



Review Article

Care and Handling of Laboratory Experimental Animals: A Comprehensive Review

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Abstract

Animals are used to learn about living things and the disease that harm humans and other animals. In today's modern technology era, it is possible to obtain information by studying or experimenting on same particular animals. When a new drug, drug dosage, surgery, diagnostic technique is developed, society or the laboratory science technicians them self considers it unethical to use that drug or technique in humans because it is likely to cause harm rather than benefits if not properly taken care all the procedure needed. The drug or technology is tested on animals to make sure it is safe and effective. Similarly, by studying in this field, we get many things like biological information about the behavior of animals, their preferred environment, food habit, lifestyle and others.

Keywords: Care, Handling, Cage, Temperature, Ventilation, Diet, Fluid, Humidity, Prevention of diseases, Cleanliness etc.

1. Introduction

Laboratory experimental animals refer to individual animals or groups of animals, regardless of species, intended exclusively for research purposes. They do not include animals meant for food production or personal economic use [1].

2. Need and aim of laboratory experiment on animal

Many behavioral, physical and chemical properties like Hormones and enzymes, electrolytes etc. are shared by certain type of organism's similarities to laboratory animals can help researchers understand important biological and physiological processes in human these understandings may confirm how we can better prevent, diagnose, treat and cure diseases [2].

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3. Principles and handling for laboratory experimental animal

- One must very careful and kind in handling to laboratory animals.
- There should be a special constitutional rule and regulations for the use of any laboratory experimental animal so that no animal is treated cruelly.
- One should have in-depth knowledge about all the facts animals their biological activity, life cycle and all other facts.
- All personnel caring for laboratory experimental animals should be diversely trained.
- Such species of laboratory experimental animals should be selected that they yield very pure and effective results.
- Laboratory procedure involving experimental animals and humans must have a good health purpose [3].

4. Guidelines, caring and staff responsibilities for laboratory experimental animals

Guideline

- **Clean and Hygiene:** All workers and users must maintain the highest level of cleanliness and hygiene in the facility.
- **Safety Equipments:** The use of safety equipment such as gloves, masks, and other necessary protective gear is mandatory.
- **Entry and Exit:** Only authorized personnel are allowed to enter the facility. Entry and exit times should be properly maintained.
- **Animal Care:** Use appropriate techniques while caring for the animals and avoid any kind of violence.

Practice

- **Inspection:** Regularly inspect the animals and their habitats to ensure their health and safety.
 - **Documentation:** Maintain complete records of the animal's health, diet, and any medical treatments.
- Fig.1**
- **Trainings:** Conduct training sessions for all staff from time to time to keep them informed about the latest procedures and protocols.



Fig.1 Technical Officer Maintaining the Record

Working Procedure

- **Assessment:** All animals should undergo an initial health assessment before entering the facility.

- **Caring:** Provide balanced diet, adequate food, water, and clean-living conditions for the animals daily (routinely).
- **Emergency Conditions:** There should be a set procedure and first aid for any emergency situations, and all staff should be trained in it.

Responsibilities of staff

- Maintain the daily care and cleanliness of the animals and their habitats.
- Keep records up-to-date and report any unusual conditions. **Fig.2**
- Follow all safety protocols.



Fig.2 Record keeping of requirements

These guidelines, practices, working procedures, and responsibilities ensure that all operations in the animal facility are conducted safely, effectively, and ethically [4].

5. List of animals and their experimental areas and importance

RAT (NORWAY RAT)- *Rattus norvegicus*

1. They are very similar to people genetically, according to Foundation Biomedical Research (FBR).[5]
2. They are perfect pets, social, low maintenance, safe and highly intelligent, shorter life span.[6]
3. This rat (**Fig-3**) is a very useful animal for the analysis of many broad areas of **Biomedical**, Such as **Cardiovascular** disease, **metabolic disorders** like **Diabetes Mellitus**, **Neurological disorders**, and **behavioural** like areas of **motor function**, **healing**, **vision**, **learning**, **epilepsy**. [7]

Fig-3. Rat



GUINEA PIG- *Cavia procellus*

1. Guinea pig have resemble to many biological similarities to the humans (**Fig.4**)
2. Guinea pig are highly sensitive to **Histamine** and **Penicilline** substances.
3. They are use as many microbiological examination and they are specially susceptible to bacterial such as **Tuberculosis**¹⁵³ and **Diphtheria**²⁸⁷ [8,9].

4. The guinea pig are used as blood, tissue, organs to research like **Antigen studies**, **Transplantation studies** etc and new medicine discovery [10].



Fig-4. Guinea pig

ZEBRA FISH- *Danio rerio*

1. They are small, short life span, reproduced quickly (100 progeny per week) easy to collect a large number of embryo's samples and easy to care and handling [11,12].
2. The zebrafish (**Fig.5**) genome-sequencing project was initiated at the *Wellcome Trust Sanger Institute* in 2001 and was found to contain 84% of genes known to be associated with diseases in humans [13].
3. Many advantages of these animals like **investigation of synopsis** and **neuronal connectivity, mapping**, including their **optical transparency**, rapid development and **genetic flexibility** [14].
4. The toxic drug candidates, allowing safer molecule to be tested in mammalian model by using of Zebrafish's larva [15].



Fig-5 Zebra fish

MONKEY- *Macaca mulatta*

1. Many monkey are used in the laboratory experiments- Cynomolgus, squirrel monkey, owl monkey and baboons etc. **Fig.6**
2. The genetic structures of monkey similar to the humans make them particularly suitable organism for the testing the safety of new drugs and intensive studies of diseases of the brain.[16]
3. Many experiments done on the monkey like development of vaccines, treatment of severe infections and disease and drug dosages and their side-effects.[17]



Fig-6 Monkey

CAT- *Felis cattus*

1. A study of cats showed that the brain must be exposed to certain sights early in life or it will remain blind to those sight forever. **Fig-7**
2. The cats are important for study of **cancer, genetic disorders, and SARS-Cov-2**. [18]
3. Cat are also important of other importance like- **HIV/AIDS**, research due to a pairs of AIDS like Feline viral disease.[19]
FIV (Feline immunodeficiency virus).



Fig- 7 Cat

DOG- *Canis lupus familiaris*

1. A lots of experiments and study done on the dog like- **Fig.8**
-Pacemaker testing
-Biomedical experiments including **cardiac, Neurological, respiratory and dental experiments** [20].
2. Discovery and experience of insulin to treat diabetic patients, development of blood transfusion procedures and the creation of electrical defibrillator to restore normal heart rhythm [21].

Fig-8 Dog



Some other animal are useful in the laboratory experiments- **Frog, Zebra, Pigeon, Fish, Chicken, Birds** etc.

6. Requirements of Animals

Housing requirements

- **Species-Specific Needs:** Each species has distinct requirements for space, social interaction, and environmental enrichment.
- **Comfort and safety zone:** Housing must be designed to provide comfort, healthy and safety zone for the animals, minimizing the risk of injury and distress [22].
- **Environment and Enrichment:** Maintain optimal levels of temperature, humidity, lighting, and ventilation suitable for the housed species. Include provisions such as nesting materials, climbing structures, and toys to support the physical and mental well-being of the animals [23].

Cage types and features

- **Size and space:** -Rodents (mice, rats, hamsters): Cages should provide adequate space for natural

postures and movements. For instance, mice generally need a minimum of 330 cm² of floor space per adult animal.

- **Rabbits:** Ensure cages are spacious enough to accommodate hopping and standing on their hind legs comfortably. A typical rabbit cage might measure 60 x 90 x 60 cm.

- **Primates:** Provide enclosures that support climbing and social interaction. For smaller primates like macaques, ensure the enclosure is at least 3 cubic meters in size.

- **Durability, design and safety of materials of :** Cages should be constructed from durable materials that are easy to clean and disinfect, such as stainless steel or high-quality plastic or other materials **Fig.9**

Design: Ensure the cages are escape-proof with secure latches and adequate ventilation. The design should facilitate easy access to food and water for the animals [24].



Fig-9 Experimental cages

Diet

- Provide a well-balanced and appealing diet that meets the specific nutritional requirements of the animals.
- Use good-quality commercial feed formulated for their species and life stage.
- Maintain access to food except when restricted for experimental or health reasons.
- Monitor food intake carefully and adjust as needed to prevent overfeeding or underfeeding to each animal [25].

Fluid

- Ensure continuous availability of fresh, drinkable water.
- Use appropriate water bottles or bowls designed for the species, ensuring ease of cleaning.
- Change water regularly to avoid bacterial and other microbial contaminations.
- Monitor water consumption and make adjustments to prevent dehydration or overhydration as necessary to animals [26].

Bedding and Lighting

- ***Bed:*** Ensure bedding material is comfortable, non-toxic, absorbent, and dust-free, necessitating periodic replacement to uphold cleanliness and dryness.
- ***Natural Light Cycles:*** Emulate natural light cycles by incorporating suitable periods of light and darkness.
- ***Intensity and Spectrum:*** Ensure lighting is gentle and not overly bright; consider using lights that replicate natural sunlight.

Humidity

The optimal humidity range for laboratory animals varies depending on the species, generally falling between 30% - 70%. Deviations from these ranges may lead to discomfort, stress, and weakened immune system, which could impact experimental outcomes of results. Maintaining ideal humidity levels is crucial for ensuring animal welfare and obtaining consistent

accurate, timely, precise and reliable research results [27].

Other affective factors

Ventilation:

Ventilation in laboratory animal facilities is essential for maintaining a healthy environment for both animals and staff by avoiding harmful airborne contaminants. Important design factors include the species of animals, cage design, room layout, airflow rates, and air treatment. It is recommended to have 10-15 air changes per hour, with HEPA filters that can remove 99.97% of particles $\geq 0.3 \mu\text{m}$, such as dust, dander, and bacteria. Effective ventilation design and operation are crucial to ensuring animal welfare, reducing stress, and preventing the spread of diseases [28].

• **Temperature:**

The impact and importance of temperature on laboratory animals are significant, affecting their physiological responses, comfort, stress levels, immune function, behaviour, reproduction, and experimental outcomes. Deviations from the optimal temperature range can lead to discomfort, stress, anxiety, a weakened immune system, and altered behaviour and reproductive performance, thereby influencing experimental results. Effective temperature control is crucial for maintaining animal welfare, preventing distress, and ensuring consistent experimental conditions, which are essential for reliable and reproducible research findings. By keeping temperatures within the optimal range, researchers can enhance animal well-being, minimize stress, and achieve accurate and valid experimental outcomes.[29]

It is essential that other factors crucial for the requirements of laboratory experimental animals are also made readily available. Like **Noise and vibration control, Toys and puzzles, Physical enrichment (shelves, Tunnel, climbing, hiding), social contact** etc.

Table-1

Tere are some other temperature ranges for laboratory animals:

ANIMALS	Temperature
Rats	21-24°C (70-75°F)
Hamsters	20-24°C (68-75°F)
Guinea pigs	20-22°C (68-72°F)
Rabbits	16-20°C (61-68°F)
Dogs	16-22°C (61-72°F)
Primates (non-human)	20-24°C (68-75°F)
Cats	20-22°C (68-72°F)
Ferrets	16-20°C (61-68°F)
Gerbils	20-24°C (68-75°F)

Table-1 Some animals and their required Temp.

7. Prevention of diseases in laboratory experimental Animals

Preventing diseases in laboratory animals involves several strategies, including ensuring proper housing, sanitation, and hygiene, providing clean food and water, administering vaccinations and controlling parasites, handling animals carefully, and monitoring their health regularly. Effective barrier systems like personal protective equipment (PPE) and HEPA filtration are crucial to prevent the introduction and spread of pathogens. Regular cleaning and disinfection of cages, equipment, and facilities, along with sterilization of instruments and materials, also play a vital role in disease prevention. Additionally, maintaining optimal environmental conditions such as temperature, humidity, and ventilation, and offering suitable bedding and enrichment, are essential for reducing stress and promoting animal welfare, thereby preventing diseases [30].

8. Conclusion

The welfare of laboratory experimental animals is critical to the success and integrity of scientific research. By meeting species-specific needs, ensuring a safe and clean environment, and providing appropriate enrichment, we can enhance the animals' well-being. Consistent monitoring, ethical treatment, and strict adherence to established guidelines are imperative. These practices not only ensure humane treatment but also contribute to the reliability and validity of research findings.



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