SUST
Journal of Agricultural and Veterinary Sciences
Journal homepage:
http:// journals.sustech.edu

Lead Levels in Selected Animal Products From Public Markets in Khartoum State

Wesal Abbas Eltaib, Daoud Alzuber Ahmed and Hayder Elamin Ahmed

College of Animal Production Science and Technology
Corresponding Author: hayderelamin@sustech.edu
Article history: Received:
Accepted: 11/12/2013

Abstract
This study was carried out to determine the level of contamination with lead element in some animal products (meat, milk and egg), that sold in four public markets in Khartoum state (Jackson, Mayo, Alftahab and Souk Seta). The lead concentration in animal products was determined in the Central Laboratory, (Shambat complex) University of Khartoum. The results showed that, there were significant differences) $p<0.05$), of lead level in meat samples. Souk Seta reported the highest lead level (0.11µg/g) in meat samples compared to other three public markets and the limits of Sudanese Standards and Metrology Organization (SSMO) (the permissible limits) of lead level in meat(0.1µg/g),(2008a).No significance difference between milk samples from different markets, but Mayo market showed the highest concentration of lead in milk(0.0023µg/ml),compared to other markets ,but less than the limits of SSMO (0.02µg/ml),(2008_b).Regarding the results of egg samples there was no significance difference between four public markets in Khartoum state, but Alftahab market showed a higher lead concentration (0.133µg/ml).

Keywords: Contamination, Food safety, Lead emission

Introduction
Toxic metal is defined as that metal, which is neither essential nor has beneficial effect .On the contrary, it displays severe toxicological symptoms at even low levels. With increasing industrialization, more metals are contaminants the environment. These metals stay permanently because they cannot be degraded from the environment. They pass into the food and ultimately make their passage into the animal and human tissue (Mariam *et al.*, 2004).

Lead is a toxic metal that can be found everywhere in the environment. Over exposure to lead continues to be an important worldwide problem (Zeid, 2010). Food is an important source of lead and determination of lead in food can be used for the estimation of lead exposure. The level of lead in the earth's crust is about 20 µg/g. The industrial revolution gave rise to an increase in the amount of lead emitted in the environment and an even bigger increase occurred around 1920 when leaded gasoline was introduced. Leaded gasoline is still not banned everywhere in the world, and its still widely used in the developed countries. In areas where leaded gasoline is banned, the major exposure pathways of non smoking adults are from food and water (Mariam *et al.*, 2004). Several studies were done to determine the concentration of lead in foods and to study its dangerous effects for human and animals. Recently, the USA, all European countries and many

developing countries have out lowed or strictly regulated the use of leaded petrol. In such countries, levels of lead in food and drinking water are closely monitored (Mariam *et al*, 2004).

Lead may reach and contaminate food through air, water and soil during cultivation and industrial processing and packaging (Zeid, 2010).

The United Nations World Health Organization (WHO) has given recommendations for maximum lead content in food and water (WHO, 1995 and CAC/FAO, 1999).The Joint FAO/WHO Expert Committee on Food Additives (JECFA, 2000) has established a provisional tolerable weekly intake (PTWI) of 25 µg/kg bwt/week for lead. PTWI is an estimation of the amount of a contaminant that can be ingested over a life time without appreciable risk.

The Objectives of the study were summarized as follows:-

-To awareness the levels of lead element contamination of beef meat, cow milk and poultry egg .

-To identify public citizens with the health risk of such contamination.

-To assess the conformity of such products with SSMO specifications.

-To assess the effect of such contaminations on food safety.

Materials and Methods

Collection of samples:

This study was conducted in the period from December -2012 to June 2013. The samples were collected from four open markets at public transport stations in Khartoum state (Jackson, Mayo, Alftahab and Souk Seta). 12 samples of beef meat, milk and chicken eggs were taken and labeled for further determination of lead element .The lead concentration in animal products was determined in the central laboratory, Shamb at complex, Khartoum university.

Determination of lead element in meat, milk and egg samples:

Preparation of meat samples:

The fresh beef meat samples were dried in drying oven at 105 ºc for 24 hour and then put in desiccators to absorb residual of moisture to a fixed weight,2 gm of dried samples were put in crucible .The crucible was placed in muffle furnace and ashed at 550ºc for 2 hour , then cooled . one ml of concentrated HNO_3 was added to the obtained ash then transferred to 50 ml volumetric flask by carefully washing crucible with 1ml of diluted HNO_3 then the mixture was diluted with de ionized water to 50 ml(Dalton and Malanoski ,1969 ; Blake and Bourqui ,1998).

Preparation of milk samples:

25 ml of fresh milk was taken into 100 ml beaker and covered with glass watch and then heated in water bath at 120cº for 24 hours until the volume decreased to 5 ml. 10 ml of HNO_3 (conc.) and 3 ml of H_2O_2were added to the residual and heated in hot plate for 4 hours. 10 ml 1M HNO_3 was added to the residual to dissolve, and then filtered through whatman paper NO 42 to 50 ml volumetric flask and the volume was completed with 1M HNO_3 to 50 ml (Fiorino, *et al* ,1973) .

Preparation of egg samples:

The fresh chicken egg (mixture of yolk and albumin) samples were dried in drying oven at 105 ºc for 24 hour and then put in a desiccator to absorb residual moisture until fixed weight obtained, 2 gm of dried samples was taken to crucible. The crucible was placed in muffle furnace and ashed at 550 ºc for 2 hour, then cooled. 1 ml of concentrated HNO3 was added and transferred to 50 ml volumetric flask by carefully washing crucible with ml of diluted HNO_3. The mixture was transferred to the volumetric flask, and diluted with de ionized water to 50 ml (Dalton and Malanoski, 1969, Blake and Bourqui, 1998.

Determination of lead in samples: For determination of lead element. Atomic

Absorption spectrophotometer (version 6800), was used. The results were recorded for analysis.

Statistical Analysis:

Data collected were presented as mean ± standard deviation and were analyzed using **SPSS** (Version 17.0) (2008) computer software program as one way analysis of variance (ANOVA) ($p<0.05$).

Results

Lead concentration in meat, milk and egg samples:

The concentrations of lead element in beef meat in four open markets in Khartoum state (Jackson, Mayo, Alftahab and Souk Seta) are presented in Fig (1). The concentrations were as follows, 0.0407 ± 0.018, 0.0354±0.005, 0.0283 ±0.006 and 0.1105±0.090 (µg /g), respectively .There was significant difference ($P<0.05$), between the values obtained in different collection sites. Figure (2), showed the lead concentration in fresh cow milk in Jackson, Mayo, Alftahab and Souk Seta Open Markets.

The concentration values were 0.0009±0.00164, 0.0023±0.00088, 0.001± 0.00302 and 0.0018±0.00313 **(**µg /ml) of fresh cow milk respectively. No significant difference between the four markets.

Figure (3), showed the lead concentrations in chicken egg in the four open market (Jackson, Mayo, Alftahab and souk Seta as 0.0784±0.017, 0.0811±0.025, 0.01335±0.041and 0.1152±0.102 **(**µg/ml) respectively. No significance difference between different markets values was recorded were-observed

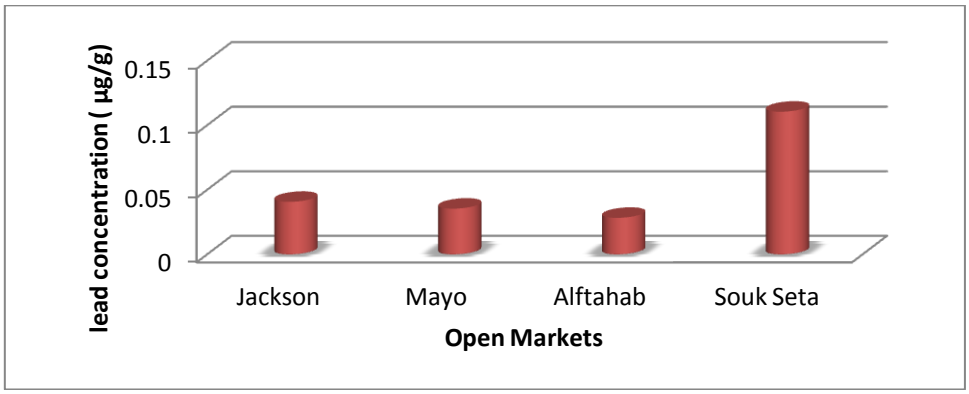

Figure 1: lead concentration (µg / g) of fresh beef meat

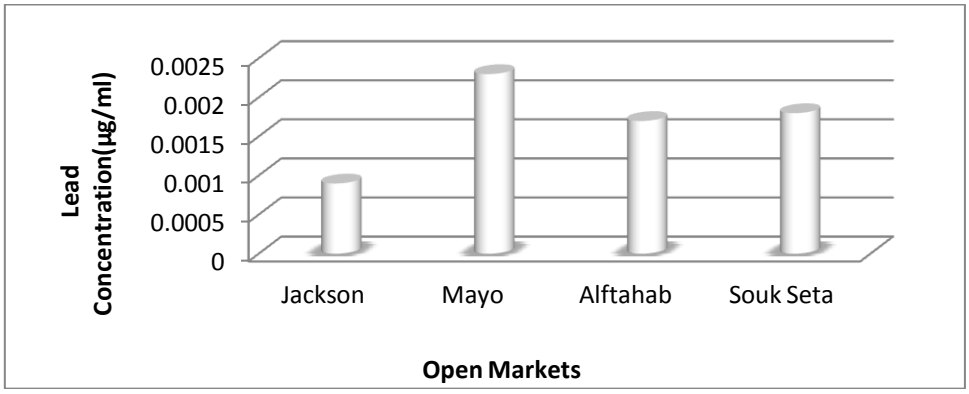

Figure 2: lead concentration (µg / ml)of fresh milk

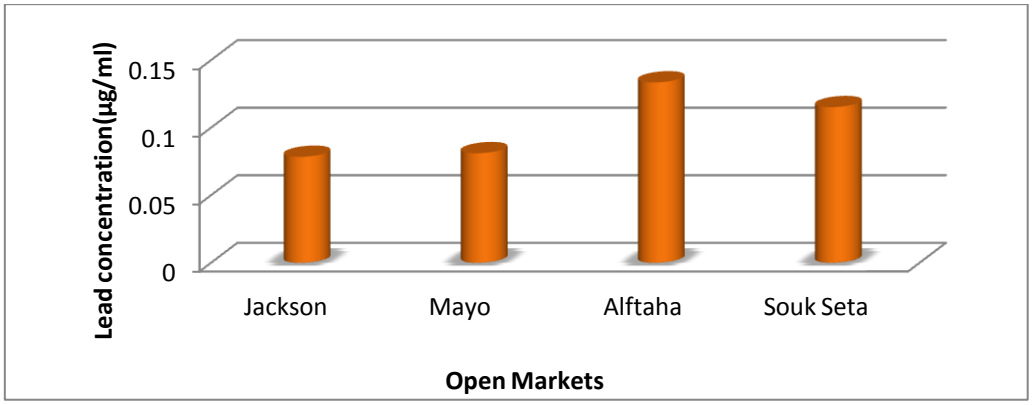

Figure 3: lead concentration (µg / ml) of chicken egg

Discussion

Lead concentration in meat, milk and egg samples:

Lead concentration in meat:-

There is significant difference between markets values at ($p<0.05$).The lead concentration in beef meat in Jackson Market (0.0407 ± 0.018µg /g) was similar to that reported by Syed *et al*,(2003). Where the concentration in the present study were lower than that reported by Mariam *et al.*, (2004), Beata *et al.*, (2002) , EOS (1993) and the limits of SSMO (2008a). This result was higher than that reported by, Llobet *et al.*, (2003) and Zeid (2010). as 0.03 and 0.014µg /g respectively.

The lead levels in Mayo market (0.0354±0.005) was similar to that reported by Syed *et al.*, (2003), and Llobet *et al.*, (2003). Where the value of the present study was lower than Mariam *et al.*, (2004), Beata *et al.*, (2002), Akan *etal* (2010), EOS (1993) and the limits of SSMO (2008_a).The lead concentration in Alftahab market (0.0283 ±0.006) was similar to that found by Syed *et al.*, (2003) ,and lower than Mariam *et al.*, (2004) , Beata *et al.*, (2002), Akan *et al.*, (2010), Llobet *et al.*, (2003), EOS (1993) and SSMO(2008_a), but was higher than Zeid (2010).However the lead level in Souk Seta (0.1105±0.090) was higher than that found in other markets, and than that reported by Syed *et al.*, (2003, Akan *et al* (2010) , Mariam *et al.*, (2004), Zeid (2010), Llobet *et al.* , (2003), Beata *et al.*, (2002), EOS (1993) and SSMO (2008a)(0.1µg/g).

Lead concentration in milk:

There was no significant difference between different markets .The lead concentration in milk samples in all markets was lower than the recorded by,Ali *et al*,(2011), Ogabiela *etal*,(2010), Enb *et al* , (2009) ,Lamia *and Amal* (2008), Zeid,(2010)and limits of SSMO((2008_b) (0.02µg/ml).

Lead concentration in egg:

The statistical analysis showed no significance difference between different markets values. The lead levels in egg samples, (0.0784±0.017 and0.1335±0.041 µg/ml), were similar to that reported by Abdulkhaliq *et al.*, (2012) and Samia *et al.*, (2012).Whereas the values were lower than that reported by Zeid ,(2010),and Salwa and Othman (2011).

Conclusion

The results of this study revealed that, the animal products were contaminated with different concentrations of lead elements in some public markets in Khartoum state. The lead concentration in beef meat samples in Souk Seta market were higher than that recorded by SSMO, the concentrations in Jackson, Alftahab and Mayo were less than SSMO recommendation .However the lead level in milk samples from Jackson, Alftahab and Souk Seta markets were less than SSMO limits. Where as Mayo market recorded higher lead concentration than other markets and SSMO limits. Alftahab market showed highest lead level in egg samples compared with other markets.

Recommendation

-To acquaint the community with seriousness of buying food products from open public markets.

-Checking of water, food and feed before intake as the recommendation of SSMO specifications.

- Continuation of researches in the field of food safety at public markets in Khartoum state, for wholesome and good quality animal products.

References

Abdulkhaliq, A.; Swaileh, K. M.; Hussein, R. M. and Matani, M. (2012). Levels of metals (Cd, Pb, Cu and Fe) in cow's milk, dairy products and hen's eggs from the West Bank, Palestine, *International Food Research Journal* **19** (3): 1089-1094.

Akan, C.J.; Abdulrahman, I.F.; Sodipo, A.O. and Chiroma, A.Y. (2010). Distribution of Heavy Metals in the Liver, Kidney and Meat of Beef, Mutton, Caprine and Chicken from Kasuwan Shanu Market in Maiduguri Metropolis, Borno State, Nigeria, *Research Journal of Applied Sciences, Engineering and Technology* **2**(8): 743-748,2010 .ISSN: 2040-7467.

Ali, A.J.; Bukar, E.N.; Jimoh, T.; Hauwa, N.Y. and Umar, Z. T. (2011). Determination of copper, zinc, lead and some biochemical parameters in fresh cow milk from different locations in Niger State, Nigeria. *African Journal of Food Science* Vol. **5**(3), pp. 156- 160.

Beáta, K.; Magdaléna, S. and Pavel, N. (2002). Concentration of some heavy metals in cattle reared in the vicinity of a metallurgic industry, *Veterinarski Arhiv* **72** (5), 259-267.

Blake, C. and Bourqui, B. (1998). Determination of Lead and Cadmium in Food Products by Graphite Furnace Atomic Absorption Spectroscopy. *AS Atomic Spectroscopy* **19**(6).

CAC/ FAO (1999). Food Standards Programme. Codex Committee on Food Additives and Contaminants. 32nd Session. Draft maximum levels of lead. GoK/UNICEF. Situation Analysis of Children and women in Kenya. Nairobi : UNICEF /GOK.

Dalton, F. E. and Malanoski, J. A., (1969). Atomic Absorption Analysis of Copper and Lead in meat and meat products ,AOAC 52, 1035

Enb, A.; Abou Donia, M. A.; Abd-Rabou, Abou Arab and El-Senaity, M. H. (2009). Chemical Composition of Raw Milk and Heavy Metals Behaviour During Processing of Milk Products, *Global Veterinaria* **3** (3) 268 275.

EOS (Egyptian Organization for Standardization)(1993). Egyptian standards for requirement of fresh meat. *Minstry of Industry. EOS, Cairo*,**63.**5-11.

Fiorino, A. J.; Moffitt, A. R,; Woodson, L. A.; Gajan, J. R.; Huskey, E. G. and Scholz, G. R.; (1973).Determination of Lead in Evaporated Milk by Atomic Absorption Spectrophotome - ter and Anodic stripping Voltammeter: Collaborative Study**,** *AOAC* **56**, 1246.

JECFA (2000). Safety Evaluation of Certain Food Additives and Contaminants. 44 IPCS International Programme on Chemical Safety Contaminants,http://www.inchem.org/documents/jecfa/jecmono/v44jeeI2.htm/, accessed on 21 June 2000.

Lamia, M. H. and Amal M. K. (2008). Level of Lead and Cadmium in Infant Formulae and Cow's Milk, *J Egypt Public Health Assoc*. Vol. **83** No.3 & 4.

Llobet , M.J., Falcoa G , Casas C, Teixidoa A. and Domingo L.J**.** (2003). Concentrations of Arsenic, Cadmium, Mercury, and Lead in Common Foods and Estimated Daily Intake by Children, Adolescents, Adults, and Seniors of Catalonia, *Spain, J. Agric. Food Chem***, 51**, 838-842.

Mariam, I.; Shehla, I. and Saeed, A. N. (2004). Distribution of Some Trace and Macro minerals in Beef, Mutton and Poultry *International Journal of Agriculture and Biology*, 1560– 8530.

Ogabiela, E. E.; Yebpella, G. G.; Ade-Ajayi, A. F.; Mmereole, U. J.; Ezeayanaso, C.; Okonkwo, E. M.; Ahola, D. O.; Udiba, U. U.; Mahmood, A. and Gandu, I. (2010). Determination of the level of some elements in edible oils sold in zaria, northern Nigeria. *Global Journal of Pure and Applied Sciences* .**6** (3): 325-331.

Salwa, A. and Othman, S. M. (2011). Metals Concentration in Egg of Domestic Avian and Estimation of

Health Rick from Egg Consumption, *Journal of Biological Sciences* , 1727-3048.

Samia, M. H.; Laila, D. A. and Mosaad, A. A. (2012). Mineral and Heavy Metals Content in Eggs of Local Hens at Different Geographic
Areas in Egypt, *Global Veterinaria* **8** (3): 298-304.

SSMO (2008a).Sudanese standards and metrology organization. Contaminants in meat and meat product, SDS 4144/ 2008.

SSMO (2008b**).** Sudanese standards and metrology organization**.** Contaminants in milk SDS, 3952/2008.

SPSS (2008). Statistical package for the social science. Version 17.0 SPSS Inc. Chicago.

Syed, M. S.; Sardar, W. K. and Imran, H. (2003). Effect of Environmental Pollution on Quality of Meat in District Bagh, Azad Kashmir *Pakistan Journal of Nutrition* **2** (2): 98-101.

WHO (1995). (World Health Organization) Trace elements in human nutrition and health. World Health Organization, Geneva, 1995.

Zeid, A.A. (2010). Lead Contamination in Selected Foods from Riyadh City Market and Estimation of the Daily Intake, *Molecules* .**15**, 7482-7497; doi:10.3390/molecules15107482.

مستويات عنصر الرصاص في بعض المنتجات الحيوانية بالاسواق الشعبية بولاية الخرطوم

وصال عباس الطيب ، داؤود الزبير أحمد ، حيدر الأمين أحمد

كلية الطب البيطري – جامعة السودان للعلوم والتكنولوجيا

المستخلص

أجريت هذه الدراسة لتقدير مدى تلوث بعض المنتجات الحيوانية (لحم ، لبن وبيض) ،المباعة في اربعة اسواق شعبية بولاية الخرطوم (جاكسون ، مايو، الفتيحاب وسوق ستة) بعنصر الرصاص.تم قياس تركيز عنصر الرصاص بالمنتجات الحيوانية في ألمعمل المركزي (مجمع شمبات) جامعة الخرطوم.اظهرت النتائج بأنه توجد فروق معنوية عند ($P<0.05$)، بعينات اللحم من حيث محتواها من الرصاص ،سجل سوق ستة اعلى مستوى من الرصاص (0.11 مايكرو جرام/جم) مقارنةً بالثلاثة اسواق الشعبية الاخرى و الحد المسموح به لعنصر الرصاص باللحم من قبل هيئة المواصفات والمقاييس السودانية (0.1 مايكرو جرام/جم).لا توجد فروق معنوية بين عينات اللبن من مختلف الاسواق ولكن اظهرت عينات سوق مايو اعلى مستوى لتركيز عنصر الرصاص باللبن (0.0023 مايكرو جرام/مل) مقارنة مع الاسواق الاخرى ولكن اقل من الحد المسموح به من قبل هيئة المواصفات السودانية (0.02 مايكرو جرام /مل). اوضحت نتائج تحليل عينات البيض عدم وجود أي فرق معنوي للعينات بين الاسواق الشعبية الاربعة بولاية الخرطوم بينما سجلت عينات سوق الفتيحاب اعلى تركيز لعنصرالرصاص(0.133 مايكروجرام/مل).