Program Profile		
Program	Program name	Determination of Tissue-Specific Heavy Metal Accumulation in Mice via AAS, ICP-MS and Toxicological Evaluation
	Category	"A5"

Summary of Program	
Program Name	Determination of Tissue-Specific Heavy Metal Accumulation in Mice via AAS, ICP-MS and Toxicological Evaluation
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Abstract of Program	Heavy metal contamination represents a serious environmental and public health concern due to the persistent and bioaccumulative nature of elements such as lead (Pb), cadmium (Cd), mercury (Hg), and arsenic (As). Prolonged exposure to these metals can lead to their accumulation in specific tissues and organs, resulting in oxidative stress, inflammation, and organ dysfunction. This study aims to investigate the tissue-specific accumulation of selected heavy metals in mice and evaluate the associated toxicological effects using both **Atomic Absorption Spectroscopy (AAS)** and **Inductively Coupled Plasma Mass Spectrometry (ICP-MS)**. Adult Swiss albino mice will be exposed orally to a controlled mixture of Pb, Cd, Hg, and As over a 28-day period. Post-exposure, vital organs including the liver, kidney, brain, lungs, and spleen will be harvested for analysis. AAS and ICP-MS will be employed to determine metal concentrations, allowing a comparative assessment of the sensitivity, precision, and efficiency of both analytical methods. In addition to quantification, toxicological evaluation will be performed using biochemical markers (e.g., ALT, AST, urea, creatinine) and histopathological examinations to assess structural and functional damage in tissues. These combined analyses will help to establish correlations between tissue metal burden and pathological changes. The anticipated results are expected to demonstrate organ-specific differences in metal accumulation, with particular emphasis on the liver and kidneys due to their detoxification roles. This study will also highlight the advantages of using ICP-MS over AAS for multi-element and ultra-trace detection. The findings will provide valuable insights into heavy metal toxicokinetics and systemic toxicity, contributing to risk assessment models and the development of public health strategies for minimizing metal exposure. Moreover, the methodological approach can serve as a model for future environmental toxicology research.

Details of Program		
Planning		
Objectives	Long-term Goals	1. Develop a reliable model for predicting heavy metal bioaccumulation in mammals. 2. Establish a reference database of tissue-specific heavy metal distribution for risk assessment. 3. Contribute to understanding the relationship between chronic heavy metal exposure and organ toxicity. 4. Provide scientific basis for regulatory guidelines on environmental and occupational heavy metal exposure. 5. Facilitate translation of findings to human health studies and public health policies.

		6. Open opportunities for further research on protective agents, detoxification mechanisms, and therapeutic interventions
	Short-term Targets	1. Standardize tissue sample preparation protocols for AAS and ICP-MS analysis. 2. Accurately quantify levels of specific heavy metals (e.g., Pb, Cd, Hg, As) in different mouse tissues (liver, kidney, brain, muscle, etc.). 3. Compare sensitivity and accuracy of AAS vs ICP-MS for tissue-specific detection. 4. Conduct preliminary toxicological evaluation (biochemical assays, histopathology). 5. Establish correlation between heavy metal concentration and observed toxicological changes. 6. Generate initial dataset to validate experimental design and methodology.
	Rationale	Heavy metals such as Pb, Cd, Hg, and as persist in the environment, bioaccumulate in organisms, and cause severe health risks. Their distribution is often tissue-specific, leading to organ-related toxic effects. However, clear data on organ-wise accumulation and its correlation with toxicity are limited. This project uses **AAS and ICP-MS** to quantify heavy metals in mouse tissues and evaluates associated toxicological changes. The findings will bridge knowledge gaps, support risk assessment, and provide a scientific basis for regulatory and public health interventions
Subject (Leader)	Initiator(s)	AKTER, Rahima
	Champion(s)	CHOUDHURY, Musfiq Mannan
	Major team member(s)	RASHID, MHO; LABU, Zubair Khalid; LABONI, Farhina Rahman, RUPON Farjana Akter; SHAKIL Md.
Environment	Nature/Society	Public health concern due to the bioaccumulation of toxic metals in the food chain. Outcomes can guide health warnings, community awareness, and protective regulations.
	Industry/Market	Industries dealing with metals, waste management, and agriculture may benefit from risk assessments and safe disposal practices. Demand for precise toxicology tools may increase
	Citizen/Government	Relevant for government agencies (e.g., environment, health ministries), NGOs, and regulators to develop safety guidelines, emission control policies, and environmental monitoring programs.
Resources	Human resources	Researchers (toxicologists, pharmacist, analysts, pathologists)
	Financial resources	Funding would be necessary for plant collection, testing, and development. Salaries for researchers and technical staff also contribute to the financial requirements. (4,00,000/- BDT).
	Technological resources	Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma, Mass Spectrometry (ICP-MS) Statistical Analysis Software, Light Microscope with Histopathology Tools, Biochemical Analyzer, Microwave-Assisted Acid Digestion System.
Mechanism	Strategy (Weight/Sequence)	The research will begin with a literature review and protocol development, followed by ethical approval and animal procurement, which are critical for study validation. Subsequent steps include metal exposure, tissue collection, AAS/ICP-MS analysis, and toxicological evaluations. Finally, data will be analyzed statistically, and findings will be compiled into a report or publication.
	Organization	The university's organizational structure supports the project by providing research facilities, an ethical review committee, and administrative channels for animal procurement and compliance. Laboratory resources and technical

		staff align with the program's strategy of applying advanced analytical methods (AAS/ICP-MS) and toxicological evaluation. However, smooth execution will depend on efficient coordination between research, ethics, and laboratory units—highlighting the need for clear communication and timely decision-making within the structure.
	Culture	The university's culture of promoting research, academic freedom, and interdisciplinary collaboration generally supports the program's execution by encouraging innovation and compliance with ethical standards. A supportive environment for publishing and presenting findings also aligns with the program's goals. However, if bureaucratic delays, limited funding flexibility, or resistance to new methodologies exist, these cultural aspects could hinder smooth and timely project implementation.
Doing		
Launch date		January, 2025.
Responsible organization		World University of Bangladesh
Program content and process		This study investigates how heavy metals like lead, cadmium, mercury, and arsenic accumulate in different mouse organs. Using sensitive techniques such as Atomic Absorption Spectroscopy (AAS) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS), the metal concentrations in tissues will be measured. Additionally, toxicological assessments including biochemical tests and histopathology will evaluate the damage caused by metal buildup, providing insights into organ-specific toxicity and health risks.
Key highlights of the content/process		Accumulation, AAS, ICP-MS, toxicological, biochemical
Differences from traditional approaches		This study uniquely combines AAS and ICP-MS to precisely measure heavy metal accumulation in specific mouse organs, linking these levels to biochemical and histopathological toxicity assessments. Unlike traditional approaches that often use a single technique or analyze whole-body metal levels, this integrated, tissue-specific method provides a more comprehensive understanding of metal-induced organ damage.
Progress as of today		Literature review, study design, methodology development and sample collection has already been done. Now preparation of heavy metal is going and animals are breeding.
Problems in implementation		There is a shortage of all advanced instruments and animal handling facilities in the university.
Approaches to solve the problems		Need all advanced instruments and animal handling facilities in the university.
Completion date, if completed		Not completed yet
Seeing		
Impacts on students		Students involved in the project will gain hands-on experience in advanced analytical techniques (AAS, ICP-MS) and toxicology. This enhances their practical skills, research capacity, and employability in scientific and industrial sectors.
Impacts on professors		Professors will benefit from research publications, grants, and academic recognition, while the university strengthens its profile in environmental toxicology. This can lead to higher research funding, collaborations, and improved institutional ranking.
Impacts on university administration		This study enhances the university's research profile by demonstrating

	capacity in advanced analytical techniques (AAS/ICP-MS) and ethical animal studies, strengthening its position in scientific innovation and public health research. It may guide administrative decisions on investing in laboratory infrastructure, research funding, and compliance frameworks. Additionally, successful outcomes can improve the university's reputation, attract external collaborations, and support accreditation or ranking goals.
Responses from industry/market	Not yet introduced with any industry for response.
Responses from citizen/government	N/A
Measurable output (revenues)	**Research Funding Leverage** • Successful completion can attract **national/international research grants** (approx. USD 20,000–50,000) for follow-up studies. **Laboratory Infrastructure Utilization** • Optimized use of AAS/ICP-MS reduces outsourcing costs (savings of **USD 5,000–10,000 per year**) by conducting in-house analyses. **Capacity Building** • Training students and staff on advanced instrumentation enhances employability, indirectly adding value of **USD 2,000–3,000 per trainee** in professional skill development. **Publications and Recognition** • High-impact publications can bring **performance-based research incentives** (USD 500–1,000 per paper, depending on university policy). **Industry & Government Collaborations** • Findings may initiate consultancy projects with environmental, pharmaceutical, or public health agencies (potential revenue **USD 10,000+ annually**). • **USD 50,000+ in tuition revenue** over several years.
Measurable input (expenses)	N/A
Cost-benefit analysis for effectiveness	N/A
Future Planning	
Where does the project go from here?	The project can be extended to human biomonitoring studies or environmental sampling to assess real-world exposure risks. It also opens avenues for developing preventive strategies, public health guidelines, and advanced detection tools for heavy metal contamination.
Addendum	
Exhibits, pictures, diagrams, etc.	Social Media/ Seminar /Symposia
Reports, mimeos, monographs, books, etc.	University, Journal
Others which may help explain the program (including website links)	https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2022.791052/full?utm_source=chatgpt.com