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RESEARCH ARTICLE

DETERMINE OF HEAVY METALS IN THE HEART, KIDNEY AND MEAT OF BEEF, MUTTON AND CHICKEN FROM BAQUBA AND HOWAYDIR MARKET IN BAQUBA, DIYALA PROVINCE, IRAQ

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ABSTRACT

This study was to determine the concentrations of heavy metals (Cu, Fe, Cd, Ni and Pb) in heart, kidney and meat of beef (cow), mutton (sheep), and chicken, from Baquba and Howaydir Market in Baquba, Diyala province, Iraq by using Aurrora Analyst 2003Atomic Absorption Spectroscopy (AAS). The levels of heavy metals in the heart, kidney and meat of beef, mutton and chicken ranged from 0.0053 ppm to 0.7892 ppm Cr; 2.1099 to 7.2834 ppm Fe; 0.0579 to 0.6801 ppm Cd; 0.12243 to 1.4750 ppm Ni; 2.2686 to 5.7260 ppm Pb. Generally, meat was found to have the highest significant levels of metals and the heart and kidneys lowest levels. When we compared our result concentration of heavy metals in our samples (beef, mutton and chicken), there showed a significant differences. The result also showed that the concentration of Pb, Cd and Cr exceeded the permissible limits set by WHO/FAO and ANZFA. The concentrations of Fe and Ni in all samples were within the tolerance limits.

INTRODUCTION

Heavy metals are metals that have density five times more than water density. These metals are permanent which mean they are not consumed by human body through the food chain. The most effect heavy metals are Lead, Mercury, Arsenic, Cadmium, and Aluminum, on human healthiness. These metals get into human body by many manner, such as smiling, eating, and can be absorbed by skin. These metals have no beneficial effect to our body, however, they are directly physiological toxic effects at lower level to the body. Heavy metals incorporate or store in living tissues (Baykov *et al*., 1996). A results of study, which is done by John and Jeanne (1994), showed that arsenic, cadmium, mercury, and lead levels are above the permissible level and very high in numerous tissues of goats. Lead is Neurotoxin and metabolic poison which can bind to vital enzymes and some other cellular components (Cunningham and Saigo, 1997). Lead toxic effects' can be seen on nervous, haemopoietic, renal systems, and gastrointinal (Baykov *et al*., 1996). Cadmium can be found in food which is considered as the principle environmental sources for it (Baykov *et al*., 1996). Concentration of Cadmium turn out to be more and more as moving via food chain, concentration increases by a factor of approximately, 50 to 60 times, as it approaches the carnivores (Daniel and Edward, 1995).Cadmium has toxic effects of such as kidney dysfunction, hypertension, hepatic injury and lung damage (John and Jeanne, 1994). Nowadays, there is widespread concern about human health form risk of heavy metals that present in food product. Processing technology in the food production increase the probabilities of pollution the food with heavy metals. Eating of polluted food by animals give rise to precipitation of deposit in meat. A study show that higher levels of metals have been indicated in mutton and beef, as cattle graze on contaminated soil (Sabir *et al*., 2003). Level of lead and cadmium was reported by Gonzalez-Waller *et al*. (2006), in meat product higher than recommended limits. Meat is considered as the convenient and richest source of nutrients. Where, meat chemical composition depends on feeding animal, as the kind and degree of chemical element. The necessity of inorganic compounds determine by physiological state, feed intake, living condition as well as age (Baykov *et al*., 1996).Since the pollution with heavy metals are toxicity, biomagnification, and bioaccumulation in the food chain, it is a serious hazard (Demirezen and Uruc, 2006). Kostial, in 1986, has described the toxic effects of metals in animals which was under relatively low levels of metals exposure, the disruption of trace element metabolism is one of the earliest effects (Goyer, 1997; Lo'pez-Alonso *et al*., 2002).In addition, meat contamination with heavy metals is concern for both human health and food safety since these metals at relatively minute concentrations are natural toxicity (Santhi*et al*., 2008;

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Mahaffey, 1977). In Iraq, people are commonly consumed chicken meat, the heart, kidney and meat of beef and sheep since they are a major source of protein. The drinking water and poultry feed are main source metals in chicken meat. Meat is a very important element of food because it is contain essential protein, fat and some critical elements. Moreover, it is necessary for growth and maintenance of good health. The main reason of animal contamination with heavy metals are industrial west, direct sewage water and dirty butchery places (Akan *et al*., 2010). This study is carried out to determine the levels of heavy metals in different organs (heart, Kidneys and meat)of beef, mutton and chicken obtained from Baquba and Howaydir Market in Baquba, Diyala province, Iraq.

MATERIAL AND METHODS

Sample collection: Fresh samples of liver, Kidneys and meat of beef (cow), mutton (sheep) andchicken were collected from the Baquba and Howaydir Market in Baquba, Diyala province, Iraq. The samples were collected in polyethylene bags and transported to the laboratory for analysis. The study was carried out between the periods of January 2015 to March, 2015.

Sample preparation: The collected samples were decomposed by wet digestion method for the determination of various metals. A known quantity, 10 g of each sample (heart, kidney and meat) was introduced into the digestion flask. 20 mL of sulphuricacid was added into it. The digestion flask was heated for 30 min. After the flocculation was settled, the flask was heated on high flame. After digestion, hydrogen peroxide was added drop wise until a clear solution was obtained. The content of the flask was filtered into a 50 mL volumetric flash and made up to the mark with distilled water.

Elemental analysis of samples: Determination of Cu, Fe, Cd, Ni and Pb in meat, heart and kidney samples of beef (cow), mutton (sheep) and chicken were made directly on each of the finalsolutions using AurroraAnalyst 2003 Atomic Absorption Spectroscopy (AAS).

RESULTS AND DISCUSSION

The concentrations of heavy metals in the heart ofbeef, mutton, and chicken are presented in Table 1. Cu levels ranged between 0.0053 and 0.7892ppm; 3.3212 and 5.3864ppmFe;0.0817 and 0.4082 ppm Cd; 0.2134 and 0.6174 ppm Ni; 2.5877and 3.7985 Pb. The level of heavy metals in the kidney of beef, mutton, and chicken is as presented in Table 2. Cu concentrations range from0.1739 to 0.3638ppm; 4.5484 to 7.2834ppm Fe; 0.1324 to 0.5429 ppm Cd; 0.12243 to 0.8794 ppm Ni; 2.8726 to 5.3580ppm Pb.

Table 1 Concentrations of heavy metals in heart of Beef, Mutton, and Chicken from Howaydir Market in Baquba, Diyala province, Iraq. Concentrations (ppm)

Samples	Cu	Fe	Cd	Ni	Pb
Beef	0.7892	5.3615	0.4082	0.6174	3.7985
Mutton	No.d	3.3212	0.0817	0.2134	2.5877
Chicken	0.0053	5.3864	0.0953	0.2770	2.6155

The levels of heavy metals in the meat of beef, mutton,and chicken are as presented in Table3. Cupper concentrations range from 0.0368 to 0.3340ppm; 2.1099to 5.5537ppm Fe; 0.0953to 0.6801ppm Cd; 0.2975 to 1.4750ppm Ni; 0.0953 to 0.6801ppm Pb.

Table 2 Concentrations of heavy metals in kidney of Beef, Mutton, and Chicken Baquba and Howaydir Market in Baquba, Diyala province, Iraq.Concentrations (ppm)

Samples	Cu	Fe	Cd	Ni	Pb
Beef	0.1739	6.5960	0.5429	0.8794	4.6176
Mutton	0.3638	7.2834	0.4654	0.12243	5.3580
Chicken	No.d	4.5484	0.1324	0.3758	2.8726

Table 3 Concentrations of heavy metals in meat of Beef, Mutton, and Chicken Baquba and Howaydir Market in Baquba, Diyala province, Iraq. Concentrations (ppm)

Samples	Cu	Fe	Cd	Ni	Pb
Beef	No.d	2.5417	0.2314	0.2975	0.2314
Mutton	0.0368	5.5537	0.6801	1.4750	0.6801
Chicken	0.3340	2.1099	0.0953	0.4146	0.0953

The concentrations of Cupper (Cu) were observed in the heart, kidney and meat of beef, mutton and chicken are as presented in Table 1, 2 and Table 3. The highest concentration of Cu was found in the heart of beef (0.7892ppm) and the lowest level was observed in kidney of chicken (0.0053ppm).Copper plays a key role in human health since it is critical component of different enzyme, bone formation and the integrity of the connective tissues. However, it can lead to health problems for example kidney and liver damage when its level became high in human body (ATSDR, 2004). High concentrations of copper as well can be very risk for public health (Brito *et al*., 2005).Johnson, 1993, was reported that 10-30 mg of orally consumed copper from foods deposited in copper vessels and could cause headaches, intestinal discomfort, and dizziness. Whereas, surplus gathering of copper in liver can consequence cirrhosis or hepatitis or a hemolytic crisis like that seen in acute copper poisoning.

The concentrations of Iron (Fe) were observed in the heart, kidney and meat of beef, mutton and chicken are as presented in Table 1, 2 and Table 3. The results indicate that the kidney of mutton (7.2834 ppm) contained the highest concentration of Fe, followed by beef's kidney (6.5960 ppm), while mutton's meat (5.5537 ppm) showed the third highest. The beef meat showed the least concentration(2.1099ppm).Highest cadmium concentration was observed in the meat of mutton (0.6801 ppm) Table 3, while the lowest (0.0579 ppm) was in the heart of chicken Table 1. Cadmium is toxic to virtually every system in the animal body. It is almost absent in the human body at birth, however accumulates with age. McLaughlin *et al*, in 1999, had reported, in the kidney and liver, that Cadmium is accumulated over long time. Due to chemical similarities of cadmium with a number of minerals mainly Zn, Fe, Cu and Se, Cd interacts and competition for binding stage. In addition, Cd can affect P, Ca and bone metabolism in both people exposed to Cd and industrial in general environment (Jarup *et al*., 1998).The concentrations of nickel (Ni) in the heart of beef, mutton and chicken ranged between 0.6174and 0.2770 µg/g Table 1, while kidney concentrations ranged from 0.8794 to

0.3758 ppm Table 2. The levels of Ni ranged between 0.2975 and 0.4146 ppm for beef meat, mutton meat and chicken meat respectively as shown in Table 2. The highest Ni concentration was observed in the meat of mutton, while lowest value (0.12243 ppm) was found in the muttonkidney. Lead as observed in the meat of mutton showed the highest concentration of 5.7260µg/g and the lowest Concentration of 2.2686µg/g in the meat of beef.

CONCLUSION

The results of the study confirmed that heavy metals, namely, Cd, Cr, Ni, Fe, and Pb, are presence in all the analyzed samples. Generally, meat was found to have the highest significant levels of metals and the heart and kidneys lowest levels. When we compared our result concentration of heavy metals in our samples (beef, mutton and chicken), there showed a significant differences. The result also showed that the concentration of Pb, Cd and Cr exceeded the permissible limits set by WHO/FAO and ANZFA. The concentrations of Fe and Ni in all samples were within the tolerance limits.

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