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SOME HEAVY METAL LEVELS IN BROILER'S MEAT CUTS

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SUMMARY

Owing to increasing importance of heavy metal as one of the most dangerous form of pollutants, which have the tendency to accumulate in the tissues and organs of animals as well as human beings, the present study was planned to detect the residues of heavy metals in broiler's meat cuts. The collected samples consists of 60 samples of broilers meat from breast and thigh muscles 30 of each. Samples were examined using atomic absorption spectrophotometer, and the obtained results indicated that the examined broilers meat cuts had variable amounts of heavy metals. All results appeared to be lower than the permissible limits of heavy metals in food recognized by E.O.S.Q.C (1993). The public health significance of the achieved results with discussed.

INTRODUCTION

Poultry meat constitutes an excellent source of high quality, easily prepared, cooked and digested animal protein, which contain all essential amino acids beside vitamins and minerals which are required for human development. Heavy metals are among the most dangerous forms of pollutants that have tendency to accumulate in animal tissue. They are recognized as toxic substance due to low rate of elimination from the body. They also differ from other toxic substances in that neither created nor destroyed by humans (Casarett and Doull's 1996).

Although toxic metals are naturally present in the environment, industrial processes have resulted in an increased concentration of heavy metals in air, water, and soil. Consequantly, they found their way into food chain lead to progressive irreversi-

ble accumulation in the human bodies as a result of repeated consumption of small amounts of these elements (Wheaton and Lawson, 1985). Exposure of poultry to heavy metals may be coming from their feeding on grains and/or drinking water polluted with pesticides, fungicides or industrial byproducts. (Copper, Lead, Iron, Zinc and Codmium) are considered of major interest and commonly arise from natural geological sources and human activities. As Copper (Cu) known to be essential element at low concentration but at high level it is toxic, leading to sever nausea, bloody diarroea, hypotention and Jaundice (Gossel and Bricker, 1990). While lead (pb) easily accumulated in the body due to it's low elimination rate causing chronic poisoning characterized by neural defect, renal disfunction, ulcerative stomatitis, blue gingival lead line and grey spotes on buccal mucosa (Bryson, 1989). It was recorded that low iron storage in the body or low intake would increase cadmium toxicity so administration of iron administration of iron protect body against cadmium toxicity (Fox et al., 1980). Zinc and Iorn are essential at low concentration, but they are toxic at higher levels. There is a narrow range between the concentration at which metal is considered essential and the concentration at which it considered toxic (Higham and Tomkins, 1993). Naturally zinc level in protein foods (Meat, Fish, egg, Milk) is higher than it's level in non protein foods as vegetables, fruit and drinks (Terres et al., 2001). Chemically Zinc is very similar to cadmium and usually contaminate water through industrial discharge and mining wastes (Manahan, 1993). However, cadmium (Cd) is a very toxic heavy metal causing sever abdominal pain, vomiting, diarrhoea, and it's accumulation in the body resulted in kidney stones which may lead to death due to renal failure (Peter, 1993).

Therefore, the current study was planned to evaluate the levels of such heavy metals as Copper, lead, iron, zinc and cadminum in broiler's meat cuts with special reference to their public heath significance.

MATERIALS AND METHODS

A total of 60 Broiler's meat cuts (30 of each) of breast and thigh samples were collected from Cairo and kalyobia goverorates to determine the levels of copper, lead iorn, Zinc, and cadmium. The collected samples were prepared and digested according to the technique recommended by Teeny et al. (1984) and Pandya et al., (1985). 10 grams of each sample were placed in a clean (colorless) glass bottle and then dried in a hot air oven at 110°C overnight. The dried samples were placed in a muffle furnace (Thermalyne, 6000, Germany) at 450°C for 32 hours. The obtained white ashs were dissolved in 1 mol nitric acid. The concentration of heavy metals in the solution were determined using the Atomic Absorption Spectrophotometer (AAS) [Perkin Elmer, 2380 USA], of the centeral lab. Of faculty of veterinary Medicine,

Moshtohour, Zagazig University (Banha Branch). The values of the heavy metals under investigation in each examined sample was recorded as ppm (mg/kg) in wet weight.

RESULTS

Table (1): Concentration of heavy metals (ppm) in examined thigh muscle samples (n=30).

Types heavy metal	Min	Max	Mean	S.D.	± SE
Copper	0.008	0.2100	0.0247	0.381	0.007
Lead	0.044	0.2400	0.1636	0.047	0.009
Iorn	0.260	1.900	0.6793	0.365	0.067
Zinc	0.040	1.380	0.5670	0.338	0.062
Cadmium	0.000	0.1040	0.0108	0.019	0.003

Table (2): Concentration of heavy metals (ppm) in examined Breast muscle samples (n=30).

Types heavy metal	Min	Max	Mean	S.D.	± SE
Copper	0.004	0.410	0.058	0.113	0.021
Lead	0.018	0.241	0.128	0.072	0.013
Iorn	0.290	1.650	0.669	0.337	0.062
Zinc	0.320	0.920	0.591	0.170	0.031
Cadmium	0.008	0.22	0.013	0.003	0.0007

Table (3) : T. Test for examined thigh and Breast muscle samples.

	Copper	Lead	Iron	Zinc	Cadmium
T. Test	1.52	2.29	0.11	0.35	0.51
Significance	*	*	*	*	*

* Significant at 5%.

Table (4): Over all concentration of heavy metals (ppm) in examined Broiler's meat samples (n=60).

Type of heavy metal	Min-	Max.	Mean	± S.D.	Permissible limits (ppm)**
Copper	0.0040	0.4100	0.0412	0.0109	1.0
Lead	0.0180	0.312	00.1474	0.0084	1.0
Iorn	0.2600	1.9000	0.6742	0.0449	-
Zinc	0.0400	1.3800	0.5792	0.0342	-
Cadmium	0.0000	0.1040	0.0117	0.0017	2.0

** E.O.S.Q.C= Egyptian organization for standardization and quality control No. 2360 (1993).

Table (5): Correlation coefficients between studied heavy metals.

Heavy metal type	Copper	Lead	Iron	Zinc	Cadmium
Copper	1.0000	-			
Lead	0.27005	1.0000	-		
Iorn	0.15932	0.00405	1.0000	-	
Zinc	0.06611	-06630	-0.24877	1.0000	-
Cadmium	0.17205	0.04564	0.05183	0.04098	1.0000

DISCUSSION

Levensen and Barnand, (1988) discussed the human health impacts arising from disposal of wastes in aquatic environment and stated that cadmium and lead are of primary concern, while copper, iron, and zinc are of secondary one. The outhors further added that heavy metals are conservative or persistent type of pollutants which can not be destroyed over long time of heat treatement or environment degradation.

Results recorded in table (1) reveald that the concentration of heavy metal in examind thigh muscle samples of Broiler's meat cuts varied from 0.008 to 0.2100 with a mean value of 0.0247 (0.007. and 0.044 to 0.24 00 with a mean value of 0.1636 (0.009. and 0.260 to 1.900 with a mean value of 0.6793(0.067. and 0.040 to 1.380 with a mean value of 0.5670 (0.062. and 0.000 to 0.1040 with a mean value of 0.0108 (0.003 ppm for copper, lead, Iorn, Zinc and Codmium respectively. Such results were clearlly lower than the

permissible limits (ppm) of the Egyptian organization for standardization and quality control (E.O.S.Q. C. 1993) which indicate that the permissible limits of copper, lead, iron and zinc were 1 ppm while for cadmium is 2 ppm.

While results recorded in table (2) showed that the concentration of heavy metal in examined breast muscle samples of Broiler's meat cuts varied from 0.004 to 0.410 with a mean value of 0.058(0.021 ppm for copper and 0.018 to 0.241 with a mean value of 0.128(0.013 ppm for lead, and 0.290 to 1.650 with a mean value 0.669 (0.062 ppm for iron, and 0.320 to 0.920 with a mean value of 0.591(0.031 ppm for zinc, and 0.008 to 0.22 with a mean value of 0.013(0.0007 ppm for cadmium. Such results also show marked lower values comparing with the permissible limits recorded by (E.O.S.Q.C.1993).

Table (3) showed that there's a significant variation between the concentration of all studied heavy metals between breasts and thighs samples which indicate significant higher levels in thighs samples comparing with breasts ones. This may attributed to high blood supply and high fat contents of thigh muscles than breast ones as most heavy metals have a more tendancy to accumulate in Fatty Tissues (Sorensen 1991).

Results recorded in table (4) reveald that the concentration of heavy metals in examined samples of broiler's meat cuts (breasts and thighs) varied from 0.0040 to 0.4100 with a mean value of 0.0412 (0.0109 ppm for copper; 0.0180 to 0.3120 with a mean value of 0.1474 (0.0084 ppm for lead; 0.2600 to 1.9000 with a mean value of 0.6742 (0.0449 ppm for iorn; 0.0400 to 1.3800 with a mean value of 0.5792 (0.0342 ppm for Zinc and 0.000 to 0.1040 with a mean value of 0.00117 (0.0017ppm for cadmium. Such results indicated that the level of heavy metals in examined samples were lower than the permissible limits recorded by (WHO 1989) and (E.O.S.Q.C 1993). This mean that there no danger to human health from heavy metals poisoning through consumption of Broiler's meat.

Comparing the results recorded in table (4) with the levels of heavy metals in other sources of animal protein as red meat and offals obtained by El- Seady (2001) and the levels of heavy metals in fish detected by Mostafa (1999) the obtained results indicated a clear lower levels of heavy metals in broiler's meat. This may attributed to the direct exposure of fish, shellfish to sewage water and industrial pollution and grassing of animal, near to rivers and leaks such habitat of fish and the nature of feeding of animals lead to sever contamination of fish, shellfish and animals meat with such toxic agents, which may results in serious illness in human when consumed such meat Wheaton and lowson (1985).

While rearing of broiler's in closed houses, clear water and diets greatly protect them from

exposure to such heavy metals.

Explaining to these the very low concentrations of heavy metals in broiler's meat might be explained on the bases of the presence of increased concentration of heavy metals in nature (air - water - soil) resulting from uncontrolled industrial processes, and feeding of poultry on grains which may contain some of these heavy metal due to using of some types of fertilizers in production of such plants.

On the other hand table (5) showed that there a positive significant linear correlation between lead and the corresponding copper and negative significant between zinc and corresponding iron at a level of $P< 0.05$. This means that there is increase in the level of lead in cut-up broiler's meat sample with increase in the level of copper. On the other hand significant decrease in the level of zinc in the same sample with the decrease in the level of iron had been established and the same correlation between the level of zinc with lead had been observed but not of significant level. In this required (petering, 1978). Stated that copper deficiency increased the toxic effect of lead and increase its accumulation in the parenchymal organs.

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