

# Estimation of Selenium and Toxic Metals (Mercury, Lead) in Some Type of Canned and Fresh (Meat and Fish)

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## Abstract

The present study was aimed to estimate the concentration of selenium Se and toxic metals (mercury Hg and lead Pb) in canned and fresh (meat and fish) from different countries, the results show that the concentrations of Se were above the limits and was ranged between 6.25 ppm to 19.12 ppm in fresh and canned meat and between 0.27 ppm to 9.23 ppm in fresh and canned fish, the concentration of Hg was also above the permitted limits and was ranged between 0.002 ppm to 2.1 ppm in fresh and canned meat and between 0.1 ppm to 3.5 ppm in fresh and canned fish, while the concentration of Pb was within the limits and was ranged between 0.029 ppm to 2.3 ppm in fresh and canned meat and between 0.095 ppm to 1.59 ppm in fresh and canned fish.

**Keywords:** Fresh meat and fish, Canned meat and fish, Selenium, Heavy metals.

## Introduction

The analytical control of heavy metals in food is particularly important, since these pollutants are notably cumulative in nature and, therefore, can be toxic to humans. Their determination in foods of animal origin is, thus, of interest.

Foods contain a wide range of elements such as selenium (Se), sodium (Na), potassium (K), iron (Fe), calcium (Ca), copper (Cu) and zinc (Zn). Many of these metals are essential in living organisms. Metals and other elements can be naturally present in food or can enter food as a result of human activities such as industrial and agricultural processes. Many elements that are present in seafood are essential for human life at low concentrations<sup>[1],[2],[3]</sup>.

The metals of particular concern in relation to harmful effects on health are mercury, lead, cadmium, tin and arsenic. Mercury and lead are often referred to as heavy metals<sup>[4],[5]</sup>. The toxicity of these metals is in part due to the fact that they accumulate in biological tissues, a process known as bioaccumulation. This process of bioaccumulation of metals occurs in all living organisms as a result of exposure to metals in food and the environment, including food animals such as fish and cattle as well as humans.

Toxicological and environmental experts have shown concern for the increasing cases of food contamination with these heavy metals over the years as reported in several literatures<sup>[6],[7],[8],[9]</sup>. Maximum levels for mercury, lead, cadmium and tin in foodstuffs have been set by Commission Regulation No 1881/2006, the framework EU legislation which sets maximum levels for chemical contaminants in foodstuffs.

In the current study the concentration of Se, Hg and Pb were investigated of fresh and canned (meat and fish).

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## Material and Methods

The study was carried out during 2018. The aim was to identify and quantify the content of Se and heavy metals Hg and Pb in Twenty-eight type of meat and fish. Apart of sample was fresh and another part was canned from different country.

### Apparatus:

All glassware was soaked overnight in 10% (v/v) nitric acid, followed by washing with 10% (v/v) hydrochloric acid, and rinsed with deionized distilled water and dried before using. A Shimadzu Model 12-630-AA Atomic Absorption /flame Emission equipped was used to determine Selenium, Mercury and Lead.

### Sample preparation and digestion:

Twenty-eight fresh and cans of fish and meat samples dried in oven at 1050C for 24h, then this sample transferred to desiccators, to remove moisture, then samples leaved to matching with room temperature. The tissue crush by ceramic mortar, then 1g weight from tissue powder and put it in 25 ml glass volumetric flasks and vent closed by a glass plug during digestion. The sample is then taken and digested promptly as follows, the 1gm was weighed into a 25ml glass volumetric flask, and 4.5ml of concentrate HNO<sub>3</sub> and 1.5ml of concentrate HClO<sub>4</sub> were slowly added, the flask was then shaken well to blend between powder of tissue and acids, the flask was covered by watch glass and left for 24h under the exhaust fan to complete the digestion process. After that, samples were warm at 700C for 2-3h in block digestion, the flasks take out block the digestion, 2-3ml of deionized distilled water was added. Then the opening flasks warmed again in block digestion at 700C until the volume of solution reduced to 2ml. The samples transferred to a flask (50 ml) and complete the volume of deionized distilled water. The solution put in clean plastic tube and centrifuge was used with 3500r/m to 30m, the filtered solution put again in flask (50 ml) and this solution was ready for measurement by atomic absorption spectrophotometer [10].

## Results and Discussion

The concentrations of Se, Hg and Pb in fresh and canned (meat and fish) are presented in (Table1-2, Figure1-2). Twenty-eight samples for each fresh and

canned (meat and fish) were analyzed to assess the amounts of these metals.

The results indicate that the concentration varied from 6.25 to 19.12 ng/ml (mean = 11.73 ng/ml) for Se in meat samples and from 0.27 to 9.23 ng/ml (mean = 1.94 ng/ml) in fish samples as Shown in (Table 1, Figure 1). It is observed (Table 2, Figure 2) that fresh meat, has lower concentration of Se than the canned meat, while the concentration of Se in the fresh fish is about four times that observed for the canned fish.

As well as the results indicate that the concentration varied from 0.002 to 2.1 mg/l for Hg in meat samples and from 0.1 to 3.5 mg/l in fish samples, the limits set by US- EPA for mercury was 0.50 µg/g in fish [6]. Any study doesn't record mercury exist in meat samples [11]. The results indicate the concentration of Hg in meat and fish samples exceed normal levels (Fig 1). Bioaccumulation of Hg by fish and shellfish in canned food item can be a rich source of metals, and of the serious contamination of foods that occurs from time to time during commercial handling and processing, most countries monitor the levels of toxic elements in foods [12]. Hg has been recognized as severe environmental pollutant, with high toxicity even at low concentrations it has the ability to enter into biological systems [13], it has strong tendency to accumulate in aquatic food chain and about 95% of the methylmercury in humans is originated from the ingested fish [14]. Mercury and methylmercury are neurological toxicants to humans [15]. However, the levels the metals in fresh meat and fish are higher than the canned meat and fish as shown in (Table 2 and Figure 2). The high level of this metal in fresh food may be connected with environmental factors such as polluted soil and polluted waste water used for irrigation of the farms.

Determinate mean concentrations of pb in meat and fish were 0.53 mg/l and 0.5 mg/l respectively (Table 1, Figure 1), this results are higher than acceptable Concentrations of pb limits in fish according to FDA [16], but concentrations in canned meat and fish was below the prohibited limits for this element (Figure 2), which is 0.5 mg/ kg as given by (FDA), while found high concentration of Pb in fresh meat and fish (Table 2). An exposure to (pb) for a long time can increase (pb) in human body and lead to cause many serious diseases

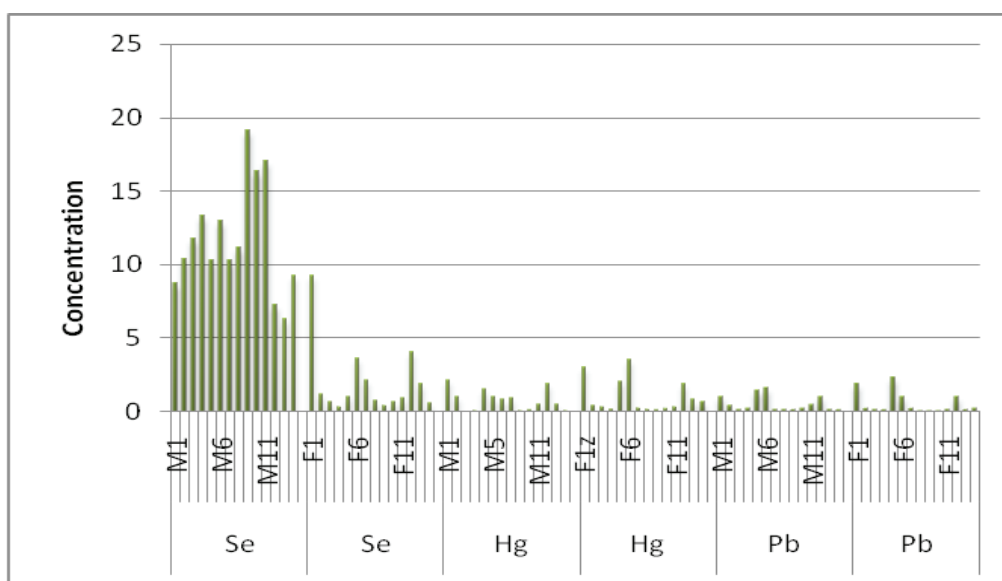
such as anemia, Pale skin, abdominal pain, Nausea, Vomiting and Joints paralysis, exposer to (pb) for a long period may cause kidney filler and reducing fertility and increasing probability of pregnant or Incidence of congenital malformations [17].

**Table 1. Total concentration of Metal (Se, Hg and Pb) in various varieties of Meat and Fish.**

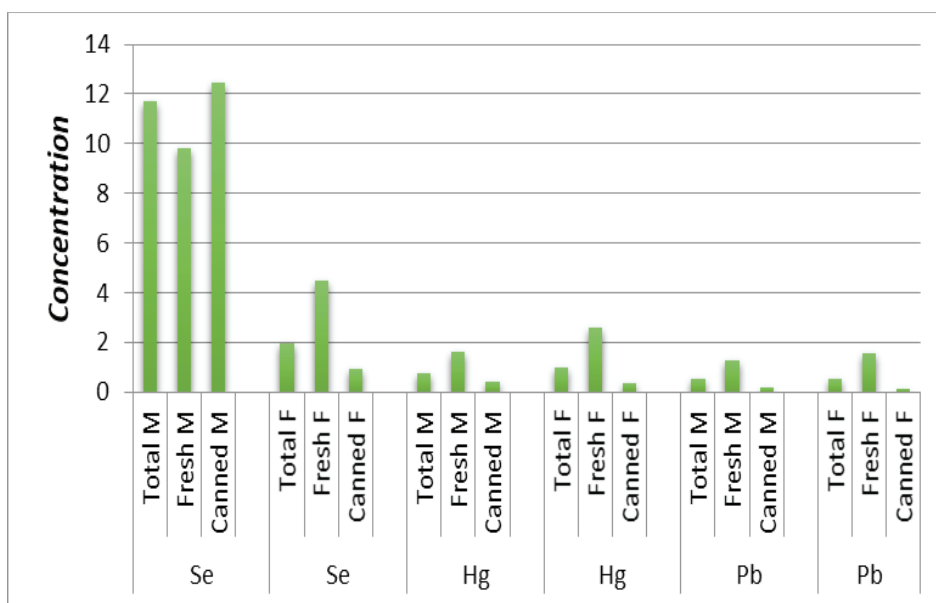
Type of sample	Number	Concentration					
		Se (ng/ml)		Hg (mg/l)		Pb (mg/l)	
		range	mean	range	mean	range	mean
Fresh and canned Meat	14	6.25-19.12	11.73	0.002-2.1	0.743	0.029-2.3	0.53
Fresh and canned Fish	14	0.27-9.23	1.94	0.1-3.5	0.980	0.095-1.59	0.5

**Table 2. Concentration of metals (Se, Hg and Pb) in fresh and canned (Meat and Fish).**

Mean Concentration	Meat		Fish	
	Fresh	Canned	Fresh	Canned
Se (ng/ml)	9.805	12.48	4.46	0.94
Hg (mg/l)	1.625	0.39	2.6	0.325
Pb (mg/l)	1.25	0.2	1.55	0.11



**Figure 1. Concentration of metals (Se, Hg and Pb) in fresh and canned (Meat and Fish).**



**Figure 2. Total concentration of Se, Hg and pb compared with concentration in fresh and canned meat and fish.**

### Conclusion

In this study, the levels of Se, Hg and nickel and Pb in fresh and canned food samples were investigated. The result of the analysis showed that these heavy metals were present in the selected canned and fresh foods. Considerable differences were found in the levels of these metals among the samples. The level of Se was found within acceptable limit set by World Health Organization (WHO). However, Pb and Cd call for concern as they were found to be above permissible acceptable limit set by World Health Organization (WHO).

The canned samples generally, recorded lower concentration of heavy metals as compared with the fresh fish and meat samples and could be considered safer for consumption. Consumption of fishes grown in rivers and fish ponds within the study area should be avoided in order to prevent Hg or Pb poisoning due to accumulation over time. which could pose a risk to human health due to the accumulation of these elements in the sensitive internal organs such as liver, kidneys, and brain. So we recommend tightening health control methods and ways of breeding fish caught and processed water that equips fish farms and methods of disposal of industrial waste, which has the main reason for the pollution of fish and meat and determine the extent of the safety and validity

of these fish and meat for human consumption.

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**Conflict of Interest:** It is nil.

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