# Heavy Metal Residues In Marketed Duck Carcasses

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## ABSTRACT

Twenty Egyptian Balady ducks were freshly slaughtered and prepared at different poultry shops in Dakahlia Province .A total of 40 samples of muscle and liver from the examined duck carcasses were subjected to chemical analysis to determine the heavy metal residues . The obtained results showed that the mean values of lead in muscle and liver was 4.66 ± 0.82 and 4.78 ±.0.82ppm. While the mean values of cadmium residues was 0.31 ±0.04 ppm and 0.30 ±0.05ppm in muscle and liver respectively. Copper residue levels in muscle and liver were 0.83±0.138 and 2.32± 0.47 ppm respectively. The results of our study indicated that the mean value of lead and cadmium were exceeded the permissible limits. While the mean value of copper concentration was lower than the permissible limits. Public health importance and hazardous effects of the detected heavy metals as well as recommendations to reduce the sources of pollution were discussed.

## INTRODUCTION

The ducks have been recognized as important source of protein for human consumption. In Egypt, the peoples nowadays prefer to consume ducks meat as it is more palatable and contain more fat content in comparison with those of other poultry of similar age or weight *(1, 2)* .

Pollution with heavy metals is a problem of magnitude and ecological significance because they are not biodegradable and can not be easily eliminated *(3)*. The most important route of pollution to poultry is water contamination with heavy metals arising from industrial activity *(4)*. Contamination in poultry feeds and drinking water only become significant if their degradation products are present in sufficient quantities either to cause toxic effects in poultry or accumulate in tissues at levels which threaten public health.

Lead is a wide spread constituents of the earth crust and soils and recognized as a toxic substance which accumulates in the body due to its low rate of slow elimination. Excess lead can cause serious damage to the brain , kidney, nervous, reproductive and cardiovascular systems *(5)*. Young children, infants and fetuses are particularly vulnerable to lead poisoning *(6)*

Cadmium is a cumulative toxic substance with biological half life ranging from 20-40 years *(7)*. Pollution with cadmium from industrial sources may transmitted to human through contamination of foods *(8)*. The toxicity of cadmium are associated with several human diseases as renal insufficiency , nephrolithiasis, hypertension, cancer and immaturity of newborn *(9)*.

Copper is essential trace element for physiological activities of living bodies of animals and human. It released into environment primary through mining , sewage treatment plant, solid waste disposable and agriculture processes *(10)* . Acute toxicity of ingested copper is characterized by abdominal pain, diarrhea, vomiting, tachycardia and debilitating liver condition.

For all the pervious mentioned risks , the present study was done to estimate the degree of heavy metal residues in marketed duck carcasses.

## MATERIALS AND METHODS

### Collection of samples

Forty random samples of muscle and liver (20 of each) were collected from twenty freshly prepared duck carcasses from different poultry shops in Dakahlia Province . The

collected samples were separately placed in polyethylene bags and kept frozen at -20°C until analysis.

**Digestion technique *(11)***

One gram of each sample was macerated in screw capped tube by sharp scalpel . five ml of digestion mixture (3 parts of Nitric acid and 2 parts of Perchloric acid ) were added to the tissue samples. The tubes were tightly closed and the contents were vigorously shacked and allowed to stand overnight at room temperature for complete digestion . The tubes were warmed at 95°C until completely evaporated and allowed to cool. The residues were redissolved in 10 ml of 1 N Nitric acid. The solutions were filtered through Whatman paper N0. 1 . then the filtrate was collected in tubes and kept in room temperature until analysis .

**Analysis of samples**

The resultant solutions were then analyzed using the Atomic Absorption Spectrophotometer . The estimation of lead , cadmium and copper residue of each sample was in ppm.

**Statistical analysis:** It was carried according to *(12).*

## RESULTS AND DISCUSSION

Public health aspects of pollution with heavy metals have a special interest all over the world , so contamination of meat and offals with toxic metals have recently come to forefront dangerous substances. They are considered as serious chemical health hazards for men and animals

The results recorded in Table 2 and 3 revealed that the mean value of lead in muscle and liver of the examined duck carcasses was 4.66 ± 0.82 and 4.78 ±0.82 ppm respectively.

The obtained results were much higher than that previously reported by *(13), (14)* in ducks and *(15), (16), (4) and (17)* in chicken . However lower levels were recorded in migratory quail *(18)*, turkey *(19)*, ostrish, broiler and rabbit *(20).* The recorded levels exceeded the permissible limits of World Health Organization *(21), (22)* **and** *(23)* as shown in Table 1.

The high concentration of lead in muscle and liver of examined ducks may be attributed to the dietary habit of ducks, high level in feed and drinking water, collection of samples from areas subjected to high level of environmental pollution. and also pollution during slaughtering process.

From the public health point of view, the lead has an effect on kidney, liver and brain cells which reduce the function or completely breakdown of these tissues *(24).* Therefore, CNS , kidney , liver and haemobioetic system are important targets of lead toxicity. On the other hand CNS is the target organ of lead toxicity in children. The characteristic of lead toxicity are nephritis, peripheral neuropathy, ruhmatic symptoms and anemia *(25).*

The mean value of cadmium concentrations in muscle and liver were nearly similar , 0.31 ±0.04 and 0.30 ± 0.05 ppm respectively (Table 2& 3)

The examined samples exceeded the permissible limits of *(22)* and *(23 ).* Moreover similar results were reported by *(19)* in liver and *(4)* in muscle and liver. lower values also recorded *(13, 26, 15, 4, 20).* High residue levels were cited in liver samples *(15 , 27).*

High cadmium concentrations may be related to industrial pollution which increase the level of the element in the surrounding environment and also the presence of cadmium in raw materials used during production .

Cadmium accumulates mainly in liver and kidney. The chronic cadmium toxicity included kidney damage with proteinuria , impaired regulation of calcium and phosphorous, manifesting bone demineralization, osteomalacia and pathological fractures *(28).*

The mean concentration values of copper were 0.83± 0.138 ppm for muscle and 2.23 ± 0.47 ppm for liver ( Table 2&3) .The obtained results were lower than the permissible limits of World health Organization *(21)* , *(22)* and

*(23)* as shown in Table (3). Also the results were lower than those recorded ***by (13 ) and (29)*** in ducks , ***(30) , (31) , (32 ) and (17)*** in broilers, *(18)* in quail , *(19)* in turkey and *(20)* in ostrish , broilers and rabbits.

Copper is known to be essential at low concentrations but it toxic at high levels . Accordingly ingestion of an excessive dose of Cu may lead to sever nausea , bloody diarrhea , hypertension and jaundice. Moreover chronic copper poising may result in what known Wilson's disease which manifested by destruction of nerve cells, liver cirrhosis, ascitis, edema and hepatic failure *(33)*

It is essential in order to protect public health to keep contaminants at levels which are toxicology acceptable and this occur through, avoid the contamination of water and feeds sanitary precautions during scalding evisceration and processing of poultry carcasses , prevent rearing of poultry near high traffic density and periodical examination of water sources.

**Table 1. Recommended levels of lead , cadmium and copper in food**

| Metal | EOSQC(1993) Minimum Permissible limits in meat and meat product | Commission regulation(EC))No 853/2004 | WHO ( 1984) |
|---|---|---|---|
| Lead | 0.5ppm | Maximum levels of Pb in meat of bovine animals 0.10mg/ kg B.W. | Pb level should not more than 0.05 ppm |
| Cadmium | 0.1ppm | Maximum levels of Cd in meat of bovine animals 0.050 mg/kg B.W | Cd should not exceed 0.05ppm |
| Copper | 15ppm | | |

*EOSQC* : Egyptian Organization for Standardization and Quality control

*Commission Regulation ( EC)* : Regulation of European communities

*WHO* : World Health Organization

**Table 2.** Concentrations of lead , cadmium and copper residues (ppm) in muscles of examined ducks

| Metals | No. of examined Samples | Min. | Max. | Mean | S.E. ± |
|---|---|---|---|---|---|
| **Lead ( Pb)** | 20 | 0.200 | 11 | 4.66 | 0.82 |
| **Cadmium ( Cd)** | 20 | 0.097 | 0.783 | 0.31 | 0.04 |
| **Copper ( Cu)** | 20 | 0.07 | 2.1 | 0.83 | 0.138 |

**Table 3.** Concentrations of lead , cadmium and copper residues (ppm) in liver of examined ducks

| Metals | No. of examined Samples | Min. | Max. | Mean | S.E. ± |
|---|---|---|---|---|---|
| **Lead ( Pb )** | 20 | 0.44 | 12.3 | 4.78 | 0.82 |
| **Cadmium ( Cd)** | 20 | 0.1 | 0.97 | 0.30 | 0.054 |
| **Copper ( Cu)** | 20 | 0.09 | 8.08 | 2.23 | 0.47 |

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## الملخص العربى

## بقايا المعادن الثقيلة فىذبائح البط المسوقة

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المعمل البيطرى فرع المنصورة

أجريت هذه الدراسة على ٤٠ عينه من العضلات والكبد بواقع ٢٠ من كل منها وذلك لعدد ٢٠ذبيحة من ذبائح البط البلدي المذبوح في محلات الدواجن في الأسواق المختلفة في محافظة الدقهلية وذلك لقياس تركيز عناصر الرصاص , الكادميوم و النحاس باستخدام مقياس الامتصاص الطيفي حيث كان تعين العنصر في كل عينة على أساس جزء في المليون.

وقد أظهرت النتائج آن القيم المتوسطة لعنصر الرصاص في العضلات والكبد هي ٤,٦٦ و ٤,٧٨ على الترتيب. وكان تركيز عنصر الكادميوم في العضلات هو ٠,٣٢ وفى الكبد ٠,٣٠. واخيرا كان تركيز النحاس ٠,٨٣ و ٢,٣ في كل من العضلات والكبد على الترتيب.

وقد وجد آن تركيز كل من عنصري الرصاص والكادميوم قد تجاوز الحد المسموح به حسب المواصفات القياسات المصرية بينما تركيز عنصر النحاس لم يتجاوز الحد المصري المسموح به. وقد تم مناقشة الأهمية الصحية والتأثيرات السامة لهذه المعادن الثقيلة وكيفية الحد آو التحكم في مصادر التلوث بهذه العناصر.