# Some Heavy Metal Residues in Ostrich Meat Products

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## ABSTRACT

Great attention is paid to the ecological production of pure and safe meat for human consumption, in order to improve public health in most countries of the world, as well as in Egypt. The aim of this research was to determine the levels of some heavy metals as lead (Pb), cadmium (Cd), mercury (Hg), Nikee (Ni), Cobalt (Co), Copper (Cu), zinc (Zn), iron (Fe) and magnesium (Mg) in some ostrich meat product as burger, frankfurter and luncheon. The mean value of lead was 0.39 ±0.04, 0.29 ±0.002, 0.45± 0.01, respectively, the mean values of both Hg and Cd in the same for mention products were 0.02 ± 0.02, 0.045 ± 0.001 and 0.017± 0.05 and 0.12 ± 0.001, 0.03 ±0.001 and 0.011 ± 0.001, respectively. The mean value of Ni in burger, luncheon and frankfurter were 0.09 ± 0.01, 0.014 ± 0.02, and 0.0 ±0.0, respectively. The mean values of both Co and Cu in the same aforementioned products were 0.17 ± 0.09, 0.81± 0.0 and 0.03 ± 0.001 and 0.04 ± 0.002, 0.08 ± 0.091 and 0.05 ± 0.007 respectively. The mean value of Zn in burger, luncheon, and frankfurter were 96.76 ± 0.274, 96.76 ± 0.067 and 111.43 ± 0.086 respectively. The mean values of both Iron and Magnesium in the same for mention products were 110.51 ± 0.273, 110.51 ±0.290 and 120.36 ±0.321 and 0.34 ±0.63, 0.34 ± 0.067 and 0.29 ± 0.039 respectively.

## INTRODUCTION

Ostrich meat is a good source of protein, many nutrients and is relatively low in fat especially when skin is removed besides that it contains high proportion of unsaturated fatty acids & less cholesterol. It is also characterized by ease of preparation and the availability of wide range of pre – packaged ,branded, raw and ready to eat serve products *(1).*

Heavy metals are a wide spread environmental contamination with largely air borne source, such as combustion of fuel and industrial emission that include smelters *(2).* Heavy metals are widely distributed and always present in food. They are essential for all plants and animals *(3).* Copper is important in the formation of erythrocytes, development of bone, central nervous system and correlative tissues. Also zinc is necessary for normal growth and development in mammals and birds. *(4).* the contamination with heavy metals is a serious threat because of their toxicity, bioaccumulation and biomagnifications in food chain *(5).*

## MATERIAL AND METHODS

### 1. Material

### 1.1. Sampling

Twenty five samples of each of (Luncheon, frankfurter , Barger of ostrich meat product were collected from Cairo & Giza cities, all samples were kept frozen and separately in clean polyethylene bags till analysis with an identification card showing type of meat product.

The samples were analyzed to estimate lead (Pb), cadmium (Cd), copper (Cu), zinc (Zu), iron (Fe) and magnesium as residual levels by atomic absorption spectrometry (AAS) *(6).*

### Methods

### 2.1. Washing Procedure

Washing of equipment is an important process to avoid contamination especially when trace elements of heavy metal are to be analyzed.

### 2.2. Digestion Procedure

Digestion of sample was done *(7)* by weighting one gram of each sample that was macerated in 250ml flask by sharp scalpel. Ten ml of a 7: 3 mixture of ultrapure concentrated

nitric acid: perchloric acid ($HNO_3$: $HClO_4$) then water added to the tissue sample.

### 2.3.1 Preparation of blank and standard solutions

Blank solution consisted of 7 parts of nitric acid and 3 parts of perchoric acid was treated similar to the wet digestion procedure then diluted with 10 parts of 1 N nitric acid.

The blank was used to determine the heavy metal contamination that may be present in the chemicals used for wet digestion.

However, standard solutions, using pure certified metal standards were prepared for each metal. Serial standard solution for lead and cadmium were prepared at strength of 0.005, 0.01 and 0.2 ppm respectively. Whereas serial standard solutions for copper and zinc were prepared at concentration of 0.1 , 0.5,1.0 and 3.0 ppm. All standard solutions were prepared using 7 parts of nitric acid, 3 parts of perchloric acid and 10 parts of 1 N nitric acid.

### 2.3.2 Analysis

The digest, blanks and standard solutions were aspirated by the Atomic Absorption spectrophotometer (AAS) and analyzed for heavy metal contents. Analysis of lead, cadmium, copper and zinc was conducted at the Nutritional Institute related to Ministry of Health, using unicam 929 Atomic Absorption spectrophotometer with the following parameters:

| Metal | Lamp wave length (nm) | Lamp Current | Burner height (cm) | Fuel flow rate (L/min) | Sit width (nm) | Detection limit (ppm) |
|---|---|---|---|---|---|---|
| Lead | 217.0 | 90% | 8 | 1.1 | 0.7 | 0.001 |
| Cadmium | 228.8 | 50% | 8 | 1.2 | 0.7 | 0.001 |
| Copper | 324.8 | 75% | 8 | 1.1 | 0.7 | 0.1 |
| Zinc | 213.9 | 75% | 8 | 1.1 | 0.7 | 0.1 |

### 2.3.3. Quantitative determination of heavy metal:

Lead, cadmium, copper and zinc concentration were recorded directly from the digest scale of AAS and they were calculated according to the following equation:

$$\text{Element ppm} = R \times D/W.$$

Where:

R =Reading of element concentration ppm from the digital scale of AAS.

D =Dilution of the prepared sample.

W =Weight of the sample.

The concentration or the absorbency values of heavy metals in blank samples were also calculated and subtracted from each analyzed samples. The registered values for lead, cadmium, copper manganese and zinc were expressed as ug/gm wet weight (ppm).

### 2.4. Statistical Analysis

The results were analyzed statistically by using computer program statistics (ANOV and LSD).

## RESULTS AND DISCUSSION

### Heavy Metals

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

The mean value of lead in burger, frankfurter, and luncheon, were 0.39 ±0.o4, 0.45± 0.01, 0.29 ±0.002, respectively. In the same table the mean values of both Hg and Cd in the same mentioned products were 0,020 ± 0.02, 0,017± 0,05 and 0.045±0.001 and 0,12 ± 0.001, 0,03 ±0,002 and 0,011 ± 0.001 respectively (Table 1 ).

The present results were nearly parallel to that previously recorded ***(8, 9),*** while, relatively higher results were obtained previous studies (***10, 11).***

In general, the safe permissible limit of Pb in meat products was stipulated to be 1 mg /kg ***(12)*** and 0.5 mg/kg by the Egyptian standards ***(13)*** . The level found in this study were much lower than these values and were under the permissible limits.

Excess lead is known to reduce the cognitive development and intellectual performance in children and increase blood pressure and cardiovascular disease incidence in adults.

Lead is a wide spread constituents of earth crust and soils and recognized as a toxic substance which accumulates in the body due to its slow rate of elimination.

The present results showed that cadmium content in samples were within safe value in comparison to maximum permissible hygiene limit for cadmium (0.5 mg/kg) on the basis of our results of cadmium analysis it was below the highest permissible limits for cadmium. These results guarantee that the consumer is protected against unfavorable effects of cadmium in human body.

The mean value of Ni in burger, luncheon and frank furter were 0.09± 0.01, 0.014 ±0.02, and 0, 0 ±0.0, respectively.

In the same Table showed that the mean values of both Co and Cu in the same aforementioned products were 0,17 ± 0.09, 0.03 ± 0.001 and 0.81± 0.0 and 0,04 ± 0.002, 0.05± 0.007 and 0.08 ± 0.091, respectively (Table 1).

It should be highlighted that food is a principal source of copper all the examined samples (100%) were within the permissible limit (20 ppm) which recommended by ***EOSQC (13)***.

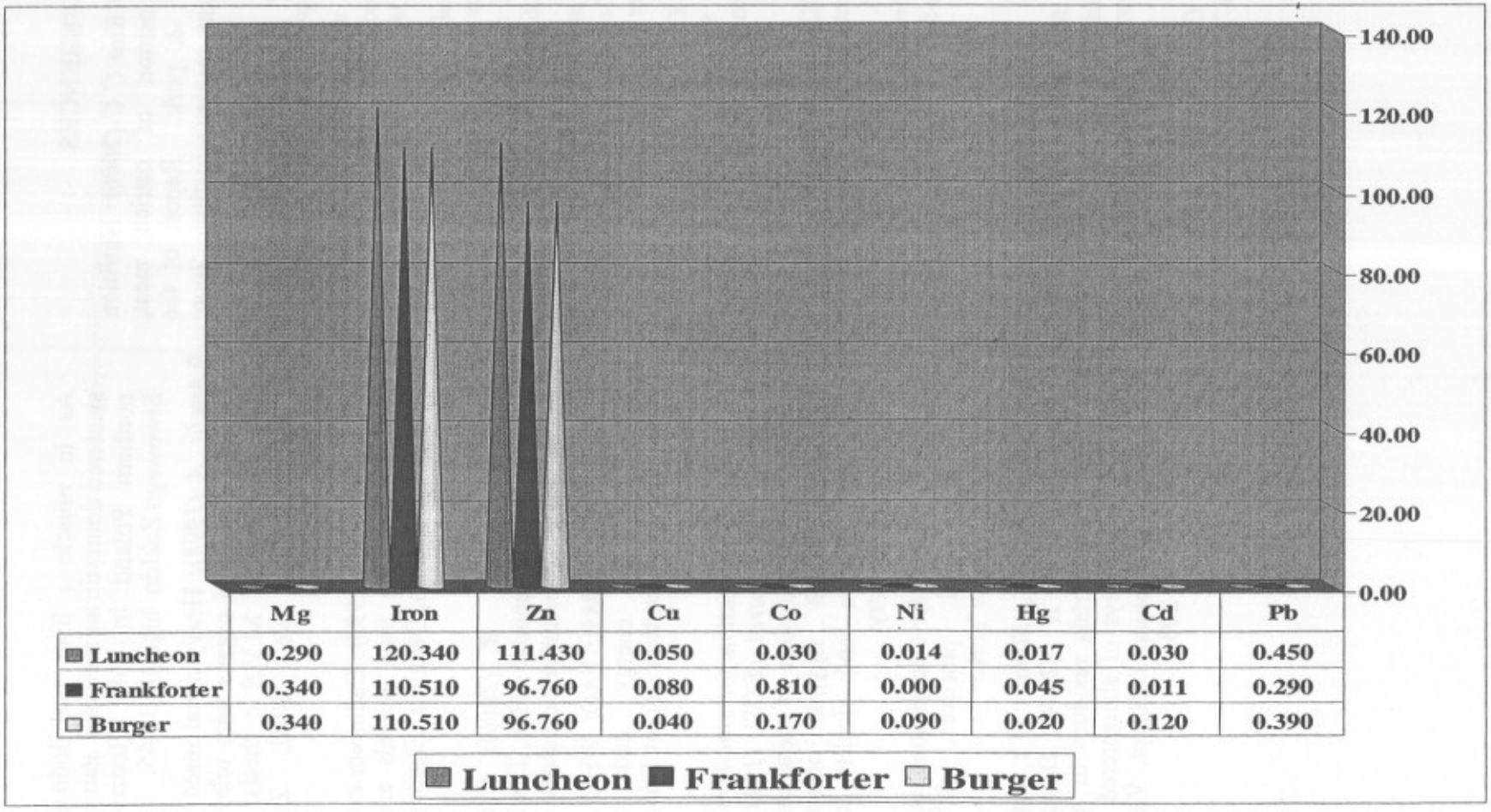
Copper poisoning include nausea, vomiting, diarrhea, hematemesis and jaundice, while chronic disease from excessive copper storage was epitomized by Wilson's disease, which characterized by excessive copper deposition in most organs (liver, kidney, brain and eyes) ***(14).***

The mean value of Zn in burger , luncheon, and frankfurter were 96.76 ±0.274, 111.43 ± 10.086 and 96.76 ± 0.067 respectively.

In the same Table the mean values of both Iron and Magnesium in the same foremention products were 110.51± 0.273, 120.36 ±0.321 and 110.51 ±0.290 and 0.34 ±0.63, 0.29 ± 0.039 and 0.34 ± 0.067 respectively (Table 1).

**Table 1 . Heavy metals levels in Burger , Frankfurter and Luncheon**

| Metal | Burger | | | Frankfurter | | | Luncheon | | |
|---|---|---|---|---|---|---|---|---|---|
| **Pb** | 0.390 | ± | 0.040 | 0.290 | ± | 0.002 | 0.450 | ± | 0.000 |
| **Cd** | 0.120 | ± | 0.001 | 0.011 | ± | 0.001 | 0.030 | ± | 0.001 |
| **Hg** | 0.020 | ± | 0.020 | 0.045 | ± | 0.001 | 0.017 | ± | 0.040 |
| **Ni** | 0.090 | ± | 0.010 | 0.000 | ± | 0.000 | 0.014 | ± | 0.020 |
| **Co** | 0.170 | ± | 0.090 | 0.810 | ± | 0.000 | 0.030 | ± | 0.001 |
| **Cu** | 0.040 | ± | 0.002 | 0.080 | ± | 0.091 | 0.050 | ± | 0.007 |
| **Zn** | 96.760 | ± | 0.274 | 96.760 | ± | 0.333 | 111.430 | ± | 10.086 |
| **Iron** | 110.510 | ± | 0.273 | 110.510 | ± | 0.290 | 120.340 | ± | 0.321 |
| **Mg** | 0.340 | ± | 0.630 | 0.340 | ± | 0.067 | 0.290 | ± | 0.039 |




| | Mg | Iron | Zn | Cu | Co | Ni | Hg | Cd | Pb |
|---|---|---|---|---|---|---|---|---|---|
| Luncheon | 0.290 | 120.340 | 111.430 | 0.050 | 0.030 | 0.014 | 0.017 | 0.030 | 0.450 |
| Frankforter | 0.340 | 110.510 | 96.760 | 0.080 | 0.810 | 0.000 | 0.045 | 0.011 | 0.290 |
| Burger | 0.340 | 110.510 | 96.760 | 0.040 | 0.170 | 0.090 | 0.020 | 0.120 | 0.390 |

**Fig. 1. Heavy metals levels in Burger , Frankfurter and Luncheon**

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## الملخص العربى

## بقايا بعض المعادن الثقيلة فى منتجات لحوم النعام

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تعتبر منتجات لحوم النعام مصدر غنى بالبروتين لاحتوائها على نسبة عالية من البروتين بالإضافة إلى الأحماض الامينية الأساسية اللازمة لنمو الإنسان كما تحتوى على نسبة عالية من الأحماض الدهنية الغير مشبعة . وكذلك إحتوائها على نسبة ضئيلة من الكوليسترول. وتعتبر لحوم النعام غنية أيضا بالمعادن والأملاح المعدنية مثل الصوديوم والبوتاسيوم والكالسيوم والحديد والفسفور والكبريت واليود. – وكانت نسبة المعادن الثقيلة التى تم تحليلها فى منتجات لحوم النعام على النحو التالى . متوسط نسبة الرصاص فى البرجر والفرانكفورتر واللانشون ٠,٣٩ ± ٠,٠٤ ، ٠,٢٩ ± ٠,٠٠٢ ، ٠,٤٥ ± ٠,٠١ جزء فى المليون على التوالى وكانت نسبة الزئبق فى البرجر والفرانكفورتر واللانشون ٠,٠٢٠ ± ٠,٠٢ ،٠,٠٤٥ + ٠,٠٠١ ، ٠,٠١٧ + ٠,٠٤ جزء فى المليون على التوالى. كان متوسط نسبة الكادميوم ٠,١٢٠ ± ٠,٠٠١ ، ٠,٠٣٠ ± ٠,٠٠١ ، ٠,٠١١ ± ٠,٠٠١ جزء فى المليون على التوالى ٠ كما كان متوسط نسبة النيكل ٠,٠٩ ± ٠,٠١ ، ٠,٠١٤ ± ٠,٠٢ ، ٠,٠ ± ٠,٠ جزء فى المليون على التوالى ومتوسط نسبة الكوبالت ٠,١٧ ± ٠,٠٩ ، ٠,٨١ ± ٠,٠ ، ٠,٠٣ ± ٠,٠٠١ جزء فى المليون ومتوسط نسبة النحاس ٠,٠٤ ± ٠,٠٠٢ ، ٠,٠٠٨ ± ٠,٠٩١ ، ٠,٠٥ ± ٠,٠٠٧ جزء فى المليون ٠ ومتوسط نسبة الزنك ٩٦,٧٦ ± ٠,٠٢٧٤ ، ٩٦,٧٦ ± ٠,٠٦٧ ،، ١١١,٤٣ ± ٠,٠٨٦ جزء فى المليون كما كانت متوسط نسبة الحديد ١١٠,٥١ ± ٠,٢٧٣ ، ١١٠,٥١ ± ٠,٢٩٠ ، ١٢٠,٣٦ ± ٠,٣٢١ جزء فى المليون) ٠ وكان متوسط نسبة الماغنسيوم ٠,٣٤ ± ٠,٦٣ ، ٠,٣٤ ± ٠,٠٦٧ ،، ٠,٢٩ ± ٠,٠٣٩ جزء فى المليون على التوالى ٠ وقد خلصت النتائج إلى أن كل العينات المفحوصة تحتوى المعادن الثقيلة فى حدود المسموح به دولياً٠