



Danio rerio

Zebra fish

The IAEC, Jamia Hamdard is also authorized to approve the experimental research on Zebra fish (*Danio rerio*).

The facility is housed in the AYUSH Centre of Excellence in Unani Medicine and is inspected by the CCSEA nominee as per the schedule. Zebra fish facility supports biomedical, pharmaceutical, toxicological, and behavioural research due to its acceptability as vertebrate alternate experimental model due to small size, ease of maintenance, rapid development, high fecundity, and conserved physiological pathways relevant to human health and disease. The facility ensures species-specific husbandry, welfare, and reproducibility of experimental outcomes. At JH, the research of zebra fish focuses on:

- Pharmacological screening and dose-response evaluation
- Acute and sub-acute toxicity studies
- Neurotoxicity and neurobehavioral assessment
- Developmental and organ-specific toxicity
- Screening of herbal extracts, fractions, and bioactive compounds

The conservation of biological pathways related to oxidative stress, inflammation, metabolism, neuroendocrine regulation, and organ function makes zebrafish a valuable translational research model. Embryos and larvae are used for early developmental studies, while adult zebrafish is commonly employed for behavioural, chronic exposure, and disease-relevant investigations.

Facility Design and Operational Setup

The zebrafish facility is a dedicated, controlled unit organized to support systematic daily operations, including feeding, tank cleaning, water quality management, health surveillance, breeding, record maintenance, and research procedures. All activities are conducted in a standardized manner to minimize stress, maintain stable baseline conditions, and ensure consistency across experimental studies.

Tank System and Housing Capacity

The zebrafish facility at Jamia Hamdard consists of a total of 20 tanks, arranged in two size categories:

- 10 L tanks: 5 units
- 3 L tanks: 15 units

Stocking density is managed as per tank capacity:

- Each 10 L tank houses up to 50 zebrafish (total capacity: 250 fish)
- Each 3 L tank houses up to 15 zebrafish (total capacity: 225 fish)

The maximum holding capacity is 475, while an average stock of 300 (approx.) is maintained, ensuring maintenance well within the capacity limits to support reduce stress and improve experimental consistency.

Stocking Density Control and Colony Management

Fish are distributed across tanks according to volume and experimental requirements. Controlled stocking density ensures:

- Adequate dissolved oxygen availability
- Uniform access to feed
- Reduced aggressive interactions
- Lower physiological and behavioural variability

This approach supports colony sustainability, minimizes mortality risk, and allows smooth allocation of zebrafish for experimental and reserve purposes.

Environmental Control: Temperature and Photoperiod

The zebrafish facility maintains standardized environmental conditions essential for welfare and experimental reproducibility:

- Temperature: 26–28°C
- Photoperiod: 14:10 light–dark cycle

Stable temperature and photoperiod are critical for maintaining circadian rhythm, feeding behavior, breeding efficiency, locomotor activity, and reliability of behavioural assays.

Water Quality Management

Water quality is maintained through daily water changes using dechlorinated water. The following parameters are regularly monitored and documented:

- pH
- Temperature
- Hardness
- Alkalinity
- Dissolved oxygen
- Ammonia, nitrite, and nitrate levels

Strict water quality control prevents stress, abnormal behavior, gill irritation, and mortality, thereby protecting both animal welfare and the quality of experimental data.

Tank Cleaning, Hygiene, and Maintenance

Routine tank cleaning and hygiene practices are followed to remove debris and reduce biofilm formation. Regular maintenance minimizes microbial load, stabilizes water conditions, and reduces disease risk. All cleaning procedures are standardized to ensure uniformity across tanks and minimize handling-related stress.

Feeding Schedule and Feeding Records

The facility follows a documented feeding program, with zebrafish fed three times daily at standardized times. Feeding records are maintained in designated registers to ensure consistency, traceability, and uniform metabolic status across experimental groups—an important consideration for behavioral and toxicity studies.

Breeding Facility and Breeding Records

Zebrafish breeding is conducted as a controlled and traceable activity to support colony maintenance and experimental requirements.

Breeding records include:

- Tank identification
- Date of breeding
- Parent stock details
- Quantity of offspring

These records support genetic traceability, planned colony expansion, and availability of fish for research studies.

Health Monitoring, Quarantine, and Treatment

Routine health surveillance is conducted to identify early signs of disease, distress, or abnormal behaviour. Fish showing signs of illness are isolated for quarantine and focused monitoring. Symptom-based treatment and supportive measures are provided when required, and all observations and outcomes are documented to prevent disease spread and maintain colony stability.

Mortality Records and Welfare Monitoring

The facility maintains systematic records of mortality, clinical signs, treatments provided, and outcomes. These records support welfare tracking, trend analysis, and implementation of corrective actions when required, strengthening quality assurance and regulatory compliance.

Records, SOPs, and Staff Training

A structured documentation system is maintained, including:

- Entry and stock registers
- Feeding logs
- Water quality monitoring records
- Breeding records
- Health and mortality records

Standard operating procedures are followed for husbandry, feeding, water management, cleaning, handling, and health surveillance. Staff training and competency are documented to ensure consistency, reduced handling stress, and reproducible experimental outcomes.

Behavioural Research Facilities

The zebrafish unit includes dedicated behavioral testing setups, such as:

- Light–Dark Chamber
- Open Field Apparatus
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These facilities support standardized assessment of locomotion, exploration, and anxiety-like behavior, enabling reliable neuropharmacological and safety evaluations.

Training, Student Projects, and Research Support

The zebrafish facility is actively used for the hands-on training of postgraduate students and research scholars, demonstration of aquatic animal handling and husbandry, and behavioural assay training and data interpretation.

The facility supports MSc, MPharm, MD, and PhD projects, as well as intramural and extramural funded research, facilitating timely completion of research activities within a regulated environment.

