Assessment of some trace elements in frozen chicken livers and gizzard in Erbil local markets.

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Abstract

To evaluate the quality of local frozen chicken liver and gizzard produced in Erbil province , residue of five heavy metals :Cobalt , Copper , Arsenic , Mercury and lead in ppm were determined in 120 random samples of three different local company for producing chicken products. Fortunately all samples concentration within permissible limits allowed by Australia New Zealand Food Authority (ANZFA) , even the highest significant level which showed by Vano company (Cobalt : 1.82 ± 0.05 , Copper : 35.08 ± 3.10 , Arsenic : 1.58 ± 0.05 and lead 0.76 ± 3.87) in compression with Al-Eteemad com. and Al-Shemal com. liver samples were within international tolerance limits of traces.It's concluded that these organs safe for human consumption , we encourage the people to consume national chicken rather than imported ones.

تقييم بعض بقايا العناصر المعدنية في الاكباد والقوانص المجمدة للدجاج في الاسواق المحلية للمدينة اربيل

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الخلاصة

لتقييم نوعية الاكباد والقوانص المجمدة للدجاج المحلي المنتج في مدينة اربيل تم قياس بقايا خمسة عناصر معدنية هم : الكوبالت , النحاس , الزرنيخ , الزئبق والرصاص في ١٢٠ عينة عشوائية من انتاج ثلاثة شركات محلية لانتاج منتجات الدواجن , لحسن الحظ كانت تراكيز المعادن في جميع العينات المجموعة ضمن المديات المسموحة بها عالميا حسب مقياس Australia New Zealand Food Authority(ANZFA, 2001) , حتى التراكيز العالية التي اظهرتها شركة فانو (كوبالت : ٠,٠٥±١,٨ ,النحاس :٣٥,٠٨±٣,١٠ الزرنيخ :٠,٠٥±١,٥٨والرصاص : ٠,٧٣±٣,٨٧) بالمقارنة التراكيزالتي اظهرتها شركتي الاعتماد والشمال كانت ضمن الحدود المسموحة بها عالميا .مما يستدل على ان هذه الاعضاء امنة للاستهلاك البشري وبالتالي نشجع الناس على تناول الدجاج المحلي بدلا من المستورد.

Introduction

Liver is the most important organ involved in metabolic processes and is consider to be one of the most eloquent witnesses of any disturbance in the body as it's the subject of different types of etiologic attacks : infection , toxic , metabolic and nutrition traumatic. (Doneley , 2004) complete and balanced diets are necessary for human health .Heavy metals can enter food chain during consumption of broiler meat , there are many studies carried out to detect accumulation of heavy metals chicken meat (Khan and Meijer , 2005) assessed the risk of polluted and excessive amount of various ingredients used in animal feed. After prolonged evaluation studies on food additives and their toxicity , the World Health Organization (WHO) has come to the conclusion that even low levels of some metals such as lead and cadmium can cause disease in

human.(WHO,2001, WHO,2000) According to the Duruibe et al (2007) , some heavy metal ions that are known to be potentially toxic include aluminum , arsenic , cadmium and lead also essential metals such as iron , manganese , copper , zinc , selenium , nickel and cobalt. Heavy metals are dangerous because they are bioaccumolate in living tissues and decrease or even block the intracellular biochemical processes.The absorption , accumulation and toxicity of each heavy metal are affected by divers factors including interaction with other metals , both essential and toxic hence interactions between toxic and essential metals are central to mineral balance and the antioxidant defense system in mammals and birds (Lopez-Alonso et al , 2007, Pappas et al , 2010) .The risk association with the exposure to heavy metals present in food stuffs represent a concern problem in human health .For this reason we try in our present study to provide information about concentration and distribution of cobalt (co) , copper (cu) , arsenic (as) , mercury (Hg) and lead (pb) in frozen chicken liver and gizzard of three different local companies for production of poultry products since these parts consumed in high level by Erbil city people as source of protein .

Materials and methods

1. Samples collection

One hundred and twenty random samples of chicken frozen liver and gizzard were collected (60 samples for each organ) from three different local production companies of poultry products named Al-Etemad co. , Al-Shemal co. and Vano co. present in Erbil city by (20) samples for each organ for each company. The samples after collection from local market taken to the laboratory , then weight about 10 gram from each sample and put in to oven for 48 hours at 60º to be dry. After powdering the dry samples by using a mortar, five grams were weighted for detection of trace elements.

2. Samples analysis for trace elements

The residue of cobalt, copper, arsenic, mercury and lead were determined using X-ray fluorescence spectrometer (XRF). The equipments were used a brand Skyray9000, portable XRF device, whose measurement period was 100 sec in case of the investigated samples. The X-ray fluorescence spectrometry as an instrumental analytical method is able to determine elemental composition of solid and fluid samples from minimal prepared sample size, additionally this method can be used for direct analysis of solid and liquid materials as well. In the course of the process, the sample is shot by the X-ray thus the atoms within the sample got into excited position so typical characteristic radiation for particular elements is emitted. Energy (wavelength) of these characteristic radiations changes element by element and this fact is considered as the bottom line of the qualitative element analysis. The intensity of characteristic radiation of the element is commeasurable to its concentration which permits of the qualitative analysis.

3.Statical analysis of samples

Data were analyzed statically using the ready statical program SAS(2002-2003) statical analysis system to study means of trace elements residues in chicken organs: frozen liver and frozen gizzard of three different local company in Erbil city/Kurdistan region , following by Duncan(1955) multiple range test $p \leq 0.05$ was used to compare the differences between the treatments.

Results

Results achieved in table1 revealed that the concentration of trace elements in the collected liver samples record highest level in Vano com. pany which were as follow cobalt:1.82 ± 0.05 , copper:35.08 ± 3.10 , Arsenic:1.58 ± 0.05 , lead:0.76 ± 3.87 , while Al-Shemal com. levels cobalt:1.7 ± 0.02 , copper:28.86 ±2.75 , Arsenic:1.45 ± 0.04 , lead:0.74 ±3.94) then Al-Eteemad com. cobalt:1.68 ±.0.02 ,copper: 18.98 ± 2.42 ,Arsenic: 1.42 ± 0.05,lead:0.73 ± 3.19. On the other hand, it was appear that mercury recorded the same level in all samples of the three different companies (0.02±0.00). Table 2 showed that the highest level of trace elements in gizzard samplesin Al- Shemal company were as follow: cobalt:1.77±0.02 , copper: 10.44±1.26, Arsenic: 1.65±0.04 , mercury:0.03 ± 0.00 , lead 60.05±2.72 compared with the result of Al-Eteemad com which were cobalt : 1.60 ± 0.04 , copper: 7.98 ± 0.74 , Arsenic: 1.57 ± 0.05 , mercury: 0.02 ± 0.01 and lead: 0.53 ± 2.71 respectively and with the results of Vano com. cobalt:1.60 ± 0.04, copper: 9.53 ± 1.06 , Arsenic: 1.64 ± 0.04 , mercury: 0.02 ± 0.00 and lead: 0.55 ± 2.95consecutively ,surprisingly all samples concentration of trace elements lower than permissible limits.Table 1 concentration of some trace elements (ppm) in frozen chicken liver for different companies

Element name	Al-Eteemad company	Al-Shemal company	Vano company	IPL
Cobalt	1.68 ± 0.02 b	1.7 ± 0.02 b	1.82 ± 0.05 a	-
Copper	18.98 ± 2.42 b	28.86 ± 2.75 a	35.08 ± 3.10 a	200
Arsenic	1.42 ± 0.05 b	1.45 ± 0.04 b	1.58± 0.05 a	2
Mercury	0.02 ± 0.00 a	0.02 ± 0.00 a	0.02 ± 0.00 a	0.5
Lead	0.073 ± 3.19 a	0.74 ± 3.94 a	0.76 ± 3.87 a	1

bearing different letters are significantly different (p≤0.05)between rows ,ILP: international permissible limits Table 2 concentration of some trace elements(ppm) in frozen chicken gizzard for different companies

Element name	Al-Eteemad compan	Al-Shemal company	Vano company	ILP
cobalt	1.60 ± 0.04 b	1.77 ± 0.02 a	1.60 ± 0.04 b	-
copper	7.98 ± 0.74 a	10.44 ± 1.26 a	9.53 ± 1.06 a	200
Arsenic	1.57 ± 0.05 a	1.65 ± 0.04 a	1.64 ± 0.04 a	2
Mercury	0.02 ± 0.01 a	0.03 ± 0.00 a	0.02 ± 0.00 a	0.5
Lead	0.53 ± 2.71 a	0.60 ± 2.72 a	0.55 ± 2.95 a	1

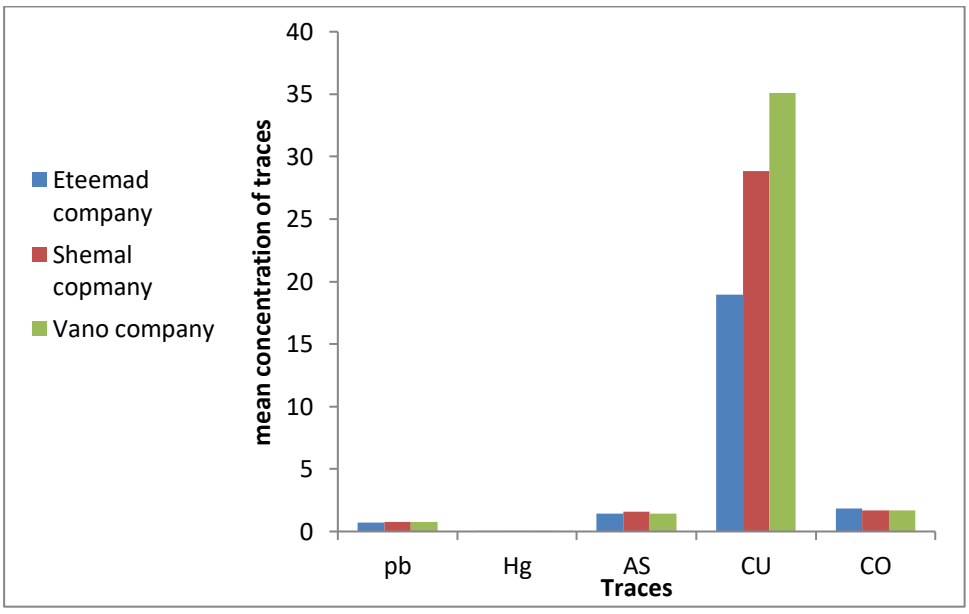
bearing different letters are significantly different (p≤0.05)between rows , IPL :international permissible limits

Discussion

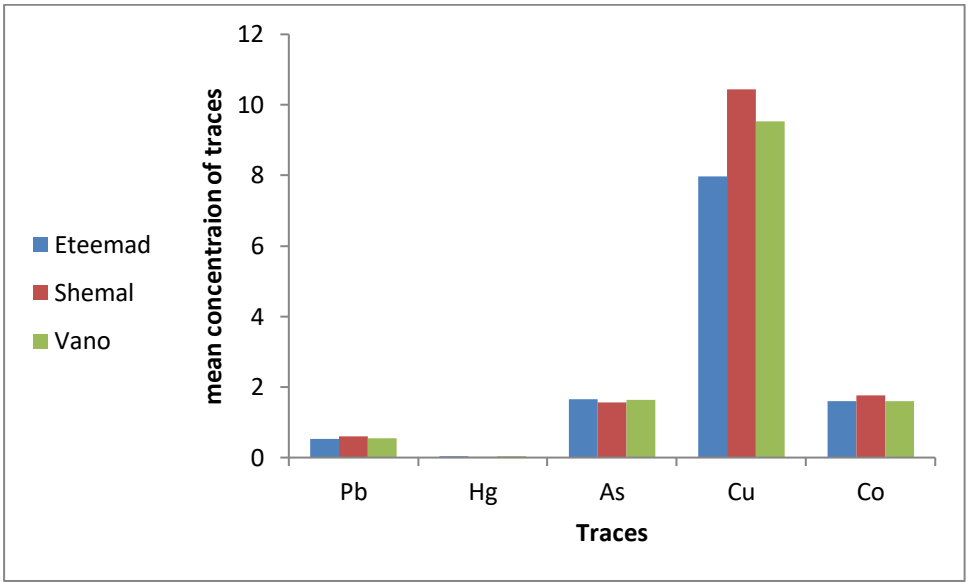
Today , the environment pollution by heavy metals is consider as one of the most serious problems in the world over the last few decades. Emission of heavy metals to the environment occur via a wide range of pathway including air , water and soil .(Jarup , 2004) with respect to human impact , Copper , Arsenic , Mercury and Lead are primary concern because of their toxicity to human being (Levensen and Barnard , 1988).

Because chicken meat constitutes an excellent source of high quality animal protein for feeding infant , young , children and adults due to its ease of cooking , serving and low cost , it fits well in to the menu of food service (Zhang et al , 2001) .

In present study we care about the residue of some trace elements in internal organ of chicken: frozen liver and gizzard of three different local companies for production of chicken products located in Erbil city, where people prefer consumption of these organs at high rate as a source of animal protein. In graph No. 1 note that traces of Cobalt record highest concentration in liver samples of Vano com.(1.82±0.05) as appear in graph No. 1 which differed significantly ($p \leq 0.05$) from Al-Shemal com. and Al-Eteemad com. Livers , while the same traces appear highly significant in Al-Shemal com. When compared with other two companies as appear in graph No. 2, this may belong to level of trace elements in feed which fed to chicken during rearing period in the farm. Cobalt is beneficial for human because it's considered as part of vitamin B_{12} which is essential for human health and used to treat anemia in pregnant women because it stimulates the production of red blood cell. The total daily intake of cobalt may be as much as 1 mg, however high concentration of cobalt may damage human health , when breath in a high concentration though air we experiences lung effect such as asthma and pneumonia. Trace copper is essential substances to human life as it's involved in absorption , storage and metabolism of iron but in high doses it can cause anemia , liver and kidney damage and stomach and intestinal irritation. The concentration of copper obtained in the present study showed positive value and found to be in lower concentration than permissible limit(200 ppm; ANZFA,2001) even Vano company liver samples elevate high level (35.08 ± 3.10)in which significantly differ than other two companies ,appear to be under permissible limit[graph No.1]. The same results obtained by gizzard samples of the three companies[graph No.2] ,this findings agree with results detected by Abduljaleel et al(2012)



Graph (1) concentration means of some trace elements in liver samples for three poultry product production companies



Graph (2) concentration means of some trace elements in gizzard samples for three poultry product production companies Arsenic is a steel gray metal , it occur naturally in the environment. It cannot destroyed or eradicated ,it's possible to exposed to it through air , water and soil contact. One of the major mechanism by which it exerts it's toxic effect is through an impairment of cellular respiration by inhibition of various mitochondrial enzymes and the un coupling of oxidative phosphorylation (Partula and Tchounwou ,2005). This study didn't show any positive value. All concentration in both organs within permissible level 2 ppm according to(ANZFA 2001), even the highest level in liver seen by Vano com. (1.58 ± 0.05) and concentration elevated by AL-Shemal com. (1.65 ± 0.04) for gizzard samples which differ significantly ($p \leq 0.05$) from other companies. This may belong to lower Arsenic level in water drank by chicken in rearing period since water one of the important sources of trace accumulation in side organs and tissues of chicken. Most studies showed that residues of Arsenic ,Cadmium , lead and mercury are the most frequent heavy metals to be determine in poultry liver. Mercury is a widespread and is among the most highly bio concentrated trace metals in human food chain , mercury is a constant component of municipal sewage , which may be used as soil conditioner and agriculture fertilizer which creates a serious damage of introducing this heavy metal in to food products and feeds for farm animals (Zarski et al. , 2003 ; Tuzen et al . , 2009).As seen in graph No. 1 and 2, the concentration of this trace elements appear within permissible limit 0.5 ppm according to (ANZFA 2001; European Union Regulation [EC] No. 1881/2006) in all tested samples.

The consumption of polluted food is the main source of lead and cadmium intake in the non-smoking population (Ciobanu et al. ,2012).Lead is abundant in the environment from different sources include gasoline piston engines , oil burner , lead pipes , incinerators , industrial effluents and smokestack fallout(Sharma and Street , 1995).In humans lead affect different systems and cause neurological symptoms which can range from fatigue , headache and lethargy to peripheral neuropathy , sever convulsion , encephalopathy and even coma.(Ciobanu et al. ,2012).

In poultry , Eco toxicological researches regarding lead accumulation have been focused on the liver and kidney because their key role in the detoxification processes(Kalsinska and Salickiw , 2010).Broiler chickens are vulnerable to lead intoxication , 1 ppm in diet can cause

significant growth suppression in chicken and consistent decline in blood D-amino levulinic acid dehydrates , an erythrocyte enzyme sensitive to lead .(Bakalli et al. , 1995) Because people have great tendency to consume frozen or even fresh liver and gizzard as source of protein , it's best for our knowledge to know the concentration of lead in these organs which produced by local poultry companies present in out province , likely all samples exhibit lower level of the trace than permissible limit(1 ppm) according to (ANZFA 2001) and other international standard , even the highest lead concentration record by Vano com. liver samples under tolerance limit. This mean that these organs are safe for human consumption and Pb pollutant of environment under control despite the great number of existing factories in the region as a result of industrial development.

Conclusion

Although it is known that people ingest heavy metals from water and animal products, the concentrations obtained in this study showed that this intake from liver and gizzard is most probably very low and it can be considered that there is no risk for human health linked to the consumption of poultry organs. Poultry liver is considered to be an important source of nutrients, such as vitamins, macro elements and microelements, and in some countries, it is used in pregnant women diet and in nutritional disorders and so, a careful monitoring of contaminants must be done.

References

1. **Abduljaleel SA, M. Shuhaimi-Othman, Abdulsalam B (2012).**Assessment of trace metals content in chicken (*Gallus gallus* domesticus) and Quail (*Coturnix coturnix* japonica) Tissues FromSelangor (Malaysia). *J. Environ. Sci. Technol.* 5: 441-451.
2. **ANZFA, 2001.Australia New Zealand Food authority. Wellington , New Zealand 6036.**
3. **Bakalli RI , Pesti GM , Ragland WL(1995) .** The magnitude of lead toxicity in broiler chickens. Vet Hum Toxicol ; 37: 15-9.
4. **Ciobanu C, Slencu BG , Cuciureanu R.(2012**).Estimation of dietary intake of cadmium and lead through food consumption .Rev Med Chir Soc Med Nat Iasi ; 116: 617-23.
5. **Donneley B.(2004).**Treating liver diseases in the avian patient. Seminars in avian and exotic pet medicine ; 13:8-15.
6. **Duruibe , J.O. , M.O.C.Ogwuegbu and J.N.Egwurugwu .(2007**).Heavy metal pollution and human biotoxic effects . Int.J.Phys.Sci. ; 2:112-118.
7. Duncan DB (1955). Multiple range and Multiple F ted. *Biometric*. 11: 1-
8. **.European Commission.(2006**).Council Regulation (EC)N˚.1881/2006 of 20/12/2006 setting maximum levels for certain contaminant in food stuffs .Off.J.Eur.Union , 34-38 (L364/5,20.12.2006).
9. **Jarup , L.(2004).**Hazards of heavy metal contamination. British Medical Bulletin , 68:167-182.
10. **Kalsinska E , Salicki W. (2010).**Lead and Cadmium level in muscle , liver and kidney of scaup aythya marila from
11. Szczecin lagoon .Poland . Polish J.Environ Stud ; 19:1213-22.
12. **Khan , C.A. and G.A.L. Meijer , (2005).**The risk of contamination of food with toxic substances present in animal feed. Anim. Feed Sci .Tech ,133:84-108.

13. **Levensen , H. , Barnard W. (1988).**Wastes in marine born pathogens plant considerations . Poultry Meat Processing . Chapter 9 . ISBH 0-8493-0120-3 CRC Press LLC , New Yourk , USA.

14. **Lopez. Alons M . , Miranda M. ,Castilo C., Hernandez J. , Garcia-Vaquero M. , Bendito JL.(2007).**Toxic and essential metallic in liver , kidney and muscle of pigs at slaughter house in Galicia , north west Spain .Food Addit. Contam. 24:943-954.
15. **Partolla A. K. ,Tchounwou P. B.(2005**). "Serum acetyl cholinesterase as a biomarker of arsenic included neurotoxicity in Sprague dawley rats" , International Journal of Environmental Research and Public Health , 2(1) pp.80-3.
16. **Pappas AC , Zaidis E , Fegeros K , Surai PF , Zervas G. (2010).** Relation of cadmium to other elements and antioxidant system in : Parvau PG , editor. Cadmium in the Environment. New York . Nova Science Publishers .pp.263-295.
17. **Sharma RP, Street JC.(1995).** Public health aspects of toxic heavy
18. **metals in animal feeds. J Am Vet Med Assoc. ; 177:149–53.Statistical Analysis System (SAS) (2002-2003).** User's guide for person computer. Release V.9.1 SAS Institute Inc. Cary, NC, USA.
19. **Tuzen , M. , Sari , A. , Mendil , D. Soylak , M. (2009).** Biosorptive removal of mercury (II) from aqueous solution using lichen (Xanthoparmelia conspersa) biomass : Kinetic and equilibrium studies . J. Hazar . Mater.169:263-270.
20. **World Health Organization (WHO)2000**. Lead In : safety evaluation of certain food additives and contaminants .Fifty third meeting of the joint FAO/WHO Expert Committee on Food Additives (JECFA). Food Additive Series. 44:273-312.
21. **World Health Organization (WHO)2001**.Cadmium In : safety evaluation of certain food additives and contamination .55th meeting of the Jion FAO/WHO Expert Committee on Food Additives(JECFA). Geneva : WHO Food Additives Series . 46:247-305.
22. **Zarski , T.P., Arkuszewska , E. , Samek ,M., Majdecka , T.(2003**). The evaluation of dexoticating sulphonic acid [Mesna] in experimental mercury poisoning in chicken .J . Pol. Agric. Univ. 6 : 06-08.
23. **Zhang , L., Davis , M.A.Conner , D.E.(2001).**Poultry borne pathogenesis : plant consideration .Poultry Meat Processing . Chapter 9. ISBH 0-8493-0120-3 CRC Press LLC , New York , USA.