Demonstration of Lead and Cadmium residues in Street vended foods

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A B S T R A C T

One hundred and thirty-five random samples of street vended foods represented by kofta, hawawshi and liver (45 of each) were collected from Benha (15 of each product), Tukh (15 of each product) and Moshtohor (15 of each product) in Kalyobia governorate for determination of their content of lead and cadmium. The obtained results recorded that the occurrence of cadmium in Benha city were 26.67, 40.00 and 46.67% in the kofta, hawawshi and liver samples, respectively. In Tukh center were 26.67, 46.67 and 60.00% in the kofta, hawawshi and liver samples, respectively. Whereas in Moshtohor village were 40.00, 53.33 and 73.33% in the kofta, hawawshi and liver samples, respectively. In addition, our results showed that the percentage of occurrence of lead in Benha city were 20.00, 60.00 and 66.67 % in the kofta, hawawshi and liver samples, respectively. In Tukh center were 33.33, 40.00 and 53.33 % in the kofta, hawawshi and liver samples, respectively. Whereas in Moshtohor village were 20.00, 33.33 and 40.00 % in the kofta, hawawshi and liver samples, respectively. It could be inferred that regarding the products contamination, the highest cadmium contamination was in liver followed by hawawshi then kofta. Whereas kofta showed the highest lead contamination followed by hawawishi then liver. Regarding the locality, Moshtohor represented the highest contamination of both cadmium and lead followed by Tukh then Benha city.

Key words: Lead, Cadmium, Liver, street vendors, meat products.

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1. INTRODUCTION

Meat is composed of protein, minerals, fats, vitamins and other bioactive components as well as small quantities of carbohydrates. From the nutritional point of view, meat's importance is derived from its high-quality protein, containing all essential amino acids and its highly bioavailable minerals and vitamins (FAO, 2013). Street foods vending is famous to a large number of people as a source of inexpensive, convenient and often nutritious foods for urban and rural poor; a source of attractive and varied foods for tourists and those economically advantaged individuals; and it also provides business opportunities for a very low capital. Street foods vending plays an important role in assuring food security for low-income urban populations (WHO, 2010). In developing countries where farmers use excessive chemicals to achieve bumper yield. Farmers in developing countries often patronize easily synthetized, cheap and patent expired chemicals. Residues from excessive chemical applications to boost farming operations have been reported in high concentrations in soils, livestock and aquatic animals. Significant relationship has been established between residual chemical accumulation in the soil and uptake by crops during growth. These chemicals are stored in the edible parts of crops, livestock and aquatic animals. The accumulation of foreign chemicals such as cadmium(cd) and lead (pb) in human system has been linked to immune-suppression, hypersensitivity to chemical agents, breast cancer, reduce sperm count and infertility. Recent reports also highlighted the danger of high levels of heavy metals such as lead and cadmium. Cadmium is classified as a probable human carcinogen. Chronic exposure to cadmium is also associated with a wide range of other diseases, including heart disease, anemia, skeletal weakness, depressed immune system response as well as kidney and liver disease (Codex Alimentarius Commission Procedural Manual, 2001). Lead is recognized as a toxic substance, which accumulates in body due to low rate of elimination (Underwood, 1977). Moreover, lead levels in street vended foods 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 (Barltrop, 1969).

The aim of the current study is to evaluate the contamination levels of street vended food with heavy metals and their availability of human consumption.

2. MATERIAL AND METHODS

2.1. Collection of samples:

A total of 135 random samples of street vended foods represented by kofta, hawawshi and liver (45 of each) were collected from Benha (15 of each product), Tukh (15 of each product) and Moshtohor (15 of each product) in Kalyobia governorate. The collected samples were examined for determination of cadmium, lead levels on the basis of wet weight (mg/Kg).

2.2. Determination of heavy metals:

2.2.1. Digestion technique:

Accurately, 2 g of each sample were macerated by sharp scalpel and digested by 10 ml of digestion mixture (60 ml of 65% Nitric acid and 40ml of 70% perchloric acid) in screw capped tube after maceration by (Deng et al., 2007). The tubes were tightly closed and the contents were vigorously shaken and allowed to stand over night at room temperature. Moreover, the tubes were heated for 4 hours in water bath starting from 60 ^{o}C till reach 110 ^{o}C ensure complete digestion of the samples. The digestion tubes were vigorously shaken at 30 minutes' intervals during the heating period. The tubes were then left to cool at room temperature and diluted with 1ml deionized water (30%) as well as reheated in water bath at 70 ^{o}C to ensure complete digestion of the samples. At this point, all organic matrixes have been destroyed. Each tube was diluted with deionized water till reach 25 ml and the digest was filtered with Whattman filter paper No. 42. The filtrates were collected in Pyrex glass test tubes capped with polyethylene film and kept at room temperature until analyzed for their cadmium, lead and copper concentrations.

2.2.2. Preparation of blank and standard solutions:

Instrumental procedures for various analyses were based on those suggested in the operator manual of the Atomic Absorption Spectrophotometer. However, blank and standard solutions were prepared in the same manner as applied for wet digestion and by using the same chemicals (Shibamoto and Bjeldanes, 2000).

2.2.3. Analysis:

The digest, blanks and standard solutions were aspirated by Flame Atomic Absorption Spectrophotometer (VARIAN, Australia, model AA240 FS) and analyzed for heavy metals concentration. Absorbency of lead, cadmium and aluminum was directly recorded from the digital scale of and its concentration was calculated according to the following equation: C=R x (D/W), where C=Concentration of heavy metal (wet weight), R= Reading of digital scale of AAS and D= Dilution of the prepared sample. W= Weight of the sample.

3. RESULTS

The obtained results in table (1) revealed that the mean value of cadmium in the kofta samples were 0.09 ± 0.01, 0.13 ± 0.01 and 0.19 ± 0.01 mg/kg in Benha, Tukh and Moshtohor village, respectively. The average concentration of cadmium in hawawshi samples were 0.17 ± 0.01, 0.25 ± 0.01 and 0.28 ± 0.01 mg/kg in Benha, Tukh and Moshtohor village, respectively. The average concentration of cadmium in liver samples were 0.26 ± 0.01, 0.37 ± 0.02 and 0.43 ±0.02 mg/kg in Benha, Tukh and Moshtohor village, respectively. Furthermore, in Benha city, the percentage of unaccepted samples in table (2) were 13.33, 13.33 and 20.00 % in the kofta, hawawshi and liver samples, respectively. In Tukh center, the percentage of unaccepted samples were 20.00, 26.67 and 33.33 % in the kofta, hawawshi and ±liver samples, respectively. In Moshtohor village, the percentage of unaccepted samples were 20.00, 33.33 and 46.67 % in the kofta, hawawshi and liver samples, respectively. Furthermore, the average concentration of lead in the kofta samples in table (3) were 0.21±0.01, 0.16 ±0.01 and 0.10 ±0.01mg/kg in Benha, Tukh and Moshtohor city, respectively. The average concentration of lead in hawawshi samples were 0.39 ± 0.01, 0.31 ± 0.01 and 0.24 ± 0.01 mg/kg in Benha, Tukh and Moshtohor city, respectively. The average concentration of lead in liver samples were 0.58 ± 0.02, 0.42 ±0.01 and 0.29 ± 0.01 mg/kg in Benha, Tukh and Moshtohor city, respectively. In addition, in Benha city, the percentage of unaccepted samples in table (4) were 26.67, 13.33 and 6.67 % in the kofta, hawawshi and liver samples, respectively. In Tukh center, the percentage of unaccepted samples were 40.00, 20.00 and 13.33 % in the kofta, hawawshi and liver samples, respectively. In Moshtohor village, the percentage of unaccepted samples were 46.67, 33.33 and 26.67 % in the kofta, hawawshi and liver samples, respectively.

Table (1): Statistical analytical results of cadmium levels (mg/kg) in the examined samples of street vended foods. (n=15)

Locality / Sandwich	+ve samples		Min.	Max.	Mean ± SEM*
	No	%			
Benha city:					
Kofta	4	26.67	0.01	0.19	0.09 ± 0.01
Hawawshi	6	40.00	0.02	0.33	0.17 ± 0.01
Liver	7	46.67	0.02	0.48	0.26 ± 0.01
Tukh center:					
Kofta	4	26.67	0.01	0.27	0.13 ± 0.01
Hawawshi	7	46.67	0.03	0.41	0.25 ± 0.01
Liver	9	60.00	0.02	0.60	0.37 ± 0.02
Moshtohor village:					
Kofta	6	40.00	0.03	0.31	0.19 ± 0.01
Hawawshi	8	53.33	0.03	0.49	0.28 ± 0.01
Liver	11	73.33	0.04	0.67	0.43 ± 0.02

SEM*= Standard error of mean

Table (2): Acceptability of the examined samples of street vended foods based on their levels of cadmium (n=15).

Locality	Maximum Permissible Limit (mg/kg)*	Unaccpted Kofta		Unaccepted Hawawshi		Unaccepted Liver	
		No.	%	No.	%	No.	%
Benha	0.05	2	13.33	2	13.33	3	20.00
Tukh	0.05	3	20.00	4	26.67	5	33.33
Moshtohor	0.05	3	20.00	5	33.33	7	46.67
Total (45)	0.05	8	17.78	11	24.44	15	33.33

* Egyptian Organization of Standardization "EOS" (2005)

Table (3): Statistical analytical results of lead levels (mg/kg) in the examined samples of street vended foods. (n=15)

Locality / Sandwich	+ve samples		Min.	Max.	Mean ± S.E*
	No	%			
Benha city:					
Kofta	6	20.00	0.03	0.49	0.21± 0.01
Hawawshi	9	60.00	0.03	0.67	0.39 ± 0.01
Liver	10	66.67	0.05	1.02	0.58 ± 0.02
Tukh center:					
Kofta	5	33.33	0.02	0.40	0.16 ± 0.01
Hawawshi	6	40.00	0.03	0.56	0.31 ± 0.01
Liver	8	53.33	0.04	0.87	0.42 ± 0.01
Moshtohor village:					
Kofta	3	20.00	0.01	0.18	0.10 ± 0.01
Hawawshi	5	33.33	0.02	0.39	0.24 ± 0.01
Liver	6	40.00	0.02	0.53	0.29 ± 0.01

S.E*= Standard error of mean

Table (4): Acceptability of the examined samples of street vended foods based on their levels of lead. (n=15)

Locality	Maximum Permissible Limit (mg/kg)*	Unaccpted Kofta		Unaccepted Hawawshi		Unaccepted Liver	
		No.	%	No.	%	No.	%
Benha	0.1	4	26.67	2	13.33	1	6.67
Tukh	0.1	6	40.00	3	20.00	2	13.33
Moshtohor	0.1	7	46.67	5	33.33	4	26.67
Total (45)	0.1	17	37.78	10	22.22	7	15.56

* Egyptian Organization of Standardization "EOS"

4. DISCUSSION

From the obtained results, the collected street vended food samples (kofta, hawawshi and liver) were highly contaminated with toxic biogenic amines residues (histamine and tyramine). Regarding the products contamination, the highest cadmium contamination was in liver followed by hawawshi then kofta. The current results in cadmium relatively agree with those recorded by El-Tawwab (2004) surveyed that the cadmium concentration ranged from 0.195 to 0.281 with a mean value of 0.241 ± 0.004 mg/kg wet weight, in examined samples of shawarma, Hala and Shireen (2008) cited that the average concentration of cadmium in chicken shawarma samples were 0.338 ± 0.435 mg/kg, Shaltout et al. (2003) recorded that, the cadmium concentration ranged from 1.741 to 3.861 with a mean value of 2.185 mg/kg wet weight, in the examined samples of shawarma and Abdulmajid et al. (2014) recognized that, the presence of cadmium in grilled chicken small intestine weight about 10 to 20 g, was 1.4321 to 2.862 µg and these values would increase to 2.398 to 4.796 µg. On the other hand, these results disagree with those observed by Aiad et al. (2007) recorded that the average concentration of cadmium in examined samples of nuggets and chicken fillets were 0.047 ± 0.013 and 0.05 ± 0.006 mg/kg, respectively. Cadmium is considered as the most human carcinogen. In addition, the acute cadmium poisoning can be fatal, because it changes the behavior of successful reproduction, so affects poultry population, in addition, it alters the immune response and can cause cancer in the chronic exposure (Burger and Gochfeld, 2000). Our findings revealed that, kofta showed the highest lead contamination followed by hawawishi then liver. The obtained results agree with those recorded by El-Tawwab (2004) observed that lead concentration ranged from 0.233 to 0.408 with a mean value of 0.318 ± 0.008 mg/kg wet weight, in the examined samples of shawarma. Shaltout et al. (2003) found that lead concentration ranged from 0.316 to 1.168 with a mean value of 0.79 mg/kg wet weight in examined samples of shawarma. Hala and Shireen (2008) detected that, the mean values of lead in chicken shawerma was 1.484 ±1.771 as well as Abdulmajid et al. (2014) noted that the presence of lead in grilled chicken small intestine weigh about 10 to 20 g, was 5.4 to 10.8 µg and these values would increase to 21 to 42 µg. In contrast, these results disagree with those observed by El-Sakkary (2007) cited that the lead concentrations in chicken panne were 0.07 ± 0.01 mg/kg. Lead in young children causes mental and physical development retardation, due to their ability to effectively absorb it, so they are considered at high risk (Karovicova and Kohajdova, 2005).

It could be inferred that regarding the product contamination, the highest cadmium contamination was in liver followed by hawawshi then kofta. Whereas kofta showed the highest lead contamination followed by hawawishi then liver. Regarding the locality, Moshtohor represented the highest contamination of both cadmium and lead followed by Tukh then Benha city.

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