Program Profile		
Program	Program name	"Evaluating the Hepatoprotective Efficacy of *Terminalia arjuna* Against Combined High-Fat Diet and Heavy Metal-Induced Liver Injury: A Preclinical Study"
	Category	**'A3'**

Summary of Program	
Program Name	"Evaluating the Hepatoprotective Efficacy of *Terminalia arjuna* Against Combined High-Fat Diet and Heavy Metal-Induced Liver Injury: A Preclinical Study"
Category	**'A3'**
Abstract of Program	The increasing global burden of metabolic liver diseases and environmental heavy metal exposure presents a critical public health challenge, yet their combined hepatotoxic effects remain poorly characterized. This research looks forward to investigate the therapeutic potential of *Terminalia arjuna*, a medicinal plant with documented antioxidant properties, against high-fat diet (HFD) and heavy metal mixture (HMM)-induced liver injury. Using a murine model, we will systematically evaluate the hepatoprotective efficacy of *T. arjuna* leaf and bark ethanolic extracts (200/400 mg/kg) compared to silymarin (140 mg/kg), the clinical gold standard. The study will employ a comprehensive analytical approach, including serum biomarkers (ALT, AST, ALP, triglycerides), oxidative stress markers (catalase activity), and histopathological assessment to elucidate mechanisms of action. This work will address three key knowledge gaps: (1) the lack of preclinical models for combined HFD-HMM hepatotoxicity, (2) underexplored therapeutic potential of *T. arjuna* leaf extracts, and (3) optimal dosing strategies for phytochemical interventions in metabolic-toxic liver injury. The proposed research has significant translational potential, particularly for developing affordable hepatoprotective agents in heavy metal-polluted regions with high NAFLD prevalence. Outcomes will provide essential data for future clinical trials and may inform public health strategies addressing synergistic diet-environment liver disease risks.

Details of Program		
Planning		
Objectives	Long-term Goals	To establish *Terminalia arjuna* as a clinically validated hepatoprotective agent for treating combined environmental and metabolic liver diseases and develop accessible, affordable therapeutic formulations in collaboration with industry over the next 5 years.
	Short-term Targets	Complete preclinical efficacy and safety studies within one year, publish results in peer-reviewed journals, and initiate partnerships for clinical translation and pharmaceutical development.
	Rationale	Given the global rise in liver diseases attributed to high-fat diets and environmental heavy metal exposure, existing hepatoprotective treatments remain insufficient Antioxidant and chelating properties of *Terminalia arjuna* present an untapped, promising natural remedy requiring empirical validation to fill this therapeutic gap.
Subject (Leader)	Initiator(s)	RUPON, Farjana Akter

	Champion(s)	CHOUDHURY, Musfiq Mannan
	Major team member(s)	RASHID, Md. Harun-Or-; LABONI, Farhina Rahman; AKTER, Rahima; SHAKIL, Md.
Environment	Nature/Society	Increasing environmental heavy metal pollution combined with dietary westernization exacerbate liver-related health burdens, positioning this program at the intersection of public health and environmental science.
	Industry/Market	Pharmaceutical and nutraceutical markets show rising demand for novel hepatoprotectants, especially plant-based agents with lower side-effect profiles.
	Citizen/Government	The findings will influence public information and facilitating support for novel therapeutic research addressing diet and pollution-related health impacts
Resources	Human resources	The study required experts in pharmacy, biology, computational biology and pathologist. One research associate is already engaged. Then four students will be involved in this program for smooth operation of the research work
	Financial resources	Self-funded with plans for external funding applications.
	Technological resources	Access only to animal study facilities, biochemical analysis.
Mechanism	Strategy (Weight/Sequence)	1. Subject matter research and extraction method optimization. 2. Preclinical efficacy evaluation. 3. Safety profiling and formulation development. 4. Industry partnerships and clinical trial preparation.
	Organization	Program integrated within the university's Pharmacy department.
	Culture	The university fosters innovation and interdisciplinary collaboration, supporting program goals actively.
Doing		
Launch date		July, 2025
Responsible organization		Department of Pharmacy, World University of Bangladesh
Program content and process		The program encompasses phytochemical extraction of *Terminalia arjuna* experimental induction of hepatic injury in mice via combined heavy metal and high-fat diet exposure, biochemical and histological evaluation of liver function and morphology, and comparative efficacy testing against standard hepatoprotective agents. Data analysis and ongoing optimization pave the path toward scalable therapeutic development.
Key highlights of the content/process		**Content:** Focus on combined metabolic-toxic liver injury; use of ethnopharmacological agent; comprehensive biochemical/histological evaluation. **Process:** Rigorous animal modeling; systematic comparative testing; integration of biochemical, histological, and molecular endpoints.
Differences from traditional approaches		Targets combined liver insults rather than isolated single factors; uses a medicinal plant extract with multifunctional antioxidant and chelating properties, diverging from conventional synthetic hepatoprotectants.
Progress as of today		Completed initial animal model validation and biochemical analysis showing promising hepatoprotective effects.

Problems in implementation	Challenges in standardizing extract concentrations and scaling up for clinical translation.
Approaches to solve the problems	Adopted rigorous quality controls in extraction; initiated collaborations with phytochemistry experts
Completion date, if completed	Ongoing, with expected completion of preclinical phases by mid-2026.
Seeing	
Impacts on students	Enhanced hands-on research training in innovative pharmacology and toxicology fields.
Impacts on professors	Expanded research expertise and publication opportunities in translational medicine.
Impacts on university administration	Elevated research profile and potential for industry collaboration and funding.
Responses from industry/market	Not yet introduced with any industry for response.
Responses from citizen/government	Not yet introduced for response.
Measurable output (revenues)	Early research phase, no revenue yet.
Measurable input (expenses)	Funding would be necessary for plant collection, testing, and development. Salaries for researchers and technical staff also contribute to the financial requirements. (3,50,000/- BDT)
Cost-benefit analysis for effectiveness	Not yet applicable
Future Planning	
Where does the project go from here?	Progress toward clinical trial applications, scale-up of production, patent filing, and collaboration with pharmaceutical companies to deliver accessible hepatoprotective treatments addressing combined environmental and metabolic liver diseases globally.
Addendum	
Exhibits, pictures, diagrams, etc.	Not yet applicable
Reports, mimeos, monographs, books, etc.	Not yet applicable
Others which may help explain the program (including website links)	Not yet applicable