



## Overview of Laboratory Animal Lifestyle, Care, and Management: a Case Study of Albino Rats

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**ABSTRACT:** The review was design to look at an overview of laboratory animal's lifestyle, care and management using albino rats as case study. The use of laboratory animals (albino rats) in scientific research can be dated as far back as 16<sup>th</sup> century. Thus, using laboratory animals in scientific research as model to human with expectation that such use will provide either significant new knowledge or lead to improvement in human and animal well-being should be considered as a privilege granted by society to research communities. The environment is central to laboratory animal care, management and welfare and must be considered throughout the breeding-holding and experimental phase under standard laboratory conditions and a well-controlled environment to keep them healthy. The factors affecting health and welfare of the animals include noise, temperature, humidity, ventilation and daylight/darkness. The nutritional requirement of some laboratory animals are fairly documented, the animals however, should have access to clean reliable water *at libitum* and wholesome, clean nutritious palatable diet on regular basis to ensure the appropriate intake of protein, fat, carbohydrate vitamins, salt, minerals and fibre. Euthanizing of laboratory animals should be carried out in three main circumstances which include culling of unwanted animals, relief of suffering in individual animal and the techniques chosen should strive to achieve quick, quiet and painless death and thus, should not induce fear, apprehension or panic in the animal. The other animals left should be well protected from the sight, sound, and smell of the procedure and therefore, not to be carried out in public areas.

**DOI:** <https://dx.doi.org/10.4314/jasem.v23i8.4>

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**Dates:** Received: 30 April 2019; Revised: 19 July 2019; Accepted 27 July 2019

**Keywords:** Laboratory, Animal, Rats, Management and Welfare

The use of laboratory animals (rat) in scientific research can be dated as far back as 16<sup>th</sup> century. The decision to use animals in research requires critical thought, judgement and analysis. Thus, using laboratory animals in search is should be considered a privilege granted by society to research communities with the expectation that such use will provide either significant new knowledge or lead to improvement in human and or animal well-being (McCarthy, 1999; Perry 2007). It is a trust that mandates responsible and humane care and use of these animals. The Guide endorses the responsibilities for investigators as stated in the U.S. Government principles for utilization and care of veterinary animals used in testing, Research, and Training (IRAC 1985), other government agencies and professional organizations have purplish similar principles (NASA 2008; NCB 2005, NIH 2006, 2007). This review is design to study the general overview of laboratory animal lifestyle, care and management using albino rats as case study thus with particular emphasis on animal physiology, morphological changes, care, management and welfare in scientif research.

*Puberty in Rat:* Rat attains puberty at an average day of fifty days (Long and Evans, 1922). Sexual maturity in animals is characterized by verging opening in female and balanoprepatial separation in male. At approximately thirty days of age, the Luteinizing Hormone (LH) is release, and this lead to ovarian maturation this LH is release eight days before the first pro-estrus and this period of change is made of LH and is considered anestrous (Urbanski and Ojeba 1985).

*Human Care:* Human care means those actions taken to ensure that laboratory animals are treated according to high ethical and scientific standards. Implementation of a humane care programme and creation of laboratory environment in which humane care requirements of the Guide and System of self-regulation it supports (Klein and Bayne 2007).

*Animal Care and use Programme:* The animal care and use programme (The Programme) means the policies, procedures, standard, organizational structure, staffing, facilities and practices put into place by an institution to achieve this humane care and use of these animals in the laboratory and throughout

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the institution. It include the establishment and support of an Institute of Animal Care and Use Committee (IACUC) or equivalent ethical oversight committee and the maintenance of an environment in which the IACUC can function successfully to effectively carry out its responsibilities under the guide and applicable laws and policies (NRC 2008)

*Ovulation in Rat:* In the young adult laboratory rats, ovulation occurs every four to five days throughout the year.

*Reproductive Cycle of Rat:* Rats do not have menstrual cycle like other mammals, they have estrus cycle. Animals with estrus cycle are only sexually active during the estrus phase of their cycle unlike other animals with menstrual cycle that is sexually active all through. The animals that have estrus cycle like rat do not shed their endometrium instead they reabsorb their endometrium if conception do not occur, whereas, animal with menstrual cycle like human shed their endometrium if conception do not occur.

*Pro-estrous Phase in Rat:* This phase can last as little as one day or as long as three weeks depending on the species. In this phase the female is not yet sexually active. By now one of the several follicles of the ovary start to grow also the endometrium lining of the uterus also grow due to the influence of estrogen.

*Estrus in Rat:* This is the phase when the animal is in heat period i.e. sexually active. Females during this period exhibit receptive behavior (Geoffrey *et al.*, 2007). Examples of such behavior are: reddened labia, elevation of hind quarters, ovulation etc. Hormones such as the Gonadotropin Hormones (secreted by gonadotrope cells of the pituitary gland of vertebrates) stimulate maturation of ovarian follicle. It is at this stage that the activity of estrogen hormone is at its peak.

*Metestrus or Diestrus Phase in Rat:* In this phase the activity of estrogen hormone is reduce to minimal, while the activity of progesterone produce by the corpus luteum take over. This progesterone hormone produce lining in the uterus in case of a pregnancy, this lining is shed but not remove from the body as in the case of animals with menstrual cycle but it reorganize for the next cycle.

*Anestrus Phase in Rat:* This is a reproductive phase in a female rat, when all sexual cycle is at rest. This occurs when the female rat is lactating, pregnant, chronic energy deficit, significant illness etc. this seasonal event is controlled by the pineal gland that releases melatonin. Melatonin act by regulating the

hypothalamus pulse activity of the gonadotropin-releasing hormone. Rats in general do not have breeding season, although very hot or cold temperature will reduce their breeding proficiency. Female of breeding age come into heat all year round, every four to five days, unless they are pregnant, and even then, they may come on heat once or twice early in pregnancy stage. Each heat period usually begins in the evening and last most of the night.



Fig 1: a lactating female albino rats with her two days old pups

*Mating in Rat:* Effective mating is ensured when a pair of rat stay together for at least two mating cycle i.e. ten days. It is best to pair them, when the female is at heat in order to avoid them fighting (Festing 1976).

*Signs of Heat Period in Rat:* Female rat in heat period show the following sign; she lift her head and tail, vibrate her ear, brace her leg stiffly; she may first do not forward or spin around. The interested male will sniff and perhaps lick her, in the process of courtship, the male rat mounts the female rat severally, and this he does by grasping her scruff with his teeth, usually the male most mount the female several times before the act is completed. However, one mount is enough to impregnate a female rat. Sometimes when the female is not at heat, some male can stimulate her into coming to heat.

*Gestation Period in Rat:* The gestation period of female rat is varies from 21-23 but normally 22 days and very rarely 26 days. Two weeks into the pregnancy the mammary glands will start to enlarge, the abdomen of the rat increases in size, close to deliver the pups can be seen moving in her abdomen. Some pregnant and nursing rat change in personality like human during pregnancy as a result of hormonal changes, e.g. less interested in play, more aggressive, but this mood changes after delivery or nursing of her children. Avoid keeping a male and female rat together after delivery as she can return back to heat within 24 hours of delivery. In rat, average size of litre is about 6 – 13, each delivery comes every 5-10 minute and the whole

delivery process can just be about an hour. The first sign of labour is bloody discharge, contraction follows, once the baby start coming, the mother will sit up and help deliver them with her teeth, the mother eat each placenta and umbilical cord, then she clean off the birth sac and lick the new born.



Fig 2: a 21 days pregnant albino rat under observation

**Reproductive Senescence in Rat:** In female rat, after the period of active mating which usually occur when the female is at ovulation in spontaneous ovulator and primed to ovulation in reflex ovulators, 93 some of the female aging rat exhibit a period of constant sexual receptivity, this receptivity is due to the secretion of tonic estrogen which stimulates persistent vaginal cornification (Sengen, 2012). Usually attain reproductive senescence between 15 – 20 months of age. Female rat live an average of 485 days after senescence.

**The Animal and the Environment:** The environment is central to laboratory animal management and the welfare of this anima must be considered throughout the breeding-holding phase and the experimental phase.

**The Breeding-holding Phase:** The laboratory animal use for experimental purpose have been selected and breed for many generations under laboratory conditions, and need a well-controlled environment to keep them healthy. The type of animal accommodation must be taken into account, the variety of species held and the differing ages and weight of the animals. The environment influencing the animals during this phase has physical, nutritional and general biological components. The factors which affect the health and welfare of the animals include noise, temperature, humidity, ventilation and light/dark cycle (Fletcher 1976).

**Noise and vibration: Optimum Temperature:** the optimum temperature for the animals is between 19-23°C ±2° (Harkness and Wagner 1983).

**Humidity:** the control humidity range is at 30-70% saturation (Harkness and Wagner 1983).

**Ventilation:** re circulation of air in an animal house is not advisable as dust and microorganism could be widely distributed. Room air changes with fresh or filtered air should be between ten and fifteen complete air changes per hour to achieve uniform ventilation depending on the arrangement and size of the cages and the stocking density (Lane-petter 1976; Harkness and Wagner 1983).

**Light and Dark Cycle:** direct sunlight in animals is usually 12 hours daylight and 12 hours darkness (Lane-petter 1976; Harkness and Wagner 1983).

**Animal Housing:** All animals should be housed under conditions that provide sufficient space as well as supplementary structures and resources required to meet physical, physiological and behavioural needs (Garner 2005, van Praag *et al.*, 2000, Wurbel 2001). Environment that failed to meet the animals need may result in abnormal brain development, physiological dysfunction and behavioral disorder that may compromise both animal well-being and scientific validity.



Fig. 3: pups of a female wistar albino rat lying-in steal metal animal cage with sawdust layer



Fig. 4: a group of adult wistar albino rats being fed with formulated animal feed

**Animal Nutrition:** The nutritional requirement of some laboratory animals are fairly well documented (Coates 1976). The knowledge about the nutritional requirements of most nonhuman primates and many other species is largely or totally lacking and in need of research attention. Laboratory animals should therefore, have access to clean, reliable water supply *at libitum*, and wholesome, clean, nutritious palatable food on a regular basis to ensure the appropriate intake of protein, fat, carbohydrate, vitamins, salts, minerals and fibre.

**Euthanasia of Laboratory Animals:** Euthanasia (mercy-killing) is the practice of deliberate or intentional and painless sacrificing animals for humane reasons, especially in order to end great suffering or poor quality of life. Euthanizing of laboratory animals is carried out in three main circumstances: Culling of unwanted animals, relief of suffering in individual animals, or as end-point of an experiment. When undertaking euthanasia, the welfare of the animals and the techniques chosen should strive to achieve quick, quiet, and painless death and should not induce any form of fear, apprehension or panic in the animals.

The other animals left behind should be protected from the sight, sound and or smell of the procedure. The welfare of the personnel is protected by adopting a procedure that is physically and chemically safe and aesthetically acceptable. Euthanasia should not be carried out in a public or communal area (Allan *et al.*, 1986).

**Conclusion:** The need to understand the physiology and morphological changes in laboratory animals utilize for scientific research purposes cannot be over emphasize. Therefore, in planning of scientific research either for therapeutic purposes, drug testing or otherwise, animal care and management, and experimental procedure should be properly design to accommodate the well-being of animals and clear euthanizing procedure that will allow for a quick, quite, and painless death of the animals in other to reduced or ameliorate the suffering of the animals. Thus, the other animals should be protected from sight, sound or smell of the procedure. In recommendation, Government should ensure that researchers follow the national standards for the use and care of laboratory animals in all institutions dealing with laboratory animal research. Again, Research institution should develop a clear written policies and procedures governing experimentation with hazardous biological, chemical and physical agents and put in place safety equipment and facility requirement for working with laboratory animals.

**Acknowledgement:** I wish to appreciate the Department of Biological Sciences Laboratory staff of Nigerian Defence Academy Kaduna for given me the opportunity and space to learn more about these special animal's Albino rat's behaviours.

## REFERENCE

- Allan, D.J., and Blackshaw, J. K., (1986). *Ethics, welfare, and laboratory animal management*. In M.W. Fox and L. D. Micklely (Eds), *Advances in animal welfare science 1986/1987* Pp 1-8. Washington, D.C: The Human Society of United States.
- Bayne, K.A., Garnett, N.L., (2008). Mitigating risk, facilitating research. *Institute for Laboratory Animal Research*. (49): 369-371.
- Fechter, L.D., (1995). Combined effects of noise and chemicals. *Occupational Medicine*. (10): 609-621.
- Festing, M.F., (1976). Production Method. In *The UFAW Handbook on the care and management of Laboratory Animals*. Edinburg, London and NY: Churchill Livingstone. Pp 57-73.
- Fletcher, J.L., (1976). *Influence of noise on animals in control of the animal House Environment*. Laboratory Animal Handbooks 7, London: Laboratory Animal ltd. Pp 51-62.
- Geoffrey, M., Joshua, M.T., and Brent, D. J., (2007). Evolution and Human Behaviour, Ovulatory Cycle Effect in Tips Earing by Lap Dancers: Economic Evidence for Human Estrus! *Evolution and Human Behaviour*, 28 (6):375-381.
- Harkness, J.E., and Wagner, J.E., (1983). *The Biology and Medicine of Rabbits and Rodents*. Philadelphia: Lea and Febiger.
- IRAC, [Interagency Research Animal committee]. (1985). U.S. Government principles for utilization and care of Vertebrates Animal use in Testing, Research and Training. Federal Register, Washington: office of science and Technology policy. Available at <http://oacu.od.nih.gov/regs/usgovtPrncpi.htm:acc esedmay10,2010>
- Klein, H.J., Bayne, K. A., (2007). Establishing a culture of care conscience and responsibility addressing the improvement of scientific discovery and animal welfare through science-

- based performance standards. *Institute for Laboratory Animal Research*. 48:3-111.
- Lane-Petter, W., (1976). The animal house and its equipment. In *The UFAW Handbook on the care and management of Laboratory Animals*. Edinburg, London and NY: Churchill Livingstone. Pp. 74-94.
- Long, J.A., and Evans, H. M., (1992). The Oestrous Cycle in Rats and its Associated Phenomena. *Men University of California*. 6:1-48.
- McCarthy, C.R., (1999). Bioethics of laboratory animal research, *Institute for Laboratory Animal Research*. 40:1-37.
- Musa, U. Hat, S., Mustapha, A., and Magaji, G., (2010). Dichlorvos concentrations in locally formulated pesticide (*Ota-piapia*) utilized in northeastern Nigeria. *Scientific Research Essay*. 5: 49-54.
- NASA [National Aeronautics and Space Administration], (2008). NASA Principles for the Ethical Care and use of Animals, NPR 8910.1B-Appendix A. Available at <http://nodis3.gsfc.nasa.gov/displayDir.cfmt=NPDand=8910ands=1B>; accessed May,10,2010
- NIH, [National Institutes of Health Concerning Laboratory Animal Welfare], (2006). Memorandum of understanding among the Animal and Plant Health Inspection Service USDA and Food and Drug Administration, US Department of Health and Human Services, and National Institutes of Health Concerning Laboratory Animal Welfare. March 1, 2006. Bethesda: office of Extramural Research, NIH. Available at <http://grants.nih.gov/grants/law/references/finalmou.htm>.
- Perry, P., (2007). The ethics of animal research: A UK Perspective. *Institute for Laboratory Animal Research*. (48): 42-46.
- PHS, [Public Health Service], (2002). Public Health Service Policy on Human Care and Use of Laboratory Animals. Department of Health and Human Service, National Institutes of Health, office of Laboratory Animals
- Segen's Medical Dictionary (2012). *Farlex, Inc*. All Right Reserved.
- Welfare. Available at <http://grants.nih.gov/grants/law/references/phspo.htm>; accessed January14, 2010
- NCB, [Nuffield Council on Bioethics], (2005). The Ethics of Research using Animals, London NCB.