ESTIMATION OF LEAD AND CADMIUM LEVELS IN FLESH OF SOME IMPORTED SALTED CANNED FISH

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ABSTRACT

Received at: 30/3/2015

Accepted: 30/4/2015

Fish accumulates substantial amounts of metals in their tissues especially muscles and thus, consider one of major dietary sources of these metals for humans. The objective of the present study is to determine the concentration of lead and cadmium levels in flesh of some imported salted canned fish (Sardine, Salmon and Anchovies) by Atomic Absorption Spectrophotometer with Graphite furnace. Fourty five imported canned salted fish were collected from different supermarkets in Sohag city produce during 2014. Samples were divided into three groups (15 for each) according to the geographic areas of production (G1 from Thailand, G2 from Morocco and G3 from Spain). Each group was subdivided into three (5 each) subgroup (Sardine, Salmon and Anchovies). Our results revealed that lead mean± SE (wet weight) levels were 2.495± 0.013, 2.320±0.010, 0.271±0.047 ppm in sardine, 0.298±0.158, 0.452±0.127 ppm and 0.275±0.132 in salmon and 6.939±2.370, 2.060±0.061 and 2.691±0.473 ppm in anchovies flesh in G1, G2 and G3 respectively. For cadmium mean levels±SE (wet weight) were 0.063±0.011, 0.098±0.025 and 0.066±0.021 in sardine flesh, 0.037±0.009, 0.053±0.010 and 0.061±0.020 in salmon flesh and 1.007±0.093, 0.464±0.055 and 1.908±0.540 in Anchovies ppm, in G1, G2 and G3 respectively. According to data presented in this study, it can be concluded that lead levels in flesh of salted canned fish collected from Sohag city were above the Egyptian Organization for Standardization and Quality Control EOSQC. (1993) recommended limit in sardine and anchovies and below this limit in salmon. Cadmium values were below the established values in all samples except G2 of anchovies. It recommended that more research and assessments of seafood quality is needed to provide more data and help safeguard the health of consumers.

Key word: *Lead and cadmium, Flesh, Imported salted canned fish.*

INTRODUCTION

Fish is widely consumed in many parts of the world by humans because it has high protein content, low saturated fat and also contains omega fatty acids known to support good health (US EPA, 2004). It have been found to be good indicators of heavy metal contamination in aquatic systems (Burger *et al.*, 2002).

Canned fishes in particular are well eaten in the developed world it is convenient and affordable for most working families (NOAA, 2002).

Fish may be contaminated by toxic elements during fish growth, transportation, and storage. Contamination may also occur during production, handling and canning process. Information on the metal content in canned fish is important to ensure that the fish consumed is safe for human consumption. The estimated weekly intakes of these metals by adults consuming different species of canned fish are also evaluated for possible human health risks (Ikem and Egiebor (2005).

Heavy metals are potential environmental contaminants with the capability of causing human health problems if present to excess in the food. They

are given special attention throughout the world due to their toxic effects even at very low concentrations (Das, 1990). Several cases of human disease, disorders, malfunction and malformation of organs due to metal toxicity have been reported (Jarup, 2003).

Lead is a heavy metal that accumulates in the body and affects different systems and organs such as central and peripheral neural system, gastrointestinal tract, muscles, kidneys and hematopoietic system Ciobanu *et al.* (2012). Short-term exposure to high levels of lead can cause brain damage, paralysis (lead palsy), anemia and gastrointestinal symptoms. Longer-term exposure can cause damage to the kidneys, reproductive and immune systems in addition to effects on the nervous system (Rose *et al.*, 2001).

Cadmium and lead are among the most abundant heavy metals and are particularly toxic. The excessive content of these metals in food is associated with etiology of a number of diseases (WHO, 1992, 1995).

International Agency for Research on Cancer (IARC) classified cadmium and lead as human carcinogen (IARC, 1993; Steenland and Boffetta, 2000).

Cadmium exposure induces bone damage, osteoporosis, and renal tubular dysfunction that leads to renal failure in long term (Ciobanu *et al.*, 2012) and Engström *et al.* (2012), It is also associated with several cancers (Satarug, 2012) and Sawada *et al.* (2012).

The present study was carried out to determine the current levels of total lead and cadmium in the muscle tissue of canned salted fish samples, imported from different countries and compare with the guidelines set down by FAO/WHO (1992) and EOSQC (1993).

MATERIALS and METHODS

Sampling

A total of forty five imported salted canned fish (15 each of Sardine Salmon, and Anchovies) were collected from different markets in Sohag city, Egypt that divided according geographical areas of production during 2014 (G1, G2, G3).

Lead and cadmium were determined by using ZEEnit 700P Atomic Absorption Spectrophotometer with Graphite furnace (AASG) (Atomic Absorption Spectrophotometer model AnalytikjenaAG, USA) in the Central Laboratory of the Faculty of Veterinary Medicine, Assiut University, Egypt. 0.5 g was weighed into a set of digestion tubes. 10 ml of nitric acid was mixed into the sample vessels. Mixture of content of the digestion tubes were then digested by Microwave at a temperature of 60º C for 30 min. The digestion was cooling to room temperature and diluted with ultra-pure water to make a volume of 25 ml, put in clean glass vials and kept till analysis.

The combined stock standard (Pb and Cd (1000 ppm each) was prepared from reference standards and stored in the refrigerator until use. The method of calibration curve was used for calibration and quantification of the AAS to its effective position. The working standards were first determined to create the standard curve; this was followed by the measurement of the unknown analyses. The atomic absorption spectrophotometer was adjusted to specific wavelength corresponding to each of the metals to be measured.

Statistical Analysis

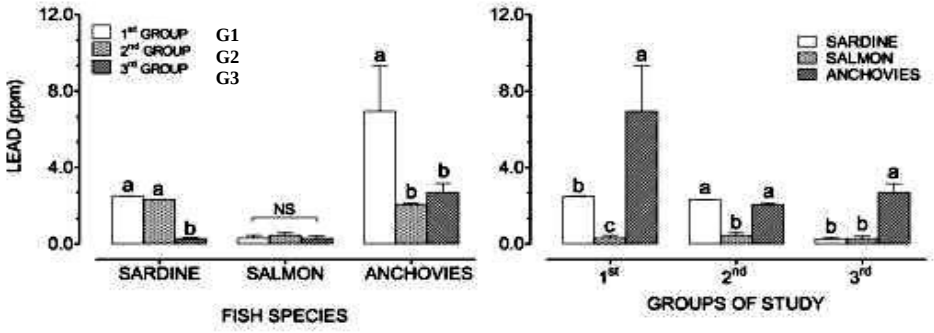
Statistical analysis was performed using SPSS 13.0 for Windows. Analysis of Variance (ANOVA) was used and statistical significance was set at $P<0.05$. Duncan Multiple Range Test was used to separate differences in treatment means.

RESULTS

Table 1: Mean lead levels ±SE in muscle of Sardine, Salmon, and Anchovies from Thailand (G1), Morocco (G2) and Spain (G3) and number of samples tested in each group (No).

Groups	Sardine			Salmon			Anchovies		
	Mean	SE	NO.	Mean	SE	NO.	Mean	SE	NO.
G1	2.495	0.013	5	0.298	0.158	5	6.939	2.370	5
G2	2.320	0.010	5	0.452	0.127	5	2.060	0.061	5
G3	0.271	0.047	5	0.275	0.132	5	2.691	0.473	5

Figure (1) lead concentration (ppm) in tested (sardine, salmon and anchovies) samples

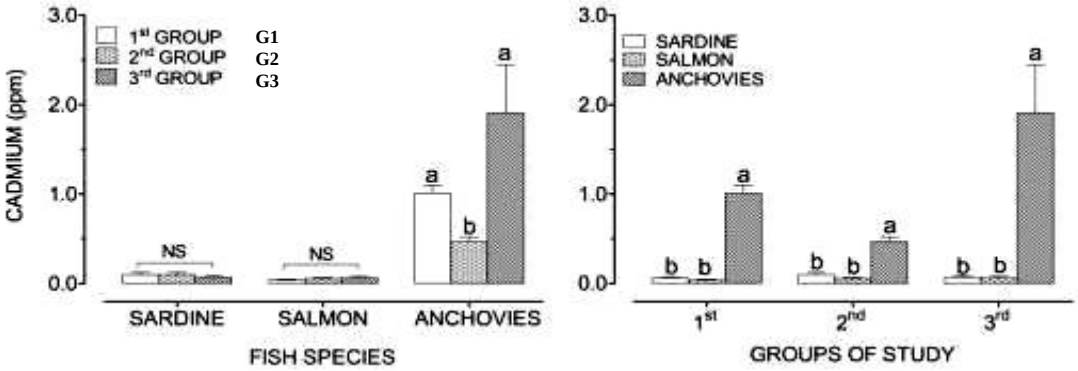


Letters on bars (a, b, c) denote the significant differences among groups (P<0.05).

Table 2: Mean values ±SE of cadmium levels in muscle of Sardine
Salmon, and Anchovies from Thailand (G1), Morocco (G2), and Spain (G3) and number samples tested in each group (No).

Groups	Sardine			Salmon			Anchovies		
	Mean	SE	NO.	Mean	SE	NO.	Mean	SE	NO.
G1	0.063	0.011	5	0.037	0.009	5	1.007	0.093	5
G2	0.098	0.025	5	0.053	0.010	5	0.464	0.055	5
G3	0.066	0.021	5	0.061	0.020	5	1.908	0.540	5

Figure (2) Cadmium concentrations (ppm) in fish species; Sardine, Salmon and Anchovies samples.



NS means non-significant differences.

DISCUSSION

The average values of lead in G1, G2 and G3 in sardine showed were 2.495±0.013, 2.320±0.010, 0.271±0.047 ppm respectively which higher than (0.1 ppm) that recommended by EOSQC (1993) while G3 had lower lead level than the limit of (0.5 ppm) that reported by FAO/WHO (1992). These result are similar to result recorded by Rafael (1975), 0.13-2.15 ppm in Spanish sardine, Olga Marta *et al.* (1991) recorded the levels of lead as 0.29-0.72 ppm in Costa Rica, also as Ashraf *et al.* (2006) 0.84 ±0.46 ppm in Saudi Arabia and Tarley *et al.* (2001), 0.77-2.15 ppm in Brazil.

Lead levels in salmon were 0.298±0.158, 0.452±0.127 and 0.275±0.132 ppm in G1, G2, and G3 respectively. These levels are higher than the permissible limit recorded by EOSQC (1993) and lower than that recorded by FAO/WHO. (1992). Ashraf *et al.* (2006) recorded a same level value of lead in salmon (0.31±0.11) ppm in Saudi Arabia.

In anchovies the lead levels were 6.939±2.370, 2.060±0.061, 2.691±0.473 ppm in G1, G2, and G3, respectively. These values are higher than the limits recommended by EOSQC (1993) and FAO/WHO (1992). Similar result were obtained with Türkmen *et al.* (2008) (0.87±0.40 ppm in samples collected from Black sea and Tüzen (2009) 0.30 ± 0.02 ppm in Turkey but the result recorded by Gilmartin and Revelante (1974) from Adriatic sea were lower than our result <0.01.

The mean values of cadmium in sardine were 0.063±0.011, 0.098±0.025 and 0.066±0.021 ppm, while in salmon were 0.037±0.009, 0.053±0.010 and 0.061±0.020 ppm, in anchovies were 1.007±0.093, 0.464±0.055 and 1.908±0.540 ppm, in G1, G2 and G3, respectively. In all samples the cadmium levels are lower than (0.1 ppm) that recommended by EOSQC (1993) and also lower than (0.5 ppm) that recommended by FAO/WHO (1992) except the third group in anchovies was higher than the permissible limits.

A similar results of cadmium levels in sardine were reported by Suppin *et al.* (2005) in Austria was (0.012 ppm), Olga Marta *et al.* (1991) in Costa Rica (0.06-0.16 ppm), Ashraf *et al.* (2006) in Saudi Arabia (0.18 ±0.19 ppm) and Gilmartin and Revelante (1974) from Black sea recorded lower levels than our result <0.01.

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تقدير مستويات الرصاص والكادميوم فى بعض الأسماك المعلبة المملحة المستوردة

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تمثل انسجة الاسماك احد المصادر الرئيسية لتعرض الانسان للعديد من المعادن من خلال تناول تلك الأسماك وتهدف الدراسة الى تحديد مستوي بعض المعادن الثقيلة (الرصاص والكاديوم) فى انسجة بعض الاسماك المملحة المعلبة المستوردة من الخارج (سردين – سلمون – انشوجة) وذالك باستخدام جهاز الامتصاص الطيفى الذرى. تم جمع خمسة واربعون عينة من الاسماك المعلبة المملحة من بعض السوبر ماركت بمدينة سوهاج وقسمت العينات الى ثلاث مجموعات (١٥) لكل منهما وفقا لمناطق الانتاج المجموعة الاولى من تايلاند ، المجموعة الثانية من المغرب والمجموعة الثالثة من اسبانيا وكل مجموعة تم تقسيمها الى ثلاث مجموعات فرعية (٥ لكل منهما) (سردين – سلمون – انشوجة) وقد اظهرت النتائج ان متوسط تركيز الرصاص في عينات السردين: المجموعة الاولى والثانية والثالثة كانت ٢.٤٩٥±٠.٠١٣، ٢.٣٢٠±٠.٠١٠، ٠.٢٧١± ٠.٠٤٧ ملجم/كجم (وزن رطب) على التوالى وللسلمون ٠.٢٩٨±٠.١٥٨ ، ٠.٤٥٢±٠.١٢٧ و ٠.٢٧٥± ٠.١٣٢ ملجم/كجم (وزن رطب) على التوالى وللانشوجة ٦.٩٣٩±٢.٣٧٠ ، ٢.٠ ±٠.٠٦١ و ٢.٦٩١±٠.٤٧٣ ملجم/كجم (وزن رطب) على التوالى بينما كان متوسط تركيز الكادميوم فى المجموعة الاولى ، الثانية والثالثة للسردين ٠.٠٦٣±٠.٠١١، ٠.٠٩٨±٠.٠٢٥ و٠.٠٦٦± ٠.٠٢١ ملجم/كجم (وزن رطب) على التوالى وللسلمون ٠.٠٣٧±٠.٠٠٩، ٠.٠٥٣±٠.٠١٠ و٠.٠٦١±٠.٠٢٠ ملجم/كجم (وزن رطب) على التوالى وللأنشوجة ١.٠٠٧± ٠.٤٦٤±٠.٠٩٣ و ٠.٠٥٥± ١.٩٠٨±٠.٥٤٠ ملجم /كجم (وزن رطب) على التوالي أظهرت النتائج ان تركيز الرصاص كان في اغلب العينات التي تم جمعها اعلى من المستويات المسموح بها وفقا للمواصفات المصرية وكذا العالمية بينما كان تركيز الكادميوم اقل من المستويات المسموح بها عدا فى الانشوجة كانت اعلى من تلك المستويات ، لذلك يجب عمل مسوحات دورية لهذه المنتجات.