ISSN: 2583-9365

Status of laboratory animal welfare in India: a way forward

P Krishnamoorthy and N Karthika

Laboratory Animal Facility, Indian Council of Agricultural Research-National Institute of Veterinary Epidemiology and Disease Informatics (ICAR-NIVEDI), Bangalore, KA, India.

Corresponding author:
Dr. P. Krishnamoorthy, PhD
Senior Scientist,Laboratory Animal Facility,
ICAR National Institute of Veterinary Epidemiology and Disease Informatics,
Post Box No.6450, Yelahanka, Bangalore 560064, Karnataka, India.
E-mail: p.krishnamoorthy@icar.gov.in, krishvet@gmail.com

Abstract

Laboratory animals are being used widely in the research and development organizations and hence their welfare is of a great concern. The welfare of laboratory animals varies in a continuum between the countries in the world and are linked to their cultural, societal and religious practices. There is a need for very good laboratory animal welfare in India and also countries for the advancement of scientific knowledge and benefit of the human kind. The status of the welfare of the laboratory animals used for research in India was discussed and also the way forward is explained.

Key words: Laboratory animal welfare, Status, India, Way forward

Introduction

Laboratory animals are being used for various experimentations in the past decades and will be used in the future also. Over the centuries, animal studies have played an important part in numerous research plus scientific developments, which therefore flagged the way for our perception of numerous physiological mechanisms and process of diseases. Animal experimentation, a term to illustrate the animal use in educational, tutoring, and research experiments (Badyal and Desai, 2014). It is a vital constituent of biomedical and behavioral research envisioned to prevent, heal, and therapeutics for wide array of human and animal diseases. The animal use in research considerably augmented the scientific understanding and has aided the mankind in several ways. The terms animal research, animal experimentation, *in vivo* testing, and vivisection are often used interchangeably, even though they have various consequences.

The use of animals in research has become increasingly globalized in the recent years. This is mainly due to the increase in the number of pharmaceutical companies, Contract Research Organizations (CRO's), research institutes coming up in various fields of science. On the other side, animal usage in research, education, and testing rises problems involving to the ethical handling of animals, the starting place from which animals are procured, painful experiments, significance of results from the animal testing, issues of welfare, biodiversity issues, environmental concerns, etc. Therefore, animal experimentation has a lot of ethical questions such as justification for studies involving pain and distress to the animals that are detrimental to animal welfare. Also the animal handling varies with different individuals in each animal facility, research and academic institutions. Animals are undergoing painful processes while imparting education and skill development as reported (Badyal and Desai, 2014). Concerns have been raised about how animals are sacrificed for cosmetic studies and dermatological testing have arisen as a result of their use. Many nations, organizations, and non-governmental organizations have released recommendations for acceptable veterinary medical care for laboratory animals, and thought globally to be key constituent of animal care and use programs as mentioned earlier (Zurlo et al., 2009). The animal use in research and education evokes an emotional

response in students that may impact their learning outcomes. Knowing the animal welfare rules might reassure the students that the animals are well-cared for, which can change their attitude towards animals (Tekulapally and Padmavathi, 2020). Medical students do have a positive attitude toward the animals use in research, but they have inadequate awareness on the regulations on animal welfare being followed in India (Tekulapally and Padmavathi, 2020). In India, there is currently a need for shift in researchers' attitudes on the animal use and caring of experimental laboratory animals. This could be achieved by improving training and furthering the combination of the 3R concept in the research and also in the Committee for the Purpose of Control and Supervision of Experiments on Animals' regulations (CPCSEA) guidelines (Pratap and Singh, 2016). Many industrial testing companies thought that India is low-cost testing centre including preclinical animal experiments and human tests (Pereira et al., 2004). However, in the country, there is a rising concern and sympathy for animal suffering and aversion for double morals. The public expresses a strong desire to protect animals (Pereira et al., 2004). There are two sides of animal welfare in India, on one side the animals are being worshipped and on the other side the cruelty to animals being practiced widely due to lack of awareness. Hence the present article will discuss about the status of laboratory animal welfare in India and the way forward in future.

Animal Welfare

Animal welfare is the property of the particular animal and exists within a range of very poor to very good rather than being an absolute value. Animal welfare acts is a dais in which animals are prevented from the unnecessary sufferings as described earlier (Preetha and Arunkumar, 2017). The term ‘animal welfare’ was initially envisages in the public to state the ethical apprehensions concerning the animal treatment (Mallapur, 2008). Broom, 1986 reported that the animal welfare is a physical and psychological state of an animal and its attempt to manage the environment available. The individual was affected by the environment and it determines the physiological systems and fitness to survive (Fraser and Broom, 1997). However, individuals' interpretations of the term "animal welfare" differ, and debates over it frequently devolve into a battle of wits (Singh and Yadav, 2021). Animal welfare was related to the humane treatment of animals; providing good health, increasing the positive states and decreasing negative states such as pain and suffering, and offering the animals freedom to perform the ways which are usual to that particular animal species (Gilbert et al., 2012). All the animals have a fundamental value, and must be valued and safeguarded. Animal rights implies the philosophical opinion of rights for animals, comprising the right for living their lives without human involvement. Stress might affect the ability of the animal for breeding and display of behaviours which are unusual (Carlstead, 1996). Animal welfare is a complex that it’s not just the lack of cruelty but rather it includes three states of wellbeing such as physical, mental, and naturalness states. Physical state means how the animal copes with its environment, mental state means how the animals feel when exposed to stress conditions or harmonious with the environment. Naturalness is the proficiency of animals to achieve its usual wants and desires (Preetha and Arunkumar, 2017). Animal welfare aspires to ease the misery of animals within the human control by ensuring a fundamental means of living environment and treatment. It is critical to devise a strategy for linking the distance between issues which are frequently seen contrasting items in terms of public and care for animals. Towards this, we crave for a strong regulatory framework that demands a great ethical yardstick. The current disparity between animal ethics and welfare science, as well as with regulations, acts, and legislations, is thin and fuzzy. It's worth noting that scientific progress in laboratory animal science, and consequently the development of all fields of science, will linger around the animal welfare and care (Singh and Yadav, 2021). The assessment methods and indicators of animal welfare vary between different approaches and there is a need to design newer tools to assess and improve the animal welfare (Sejian et al., 2011).

Animal Husbandry and Management Practices

Animal husbandry practices are the supervision and upkeep of animals in the conditions under the genetic merits and performance of animals are used for benefit by the humans. It is imperative to look after and preserve the animals in the environmental conditions which are free from diseases. Healthful living conditions in the animal house will prevent the occurrence of various diseases and also reduce stress levels in the animals. This includes provision of clean water, feed and housing, suitable temperature, regular feeding, quarantine of unwell animals, nutritious diet and control of noise levels. The location of the animal house should be selected with proper drainage system, adequate lighting and sufficient ventilation. The space availability between the animals should be sufficient and prevent overcrowding. Animal inspection, observation and handling should be done properly each time by the animal handlers in laboratory animal facilities. A study reported that the blood sampling methods used for rats and mice have effect on welfare of the animals (Harikrishnan et al., 2018).

Animals are multifaceted living beings that may react to environmental conditions within the range of macro and micro environments. Being aware of these variables may certainly lead to better-controlled animal trials and improved animal care. Even minor modifications in living conditions can result in a wide range of research outcomes. These generally explain the expectations for diverse species in terms of care and use, as well as normal environmental variables including feed, water, light intensity, temperature, cleanliness, and shelter conditions. Monitoring and controlling environmental variables along with the provision of proper housing and management is essential for the suitable usage and comfort of animals. The animal housing plan and supervision of the research facility are prime for the monitoring and controlling the suitable environmental conditions for laboratory animals (Hessler, 1999). Heat, winter, storms, and noise can be harmful to animals in natural surroundings however, it has been controlled in the animal facilities. The personnel working

in the animal facility should be well trained and qualified and following the standard operating procedures may result in good care to the animals.

There are two environments provided for animals includes macro and micro environments. Macro environment is defined as the physical conditions which is comprised of animal rooms, barns, pastures and many a times, the micro environment is alike to the macro environment. The micro environment is the primary enclosure of an animal. This includes the direct part proximate to the animal, such as cages, pens, stalls, and comes in contact with the animal. Animals are subjected to micro environment includes temperature, humidity, vibration, noise and composition of air. Nowadays, most of the laboratory animal facilities are having heating, ventilation and air conditioning (HVAC) system, thereby maintaining the desired and controlled setting for the lab animals. The micro environment can be extensively different to macro environment due primary enclosure design. On similar macro environment, the individually ventilated caging systems provide different micro environments in different cages. The high-efficiency particulate air (HEPA) filtered airflow provided in each cage, there is possibility of maintaining positive pressure in one rack, to prevent entry of pathogens, whereas other rack can be maintained at negative pressure to stop the outflow of pathogens. The micro environment and macro environment should be suitable according to genetic makeup, age and purpose for which animals are being used in the animal experimentations.

Laboratory Animal Welfare Regulations and Guidelines

In India, the Prevention of Cruelty to Animals (PCA) Act of 1960, which was amended in 1982 is a primary law concerning animal welfare. The laws and regulations in India for animals in general in chronological order are given in Table 1. The Government of India has enacted the Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998, and revised in 2001 and 2006, to regulate the animal experiments

Table 1: Laws and regulations in India for animals in general

Year	Laws/ Regulations
1960	Prevention of Cruelty to Animals (PCA) Act 1960, amended in 1982
1964	Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA)
1965	Prevention of Cruelty to Drought And Pack Animals Rules
1972	Wild life Protection Act
1973	Performing Animals Rules
1978	Transport of Animals Rules
1978	Prevention of Cruelty to Animals (Registration of Cattle Premises) Rules
1979	Prevention of Cruelty (Capture of Animals) Rules
1992	Indian National Science Academy (INSA) Guidelines for care and use of animals in scientific research, revised in 2001
1998	Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998, amended in 2001, 2006
1998	Ban on Exhibition/Training of Five Performing Animals- Bear, Monkey, Tiger, Panther, and Lion
2001	Indian Council of Medical Research (ICMR) Guidelines for use of Laboratory animals in Medical Colleges
2001	Prevention of Cruelty to Animals (Slaughter House) Rules
2001	Prevention of Cruelty to Animals (Transport of Animals on Foot) Rules
2001	Performing Animals (Registration) Rules
2001	Animal Birth Control (Dogs) Rules
2002	Performing Animals (Registration) Amendment Rules
2009	MCI Amendment-Recommends to use alternatives to replace animal experiments
2010	Animal Birth Control (Dogs) Amendment Rules
2012	Ministry of Health and Family Welfare bans use of animals in educational institutions
2012	University Grants Commission (UGC) Guidelines for discontinuation of dissection and animal experimentation in zoology/life sciences in a phased manner
2014	Drugs and Cosmetics Rules (Second Amendment). Under this, the animals testing for cosmetic products was prohibited all over India.
2017	Dog Breeding and Marketing Rules
2017	Proper implementation of Prevention of Cruelty to Animals (Regulation of Live stock Market) Rules
2017	Prevention of Cruelty to Animals (Care and Maintenance of Case Property Animals) Rules
2018	Prevention of Cruelty to Animals (Pet Shop Rules) Rules
2019	Prevention of Cruelty to Animals (Egg laying hens) Rules

The Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), a legislative organization established under Prevention of Cruelty to Animals Act, which was approved by Parliament of India. It was founded in 1964 and resurrected in 1998 under the dedicated leadership of Smt. Maneka Gandhi. The CPCSEA have improved the lives of animals used for experiments in research laboratories in India for two decades. The CPCSEA committee comprises of researchers, regulatory bodies, and animal welfare activists. Further, CPCSEA sets rules for animal experimentation and animal house maintenance. The registration of an animal house with the CPCSEA is required and must be renewed every five years. There are currently several prerequisites for CPCSEA's registration and renewal. Beside the CPCSEA's norms and procedures, the Indian National Science Academy (INSA) and the Indian Council of Medical Research issued guidelines for the animal care and use in research and medical colleges. As a result, wherever possible, non-animal alternatives are being explored. The usage of animals has decreased by 40%, while tissue culture and biotechnology have increased, indicating that scientifically valid, non-animal approaches can be implemented. In 2009, the Medical Council of India (MCI) amended the law to make it mandatory for the medical colleges to employ alternatives to animal experiments in medical degree education. The MCI's decision to add a chapter on animal welfare and CPCSEA recommendations in the undergraduate curriculum to educate students about animal care is gaining importance (Tekulapally and Padmavathi, 2020). Significant progress has been recorded internationally in this field over the previous decade, and a few governments have established specific institutions to promote the development and acceptance of these alternatives (Badyal and Desai, 2014). The veterinarians are the one having knowledge or experience in laboratory animal science or medicine, according to Indian guidelines (Zurlo et al., 2009). However, if we are to improve global animal welfare standards, we must bring together people with opposing goals, which affects the human well-being and the scientific excellence as reported (Singh and Yadav, 2021). Veterinary care requirements vary by country and, in most cases, are developed by professional associations of laboratory animal veterinarians rather than by government legislation. The guidelines include detailed veterinarian's qualification for working in laboratory animal house, the role of veterinarians in overseeing facilities and experiments, and their role in research and reviewing of protocols engaging laboratory animals. The Institutional animal ethics committee (IAEC), grants approval and advises researchers on the animal use for research protocols. This committee is responsible for ensuring alternatives, including exploration of non-animal options and necessary pain management is provided without interfering the study (Badyal and Desai, 2014).

In Austria, Animal Welfare Act 2004 defines animals as "fellow creatures" to humans and applies to most cephalopods, vertebrates, and decapod crustaceans. This act also prohibits inflicting unnecessary pain, suffering, or injury to animal, as well as subjecting the animal to 'extreme anxiety,' indicating that the mental state of animals is considered. Sweden has implemented a new version of its major animal welfare legislation, the Animal Welfare Act 2018. This act of 2018 applies to domesticated animals as well as wild animals employed for research purposes. Sweden, has higher minimum area requirements for laboratory animals. Furthermore, Sweden has taken a positive stance on animal testing, having banned the animal use in testing of cosmetic products and establishing a center for three Rs, which is devoted to raising awareness of the Replacement, Reduction, and Refinement principles and finding ways for alternatives to animal use. Switzerland has extensive and thorough animal welfare legislation such as The Animal Welfare Act (2005) and the Animal Welfare Ordinance (2020) to safeguard animals from cruelty and animal welfare. The Animal Welfare Act of 2005 does not use the term "sentience," it recognizes an animal's bodily as well as mental status. The word 'dignity' implies a desire to guarantee that all the animals are protected and provide a life of good quality. The United Kingdom (UK) has a history of animal welfare, and first country to pass animal welfare legislation in the year 1876 in the world. Animal welfare, a significant one for the British public, as proved by the fact that UK legislations are beyond EU requirements in some aspects. The UK implemented the voluntary ban on certain types of animal experimentation. Surprisingly, the United Kingdom has also prohibited all forms of fur farming (API, 2020). The United States of America (USA) has federal legislation on animal welfare and the American Society for the Prevention of Cruelty to Animals (ASPCA) was established in the year 1860s. The American Anti Vivi Section Society (AAVS) was founded in 1883 and states that "several techniques can be implemented in animals provided it is effectively demonstrated as it is technically justifiable, as per the Animal Welfare Act" (NRC, 2011). The Animal Welfare Act (1966) establishes general guidelines for humane care and animal treatment that are propagated for profitable sale, public exhibition, biomedical research use, or transported commercially. The mainstream of animal welfare laws in the United States are applicable at the state level, and the states varies in the applicability of the statutes (API, 2020).

Animal Protection Index (API)

The Animal Protection Index (API) is a project of the World Animal Protection, and it helps us campaign for greater animal protection legislation. The API's approach was established by World Animal Protection working group, and first version was published in 2014. This assigns a score to 50 countries based on their animal welfare policies and regulations. The API for India and few countries are given in Table 2 for better understanding. The working committee includes senior members following animal protection, Non-Governmental Organizations. The committee also have numerous academic experts to guarantee the acceptability of the design, international recognized, and the adequacy of issues addressed in the API. The API Lead Researcher and Project Manager developed the technique for the second version, which was launched in 2020. Countries are graded on a set of ten indicators that encompass a wide range of animal species (i.e. Captive animals, farm animals, companion animals, draught animals, research animals and wild animals). For every indicator, each country earns a grade in letters vary between A (highest) to G (lowest), as well as an overall rating with grade (API, 2020).

able 2: The Animal Protection Index of few countries in comparison to India

No.	Parameters	UK	**India**	USA	China
1	Animal Sentience is lawfully recognized in legislation	C	**C**	D	D
2	Laws to counter suffering of animals	B	**B**	C	G
3	Protection to farm animals	D	**E**	E	G
4	Protection to captive animals	B	**C**	D	E
5	Protection to companion animals	B	**C**	F	F
6	Protection to draught and recreation animals	D	**D**	D	F
7	Protection to research animals	C	**B**	C	D
8	Protection and welfare to wild animals	C	**E**	E	D
9	Government responsibility towards animal welfare	B	**B**	D	G
10	OIE standards on animal welfare	A	**E**	D	E
11	Universal declaration on animal welfare endorsement	-	**-**	-	-
	Overall grading	B	**C**	D	E

India was ranked 'C' grade by the API in 2020. However, compared to UK it is lower and higher in comparison with USA and China. The protection of animals used in drought and recreation, welfare of wild animals and following the OIE international standards are the areas of concern for India with scope for improvement in near future. The API ranking for India was same even in the year 2014 also, as per the WAP grading.

Principles of Three R's and laboratory animal welfare

The Three R principles of replacement, reduction, and refinement may be included in the planning and execution of scientific or instructional initiatives while using animals. The study and knowledge of scientific literature, as well as correct experimental design, are used to provide scientifically valid results and avoid unnecessary replication of animal-based activities (Bayne and Anderson, 2015). The term "replacement" refers to methods without the use of animals. This term encompasses both absolute replacements (i.e., replacing animals with simulation methods e.g., computer programs) and relative replacements i.e., replacing animals, such as vertebrates with animals that are lower animals on sentience or phylogeny (NRC, 2011). Many a times, the researchers or regulatory authorities might object to relative replacement because of 'speciesism' (Singer, 1975). Refinement refers to changes in husbandry or experimental procedures that improve animal well-being and reduce or eliminate pain and distress. Refinement is a technique commonly used by researchers in an attempt for betterment of science. Good animal welfare leads to better scientific quality, especially when the effects of distressed animal forms a confusing variable (NRC, 2011). The regulatory authority, CPCSEA, is aiming to improve the ethical concerns about the use of animals in research and the importance of 3Rs and animal welfare in India. The 3Rs are important principles to be considered while using animals for teaching, testing and research, yet the general population in India is mainly unaware of them. The 3Rs idea is just recently gaining importance among the Indian scientists who conduct study with laboratory animals. The CPCSEA has 1,792 registered establishments or organizations in India which conducts animal experiments in India. The CPCSEA's continued efforts, which included regular workshops, national conferences, training for CPCSEA nominees and strict criteria, helps to maintain and develop the awareness among the laboratory animal users in India.

Animal welfare in prevailing Laws or Guidelines

The Indian Government accounts for standardization of the ethical use of animals in research as a requirement. As a result, with the support of members of the research community, animal welfare organizations, and veterinarians, the Government of India have developed a robust and unified regulatory framework for animal use in research. Any experimental animal higher on the evolutionary or phylogenetic spectrum in terms of amount of sensibility than invertebrates, such as mice, rats, rabbits, birds, and farm animals, comes under the control and supervision by CPCSEA. According to Rule 13 of the Breeding of and Experiments on Animals (Control and Supervision), 1998, every facility created and managed in agreement with the processes provided by CPCSEA, are obligated to form an Institutional Animal Ethics Committee (IAEC). After giving permission to perform animal studies, the IAEC will assess the projects for their validity and effectiveness in implementing the 3Rs. According to Rule 9 (bb) of the Breeding of and Experiments on Animals (Control and Supervision) Rules, 1998, the animals in the lowest scale of phylogeny may be considered initially and design of experiments with use of less number of animals feasible to yield a statistically acceptable results with confidence at 95% level.

CPCSEA appoints nominees to every registered institutes/ establishments/organizations to oversee the successful application of these standards at the institutional level and to approve project proposals for animal experimentation. The CPCSEA nominees acts as a liaison between CPCSEA and the institutes/establishments/organizations. Major task of the nominees is to monitor the wellbeing of the animals housed or employed for studies or breeding. The CPCSEA nominee is responsible for interpreting, overseeing, and evaluating institutional animal care programs. The CPCSEA nominee verifies that no animals were harmed during or after the experiment, and that the right number or minimum number of animals were utilized. The representatives must be aware with the CPCSEA rules, the 3Rs concept, other animal welfare issues, animal experimentation methods, husbandry conditions, humane animal care, handling procedures, and other CPCSEA criteria. Furthermore, the CPCSEA nominees must also be knowledgeable with alternatives, as well as reduction and refining techniques used in biological research projects and programs. The CPCSEA nominee and the IAEC collaborate to ensure that the 3Rs are effectively implemented in animal research. Animals should not be exposed to any dangerous or infectious items unless they are properly justified. Before proposing the species indicated in the protocol, the investigator must state that alternatives to animals and the use of lower phylogenetic species were given fair consideration. According to CPCSEA requirements, the main nominee should inspect the animal facility once every year and present a report in the specified format to the CPCSEA headquarters within a month from the date of inspection. The veterinary care of animals, animal health status, animal procurement, quarantine and stabilization, temperature, humidity, ventilation, lighting, housing system, sheltered or outdoor housing, feeding, bedding, water, waste disposal, record keeping, anesthesia, euthanasia, and details of rehabilitation facilities are all evaluated by the nominees during the inspection (CPCSEA, 2018). In addition, the IAEC monitors animal testing after it has been approved on a regular basis as a part of post approval monitoring. These two methods aid in the long-term deployment of the 3Rs.

Training on laboratory animals

The Laboratory Animal Information Service of the Indian Cancer Research Centre was developed by the Indian Council of Medical Research, now called as Advanced Centre for Treatment, Education and Research in Cancer. This facility conducted the country's first-ever survey of animal facility conditions and began offering regular animal handling and experimentation courses at the junior level. In 1976, the National Centre for Laboratory Animal Sciences was transferred to the National Institute of Nutrition and presently renamed as National Animal Resource Facility for Biomedical Research, Hyderabad. Although there is a shortage of skilled labour at the junior and senior levels at many facilities, the Centre provided training for junior and senior level animal facility personnel. Laboratory animal science is comparatively new field in India, and as a result, it has not been included in the curricula of graduate courses in the country, whether they are in veterinary medicine, medicine, pharmaceutical science, or any other bioscience. Several veterinary colleges have begun to include laboratory animal medicine and management in their veterinary education curriculum as a result of which remarkable improvement is seen in usage of laboratory animals in the last decade. Further, training programs by Federation of European Laboratory Animal Science Associations' accredited certificate courses in Laboratory Animal Sciences have been established in Tamilnadu Veterinary and Animal Sciences University, Chennai. To raise public awareness and spread knowledge on animal welfare. National Institute of Animal Welfare (NIAW) was established by the Government of India in Ballabgarh, Haryana to provide professional education in the field of Animal Welfare. The Institute was conceived as a high-level organization in the subject of animal welfare, with a comprehensive mandate that includes the prerequisite to promote animal welfare research, teaching, and public awareness. Scientists in India are often trained by their own institutes and encouraged to attend CPCSEA and other universities' periodic training programs. In addition, CPCSEA educates IAEC members, and all CPCSEA nominees also complete the NIAW's training curriculum. Since the establishment of the CPCSEA guidelines, and as a result of CPCSEA's ongoing efforts, knowledge among Indian scientists has progressively increased, and the vast majority of scientists in India who use animals in biomedical research are aware of the guidelines and the 3Rs. The Animal Welfare Board of India has around 2,500 organizations registered as working in the area of animal welfare. The Institute is expected to provide training and teaching on various aspects of animal welfare topics, including animal management, behavior, and ethics. Indian scientists from many fields and disciplines have come together to form a network to promote animal experimentation alternatives and welfare. Several animal welfare organizations, including the Laboratory Animal Scientists Association (LASA) India, Federation of Indian Animal Protection Organizations, are pushing the animal welfare and use of alternatives in animal experiments. The Indian Institute of Science, Bangalore and Central Food Technological Research Institute, Mysore are also offering certificate and short term course on laboratory animals. The Central Drug Research Institute, Lucknow is also offering training course on care and management of laboratory animals and experimental techniques. The Good Laboratory Practices (GLP) is also certifying the testing laboratories for the good quality performance of organizations involved in toxicity studies in animals. In India, at present there are 49 GLP certified test facilities carrying on toxicity studies and many facilities are involved in animal experiments. In the year 2020, the Indira Gandhi National Open University, New Delhi has started a distance learning course on Post Graduate Diploma in Animal Welfare which is recognized by Animal Welfare Board of India, New Delhi.

Way forward

The baseline information on laboratory animal welfare activities in India is provided in this study. The laboratory animal welfare in India have numerous laws, regulations, guidelines available to be followed and implemented. However, the penalties or fines applicable for the animal cruelty is very meagre and less. There is a need to increase the penalties and fines for the same in future for the better welfare of animals in India. There is requirement of awareness on animal welfare among the stakeholders and also the general public. This will allow the public to have the concern for the animals and its welfare. The people in India worship animals as the means of transport of Gods and at the same time, there is also cruelty to animals being happening. The CPCSEA guidelines have been

evolved over the period of time and improved the laboratory animal welfare and animal experimentations in India. There is also scope for improvement and implementing principles of 3Rs in better way in the CPCSEA guidelines. There is need to improve the post approval monitoring of the animal experiments by the IAEC members in the establishments/ organizations involved in animal experiments in the CPCSEA guidelines. The IAEC should not act only to approve the animal experiments but also to monitor the welfare of the animals involved in the animal experiments regularly. According to the API grade, India is in better position but needs improvement in the areas already mentioned, to move up in the grade in future years to come. Animal testing are still vital for toxicity studies, drug carcinogenicity, and behavioral studies, despite the fact that amalgamation of latest *in vivo* and *in vitro* techniques deliver feasible and profitable alternatives to certain pharmacodynamics and pharmacokinetic assessments of new chemical entities. Alternative approaches and models are anticipated to partially or completely substitute completely the animals in pharmacological research and education in near future. It is critical that an independent authority be established to ensure that non-animal approaches have been investigated. The law should ensure that there is actual control and responsibility for the animal experimentations conducted in India. Laboratory supervisors should be held legally responsible for the treatment of animals at their institutions. Lack of funds should not be used as an excuse; poorly funded and conducted research is worse than nothing at all. The research project or contract research funds should include the expenditure on the better management of animals before, during and after animal experimentations. The status of laboratory animal welfare is good at present but still it can be very good in future. Thus, there is need for continued efforts and support from all stake holders of laboratory animals for improving the laboratory animal welfare in India.

Conflicts of interest

Authors declare no conflict of interest.

Acknowledgments

The authors acknowledge the support extended by The Director, ICAR National Institute of Veterinary Epidemiology and Disease Informatics, Bangalore in preparing this article.

References

1. API (2020). Animal Protection Index https://api.worldanimalprotection.org/. Accessed on 22nd December 2021.
2. Badyal D.K and Desai C (2014). Animal use in pharmacology education and research: The changing scenario. *Indian J Pharmacol*. 46(3): 257–265.
3. Bayne K and Anderson L C (2015). Laws, regulations, and policies affecting the use of laboratory animals. In Laboratory Animal Medicine, ed. J G Fox, L C Anderson, G M Otto, K R Pritchett-Corning, and M T Whary, 3rd edition, Elsevier, San Diego, p 23–43.
4. Broom D.M (1986). Indicators of poor welfare. *British Vet J*. 142: 524 -526.
5. Carlstead K (1996). Effects of Captivity on the Behavior of Wild Mammals. Wild Mammals in Captivity Principles and Techniques, University of Chicago, pp 317–333.
6. CPCSEA (2018). Compendium of Committee for the purpose of control and supervision of Experiments on animals (CPCSEA) under Ministry of Environment, Forest and Climate Change, Government of India, New Delhi.
7. Gilbert S F, Sapp J and Tauber I A (2012). A Symbiotic View of Life: We Have Never Been Individuals. *Q Rev Biol.* 87(4): 325–341.
8. Fraser A F and Broom D M (1997). Farm Animal Behavior and Welfare, 3rd edition, CAB International, London, UK.
9. Harikrishnan V S, Hansen A K, Abelson K S P and Sorenson D B (2018). A comparison of various methods of blood sampling in mice and rats: Effects on animal welfare. *Lab. Anim*. 52(3): 253–264.
10. Hessler J R (1999). The history of environmental improvements in laboratory animal science: Caging systems, equipment, and facility design. In Fifty Years of Laboratory Animal Science, ed. C.W. Mc Pherson and S.F. Mattingly, Memphis: American Association for Laboratory Animal Science, pp: 92–120.
11. Mallapur A (2008). Animal Welfare research and its implications to non-human primate breeding programs: A Case Study of the Lion-tailed macaque conservation breeding program from India. *Rev. Electron. Vet*. 9(10b): 1–21.
12. NRC (2011). National Research Council, Guide for the care and use of laboratory animals, 8th edition, National Academic Press, Washington, DC.
13. Pereira S, Veeraraghavan P, Ghosh S and Gandhi M (2004). Animal Experimentation and Ethics in India: The CPCSEA Makes a Difference. *ATLA*. 32(1): 411–415.
14. Pratap K and Singh V P (2016). A Training Course on Laboratory Animal Science: An Initiative to Implement the Three Rs of Animal Research in India. *ATLA*. 44(1): 21–41.
15. Preetha M and Arunkumar T (2017). Animal ethics and welfare- Review. 1st National Conference on Teaching Innovations and Enhancing Learning (Arts, Science and Technology), 5(1): 108–114.
16. Sejian V, Lakritz J, Ezeji T and Lal, R (2011). Assessment methods and indicators of animal welfare. *Asian J Anim Vet Adv*. 6(4): 301–305.
17. Singh V P and Yadav S. 2021. Ethics, Animal Welfare and Regulation: The Indian Perspective. In: Nagarajan P, Gudde R, Srinivasan R. (eds) Essentials of Laboratory Animal Science: Principles and Practices, Springer, Singapore. p 39–51.
18. Singer P (1975). Animal Liberation- A new ethics for our treatment of Animals. Avon Books, New York.
19. Tekulapally K and Padmavathi V (2020). Knowledge and attitude of medical students toward animal research and welfare-A cross sectional study. *Natl J Physiol Pham Pharmacol*. 11(3): 257–262.
20. Zurlo J, Bayne K and Clark M J (2009). Adequate Veterinary Care for Animals in Research: A Comparison of Guidelines from Around the World. *ILAR J.* 50(1): 85–88.