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DETERMINATION OF LEAD RESIDUES IS CHICKEN MEAT

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A B S T R A C T

Ninety random samples of chicken breast and thigh (45 of each) were collected from 3 different chicken processing plants A, B, C (30 of each) located in Kalyobia Governorate. Thus, each plant was represented by 15 thigh and 15 breast samples. The collected samples were analyzed for detection of their contents of lead residues using digestion technique by atomic absorption spectrophotometer. The result showed that the positive samples were 40.00% & 53.33%, 33.33% & 46.67% and 26.67% & 46.67% in chicken breast and thigh samples in plant A, B and C, Respectively. Concerning that the mean values of lead levels (mg/kg) in the examined chicken meat samples were 0.16 ± 0.01, 0.10 ± 0.01 & 0.07 ± 0.01 for breast samples and 0.27 ± 0.02, 0.18 ± 0.01 & 0.11 ± 0.01 for thigh samples in plant A, B and C, respectively. Accordingly, the unaccepted samples of breast and thigh were 26.67 % & 40% for plant A, 13.33% & 26.67% for plant B and 6.67% & 20% for plant C, respectively. Finally, the public health significance of these serious residues and sources of their presence in chicken meat as well as some recommendations to avoid them in such food items were discussed.

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1. INTRODUCTION

In recent years, there has been arapid expantion in commercial processing of eviscerated chicken meat products to satisfy the consumer demand and play an important role in solution of protien shortage in developing countries. In this respect, the poultry meat production world wid has increasing rapidly with an annual growth rate 6% (4).

Today, the environmental pollution is considered as one of the most serious problems in the world. The deleterious effect of the environmental pollution by heavy metals is considered as one of the principal research activities. The problem of residues in food has been addressed at international level through several committees sponsored by some united nations organizations (7). Pollution and industrial practices results in concentrations of metals and other environmental agents that are related to environmental toxicity (10).

The pollution of aquatic environmental with heavy metals consititues a public health hazard during recent years. Untreated municipal and industrial wastes, together with inputs from the atmosphere, are the primary sources of heavy metal pollution (13).

The lead was mainly coming from automobile emissions. Lead concentration depended on street topography, traffic volume. Average speed of vehicle, congesion and atmospheric condition. Lead deposition increase in cold season (11).

Lead is recognized as atoxic substance, which accumulates in body due to low rate of elimination (14). Moreover, lead levels in chicken meat products over permissible limits are implicated in chronic lead toxicity results in anemia, abdominal pain, encephalopathy and renal damage. Recently, Lead is

considered as one of immunosuppressive agents in both animal and human (3).

Heavy metal have a major role in human and animal health, causing injury to health through progressive and irreversible accumulation in the body via ingestion of small repeated amount (2). Lead toxicity lead to renal tubular dysfunction as indicated by proteinuria or aminoaciduria in human. They added that lead may inhibit hemoglobin synthesis and caused fragile red blood cells resulting in anemia (9).

2. MATERIAL AND METHODS

2.1. Samples

90 random samples of chicken meat products represented by breast and thigh (45 of each) were collected from there different chicken processing plants (30 of each) located in Kalyobia Governorate to determine their toxic residues. In other words, each plant was represented by 15 thigh and 15 breast samples.

Each sample was kept in a separate sterile plastic bag and transferred to the laboratory in an insulated ice box as quickly as possible. All collected samples were examined for detection of their contents of lead residues.

2.2. Determination of Lead residues

The collected samples were examined for determination of lead levels on the basis of wet weight (mg/kg).

2.3. Washing procedures

the samples were prepared and digested according to the technique described by **(12).** Washing of equipment is an important process to avoid contamination especially when trace element or heavy metals are to be analyzed. The tubes, plastic film and glassware were soaked in water and soap for 2 hours and then rinsed several times with tap water, they were rinsed once with distilled water, once with therand mixture (520 ml deionized water, 200 ml conc. HC1 and 80ml H_2O_2) and once with washing acid (consisted of 90ml deionized water and 100ml conc. HC1) then followed by washing with deionized water and air-dried in incubator from contamination of dust.

2.4. Digestion technique

After washing, digestion of one gram from each sample of dorsal muscle was digested by 10ml of digestion mixture (60ml Nitric acid "HNO3" 65% 40ml Perchloric acid " $3HCLO_4$" 70-72%) in screw capped tube after maceration by sharp scalpel. The tubes were tightly closed and the contents were vigorously shacked and allowed to stand over night at room temperature.

The tubes were heated for 4hours in water bath adjusted at 70C to ensure complete digestion of samples, the tubes were then left to cool at room temperature and diluted with 10ml deionized water, capped with plastic film and thoroughly mixed the digest was then filtered with Whattman filter paper and the filtrate was collected in pyrex glass test tubes capped with polyethylene film and kept at room temperature until analyzed for heavy metal contents.

Preparation of blanks and standard solution in the same manner was applied for wet digestion and by using the same chemicals.

2.5. Analysis

The digest, blanks and standard solutions were aspirated by Atomic Absorption Spectrophotometer (AAS) (UNICAM969AA Spectrophotometer) and analyzed for lead under the following conditions:

Heavy metal condition	
Lamp wave length (nm)	217.0
Lamp current (m.amp)	15
Fuel flow rate	1.4
Measurement time (seconds)	4.0
Detection limit (mg/kg)	0.01

N.B: Estimation of heavy metals is each examined sample was expressed by (mg/kg) of wet weight samples.

2.6. Quantitative determination of heavy metals:

Lead absorbency were recorded directrly from the digital scale of AAS and its concentration was calculated according to the following equation:

C=R x (D/W)

Where:

C= Concentration of lead (mg/kg) wet weight.

R= Reading of digital scale of AAS.

D= Dilution of prepared sample.

W= Weight of the sample.

3. RESULTS

Table (1): Statistical analytical results of lead levels (mg/kg) in the examined samples of chicken meat (n=15).

Chicken Meat / Plant	Breast			Thigh		
	Min.	Max.	Mean ± S.E	Min.	Max.	Mean ± S.E*
A	0.04	0.28	0.16 ± 0.01	0.05	0.63	0.27 ± 0.02
B	0.03	0.23	0.10 ± 0.01	0.02	0. 34	0.18 ± 0.01
C	0.01	0.16	0.07 ± 0.01	0.01	0.25	0.11 ± 0.01

Table (2): Analysis of Variance of lead levels in the examined samples of chicken breast and thigh.

Source of Variance	DF	S.S	M.S	F.value
Total	89	0.2238		
Between Chicken Cuts (C)	1	0.0179	0.0179	12.85 ++
Between Plants (P)	2	0.0851	0.0426	30.46 ++
(P) × (C) interaction	2	0.0032	0.0016	1.17 NS
Error	84	0.1176	0.0014	

D.F = Degrees of freedom ++ = High significant differences (P<0.01)

S.S = Sum squares NS = Non significant differences

M.S = Mean squares

Table (3): Acceptability of the examined samples of chicken breast and thigh based on their levels of lead (n=15).

Plant / Chicken Meat	Maximum Permissible Limit (mg/kg)*	Total positive samples		LIMIT	
		No.	%	No.	%
Plant (A):					
Chicken breast	0.1	6	40.00	4	26.67
Chicken thigh	0.1	8	53.33	6	40.00
Plant (B):					
Chicken breast	0.1	5	33.33	2	13.33
Chicken thigh	0.1	7	46.67	4	26.67
Plant (C):					
Chicken breast	0.1	4	26.67	1	6.67
Chicken thigh	0.1	7	46.67	3	20.00

* Egyptian Organization of Standardization "EOS" (2005)

4. Discussion

Residues in meat form a great problem facing the food hygienists in the recent time. Heavy metals have been considered as dangerous substances causing serious health hazard to human and other living organisms, through progressive irreversible accumulation in their bodies (15).

it is evident from the results recorded in table (1) that the concentration (mg/kg) of lead in the examined samples of chicken breast were 0.04 to 0.28 with an average of 0.16 ± 0.01 for plant A, 0.03 to 0.23 with an average of 0.10 ± 0.01 for plant B and 0.01 to 0.16 with an average 0.07 ± 0.01 for plant C. while the mean values of lead levels in the examined thigh samples were 0.27 ± 0.02, 0.18 ± 0.01 and 0.11 ± 0.01 for plant A, B and C, respectively.

Results achieved in table (2) declared that the difference associated with the examined chicken meat samples were highly significant (P<0.01) as a result of chicken cuts, Also, the processing plants differences were highly significant (P<0.01) effect on lead levels. However, the interaction between chicken cuts and processing plants were not significant.

Acceptability of the examined samples of chicken breast and thigh based on their levels of lead is shown in table (3). (5) stipulated that the permissible limit of lead in chicken meat was 0.1 mg/kg. therefore, the unaccepted samples of breast and thigh were 26.67% & 40% for plant A, 13.33% & 26.67% for plant B and 6.67% & 20% for plant C, respectively.

From the obtained results we can detect that the lowest contaminated plant is C followed by plant B then plan C, (highly contaminated

plant). These results nearly similar to the results obtained by (1). While higher results were reported by (8). In addition, lower results obtained by (6). The present study allows confirming the bad hazards of heavy metals (Lead) residues on human health; the concerned authorities must take extra efforts toward avoiding heavy metals contamination.

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قياس متبقيات الرصاص السامة في لحوم الدواجن

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الملخص العربي

أجريت الدراسة لمعرفة مدي تواجد متبقيات الرصاص في لحوم الدواجن من عينات الصدور والأوراك حيث تم جمعها من ثلاثة مصانع مختلفة A و B و C في محافظة القليوبية فكل مصنع منهم تم تمثيله بعدد (15) عينة من الصدور و (15) عينة من الأوراك وتم استخدام جهاز الإسبكتروفيتوميتر لتحليل هذه العينات. وقد كشفت النتائج أن متوسط قيم الرصاص (مجم/كجم) في العينات كالتالي 0.16 ± 0.01، 10 ± 0.01، 0.07 ± 0.01 في عينات الصدور وكانت 0.27 ± 0.02، 0.18 ±0.01، 0.11 ± 0.01 في عينات الصدور في مصنع A ثم B ثم C على الترتيب وقد كانت نسبة العينات الغير مقبولة في الصدور هي 26.67%، 13.33%، 6.67% وفي الأوراك هي 40%، 26.67%، 20%، لمصنع A، B، C على الترتيب. كما اهتمت الدراسة ببيان الأهمية الصحية لوجود متبقيات الرصاص في لحوم الدواجن ومدي تأثيرها على صحة الإنسان مع وضع بعض التوصيات اللازمة للسيطرة على هذه المتبقيات السامة.

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