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Examination of postgraduate theses using experimental animals in nursing in Türkiye: Systematic review

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Abstract
The aim of this study was to examine the postgraduate theses conducted in the field of nursing in Türkiye between 2013 and 2023 using experimental animals and to determine the contribution of the use of experimental animals in nursing research to nursing science. The literature review was conducted from September to October 2023 in the National Thesis Center database of the Council of Higher Education (CoHE) using the keywords "experimental animal, animal experiments, rat, mouse and nursing" in Turkish. We found 14 published postgraduate thesis studies in the field of nursing registered in the CoHE National Thesis Center. All theses that met the screening criteria were included in the study (n=14). The theses were examined in terms of year, department, sample group, method, master's and doctoral theses. The data were evaluated as percentages and numbers in the SPSS package program. It was determined that 50% of the postgraduate theses included in the study were conducted between 2013-2018 and the other half between 2019-2023, 85.72% of the theses subject to the study were doctoral dissertations, 28.57% of the studies were conducted in the department of internal medicine nursing, and rats were used as experimental animals in 78.57% of the sample group. Characteristics of the theses included in this review; hypericum perforatum-clinoptilolite-hydrocolloid dressing, olive leaf extract wound dressing, allicin application, tea tree oil, lavender oil and bay leaf essential oil in diabetic wound healing (n=6), use of transcutaneous electrical nerve stimulation in wound healing and oxidative stress in diabetic rats (n=1), application of silk protein, propolis, frankincense oil and a hemostatic product in full-thickness wound healing (n=1), topical propolis application in burn healing (n=1), oxidative damage in rats exposed to noise stress in surgical intensive care unit (n=1), application of different diet types in pressure sores (n=1), effects of diabetes on newborn in pregnant rats (n=1), cadmium application in fertility parameters (n=1), and the use of vitamin C and E combination and brown algin in the improvement of semen parameters in infertile male rats (n=1). In conclusion, it is suggested that postgraduate studies using experimental animals in the field of nursing in Türkiye are limited, more evidence-based studies that will contribute to nursing science and care in our country, as in the international arena should be conducted and researchers should be supported.
Keywords: *Nursing, experimental animals, postgraduate, thesis*

1. Introduction

Scientists have been conducting animal experiments for more than two millennia.[1,2] Animal experimentation research has played a vital role in many scientific and medical advances over the past century, helping us understand and care for a variety of diseases.[1,3,4] Animal models are irreplaceable assets for basic and clinical research.[5] Indeed, preclinical research with animal models has provided invaluable data to the scientific world in understanding the basic mechanisms of human health and disease, alleviating pain and suffering, and developing treatments for health.[6,7] For example, most of the drugs discovered and used were obtained as a result of animal experiments. Alexander Fleming discovered penicillin and made it available to humans thanks to his research on rats.[8] Animal studies have contributed to the development of new drugs and vaccines, as well as new surgical techniques and anesthesia protocols.[4] All over the world, people enjoy a better quality of life thanks to these advances and the subsequent development of new medicines and treatments, all made possible by animal research.[3] The role of animal studies in nursing research and clinical practice is increasing and becoming popular.[1] This is because nursing is a professional profession that provides care within the health system for individuals, families and communities to achieve and maintain optimal health and quality of life.[2] For this reason, more and more nurses are expected to lead or collaborate in research using experimental animals.[9] Since nurses have an important role in the care and treatment of patients, for decades nurses have been using animal models to investigate research problems related to how diseases affect our health.[10,11]

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At the same time, since nurses are also representatives of the science of care, they obtain valuable information from animal research that facilitates informed decision-making regarding the quality and management of effective care.[12] With their clinical experience, specialized knowledge and holistic perspective, nurses are in an active position to fill scientific gaps with pre-clinical animal experiments.[7] For example, animal research models are necessary when studies on patients are unethical.[11] Selye developed the theory of stress, which is important for nursing, by utilizing animal experiments to reveal stress-related ulcers.[13] Two nurses Janean Holden and Leslie Ritter were honored by the US government with the 79th Presidential Early Career Award for Scientists and Engineers for their work on animal experiments.[14] Nurses using animal research have contributed to science by conducting numerous scientific studies on pulmonary functions, diabetes, skeletal muscles, cardiac functions, cerebral ischemia, wound healing and many different animal modeling.[14] Since nursing is a research-based and professional profession, nurses should conduct more scientific studies using animal research.[11,15] As a way to expand nursing knowledge and improve nursing interventions, it is necessary to promote and raise awareness of the application of animal experiments in various areas of nursing research.[9] The use of animal experiments and models in nursing research is vital for the advancement of science and nursing science.[11,15]

In this sense, a small but growing number of nurse researchers have been using animals to study diseases and find solutions to patient care questions for decades.[11] As a result, animal research promotes the development of clinically based research questions that help nurses provide effective care. When nurses and other healthcare providers appropriately interpret and apply this valuable information in the clinical setting, patients will benefit from animal research in the provision of effective care. Therefore, nurses should become competent in conducting studies with animal models, interpreting study results and translating these results into clinical practice.

The aim of this study is to examine the postgraduate thesis studies using experimental animals in the field of nursing between 2013 and 2023 in Türkiye and to contribute to a comprehensive understanding of the role that the use of animals in nursing research can play in the development of nursing science.

2. Material and methods

2.1. Type of research

This study is a systematic review of master's and doctoral theses conducted in Türkiye between 2013 and 2023 using experimental animals in nursing. Since the first studies using experimental animals in nursing were conducted in 2013 and the theses were published in CoHE Thesis in 2013, the research year intervals of the systematic review were determined as 2013-2023: "2013-2023".

2.2. Population and sample of the study

In order to determine the master's and doctoral theses using experimental animals in nursing, CoHE National Thesis Center database was searched, and the search results constituted the population of the study. In the CoHE thesis database, theses were scanned by using nursing as the search criteria, keywords; experimental animal, animal experiments, rat, mouse and nursing in the subject section and thesis name section, and the years 2013-2023 were selected as the research year. As a result of screening the theses, 17 theses that met the search criteria were determined as the population of the study. The 17 theses that met the inclusion criteria constituted the sample of the study.

2.3. Inclusion criteria

Graduate theses;

It must have been made in the Department of Nursing,

The use of experimental animals in their methods,

To be made between 2013-2023,

Availability of the full text,

2.4. Exclusion criteria for the study

Graduate theses;

To be made outside the years 2013-2023,

Failure to access the full text.

2.5. Data collection

The data of the postgraduate theses were obtained from the theses made with experimental animals in the field of nursing registered in the Institute of Health Sciences of CoHE National Thesis Center. The data of the study were obtained from the CoHE National Thesis Center database between 15.09.2023-15.10.2023. The data collection form developed by the researchers was used to collect data from the theses constituting the sample. In the form; the author of the research, the year the research was conducted, the type of thesis, the department, the purpose of the research, the number of the sample, the study group constituting the sample, the application method, and the result of the research were systematically analyzed. The data obtained from the research were recorded in the data collection form developed by the researchers. The data of master's and doctoral theses were examined in chronological order.

2.6. Data analysis

Using keywords in the CoHE National Thesis Center database, 14 graduate thesis studies were accessed. Among these studies, 14 full-text thesis studies that met the inclusion criteria constituted the sample of the study. There were no thesis studies that met the inclusion criteria but were not full-text or not open to access. All data obtained from the study were analyzed using SPSS (Statistical Package Social Sciences) 25.0 package program. Descriptive statistical methods such as number and percentage were used in the evaluation of descriptive data of graduate theses. Research findings were presented in the form of tables.

2.7. Ethical aspects of the research

Since this study is a literature search aimed at examining

postgraduate theses using experimental animals in nursing, it is not necessary to obtain ethics committee permission in this study because it does not involve any experimental intervention directly on humans and animals and the authors of the postgraduate theses have approved the accessibility of the theses in the CoHE National Thesis Center. This study was conducted in accordance with the principles of the Declaration of Helsinki and all the rules specified in the Directive on Scientific Research and Publication Ethics of Higher Education Institutions.

3. Results

In this study, 14 full-text published postgraduate theses that were scanned in the CoHE

National Thesis Center database and met the inclusion criteria were examined. Descriptive information about the postgraduate theses using experimental animals in nursing between 2013 and 2023 in Türkiye is given in Table 1 and the method and sample characteristics of the theses are given in Table 2.

Descriptive information about the postgraduate theses using experimental animals in nursing between 2013 and 2023 in Türkiye is given in Table 1. When Table 1 was examined, it was determined that 50% of the postgraduate theses using experimental animals in nursing were conducted between 2013-2018 and 50% between 2019-2023. 85.72% of the theses subject to the study were doctoral dissertations. When the department of nursing in which the studies were conducted was examined, it was found that 28.57 of the theses were conducted in the department of internal medicine nursing. In the sample group of the theses, 78.57% rats were used as experimental animals. The characteristics of the postgraduate theses using experimental animals in nursing between 2013 and 2023 in Türkiye are given in Table 2. In Table 2, the thesis author, thesis title, thesis type, purpose of the research, sample group, experimental animal model used in the method and the result of the research of the postgraduate theses using experimental animals in nursing were examined.

4. Discussion

In this study, postgraduate theses using experimental animals in the field of nursing in Türkiye were examined. In the review, 2 master's and 12 doctoral theses were evaluated in detail in terms of quantitative and content. It was determined that the first studies using experimental animals in the field of nursing in Türkiye were conducted in 2013 and after. The first study using animal experimentation in the field of nursing was conducted by graduate nurse Ruby Bohart as a doctoral thesis and was introduced to the literature in 1930. Ruby used guinea pigs to evaluate killed tuberculosis antigen.[15] In Türkiye, the first scientific study using experimental animals was published in the literature in 2013. The reason for the publication of the first study in the field of animal experiments in Türkiye after almost 85 years may be the lack of laws and regulations to support nurses to publish and the lack of course curricula on the use of animals. However, animal research has an extremely important place in terms of public health and medical research. In the study, it was found that 85.72% of the theses published using animal experiments were doctoral dissertations. It is no coincidence that the first thesis in the field of nursing in the literature was a doctoral study.[15] The regulation on postgraduate education and training states that "the doctoral program provides the student with the necessary skills to conduct independent research, to interpret, analyze and reach new syntheses by examining scientific problems and data from a broad and deep perspective".[30] Due to the difficulty of animal experimentation studies, the need for advanced applications and the need for researchers with high analysis and synthesis skills in these studies, it can be thought that researchers focus on post-doctoral studies. When the departments to which the thesis authors were affiliated and in which the studies were conducted were examined, it was found that 28.57% of the studies conducted with animal experiments were carried out by researchers in the department of internal medicine nursing and mainly on DM. Diabetes is a chronic and metabolic disease that causes serious damage to blood

Table 1. Descriptive information about postgraduate theses using experimental animals in nursing between 2013 and 2023 in Türkiye (n=14)

Features		***n***	***%***
Thesis year	2013-2018	7	50
	2019-2023	7	50
Thesis type	Master's degree	2	14,28
	PhD	12	85,72
Department where the studies were conducted	Internal medicine nursing	4	28,57
	Women's health and diseases nursing	2	14,29
	Master's program in nursing	1	7,14
	Surgical diseases nursing	3	21,43
	Nursing	3	21,43
	Pediatric health and diseases nursing	1	7,14
Sample group of the studies	Rat	11	78,57
	Mouse	3	21,43

n: number; %: percentage

Table 2. Method and sample characteristics of the theses (n=14)

Author	Thesis Name	Year	Thesis Type	Purpose of the Study	Sample Group	The model used in the method	Results of the study
Samancıoğlu S.	Preclinical study for diabetic foot care: comparison of classical wound dressing material and olive leaf extract in ischemic wound care in rats with experimental diabetes model	2013	PhD	Comparison of the effect of olive leaf extract with the classical dressing material applied in clinical treatment and care in diabetic rats with ischemic wound model	Group 1 (Control-Saline, n=10), Group 2 (Control-OLE, n=10), Group 3 (DM-Saline, n=10), Group 4 (DM-OLE, n=10) All rats were dressed with a wound care product appropriate for their group on the 21st day.	Ischemic wound model in diabetic rats	Olive Leaf Extract wound dressing was found to be more effective in wound healing than classical wound dressing in diabetic and non-diabetic wounds.
Karaöz B.	Cadmium administration in mice effect on fertility parameters	2014	PhD	To determine the effects of cadmium administered independently of estrous cycle phases on fertility parameters of female mice	3 control and 3 experimental groups totaling 6 groups. The study was conducted with a total of 54 female mice. The drinking water of mice was treated with 200 ppm CdCl2 (cadmium chloride) was added.	200 ppm CdCl2 (cadmium chloride) was added to the drinking water of mice.	This study demonstrated that cadmium exposure has the potential to negatively affect serum estrodiol levels.
Canlı N.	Effects of Diabetes Mellitus induced by different types of chemical agents on neonates in advanced pregnant rats	2014	Master's Degree	Determination of the effects of DM induced by different types and doses of chemical agents on offspring health in advanced pregnant rats	35 female Wistar rats; 1st Group: control group intraperitoneal -saline (n=7), 2nd Group: Alloxan (n=7), 3rd Group: Alloxan 60 mg/kg (n=7), 4th Group: STZ 40mg/kg (n=7), 5th Group: STZ 60mg/kg (n=7) Rats were made DM with the agents used.	DM induced by different types and doses of chemical agents in rats	In this study, prolonged normal delivery time, anomalous, stillbirths and abortions occurred and no other striking results were found in laboratory findings.
Gökçe S.	An experimental study for diabetic foot: effect of Hypericum perforatum - Clinoptilolite - Hydrocolloid dressing on wound healing in diabetic rats	2015	PhD	Comparison of the effects of Hypericum perforatum extract, Clinoptilolite, Hydrocolloid Dressing on wound healing in diabetic rats with ischemic wounds	30 Spraque Dowley species Rats were used. Experiment 1 DM group: Wound care with Hypericum Perforatum extract, Experiment 2 DM group: Wound care with Clinoptilolite (Froximun), Experiment 3 DM group: Wound care with hydrocolloid dressing, 4th Control DM group: wound (+) and no wound care. Group 5 was non-diabetic. The experimental groups were treated once every day/every other day for 21 days with 3 wound care was performed with different wound care products.	A full-thickness skin incision was made on the back of the rats in all experimental-control groups	Hypericum in diabetic wound care It was concluded that wound care with Perforatum and Clinoptilolite had more effective healing power than wound care with Hydrocolloid Dressing.
Boyacıoğlu N.	Investigation of the effect of noise stress in surgical intensive care unit on oxidative damage in rats	2017	Master's Degree	Determination of oxidative damage caused by noise stress in the intensive care unit	30 male Wistar albino rats, Group I: Not exposed to intensive care noise, Group II: 24 hours, Group III: 48 hours, Group IV: 72 hours, Group V: 168 hours exposed to intensive care noise.	Rats exposed to intensive care noise	It has been determined that noise stress in the intensive care unit causes oxidative damage in rats.
Güner Ö.	Investigation of the effect of vitamin C and E combination and brown algin (halopteris scoparia sauvageau) on the improvement of sperm parameters in male mice with impaired sperm parameters	2017	PhD	To determine and compare the effects of antioxidant vitamins and brown algin (Halopteris scoparia Sauvageau), which are known to improve infertility, on infertility caused by changes in semen parameters caused by cadmium exposure in male mice	In the study, 36 male Balb-C strain experimental mice were used. Group: Control Group (n:6), Group 2: CdCl2 group (n:6), Group 3: Algae group (n:6), Group 4: Antioxidant (vitamin C and E) group (n:6), Group 5: CdCl2 + Algae group (n:6), Group 6: CdCl2 + vitamin C/E (n:6). The duration of the experiment was 21 days.	Infertility in male mice as a result of cadmium exposure	As a result of the study, it was observed that the Algae and Vitamin C and E groups were similar to the control in sperm count, but there was a statistically significant decrease in sperm count in CdCl2, CdCl2 +Alg, CdCl2 +Vitamin C and E groups.
Toyğar İ.	Effect of Allicin administration on wound healing in an experimental diabetes model	2018	PhD	Investigation of the effect of Allicin on wound healing with the aim of developing a care material that accelerates wound healing in diabetic foot care	50 wistar albino rats, 25 males and 25 females, were used. 1st DM-Allicin (n=10), 2nd DM-Salin (n=9), 3rd DM-Control (n=9), 4th Non-DM-Allicin (n=10), 5th Non-DM-Control (n=10). Allicin dressing was applied for 21 days.	A full-thickness skin incision was made on the back of the rats in all groups.	Dressing with Allicin was found to be effective in healing diabetic and non-diabetic wounds.

Table 2 continued. Method and sample characteristics of the theses (n=14)

Author	Thesis Name	Year	Thesis Type	Purpose of the Study	Sample Group	The model used in the method	Results of the study
Sürme Y.	Effect of tea tree oil on wound healing in diabetic rats	2019	PhD	To determine the effect of tea tree oil on wound healing in diabetic rats	1st DM-Tea tree oil (n=8), 2nd DM-Sunflower oil (n=8), 3rd DM-Salin (n=8), 4th Non-DM-Tea tree oil (n=8), 5th Non-DM-Sunflower oil (n=8), 6th Non-DM-Salin (n=7). The incisional wound was dressed with the wound solution of each group for 15 days.	An incisional wound model was created by making a full-thickness skin incision and suturing the rat back.	It can be said that wound care with tea tree oil accelerates wound healing in both diabetic and non-diabetic wounds.
Gülpak M.	Effect of lavender oil on wound healing in rats with experimental diabetes model	2020	PhD	Determination of the effect of lavender oil on diabetic wound healing in rats with experimental diabetes model	Wistar Albino male rats were used. 1st Group Non-DM-Salin (n=8), 2nd Group Non-DM-Lavender Oil (n=8), 3rd Group Non-DM-Madecassol (n=8), 4th Group DM-Salin (n=8), 5th Group DM-Lavender Oil (n=8), 6th Group DM -Madecassol (n=8). The incisional wound was dressed with the wound solution of each group for 14 days.	A full-thickness skin defect wound was created on the back of the rats.	Lavender oil dressing was found to be effective in wound healing macroscopically and microscopically in all groups.
Çetinkaya S.	Effects of standard, ketogenic and western type diet on pressure sores in rats	2020	PhD	Investigation of the effect of ketogenic and western type diet on pressure sores	Thirty-three healthy male Sprague Dawley rats were used. Group I (Control, n=11):9 weeks 3 days on standard diet, Group II (Intervention I, n=11):9 weeks 3 days on ketogenic diet, Group III (Intervention II, n=11): 9 weeks 3 days on western type diet.	The skin of the animals was held between two magnets to create a pressure sore model.	The Western-type diet was more effective in healing pressure sores than both the ketogenic diet and the standard diet, and the ketogenic diet was more effective than the standard diet.
Ardahan Akgül E.	Effect of topical propolis application on burn healing in experimental burn model	2021	PhD	Histopathologic comparison and evaluation of the efficacy of 1% silver sulfadiazine, 0.2% nitrofurazone, propolis solvent, water soluble 10% and water soluble 15% propolis on wound healing in partial thickness burn wound in experimental burn model	36 rats of Wistar-Albino breed were used. 1st Control Group: no dressing application (n:6), 2nd Group: 1% Silver Sulfadiazine (n:6), 3rd Group: 0.2% Nitrofurazone (n:6), 4th Group: solvent group (water+glycol) (n:6), 5th Group: 10% water soluble propolis (n:6), 6th Group: 15% water soluble propolis (n:6). Group: 10% water-soluble propolis (n:6), 6th Group: 15% water-soluble propolis (n:6), Rats were topically dressed once a day for 21 days with a dressing product suitable for the group they were in.	A model of second-degree superficial burn wound induced by a brass block on the back of rats	It was determined that the application of water-soluble propolis to the burn wound of rats had a positive effect on wound healing.
Boyacıoğlu N.	The effect of Transcutaneous Electrical Nerve Stimulation (TENS) on incisional wound healing and oxidative stress in streptozotocin-induced diabetes rats	2022	PhD	Evaluation of the protective effect of TENS application on histopathologic changes and antioxidant/oxidant status in incision wounds in diabetic rats	48 male Wistar albino rats were used and divided into 6 groups. 1. Control group: Incision wound (-) and euthanized on the 3rd day, 2nd Diabetes group: incision wound (-) and euthanized on the 7th day, 3rd Diabetes+Incision group: incision wound (+) and euthanized on the 3rd day, 4th Diabetes+Incision+TENS group: incision wound (+), TENS application for 15 minutes daily for 3 days and euthanasia on day 4, 5th Diabetes+Incision group: incision wound (+) and euthanasia on day 7, 6th Diabetes+Incision+TENS: incision wound (+), TENS application for 15 minutes daily for 7 days and euthanasia on day 8	Model of TENS application to rats 24 hours after incision wound formation on the back of rats	It was determined that TENS had a positive effect on incisional wound healing and oxidative stress in diabetic rats
Çelik Yılmaz A.	Comparison of the efficacy of silk protein, propolis, frankincense oil and a hemostatic product on wound healing in full-thickness wounds in mice	2022	PhD	Investigation of the effects of frankincense oil, propolis, silk protein and Ankaferd, which have potential for wound treatment, on wound healing in an experimental excisional wound model	36 Balb/c mice were included and divided into 4 groups. 1st Group Silk Protein (n=9): silk protein extract, 2nd Group Propolis (n=9): propolis extract, 3rd Group Sweetgum Oil (n=9): sweetgum oil extract, 4th Group Ankaferd (n=9): Ankaferd Mice were dressed on the excisional wound once a day for 14 days with a dressing product suitable for the group of mice.	Excisional wound model created in the back skin of mice	Propolis, frankincense oil, silk protein and Ankaferd were found to have positive effects on different parameters in wound healing, generally supporting reepithelialization, angiogenesis, collagen production and reconstruction processes and accelerating wound healing.

vessels, eyes, kidneys and nerves over time due to high blood glucose levels. In addition, approximately 422 million people worldwide have diabetes and 1.5 million people die every year due to diabetes.[31] Since the problems caused by diabetes reduce the quality of life of individuals, drug costs impose a great financial burden on individuals and their families, have a significant economic impact on health systems and are an obstacle to sustainable economic development, researchers frequently conduct research on complementary supportive treatment methods for DM.[32] Studies with complementary supportive treatment methods have been found to be effective in diabetes.[16,19,22,23,29,33] Rats constitute the sample group of 78.57% of the studies conducted with experimental animals in nursing.

Rats are the first experimental animals used in experimental research. They are also frequently used in the modeling of human diseases such as diabetes, in the development of therapeutic agents and physiological manipulations because they provide advantages.[34] In the literature, the majority of nurse researchers used rats as experimental animals in the method of their experimental research.[16,18-20,22-24,26,29] It is thought that rats constitute the sample group of the researchers because nurse researchers see rats as the most suitable experimental animal for the manipulation of their experimental research, and rats are easily available and low-cost.

5. Conclusion

As a result of this research, it was found that nursing research using experimental animals in our country has been carried out in a limited number in the last 10 years, but it was found that thesis studies have increased gradually since 2013. Nurses should emphasize animal research and take more part in multidisciplinary studies with the use of animal models. In addition, problems such as laws and regulations, financial resources and insufficient information about animal experiments in the curricula should be solved. Researchers and nurses who will take part in animal experiments should be supported.

Notes

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Ethical approval

This study does not require approval from the Ethics Committee for Animal Experiments.

Author contribution

Study conception and design: MD, HTD, YA and MM; data collection: MD, HTD, and YA; analysis and interpretation of results: MD, HTD, YA, and MM; manuscript preparation: MD, HTD, YA and MM. All authors contributed to the article and reviewed the results and approved the final version of the manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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This situation does not exist.

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