives the mean values of (Cr) in liver and kidney were 0.028 and 0.030 ug/g p.p.m .These results agreed to certain extent with those reported by **(Reglus et al, 1990)**.

Mercury (Hg) :

The results presented in table (1) and figure (6) showed thet the mean value of mercury (Hg) residues was high in heart sample from other sample (0.34 ug/g p.p.m) respectively and within the permisible limit and the lowest mean was in meat (0.116 mg/kg p.p.m), this was agreed with Hassouba and **Omima, (2007)** which found that mean values of Hg residues were 0.02,0.01 ug/g p.p.m in meat samples and also agreed with **S.K. Pathaka and M.K.Bhoumik (2007)** and in accordance with those reported by **Omima (1995)** which recorded that mercury was 0.002 ug/g in beef meat.

In a study of a typical Canadian diet including red meat, organs, poultry and fish are found mercury intake which is know to accumulate in aquatic food chain **(Davia and Mertz w 1996)**.

Mercury toxicity causes abnormal nervous and physical development (fetal and childhood), anemia, anorexia, blood changes, blindness, blue line on gums, colitis, dermatitis, difficulty chewing and swallowing, headache, hypretension, memory loss, Kidney damage or failure and nerve damage **(Skibnienska 2002)** Chronic Toxicity which are toxic signs of gastrointestinal disturbances and renal dysfunction developed from 43 days on wards without any mortality. The toxicity also induced nephritis and tubular nephritis, centrilobular, necrosis of liver, mild to moderate necresis in spleen, intestine and lymph nodes, Zenkers degeneration of cardinc muscles. The kidneys contained the largest residues of mercury, followed by liver, spleen, intestine, lymph node, skeletal muscle, lungs and heart. The intensity of cgtotoxic changes in various organs was proportional to the amount of mercury accumulated **(S.K. Pathak and Bhoumik 2007)** studies of the content of another heavy metals which found naturally in food in different species for example arsenic and iron which vary in toxicity and benefit in the diet **Buchet et al 1994 and Schoof et al 1999.**

From table (2) we detected that there was a weak strong correlation (r) between different organs according to the levels of the examined heavy metals and illustrated that data from this table revealed that ther was a strong positive correlation betwon the samples for lead (Pb) residue such as between meat, kidney (r=0.2), spleen, lung (r=0.5) and heart, lung (r=0.04) and also there were a weak negative correlatin between examined samples for (Pb) between liver, lung (r=-0.12) Meat, lung (r=-0.13), liver, spleen (r=-0.05), kidney heart (r=-0.4), kidney, liver (r=-0.3), and meat, liver (r=-0.3) .

And also for cadmium (cd) we found a strong positive correlation between examined samples such as between meat, kidney (r= 0.6) meat, heart (r= 0.3) and kidney, heart (r= 0.2) and there was a weak negative correlation between kidney, lung (r=-0.2), liver, heart (r=-0.2) heart, lung (r=- 0.1) and spleen, lung (r=-0.2) all other heavy metals such as Cu, Zn, Cr and Hg had this correlation. Therefore, from the last discussion we can observe that the accumulation of heavy metal residues in animal organs was higher than those in meat and this was agreed to the results obtained by **Gary P. K. (1992)** which proved that mean residues of cd, cu, pb, Hg and zinc in kidney, liver, heart of bull and cow and showed that these trace metals in edible tissues of livestock was higher than those obtained in meat and also **Antoniou et al, 1995** showed that the general. adverse toxic effects are cumulative especially in adipose tissue than in meat, other effects include off flavour in food when present at high concentrations and this was referred to which in developing countries, the problems regarding the unhealthy environment, bad sanitation and problem of poor environment have a negative direct on the health, therefore the present study aims to monitor the levels of some heavy metals in meat and offals to ensure the availability of offals for consumption, so the study of heavy metals in edible offals has recently become a topic of public health concern because metals such as cd, pb, cu, et may be concentrated to a dangerous level by this offals in human food chain (**Gordon 1986**).

The variations of pb, cd, cu, cn, zn and Hg as to be a heavy metal residues concentration among the results and those recorded by other investigator are considered logical due to the differences in animal species, size localities the analytical proeedures, season, salinity, habitats as well as environmental pollution (**Jehan.R and Abdel Aziz 2002**).

In conclusion one can safety that Mercury, Cadmium and Lead are more toxic and not essential to human and constitute the public health hazard. These minerals accumulate in meat and organs and therefore their levels must be continually monitored especially in ready to eat one in liver, lung, spleen, kidncy and heart (**Gordon 1986**).

In general, retailed offal (liver, kidney, etc) showed the highest significant heavy metals concentration and this may be attributed to the excess and continues exposure of cut surface and contamination through the air, dusting and rusting of utensils (**Thanae. A 1999**) but meat is of low significant concentration than in offals and this is proved by **Sinigo (2000), Zakrzewska et al (2002) and Korenkova et al, (2002)**.

The recommended international codes of hygiene practice for fresh meat and offals and food standard program codex alimestaries commission (CAC) and Egyptian standards showed be followed, Moreover transport in hygiene vehicles adequate chilling and storage of offal, also the persentive measures of significant concern intended for minimizing the pollution with residues of heavy metals in animal tissues (muscles) and organs and those include:

(1) Minimize the use of phosphate and sludge for fertilization as possible and preventing industrial and agriculture discharges into the surface water.
(2) A void contamination of water surfaces with industrial waste products.
(3) Periodical examination of water surface for animal.
(4) Regular analysis of meat and offals for heavy metal pollution and their load should be evaluated according to the international guidelines as a fruitful advise.

CV=coefficient of variation SE=standard error SD=standard deviation Max=maximum Min=minimum

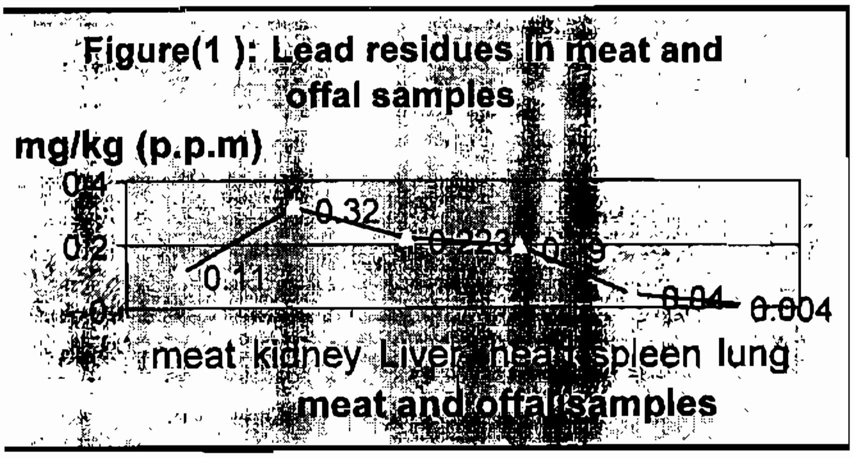
Heavy metals	Examined samples	min	max	Mean	SD	± SE	CV	Permissible limits of heavy metals in food FAO / WHO 1989 EOS (1993)
Lead (Pb)	meat	0.000	0 .24	0.110	0.080	0.020	72.72	1 p.p.m
	kidney	0.300	0.350	0.320	0.020	0.004	6.250	
	Liver	0.000	0.410	0.223	0.16	0.04	7.174	
	heart	000.0	0.42	0.19	0.15	0.030	78.94	
	spleen	0.000	0.070	0.04	0.03	0.007	75.00	
	lung	0.000	0.009	0.004	0.003	0.000	75.00	
Cadmium (cd)	meat	0.000	0.048	0.022	0.017	0.004	77.27	Not exceed 0.04 – 0.05 p.p.m
	kidney	0.010	0.061	0.038	0.016	0.004	42.10	
	Liver	0.020	0.048	0.022	0.060	0.003	272.7	
	heart	0.000	0.30	0.056	0.06	0.010	120.0	
	spleen	0.009	0.082	0.048	0.027	0.006	56.25	
	lung	0.030	0.089	0.066	0.018	0.004	28.4	
Copper (Cu)	meat	0.800	1.800	1.590	0.230	0.052	14.46	3.5 p.p.m
	kidney	2.300	2.900	2.580	0.200	0.170	7.751	
	Liver	1.900	2.300	2.100	0.150	0.030	7.142	
	heart	1.500	2.20	1.91	0.24	0.054	12.56	
	spleen	1.900	2.810	2.080	0.200	0.040	9.615	
	lung	1.000	1.400	1.300	0.140	0.031	10.76	
Zinc (Zn)	meat	6.000	7.500	7.060	0.530	0.120	7.507	40 p.p.m
	kidney	9.000	10.80	10.06	0.540	0.120	5.367	
	Liver	6.600	8.900	8.074	0.850	0.030	10.52	
	heart	7.600	8.10	7.83	0.18	0.040	2.298	
	spleen	0.780	0.910	0.857	0.050	0.010	5.834	
	lung	6.200	6.500	6.300	0.110	0.020	1.746	
Chromium (Cr)	meat	0.000	0.010	0.006	0.005	0.120	83.33	4 p.p.m
	kidney	0.000	0.043	0.023	0.014	0.003	60.86	
	Liver	0.023	0.035	0.030	0.004	0.000	13.33	
	heart	0.020	0.07	0.04	0.02	0.003	50.00	
	spleen	0.001	0.005	0.002	0.001	0.000	50.00	
	lung	0.008	0.081	0.032	0.029	0.007	90.62	
Mercury (Hg)	meat	0.700	0.169	0.116	0.030	0.006	25.86	0.5 p.p.m
	kidney	0.060	0.350	0.230	0.110	0.020	47.82	
	Liver	0.059	0.034	0.233	0.108	0.024	46.35	
	heart	0.130	0.49	0.34	0.13	0.029	38.23	
	spleen	0.048	0.206	0.161	0.054	0.012	33.54	
	lung	0.030	0.186	0.081	0.050	0.011	61.72	

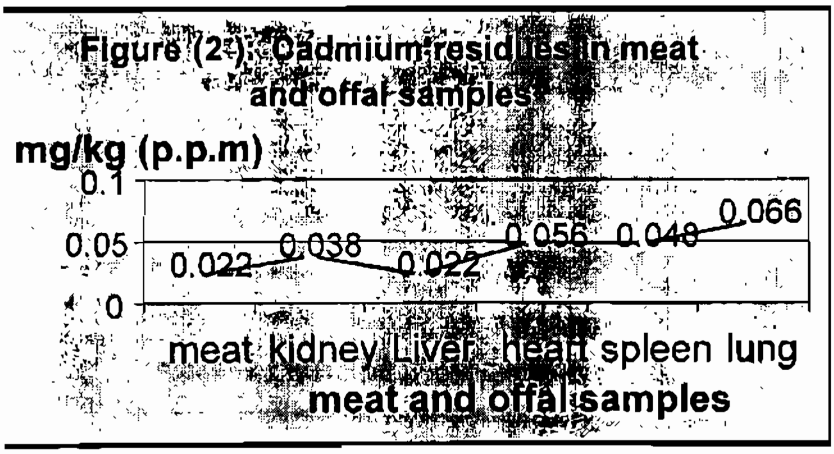
FAO : Food and Agriculture Organization
WHO : World Health Organization
EOS : Egyptian Organization for Standrization
p.p.m : mg / kg
(ug / g)

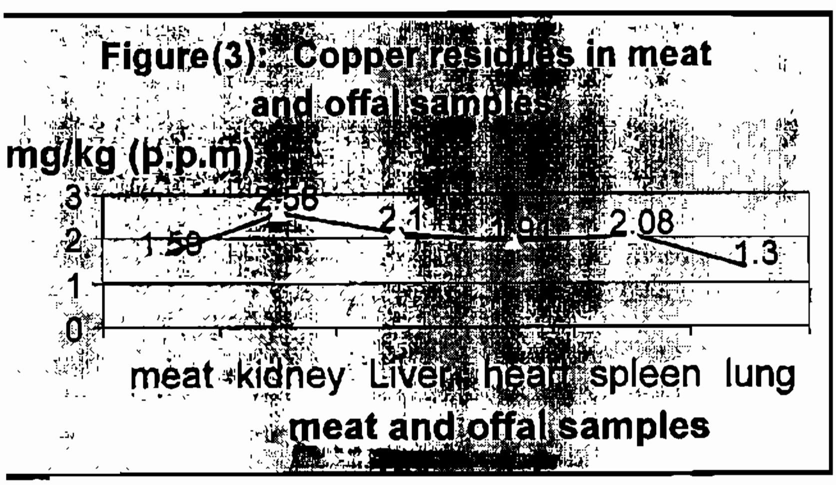
Table (2): Correlation coefficients between (r) different organs according to the levels of the examined heavy metals

		meat	kidney	Liver	heart	spleen	lung
Lead (Pb)	meat		0.2	-0.3	-0.1	-0.3	-0.13
	kidney			-0.3	-0.4	-0.2	0.08
	Liver				-0.03	-0.05	-0.12
	heart					0.02	0.04
	spleen						0.50
	lung			- 0.1	- 0.3		
Cadmium (cd)	meat		0.6	0.1	0.3	0.05	-0.30
	kidney			0.1	0.2	0.1	-0.20
	Liver				-0.2	-0.2	0.02
	heart					-0.3	-0.10
	spleen						-0.20
	lung		0.2	0.1		- 0.3	
Cupper (Cu)	meat		0.3	0.4	0.04	-0.2	0.50
	kidney			0.2	0.1	-0.1	0.20
	Liver				-0.001	0.1	0.70
	heart					-0.5	-0.00
	spleen						0.60
	lung		- 0.1	0.2		- 0.3	
Zinc (Zn)	meat		-0.4	0.1	-0.2	-0.4	-0.10
	kidney			0.6	0.02	0.4	0 20
	Liver				0.1	0.1	-0.00
	heart					0.15	0.08
	spleen						-0.30
	lung			0.1		0.2	
Chromium (Cr)	meat		0.1	-0.03	0.2	0.5	0.30
	kidney			0.2	-0.4	-0.2	-0.10
	Liver				0.1	-0.05	0.30
	heart					0.3	0.20
	spleen						0.30
	lung		0.2		0.1		
Mercury (Hg)	meat		0.4	0.4	0.4	0.5	0.60
	kidney			0.4	0.7	0.5	0.10
	Liver				0.3	0.5	0.20
	heart					0.7	0.30
	spleen						0.20
	lung			0.2	0.1		

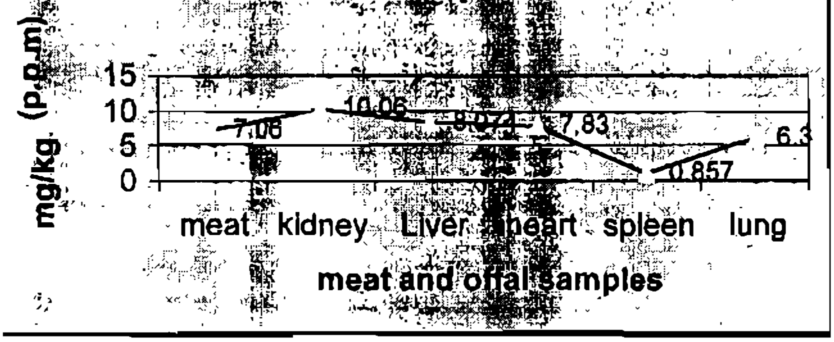
r : Correlation coefficients (strong positive or weak negative)



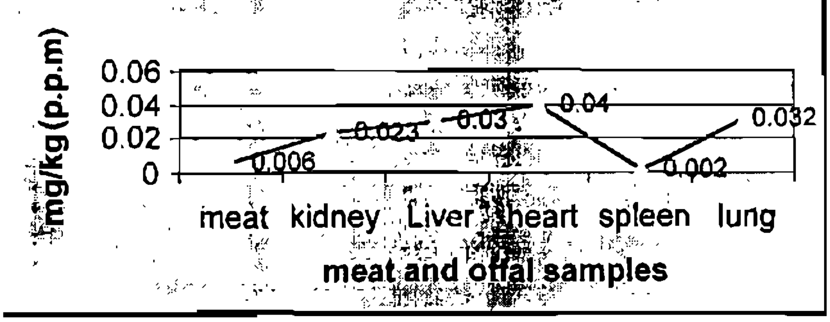




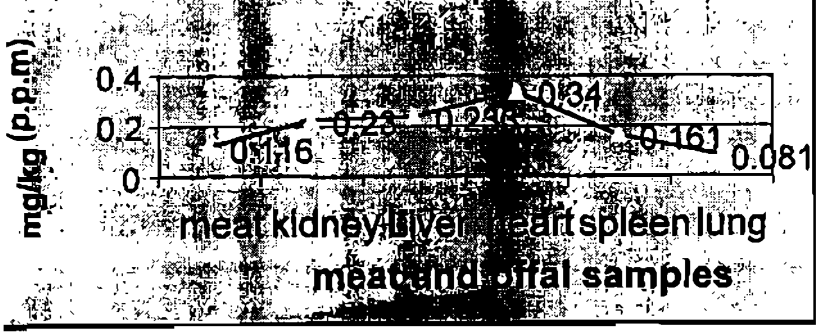
Figure(4): zinc residues in meat and offal samples



Figure(5): Chromium residues in meat and offal samples



Figure(6): Mercury residues in meat and offal samples



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الملخص العربى

بعض بقايا المعادن الثقيلة فى الأحشاء الداخلية المأكولة ولحوم الأبقار المحلية فى محافظة الإسكندرية

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تعتبر بقايا المعادن الثقيلة من أهم الملوثات الكيميائية للغذاء خاصة فى اللحوم والأحشاء الداخلية التى تؤدى إلى مشاكل عديدة على الصحة العامة ولذلك وضعت تلك الدراسة لتحديد مستويات بعض بقايا تلك المعادن الثقيلة مثل الرصاص، الكادميوم والنحاس والزنك والكروميوم والزئبق.

وتم تقدير تلك البقايا فى ١٢٠ من العينات من اللحوم والأحشاء الداخلية بواقع عشرون عينة عشوائية من اللحوم، الكبد، الكلى، القلوب، الطحال والرئتين للأبقار المحلية وتم جمع العينات من الأسواق المحلية ومحلات الجزارة فى محافظة الإسكندرية وقد حللت هذه النتائج لتقدير مستويات تلك المعادن وهى الرصاص، الكادميوم والنحاس والزنك والكروميوم والزئبق بواسطة جهاز الامتصاص الذرى.

وقد أسفرت النتائج أن متوسط تركيز الرصاص كانت (١١٠ر٠ ، ٣٢٠ر٠ ، ٢٢٣ر٠ ، ١٥٠ر٠ ، ٠٤٠ر٠ ، ٠٠٤ر٠) جزء فى المليون على التوالى فى اللحوم والكلى والكبد والقلوب والطحال والرئتين بينما فى حالة الكادميوم فكانت متوسط التركيزات بمعدل (٠٢٢ر٠ ، ٠٣٨ر٠ ، ٠٢٢ر٠ ، ٠٥٦ر٠ ، ٠٤٨ر٠ ، ٠٦٦ر٠) جزء فى المليون وأيضاً فى حالة عنصر النحاس كانت قيم المتوسطات كالآتى (٥٩٠ر١ ، ٥٨٠ر٢ ، ١٠٠ر٢ ، ٩١٠ر١ ، ٨٠٠ر٢ ، ٣٠٠ر١) جزء فى المليون تقريباً وفى حالة متوسط تركيز الزنك كانت بمعدل يتراوح من (٨٥٧ر٠ إلى ٠٦٠ر١٠) جزء فى المليون على التوالى فى العينات، بينما كانت قيمة المتوسطات لعنصر الكادميوم كالآتى (٠٠٦ر٠ ، ٠٢٣ر٠ ، ٠٣٠ر٠ ، ٠٤٠ر٠ ، ٠٠٢ر٠ ، ٠٣٢ر٠) جزء فى المليون فى كل العينات على التوالى ولكن متوسط تركيز الزئبق كانت بمعدل يتراوح مابين (٠٨١ر٠ إلى ٠٣٤ر٠) جزء فى المليون على التوالى.

ومن النتائج السابقة لوحظ إن معظم العينات موضوع الدراسة احتوت على مستويات المعادن الثقيلة فى الحدود المسموح بها طبقاً للمواصفات القياسية المصرية فيما عدا عينات الرئتين والقلوب وجد إن نسبة تركيز الكادميوم كانت (٠٥٦ر٠ ، ٠٦٦ر٠) جزء فى المليون وهى أعلى من الحدود المسموح بها وقد تم مناقشة النتائج ومدى خطورتها على الصحة العامة للإنسان مع إعطاء المقترحات والتوصيات التى تقلل من مدى تلوثها.

هذا وقد تم مناقشة النتائج وخطورة تلك المتبقيات على الصحة العامة وكذلك الاشتراطات الصحية مع إعطاء المقترحات الراجب مراعاتها مع تقليل نسبة تلك المتبقيات بها.