



UNIVERSITI PUTRA MALAYSIA

**EFFECTIVENESS OF ANATOMICAL MODEL AS LEARNING TOOL FOR
OVARIOHYSTERECTOMY PROCEDURE AMONG VETERINARY
STUDENTS IN FACULTY OF VETERINARY MEDICINE,
UNIVERSITI PUTRA MALAYSIA.**

SITI NUR JANNA BINTI AHMAD MOHED

**Ip
FPV 2020 60**

**EFFECTIVENESS OF ANATOMICAL MODEL AS LEARNING TOOL FOR
OVARIOHYSTERECTOMY PROCEDURE AMONG VETERINARY
STUDENTS IN FACULTY OF VETERINARY MEDICINE,
UNIVERSITI PUTRA MALAYSIA.**

The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white design with a central vertical element and a book icon at the top right. The letters 'UPM' are prominently displayed in a red box at the top left of the shield.

SITI NUR JANNA BINTI AHMAD MOHED

**A project paper submitted to the
Faculty of Veterinary Medicine, Universiti Putra Malaysia (UPM)**

**In partial fulfilment of the requirement for the
DEGREE OF DOCTOR OF VETERINARY MEDICINE**

Universiti Putra Malaysia

Serdang, Selangor Darul Ehsan

2020/2021

CERTIFICATION

It is hereby certified that we have read this project entitled “Effectiveness of Anatomical Model as Learning Tool for Ovariohysterectomy Procedure Among Veterinary Students in Faculty of Veterinary Medicine, Universiti Putra Malaysia”, by Siti Nur Janna Binti Ahmad Mohed and in our opinion it is satisfactory in terms of scope, quality and presentation as partial fulfilment of the requirement for the course VPD 4999 – Final Year Project.

ASSOC. PROF. DR. INTAN SHAMEHA BINTI ABDUL RAZAK
DVM (UPM), PhD (UPM)

Lecturer, Faculty of Veterinary Medicine, Universiti Putra Malaysia
(Supervisor)

DR. NORHARIANI BINTI MOHD NOR

Lecturer, Faculty of Veterinary Medicine, Universiti Putra Malaysia
(Co-Supervisor)

DEDICATION

This project is dedicated to Baba, Mommy, Irham, Faraheen, Kamalea and Messy,

For all the sacrifices throughout my DVM years.



ACKNOWLEDGEMENT

All praises and thanks to Allah, the Lord of the worlds, Most Gracious, Most Merciful, Master of the Day of Judgement.

Million thanks to my project supervisor, Assoc. Prof. Dr. Intan Shameha binti Abdul Razak, for the sleepless nights, endless care and support throughout the whole journey and my co-supervisor, Dr. Norhariani Binti Mohd Nor, for introducing me to Putrabiz@Vet, for believing in me and guided me. This might not be the best project, but with both of you around, I am able to make the best of it. Thank you for all the time spent on me and my project when it's time to go home, it's time for lunch, or it's time to sleep. May Allah bless both of you with endless happiness.

I thank Allah for granting me such supportive and understanding not just parents, but best friends. Thank you Baba, Ahmad Mohed bin Yusof, and Mommy, Siti Hajar binti Hashim, for always being there for me through my ups and my downs. Thank you for everything.

Special thanks to Yanie and Amirah for always being my shoulder to cry on, no matter how stupid the situation is. To Hanum, for the countless laughs and crazy things we did together. Thanusha, for always accompanied me during presentations and most importantly; to tell me not to cry when it is not time to cry yet. To Mirahoi, my sleeping partner, for always making sure if I'm alright. To Najah, for all the positive words and support. And to Husna, thank you for being you, thank you for the sacrifices you have made for me and all your friends.

And to those who have contributed directly or indirectly in completing this project, thank you very much. To *you*, thank you for your presence.

TABLE OF CONTENTS

	PAGE
TITLE	i
CERTIFICATION	ii
DEDICATION	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENT	v
LIST OF FIGURES	viii
LIST OF TABLES	ix
LIST OF APPENDICES	x
ABSTRAK	xiv
ABSTRACT	14
1.0 INTRODUCTION	1
2.0 LITERATURE REVIEW	3
2.1 Overpopulation of cats and dogs in Malaysia	3
2.2 Neutering	4
2.3 Ovariohysterectomy	5
2.3.1 Anatomical structure	6
2.3.2 Surgical procedure	7

2.4 Learning tools	.....	8
2.4.1 Anatomical prototype	.....	9
2.4.2 Video based learning	.....	10
3.0 MATERIALS AND METHODS	.....	10
3.1 Instruments	.....	13
3.1.1 Questionnaire	.....	13
3.1.2 Pre-training reading material	.....	14
3.1.3 Anatomical model	.....	15
3.1.4 Video	.....	18
4.0 RESULTS	.....	19
4.1 Demographic	.....	19
4.2 Attitude on reading material and anatomical model	.....	20
4.3 Knowledge on ovariohysterectomy procedure	.....	22
4.4 Loyalty and satisfaction toward anatomical model	.....	26
5.0 DISCUSSION	.....	31
5.1 Demographic	.....	31
5.2 Attitude on reading material and anatomical model	.....	31

5.3 Knowledge on ovariectomy procedure	34
5.4 Loyalty and satisfaction toward anatomical model	36
5.5 Limitation to study	37
5.6 Recommendation to future study	38
6.0 CONCLUSION	38
REFERENCES	39
APPENDICES	42

LIST OF FIGURES

		PAGE
Figure 1	Ventral Midline approach in cats and dogs	8
Figure 2	Summary of the study design and questionnaire	12
Figure 3	Polystyrene foam (24.5cm x 23cm x 4.5cm) was used as the base	15
Figure 4	The polystyrene foam was scraped off to shape the curved area to serve as abdominal lining	16
Figure 5	Paperclay was shaped and designed according to the reproductive organs related to the procedures; including kidneys, ovaries, and uterus	16
Figure 6	Transparent straws were used as blood vessels	17
Figure 7	Rubber bands were used as suspensory ligaments; final look of the anatomical model	17
Figure 8A	Youtube video on Ovariohysterectomy procedure with anatomical model	18
Figure 8B	Youtube video on Ovariohysterectomy procedure with anatomical model	18

LIST OF TABLES

		PAGE
Table 1	Demographics characteristic of study participants	19
Table 2	Attitude of respondents toward reading material given (n=103)	21
Table 3	Attitude of respondents toward anatomical model (n=103)	21
Table 4	Comparison of knowledge before using anatomical model and after using anatomical model. (Wilcoxon test)	23
Table 5	Comparison of answers between intervention of reading material and intervention of reading material with anatomical model among participants(n=103)	24
Table 6	<i>p-value</i> comparison of knowledge with demographic characteristic before using anatomical model and after using anatomical model (Independent samples Mann-Whitney U test)	25
Table 7	Correlation between knowledge with attitude, satisfaction and loyalty	26
Table 8	Correlation between attitude with knowledge, satisfaction and loyalty	27
Table 9	Correlation between satisfaction with attitude, knowledge and loyalty	27
Table 10	Respondent's satisfaction towards anatomical model (n=103)	29
Table 11	Respondent's loyalty towards anatomical model (n=103)	30

LIST OF APPENDICES

		PAGE
Appendix A	Pre-training questionnaire for year one and two veterinary students	42
Appendix 1	Section A of pre-training questionnaire consist of the respondent's information and consent form	42
Appendix 2	Section B comprises of sociodemographic and socioeconomic background of the respondent	43
Appendix 3	Section C consist of knowledge related to anatomy and procedure of the OHE procedure	44
Appendix 4	Section D consist of attitude and practice on neutering procedures among the respondents	45
Appendix B	Post-training questionnaire for year one and two veterinary students	46
Appendix 1	Section A consist of knowledge questions related to anatomy and procedure of OHE	46
Appendix 2	Section B consist of attitude and knowledge questions on neutering prototype	47
Appendix C	Reading material provided that was adapted from the "Small Animal Surgery 4 th Edition" by Theresa Welch Fossum	48

ABSTRAK

Abstrak kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada kursus VPD 4999 - Projek Tahun Akhir.

**KEBERKESANAN MODEL ANATOMI BAGI PROSEDUR
OVARIOHISTEREKTOMI DI KALANGAN PELAJAR PERUBATAN
VETERINAR DI FAKULTI PERUBATAN VETERINAR,
UNIVERSITI PUTRA MALAYSIA**

**OLEH
SITI NUR JANNA BINTI AHMAD MOHED
2020**

Penyelia: Prof. Madya Dr Intan Shameha Binti Abdul Razak

Penyelia bersama: Dr Norhariyani Binti Mohd Nor

Pandemik COVID-19 telah menghadkan segala aktiviti rutin harian dan memberikan impak yang besar terhadap sektor pendidikan, dan secara tidak langsung membabitkan pelajar veterinar. Subjek anatomi dan pembedahan veterinar merupakan subjek asas yang penting di dalam bidang veterinar dan memerlukan pelajar veterinar untuk praktikal secara langsung semasa kelas. Walau bagaimanapun, segala aktiviti yang melibatkan pertemuan secara langsung telah dilarang semasa perintah kawalan pergerakan (PKP). Sama seperti silibus

perubatan, pelajar veterinar mempunyai sebilangan surgeri dan terminologi yang perlu dipelajari, sekali gus menjadikannya satu cabaran untuk mengingati setiap prosedur surgeri semasa peperiksaan. Justeru itu, model pengkasian yang menyerupai sistem reproduktif haiwan betina telah dibina sebagai salah satu kaedah pembelajaran yang dipercayai boleh membantu proses pembelajaran bagi pelajar veterinar. Tujuan kajian ini dijalankan adalah untuk mengenalpasti sejauh mana keberkesanan model anatomi untuk prosedur ovariohisterektomi terhadap pengetahuan pelajar veterinar. Tinjauan dalam talian melibatkan 103 pelajar veterinar tahun pertama dan kedua (75 pelajar perempuan, 28 pelajar lelaki). Kajian telah dijalankan bagi mengenalpasti sejauh mana keberkesanan model anatomi terhadap pengetahuan pelajar veterinar. Pelajar veterinar yang mengambil bahagian di dalam tinjauan ini perlu membaca petikan teks daripada buku “Small Animal Surgery” yang telah disediakan. Setelah itu, pelajar perlu menjawab 14 soalan berkenaan anatomi dan prosedur surgeri. Pelajar kemudian dikehendaki untuk menonton video yang menggunakan model anatomi dan perlu menjawab soalan yang sama berkenaan anatomi dan prosedur surgeri. Soalan tinjauan direka untuk dinilai berdasarkan keberkesanan model, fungsi model sebagai salah satu kaedah pembelajaran dan keperluan model ini untuk prosedur surgeri selainnya bagi masa yang akan datang. Skala kepuasan adalah daripada 0 (sangat tidak memuaskan) hingga 5 (sangat memuaskan), manakala selebihnya menggunakan pilihan jawapan “ya” atau “tidak”. Analisis data mendapati 100% pelajar veterinar bersependapat bahawa model tersebut dapat membantu mereka memperbaiki pengetahuan terhadap prosedur dan berfikiran bahawa model seperti ini perlu dibina bagi kegunaan masa hadapan. Kadar kepuasan bagi model ini dinilai

berdasarkan fungsinya (95%), warna yang dipilih (96%) dan struktur (93%). 94% pelajar beranggapan bahawa model tersebut mudah difahami. Hampir semua pelajar (93%) bersetuju model tersebut dapat membantu mereka memahami prosedur surgeri dengan lebih mudah dan memilih untuk menggunakan model berbanding dengan hanya menggunakan buku teks sahaja (97%). Kesimpulannya, model anatomi mampu menjadi salah satu kaedah pembelajaran di dalam suasana kelas yang positif yang boleh diaplikasikan di dalam aktiviti kurikulum perubatan veterinar, di mana penglibatannya akan menjurus ke arah pembelajaran dan pengajaran yang lebih sistematik dan menghasilkan pelajar yang berpengalaman.

Kata Kunci: Model anatomi, pengkasian, ovariohisterektomi, Veterinar, Covid-

19.

ABSTRACT

An abstract of the project paper presented to Faculty of Veterinary Medicine in partial fulfilment of the course VPD 4999 - Final Year Project.

**EFFECTIVENESS OF ANATOMICAL MODEL AS LEARNING TOOL FOR
OVARIOHYSTERECTOMY PROCEDURE AMONG VETERINARY
STUDENTS IN FACULTY OF VETERINARY MEDICINE,
UNIVERSITI PUTRA MALAYSIA**

By

SITI NUR JANNA BINTI AHMAD MOHED

2020

Supervisor: Assoc. Prof. Dr Intan Shameha Binti Abdul Razak

Co-supervisor: Dr Norhariani Binti Mohd Nor

Pandemic COVID-19 limits most of the norms and give great impact to the educational sector including veterinary students. Both veterinary anatomy and surgery are important subjects in the veterinary curriculum which require students to practice hands-on during class. However, these activities were restricted during movement control order (MCO). Similar to another medical syllabus, veterinary

students are bombarded with many different surgeries and anatomical terms to remember, making it a challenge for them to memorize and explain any procedure in exams. Thus, the anatomical model which resemble the female reproductive organs was built as one of the learning intervention that can help veterinary students throughout the learning process. This study was conducted to measure the effectiveness of the anatomical model towards students' knowledge of the surgical procedure namely the ovariohysterectomy (OHE). Formerly, a survey involving 103 first-year and second-year veterinary students (75 females, 28 male) was conducted to measure the effectiveness of the model toward students' knowledge of the procedure. First, the students are required to read provided "Small Animal Surgery" reading material. After gaining prior knowledge of the procedure, they need to answer a questionnaire contained 14 questions related to the anatomy and procedure. Next, they are required to watch the video of using the anatomical model and answered the same questions again. Questionnaires were designed to assess the effectiveness, the rate of the model, helpful in their study and continuity of the model for a different procedure. The scale range from 0 (very unsatisfied) to 5 (very satisfied) for the rate of program and satisfaction. The scale yes or no was used for the remainders. The analysis revealed that 100% of students agreed that the model has improved their knowledge on the procedure and should be continued in future. The satisfaction rate for the model was rated based on its function (95%), colour choice (96%) and structure (93%). 94% of the students agreed that the model is simple and easy to understand. Almost all of the students (93%) agreed that this model helps them to understand the surgery better and prefers to use anatomical model rather than reading the textbook only (97%).

In conclusion, these results indicated that anatomical model is a pedagogy that can be applied within veterinary medicine curricular and may lead to a more well-planned intervention for the education module with the positive classroom environment and student experience.

Keywords: Anatomical model, neutering, ovariohysterectomy, Veterinary, E-learning, Covid



1.0 INTRODUCTION

The number of strays growing in Malaysia is quite worrying as such condition will cause many problems in the future such as overpopulation of strays that could lead to diseases development. When the bad outweighs the good, it might be difficult for the responsible authorities to tackle the issues of overpopulation of cats and dogs. The process might as well, needs involvement of bigger organizations to implement awareness to the public in combatting the problems. Cats and dogs are capable of having more than three gestations per year, with four to six kittens or puppies each time. The latest statistic stated that the number of cats and dogs in Malaysia, including pets and strays, have increased over the years. The cat population steadily grew from 651,000 in the year 2014 to 795,000 in the year 2018 while the dog population increased from 361,500 in the year 2014 to 402,500 in the year 2018 (The Star Online, 2019). The overpopulation crisis can eventually become a threat to the human population if it is not controlled and prevented. Among all the drawbacks of overpopulation, one of the most worrying issues is the development of diseases in cats and dogs. With such a great amount of population in an area, diseases are widespread and can be easily transmitted to others, for example, humans can easily get infected with a cat suffers from Sporotrichosis simply by touching them, while Feline Infectious Peritonitis (FIP) and Canine Distemper Virus (CDV) which are mainly transmitted by aerosol. Recently, the reported cumulative case for rabies in Sarawak was 24 cases with 23 deaths (Datuk Dr. Noor Hisham Bin Abdullah, 2020). Other than that, free-roaming cats, which are more likely to host and transmit parasite by defecating in parks, gardens, or other locations visited by the public, has increased the

risk of human infection with toxoplasmosis. Cats and dogs with weak or poor immunity and in favour of stress will be the first one to get infected.

Pet overpopulation can only be solved by implementing widespread sterilization programs, also spaying and neutering all companion animals (The Humane Society of the United States, 2004). Neutering is a profound method that ceases the overpopulation crisis at source – unlike other short-term solutions such as dog-catching and euthanasia which are known to be less effective, costly, and short-sighted. Neutering brings a whole lot of differences in many aspects including the prevention of unintended reproduction, lessen the risk of getting any diseases or tumour and the most importantly it will improve their (pets) quality of life (Engel, 2016). Society has created and attracts the public to get involved in many programs to improve the awareness of neutering their pets or even strays. Some veterinary clinics support the neutering campaign by offering services at a discounted price. In 2017, a total of 935 companion animals including dogs, puppies, cats, and kittens entered the Society for the Prevention of Cruelty to Animals (SPCA) Selangor (SPCA, 2017), while in 2018, the number has reduced to 9.5%(SPCA, 2018). The reduction in the total number mentioned before indicates that the pet overpopulation crisis is decreasing or resolving.

Since the public is more aware of neutering, it is very crucial for veterinarian to know the procedures. Sometimes, it is a challenge for a veterinarian student to memorize and explain the neutering procedure in exams since there are plenty of procedures such as ovariohysterectomy, ovariectomy, and castration. Indeed, the procedure is associated with various anatomical structures thus misunderstanding of

the terminologies used and conception occurred. Therefore, with the aid of the anatomical model or prototype that resembles the neutering procedure on cats and dogs, students can easily explore and gain a better understanding of the neutering procedure involved. The purpose of this study is to measure the effectiveness of the prototype as a learning tool in providing a better understanding of the neutering surgical procedure which is an ovariohysterectomy, among veterinary students.

2.0 LITERATURE REVIEW

2.1 Overpopulation of cats and dogs in Malaysia

The overpopulation crisis of cats and dogs has been discussed over and over again and yet this problem has not found its solution (The star online, 2015). It is best to believe that the number of existing cats and dogs outweighed the number of homes that want a pet and humans are not always the most responsible owners even when they do accept these innocent animals into their homes. Of the total 662 animal welfare complaints received last year, nearly 60% or 397 were involving pet owners with the remaining cases concerning animals without owners (Department of Veterinary Services, 2019). Data from the Department of Veterinary Services stated that in October 2019, a total of 265 reports on animal cruelty were received, and 60% or 159 of the cases are involving animal owners. As Director-general of the Department of Veterinary Services, Datuk Dr Quaza Nizamuddin Hassan Nizam in 2019 agreed that many still need to be educated to become responsible pet owners. Subsequently, these unfortunate cats and dogs always end up in shelters or lost or abandoned and revert to

a feral lifestyle to survive. Apart from that, animal shelters often suffer under the weight of high demand for services and too few resources, and the result is a tremendous population of unowned cats that urgently require attention and effective management. According to the Society for the Prevention of Cruelty to Animals (SPCA) Selangor, in 2017, a total of 935 of dogs and cats including puppies and kittens were registered while in 2018, the number has a slight reduced to 847 dogs and cats. However, the digits are still high and the solution must be carried out.

2.2 Neutering

The best way to control the population is by neutering cats and dogs. According to the World Organization for Animal Health, dog catching and euthanasia are not effective for population control. Hence it is therefore recommended to act on the cause of the problem, which is mainly the lack of responsible care of pet owners and the uncontrolled reproduction of pets. Neutering of dogs has been used in general veterinary practice for many years as a means of population control and is one of the most common surgical procedures carried out by veterinarians (Stockner 1991, Brodbelt and others 2008). A study conducted by Weedon et.al (2019) agreed that to reduce shelter intake and euthanasia, all male and female dogs and cats should be spayed or castrated before adoption from humane organizations or animal shelters. The statement is strengthened by a study conducted by Wongsangchan & McKeegan in 2019 whereby more than 80% of the public supported the practice of neutering. Neutering is a process of removing the source of the hormones that control the reproduction and determine secondary sexual characteristics. In cats and dogs, the act of neutering is commonly accomplished by ovariohysterectomy and castration (Bushby and White, 2019). Other than controlling the population, neutering also can

prevent cats and dogs from getting any kind of reproductive diseases like mammary gland tumour, testicular tumour, pyometra, metritis, and also prostatitis. Other than that, neutering can also eliminate most behaviours associated with sexual activity in dogs and cats (Bushby, 2017).

2.3 Ovariohysterectomy

Ovariohysterectomy (OHE) is one of the most commonly performed surgical procedures in small animal practice, and its potential complications are well recognized (Joshua 1965, Pearson 1973, Dorn and Swist 1977, Rubin and Moplesden 1978). OHE is a procedure of removing the ovaries and the uterus and it is an option treatment for most uterine diseases be it congenital anomalies, pyometra, cystic endometrial hyperplasia (CEH), uterine torsion, prolapse, rupture, and even neoplasia (Fingland 1998, Hedlund 1997, Stone 2003, Kyles et al. 1996). This procedure is the recommended procedure for gonadectomy in dogs and cats (Fingland 1998, Hedlund 1997, Stone et al. 1993, Stone 2003). This statement is supported with a previous study conducted by Wilson and Hayes in 1983 whereof all 1712 canine undergo for ovariohysterectomy, 1409 (82%) were performed for elective sterilization, and only 313 (18%) for reproductive tract disease (as adjunctive therapy for mammary neoplasia, for treatment of pyometra, endometrial hyperplasia, vaginitis, and several miscellaneous genital tract diseases). Though it is convincing as it may sound, there are possible complications after the procedure and it was explained in a study conducted by Goethem et al., (2006) where subsequently agreed that OHE is more complex and can be confusing as there are more tissues involved that need to be ligated

and transected, and it is time-consuming due to a larger celiotomy is needed to expose the entire uterus.

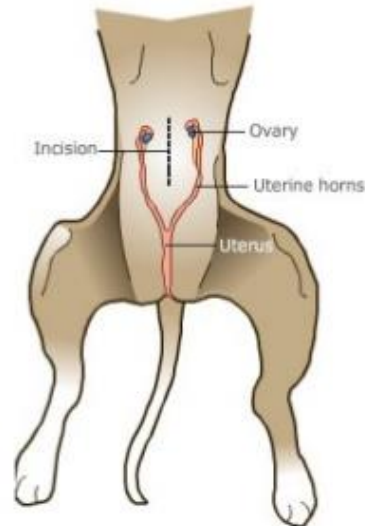
2.3.1 Anatomical structure

Veterinary anatomy is one of the most important topics in the veterinary curriculum and it is the main foundation of veterinary medicine. An extensive understanding of anatomical variations will improve a student's breadth of experience and knowledge and that makes the anatomy a cornerstone for surgery. In ovariohysterectomy, many organs, vessels, and ligaments were involved throughout the procedure. Indeed, individual anatomy knowledge is crucial before performing surgery as unfamiliar thoughts could cause confusion and mistakes in the operational theatre. Not only that, it also improves their ability to deal with the unpredicted event. This statement is supported by a study conducted by Sbayeh et al. in 2016 where almost all groups of respondents showed a high level of agreement with the proposition that anatomy education was an important element of the medical curriculum. However, almost all first-year student regarded anatomy as a complex and hard subject because of the burden of nomenclature, descriptive nature of the subject matter, little interactive activity in class, and the view that anatomy is a dogmatic subject (Sissons, et al., 1975; Notebaert, 2009). Always, a phenomenon called the cognitive overload strikes due to the limitation of working memory in the brain especially when one is bombarded with complex information and it is not properly managed. Cognitive overload weakens schema acquisition, later resulting in poor performance (Paas et al., 2004).

2.3.2 Surgical procedure

Conventionally, ovariohysterectomy in cats is routinely carried out either through a ventral midline approach or a lateral flank approach (Figure 1). The ventral midline approach is an absolute choice for a pregnant queen or in a cat having a uterine pathological condition. However, there is often significantly more bleeding from the skin and subcutaneous tissue changes of wound inflammation or infection and due to the site being ventral, it may trigger wound complications as it is difficult for the owner to monitor the suture site. For this reason, many veterinarians prefer performing ovariohysterectomy in cats through a lateral flank approach. The lateral flank approach is indicated if the queen cat is lactating and provides the advantage of observing and monitoring the surgical wound from a distance and reduces the potential for evisceration (Holly and Hardie, 2004). However, for a teaching hospital, veterinarian students are taught on the advanced way to perform the procedure so that students are prepared for the worst-case scenario that might happen after they graduated. Referring to the textbook “Small Animal Surgery” by Theresa Welch Fossum and her team, there are a lot of procedures involving all systems, and all the details were explained clearly in the book. Ovariohysterectomy is a surgical procedure for removal of the ovaries and uterus while ovariectomy is a surgical procedure for removal of the ovaries alone (Fossum, 2012). The suspensory ligament must be broken down with either procedure to allow identification of the ovaries, the ovarian pedicles are ligated and severed. However, in OHE, the uterine vessels are also ligated and the uterus is crushed and severed. Based on a study by Peeters and Kirpensteijn in 2011, the time allocated for the surgery is approximately the same for both ovariohysterectomy and ovariectomy.

Figure 1: Ventral midline approach (adapted from Cat Trap Depot Workshop)



2.4 Learning tools

The process of learning and teaching with the aid of technological tools is an organized way of conceptualizing the execution and evaluation of the education system (Richey, Silber, & Ely, 2008). Several computer applications were taught to veterinary students using a collaborative learning tool called the CLIVE (Computer-Aided Learning in Veterinary Education) application. CLIVE is known as a government-funded initiative that aimed to make teaching and learning more productive and efficient by harnessing modern technologies, which was launched in February 1992 (Vicky et al., 2005). Apart from that, most teachers think that 'class discussion' is one of the most productive ways of teaching and do most of this in-class discussion groups (Bruffee, 1984). The approach implemented in this study of the efficacy of using model or prototype as learning tools was to develop a simulation of running the ovariohysterectomy surgery where students could actively participate and

interact with others in a conducive scenario. Research by Tramonti in the year 2019, concludes that integrating art into learning not only allows students to participate into the educational process better, thus stimulating their enthusiasm from the aspect of open-minded future employees and out-of-box thinkers, but it also helps to produce citizens of the world with wide and boundless views to embrace all the complexity of the actual reality.

2.4.1 Anatomical prototype

Surgical training models are just as good, if not better, than cadavers and live animals for practising basic surgical skills (Smeak, 2007). In his research, he agrees that by using models as part of surgical training, it is affordable and the opportunity to utilize these skills repeatedly likely benefits the students' learning curve. In one research study by Langebæk in 2011, educators noticed that students' surgical performance when operating on live pigs considerably improved after using surgical training models. Overall, the teachers came out with observations that students appeared calmer, well-prepared, and more confident, with lesser technical mistakes, and worked more systematically and efficiently. Apart from that, the students were also able to perform the surgical procedures on or even before the set deadline, which seldom happened before these new implementations. Burrow et al., 2015, supported the use of surgical training models as he thinks that the development of an abdominal training model, which accurate in appearance, anatomy, and handling characteristics, would be a valuable additional feature to the existing surgical training program.

2.4.2 Video-based learning

Globally, students and teachers are discovering and looking forward to new, exciting ideas and innovative ways to make the learning process more interesting with dynamic, longer-lasting, and more applicable to the world outside of the classroom. It is widely accepted that student motivation is a key focus within the learning process (Pintrich, 1999). Green et al., 2003 states that among all available tools, a video has been used 'off-line' for many years to support student learning in a variety of settings. In 2011, research by Bravo et al. demonstrated that usage of videos as a learning tool has a good effect on students' impressions regarding the enhancement of their learning motivation. From the study, lecturers experienced a sense of satisfaction because of the improvement of students' motivation and interest in the subject and encouraged them to keep on working on educational innovation and fostering continuous improvement.

3.0 MATERIALS AND METHOD

This is a quantitative, cross-sectional, questionnaire-based study that aims to determine the effectiveness of the anatomical model as a learning tool for ovariohysterectomy procedure among veterinary students in the Faculty of Veterinary Medicine, Universiti Putra Malaysia. The study involved first- and second-year veterinary students pursuing program Doctor of Veterinary Medicine, FPV, UPM as respondents. Data collection was conducted in August 2020. Respondents were invited to study via *Google Form* application on the mobile phone, on a volunteer basis without getting any form of incentive. The study was carried out at individual homes

as there was a restriction movement order (RMO) due to the pandemic COVID-19 and because it was during the semester break for the students.

The respondents were introduced to the objectives of the survey and clear instructions on answering the questionnaire was given at the beginning of sessions. Digital informed consent was obtained from the respondents before the administration of the questionnaire. Before answering the questionnaire, respondents were requested to read the surgical procedure for ovariohysterectomy as described in “Small Animal Surgery 4th edition” textbook, then only they are allowed to answer the questionnaire, where their current attitudes and knowledge on ovariohysterectomy surgical procedure are recorded and followed by participating in a 3-minutes video of explaining the procedure using an anatomical model. The summary of the study design described is shown in Figure 2 below.

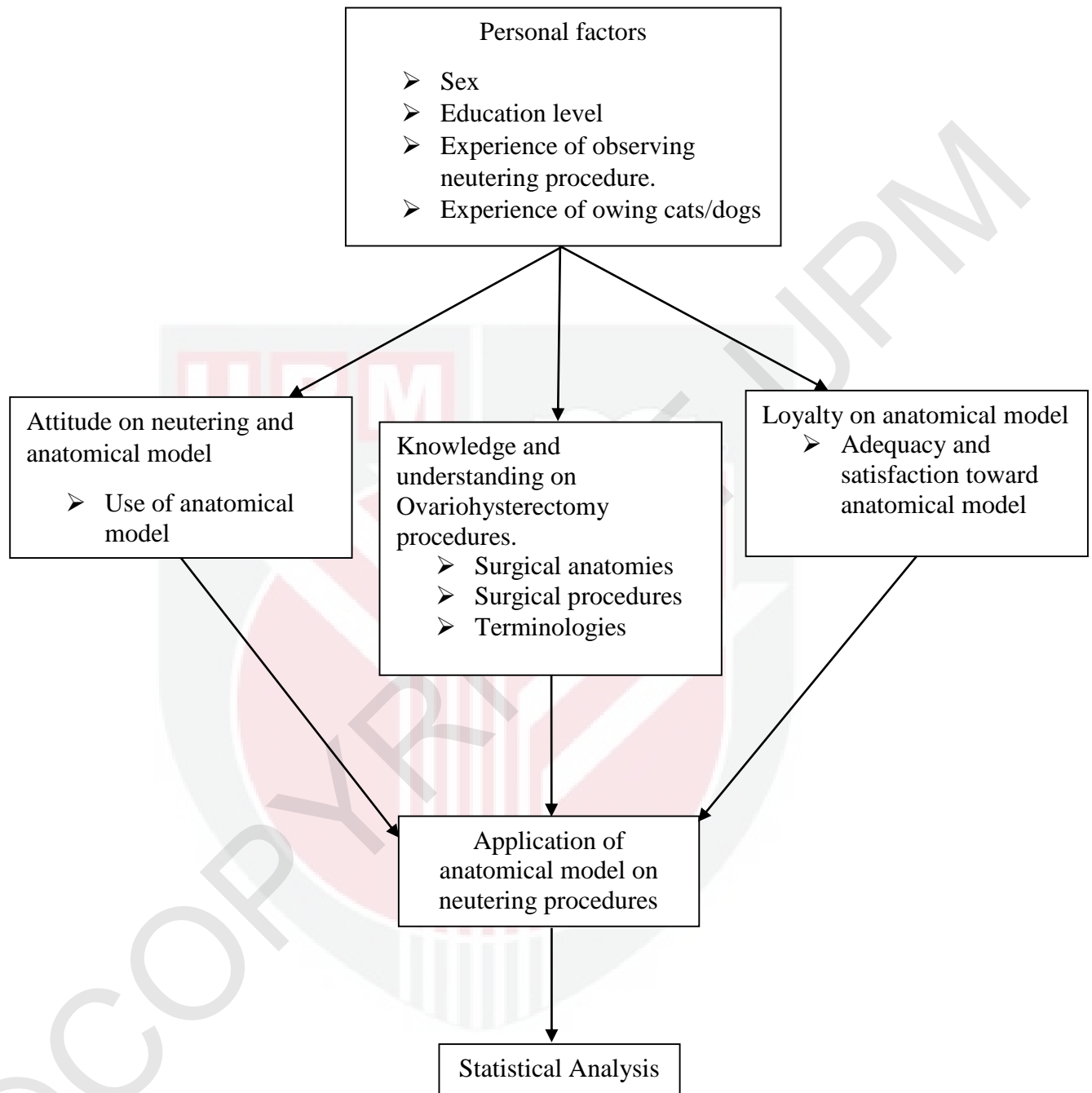


Figure 2: Summary of the study design and questionnaires

The duplicated set of questionnaires, except demographics, shall be answered again after watching the video of using anatomical model, where the impact of the model on their attitude and knowledge on ovariohysterectomy procedure will be

assessed by comparing the results yielded from pre- and post-training questionnaire. The results yielded remained anonymous when published and did not influence the academic grade of the participating students.

3.1 Instruments

3.1.1 Questionnaire

Two set of questionnaire were developed in this study, namely the pre- and post-questionnaire. Pre-questionnaire needs to be answer before using anatomical model while post-questionnaire questions need to be answer after using anatomical model. Pre-questionnaire questions include demographics questions (gender, year of study, observe ovariohysterectomy procedure before) and 14 questions related to surgical anatomy, procedure, concept and terminologies (Please see Appendix A). Post-questionnaire questions consist of the same 14 questions, with additional questions related to anatomical model including attitude, satisfaction and loyalty towards anatomical model. There are four sections in the pre-questionnaire namely Section A, B, C and D. Section A comprises of the respondent's information sheet and consent form to be filled in by respondents. Section B requires the demographic background of respondents (e.g. gender, current year of study) while section C, consist of questions related to anatomy, procedure, concept and terminologies in Ovariohysterectomy procedure. This section evaluates students' knowledge toward ovariohysterectomy procedure (e.g. bladder can be good indications to locate the uterine body and uterine bifurcation, the suspensory ligament is a smooth and fragile whitish band of tissue that diverges as it travels from the ovary to attach to the last two ribs). Section D evaluates student's attitude on neutering and adequacy and usefulness

of the textbook used in the study. (e.g., have you observed ovariohysterectomy procedure before, difficulty to understand the term used in the ovariohysterectomy procedure script given).

The same questionnaire was used for post-training evaluation except demographic to measure the knowledge of ovariohysterectomy after using the anatomical model (please see Appendix B). In the post-training questionnaire, the attitude towards the anatomical model was evaluated (e.g. rating of the anatomical model, the confidence level after using the anatomical model). A comparison of knowledge between respondents pre and post-training was then made.

3.1.2 Pre-training reading material

Respondents were required to read the reading material provided before answering the pre-training questionnaire (Appendix C). This is to provide prior knowledge to the respondents since both first-year and second-year veterinary students have a minimum or less knowledge about the surgical procedure. The reading material was taken from the textbook “Small Animal Surgery (4th edition)” written by Theresa Welch Fossum and her team. The textbook provides updated procedures with new information and, in many cases, descriptions of entirely new procedures that were either rarely used or not used were included. Additionally, anaesthetic concerns, surgical anatomy, wound healing, postoperative concerns, and potential complications are detailed. The surgical technique for every single procedure is described in detail, which prepares the reader with a comprehensive and thorough description. The ovariohysterectomy procedure from the textbook was taken and separated in a new 3

pages Microsoft document consisting of an introduction, surgical anatomy, and surgical procedure of ovariectomy.

3.1.3 Anatomical model

The neutering procedure chosen for this study was ovariectomy. In developing the anatomical model, polystyrene foam (24.5cm x 23cm x 4.5cm) was used as the base to place all the organs (as shown in Figure 1). It was scraped off to shape the curved area to serve as the abdomen lining (Figure 2). Paper clay was used to mimics the organs. It was shaped and designed according to the reproductive organs related to the procedures; including kidneys, ovaries, and uterus (Figure 3). The organs were dried off and coloured with watercolour. The coloured organs were left overnight and sprayed with spray paint to preserved and maintain the colour.

Figure 3: A polystyrene foam (24.5cm x 23cm x 4.5cm) was used as the base

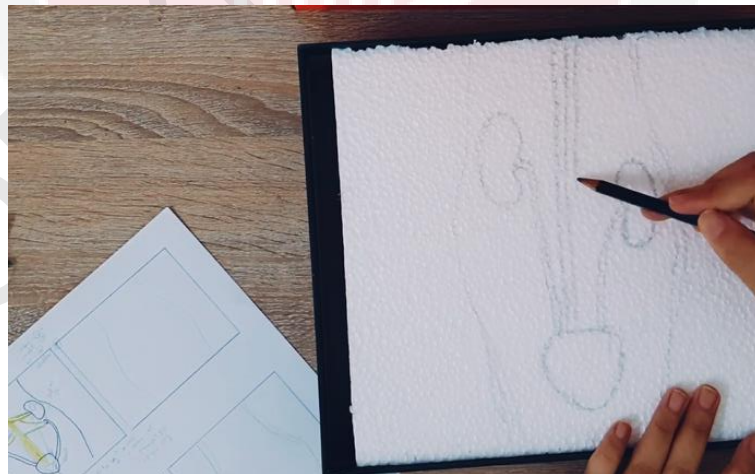


Figure 4: The polystyrene foam was scraped off to shape the curved area to serve as abdominal lining



Figure 5: The clay was shaped and designed according to the reproductive organs related to the procedures; including kidneys, ovaries, and uterus



A transparent straw (13cm) was used as blood vessels to serve as the aorta (red), caudal vena cava (blue), ovarian arteries and veins, renal arteries and veins (Figure 4). Attached to the kidney mimics the suspensory ligament made by a rubber band at both left and right sides (Figure 5). A magnet was used to serve the attach and

detach function as it was glued to the end of each rubber band to represent the act of breaking down or stretch the suspensory ligament.

Figure 6: The usage of transparent straws were used as blood vessels



Figure 7: Rubber bands were used as suspensory ligaments; final look of the anatomical model



3.1.4 Video

A 3-minutes video was made by using a video editor application Wondershare Filmora9 and was uploaded to YouTube (Figures 6A and 6B). The video was compact with the explanation of the anatomy involved and a step-by-step surgery procedure by using the anatomical model. Subtitles were provided in English. Since the video was made for a research purpose, only students with the provided link will be able to have an access to the video.

Figure 8A: Youtube video on Ovariohysterectomy procedure with anatomical model

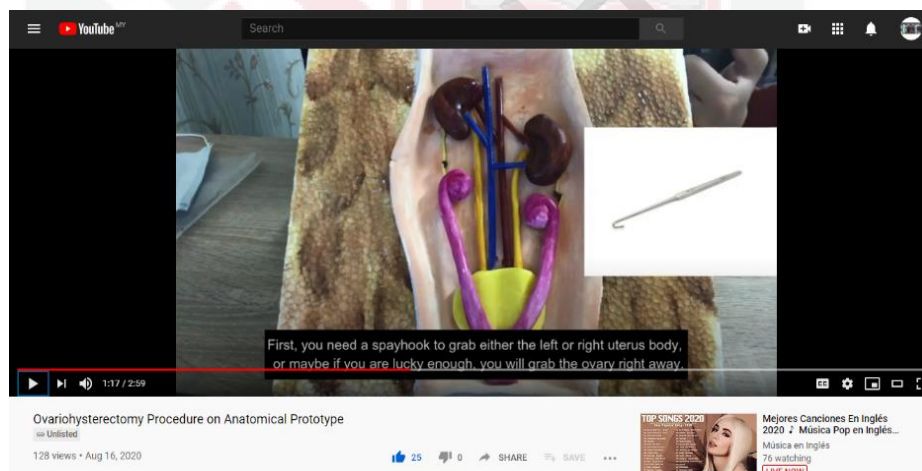
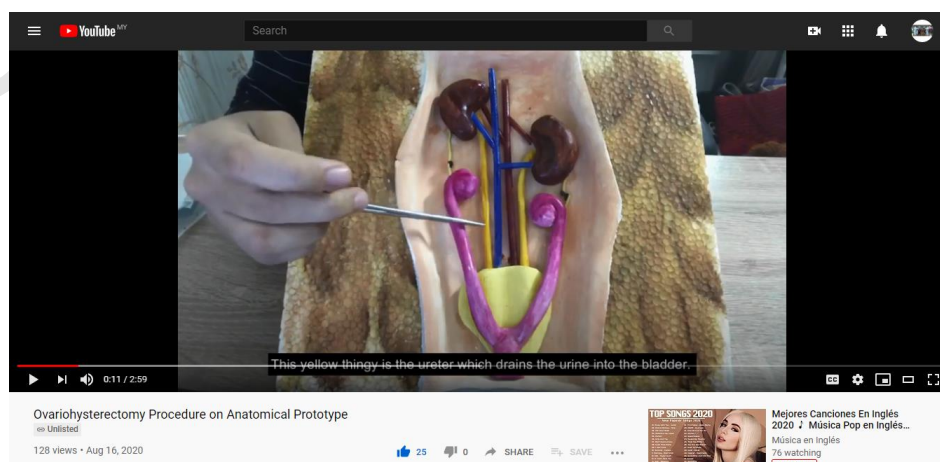


Figure 8B: Youtube video on Ovariohysterectomy procedure with anatomical model



4.0 RESULT

4.1 Demographics

A total of 103 questionnaires was completed by 74 year-one veterinary students (71.84%) and 29 year-two veterinary students (28.16%). The respondents were predominated by female (72.82%). Most of the veterinary students owned pet(s) (96.12%) and only half of them neutered their pet(s) (58.25%). Most of them are familiar with the term neutering (99.03%) however, only few of them had observed the surgery (4.85%). Demographic characteristics of the respondents are presented in Table 1.

Table 1: Demographics characteristic of study participants

Characteristic	Distribution
Gender	
Male	28 (27.18%)
Female	75 (72.82%)
Year of study	
First-year	74 (71.84%)
Second-year	29 (35.92%)
Pet Ownership	
Owned pet(s)	99 (96.12%)
Do not own pet(s)	4 (3.88%)
Pet neutering status	
Neutered	60 (58.25%)
Intact	43 (41.75%)
Experience observing OHE procedure	
Yes	5 (4.85%)
No	98 (95.12%)

Familiar with term neutering

Yes	102 (99.03%)
No	1 (0.97%)

4.2 Attitude on reading material and anatomical model

The responses for attitude on reading material and anatomical model for ovariohysterectomy procedure were provided in Table 2. Half of the respondents agreed the terminologies used in the textbook was difficult or hard to understand. Up to 80% of the students admitted learning anatomy is hard without the model or organ with them. Furthermore, in Table 3, there was significantly higher number of students who agreed that it is easier to remember and understand the surgical procedure with a model or prototype together. More than 80% of the students are confident to explain the ovariohysterectomy procedure after using the anatomical model however, the confident level differs from year-one and year-two veterinary students ($p=0.001$). Almost all respondents agreed that the anatomical model is a useful learning tool. Up to 95% of year-one veterinary students, and 96% of year-two veterinary students, perceived that the anatomical model helped them to imagine the surgery flow and organs involved in the procedure as well. The responses on attitude on reading material from the textbook and anatomical model were not affected by gender, pet ownership, pet neutering status, experiences of observing OHE and familiarisation towards neutering procedure.

Table 2: Attitude of respondents toward reading material given (n=103)
(Kolmogorov-Smirnov)

Statement	Opinion	Percentage (%)			
		First year veterinary student		Second year veterinary student	
			<i>p</i> -value		<i>p</i> -value
It is hard to understand the term used in the ovariohysterectomy procedure script given.	Agree	49.0	0.00*	8.0	0.00*
	Neutral	21.0		14.0	
	Disagree	4.0		7.0	
Learning anatomy is hard without the model or organ in front of me.	Agree	66.0	0.00*	25.0	0.00*
	Neutral	4.0		4.0	
	Disagree	4.0		0.0	

Table 3: Attitude of respondents toward anatomical model (n=103) (Kolmogorov-Smirnov)

Statement	Opinion	Percentage (%)			
		First year veterinary student		Second year veterinary student	
			<i>p</i> -value		<i>p</i> -value
The prototype helps me to understand the surgery procedure better	Neutral	6.0	0.00*	1.0	0.00*
	Agree	23.0		5.0	
	Strongly agree	45.0		23.0	
The prototype helps me to imagine the flow and organs involved in the procedure	Neutral	3.0	0.00*	1.0	0.00*
	Agree	24.0		5.0	
	Strongly agree	47.0		23.0	
My knowledge level improved after using the prototype	Good	6.0	0.00*	1.0	0.00*
	Excellent	34.0		6.0	
	Very excellent	34.0		22.0	
I feel more confident to explain OHE procedure to my	Neutral	14.0	0.00*	2.0	0.00*
	Agree	36.0		15.0	

friends/others after using the prototype	Strongly agree	24.0		12.0	
I think it is easier to remember and understand the procedure with a prototype together	Neutral	2.0	0.00*	1.0	0.00*
	Agree	72.0		28.0	
	Strongly agree				

4.3 Knowledge on ovariohysterectomy procedure

Knowledge of respondents on the ovariohysterectomy procedure was demonstrated in Table 4. With only provided reading material from the textbook, an alarmingly high number of respondents (70.87%), were presented with poor knowledge toward the ovariohysterectomy procedure, followed with moderate (28.16%) and good knowledge (0.97%). However, with an anatomical model, percentage of students with poor knowledge toward ovariohysterectomy procedure has significantly reduced by 64% while the percentage for moderate and good knowledge has increased by 30% and 34%, respectively. When using reading material only, first-year veterinary students (22.97%) and second-year students (13.79%) misapprehended that neutering for the animal is the same as in the human. However, after using the anatomical model, the percentage has reduced to 10.81% and 3.45%, respectively. Based on table 5, both first-year (48%) and second-year of veterinary students (15%) obtained the highest percentage of increment on surgical procedure related question (three clamp pedicle technique was used to resect the ovarian vessels and uterine body). The least percentage of increment for first-year veterinary students was anatomy related question (the left and right ovarian vein drains into caudal vena cava, 1%) while for second-year veterinary students was concept related question (neutering is the same as human sterilization, 3%).

Table 4: Comparison of knowledge before using anatomical model and after using anatomical model (Wilcoxon test)

	Knowledge before using anatomical model (%)	Knowledge after using anatomical model (%)	<i>p</i> value
Poor	73	7	0.000*
Moderate	29	60	
Good	1	36	
Total	103	103	

Table 5: Comparison of answers between intervention of reading material and intervention of reading material with anatomical model among participants (n=103)

Questions	Year-one veterinary students			Year-two veterinary students		
	Correct (%)			Correct (%)		
	Reading material from textbook	Reading material with anatomical model	± (%)	Reading material from textbook	Reading material with anatomical model	± (%)
Ovariohysterectomy is a procedure of removing the ovaries only.	48 (64.86)	63 (85.14)	15	24 (82.76)	28 (96.55)	4
Bladder can be good indications to locate uterine body and uterine bifurcation	40 (54.05)	73 (98.65)	33	19 (65.52)	29 (100)	10
To allow exteriorization of the ovary, broad ligament has to be stretch or break.	20 (27.03)	39 (52.70)	19	11 (37.93)	19 (65.52)	8
The cervix is the constricted cranial part of the uterus and is thicker than the uterine body and vagina.	25 (33.78)	44 (59.50)	19	18 (62.07)	24 (82.76)	6
The suspensory ligament is a smooth and fragile, whitish band of tissue that diverges as it travels from the ovary to attach to the last two ribs.	24 (32.43)	39 (52.70)	15	6 (20.68)	15 (51.72)	9
Ovarian arteries originate from the aorta.	61 (82.43)	71 (95.95)	10	20 (68.97)	28 (96.55)	8
Uterine body is ligated and resected just below the cervix.	21 (28.38)	51 (68.92)	30	16 (55.17)	22 (75.86)	6
Three clamps pedicle technique was used to resect the ovarian vessels and uterine body.	26 (35.14)	71 (95.95)	48	13 (44.83)	28 (96.55)	15
Ovariectomy is a procedure of removing the ovaries and uterus.	39 (52.70)	43 (58.12)	4	15 (51.72)	20 (68.97)	5
Uterine body is clamp proximal to cervix.	22 (29.73)	65 (87.84)	43	16 (55.17)	24 (82.76)	8
The left and right ovarian vein drains into caudal vena cava.	34 (45.95)	35 (47.30)	1	12 (41.38)	16 (55.17)	4
The right kidney is more cranial compared to the left kidney	34 (45.95)	74 (100)	40	24 (82.76)	28 (96.55)	4
In ovariectomy, ovarian vessels are remove using three clamps pedicle technique.	23 (31.08)	61 (82.43)	38	10 (34.48)	25 (86.21)	15
Neutering (pengkasian) is as the same as "sunat"	57 (77.03)	66 (89.19)	9	25 (86.21)	28 (96.55)	3

Table 6: *p-value* comparison of knowledge with demographic characteristic before using anatomical model and after using anatomical model. (Independent samples Mann-Whitney U test)

Demographic		Total (n)	<i>p-value</i> of knowledge before using anatomical model (%)	<i>p-value</i> of knowledge after using anatomical model (%)
Gender	Male	28	0.128	0.076
	Female	72		
Year	Year one	67	0.018*	0.083
	Year two	33		
Pet ownership	Owned pets	96	0.121	0.531
	Doesn't owned pets	4		
Pet neutering status	Intact	40	0.65	0.629
	Neutered	60		
Neutering awareness	Yes	97	0.115	0.512
	No	3		
Experience observing OHE before	Yes	5	0.111	0.468
	No	95		

Table 6 shows the comparison of knowledge pre-training and post-training with demographics characteristics. Before using anatomical model, there are significantly differences in term of knowledge between first-year and second-year veterinary students ($p < 0.018$). After using the anatomical model, there is still a difference of knowledge, however, it is not significant. Other demographic parameters like gender, pet ownership, pet neutering status, neutering awareness and experience observing ovariohysterectomy procedure before does not influence one's knowledge about the procedure.

4.4 Loyalty and satisfaction towards the anatomical model

Spearman's correlation was used to measure the correlation of knowledge, attitude, satisfaction and loyalty towards the anatomical model. Table 7 and 8 indicates that knowledge has significant positive correlation with loyalty ($r_s = 0.255$, $p < 0.01$) while attitude has significant positive correlation with satisfaction ($r_s = 0.534$, $p < 0.01$). Table 8 concludes that satisfaction has a negative correlation with knowledge ($r_s = -0.21$).

Table 7: Correlation between knowledge with attitude, satisfaction and loyalty

	Mean	SD \pm SE	r_s	p-value
Attitude	85.42	8.65 \pm 0.863	0.046	0.648
Satisfaction	85.86	14.91 \pm 1.47	-0.21	0.833
Loyalty	77.30	14.72 \pm 1.45	0.255	0.009**

** . Correlation is significant at the 0.01 level (2-tailed).

Table 8: Correlation between attitude with knowledge, satisfaction and loyalty

	Mean	SD±SE	r _s	p-value
Satisfaction	85.42	8.65±0.863	0.534	0.000**
Knowledge	85.86	18.03±1.78	-0.21	0.833
Loyalty	77.30	14.72±1.45	0.102	0.306

** . Correlation is significant at the 0.01 level (2-tailed).

Table 9: Correlation between satisfaction with attitude, knowledge and loyalty

	Mean	SD±SE	r _s	p-value
Knowledge	85.42	18.03±1.78	0.046	0.648
Attitude	85.86	14.91±1.47	-0.21	0.833
Loyalty	77.30	14.72±1.45	0.083	0.405

** . Correlation is significant at the 0.01 level (2-tailed).

Table 10 illustrates the satisfaction among respondents toward the anatomical model. Almost all of first-year (93.2%) and second-year veterinary students (89.7%) are satisfied with the anatomical structure of the model. 94.6% of first-year veterinary students are satisfied with the colour chosen for the model and think that the model serves the function as learning tool very well while 96.6% of second-year veterinary students are satisfied with the colour chosen for the model and only 93.1% of them think that the model fit to its function as a learning tool.

Table 11 illustrates the loyalty among respondents toward the anatomical model. More than half of first-year veterinary students (79.73%) and almost all of the

second-year veterinary students (82.76%) are willing to buy the anatomical model and majority of them are willing to spend about RM21 to RM40 on the model (43.24% and 58.62%, respectively). With regard to the necessity of anatomical model for the different surgical procedure, majority of the respondents (100% of first-year veterinary students and 100% of second-year veterinary students) recognized the importance of anatomical model as a learning tool.



Table 10: Respondent's satisfaction towards anatomical model (n=103)

Statement	Opinion	Percentage (%)					
		First-year veterinary student			Second year veterinary student		
		Frequency (%)	mean	SD±SE	Frequency (%)	mean	SD±SE
Rate the prototype based on the anatomical structure	Neutral	5 (6.8)	2.47	0.624±0.073	3 (10.3)	2.45	0.686±0.127
	Satisfied	29 (39.2)			10 (34.5)		
	Totally satisfied	40 (54.1)			16 (55.2)		
Rate the prototype based on the colour choice	Neutral	4 (5.4)	2.54	0.601±0.070	1 (3.4)	2.79	0.491±0.091
	Satisfied	26 (35.1)			4 (13.8)		
	Totally satisfied	44 (59.5)			24 (82.8)		
Rate the prototype based on the function	Neutral	4 (5.4)	2.68	0.576±0.067	2 (6.9)	2.62	0.622±0.115
	Satisfied	16 (21.6)			7 (24.1)		
	Totally satisfied	54 (73.0)			20 (69.0)		
How complicated the prototype is	Neutral	4 (5.4)	2.43	0.599±0.070	2 (6.9)	2.66	0.614±0.114
	Easy to understand	34 (45.9)			6 (20.7)		
	Very easy to understand	36 (48.6)			21 (72.4)		

Table 11: Respondent's loyalty towards anatomical model (n=103)

Statement	Opinion	Percentage (%)					
		First-year veterinary student			Second year veterinary student		
		Frequency (%)	mean	SD±SE	Frequency (%)	mean	SD±SE
Will you buy this prototype	No	15 (20.27)	1.80	0.405± 0.047	5 (17.24)	1.83	0.384± 0.071
	Yes	59 (79.73)			24 (82.76)		
How much are you willing to spend on this prototype	Not interested	14 (18.92)	2.35	0.851 ±0.099	5 (17.24)	2.41	0.780± 0.145
	Less than RM20	24 (32.43)			7 (24.14)		
	RM21-RM40	32 (43.24)			17 (58.62)		
	RM41 and above	4 (5.4)			0 (0)		
Would you like to have more model for other surgical procedures? (Orthopedic-bone model)	No	0 (0)	2.00	0.000± 0.000	0 (0)	2.00	0.000± 0.000
	Yes	74 (100.0)			29 (100.0)		

5.0 DISCUSSION

5.1 Demographic

The study has received satisfactory participation rate from each respondent group (92.5% first-year veterinary students, 72.5% second-year veterinary students) of over 60% which is the targeted response rate of most study (Fincham, 2008). The high voluntary participation rate may reflect the high-interest level to learn ovariohysterectomy procedure among the respondents, with the first-year veterinary students showing the greatest interest and the second-year veterinary students expressed the least interest. This may due to the fact that the first-year veterinary students are still figuring out what this course is about hence, the eagerness to learn something new is beyond their capability while second-year veterinary students have already been exposed to this course.

5.2 Attitude on reading material and anatomical model

Half of the respondents agreed terminologies used in the textbook was difficult or hard to understand. This finding is consistent with other studies conducted in Malaysia (Said et al., 2015), Spain (Bravo et al., 2014) and Australia (Pandey & Zimitat, 2007). Medical students in Australia reported that academically, approximately one-third of students suggested, or used, approaches that involved memorising (n= 39), understanding (n= 36) and visualising (n= 29). Students benefit from a curriculum that fosters deep understanding; they perform at least as well as and sometimes better than students not so exposed on the tests typically used to assess student progress and hold schools accountable for student performance (Leithwood et

al., 2006). This claim has obtained support in several recent studies, for example, Weglinsky's (2004) analysis of evidence from both the U.S. National Assessment of Educational Progress (NAEP) and the Third International Mathematics and Science Study (TIMSS). Both sets of data acknowledge the comparison of student performance on basic skills with performance on critical thinking, higher-order thinking skills, and other outcomes associated with understanding.

Almost all of the respondents agreed that the anatomical model is a useful learning tool and that the model has helped them to imagine the surgery flow and organs involved in the procedure which then leads to easing the process of memorizing and understanding the surgery itself. The responses were close to the finding from studies in Asia (Oh et al., 2009), North America (Estevez et al., 2010) and Europe (Brinke et al., 2014). Similar to the study by Oh et al., in 2009, the students were asked for their opinions about the use of clay models in learning anatomy and assess the effectiveness of this method. The targeted audience for the study is similar to this study where undergraduate students were chosen (n=70). To assess the impact of the model on learning, two feedback surveys were completed by the students. In the contrary, the study consists of a test group and control group; students who used the clay models and students from another school that did not use clay models, respectively. The students reported that the clay modelling emerge to be a useful addition to conventional anatomy and radiologic anatomy education accompanied by the students' average scores on CT examinations were higher than that of a group that did not use clay models. This was supported by a study conducted by Brinke et al., in 2014 where the students who received the three-dimensional teaching (groups II and III)

scored far better in the short and long term when compared with students who received only conventional, two-dimensional teaching (group I), hence concludes that three-dimensional anatomy education with dissection models increases anatomy learning by medical students, as proved from their test scores in the short and long-terms.

More than 80% of the students in this study stated that they are more confident after using the anatomical model. Students who practiced the hands-on exercise demonstrated greater confidence and proficiency in later assignments that required anatomical and taxonomic identification of isolated bones (Pandey and Zimitat 2007). Align with a study by Badman et al., in 2018, students in the test group rated their level of confidence (question 2) increased after performing their first feline OHE surgery (mean rating \pm SD = 8.5 ± 0.97) compared to before surgery (mean rating \pm SD = 7.1 ± 1.2) ($p < .05$). Increased confidence level was not demonstrated for question 2 ($p = 0.12$) in the control group (mean rating \pm SD pre/post-surgery = 5.4 ± 2.32 and 6.5 ± 2.32 , respectively). The test group also tended to rate question 1 (“How well prepared do you feel for performing an OHE?”) more highly than the control group ($p = .08$), but the comparison did not reach statistical significance. The present and the past study suggest that even as little as one practice session with an inexpensive surgical training model including anatomical model also may help improve veterinary student confidence. The results are strengthened in a previous study of Langebæk et al., where practicing with a build-it-yourself surgical training model increased the students’ level of confidence, competence, and anatomic knowledge. In the contrary of a similar study, Lisk et al (2014) showed that Anatomy Glove Learning System (AGLS) and the traditional 2D learning approaches had the same impact on

students' self-perceived confidence and knowledge of hand anatomy. Several studies also showed that there were no differences when 3D outcomes were compared to 2D or traditional teaching (Donnelly et al. (2009), Oh et al. (2009) and Hu et al. (2010)).

5.3 Knowledge on ovariohysterectomy procedure

Improvement of knowledge of ovariohysterectomy was seen in veterinary students after training module. Remarkable positive effects were observed in the first and second-year students who showed significant improvement of knowledge by 64%. Over more than half of the respondents (70.87% veterinary students) were presented with poor knowledge when only using provided reading material. However, with the aid of anatomical model, the percentage of students with poor knowledge has significantly reduced by 64%. A study conducted by Marsh et al, 2008 supports the result by concluding from his study that students who utilized the module performed better than those given only traditional resources and the findings suggest that the 3D computer-assisted-instruction modules, in general, are more applicable if used toward the later stages of learning, rather than as an initial resource. In contrast, Maggio et al, 2012 reported that in his study The interactive module was just as effective as the traditional classroom method.

Following training, there was significantly more veterinary students acknowledged that neutering in animals is not the same as human sterilization. In pre-training session, 22.97% of first-year veterinary students and 13.79% of second-year veterinary students misapprehended that neutering for the animal is as the same as human sterilization or circumcised. However, post-training session reported reducing in percentage by 10.81% and 3.45%, respectively. The causes of this phenomenon

were unknown, although less emphasis given on these topics may play a role. However, this is probably due to the amount of knowledge received after using the anatomical model that it has the ability to influence one's opinion or thought to change. Integrating art into learning not only allows to involve students into the educational process better, thus stimulating their enthusiasm from the view of open-minded future employees and out-of-box thinkers, but it also helps to produce natives of the world with larger views to embrace all the complexity of the actual reality (Tramonti, 2019). 48% of first-year veterinary students and 15% second-year of veterinary students obtained the highest percentage of increment on surgical procedure related question (three clamp pedicle technique was used to resect the ovarian vessels and uterine body) after using anatomical model while the least percentage of increment for first-year veterinary students was anatomy related question (the left and right ovarian vein drain into caudal vena cava, 1%) and for second-year veterinary students was concept related question (neutering is the same as human sterilization, 3%). This proves that the anatomical model is able to direct students on the right track of surgical procedure and anatomy. In the previous study by Rothenberger et al., in 2015, reported that the subjective skill assessment showed that the students believed that surgical training in the operating room helped them to improve their self-confidence and to be more comfortable in the same real situations in future (4.25 ± 0.638), therefore, they are expected to be more prepared during the same real-life situations in the future since they already knew what or which step to go next.

Before using anatomical model, there are significantly differences in term of knowledge between first-year and second-year veterinary students ($p < 0.018$). After using the anatomical model, there is still a difference of knowledge, however, it is not

significant. This might be due to the different level of exposure on the anatomy courses between first and second-year veterinary students where second-year students have already taken their anatomy courses while first-year students were just getting started. After using the anatomical model, they are believed to be receiving the same amount of knowledge hence, the difference of knowledge is not significant enough.

5.4 Loyalty and satisfaction towards the anatomical model

Overall, knowledge has significant positive correlation with loyalty ($r_s = 0.255$, $p < 0.01$) while attitude has significant positive correlation with satisfaction ($r_s = 0.534$, $p < 0.01$). It is best believed that students who improved post-training with the use of the anatomical model see the value of the model as a learning tool. Hence, it can be concluded that the anatomical model is a way of engaging students in learning and getting more knowledge. This result was supported by Samy and Sarah in 2016, where they reported 3D anatomy models in the digital and non-digital (physical) format are preferred by students in medical, dental and other allied health schools and can be used to support the curriculum and enhance students' skills in spatial visualization of anatomical relationships. In the present study, it is proven that good attitude towards neutering can be improved by using the anatomical model since it has significant positive correlation towards each other ($r_s = 0.534$, $p < 0.01$). The anatomical model was rated based on its anatomical structure, its function as a learning tool, the colour chosen and the complexity of the model. This result was supported by several studies and one of it was a study by Sandhu et al. (2011) and Wilson et al. (2010) where they reported that students in their studies stated that learning by using 3D models was more satisfactory when compared to textbooks images and traditional teaching

modalities. However, it is also reported that satisfaction has a negative correlation with knowledge ($r_s = -0.21$). In contrast, a study by Tefera in 2011 stated that results from a previous study confirm that student performance can be enhanced through hands-on practice. The hands-on pedagogy eases the learning process according to responses in this study because it allowed more active and participatory learning and each student was able to learn on his own way and time using the prepared materials. Cognitive learning, is a dynamic process, leading to the construction of knowledge, it requires the acquisition of knowledge and the ability to process it and store it in memory (Novac, 1990).

5.5 Limitation of the study

Despite results indicated a great level of understanding ovariohysterectomy procedure and the effectiveness of the anatomical model itself, selective biases may be present due to the voluntary basis of participation. The results in this study may be biased to reflect individuals who have particular interest and concern on the subject. Hence, some degree of overestimation of their positive attitude and enhanced knowledge toward the matter may exist.

Other than that, a control group should be considered when running the study to ensure the anatomical model is really reliable and dependent. In order to appreciate the outcome when the variable is changing, the result from the experimental group should be compared with the results of the control groups. Whether or not to eliminate or isolate these variables, only a control group are able to determine it making it the most essential part of an experiment.

5.6 Recommendation for future study

Data collection was limited to first and second-year veterinary students from FPV, UPM and hence result yielded should not be used to generalize to a larger population of veterinary professionals in Malaysia. Hence, data collection involving a more diverse population of respondents in various regions should be performed such as veterinary students from FPV, UMK. Direct involvement of clients or pet owners in veterinary clinics should be considered. This is to know about their perception and current knowledge on neutering and to be educated on neutering in cats and dogs to encourage higher awareness among them. Other than that, for educational purposes, using other materials that are more versatile and compatible with the function should be considered. This is to initiate and engaged students to have a more interactive learning session.

6.0 CONCLUSION

It can be concluded that good prior knowledge will result in good understanding of ovariohysterectomy procedure. The anatomical model is capable to improve the students' surgical procedure and anatomy knowledge and is able to minimize misconception and misused of terminologies among veterinary students.

REFERENCES

- Azer, S. A., & Azer, S. (2016). 3D anatomy models and impact on learning: a review of the quality of the literature. *Health professions education, 2*(2), 80-98.
- Badman, M., Tullberg, M., Höglund, O. V., & Hagman, R. (2016). Veterinary student confidence after practicing with a new surgical training model for feline ovariohysterectomy. *Journal of veterinary medical education, 43*(4), 427-433
- Baker, B., Acquah, S., & Rada, R. (1994). Prototyping a collaborative learning tool for nurses. *Journal of Computer Assisted Learning, 10*(1), 55-64.
- Bravo, E., Amante, B., Simo, P., Enache, M., & Fernandez, V. (2011, April). Video as a new Teaching tool to increase student motivation. In *2011 IEEE global engineering education conference (EDUCON)* (pp. 638-642). IEEE.
- Burrow, R., Batchelor, D., & Cripps, P. (2005). Complications observed during and after ovariohysterectomy of 142 bitches at a veterinary teaching hospital. *Veterinary Record, 157*(26), 829-833.
- Bushby, P. A. (2012). Surgical techniques for spay/neuter. *Shelter medicine for veterinarians and staff, 625-645*.
- Bushby, P., & White, S. (2020). Dog Neuter/Cat Neuter. *High-Quality, High-Volume Spay and Neuter and Other Shelter Surgeries, 281-294*.
- Casciotti, D. & Zuckerman, D. (n.d). *The Benefits of Pets for Human Healths. National Center for Health Research. Retrieved from <http://www.center4research.org/benefits-pets-human-health/>. Accessed 1 March 2020.*
- DeTora, M., & McCarthy, R. J. (2011). Ovariohysterectomy versus ovariectomy for elective sterilization of female dogs and cats: is removal of the uterus necessary? *Journal of the American Veterinary Medical Association, 239*(11), 1409-1412.
- Diesel, G., Brodbelt, D., & Laurence, C. (2010). Survey of veterinary practice policies and opinions on neutering dogs. *Veterinary Record, 166*(15), 455-458.
- Dorothy, K. S., Khoo, C. K., Ho, H. W., Navanithakumar, B., Faizah, H. M. S., Tishrin, M. I., & Quaza, N. H. N. (2019). A study of public preferences of trap-neuter-release (TNR) and trap-euthanasia (TE) programmes of free roaming dogs in Penang. *Malaysian Journal of Veterinary Research, 10*(2), 113-124.

- Hanisch, M., Kroeger, E., Dekiff, M., Timme, M., Kleinheinz, J., & Dirksen, D. (2020). 3D-printed Surgical Training Model Based on Real Patient Situations for Dental Education. *International Journal of Environmental Research and Public Health*, 17(8), 2901.
- Jose, J., Jimmy, B., Al Gahliya Mohammed Saif AlSabahi, G., & Al Sabei, A. (2013). A study assessing public knowledge, belief and behavior of antibiotic use in an Omani population. *Oman medical journal*, 28(5), 324.
- Meikeng, Y. (2019). Feature: Pet peeves in animal welfare. *The Star Online*. Retrieved from <https://www.thestar.com.my/news/nation/2019/12/01/pet-peeves-in-animal-welfare>. Accessed 1 March 2020.
- Oh, C. S., Kim, J. Y., & Choe, Y. H. (2009). Learning of cross-sectional anatomy using clay models. *Anatomical sciences education*, 2(4), 156-159.
- Pandey, P., & Zimitat, C. (2007). Medical students' learning of anatomy: memorisation, understanding and visualisation. *Medical education*, 41(1), 7-14.
- Rothenberger, J., Jafari, S. M. S., Schnabel, K. P., Tschumi, C., Angermeier, S., & Shafiqhi, M. (2015). Evaluation of medical students' attitudes and performance of basic surgery skills in a training program using fresh human skin, excised during body contouring surgeries. *Journal of surgical education*, 72(5), 868-874.
- Said, C. S., Shamsudin, K., Mailok, R., Johan, R., & Firdaus, S. The Application of 3D Visualization Tool in Anatomy Education
- Sbayeh, A., Choo, M. A. Q., Quane, K. A., Finucane, P., McGrath, D., O'flynn, S., ... & O'Tuathaigh, C.M. (2016). Relevance of anatomy to medical education and clinical practice: perspectives of medical students, clinicians, and educators. *Perspectives on Medical Education*, 5(6), 338-346.
- Society for the Prevention of Cruelty to Animals (SPCA) Selangor. (2017). *Society for the Prevention of Cruelty to Animals (SPCA) Selangor Annual Report 2017*. Retrieved from http://www.sPCA.org.my/wpcontent/uploads/2018/06/AR2017_26Jan2017.pdf. Accessed 1 March 2020
- Tefera, M. (2011). Enhancing cognitive learning in veterinary osteology through student participation in skeleton preparation project. *Ethiopian Veterinary Journal*, 15(1).

The Humane Society of the United States. (2004). Retrieved from <http://www.HSUS.org>. Accessed 1 March 2020.

Van Goethem, B., Schaefers-Okkens, A. U. K. E., & Kirpensteijn, J. (2006). Making a rational choice between ovariectomy and ovariohysterectomy in the dog: a discussion of the benefits of either technique. *Veterinary Surgery*, 35(2), 136-143.

Vendramini, T. H., Amaral, A. R., Pedrinelli, V., Zafalon, R. V., Rodrigues, R. B., & Brunetto, M. A. (2020). Neutering in dogs and cats: current scientific evidence and importance of adequate nutritional management. *Nutrition Research Reviews*, 1-11

Walker, J. K., Bruce, S. J., & Dale, A. R. (2017). A survey of public opinion on cat (*Felis catus*) predation and the future direction of cat management in New Zealand. *Animals*, 7(7), 49.

Weedon, G. R., Kustritz, M. V. R., & Bushby, P. (2020). Influence of Spay–Neuter Timing on Health. *High-Quality, High-Volume Spay and Neuter and Other Shelter Surgeries*, 509-520.

Wongsaengchan, C., & McKeegan, D. E. (2019). The views of the UK public towards routine neutering of dogs and cats. *Animals*, 9(4), 138.

APPENDICES

APPENDIX A: Pre-training questionnaire for year one and two veterinary students

Section A : Respondent's information sheet and consent form.

Pet overpopulation can only be solved by implementing widespread sterilization programs, also spaying and neutering all companion animals. Neutering is a profound method that ceases the overpopulation crisis at source – unlike other short-term solutions such as dog-catching and euthanasia which are known to be less effective, costly and short-sighted.

Since public are more aware about neutering, it is crucial for every veterinarian to master the procedures. Sometimes, it is a challenge for a veterinarian student to memorize and explain the neutering procedure in exams. Indeed, misunderstanding of the terminologies used and conception occurred. Thus, with the aid of the anatomical model or prototype that resembles the neutering procedure on cats and dogs, students can easily explore and gain a better understanding about the neutering procedure. The purpose of this study is to measure the effectiveness of the prototype as learning tool in providing a better understanding of the neutering surgical procedures among the veterinary students.

What will you have to do?

You as a veterinarian student, are invited to participate in this study as this study requires 100 students as respondents. However, you are under no obligation to participate in this research, thus, you are required to declare your consent at the end of this page. This should be done only after going through the information in this 'Respondent's Information Sheet and Informed Consent Form' thoroughly.

This study consist of four (4) sections :

Section A : Consent form

Section B : Sociodemographic and socioeconomic background

Section C : Knowledge

Section D : Attitude and practice on neutering procedure (OHE)

Who should participate in this study?

Respondents from first year or second year student of Doctor of Veterinary Medicine, Faculty of Veterinary Medicine, UPM.

What are the benefits of the study for you as a subject?

By participating in this study, you will have self-assessment on your current understanding and knowledge in neutering anatomies and procedures on cats and dogs and enhanced knowledge on the topic via watching the demonstration video with the aid of anatomical prototype.

What are the possible risks?

There is no risk in participating in the study.

Will the information that you provide and your identity remain confidential?

Yes. The results yielded from the study shall remain anonymous when published.

A1: Section A of pre-training questionnaire consist of the respondent's information and consent form

Section B : Sociodemographic and socioeconomic background

2. Gender *

Male

Female

3. DVM *

DVM 1

DVM 2

4. Matric Number *

Your answer _____

A2: Section B comprises of sociodemographic and socioeconomic background of the respondent

Section C: Knowledge

5. Ovariohysterectomy is a procedure of removing the ovaries only. *

True

False

Unsure

6. Bladder can be good indications to locate uterine body and uterine bifurcation *

True

False

Unsure

7. To allow exteriorization of the ovary, broad ligament has to be stretch or break. *

True

False

Unsure

A3: Section C consist of knowledge related to anatomy and procedure of the OHE procedure

Section D : Attitude and practice on neutering procedures

18. Are you familiar with the term "neutering"? *

Yes

No

19. Have you ever done ovariohysterectomy procedure before? *

Yes

No

20. Is your cat/dog neutered? *

Yes

No

21. Will you consider to neuter your cat/dog? *

Yes

No

A4: Section D consist of attitude and practice on neutering procedures among the respondents

APPENDIX B: Post-training questionnaire for year one and two veterinary students

POST-ASSESSMENT OF KNOWLEDGE AND UNDERSTANDING ON NEUTERING SURGICAL ANATOMY AND PROCEDURE AMONG DVM 1 & 2 STUDENTS.

** Only answer this questionnaire after you watch the video.

* Required

1. Ovariohysterectomy is a procedure of removing the ovaries only. *

- True
 False

2. Bladder can be good indications to locate uterine body and uterine bifurcation. *

- True
 False

3. To allow exteriorization of the ovary, broad ligament has to be stretch or break. *

- True
 False

B1: Section A consist of knowledge questions related to anatomy and procedure of OHE

Section B: Attitude and knowledge on neutering prototype.

14. The prototype helps me to understand the surgery procedure better. *

1 2 3 4 5

No Yes

15. This is my knowledge level improvement after watching the video : *

1 2 3 4 5

Not improved Improved

16. The prototype helps me to imagine the flow and organs involved in the procedure. *

1 2 3 4 5

No Yes

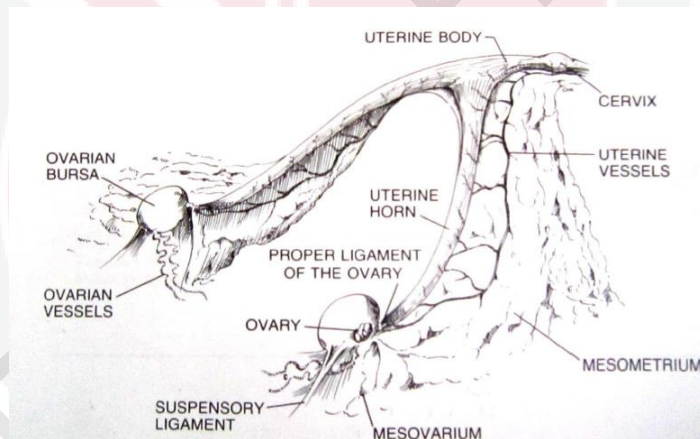
B2: Section B consist of attitude and knowledge questions on neutering prototype

APPENDIX C: Reading material provided that was adapted from the “Small Animal Surgery 4th Edition” by Theresa Welch Fossum

Ovariohysterectomy

The word “hystera” means the uterus, while –ectomy is the act of cutting or excision of organ. The most common reason to perform OHE is to prevent estrus and unwanted offspring. Other reasons for OHE include prevention of mammary tumors or congenital anomalies; prevention and treatment of pyometra, metritis, neoplasia (i.e., ovarian, uterine, or vaginal), cysts, trauma, uterine torsion, uterine prolapse, sub involution of placental sites, vaginal prolapse, and vaginal hyperplasia; and control of some endocrine abnormalities (i.e., diabetes and epilepsy) and dermatoses (e.g., generalized Demodex).

SURGICAL ANATOMY



Female Reproductive Tract

The female reproductive tract includes the ovaries, oviduct, uterus, vagina, vulva, and mammary glands. The ovaries are located within a thin-walled peritoneal sac; the ovarian bursa is located just caudal to the pole of each kidney. The uterine tube or oviduct courses through the wall of the ovarian bursa. The right ovary lies further cranially than the left. The right ovary lies dorsal to the descending duodenum, and the left ovary lies dorsal to the descending colon and lateral to the spleen. Medial retraction of the mesoduodenum or mesocolon exposes the ovary on each side.

Each ovary is attached by the proper ligament to the uterine horn and via the suspensory ligament to the transversalis fascia medial to the last one or two ribs. The ovarian pedicle (mesovarium) includes the suspensory ligament with its artery and vein, ovarian artery and vein, and variable amounts of fat and connective tissue. Canine ovarian pedicles contain more fat than feline ovarian pedicles, making it more difficult to visualize the vasculature.

Ovarian arteries originate from the aorta. The left ovarian vein drains into the left renal vein; the right vein drains into the caudal vena cava. The suspensory ligament is a tough, whitish band of tissue that diverges as it travels from the ovary to attach to the last two ribs. The broad ligament (mesometrium) is the peritoneal fold that suspends the uterus. The round ligament travels in the free edge of the broad ligament from the ovary through the inguinal canal with the vaginal process. The uterus has a short body and long narrow horns. The uterine arteries and veins supply blood to the uterus. The cervix is the constricted caudal part of the uterus and is thicker than the uterine body and vagina. It is oriented in a nearly vertical position with the uterine opening dorsally. The vagina is long and connects with the vaginal vestibule at the urethral entrance. The clitoris is broad, flat, vascular, infiltrated with fat, and lies on the floor of the vestibule near the vulva. The clitoral fossa is a depression on the floor of the vestibule that is sometimes mistaken for the urethral orifice. The vulva is the external opening of the genital tract. The vulvar lips are thick and form a pointed commissure. The constrictor vulvae and constrictor vestibule muscles encircle the vulva and vestibule.

SURGICAL PROCEDURE

Clip and surgically prepare the ventral abdomen from the xiphoid to the pubis. Identify the umbilicus, and visually divide the caudal abdomen into thirds. In dogs, make the incision just caudal to the umbilicus in the cranial third of the caudal abdomen. More caudal incisions make it difficult to exteriorize canine ovaries. In deep-chested dogs or in those with an enlarged uterus, extend the incision cranially or caudally to allow exteriorization of the tract without excessive traction. In prepubertal puppies, making the incision in the middle third of the caudal abdomen facilitates uterine body ligation. In cats, the body of the uterus is more caudal and difficult to exteriorize; therefore, make the incision in the middle third of the caudal abdomen.

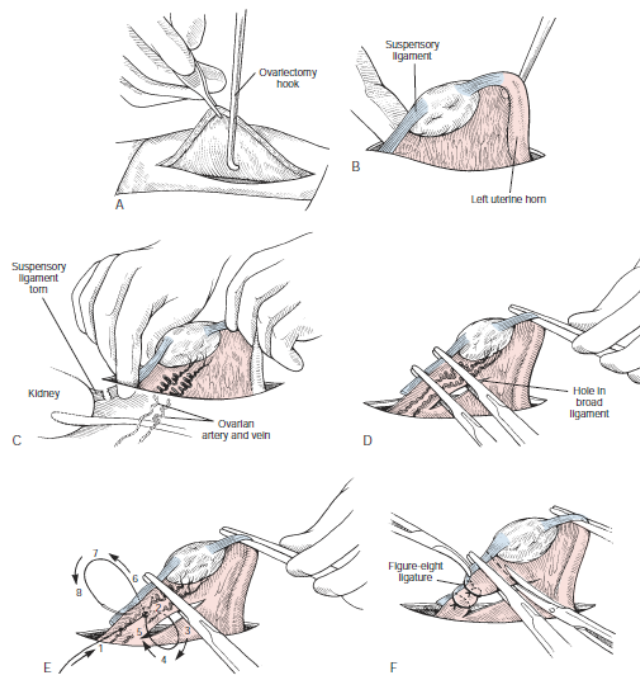
Make a 4- to 8-cm incision through skin and subcutaneous tissue to expose the linea alba. Grasp the linea alba or ventral rectus sheath, tent it outward, and make a stab incision into the abdominal cavity. Extend the linea incision cranial and caudal to the stab incision with Mayo scissors. Elevate the left abdominal wall by grasping the linea or external rectus sheath with thumb forceps.

Slide the ovariectomy hook (e.g., Covault or Snook) with the hook against the abdominal wall, 2 to 3 cm caudal to the kidney. Turn the hook medially to ensnare the uterine horn, broad ligament, or round ligament, and gently elevate it from the abdomen. Anatomically confirm the identification of the uterine horn by following it to either the uterine bifurcation or ovary. If the uterine horn cannot be located with the hook, retroflex the bladder through the incision and locate the uterine body and horns between the colon and bladder. With caudal and medial traction on the uterine horn,

identify the suspensory ligament by palpation at the taut fibrous band at the proximal edge of the ovarian pedicle.

Stretch or break the suspensory ligament near the kidney without tearing the ovarian vessels to allow exteriorization of the ovary. To achieve this, use the index finger to apply caudolateral traction on the suspensory ligament while maintaining caudomedial traction on the uterine horn. Make a hole in the broad ligament caudal to the ovarian pedicle. Place two or three Crile or Rochester-Carmalt forceps across the ovarian pedicle proximal (deep) to the ovary and one across the proper ligament of the ovary. The proximal (deep) clamp serves as a groove for the ligature, the middle clamp holds the pedicle for ligation, and the distal clamp prevents backflow of blood after transection. When using two clamps, the ovarian pedicle clamp serves both to hold the pedicle and to make a groove for the ligature. Place a figure-eight ligature proximal to (below) the ovarian pedicle clamps. Choose an absorbable suture material for ligatures (i.e., 2-0 or 3-0 polydioxanone [PDS], polyglyconate [Maxon], poliglecaprone 25 [Monocryl], glycomer 631 [Biosyn], or polyglactin 910 [Vicryl]).

Begin by directing the blunt end of the needle through the middle of the pedicle, loop the suture around one side of the pedicle, then redirect the needle through the original hole from the same direction and loop the ligature around the other half of the pedicle. Securely tie the ligature. Remove one clamp or “flash” a single clamp while tightening the ligature to allow pedicle compression. Place a second circumferential ligature proximal to (below) the first to control hemorrhage that may occur from puncturing a vessel as the needle is passed through the pedicle. Place a mosquito hemostat on the suspensory ligament near the ovary. Transect the ovarian pedicle between the Carmalt and ovary. Open the ovarian bursa and examine the ovary to be certain that it has been removed in its entirety. Remove the Carmalt from the ovarian pedicle and observe for hemorrhage. Replace the Carmalt and religate the pedicle if hemorrhage is noted. Perform the identical procedure on the other side. For ovariectomy, place one or two encircling ligature of absorbable suture material just caudal to the proper ligament at the tip of the uterine horn. Transect the mesovarium and proper ligament and remove the ovary. Trace the uterine horn to the uterine body. Grasp the other uterine horn, and follow it to the opposite ovary. Place clamps and ligatures as just described. Make a window in the broad ligament adjacent to the uterine body and uterine artery and vein. Place a Carmalt across the broad ligament on each side and transect. Apply a ligature around the broad ligament if the patient is in estrus or pregnant, or if the broad ligament is heavily infiltrated with vessels or fat. Apply cranial traction on the uterus, and ligate the uterine body cranial to the cervix. Place a figure-eight suture through the body using the point of the needle and encircling the uterine vessels on each side. Place a circumferential ligature nearer the cervix. Place a Carmalt across the uterine body cranial to the ligatures. Grasp the uterine wall with forceps or mosquito hemostats cranial to the ligatures. Transect the uterine body, and observe for hemorrhage. Religate if hemorrhage is observed. Replace the uterine stump into the abdomen before releasing the hemostats or forceps. Close the abdominal wall in three layers (fascia/linea alba, subcutaneous tissue, and skin).



A- For ovariohysterectomy, elevate the abdominal wall with thumb forceps and slide the ovarioectomy hook against the abdominal wall, 2 to 3 cm caudal to the kidney.

B- Exteriorize the uterine horn with the hook and identify the suspensory ligament at the cranial edge of the ovarian pedicle.

C- Stretch or tear the suspensory ligament to allow exteriorization of the ovary using the index finger to apply caudolateral traction on the suspensory ligament while maintaining caudomedial traction on the uterine horn.

D- Place two Carmalt forceps across the ovarian pedicle proximal to the ovary and one across the proper ligament (or place three forceps proximal to the ovary). Remove the most proximal clamp and place a figure-eight ligature at this site.

E- Direct the blunt end of the needle through the middle of the pedicle (1 to 2), loop the suture around one side of the pedicle (3 to 4), then redirect the needle through the original hole from the same direction (5 to 6), and loop the ligature around the other half of the pedicle (7 to 8). Securely tie the ligature (1 and 8).

F- Place a circumferential ligature proximal to the first ligature, then place a hemostat on the suspensory ligament near the ovary. Transect the ovarian pedicle distal to the clamp across the ovarian pedicle.