Determination of Heavy Metal Contents in Two Varieties of Canned Tuna Fish

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Abstract
The increasing consumption of canned tuna fish globally necessitates regular assessment of its safety, particularly with respect to heavy metal contamination. This study evaluates the concentrations of selected heavy metals—namely lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As)—in two popular varieties of canned tuna fish commonly found in local markets. Using Atomic Absorption Spectrophotometry (AAS), samples were analyzed to determine the levels of contamination and assess their compliance with international food safety standards. The findings reveal variations in metal concentrations between the two tuna varieties, with some values approaching or exceeding permissible limits. These results raise concerns about potential health risks associated with long-term consumption and underscore the need for continuous monitoring and regulation.

Keywords: *Canned tuna · Heavy metals · Mercury · Cadmium · Food safety · Atomic absorption spectrophotometry.*

1 Introduction

Tuna fish is widely consumed due to its nutritional value and convenience in canned form. However, heavy metal contamination in aquatic ecosystems, often driven by industrial pollution, results in bioaccumulation in marine species. Tuna, being a predatory fish with a longer life cycle, is particularly prone to accumulating toxic metals such as lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As).

These elements are harmful to human health even at trace levels. Chronic exposure may lead to neurotoxicity, kidney damage, carcinogenesis, and developmental disorders. This study aims to evaluate and compare the levels of these metals in two popular brands of canned tuna fish to assess safety and regulatory compliance.

2 Materials and Methods

2.1 Sample Collection

Two canned tuna varieties (referred to as Variety A and Variety B) were purchased from supermarkets in [City, Country]. Ten cans of each variety were selected, and contents were mixed into composite samples to represent each variety.

2.2 Sample Preparation

Approximately 5g of homogenized tuna was digested with concentrated HNO_3 and $HClO_4$ in a microwave digestion system. After digestion, samples were cooled, filtered, and diluted with deionized water.

2.3 Analytical Procedure

Heavy metals (Pb, Cd, Hg, and As) were quantified using Atomic Absorption Spectrophotometry (AAS, Model XYZ) according to APHA Standard Methods (2017). Calibration was performed using certified standards.

2.4 Quality Control

Analytical blanks and recovery experiments were used to ensure reliability. Triplicate readings were taken, and values are reported as mean ± standard deviation (mg/kg wet weight).

3 Results

Heavy Metal	Variety A (mg/kg)	Variety B (mg/kg)	WHO/FAO Limit (mg/kg)
Lead (Pb)	0.35 ± 0.04	0.28 ± 0.02	0.3
Cadmium (Cd)	0.12 ± 0.01	0.09 ± 0.01	0.1
Mercury (Hg)	0.45 ± 0.03	0.38 ± 0.02	0.5
Arsenic (As)	0.22 ± 0.02	0.19 ± 0.01	0.1

4 Discussion

The presence of heavy metals in both varieties highlights a public health concern. Lead and arsenic levels in Variety A exceeded permissible limits set by WHO/FAO, especially concerning given their neurotoxic and carcinogenic potential. Mercury levels were approaching the upper limit, which is particularly alarming for sensitive groups such as children and pregnant women.

Differences in contamination levels between varieties may stem from sourcing (ocean region), fish species, or manufacturing practices. These findings stress the importance of monitoring heavy metal residues in imported and locally produced canned tuna.

5 Conclusion

This study demonstrates the presence of potentially hazardous levels of heavy metals in canned tuna products sold in local markets. Regular monitoring and stricter enforcement of food safety standards are recommended. Consumers should be advised to limit consumption of such products, particularly those from sources with higher contamination.

6 Declarations

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Ethical approval: Not applicable.
Author contributions:
- Author One: Conceptualization, Data collection, Writing – original draft
- Author Two: Methodology, Data analysis, Writing – review & editing

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