

**THERAPEUTIC EFFECT OF KAEMPFERIA PARVIFLORA (Black Ginger)
TOWARDS SCABIES IN CAT**

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(D17A0023)

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CERTIFICATION

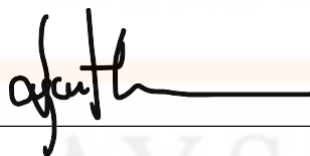
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DEDICATIONS

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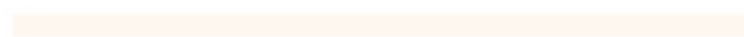
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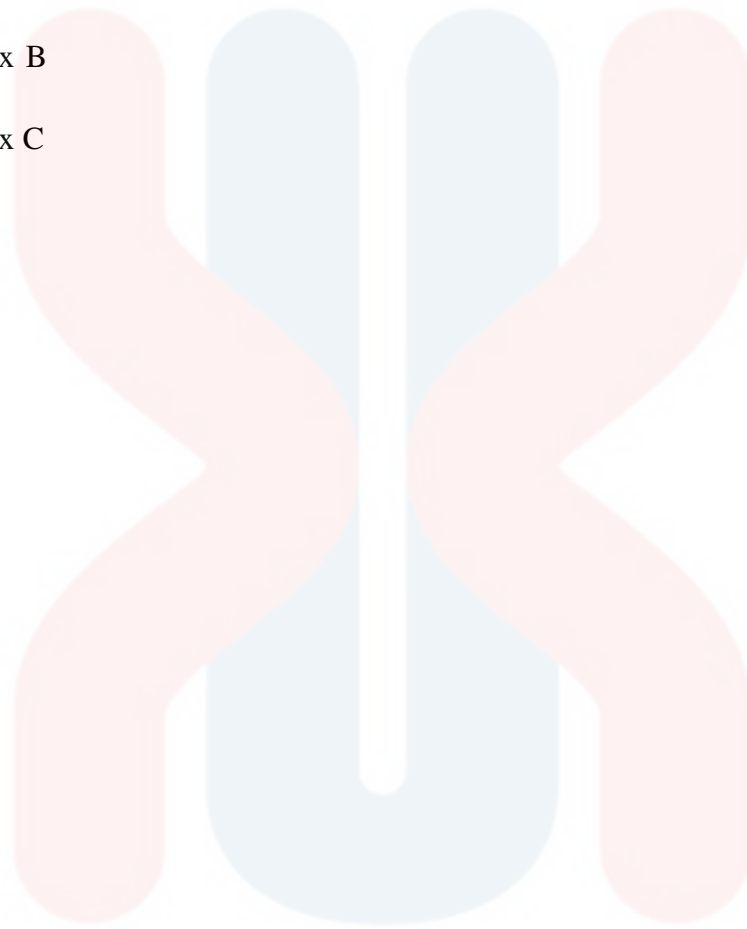
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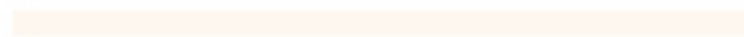
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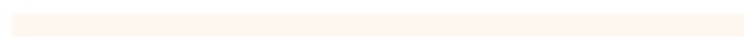
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ABSTRACT

An abstract of the research paper presented to the Faculty of Veterinary Medicine, Universiti Malaysia Kelantan, in partial requirement on the course DVT 5436 – Research Project.

Scabies in cats is a highly contagious parasitic skin disease that can be caused by *Notoedres cati* and *Sarcoptes scabiei*. This is an experimental study to determine the therapeutic effect of black ginger - *Kaempferia parviflora* towards scabies in cats. Therefore, 12 stray cats with clinical signs of scabies infestation in Kota Bharu, Kelantan were captured and placed in an isolation room of animal holding room FPV, UMK. Deep skin scrapings were performed to determine the scabies infestation in these stray cats. Lesion severity and extension score were also evaluated before treatments were given. The cats were divided into 4 treatment groups and triplicate. The higher concentration of black ginger paste (0.7 g/ml) showed better effect than lower concentration of black ginger paste (0.5 g/ml). Then, no significant difference was shown between the 4 treatment groups. Thus, black ginger might have therapeutic effect toward scabies infestation in cats.

Keywords: Black ginger, Coconut oil, Ivermectin, Scabies, Stray cats, Therapeutic effect

ABSTRAK

Abstrak daripada kertas penyelidikan dikemukakan kepada Fakulti Perubatan Veterinar, Universiti Malaysia Kelantan untuk memenuhi sebahagian daripada keperluan kursus DVT 5436 – Projek Penyelidikan.

Kudis pada kucing adalah penyakit kulit parasit yang sangat menular disebabkan oleh *Notoedres cati* dan *Sarcoptes scabiei*. Ini adalah kajian eksperimen untuk menentukan kesan terapeutik halia hitam - *Kaempferia parviflora* terhadap kudis dalam kucing. Justeru, 12 ekor kucing terbiar yang mempunyai tanda klinikal serangan kudis di Kota Bharu, Kelantan telah berjaya ditangkap dan ditempatkan di bilik pengasingan dalam bilik pegangan haiwan FPV, UMK. Pengikisan kulit dalam telah dilakukan untuk menentukan serangan kudis pada kucing terbiar ini. Keterukan lesi dan skor lanjutan juga telah dinilai sebelum rawatan diberikan. Kucing dibahagikan kepada 4 kumpulan rawatan dengan tiga kali ulangan. Kepekatan pes halia hitam yang lebih tinggi (0.7 g/ml) telah menunjukkan kesan yang lebih baik daripada kepekatan pes halia hitam yang lebih rendah (0.5 g/ml). Kemudian, tiada perbezaan yang signifikan telah ditunjukkan diantara empat kumpulan rawatan yang berbeza. Oleh itu, halia hitam mungkin mempunyai kesan terapeutik terhadap serangan kudis dalam kucing.

Kata kunci: Halia hitam, Minyak kelapa, Ivermectin, Kudis, Kucing-kucing Liar, Kesan terapeutik

1.0 INTRODUCTION

Stray cats are cats that wander outdoors and they can be found on the streets, food courts, markets and have no home. Cats can also be free roaming domestic and are not considered pets as they live outdoors and are not owned. As the stray cats are outdoors, they are prone to get parasitic infestation. The prevalence of ectoparasite on stray cat population from Kota Samarahan, Sarawak showed that 113 (75.3%) stray cats out of total 150 stray cats that have been examined for ectoparasites, were infested by at least one species of ectoparasites (Che Kamaruddin et al., 2020).

Scabies is caused by several types of mites and it is a zoonotic disease. Mites are arthropods that are included in the Arachnida class, in the sub-class Acarina, order Astigmata and the Sarcoptidae family (Iqomah *et al.*, 2020). Scabies in cats is a highly contagious parasitic skin disease that can be caused by *Notoedres cati* and *Sarcoptes scabiei*. The *Sarcoptes scabiei* and *Notoedres cati* can be differentiated by their size where *Notoedres cati* has a smaller body size than *Sarcoptes scabiei*. Then, *Notoedres cati* are more commonly found in cats compared to *Sarcoptes scabiei* (Hardy et al., 2012).

The Notoedric mange progresses to involve the face and if the lesion is not treated, it will progress and cover the cat's entire body (Muller *et al.*, 2001). Notoedric mange is also a zoonotic disease that can be transmitted and spread to humans (Iqomah et al., 2020). This feline mange manifests clinically as intense pruritic, dry scab lesions that initially on the pinna. Then, the lesion will spread quickly above ears, face and neck (Munoz et al., 2021).

There are various chemical controls for cats that have scabies include ivermectin, selamectin, moxidectin and others (Brooks, 2001). Next, parasite control in animals has been based on routine use of chemical compounds often several times per year. Even though, the vast importance of antiparasitic drugs in parasite control, there are increasing problems in drug resistance (Elsheika, 2014). Therefore, there is a need to use alternative parasitic control in animals. Moreover, there are a few alternative treatments for the cat that have scabies include turmeric, aloe vera, coconut oil and others (John et al., 2016).

Ginger is a rhizome of the *Zingiber officinale* (Rahmani et al., 2014) and belongs to the family Zingiberaceae that is in the same family with turmeric and also cardamom

(Muthuswamy et al., 2011). It has therapeutic roles in disease management via modulation of biological activities including anti-inflammatory and anti-oxidative activities (Rahmani et al., 2014). Furthermore, there are several anti-parasitic activities of ginger including nematocidal, trematocidal, cestocidal, molluscicidal, anti-leech, anti-protozoal and insecticidal. Therefore, ginger has anti-parasitic activity toward several parasites and it can be used as alternative treatment in order to prevent any drug resistance toward parasitic diseases (El-Sayed et al., 2015).

1.1 Research problem

Scabies in cats is a common disease and a zoonotic disease. Ivermectin toxicity is reported in treatment of scabies in cats but it is uncommon. The common treatment that is used to treat scabies in cats is ivermectin and it can be resistant in the near future. However, there is limited research on alternative control towards scabies in cats in Malaysia.

1.2 Research questions

1.2.1 Is black ginger effective towards reducing scabies infestation in cats?

1.3 Research hypothesis

1.3.1 Black Ginger is effective in reducing scabies infestation in cats.

1.4 Objectives

To determine the therapeutic effect of black ginger towards scabies infestation in cats.

2.0 LITERATURE REVIEW

2.1 Scabies in cat

Scabies in cats is highly contagious and it can be transmitted by direct contact. This disease can affect whole litters and both sexes of the adult cats. The large number of mites will be present in the affected cats and it will be easily found on skin scraping (Muller et al., 2001).

2.2 Life cycle of *Notoedres cati*

The life cycle of *Notoedres cati* fully occurs on the host as the mites cannot survive off the host more than a few days. Males and females will mate on the skin of a cat. Then, the females will dig subcutaneous tunnels into the skin. In the burrows beneath the epidermis, the females will lay their eggs. When the eggs hatch, it will release larvae. The larvae will develop into nymphs and then, the nymphs will develop into adult mites (Besteiros, 2019).

2.3 Control of scabies in a cat

There are several options to treat and control scabies in cats including ivermectin, selamectin, moxidectin and dipping. Ivermectin is one of the first treatments that will be used against *Notoedres cati*. The treatment usually will be given every 2 weeks for a month. Then, for selamectin, it was designed as flea, heartworm and intestinal parasite control. It is effective against *Notoedres cati* and extensively used for flea control. Next, for moxidectin, it is used against fleas, ear mites, heartworm, roundworms and hookworms. For the dipping, a series of 6 to 7 lime sulfur baths or amitraz dips were used to control scabies in cats. But, this method is rarely used nowadays as the lime sulfur will discolor the cat's fur and amitraz also can cause sedation in some patients (Brooks, 2001).

2.4 Ivermectin toxicity in cat

Ivermectin is a macrocyclic lactone disaccharide and it interacts with gamma-aminobutyric acid (GABA) and glutamate-gated channels that can lead to flaccid paralysis of parasites. Ivermectin is safe to be used in cats but acute toxicity can occur due to massive overdoses and the acute signs will appear within 10 hours of ingestion. The effects and signs of ivermectin toxicity in

cats include vocalization, extreme ataxia (dragging hindlimbs), circling, head pressing, disorientation, anorexia, bradycardia, hypothermia, loss of most reflex, tremors, mydriasis and others (Lovell, 1990). The signs completely recover within 2 to 4 weeks.

Next, ivermectin has an effective treatment towards sarcoptic mange in rabbits. However, it has several adverse effects in rabbits such as complete necrosis of spermatogenic cells with complete absence of sperms, extreme hemorrhage of the uterus, atretic follicles and degenerated ova in the ovaries of female rabbits. Besides, resistance towards ivermectin treatments also has been reported in some developing countries. Thus, alternative control of scabies is getting more concern and has been studied by several researchers (Abu Hafsa et al., 2021).

2.5 Alternative control of scabies

There are several alternative controls of scabies in cats including aloe vera, virgin coconut oil and others. There is recent research that studies the ability of aloe vera and virgin coconut oil to accelerate the healing process in cats that suffer from scabies. From the study, 32 domestic cats (26 cats positive for *Notoedres cati*, 2 cats positive for *Sarcoptes scabies* and 4 cats are negative) that suffer from scabies in Mojokerto, Indonesia were used and continued with treatment. The cats were given the treatment for 7 weeks and the physical examination was done at weekly intervals. The pruritus began to disappear in the 4 weeks of treatment. After 7 weeks of treatment, skin scrapings were done and examined for ectoparasites. Then, from the skin scraping result, ectoparasites were found to be negative (Solikhah et al., 2021).

The other alternative control of scabies including turmeric powder, neem oil and aloe vera. Next, there are five mixtures type were used in a study of alternative control methods of ectoparasites on dogs. One of the five mixtures type that were used in the study are the mix of the neem oil and turmeric powder. Based on the study, the ectoparasites were completely removed from the dogs after applying the prepared mixtures and also by fumigation methods. There are also no side effects of the mixtures towards the dogs (John et al., 2016).

Furthermore, there is a study that turmeric extract supplementation can reduce the side effects of ivermectin and also treat clinical rabbit sarcoptic mange. In this study, the rabbits were given treatment with ivermectin and together with 1 mg and 2 mg turmeric extract, respectively. The results in the study showed that the turmeric extract improved rabbit performance and can be used in conjunction with a miticide in order to treat sarcoptic mange in rabbits (Abu Hafsa et al., 2021).

2.6 Pharmacological activities of ginger and its constituent

There are several pharmacological activities of ginger and its constituents include anti-inflammatory activities, antioxidant activities and others. Inflammation involves a complex immune process and various mediators include interleukin-1 (IL-1), tumor necrosis factor (TNF) and anti-inflammatory cytokines. Ginger shows a significant role in suppressing and inhibiting the synthesis of cytokines such as IL-1, TNF- α , and IL-8. Moreover, ginger also play a role in the inhibition of COX and 5-lipoxygenase that are essential for the metabolism of arachidonate (arachidonic acid) and also down-regulating the induction of inflammatory genes.

Next, ginger also plays a role in antioxidant activities. Antioxidants are the substances that play a role to neutralize free radicals and also oxidative stress. Lastly, ginger also plays a significant role in reduction of the lipid oxidation and inhibits the pathogenesis of diseases (Rahmani et al., 2014).

2.7 Potential of ginger as alternative control of parasite

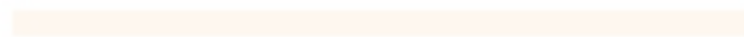
A study was done in 2019 to evaluate the insecticidal efficiency and repellency of ginger toward black bean aphid (*Aphis fabae Scop*). The ginger was prepared in a form of powder. From the study, the ginger powder showed repellent activity toward 3rd, 4th nymphal instars and adults of black bean aphid. In addition, the ginger also has insecticide activity and it can be used as alternative insecticides toward *Aphis fabae Scop* (Abdulhay et al., 2019).

Next, a study was done in 2017 to evaluate the efficacy of ginger crude extracts against *Musca domestica* (Housefly) larvae. Based on the study, the crude extracts of ginger were able to increase the larvae mortality as they had several constituent compounds that contribute to the insecticidal activity. The

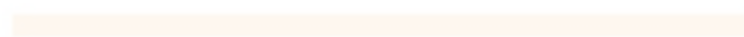
constituent compounds in ginger that enhance the insecticidal activity include gingerols, shogaol and *B*-phenylnitromethane (Ojianwuna et al., 2017).



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3.0 MATERIALS AND METHODS

This study was conducted after receiving approval from Animal Ethic Committee 2022 of the Faculty Veterinary Medicine, Universiti Malaysia Kelantan: UMK/FPV/ACUE/FYP/018/2022. The approval form was attached together in Appendix A.1.

3.1 Study animals

The study was conducted in Kota Bharu, Kelantan and involved 12 stray cats with clinical signs of scabies who were caught around the market at 'Berek 12' and 'Pengkalan Chepa'. The cats included both sexes and cats age range between 6 to 48 months. These cats were placed individually in stainless steel cage in an isolation room at the animal holding of Faculty Veterinary Medicine, UMK. In each cage, they were equipped with a plastic feed and water bowl, and also a litter box. All cats were fed with ad-libitum commercial dry food and water twice a day. They were acclimatized for 1 week before starting the experimental study.

3.2 Study design

The study was carried out in experimental study design which is a Randomized Block Design (RBD). The randomized block design is a generic name for a family of experimental designs in which the experimental material is split up into a number of mini experiments that are recombined in the final statistical analysis. It was conducted with a total of 12 selected stray cats that showed clinical signs of scabies infestation in Kota Bharu, Kelantan. The skin scraping technique was conducted to examine the presence of mites in the selected cats. One of the cats was given only coconut oil as negative control while the other two cats were given different amounts of black ginger paste at 0.5 g/ml and 0.7 g/ml respectively, and one cat was treated with ivermectin as positive control. For the negative control, coconut oil was applied by using a brush while for the positive control, ivermectin was given subcutaneously. For the treatment with black ginger paste, it will be applied twice a day at the area of skin lesion. Then,

the skin scraping was conducted again after 2 weeks of treatment. This experiment was repeated twice with another 8 cats with scabies infestation.

Table 1: Four groups with different treatments

Negative control	Black ginger Treatment Group		Positive Control
Cat 1	Cat 2	Cat 3	Cat 4
Coconut oil	0.5 g/ml of black ginger paste	0.67 g/ml of black ginger paste	Ivermectin (0.4 mg/kg)

3.3 Preparation of black ginger paste

The study was conducted by using black ginger powder, prepared by Dr Suganthi by using Black Ginger plant IFSSA variety. For the preparation of 0.5 g/ml of black ginger paste, 1g of black ginger powder was added to 2 ml of coconut oil in a 12 cm size stainless-steel bowl. Next, for the preparation of 0.67 g/ml of black ginger paste, 2g of black ginger powder was added to 3 ml of coconut oil in another stainless-steel bowl. The black ginger paste was stirred and then applied to the cat's lesion area by using a brush.

3.4 Usage of ivermectin

The study was conducted by using ivermectin, provided from 'Hospital Pengajaran Veterinar UMK (HPVUMK)'. For the preparation of ivermectin injection, a 1 ml syringe, 23-gauge needle and an alcohol swab was prepared beforehand. The ivermectin was given at dosage 0.4 mg/kg subcutaneously to the cats in the positive control group.

3.5 Study procedure

3.5.1 General health assessment

The general assessment was done on each cat. Physical examination including measuring of body weight, heart rate, respiratory rate and temperature was done before starting the treatment which is on Day 0 to ensure the cats were fit to undergo the treatments. For the general

observations including assessment of appetite, defecation and urination was done daily which begins from Day 0 until Day 15.

3.5.2 Notoedric lesion assessment

Notoedric lesion assessment was done on each cat on Day 0 (pre-treatment) and Day 15. A Notoedres lesion score was applied from a study from Hellmann *et al.* (2013) with moderately modification.

Table 2: The severity score of Notoedric lesion

Score	Description
0	no skin lesions, no alopecia, no scratching
1	mild skin lesions, mild alopecia, occasionally scratching
2	moderate skin lesions, moderate alopecia, intensive scratching, scratching wounds
3	severe skin lesions, severe alopecia, thick/ crusty and scabby appearance of the skin, intensive scratching, scratching wounds

Table 3: The extension scores of Notoedric lesion

Score	Description
0	no skin lesions
1	ear region
2	ear and face region
3	ear, face and neck region
4	ear, face, neck and feet region

Both scores were added up and expressed as Notoedres-induced skin lesions score (NISLS) with sum value between 0 and 7.

Table 4: The possible outcomes of treatments

Clinical cure	NISLS reduced to zero
Clinical improvement	NISLS < 25% compare to pre-treatment on Day 15
Clinical failure	NISLS \geq 25% compare to pre-treatment on Day 15

3.5.3 Deep skin scraping

Deep skin scraping was performed for all cats on Day 0 and Day 15 at three different sites. There are several materials used in the deep skin scraping procedure including scalpel blade, glycerine, cover slip and glass slide. There are a few steps in the procedure of skin scraping. Firstly, a scalpel blade was held perpendicularly to the skin and scraped in the direction of the hair coat until the capillaries oozed a small amount of blood. Then, the skin scraping was spread thinly on the glass slide with a few drops of glycerine. Next, a cover slip was placed over the glycerine. Lastly, the slide was observed under light microscope at 4x, 10x, 40x magnification. The result of deep skin scraping was indicated in either positive or negative.

3.6 Statistical analysis

Data were statistically analysed by using IBM SPSS Statistics 26. The notoedric lesion score results between treatment groups were analysed by using a one-way analysis of variance, Kruskal-Wallis.

4.0 RESULTS

4.1 General health analysis

The general health of the stray cats was monitored throughout the study. The cats were observed following the application of the black ginger paste treatment for any evidence of adverse effect. There are no adverse effects observed aside from there are a few cats showing signs of itching but only for a short period of time and during first time application of the black ginger paste. Positive defecation and urination were shown in all 12 cats throughout the study. The detailed health assessment results were tabulated in the Appendix B.1.

4.2 Notoedric lesion analysis

The detailed result for notoedric skin lesion of black ginger treatment group, positive control group and negative control group were tabulated in Table 5. The cats in the negative control group and black ginger paste (0.5 g/ml) treatment group showed consistent Notoedric-Induced Skin Lesions Score that indicates the treatment outcome is clinical failure. Next, reduction of Notoedres-Induced Skin Lesions Score were observed in cats from treatment group black ginger (0.7 g/ml) and positive control group (ivermectin) that indicates the outcome of treatment is clinical improvement.

The progression of notoedric lesions were observed both before the treatment (Day 0) and after the treatment (Day 15). For the black ginger paste group (0.7 g/ml), Cat A, crusted lesions, scratch wounds and alopecia were observed at ear pinnae region before the treatment and the lesion still persisted after the treatment. Next, for Cat H, only crusted lesions were observed at ear pinnae region before treatment and the lesion also still persisted after the treatment. Cat L had a crusty skin lesion and alopecia at ear pinnae region before the treatment (figure 1) and the crusted lesion mostly resolves with hair growth at the ear pinnae region after the treatment (figure 2).

For the black ginger paste group (0.5 g/ml), all 3 cats showed persistent lesions after the treatment. For Cat I and Cat C, both showed only crusted lesion at ear

pinnae before the treatment while for Cat F, it showed crusted lesion and alopecia at ear pinnae, face, neck and also feet region before the treatment.

For the positive control group, Cat D, it showed crusted lesions at ear pinnae and face region before the treatment and the lesion still persisted after the treatment. For Cat G, it showed crusted lesions at ear pinnae, face, neck and also feet region before the treatment and the crusted lesions were mostly resolved after the treatment. Then, for Cat K, crusted lesions were shown at ear pinnae, face and also neck region before the treatment and the lesion were mostly resolved after the treatment. The crusted lesions were only present at ear pinnae region after the treatment in both Cat G and Cat K.

For the negative control group, only Cat J showed persistent skin lesions after the treatment. For Cat B, it showed crusted lesions at ear pinnae, face and neck region before treatment and the lesions were extended to neck region after the treatment. Then, for Cat E, it showed crusted lesions and alopecia at ear pinnae and face region before the treatment and the lesion were extended to feet region after the treatment. Last but not least, for Cat J, it showed crusted lesions at ear pinnae region before the treatment.

Based on the Kruskal-Wallis test, there is no significant difference between 0.7 g/ml of black ginger paste, 0.5 g/ml of black ginger paste, positive control and negative control in notoedric lesion score ($p>0.05$).

Table 5: Notoedric lesion score results

Group	Cat id	Notoedres-Induced Skin Lesions Score (NISLS)			Outcome
		Pre-treatment	Post-treatment	Reduction	
Black ginger paste 0.7 g/ml	A	2	2	0	Clinical failure
	H	3	3	0	
	L	4	2	2	Clinical improvement
Black ginger paste 0.5 g/ml	C	2	2	0	Clinical failure
	F	7	7	0	
	I	2	2	0	
Positive control	D	3	3	0	Clinical failure
	G	7	2	5	Clinical improvement
	K	5	2	3	
Negative control	B	4	5	-1	Clinical failure
	E	5	7	-2	
	J	2	2	0	

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Figure 1: Notoedres-Induced Skin Lesions condition of Cat L before starting the treatment



Figure 2: Notoedres-Induced Skin Lesions condition of Cat L after finishing two weeks of black ginger paste (0.7 g/ml) treatment

4.3 Deep skin scraping analysis

The *Notoedres cati* and their eggs were identified by using a light microscope at 4x, 10x and 40x magnification. The mite has a long, unsegmented pedicle that can be observed in Figure 3. The detailed result for mite of black ginger treatment group, positive control group and negative control group were tabulated in Table 6 Next, all 12 cats were positive for *Notoedres cati* before starting any of the treatment. Then, all cats in black ginger paste group, positive control group and negative control group were absent of mites for post-

treatment except one cat from the positive control group that still had mites after the treatment.

Table 6: Number of cats positive of mites in pre-treatment and post-treatment

Group	Number of cats	
	Pre-treatment	Post-treatment
Black ginger paste (0.7 g/ml)	3	0
Black ginger paste (0.5 g/ml)	3	0*
Negative control	3	0*
Positive control	3	1

*1 cat dead from each group before finishing the 2 weeks of treatment

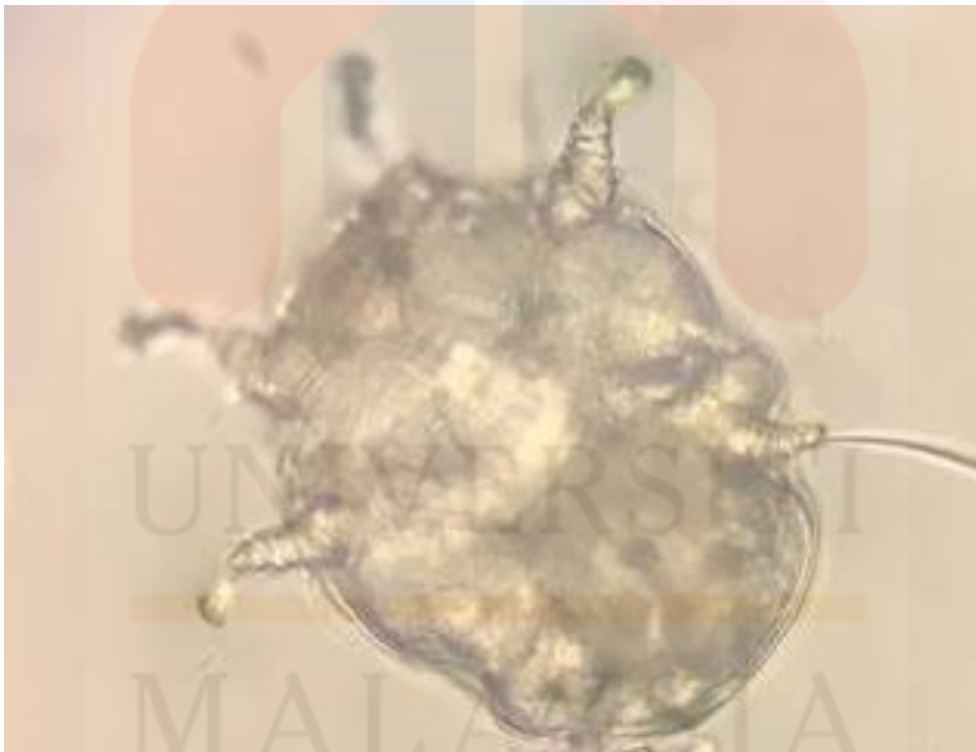


Figure 3: *Notoedres cati* at 40x magnification

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5.0 DISCUSSION

Two cats of positive control group showed reduction in notoedric skin lesion while only one cats that were treated with 0.7 g/ml of black ginger paste showed the reduction in notoedric skin lesion after the treatment. This showed that ivermectin had accelerated wound healing in cats with scabies infestation. Based on Sia, et al (2020), ivermectin can promote cutaneous wound healing through two mechanisms. The two mechanisms of promoting wound healing including modulation of inflammation and also through regulation of TGF- β 1 and VEGF levels.

Next, all cats were shown the absence of mites after the treatment except for one cat that were treated with ivermectin. The lesion score was also consistent from Day 0 to Day 15. It can be due to drug resistance. In addition, the parasitic resistance toward ivermectin has already been reported in nematodes of sheep and other animals. Next, there are two mechanisms of ivermectin resistance including the alteration of P-glycoprotein and alteration of the chloride channel receptor. The P-glycoprotein is a membrane protein that actively transports the drug across cell membranes (Dourmishev, et al, 2005). Hence, ivermectin is effective against scabies in cats but there is a possibility of drug resistance occurring in cats.

Furthermore, two cats that treated with 0.7 g/ml of black ginger paste and all three cats that treated with 0.5 g/ml of black ginger paste showed consistent notoedric lesion score after the treatment. Even though the notoedric lesion score remained the same after the treatment, the black ginger paste had ability to kill the mites as there were absence of mites in cats for both concentration of black ginger paste. Therefore, black ginger paste had antiparasitic activity against scabies infestation in cats as it was able to kill mites after the two weeks of treatment.

In addition, there were 2 cats that were treated with only coconut oil (negative control) and showed an increase in notoedric lesion score that indicated clinical failure. For that reason, the notoedric lesion in the two cats became worse after the treatment. Based on Nevin, et al (2010), animals that were treated with virgin coconut oil had accelerated wound healing activity. But, the results from

cats of the negative control group showed that the coconut oil did not heal the notoedric lesion. There are several factors that can interfere with wound healing including physical factors, endogenous factors and exogenous factors. The physical factors such as temperature, pressure and tissue oxygen levels (Winkler, 2022). Moreover, there is no significant difference between the different groups of treatment in notoedric lesion score. Thus, the reduction of the notoedric score in the positive group is not significant as based on the Kruskal-Wallis test result.

6.0 CONCLUSION AND RECOMMENDATION

In conclusion, cats in 0.7 g/ml of black ginger paste group showed absence of mites after the treatment and there are two cats that had consistent lesion score after treatment while one cat had reduced lesion score after the treatment. This shows that the 0.7 g/ml of black ginger paste can kill the mites effectively but need a longer duration of treatment to fully resolve the notoedric lesion.

For the recommendation, increase both the duration of the treatment and also the concentration of black ginger paste for future research in order to observe the significant healing of the notoedric skin lesion in cats. Last but not least, isolation and characterization of the bioactive compounds that are present in black ginger should be targeted in the future research.

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Appendix A

Fakulti Perubatan Veterinar


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RUJ. KAMI (*Our Ref*) : UMK/FPV/ACUE/FYP/018/2022
TARIKH (*Date*) : 17 SEPTEMBER 2022

DR. TAN LI PENG
Main Supervisor
Faculty of Veterinary Medicine
Universiti Malaysia Kelantan

Dear Dr,

APPROVAL OF INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC) TO CONDUCT RESEARCH INVOLVING ANIMALS

We are pleased to inform you that your application for approval to conduct research from Institutional Animal Care and Use Committee (IACUC), Faculty of Veterinary Medicine, Universiti Malaysia Kelantan has been approved. Please refer the table below for approval code:

APPROVAL CODE	UMK/FPV/ACUE/FYP/018/2022
TITLE	THERAPEUTIC EFFECT OF BLACK GINGER (<i>KAEMPFERIA PARVIFLORA</i>) TOWARDS SCABIES IN CAT

2. Please be noted for the Final Year Project, you are responsible to supervise your student to conduct all animal-related procedures as stated during ethic application. The co-supervisor(s) for the project are encouraged to help with the procedures as well.

3. You are advised to always follow "3R" (REDUCE, REFINE, & REPLACE) and all animal ethics and animal welfare principles to reduce suffering in animal.

Thank you.

"RAJA BERDAULAT, RAKYAT MUAFAKAT, NEGERI BERKAT"
"WAWASAN KEMAKMURAN BERSAMA 2030"
"BERKHIDMAT UNTUK NEGARA"

Yours sincerely,


(DR. NURSHAHIRAH BINTI SHAHARULNIZIM)
Chairman
Institutional Animal Care and Use Committee
Faculty of Veterinary Medicine

UNIVERSITI MALAYSIA KELANTAN اونیورسیتی ملیسیا کلانتن Karung Berkunci (*Locked Bag*) 36, Pengkalat Chepa, 16100 Kota Bharu, KELANTAN, MALAYSIA Tel : 609 771 7277 Fax : 609 771 7282

FYP FPV

Appendix A.1: Ethic approval letter

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Appendix B

Group	Cat ID	Body condition score	Heart rate (bpm)	Respiratory rate (bpm)	Temperature (°C)
0.7 g/ml of black ginger paste	A	3	120	32	38.1
	H	3	148	36	39.0
	L	3	128	16	38.0
0.5 g/ml of black ginger paste	C	3	132	28	38.3
	F	2	132	24	37.9
	I	3	138	40	38.5
Positive control	D	3	126	28	38.3
	G	3	128	16	38.0
	K	3	144	32	38.7
Negative control	B	3	124	20	38.4
	E	2	112	28	38.1
	J	3	132	36	38.0

Appendix B.1: General health assessment of all 12 cats on Day 0

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Appendix C

Appendix C.1: List of the treatment that given to the cats, from right to left, ivermectin (positive control), 0.5 g/ml of black ginger paste, 0.7 g/ml of black ginger paste and coconut oil (negative control)

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Appendix C.2: Measuring of black ginger powder by using portable mini digital weighing scale

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