



Research article

Detection of some heavy metals in poultry meats from some sources of meat and poultry rations

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Abstract

The present study performed to detect the concentration of the toxic heavy metals (lead Pb, cadmium Cd, arsenic as and mercury Hg) in meat and rations of broiler chickens, and their effect on animals and human public health. Seventy samples were collected 40 samples of broiler chickens highly demined by the consumers in Al-Diwaniyah markets, these samples included: 10 samples of each of the Brazilian frozen chicken (Al-kafeel), Turkish frozen chicken (Barakat Al-kadhimian), Iranian frozen chicken (Al-mahdi) and broiler chicken from local breeding, also 30 samples from the poultry final rations highly bought by breeder of chicken in the province which include 10 samples from each of the Al-kadra, Al-waha ratios and ratio which locally manufactured in the Al-Diwaniyah factory. The thighs and breast muscles of the chicken samples were then separated from the chicken body, while the edible offal (liver and gizzard) for these samples collected from same sources. Atomic absorption spectrophotometer (England origin) used to estimate the heavy metals residues. The results showed a significant variances ($p \leq 0.05$) for comparative means in the concentrations of the studied heavy metals (Pb, Cd, As and Hg) among examined organs and muscles, generally, the highest concentration were detected in the liver followed by gizzard, then thigh muscle and breast muscle in all examined samples, though, the concentrations stay under permissible standardization limits which recorded by WHO/FAO, European, Gulf Standardization Organization (GSO) and Egyptian organization for standardization and quality control (EOS). In the ratios, the highest concentrations recorded were in locally manufactured ratio followed by Al-Kadra, then Al-Waha ratio, the means also remained under standardization permissible limits allowed by the National research council (NRC) to mineral tolerance in animals feed.

Key words: Al-Diwaniyah, Heavy metals, Poultry ratios, Meat.

Introduction

Poultry meat and products play an important role as protein source in the world, specifically in developing countries. The risk of antibacterial agents residues used in poultry breeding received more attention than toxicity with heavy metal residues, which have a bioaccumulation properties in animal's body affecting the functions of body organs, and resulting in many diseases (1, 2). The heavy metals residues reach the organs of chickens body from feeding on crops growing in a soil watered from artesian wells water or drinking water contaminated with heavy metals, also from agricultural

fertilizers and pesticides (3). Although trace elements (Fe, Cu, Zn and Mn.) play an important role in biological body functions, however, an adverse effect on body organs may also result from exposure to high levels of these elements. On the other hand, a consumption of ratio and drinking water contaminated with heavy metals, especially Pb, Cd, As are toxic even in trace amounts as classified by the European Union for hazardous metals (4). It was necessary from health institutions to set standardization limits to determinant permissible and non-permissible levels of these metals in food



intake (4). Environmental pollution with heavy metals is very dangerous as the contaminants are not biodegradable or breakable (5). Some studies suggested that high rates of Pb in poultry organs lead to clear immunosuppressant, as well as weakness in growth, loss of weight and low consumption of ratio. There are many diseases caused by lead toxicity in children as encephalopathy that characterized by irritability, convulsions, ataxia and altered of consciousness also in adult toxicity of lead cause neuropathy (6). Cd naturally occur in earth crust from volcanic emissions and reach concentration on the earth crust 0.1 mg/kg other sources for this element factory waste ,sludge, sewage and fertilizers, its toxicity symptoms in birds characterized by respiratory disturbances and gizzard attribute and nephropathy, uremia, decrease glomerular filtration rate and signs in human as hypertension hepatonecrosis, lung necrosis, osteoporosis and osteomalasia (Itia-Itia disease) (7, 3). Spread of As in environment as As₂O₃ in major percentage in earth crust reach to animals and humans tissues by contaminated food planting in highly concentrated contamination, the health originations regarded the As toxicity as a predisposing factor for cancer generation (carcinogenic) (8,4). There are two form of Hg (organic and inorganic), organic form converted to toxic inorganic form by spread of microflora in environment (9,4). Toxicity of Hg lead to associate with essential body enzyme stimulants and leads to inhibition of vital functional processes (5). The current study was designed to detect the concentrations of toxic heavy metals in the meat of broilers (liver, gizzard, thigh and breast muscles) as well as in some types of broiler ratios in Al-Diwaniyah city and

compared with Arabian and global permissible limits recorded Iraqi standardization for these metals.

Material and Methods

Ethical approval

The Animal Ethical Committee of Veterinary Medicine College, University of Al-Qadisiyah, Iraq, has approved the present study under permission No: 131

Seventy samples collected involved 40 samples of the most consumed chicken meat in AL-Diwaniyah province markets 10 samples of frozen Brazilian chicken (Al-kafeel), 10 Turkish frozen chicken (Barakat Al-kadhimian), 10 frozen Iranian chicken (Al-mahdi) and chicken breeding in the fields of Al-Diwaniyah city center. Chicken cutting to the thigh and breast muscles and edible offal (liver and gizzard) collected from same source, also collected 30 samples final ratios which included 10 samples of Al-khdara, 10 Al-waha and 10 ration manufactured by locally factory. The samples digested to prepared as clear solution to measure by the Atomic absorption spectrophotometer (England origin) which depend on changing the metals from atoms to ionic form by flam till to measuring with light from lumps for each metal, prepared samples with wet digestion by using 10 ml of nitric acid and 5 ml of boric acid were used to 1 gm of the well-granted sample for 24 hours until we obtained a clear solution complete with demonized water till measurement, standard solutions presented at 10 ppm, 20 ppm and 30 ppm for Pb, Cd and As to calibration of apparatus the wavelength of each metal as determined by the device, estimation Hg measured with cold evaporation method (10,11,12).

Table (1) Arabian and global permissible limits of heavy metals (4, 5, 13, 14, 15).

Samples/metals	Permissible limit	Pb	Cd	As	Hg
Chicken meat Ppm	Arabian	0.02-1	0.01-1	0.1-1	0.01-0.5
	World organization	0.2	0.5	0.05	0.1
Chicken ratio mg/kg	World organization	10	10	30	1



Statistical analysis

Data analyzed by Statistical Package for the Social Sciences (SPSS) program (version

21) with one way ANOVA probability ($p < 0.05$) to determine of significant variances among means (16).

Results

From Table (2) it is revealed that concentrations of the Pb remained within the limits allowed by WHO/FAO and Arabian limits, but the highest concentration recorded in the liver followed by the muscle of the thigh and then the breast muscle. Cd concentrations recorded the highest rates in frozen and Turkish chickens, followed by the Brazilian and Iranian origin Table (3) stays under permissible standardization limit with significant variances in concentrations among examined parts. The concentration of as recorded significant variances ($p < 0.05$) among examines organs where the highest rates in the local meat and Turkish origin followed by the Iranian and Brazilian meat established and remained within the

standardization of permissible limits. Table (4) concentration of Hg in examined sample recorded significant variances in liver and gizzard then in thigh and breast muscles while concentration of this metal stay under standardization permissible limit. This showed in table (5). From table (6) showed concentration of heavy metals in poultry rations samples recorded a significant increases ($p < 0.05$) in concentrations of Pb in locally made ratio while Cd recorded a significant increase ($p < 0.05$) in Al-khdra ratio. While As concentration recorded significances ($p < 0.05$) in locally manufactured ratio, all concentration remained within standardization permissible limits allowed by NRC.

Table (2): Pb concentration ppm in examined parts of broiler chickens (mean \pm SE)

Parts Samples	Liver	Thigh	Breast	Gizzard	Mean
Brazilian frozen chicken (Al-kafeel)	0.397 \pm 0.034 Bb	0.201 \pm 0.029 Ba	0.147 \pm 0.015 Bb	0.280 \pm 0.012 Ba	0.256
Turkish frozen chicken (Barakat Al-kadmian)	0.566 \pm 0.022 Aa	0.305 \pm 0.065 Ab	0.260 \pm 0.012 Ac	0.390 \pm 0.011 Ab	0.380
Iranian frozen chicken (Al-Mahdi)	0.418 \pm 0.023 Ba	0.199 \pm 0.015 Bb	0.177 \pm 0.031 Ba	0.266 \pm 0.019 Ba	0.265
Locally breeding fresh chicken	0.619 \pm 0.015 Aa	0.273 \pm 0.009 Ab	0.247 \pm 0.011 Ab	0.381 \pm 0.023 Aa	0.380
Mean	0.5	0.244	0.207	0.329	

Capital letters pointed to significances ($p < 0.05$) in columns
Small letters pointed to significances ($p < 0.05$) in rows

Table (3) Cd concentration ppm in examined parts of broiler chickens (mean \pm SE)

Parts Samples	Liver	Thigh	Breast	Gizzard	Mean
Brazilian frozen chicken (Al-kafeel)	0.061 \pm 0.015 Ba	0.037 \pm 0.008 Bb	0.043 \pm 0.006 Bc	0.035 \pm 0.011 Bb	0.053
Turkish frozen chicken (Barakat Al-kadhmain)	0.082 \pm 0.007 Aa	0.071 \pm 0.009 Ab	0.062 \pm 0.005 Bc	0.051 \pm 0.003 Ac	0.066
Iranian frozen chicken (Al-Mahdi)	0.068 \pm 0.002 Ba	0.048 \pm 0.0120 Bb	0.045 \pm 0.003 Bb	0.043 \pm 0.0 Bb	0.051
Locally breeding fresh chicken	0.092 \pm 0.013 Aa	0.068 \pm 0.005 Ab	0.069 \pm 0.002 Ab	0.054 \pm 0.010 Ab	0.070
Mean	0.075	0.056	0.054	0.045	

Capital letters pointed to significances ($p < 0.05$) in columns, also Small letters pointed to significances ($p < 0.05$) in rows



Table (4); As concentration ppm in examined parts of chicken (mean ± SE)

Samples / parts	Liver	Thigh	Breast	Gizzard	Mean
Brazilian frozen chicken(Al-Kafeel)	0.040 ± 0.005 Ba	0.025 ± 0.004 Bb	0.009 ± 0.001 Bc	0.035 ± 0.022 Bd	0.027
Turkish frozen chicken(Barkat Al-Kadmian)	0.051 ± 0.004 Aa	0.039 ± 0.002 Ab	0.035 ± 0.001 Ab	0.044 ± 0.003 Ac	0.042
Iranian frozen chicken(Al-Mahdi)	0.048 ± 0.009 Ba	0.022 ± 0.003 Bb	0.030 ± 0.003 Ac	0.025 ± 0.009 Bb	0.030
Locally breeding fresh chicken	0.052 ± 0.006 Aa	0.047 ± 0.002 Aa	0.039 ± 0.006 Ab	0.047 ± 0.003 Aa	0.045
Mean	0.047	0.033	0.028	0.037	

Capital letters pointed to significances (p<0.05) in columns, also small letters pointed to significances (p<0.05) in rows

Table (5) Hg concentration ppm in examined parts of chicken (mean ± SE)

Sample / parts	Liver	Thigh	Brest	Mean	Mean
Brazilian frozen chicken(Al-Kafeel)	0.351 ± 0.034 Ba	0.250 ± 0.021 Ab	0.199 ± 0.024 Bb	0.251 ± 0.041 Bb	0.262
Turkish frozen chicken(Barakat Al-Kadmian)	0.720 ± 0.042 Aa	0.291 ± 0.034 Ab	0.277 ± 0.066 Ab	0.401 ± 0.050 Ac	0.422
Iranian frozen chicken(Al-Mahdi)	0.386 ± 0.065 Ba	0.225 ± 0.094 Ab	0.183 ± 0.022 Bc	0.362 ± 0.023 Aa	0.289
Locally breeding fresh chicken	0.689 ± 0.012 Aa	0.278 ± 0.051 Ab	0.250 ± 0.019 Ab	0.396 ± 0.066 Ac	0.403
Mean	0.536	0.261	0.227	0.352	

Capital letters pointed to significances (p<0.05) in columns, also small letters pointed to significances (p<0.05) in rows

Table (6) concentration of heavy metals mg/kg in ration of broiler chickens.

Ratio / metals	Pb	Cd	As	Hg	Mean
Al-kadra	8.105 ± 0.38 B	7.985 ± 0.274 B	20.661 ± 0.106 B	0.596 ± 0.22 B	9.336
Al-waha	7.824 ± 0.54 B	6.203 ± 0.165 B	19.220 ± 0.322 B	0.750 ± 0.45 A	8.499
Locally manufactured feeds	9.151 ± 0.81 A	7.908 ± 0.531 B	27.123 ± 0.219 A	0.880 ± 0.67 A	11.265
Mean	8.360	7.365	22.334	0.742	

Capital letters pointed to significances (p<0.05) in columns

Discussion

The presence of elements in the human and animals food is naturally such as trace elements and the lack of them cause imbalance in the body functions while the heavy metals if exceeded the limits allowed experimentally by Interested in food health organization become a risk for public health(4). The result in Table (2) revealed bioaccumulative of Pb in different examined organs especially in vital organs as liver > gizzard and then muscles this same recorded by (6,11) they suggested these organs are targets for toxins included heavy metals, while the concentrations of Pb stay under standardization permissible limits which

recorded by FOA/WHO. Contamination sources by this element resulted from human activates and car and generators exhaust and human activities in large factories which cause highly air pollution with Pb in addition that bad using fertilizers then reach to crop and to animals and human tissues as mentioned by (4,10). Table (3) results showed concentration of Cd recorded highly concentrated in liver and gizzard then in muscles this agree with (18,12 and 6) whose recorded highly contamination with this metal in poultry products and gizzard the target organ for bioaccumulation of Cd also concentrations stay under standard



permissible limits (4,14,13). (6) mentioned the Main source of mercury contamination are agricultural fertilizers and unscientific use of agricultural pesticides which precipitate on agricultural crops which enter the composition of poultry rations in added to that contaminated drinking water especially from artesian wells contain normally highly concentration of metals play a role to accumulation this metals in body organs. Table (5) revealed high concentration in gizzard then liver and less than in muscles this agree with (6,11) whose refer to sources of contamination with Hg resulted from fertilizers and pesticides in agriculture also results not exceed the standard permissible limit (14,15). That result agree with (18) who recorded lowest concentration than permissible limit of Hg levels in chicken meat in Saudi Arabian compared with other metals in different organs. Contamination of ratios from different sources contaminated

with heavy metals with different concentrations with significant increases in locally industrial this result from contamination ration from environment and bad using of fertilizers but all concentration also not exceed the permissible limit which recorded by NRC 2005 this same recorded by (10) who attribute that because using crops contain different levels from heavy metals without assessment before instillation of poultry rations. In spite of the lower concentrations of heavy elements in poultry meats and ratios, we must overlook the fact that as possess a biocumulative feature in the body organs which requires routinely and periodic examination for all sources of food imported to our country (11,19,20) and its necessary to determine the standard permissible metal limits by Iraqi central organization for standardization and quality control(COSQC).

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