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(REVIEW ARTICLE)

Laboratory animal handling techniques, basic facilities and care: A review

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Abstract

Animals have been utilized in pharmaceutical scientific research and development for more than 300 years. Pharmaceutical items are a must in order to treat illnesses caused by viruses, bacteria, or homeostatic imbalance, among other causes. Pharmaceuticals must be thoroughly characterized via *in vitro*, *in vivo*, and clinical trial investigations in order to be used in humans. It is essential to quantify organism's *in vivo* using animals whose physiology and genetics are most similar to those of humans. Common animals used for laboratory experimental research are Cats, Rats, Dogs, Mice, Guinea pigs and Monkeys. Handling of animals includes transportation, animal housing, temperature of cages, sanitation, water, and food options etc. Proper animal handling techniques affects the outcome of research study, so it very imperative to study and to practice the basics of animal handling techniques. This review is the small efforts to compile the scientific literature and basic information regarding laboratory animal handling techniques, basic facility and care.

Keywords: Animal handling techniques; Animal care; Animal Study; Animal house

1. Introduction

The only way to re-establish historical facts using contemporary methodology is through research. The study of pharmaceutical processes of pharmaceuticals, new dosage forms, the creation of drug delivery systems, *invitro* research, *in vivo* studies, and other topics are all covered by the significant fields of health science known as pharmacology and pharmaceutics. A drug's overall effects must be examined using a variety of scientific techniques. Drug experimentation is the foundation for progress. It is based on a system of trial and error. This includes various laboratory animals like rabbits, mice, cats, dogs, rats, Guinea pigs, etc., as well as study on the effects of the drug on the body's isolated systems, such as tissues or organs.

Anatomically and physiologically all internal body parts and body fluids of human and animals are having same structural, hormonal and chemical functions. So animal experimental studies can provide scientific, reliable data for preclinical research work. By injecting the pathogens or chemicals that cause the disease, artificially by creating the disease animal research experiments could be planned. For the examination of various types of drug activity, efficacy, and safety investigations, a number of animal models and methodologies have been devised.

The conduct of these animal studies requires the presence of knowledgeable, well-trained personnel who are both theoretically and practically trained in proper animal handling techniques, animal house environmental conditions, including temperature, light, and humidity, method of blood sample collection, method of anesthesia, method of euthanasia, knowledge of behavioral change observation, etc. All these environmental factors and methods for handling animals may have an impact on the findings of a study, so it is important to be aware of these facts.[1]

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So this review article is the small effort to compile the literature about animal handling techniques for experimental studies, which will provide the important scientific information about laboratory animal basic facilities, handling techniques and care.

Aim

Compilation of scientific data regarding laboratory animal handling techniques, basic facility and care.

Objectives

- Review the existing literature of basic laboratory animal handling techniques and facilities.
- To study the basic concept of animal handling techniques.

2. Methodology

As this work is review work this section includes the scientific literature about the animal handling techniques as follows.

Since it is immoral and impractical to experiment on humans, exploratory research must be done on animals. The most often employed laboratory animals include rabbits, albino rats, guinea pigs, dogs, goats, monkeys, and horses, among others. Each laboratory animal used for a study must be handled with care and by well-trained workers in accordance with CPCSEA guidelines and animal ethics.

Table 1 Types of Animal Experimental studies [7]

Types	Name	Description
Type – I	*In Vivo* experiments and	Animal experiments / biological experiments to assess the effects of different drug especially new drugs.
Type - II	*In Vitro* experiments	The physical and chemical assay, culture tests, cell line studies etc conducted outside the human body on individual isolated organs are known as *in vitro* studies

Table 2 Key Headings and subheadings of this review article [1]

I. The environment	**A**	**B**	**C**	**D**	**E**
	Climatic control	**Other environmental factors**	**Area of floor required for Lab Animals (Minimum)**	**Care of lab animals**	
1.	Temperature	Noise.	-	Well being	-
2.	Humidity	Odor	-	Reception	-
3.	Ventilation	Bedding	-	Maintenance	-
4.	Light	Population Density and Space	-	Identification and Records	
5.	-	-	-	Feed	-
6.				Water	
II. Laboratory animal care, Handling process & facility -	Sanitation and cleansing	Disposal Of waste	Control of vermin	Emergency care and holiday	Anaesthetic medicines

2.1. Environment

With respect to the species and the experimental methodology, environmental requirements will change. A comfortable and stable environment is necessary for the better health of the experimental laboratory animals and the production of significant outcome results. Numerous laboratory animals create their own microenvironments inside of their cages, especially the smaller species.

2.1.1. Climate control

Climatic conditions of animal house facility should be adjustable as per requirements of experiments animals, their species and investigator particular requirement. This is certainly made easier by projects, species, and the fact that each of these rooms has its own environmental controls. Proper colony management, careful design, installation of automatic air conditioner, humidifier, and automatic light timers can maintain the desired climatic conditions. [1]

Temperature

Animals in laboratory can adjust with temperature suitable for humans. Animals used in experiments may suffer from abrupt temperature changes. Particularly in buildings holding small laboratory animals, where the temperature range would typically be similar to that of humans, proper environmental temperatures should be provided 20^{o} C to 25^{o} C with emergency equipments.[1]

Humidity

Till the Range of temperature is acceptable for the animals and the humidity is reasonably consistent, most animals can endure a range of 30% to 70%, however they generally prefer a humidity of about 50%. Relative humidity fluctuations and extremes can hasten illness, especially respiratory conditions.[1]

Ventilation

Proper ventilation is needed in animal house. It is advised to use complete air exchange system. Good filters are needed for recirculation system. In order to maintain a consistent climate with 10 to 15 changes every hour, air conditioning is helpful. [1]

Light

Good visibility and uniform, glare-free illumination are required in animal rooms. It is strongly advised that for proper observation of animals, record keeping, and housekeeping, light of intensity 807 and 1345 lux at 76 cm (30") from the animal house floor. According to studies, most rats can reproduce and maintain normal social behavior with light levels of around 200 lux. [1]

2.1.2. Other environmental factors

Noise

In animal house, noise is unavoidable but must be kept to a minimum. Both the animal and the workers may be disturbed; however, sudden noises tend to be more detrimental. In many species and strains of animals, loud noises trigger epileptic seizures. Intermittent noise may also have an impact on how well drugs work and how well animals procreate. [6]

Odor

While some animal scents are repulsive to humans, others have been shown to have profound effects on the physiology and pharmacology of experimental animals. By keeping things clean and having enough air, you can reduce the amount of odor that comes from microorganisms decomposing excreta in an animal facility. It is important to examine cages and the surrounding area for scents since they are caused by ammonia (NH3), which is produced when excrement decomposes. [5]

Bedding

For little mice, the bedding material they choose has a significant impact on their surroundings. Small rats generally live longer when fed bedding materials like sawdust, paper scraps, and rice husk. Solid flooring and bedding should be available to animals of all types well before parturition. Unsterilized saw powder is a possible source for the

introduction of disease, particularly parasites, into the rat colony by contamination with cat faeces and those of wild rodents, which would interfere with the experimental animal's normal physiology.[1]

Population density and space

The number of animals to be housed in a cage will surely depend on the animals that are available, the available space, the available options for caging, the level of technician workload, and the kind of laboratory animals being employed. The details are given below. [1]

2.1.3. Laboratory Animal - Minimum Area of floor [1] ,[3]

Table 3 Laboratory Animal - Minimum Area of floor [1], [3]

Animal	**Weight in gm**	**Floor area / Animal (cm2)**	**Cage height (cm2)Polythene/ polypropylene/SS**
Mice	<10 gm	38.7	12
	-15 gm	1.6	
	0 - 25 gm	7.4	
	< 25 gm	96.7	
Rats	<100	109.6	14
	Up to 200	148.3	
	Up to 300	187.0	
	Up to 400	258.0	
	Up to 500	387.0	
	>500	>=451.5	
Hamster	>60	64.5	12
	Up to 80	83.8	
	Up to 100	103.2	
	>100	122.5	
Guinea pigs	<350	387.0	18
	>350	>=651.4	

Table 4 Laboratory Animal - Minimum Area of floor [1],[3]

Lab Animals	**Weight (gm)**	**Area of floor (Sq.ft)**	**Area of floor (Sq.mt)**	**Height (inch.)**
Rabbits	<2000	1.5	0.135	14
	Up to 4000	3.0	0.27	14
	Up to 5400	4.0	0.36	14
	>5400	5.0	0.45	14
	Mother with kids	4.5	0.40	14

Table 5 Laboratory Animal - Minimum Area of floor [1],[3]

Animals	Weight (kg)	Area of floor (ft2)	Area of floor (Cm2)	Height (cm)
Monkey	0 to 1	1.6	1440	50
	0 to 3	3.0	2700	72
	0 to 10-12	4.3	3870	72
	Up to 12-15	6.0	5400	72
	Up to 15-25	8.0	7200	90

2.1.4. Care of Laboratory Animals

Laboratory animals well being

A healthy, regularly behaving animal is typically referred to as being in a condition of "well-being." The achievement and maintenance of this state should be the focus of every aspect of animal care. Its upkeep calls for efficient health management and appropriate exercise. [1]

Reception

Every fresh new lab animals must be welcomed, checked out as well as put in hygienic cages in a quarantine room. Shipping containers shouldn't be allowed inside the main building; instead, they should be burned. Additionally, it is important to identify incoming animals and correctly record their arrival. The source of each shipment should be noted, along with any significant comments regarding the caliber and condition of the animals he supplied. Animals that appear ill should be put to sleep as soon as possible.[1]

Maintenance

When feasible, keep distinct species in separate spaces. Shipments of the same species that were acquired from various sources should also be kept apart, if there is enough room. When merging species and/or stocks from different sources may be necessary, every effort should be made to unite species and/or stocks that are compatible and have similar environmental requirements.[1]

Identification and record

Small lab animals can be recognized by their cage or group. The report should contain the animal's arrival time, sex, estimated age and weight, breed and type, color and markings, and any physical anomalies or other distinctive traits. Animal rooms should have room cards identifying the species posted on the doors. [1],[2]

Feed

All experimental animals must be fed delectable, clean, and nutritious food that is appropriate for their species. Observe the laboratory animal feed formulations recommended by the United Federation of Animal Welfare (UFAW) (Annexure I, II). Use of pasteurized or sterilized laboratory animal food from reputable vendors is recommended whenever possible. In contamination free conditions the bulk food is stored with care. Cool, dry and well ventilated rooms with appropriate temperature are used to keep the dry pellets. Feed containers need to be constantly cleaned and disinfected. [1],[4]

Water

Slightly acidified drinking water is used generally for laboratory animals, except the protocol of experiment mentioned. It is best to use a legal chlorine watering technique that won't compromise the water supply or transmit disease. To enable quick assessment of cleanliness and water level, water bottles should be clear, clean, and transparent. Water bottle should be cleaned, sterilized, inspected frequently and regularly to avoid the contamination of bacteria like E-Coli, pseudomonas. It is advised to use freshly filled sterile water bottle. [1]

2.1.5. Laboratory Animal Handling

When moving lab animals into new cages or removing them for other types of experiments, care should be used to manage and restrain them. For such everyday treatment, the majority of domestic and laboratory animals don't require

restriction but instead respond to gentleness; in fact, they frequently break out of their cages. Minimal holding force needed to feel the animal secure. Generally bare hands can be used to handle lab animals except primates. Absolute minimal force is required to handle the animals. In order to control tiny mammals like rodents, light intensity and kind can be changed when moving lab animals into new cages or removing them for other types of experiments, care should be used to manage and restrain them. For such everyday treatment, the majority of domestic and laboratory animals don't require restriction but instead respond to gentleness; in fact, they frequently break out of their cages. [1]

2.2. Laboratory animal handling facility and care

2.2.1. Sanitation and cleanliness

Cleanliness is very important parts in an animal care specialization, including personal hygiene on the part of the employees. The right cleaning and disinfecting techniques should be followed by staff members because of how important they are in preventing sickness. [1]

Prior to reuse, every cage, pen, rack, etc. must be scrupulously cleaned and sanitized. Daily or the every other day sanitization and deep cleaning of animal house is mandatory. Use of mechanical washing devices at running water at 83 ^{0}C (180 ^{o}F) or higher for 10-15 min is the best way form sanitization and cleaning. Cages should be thoroughly washed for complete cleaning. It is necessary to change bedding in the cage frequently, which keep the environment clean, dry and odor free. One to three changes required for smaller animals as per count of animals in laboratory. [1]

2.2.2. Vermin Control

Animal house building should be free of pest. Vermin attack on food, bedding, people, and lab animals which results in to arthropods and insects as a host for some other parasites to manifest illnesses. The species kept indoors may contract a wide range of germs, viruses, and parasites from wild rodents.

Before bringing animals inside new premises, a thorough inspection for vermin should be made. Personnel training, responsible waste management, sealing or removing breeding grounds, pesticide or trap-based eradication, and all animals' revitalization are recommended. [1]

Disposal of waste

For collecting and burning of waste products such as disposal of excreta of dead animals, bedding, for food, other bi-products, a leak proof plastic or metal container should be used carefully and burned. Waste that cannot be disposed of quickly should be kept in a hold storage space that has been set aside for that purpose. For the disposal of human and animals wastes, the installation of incinerator is recommended. [1]

2.2.3. Holiday and Emergency Care

The everyday and ongoing task of caring after lab animals 24X365 . The importance of this service should be highlighted in job descriptions for those who care for animals. The other obligations in emergency scenarios should be communicated to the entire animal care crew. [1]

2.2.4. Anesthetic Agents [1],[3]

Table 6 Use of anesthetic agents for laboratory animals [1],[3]

Drugs (mg/kg) [1],[3]	**Mouse**	**Rat**	**Guinea pig**	**Rabbit**	**Monkey**
Ketamine Hcl	22-24 IM	22-24 IM	22-24 IM	22-24 IM	22-24 IM
Pentabarbitone sodium	35 IV	25 IV	30 IV	30 IV	35 IV
	50 IP	50 IP	40 IP	40 IP	
Thiopentone Sodium	25 IV	20 IV	25 IV	20 IV	25 IV
	50 IP	40 IP	55 IP		60 IP
Urethane	-	0.75 IP	1.5 IP	1.0 IV IP	1.0 IV

(Note- *IM- in muscle * IV- In vein *IP- in peritonea)

2.3 Standard operating procedure for animal research (SOP) [1],[3]

Proper care should be taken while the moving the laboratory animals for different experimentations. However, they do respond to kindness. The majority of pets and research animals do not require restraint by such routine touching. They frequently manage to get out of their cages. Training of employee should be done so that least amount of force is to be applied for safety sense of animals. Except primates, normally all animals should be handled with bare hands. In any instance, apply no more force than is absolutely necessary. When working with small mammals like rodents, it is frequently helpful to manipulate the type and intensity of the light being used. Additionally, perception is a necessary skill for effective handling. Maintenance of SOPs, described methods and procedures should be maintained by the institution with view to animal Husbandry maintenance, breeding, animal house microbial analysis and experimentation records are as follows. [1],[3]

Table 7 Titles of Experimentation Record [1],[3]

1.	Name of the Author
2.	Title of the SOP
3.	Date of preparation
4.	Reference of previous SOP on the same subject and date (Issue no and Date)
5.	Location and distribution of Sops with sign of each recipient
6.	Objectives
7.	Detailed information of the instruments used in relation with animals with methodology (Model no., Serial no., Date of commissioning, etc)
8.	The name of the manufacturer of the reagents and the methodology of the analysis pertaining to animals
9.	Normal value of all parameters
10.	Hazard identification and risk assessment

Table 8 Life Span of Common Laboratory Animals (UFAW) [1],[3]

Animals	**Life span**
Rat	2-3 years
Mouse	1-2 years
Guinea pig	3-5 years
Rabbit	5-6 years
Monkey	15-30 years

Table 9 Approximate daily food intake (UFAW) [1],[3]

Animals	**Daily food intake**
Mice	5 gm
Rat	15 gm
Guinea pig	30 gm
Rabbit	120 gm

Monkey	200 gm
Hamster	10 gm

Table 10 Breeding data of Laboratory Animals (CPCSEA guidelines) [1],[3]

Data	Rat	Mouse	Guinea pig	Rabbit	Monkey
Age at puberty(months)	1 – 2	1	2	6 – 9	30 – 36
Minimum breeding age (months)	3	1	3 – 4	9 – 12	50 – 56
Oestrus duration (hours)	10 – 20	10 – 20	6 – 12	Induced	24 – 36
Oestrus intervals (days	5	5	14 – 16	None	30
Gestation period (days)	21 – 22	19 – 21	60 – 80	30 – 32	168
Recurrence oestrus (months)	Post partum	Post partum	Post partum	End of lactation	-
Breeding life of females (years)	1	1	2-3	2-3	6-8
Breeding life of males (years)	1.5	1.5	3	1 – 3	8 – 10
Breeding ratio (M/F)	1:2	1:2	1:5	1:1	1:1
Litter size (Nos.)	5-10	7-12	2-6	4-6	1
Birth weight (grams)	5 – 6	1 – 1.5	50 – 80	80 – 100	300 – 500
Weaning weight (grams)	35 – 40	10 – 12	250	600 – 800	800 – 1000
Weaning days (Nos.)	21	19 – 21	21 – 30	45	90 – 150

Table 11 Physiological data of laboratory animals (CPCSEA guidelines) [1],[3]

Data	Rat	Mouse	Guinea pig	Rabbit	Monkey
Daily intake of feed (gm)	10 - 15	5-10	30-50	100-200	100-300
Daily water intake (ml/100gm) body weight)	15	5 – 10	15	20	30 – 40
Urinary output (ml/100gm) Body weight	5 – 8	3 – 4	4 – 9	7 – 8	5 – 6
Daily fecal output per gram	9 – 13	6 – 9	15 – 18	20 – 30	100 – 150
Pulse rate (no's/min)	300	600	150	155	90-100
Respiratory rate (no's/min)	85 – 113	163	82 – 90	38 – 60	39 – 60
Rectal temp F	99 – 100	96 – 100	100 – 102	102 – 103	100 – 102
Room temperature (F)	65 – 75	68 – 74	65 – 75	62 – 68	68 – 72
Percentage of Relative humidity of room (%)	45-55	45-55	45-55	45-55	45-55

Table 12 Hematological Data of Laboratory Animals (CPCSEA guidelines) [1],[3]

Quantity	Rat	Mouse	Guinea pig	Rabbit	Monkey
Total blood volume (ml/Kg) body weight	58	78	75	70	75
Total blood volume (ml/Kg) body weight	20	30	35	35	40
Clotting time(seconds)	20	14	-	60- 300	90
RBC Life span (days)	45 – 68	20 – 30	-	45-70	

RBC count (cells/cumm	7.2- 9.6	7.7 – 12.5	4.5-7.0	4.5 – 7.0	4.5-6.5
Hemoglobin (Kg/100ml)	14.8	14.8	12.4	13.6	12.5
Blood plasma pH	7.3	7.3	7.3	7.3	7.3

Table 13 Chart of basic nutrients requirements for lab animlas (CPCSEA GUIDELINES) [1],[3]

	Mice	**Rat**	**Monkey**	**Guinea pig**	**Rabbit**
Crude protein(%min)	20.0	20.0	20.0	24.0	20.0
Ether extract(%min)	4	4	6	3.5	3.5
Crude fiber (%max)	4	4	4	12	12
Ash (%maximum)	8	8	8	8	8
Calcium (%minimum)	1.0	1.0	1.0	1.2	1.2
Calcium (%minimum)	0.6	0.6	0.6	0.6	0.6
Nitrogen free extract %	55.0	53.0	53.0	43.0	47.0
Metabolisable energy (K cal/Kg)	3600	3600	4000	3000	3000

Table 14 Composition of diet for Rodents: Mice, Hamster, and Rats AS PER UFAW [1],[3]

Sr no	**Name of diet**	**Composition**
1.	Wheat flour	22%
2.	Roaster Bengal gram flour	60%
3.	Ground nut flour	10%
4.	Skim milk powder	5%
5.	Casein	4%
6.	Refined oil	4%
7.	Salt mixture with starch	4.8%
8.	Vitamins & choline mixture with starch	0.2%

Table 15 Diet composition for monkeys, Rabbits & Guinea pigs [1],[3]

Sr no	**Name of diet**	**Composition**
1.	Wheat flour	61%
2.	Roaster Bengal gram flour	28%
3.	Vitamin C	50 mg/100 g diet
4.	Casein	1%
5.	Refined oil	5 %
6.	Salt mixture with starch	4.8%
7.	Vitamins &choline mixture with starch	0.2%

Table 16 Extra diet chart for Laboratory Animals [1],[3]

Sr. no	**Diet**	**Monkey**	**Rabbit**	**Guinea pig**
1.	Bengal gram	20 gm	20 gm	25 gm

2.	Ground nut	15gm	-	-
3.	Plantain	1gm	-	-
4.	Lucerne grass	-	100 gm	50 gm

Table 17 Salt mixture composition "Hamsters, Mice and Rats [1],[3]

Sr no	Mineral	Per 100 kg diet gm
1.	Di calcium phosphate	1250.00
2.	Calcium carbonate	555.00
3.	Sodium chloride	180.00
4.	Magnesium sulphate	229.20
5.	Ferrous sulphate	108.00
6.	Manganese sulphate	16.04
7.	Potassium Iodide	3.16
8.	Zinc sulphate	2.192
9.	Copper sulphate	1.908
10.	Cobalt chloride	0.092

Table 18 Values of Starch and mineral together per gm [1],[3]

All Minerals together	2345.492 gm
Starch	2454.508 gm
Total	4800.000 gm

3. Discussion

After reviewing and compiling the available online and offline literature, present work was discussed with all important aspects of laboratory animal handling techniques, facility and care.

The glorious progress of modern medicine is due to the vast animal experimentation in the field of pharmacology. An animal experiment includes physiological, pathological, biochemical, serological and bacteriological investigations. In the drug experimentation, animal study is the stepping-stone for the advancement. It is based on trial and error method. In medicine, the experimentations are carried out on animals to study normal and abnormal conditions. The diseases are produced artificially by injecting the disease-causing germs, to study the effect of new drugs.

For constant supply of animals of various ages & sex in required number to the demands of research workers, facility of an animal house attached to the laboratory should be created. Ventilation of air, light, temperature, and dampness are maintained by artificial means. Protection from harmful animals and prevention from escaping are ensured, regular supply of food & water and their cleanliness are observed. For this purpose animal house should under the in-charge of keeper and should be regularly supervised. Adequate precaution should be taken to prevent death of animals from negligence.

Experimentation on human beings is not ethical or possible, therefore preliminary experiments are to be conducted on the animals. The laboratory animals commonly used are rabbits, albino rats, frogs, guinea pigs, dogs, goats, monkeys and horses etc. [4]

The purpose of animal experimental studies as follows

- To Study the natural course of the diseases.
- To Study the toxic effects of the drug on different organs.
- To assess the therapeutic effect
- Pathological changes occurred after the administration of new drug in the blood, serum and other tissues, etc.

For conduction of animal experiments, one needs the defined animals. Defined animals means, animals which are revealed under standard conditions, free from disease, and uniform nature so that variability can be kept to minimum and consequently the experiments can produce meaningful results.[8],[9]

3.1. Physical conditions in animal house

3.1.1. Climate

Suitable temperature has to be maintained in the cages keeping in view the species concerned and local conditions. It would be both unrealistic and unnecessary for the research workers in tropical climate to follow the recommendation for temperate areas. In extreme climates, some attempts should be made to prevent excessive heating or over cooling.

3.1.2. Space

It is an essential concept in animal welfare that the individual should have adequate space in its cage for it to carry out normal behavioral functions. To remain in a state of health, most animals need exercise. Some species such as rats may become overweight when supplied with food and little opportunity for locomotion. Animals may respond to the lack of exercise facilities in a number of ways including spontaneous running for example on an activity wheel.[8]

3.1.3. Illumination

For animals like mice or rats these levels may have a critical influence on them. At lighting levels suitable for humans some strains of rodents show retinal degeneration and become blind. Levels of illumination to which different individuals are exposed may be dependent on the position of the cage in the animal room in relation to the light source.

3.1.4. Noise

A factor which must also be bear in mind is that many small mammals are capable of perceiving ultrasonic frequencies (eg. rats and mice). Very loud noises such as fire bells can make rats and mice more susceptible and exposed to sounds can influence the subsequent behavior of the offspring (Gamble 1982).

3.1.5. Relative Humidity

In most animal houses relative humidity within the range of 50 - 60% RH is aimed for and some species such as rats and squirrel, monkeys, actually show pathological signs, if the relative humidity is too low.

3.1.6. Light

In animal house usually needed is not a situation of complete darkness, but dim red lighting is normally used to simulate night while bright white light creates the artificial day.

3.1.7. Diet

The fact that the animal is unable to sees its food but must depend upon supplies provided at regular intervals by staff. The standard diet is of value in assuring that individuals do not vary in terms of the nutrients, which they take in, so that their digestive physiology can be assumed to be similar.

3.1.8. Human- Animal Interaction

The majority of warm-blooded vertebrates can probably recognize people individually. They become accustomed to those who feed and handle them but may become extremely agitated if unfamiliar individuals attempt to approach or manipulate them. Poor or clumsy handling or a caretaker who does not have good rapport with animals may have profound effects on the results of experiments. Staff must be encouraged to develop a good relationship with the animals. If animals are expected to undergo minor experimental procedures such as injections or blood sampling it is advantageous if they can be trained to submit willingly to the manipulation. The best technique is to reward the animal after or during the procedure.[8]

3.1.9. Monitoring Animals

It is extremely important that daily checks should be made on the animals' behavior, appetite, water consumption and general condition. In the later stages of pregnancy and lactation proper care should be taken with due attention. Time spent in monitoring animals is not only from the view point of the welfare of the animals but also on economic grounds. Any changes in state will be identified at an early stage where necessary remedial action can be taken.[5]

3.1.10. Records

It is very important that daily record should be kept in the animal unit in a book. These must be regularly analyzed and transferred to card index and/or computer. From these records data such as breeding, infant mortality, inter-birth intervals and overall colony mortality can be assessed. Other factors, such as body weight, growth rates, microbiology and genetic makeup may be assessed at regular intervals and comparisons made from year to year. The analysis of these records will ensure good quality control of husbandry.[9]

3.1.11. Limitation and scope of this review

No research work is perfect and complete, so this review work also have some limitations like insufficient literature search and lack of practical procedures information, so in future one can do the advance research work with meta-analysis of previous animal research work done with some appropriate practical procedure techniques and precautions to be taken while doing research with particular animal study model.

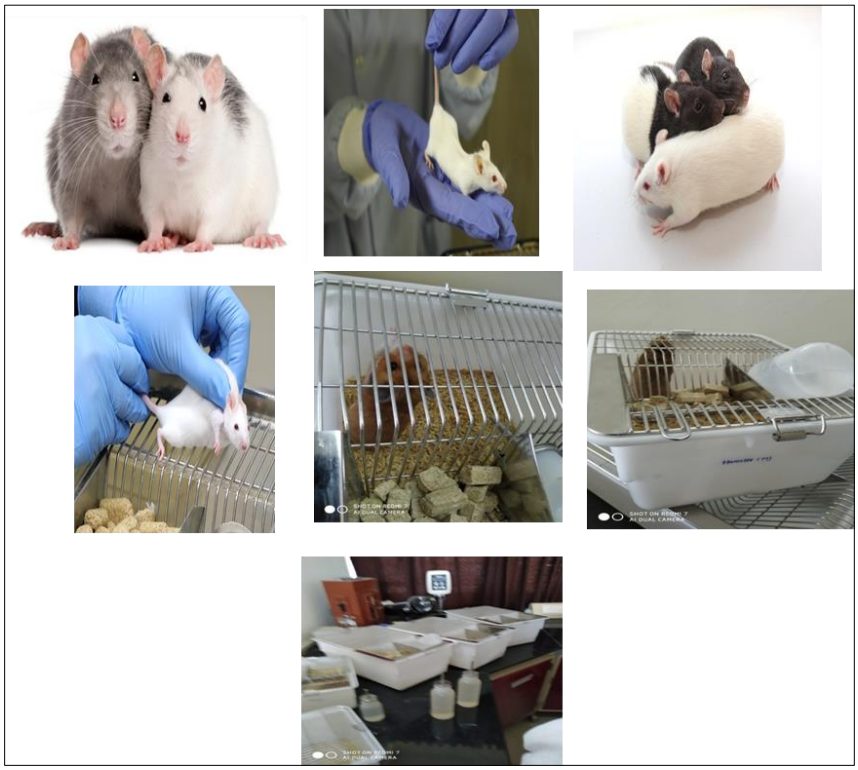

Figure 1 Scientific techniques of animal handling with cage design, feed and water bottle set up

4. Conclusion

This review work is summarized in regards with following points:

- Animal experimental study is the imperative research branch of pharmaceutical science to discover the safety and efficacy of the intervention.
- This review work was planned to provide the basic scientific information regarding animal handling techniques and supportive animal studies. It includes basics of animal handling techniques, specification of animal house, minimum floor required for laboratory animals, diet of animal, laboratory findings of animals, climate control, other environmental factors, Laboratory Animal care, Laboratory animal handling care and facility etc.

- Well trained specialized technical staff is mandatory for handling of laboratory animals while conduction of animal studies under controlled environmental conditions, otherwise it may affects the outcome of the research.
- For conduction of animal experiments, one needs the defined animals which means, animals which are revealed under standard conditions, free from disease, and uniform nature so that variability can be kept to minimum and consequently the experiments can produce meaningful results.

5. Compliance with ethical standards

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Disclosure of conflict of interest

Authors declare that there is no conflict of interest.

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