Eurasia Specialized Veterinary Publication

International Journal of Veterinary Research and Allied Science

ISSN:3062-357X

2023, Volume 3, Issue 2, Page No: 153-161

Available online at: www.esvpub.com/

Perceptions and Knowledge of Laboratory Animal Welfare Among Veterinary Students in Southeastern China: Implications for Ethics Education

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ABSTRACT

Animal experimentation has been pivotal in advancing scientific understanding and improving human well-being. To gain a deeper insight into veterinary students' knowledge and attitudes toward laboratory animal welfare, as well as to evaluate and enhance pedagogical approaches in animal ethics education, a structured questionnaire was administered to both undergraduate and postgraduate veterinary students. The survey covered multiple areas, including students' understanding of animal welfare principles, their attitudes toward laboratory animals, competence in conducting animal experiments, and opinions regarding instructional methods and course content. A total of 150 undergraduate and 148 graduate students participated in the study. Findings revealed that the majority of students demonstrated a strong sense of responsibility for protecting the welfare of experimental animals, although a small proportion exhibited limited empathy toward animals. Moreover, many students displayed insufficient foundational knowledge of animal ethics and lacked proficiency in essential experimental techniques. Despite this, most participants showed a strong commitment to advocating for animal welfare. While a significant number were unaware of regulatory bodies overseeing laboratory animal research, they expressed support for incorporating both education and supervision related to animal welfare and were receptive to diverse teaching strategies and content. In summary, this study underscores the need for targeted training and education in laboratory animal welfare and ethics to meet students' specific learning needs. These findings provide a valuable basis for enhancing future animal welfare curricula and improving both the professional competence and ethical awareness of veterinary students.

Keywords: Animal welfare, Laboratory animals, Chinese veterinary students, Higher education, Survey research

Received: 07 September 2024
Revised: 02 December 2024
Accepted: 07 December 2024

How to Cite This Article: Mason DR. Perceptions and Knowledge of Laboratory Animal Welfare Among Veterinary Students in Southeastern China: Implications for Ethics Education. Int J Vet Res Allied Sci. 2023;3(2):153-61.
https://doi.org/10.51847/iZM4jtRzIy

Introduction

Over the past few decades, global progress in understanding diseases, as well as in their diagnosis and treatment, has been remarkable. A major contributor to this advancement has been the use of laboratory animals. Experimental research involving animals remains a cornerstone in biomedical science, consistently supporting the rapid growth of precision medicine in China. Such studies allow researchers to thoroughly investigate the mechanisms underlying disease development and progression in both humans and animals [1, 2]. Laboratory animals also provide invaluable insights into anatomy and physiology and serve as essential models for evaluating the safety and effectiveness of drugs and vaccines [3–5]. Overall, animal experimentation is indispensable across multiple fields of life science, playing a crucial role in expanding scientific knowledge and improving human

quality of life. Despite widespread recognition of the necessity of animal research, concerns regarding the welfare of laboratory animals and the ethical dimensions of their use have become prominent issues worldwide [6–8].

As societies evolve and the quality of life improves, there has been a noticeable shift in the perception of animals. Increasingly, animals are viewed not merely as tools for human use but as sentient beings entitled to inherent rights, including the right to life [9, 10]. This growing acknowledgment of animal welfare and rights has prompted greater attention to the ethical implications of experimental animal use [11]. As a result, the ethical conduct of animal research has emerged as a critical area of focus.

The ethical considerations surrounding animal experimentation extend beyond the treatment of the animals themselves, influencing the reliability and validity of scientific outcomes [12]. They also affect the quality of training and research experiences for veterinary students. Evidence from previous studies indicates that researchers' attitudes toward laboratory animals are shaped by various psychosocial factors, including their education and level of practical training [13, 14]. Ensuring the welfare of experimental animals is essential for producing reliable data, and this responsibility rests directly on the researchers' conduct [15]. Consequently, higher education plays a central role in equipping veterinary students with both theoretical knowledge and practical competencies in laboratory animal welfare and ethics, enabling them to safeguard animal well-being effectively and address their needs appropriately.

Although leading veterinary organizations in China have established clear standards emphasizing animal welfare, disparities remain in the quality of veterinary education and training between southeastern regions and major "first-tier" cities, such as Beijing [16].

The present study aimed to explore how undergraduate and graduate veterinary students in southeastern China perceive and understand laboratory animal welfare. Specifically, it sought to evaluate students' grasp of animal welfare concepts, their practical skills in conducting experiments, and their views on instructional approaches for teaching animal welfare. The study also examined existing educational frameworks and highlighted the challenges faced by institutions regarding the ethical treatment and welfare of laboratory animals. The ultimate goal was to use the survey findings to enhance training in experimental animal ethics, thereby improving the effectiveness of animal welfare education and fostering the professional development of future veterinarians.

Materials and Methods

To assess students' perspectives, a bespoke questionnaire was designed. It incorporated a range of question types, including multiple-choice items with single or multiple responses and Likert-scale statements. The questionnaire content was modeled on prior research conducted on laboratory animals both in China and internationally, ensuring thorough coverage of relevant topics [17–19]. While no strict time limit was imposed, completion was expected within 10 minutes. The surveys were distributed to students by the class head following a lecture session. Participation was entirely voluntary and anonymous, targeting only senior and junior undergraduates and graduate students in veterinary programs who had direct experience with experimental animals. No incentives were offered for participation.

The questionnaire consisted of four primary sections: (1) students' comprehension of animal welfare and ethical principles; (2) current educational practices related to laboratory animal ethics; (3) attitudes toward laboratory animals and proficiency in experimental techniques; and (4) opinions on teaching methods and awareness of ethical issues regarding animal welfare.

Data from the surveys were entered into Microsoft Excel (Microsoft Corporation, Redmond, WA). Out of 300 questionnaires collected, 298 were deemed valid, comprising 150 undergraduate and 148 graduate responses, yielding a 99.3% response rate. Descriptive analyses were performed in Excel, with one author independently verifying the proportion (%) of questions answered.

This study received ethical clearance from the Ethics Committee of Scientific Research at Fujian Agricultural and Forestry University, and all participant information was anonymized to ensure confidentiality.

Results

Awareness of animal welfare and ethics

Table 1 summarizes student responses regarding familiarity with animal welfare concepts. Among undergraduates, 86.7% indicated awareness of animal welfare and ethical considerations, whereas 72.9% of

graduate students reported similar familiarity. However, only 26.0% of undergraduates and 11.5% of graduates were acquainted with the "Five Freedoms" and the "3Rs principle." Many undergraduates had only a superficial understanding of these concepts. Notably, 32.6% of undergraduates and 48.7% of graduates reported no prior exposure to animal welfare topics, highlighting a general gap in knowledge among veterinary students regarding ethical and welfare issues in laboratory animal use.

Table 1. Level of understanding of concepts relating to animal welfare and ethics

Question	Response	No. of respondents (% of survey sample)	
		Undergraduate students	Graduate students
Do you have an understanding of animal welfare and ethical considerations?	Yes	130 (86.7%)	108 (72.9%)
	No	20 (13.3%)	40 (27.1%)
Are you aware of the principles of the "3Rs" and the "Five Freedoms" in the context of animal welfare?	Yes, know well	39 (26.0%)	17 (11.5%)
	Yes, but don't know the details	62 (41.3%)	58 (39.2%)
	No	49 (32.6%)	73 (48.7%)

Status of ethics education on the use of experimental animals

The survey revealed that most students felt their knowledge of laboratory animal ethics was insufficient, with 85.3% of undergraduates and 87.9% of graduate students reporting a lack of familiarity with ethical principles related to experimental animals. Despite this, a substantial portion of students—68.7% of undergraduates and 60.1% of graduates—indicated that they would still prioritize the welfare of animals when conducting experiments. Additionally, the majority of respondents recognized the value of formal instruction in laboratory animal ethics for their future professional development. Only a small minority of students, 2% of undergraduates and 4.7% of graduate students, perceived such training as irrelevant to their careers **(Table 2)**. Overall, these results indicate that most veterinary students are aware of the ethical dimensions of animal experimentation and are receptive to education and training in laboratory animal ethics.

Table 2. Opinions on the status quo of education received on laboratory animal ethics

Question	Response	No. of respondents (% of survey sample)	
		Undergraduate students	Graduate students
Do you feel that your understanding of animal ethics concerning laboratory animals is insufficient?	Yes	128 (85.3%)	131 (87.9%)
	No	22 (14.7%)	17 (12.1%)
Are you likely to give greater consideration to the welfare of experimental animals while performing experiments?	Yes	103 (68.7%)	89 (60.1%)
	No	47 (31.3%)	59 (39.9%)
Do you believe that training in laboratory animal ethics will benefit your future professional development?	Yes	147 (98.0%)	141 (95.3%)
	No	3 (2.0%)	7 (4.7%)

Attitudes toward experimental animals and experimental skills

Responses related to animal experimentation are summarized in **Table 3**. When conducting dissections or other procedures involving injured animals, 14.7% of undergraduate and 12.2% of graduate students reported treating these experiments in a manner similar to standard laboratory tasks, such as chemical or physical experiments. Despite not outwardly showing their feelings, a majority of students—61.3% of undergraduates and 75.0% of graduates—acknowledged experiencing emotional distress during these procedures. Additionally, 24.0% of undergraduates and 12.8% of graduate students found it challenging to handle injured animals.

Regarding the principle of maintaining a "humanitarian approach" in experimental work, 19.3% of undergraduates admitted that they did not consistently follow this ethical guideline. Most students reported striving to act humanely, yet their technical skills were often insufficient: 66% of undergraduates and 81.8% of graduates indicated that, although they aimed to adhere to ethical standards, they did not fully meet procedural requirements. Only a minority—6.0% of undergraduates and 10.1% of graduates—managed to combine technical competence with strict observance of humane practices.

Overall, these results suggest that veterinary students generally value animal welfare and attempt to comply with ethical norms during experiments. However, there is a noticeable gap in practical skills, with only a few students lacking empathy entirely. The data indicate a strong ethical awareness but highlight the need for enhanced training in technical aspects of animal experimentation.

Table 3. Attitudes toward experimental animals and mastery of experimental skills

Question	Response	No. of respondents (% of survey sample)	
		Undergraduate students	Graduate students
How do you experience performing dissections or other procedures that may harm animals?	I approach it the same way as I would for physical or chemical experiments.	22 (14.7%)	18 (12.2%)
	I don't show my emotions outwardly, but I still experience feelings.	92 (61.3%)	111 (75.0%)
	I find it challenging to carry out these procedures.	36 (24.0%)	19 (12.8%)
To what extent is the principle of humanitarianism observed during animal experiments?	I do not feel that it is upheld at all.	29 (19.3%)	12 (8.1%)
	Yes, it is maintained, but the procedures are not fully standardized.	112 (74.7%)	121 (81.8%)
	Yes, it is maintained, and the procedures are properly standardized.	9 (6.0%)	15 (10.1%)

Perspectives on education and advocacy in laboratory animal welfare and ethics

Table 4 summarizes the survey results regarding students' views on education and advocacy in laboratory animal welfare and ethics. The findings revealed that an overwhelming majority of students—96.7% of undergraduates and 98.6% of graduates—recognized their responsibility to promote and uphold animal welfare. Additionally, most participants (94.7% of undergraduates and 98.6% of graduates) emphasized the importance of integrating animal welfare concepts and practical approaches into the veterinary curriculum. These results indicate strong student support for both formal education in laboratory animal ethics and ethical oversight of experimental practices.

However, awareness of institutional oversight was limited; a substantial proportion of undergraduates (81.3%) reported being unaware of the Ethics and Animal Welfare Committee. Despite this lack of familiarity, a large majority of students—92.0% of undergraduates and 94.6% of graduates—expressed their support for ethical supervision in both teaching and research activities. Overall, these findings suggest that veterinary students are committed to prioritizing animal welfare and advocate for more comprehensive education and awareness of ethical standards in laboratory animal research.

Table 4. Opinions on teaching and advocacy relating to laboratory animal welfare

Question	Response	No. of respondents (% of survey sample)	
		Undergraduate students	Graduate students
Do you see yourself as responsible for promoting and ensuring animal welfare in our country?	Yes	145 (96.7%)	146 (98.6%)
	No	5 (3.3%)	2 (1.4%)
Do you believe it is important to include training on animal welfare knowledge and skills in the current curriculum?	Yes	142 (94.7%)	146 (98.6%)
	No	8 (5.3%)	2 (1.4%)
In your opinion, should laboratory animal-related teaching or research be monitored by an animal welfare regulatory body?	Yes	138 (92.0%)	140 (94.6%)
	No	12 (8.0%)	8 (5.4%)
Are you familiar with the Ethics and Animal Welfare Committee and its role?	Yes	28 (18.7%)	45 (30.4%)
	No	122 (81.3%)	103 (69.6%)

Table 5 illustrates students' choices and priorities regarding both instructional approaches and content areas for teaching laboratory animal welfare and ethics. Among undergraduates, the most widely accepted method was the use of alternative teaching approaches for experimental skills, endorsed by 83.3% of respondents. Following this, computer simulations were supported by 76.7%, specimen-based demonstrations by 67.3%, and video-based

instruction by 46%. Only a minimal proportion (2%) of undergraduates indicated that they would not engage with any of these alternative approaches.

For graduate students, model-based instruction emerged as the preferred method, with 58.1% favoring this approach. Specimen-based teaching (45.3%), computer simulations (41.2%), and video-based instruction (36.5%) followed in preference. Interestingly, a larger share of graduates (26.4%) expressed reluctance to adopt any of the alternative teaching methods compared to undergraduates.

In terms of curricular content, both undergraduate and graduate students prioritized the practical application of laboratory animal welfare, with 91.3% and 94.6% indicating this as most important, respectively. Ethical discussions surrounding laboratory animals were also highly valued (81.3% of undergraduates, 72.0% of graduates), along with the study of relevant legislation and regulations (71.3% of undergraduates, 77.7% of graduates) and considerations for species-specific treatment (68.6% of undergraduates, 62.2% of graduates). Only a very small fraction of students—0.7% of undergraduates and 2% of graduates—considered these content areas irrelevant.

Overall, these findings suggest that veterinary students are open to diverse teaching strategies and place strong emphasis on hands-on applications, ethical reasoning, legal knowledge, and species-specific care in laboratory animal welfare and ethics education.

Table 5. Opinions on teaching and advocacy relating to laboratory animal welfare (multiple-choice questions)

Question	Response	N. of respondents (% of survey sample)	
		Undergraduate students	Graduate students
.Which alternative methods for laboratory teaching would you be willing to use or support?	Model-based instruction	125 (83.3%)	86 (58.1%)
	Specimen-based teaching	101 (67.3%)	67 (45.3%)
	Computer simulation-based teaching	115 (76.7%)	61 (41.2%)
	Video-based instruction	69 (46.0%)	54 (36.5%)
	I would not support any of these alternatives	3 (2.0%)	39 (26.4%)
If you were to study laboratory animal ethics, which topic do you consider the most important?	Discussion of ethical issues related to laboratory animals	122 (81.3%)	108 (72.0)%

Discussion

Practical work with laboratory animals is an essential part of veterinary education, providing students with hands-on experience and helping them develop critical skills. At the same time, such experiments raise important ethical and welfare concerns [20, 21]. Therefore, veterinary programs must ensure that students not only understand animal welfare principles but also actively apply them during their training. Doing so fosters both professional competence and the development of empathy and ethical awareness.

Veterinary students are expected to show responsibility and dedication toward the proper treatment of animals. Studies have shown that veterinarians often play a key role in detecting instances of animal abuse, including domestic violence cases [13, 22–24]. In this study, although most students reported being familiar with animal welfare and ethical concepts, their awareness of internationally recognized standards was limited.

Ethical frameworks such as the 3Rs principle—Replacement, Reduction, and Refinement—provide guidance for conducting experiments responsibly while minimizing harm to animals [25]. These principles, now integrated into legislation and guidelines, help ensure that experimental work meets both scientific and ethical criteria [26]. Similarly, the Five Freedoms—covering freedom from hunger and thirst, pain and injury, discomfort, fear and distress, and the ability to express natural behaviors—have become a foundational benchmark for animal welfare since their introduction in the early 1990s [27–29]. Findings from the present study show that many students lacked familiarity with both the 3Rs and the Five Freedoms, indicating that their understanding of basic welfare and ethical principles remains incomplete. This points to the need for veterinary curricula to provide more comprehensive education on these foundational concepts, particularly for graduate-level students. In contrast, previous research conducted with veterinary students in Italy reported that participants generally perceived their knowledge of animal welfare as satisfactory [30].

Gaining insight into veterinary students' attitudes and perceptions regarding animal welfare is essential for evaluating the adequacy and effectiveness of their education [31, 32]. Findings from the present study suggest that students generally value education in laboratory animal ethics for their future careers and are willing to prioritize welfare considerations while developing experimental skills. Consistent with the results reported by Pirrone *et al.* [13], most students are receptive to formal training in laboratory animal ethics, recognizing its role in enhancing professional competence and supporting humane practices.

Despite this overall positive attitude, a small subset of students still regards animals primarily as instruments for learning, demonstrating limited empathy and insufficient awareness of welfare and ethical standards. This underlines the necessity of reinforcing ethical education and training to cultivate a stronger sense of compassion and responsibility toward experimental animals.

The use of inappropriate or non-standard experimental techniques by some students is another area of concern. Ensuring that both undergraduate and graduate students are adequately trained in proper experimental procedures is critical not only for minimizing harm to animals but also for achieving reliable research outcomes. This is particularly important because these students will become future professionals responsible for addressing animal welfare challenges in research settings [33, 34]. Previous studies have identified a lack of researcher support for employing appropriate methods as a key barrier to upholding animal welfare [35]. Therefore, comprehensive training in experimental techniques is essential—it reduces animal suffering while equipping students with the skills needed to conduct successful and ethically sound experiments [36, 37].

Veterinarians carry both professional and ethical obligations to promote and safeguard animal welfare [38]. Most veterinary students in this study acknowledged this responsibility and expressed a strong commitment to advocating for animal welfare, demonstrating an understanding of the importance of preventing harm and protecting the well-being of animals [39]. In many developed countries, Ethics and Animal Welfare Committees (AECs) and Animal Care and Use Committees (ACUCs) have been established to review research proposals, balancing potential human benefits against the welfare impact on animals [40–42]. In China, however, the development of such oversight bodies is still evolving. This survey revealed that while most students were unaware of the existence of the Ethics and Animal Welfare Committee, they nonetheless recognized the value of supervision. These findings suggest an urgent need to improve awareness of ethics committees in Chinese veterinary education. Establishing localized committees—such as departmental or student-level welfare oversight groups—could further strengthen supervision and ensure consistent implementation of animal welfare standards in both teaching and research, thereby enhancing ethical practices across the country.

Currently, a variety of alternative instructional approaches exist that can serve as substitutes for traditional animal experimentation, including model-based teaching, computer simulations, specimen demonstrations, and video-based methods [43, 44]. Among these, model-based instruction was the most favored by both undergraduate and graduate students, highlighting its potential for wider adoption and integration into veterinary education. Nevertheless, a notable proportion of graduate students in this study were reluctant to embrace alternative teaching methods, consistent with previous findings [45]. Upon further inquiry, these students indicated that conventional teaching approaches facilitated better retention of new knowledge and technical skills. Consequently, they recommended a blended strategy combining traditional methods with alternative approaches to optimize learning outcomes [46].

Regarding curriculum content, students emphasized that the practical application of laboratory animal welfare principles should form the cornerstone of laboratory animal ethics education. In addition, most students considered instruction on ethical issues and relevant legal frameworks to be essential and advocated for their inclusion in future teaching programs [47, 48].

The survey responses underscore the critical role of formal education in laboratory animal ethics and provide insight into veterinary students' overall perceptions of animal welfare and ethical practice. The findings also reveal a widespread lack of familiarity with key aspects of laboratory animal ethics, techniques, and relevant laws—a gap corroborated by other studies—which points to the necessity for expanded training and awareness initiatives covering the scientific, legal, and ethical dimensions of animal research [30].

It is clear that the responsibilities of veterinarians extend far beyond diagnosing, treating, and preventing animal diseases; they also encompass advocacy for and expertise in animal welfare and ethics. Accordingly, both instructors and students should prioritize the application of the 3Rs principle in experimental work while acquiring advanced technical knowledge and practical skills. These competencies are essential not only for students'

professional development but also for ensuring the ethical conduct of scientific research and their future success in the veterinary field.

Conclusion

In summary, comprehensive education in laboratory animal welfare is essential throughout the veterinary curriculum at both undergraduate and graduate levels. Regardless of course focus, animal-related instruction should cultivate awareness of the importance of protecting the rights and welfare of experimental animals. Universities should strengthen formal education in areas such as animal medicine, surgery, and procedural skills, aiming to foster professional attitudes, ethical responsibility, and practical competence. Integrating laboratory animal welfare education into the broader learning process will better prepare future veterinarians to prioritize the humane treatment and wellbeing of all animals under their care.

Acknowledgments: We thank Kul Raj Rai of our laboratory for helpful assistance.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Financial Support: The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This research was supported by the Undergraduate Education and Teaching Reform Research Program of Fujian Agriculture and Forestry University (111421143, 111423041) and the Graduate Education and Teaching Reform Research Program of Fujian Agriculture and Forestry University (712018270373, 712018270502).

Ethics Statement: This study was approved by Ethics Committee of Scientific Research of Fujian Agricultural and Forestry University, (Permit Number 111421143). All surveys were carried out according to the regulations and the respondent information is anonymized. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements.

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