THE PRESENCE OF ENDOPARASITES IN CAPTIVE ASIAN ELEPHANTS (*Elephas Maximus)* IN MALAYSIA.

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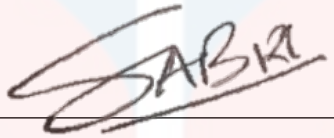
CERTIFICATION

This is to certify that we have read this research paper entitled '**Presence of Endoparasites in Captive Asian Elephants (*Elephas Maximus*) In Malaysia**' by Subeinthiran Rinagasamy. It is satisfactory in scope, quality, and presentation as a partial fulfillment of course DVT 55204 – Research Project requirement.



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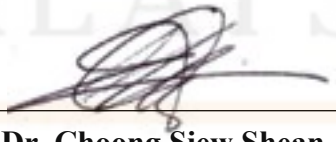

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ABSTRACT

This study is conducted to identify the endoparasite in captive Asian Elephants (*Elephas maximus*) in Malaysia as no documentaries about endoparasites in Asian Elephants is yet to be produced**.** Fecal samples were obtained from Captive Asian Elephant reared in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village. A total of 30 captive elephants were randomly recruited from the four locations. Fecal flotation, McMaster, fecal sedimentation, and Fecal culture were performed to observe and identify the endoparasites from the fecal sample. The overall detection rate of endoparasites worm infestations in the Captive Asian Elephant from all 4 locations was 77%. *Fasiola* sp., *Ancylostoma* sp.*, Strongyloides* sp.*, Oesophagostomum* sp., and *Demodex* sp. eggs were identified. The age, sex, the deworming status, and the drugs used for the Asian Elephant in captivity from Location A, B, C and D were recorded. No significant findings were obtained from the four risk factors- age, sex, area, and deworming status against the parasite load. In conclusion, the majority of the Asian elephants whose samples were taken from all four locations were infested with parasites with some the elephants had very high intensities. The outcomes of this study provide a preliminary understanding of endoparasites infestation in captive elephants with crucial diagnosis confirmation to improve treatment and prevention management.

Keywords*: Elephants, Endoparasites, Malaysia, Risk Factors, Fasiola* sp.*, Ancylostoma* sp.

ABSTRAK

Kajian ini dijalankan untuk mengenal pasti endoparasit dalam kalangan Gajah Asia tawanan *(Elephas maximus)* di Malaysia kerana tiada dokumentari mengenai endoparasit dalam Gajah Asia masih belum dihasilkan. Sampel najis diperoleh daripada Gajah Asia tawanan di Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, dan Kenyir Elephant Conservation Village. Sebanyak 30 ekor gajah dipilih secara rawak dari keempat-empat tempat tersebut. Fecal flotation, McMaster, fecal sedimentation, dan Fecal culture dijalankan untuk memerhati dan mengenalpasti endoparasit daripada sampel najis. Kadar pengesanan keseluruhan serangan cacing endoparasit dalam Gajah Asia tawanan dari semua 4 lokasi adalah 77%. *Fasiola* sp., *Ancylostoma* sp., *Strongyloides* sp., *Oesophagostomum* sp. dan telur *Demodex* sp. dikenal pasti. Umur, jantina, status ubat cacing, dan ubat-ubatan cacing yang digunakan untuk Gajah Asia tawanan dari Lokasi A, B, C dan D telah direkodkan. Tiada penemuan penting diperoleh daripada empat faktor risiko- umur, jantina, kawasan, dan status ubat cacing terhadap beban parasit. Kesimpulannya, majoriti Gajah Asia yang sampelnya diambil dari keempat-empat tempat telah dijangkiti parasit GI, dan beberapa gajah mempunyai keamatan yang sangat tinggi. Hasil kajian ini memberikan pemahaman awal tentang serangan endoparasit dalam gajah tawanan dengan pengesahan diagnosis penting untuk meningkatkan pengurusan rawatan dan pencegahan.

***Kata Kunci**: Elephants, Endoparasites, Malaysia, Risk Factors*

1.0 INTRODUCTION

Although the Asian elephant is somewhat smaller than the African elephant, the elephant is the largest terrestrial animal on Earth. Asian elephants *(Elephas maximus)*, which inhabit forested areas of India and Southeast Asia, including Myanmar, Thailand, Cambodia, and Laos, can be identified by their smaller, rounder ears. The World Wildlife Fund (2018) stated that the Asian elephant populations are captive to around a third of them. There are an estimated 20,000–40,000 Asian elephants left in the wild, excluding those kept in captivity, according to the International Union for the Conservation of Nature (IUCN), where their number has decreased by 50% over the past 75 years. (Williams *et al.,* 2019).

Nearly one-third of the Asian Elephants are kept in captivity in Thailand, India, and Myanmar. Elephants have historically been used in agriculture, logging, and occasionally in conflict. According to The National Geographic (2019) the captive Asian Elephants are utilized more frequently in the tourism sector, where many have received training to give rides, perform in shows, and engage directly with visitors.

Elephant population is threatened by many reasons such as poaching, loss of habitat, epidemic disease outbreaks and poor management. (Riddle *et al.,* 2010). In many regions of the world, it is also challenging to enforce laws governing the welfare of captive elephants. The National Geographic (2019) stated that the elephants held in captivity around the world face welfare problems such stifling conditions, isolation, hunger, physical harm, and signs of psychological distress that have been well- documented.

Furthermore, parasitism affects the host's behavior, health, and fertility, altering and helps the parasite spread. Additionally, Bornean elephants have a higher detection rate of parasites due to anthropogenic effect on their habitat. (Hing *et al.,* 2013). It is projected that due to more encounters between people, domestic animals, and wildlife animals, it could pose a serious threat to wildlife, whose populations could then serve as reservoirs and/or amplifiers of newly emerging and exotic diseases for people and domestic animals. (Kruse *et al.,* 2004)

Elephant health can be negatively impacted by gastrointestinal parasites, particularly when resource scarcity (King'ori *et al.,* 2020). The probability of death due to endoparasites is higher in young elephants compared to adult elephants. Endoparasitism may show symptoms or clinical signs and causes severe health issues to elephants, depending on the type of endoparasites they are infected with. There would be a potential for the infected elephant to spread the parasites, infecting other species in the wild or captive, as well to people living in rural areas or workers, causing a zoonotic risk. Hence, if the workers did not step up treating parasitic diseases in elephants with the consultation from a veterinarian, potential risk may occur.

Thus, this study is conducted to identify the endoparasites among the captive Asian elephants (*Elephas maximus*) in Malaysia as limited reports on endoparasites in Asian elephants is produced as endoparasitism can cause serious health problem to the elephants which may lead to breeding problem, reduce population and death.

1.1 RESEARCH PROBLEM

Depending on the type of endoparasites elephants are infected with, endoparasitism can manifest as symptoms or clinical indicators and lead to serious health problems. An infected elephant could potentially infect other animals in the wild or in captivity, as well as people living in rural regions or workplaces, posing a zoonotic risk.

There are few studies done in India regarding the endoparasites in Wild Asian elephants in a natural forest area, (Vidya and Sukumar, 2002; Dharmarajan *et al.,* 2005; Nishanth *et al.,* 2012; Vimalraj and Jayathangaraj, 2013; Pechimuthu, 2014) and in captive Asian elephants (Suresh *et al.,* 2001; Kashid *et al.,* 2003; Saseendran *et al.,* 2004; Arunachalam *et al.,* 2007; Thawait *et al.,* 2014; Pandit *et al.,* 2015). The knowledge regarding endoparasite infestation in captive Asian elephants in Malaysia is crucial, but it is still limited. Therefore, as preliminary, this present study was conducted to investigate the occurrence of endoparasites among captive Asian elephants in Zoo Taiping & Night Safari, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.

1.2 RESEARCH QUESTIONS

- What is the detection rate of the parasite load infesting **c**aptive Asian **e**lephants in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village?
- What are the species of endoparasites found in **c**aptive Asian **e**lephants in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village?
- What are the risk factors associating to the endoparasite infestation in captive Asian elephants reared in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village?

1.3 RESEARCH HYPOTHESIS

The detection rate of endoparasite infestation in captive Asian elephants would be high. The most common endoparasites that are expected to be identified in captive Asian elephants would be liver flukes (*Fasciola* sp.), cestodes such as *Anoplocephala* sp., and roundworms, mostly *Strongyle* spp. Sex, age, area, and deworming status are the main risk factors associating with parasite load.

1.4 RESEARCH OBJECTIVES

- To determine the detection rate of the endoparasites infesting captive Asian elephants in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.
- To identify the species of endoparasites found in **c**aptive Asian **e**lephants in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.
- To determine the risk factors associating to the endoparasite infestation in **c**aptive Asian **e**lephants in Zoo Taiping, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.

2.0 LITERATURE REVIEW

2.1 The Asian Elephant (*Elephas Maximus*)

The Asian elephant *(Elephas maximus),* which has a range of 13 countries in South and Southeast Asia, is the largest land mammal on the Asian continent. It lives in habitats ranging from dry to wet forests and grasslands. Although they prefer forage plants, Asian elephants have learned to survive on a variety of local resources. The World Wildlife Fund (2018) stated that Asian Elephants are very gregarious and establish herds of six to seven related females, with the eldest female serving as the matriarch. However, Asian elephant herd sizes are far smaller than those of African savannah elephants.

According to World Wildlife Fund (2018), elephants have always been closely associated with humans throughout Asia, where they have evolved into significant cultural symbols. The gods (deva) and the devils (asura), according to Hindu mythology, trawled the oceans in search of the elixir of life so they may become immortal. Ganesh, also known as Ganapati, Vinayaka, and Pillaiyar, is the Lord of Good Fortune who bestows success, prosperity, and good fortune. He is the Lord of Beginnings and the Taker Away of Physical and Spiritual Obstacles.

From Jeheskel Shoshani (1992), elephants daily consume tremendous amounts of vegetation. One of the reasons elephants are regarded as a keystone species is because it is believed that over 60% of their stools contain vegetation that has either not been fully digested or has only been partially digested due to inadequate nutrient absorption. As the vegetation is deposited along the elephant's route, the vegetation produces new plant growth. Many other species are impacted by their presence or disappearance.

According to Sharma & Baldock (1999), the elephant's digestive system differs significantly from those of other mammals in fascinating ways where unlike cattle and water buffalo, elephants have just one stomach, which makes their digestive system less effective. Elephants only digest and absorb roughly 44% of the food they eat, compared to 60% for cattle and 60% for water buffalo. They consume about 100 kg of food every day, or 6 to 12 percent of their own body weight. In order to eat as much as possible, elephants will consume plants that are typically unpalatable to other animals due to their low nutritional value. It takes 24-50 hours before the excrement is visible because the small germs, bacteria, and protozoa, rather than the elephant's own digestive acids, are responsible for breaking down the nutrients. This suggests that the elephant's stomach is its most vulnerable area.

2.2 Common Endoparasites in the Asian Elephants

Nematodes, cestodes and trematodes are three major types of endoparasites in the gastrointestinal system. They can be found frequently in captive elephants as well as wild elephants. According to Preecha (2005), liver flukes such as *Fasciola gigantica, Fasciola hepatica, and Fasciola jacksoni* are the common trematodes that can be found, in the liver and bile duct and spread by snails on the food that the elephant eats. The elephant would be skinny and feeble with poor digestion, which are clinical indications of liver fluke and may pass away in dire circumstances. Additionally, cestodes, also known as tapeworms, are 5.1 cm long and have a mouth that resembles a sucker that adheres to the wall of the stomach as well as the short and long intestines, which the worms subsequently consume. *Anoplocephala manubriata* is a cestode that parasitizes Asian elephants and inflames their gastrointestinal tracts. Nematodes, or roundworms, are 1-2 cm long and resemble the roots of onions. The majority of these worms are *Strongyle* species. Worm eggs on the elephant's diet are the source of the infection. Although the parasite is typically asymptomatic, it may exhibit signs of malnutrition and exhaustion. The growth of an elephant will be constrained by worms.

3.0 MATERIALS AND METHODOLOGY

3.1 Study Area

Four places were recruited in this study namely Zoo Taiping & Night Safari, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.

3.2 Study Design

Cross-sectional study was conducted.

3.3 Study Population

Asian elephants selected for this study are captive and resided in wildlife parks, enclosure, and zoos in Malaysia. In the total population, 60% elephants were adults and 40% were infants. In terms of gender, 80% of the study elephants were cows while the remaining 20% were bull.

3.4 Selection Criteria

Asian elephants, regardless the age and gender that resided in Zoo Taiping & Night Safari, Zoo Negara, Kuala Gandah National Elephant Conservation Centre, and Kenyir Elephant Conservation Village.

3.5 Sampling Technique

Simple random sampling was conducted in this study. Approximately 30 elephants were systemic randomly chosen from the 4 places.

3.6 Sampling sites

The study was conducted in Zoo Negara in Selangor (Location A), Kuala Gandah National Elephant Conservation Centre in Pahang (Location B), Kenyir Elephant Conservation Village in Terengganu (Location C) and Zoo Taiping & Night Safari in Perak (Location D).

3.7 Sample Collection

25–30g of freshly voided feces samples were collected from the inner surface of the feces piles into a sterile specimen container and was labeled according to the locations and ID of the elephants. The samples were then placed in an icebox for preservation and was transported to the Parasitology Laboratory, University Malaysia Kelantan for identification.

3.8 Laboratory Procedures

3.8.1 McMaster Technique

3g of the feces were weighted using weighing balance and was placed it into Container A. 10ml of saturated Sodium Chloride (NaCl) solution was measured in a measuring cylinder and was poured into Container A. The feces are mixed with the solution using spatula. 35ml of saturated Sodium Chloride (NaCl) solution was then added into Container A. The fecal suspension was then mixed and was filtered through a tea sieve into Container B. The filtrate is then stirred in Container B using spatula and an aliquot was withdrawn using a pipette, filling the chamber of the McMaster slide. The slide was left to stand for 2-3 minutes. The grid of the McMaster slide was focused on x4 and 10x magnification using the compound microscope. The strongyles eggs were observed and counted within the grids. The total number of eggs counted is multiplied by 50 as the correction factor.

3.8.2 Fecal Culture Technique

The feces were smashed using pestles and mortar and was transferred into a container. The feces were packed in the container with a gloved hand and was moisten with distilled water. The culture was then covered with gauze and were stored at room temperature for 7 days in a dark area. The culture was checked daily and was sprayed with distilled water when appeared dry. The gauze was removed on the 7th day. The container was then filled with lukewarm distilled water until a meniscus is formed. The container was then covered with a petri dish and was inverted. The petri dish was filled with lukewarm distilled water and was allowed to stand for 30 minutes. The distilled water on the petri dish was pipetted into a falcon tube and was stored in 4 ºC chiller. The L3 was pipetted from the falcon tube into a petri dish. Few drops of Lugol's iodine were added and was observed under a stereomicroscope.

3.8.3 Simple Floatation Technique

1g of feces were weighted and placed into Container A. 40ml of saturated Sodium Chloride (NaCl) was added Container A and was mixed thoroughly using a spatula. The fecal suspension was then filtered through a tea sieve into Container B. The filtrate from Container B was poured into a test tube until the filtrate was at the meniscus level. A cover slip was placed on top of the test tube and was left for 20-30 minutes. The coverslip was then lifted and was placed on the microscope slide. The slide was then examined under microscope at 10x magnification.

3.8.4 Fecal Sedimentation Technique

1g of feces were weighted and placed into Container A. 40ml of saturated Sodium Chloride (NaCl) was added Container A and was mixed thoroughly using a spatula. The fecal suspension was then filtered through a tea sieve into Container B. The filtrate from Container B was poured into a test tube until the filtrate was at the meniscus level. A cover slip was placed on top of the test tube and was left for 20-30 minutes. The coverslip was then lifted and was placed on the microscope slide. The slide was then examined under microscope at 10x magnification.

3.8.5 Endoparasite Identification and Parasite Load

Prepared slides from the McMaster technique, simple floatation technique, fecal sedimentation technique and fecal culture technique were observed using a compound microscope in different magnification and field views. The morphology of eggs and L3 larvae were recorded using the morphology of the egg and larvae. The genus of the parasite's eggs and L3 larvae were identified from referring journals, articles, books, and certified webpages. Parasite load was determined by observing the abundance of eggs or larvae observed, recording from a scale of 1-4 where 1 indicates absence of parasites, 2 indicates mild infestation, 3 indicates moderate infestation and 4 indicates severe infestation.

3.9 Statistical Analysis

The age, sex, the deworming status, and the deworming drug used for the Asian Elephant in captivity from Location A, B, C and D were recorded in dichotomous way. The collected data was tabulated in Microsoft Excel Spreadsheet. The overall detection rate of the endoparasites burden from all 4 farms, and the detection rate of the endoparasites burden in each location was calculated using the formula of:

$$Detection\ Rate\ (\%) = \frac{Number\ of\ infected\ elephants}{Total\ number\ of\ samples}\ x\ 100\%$$

For statistical analysis, the significance between the risk factors (age, sex, deworming status, and area) against the parasite load was calculated from Fisher's Exact Test using the statistical software IBM SPSS. The statistical significance should be less than 0.05 (p-value < 0.05).

4.0 RESULTS

4.1 Demographic Data & Detection rate

The demographic data of the collected samples from Location A, B, C and D are shown in Table 1. Altogether, 30 fecal samples were collected from 30 elephants.

Table 1: Demographic data of the collected samples from Location A, B, C and D

No	Location	Total Elephants	Sample Collected	Date Collected	Deworming Date	Deworming Drug
1	A	2	2	10/26/2022	x	x
2	B	26	13	10/27/2022	Apr-22	Fenbendazole
3	C	18	10	11/11/2022	Oct-22	Fenbendazole
4	D	10	5	11/20/2022	Nov-22	Fenbendazole
	Total	56	30			

The demographic data of the Asian elephant in captivity are shown in Table 2. The majority of the elephants were at the young age (n = 13) group, female (n = 20) and dewormed (n = 28). Most of these elephants were managed outdoors, living in the rural area (n = 23), which were from Location C and D, while Location A and D were in urban areas (n = 7). Based on the deworming records obtained, 28 out of 30 (93.3%) of the elephants were dewormed with a commercial dewormer drug which is Fenbendazole.

Table 2: Demographic data of the captive Asian Elephants for this study (n = 30)

Demographic Factors	No of Elephants (%)
1. Sex	
• **Male**	10 (33.3)
• **Female**	20 (66.7)
2. Age	
• **Young (≤ 14 years)**	13 (43.3)
• **Young Adult (15 – 24 years)**	10 (33.3)
• **Adult (≥ 25 years)**	7 (23.3)
3. Area	
• **Urban**	7 (23.3)
• **Rural**	23 (76.7)
4. Deworming Status	
• **Yes**	93.3
• **No**	6.7

Note: ≤ is less than or equal to; < is less than; ≥ is more than or equal to; > is more than. * Age was recorded based on published guidelines.

Out of the 30 Asian Elephant in captivity recruited in this study, 23 elephants were infested with endoparasites worms, whereas the remaining 7 elephants did not have any endoparasites worms. The overall detection rate of the endoparasites infestations from all 4 locations was 77% while the detection rate of the endoparasites infestation in location A, B, C, and D were 100%, 69.23%, 100% and 40% respectively, as shown in Figure 1. Laboratory analyses revealed that the majority of the elephants were diagnosed with low parasite load as shown in Figure 2.

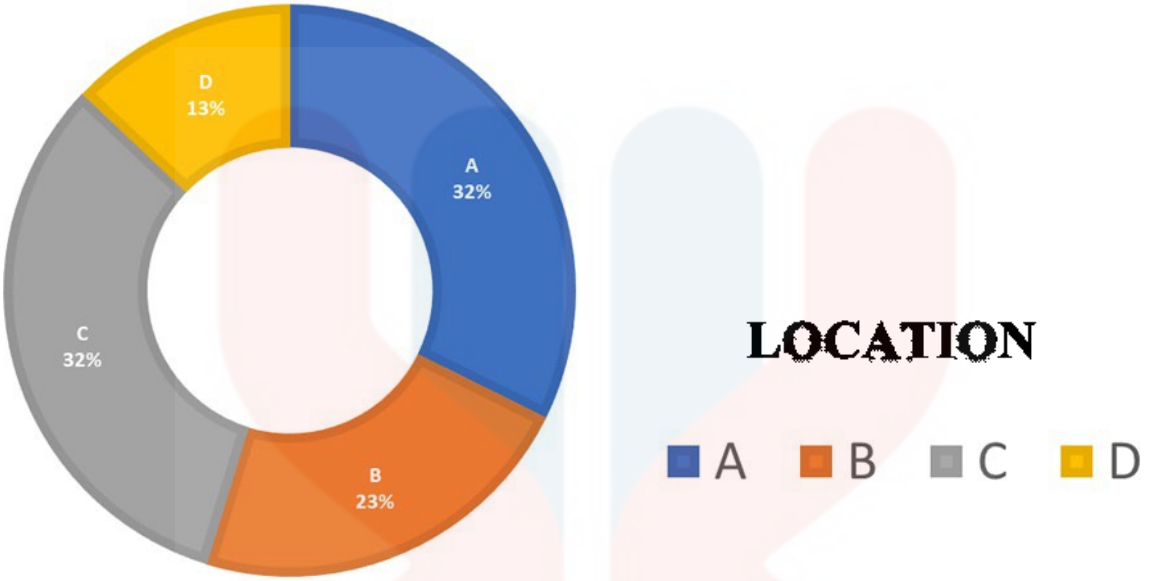


Figure 1: Detection rate of the endoparasites infestations in location A, B, C, and D

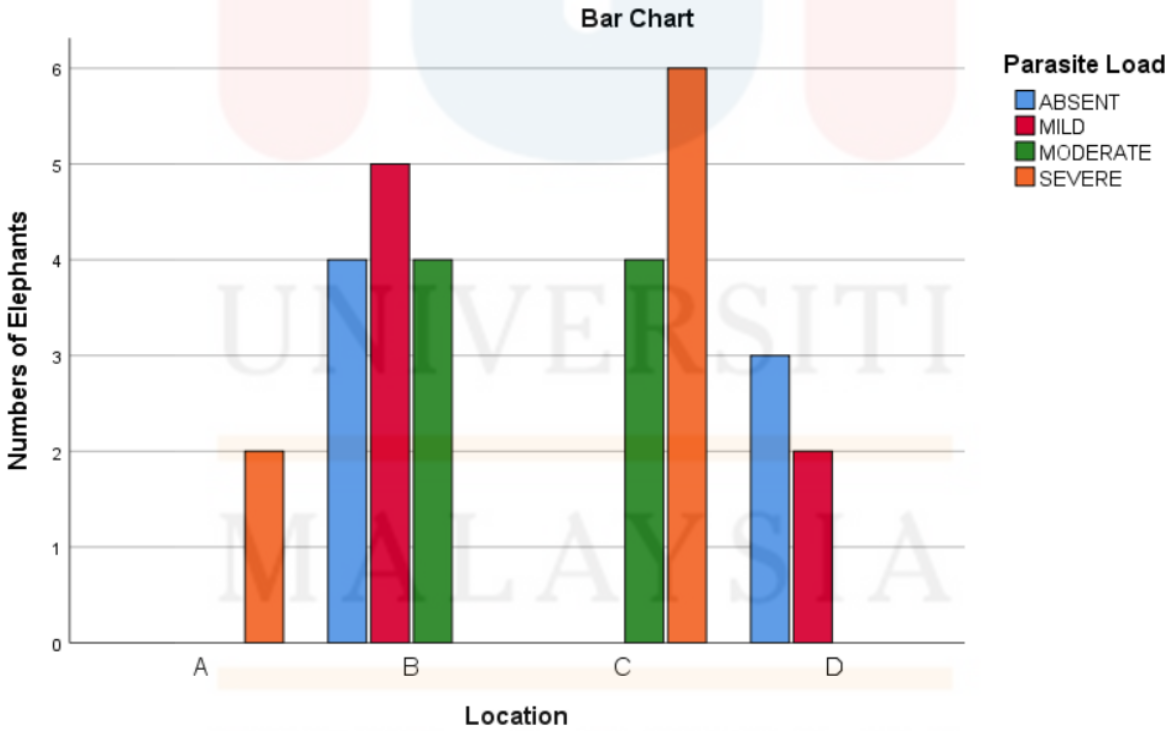


Figure 2: Bar Graph of Location against Parasite load in all 4 Locations

4.2 Identification of Parasite

- L3 Larvae

Figure 3a

10 x 10

Figure 3b

40x 10

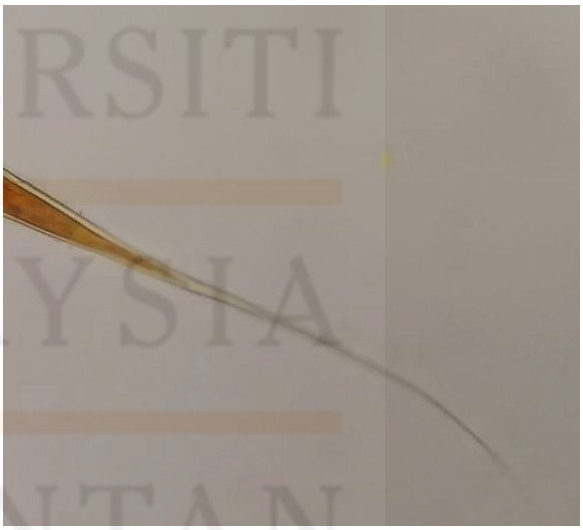


Figure 3c

40x 10

Figure 3a, 3b and **3c:**
Oesophagostomum sp. - Larvae

40x 10

Figure 4: *Strongyloides* sp. - Larvae

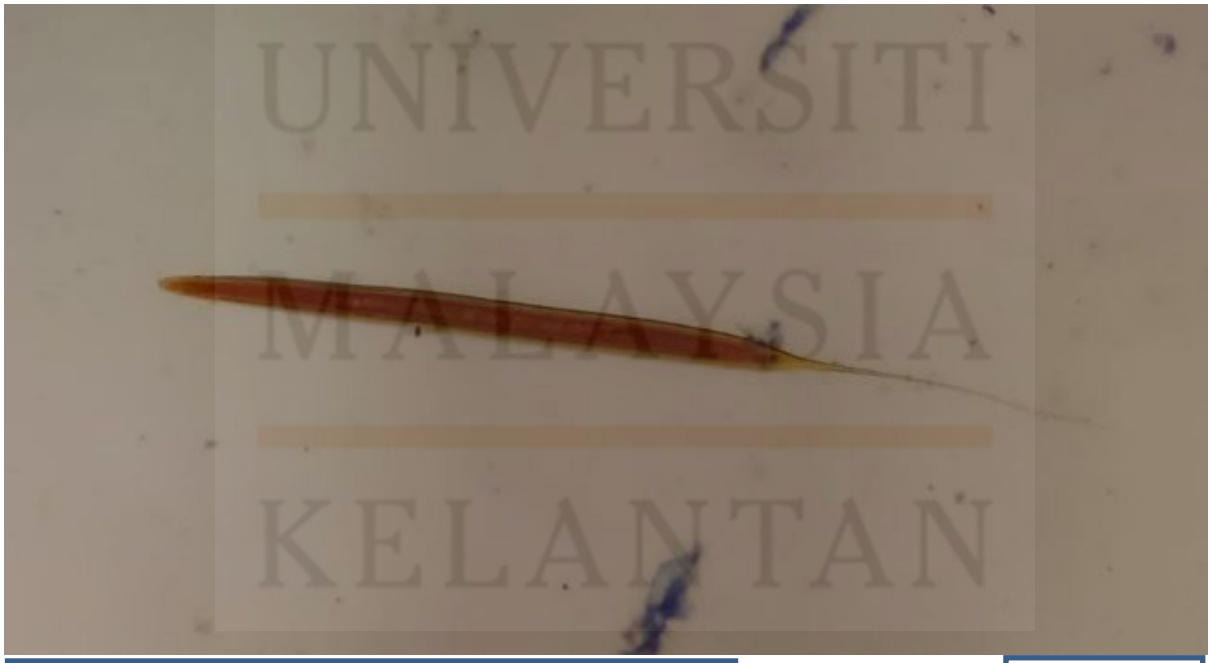


Figure 5: *Cyathostomin* sp. - Larvae

40x 10

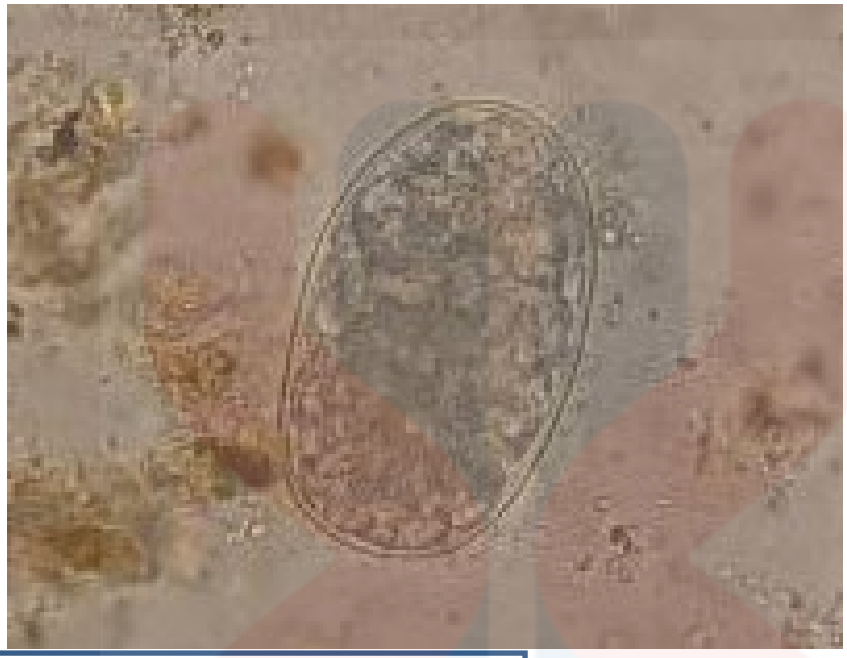
Figure 6: Rhabditiform larva of *Ancylostoma* sp.

40x 10

- Parasitic Eggs

40x 10

Figure 7: *Strongyles* - Egg

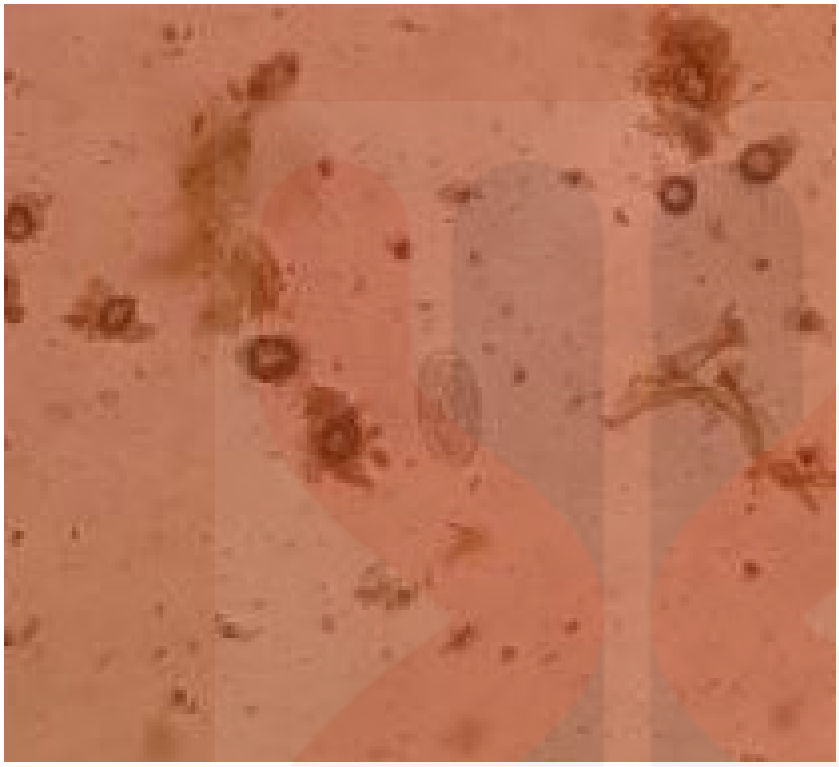


40x 10

Figure 8: *Ancylostoma* sp. - Egg

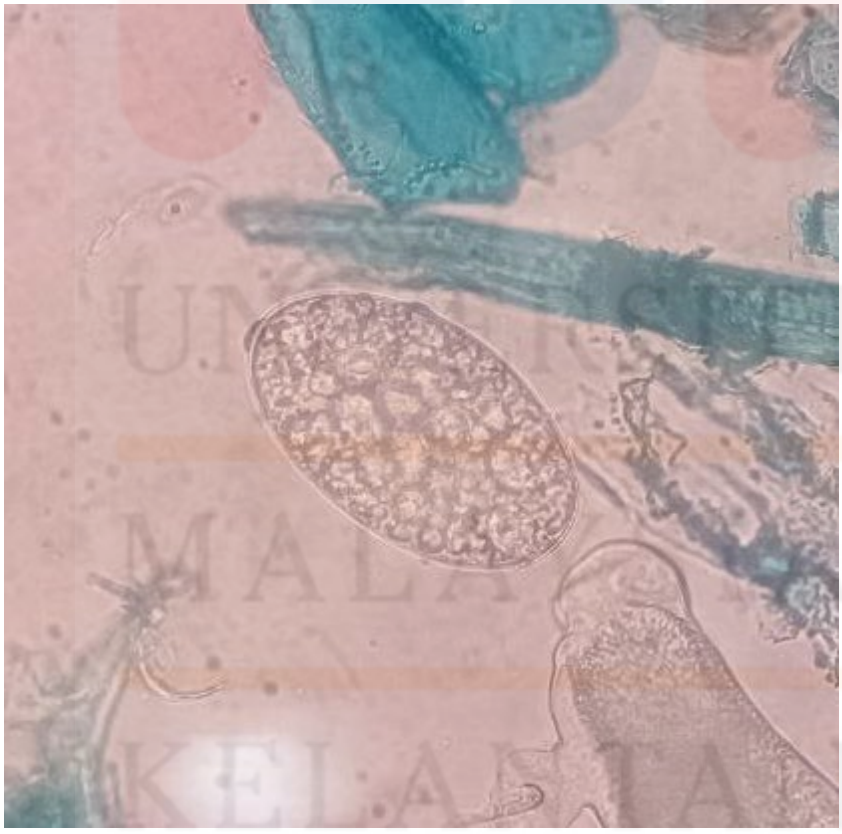
40x 10

Figure 9: *Demodex* sp. - Egg



10 x 10

Figure 10: *Strongyloides* sp. - Egg



40x 10

Figure 11: *Fasciola* sp. - Egg

Multiple species of parasitic worms were successfully isolated from 23 out of 30 elephants. Most species found were roundworms and only one species of flukes was found in this study. No tapeworm was found in this study. For flukes, *Fasiola* sp. was identified. For nematodes, *Ancylostoma* sp., *Strongyloides* sp., and *Oesophagostomum* sp. were identified. *Demodex sp.* eggs were also identified in this study.

4.3 Statistical Analysis

There is no significant association between risk factors and endoparasites infestation as *p*-value for sex, age, area, and deworming status are 0.121, 0.660, 0.266, and 0.225, respectively as shown in Table 3 below.

Table 3: Univariate analyses on four risk factors towards endoparasite infestation in captive Asian Elephant (n=30).

Risk Factors	Fisher's Exact Test	*p*-Value
Sex	4.100	0.121
Age	7.628	0.660
Area	2.885	0.266
Deworming Status	5.893	0.225

Note: * Significant at p-value < 0.05

5.0 DISCUSSION

In Malaysia, studies on endoparasites in Asian Elephant in captivity is still limited. Therefore, the current study determined the detection rate of endoparasites infestation and the associated risk factors in Asian Elephant in captivity from four different locations, which are Zoo Taiping & Night Safari in Perak, Zoo Negara in Selangor, Kuala Gandah National Elephant Conservation Centre in Pahang, and Kenyir Elephant Conservation Village in Terengganu.

The detection rate of endoparasite infestation in Elephants in this study was 76.7% (23 out of 30) while according to the recent study of Manjunatha (2018), 63.1% (12 out of 19) were found positive for gastrointestinal parasites. The detection rate in this study was higher as the number of samples influences the result. Since elephants are regarded as a flagship species, their ongoing existence is necessary to maintain the ecological integrity and biodiversity of their ecosystem. The treatment of parasites and diseases in wild elephants may therefore contribute to biodiversity preservation as a whole. Elephants kept in captivity frequently contract parasitic infections, which can lead to illness and even death (Elsheikha & Obanda, 2010). It is possible that elephant clinical parasitism is related to the distressing conditions of confinement, which may range from inadequate dietary practices to bad husbandry. Therefore, it is possible to extrapolate that these unfavorable conditions in captivity may be linked to those in overgrazed, crowded, polluted with parasite propagules, or experiencing drought natural habitats (Elsheikha & Obanda, 2010). It is possible to forecast that these situations will lead to chronic clinical illness and put the animals' lives at danger.

Fecal examination revealed that nematodes (*Ancylostoma* sp., *Strongyloides* sp. and *Oesophagostomum* sp.) were commonly observed in this study. There were also trematode eggs (*Fasciola* sp.) observed in this study. Mixed infections were also recorded. These nematodes have been identified as free-living nematodes, meaning that parasite species reproduction typically occurs through transmission of free-living infective stages that spread among their host population, with most individuals tolerating low numbers of parasites but a few individuals of host with higher parasite load. (Shaw & Dobson, 1995)

The morphology of *Fasciola sp*. eggs is oval in shape, 80-140 microns in size, with translucent walls and a yellow color, with smooth and thin egg walls, a small operculum, morula, and a highly porous exterior. The *Fasiola* egg discovered in this study was thought to be *Fasiola jacksoni,* which resembles the North American cervid parasite *Fasiola magna* more than other *Fasiola sp. F. jacksoni* is a well-known fasciolid of Asian elephants, and despite one anecdotal account of this species being present in 30 African elephants, there is no published evidence to back up that claim. Both flukes have a body that is quite thick, lack a distinguishing cephalic cone, and have lengthy median (interior) intestinal branches, which are comparatively short in *F. hepatica* and *F. gigantica.* (Jones, 1979)

Demodex sp. mites were found in this investigation using fecal flotation. Silbermayr *et al.,* (2013) asserts that even when skin scrapings and cellophane tape were negative, mites may still be found using fecal flotation. The fact that the animals constantly ingest the skin mites before passing them through the gut proves that they are not digested during intestinal transit.

In this study, risk factors such as age, sex, deworming status, and area was analyzed. No significant differences between the age groups were found in the results. Endoparasite infestation detection rate was not correlated with age. The elephants in this study do not seem to be developing immunity to parasites with age, or if such immunity does occur, it is not robust enough to induce a discernible decline in infection levels in previously exposed animals (Armour, 1989), unlike many livestock species. In a similar vein, a study on wild elephants in Namibia discovered that, within family groups, nematode burden rose with age (Thurber *et al.,* 2011). This finding was explained by the fact that older elephants ate more, exposing them to more parasites.

There is no significant association between sex and endoparasite infestation in elephants in this study. Numerous studies on mammals have discovered a male bias in parasitism, either as a result of sexual dimorphism in behavior or anatomy or due to the immune system's response to sex-specific hormones (Zuk and McKean, 1996). Bulls in musth, when plasma testosterone levels dramatically increase (Ganswindt *et al.,* 2010), may be expected to have higher parasite levels if the latter effect is evident in elephants. However, there were not enough musth bulls present for the study to determine how this elevated male hormonal condition affected parasite burden. The results of a recent Namibian study (Thurber *et al.,* 2011) on bull elephant parasite burden suggested that testosterone may not have a substantial immunosuppressive effect in this species.

Oral deworming treatments are typically administered two to three times year, with additional treatments given if elephants exhibit clinical symptoms. The most often utilized anthelminthic in this study was fenbendazole, a broad-spectrum benzimidazole. Numerous gastrointestinal parasites, such as *Giardia*, roundworms, hookworms, whipworms, tapeworms of the *Taenia* genus, pinworms, *Aelurostrongylus*, paragonimiasis, *strongyles*, and

Strongyloides, are treated with it. It is legal to give fenbendazole to sheep, cattle, horses, fish, dogs, cats, rabbits, and other wild animals under veterinary supervision (Düwel et al., 1975).

Regarding the deworming status, 93.3% (n = 28) of the **c**aptive Asian **e**lephants that were sampled had received fenbendazole deworming, whereas 6.7% (n = 2) had not. In comparison to the other two groups, Kenyir Elephant Conservation Village and Zoo Negara had a higher rate of endoparasite infestations. This could be as a result of the anthelminthic medications' primary focus on helminths. Despite receiving frequent deworming treatments, this could be attributable to the deworming technique in which individual captive elephants had individual treatments while the other captive elephants received group treatments. Additionally, sampling of elephants at the Kuala Gandah National Elephant Conservation Centre took place six months after the most recent deworming, whereas sampling at the other two locations (Zoo Taiping and Kenyir Elephant Conservation Village) took place one month after the deworming. However, deworming has not taken place at the Zoo Negara for the past ten years.

Even after receiving repeated anthelmintic treatments, the parasites may develop anthelminthic resistance (Preston *et al.,* 2009) which may explain why it is still present in the elephants at the Kuala Gandah National Elephant Conservation, the Zoo Taiping, and the Kenyir Elephant Conservation Village. The development of resistance may also be brought on by using broad spectrum anthelminthics at doses below curative. Asian and African elephants have shown resistance in Nigeria (Mbaya *et al.,* 2012) and Bangladesh (Rahman *et al.,* 2014).

Asian elephants kept in captivity in the rural area were 76.7% (n = 23) of the sample, while 23.3% (n = 7) lived in the urban environment. Elephants gather in large groups and are dependent on a single watering hole because there is a lack of water in these facilities. Due to the fact that they urinate on the ground, there is a higher risk of the entire herd becoming infected when one individual has the disease. Environmental factors that affect the survivability

and behavior of parasite propagules, as well as host feeding, mobility, and feces patterns that dictate the parasites encountered, are some potential factors that could affect the transmission of GI parasites in the wild in rural settings (Watve & Sukumar, 1995; Vidya & Sukumar 2002).

The majority of elephants have mixed infections. Animal movement and grazing practices may contribute to an increased occurrence of mixed illnesses. When animals have more flexibility to move around, they may eat in more places and on more various kinds of fodder, increasing their exposure to a wider range of endoparasites (Nunn *et al.,* 2003). Moreover, because elephants with mixed infections with higher parasite intensities are known to have worse immunity, the presence of one parasite species may make the presence of the other species easier (Fontanarrosa *et al.,* 2006).

Elephants' feces may include parasites, although this does not necessarily suggest the elephants are ill, will become ill, or need to be treated. According to Gaur *et al* (1979), although most wild animals in a free-living state have parasite infections, they rarely cause detrimental effects onto the animals unless they are under physiological or nutritional stress. Since infections could cause elephant die-offs under extremely stressful circumstances, it is crucial to understand how infections affect wild animals. Miller et al. (2015) noted that while prevention is frequently the most economical course of action, it is necessary to identify strategic expenditures in Asian elephant health that will result in the greatest advantages for overall elephant health and conservation.

6.0 CONCLUSION & RECOMMENDATION

6.1 Conclusion

Understanding the function of disease in causing endangerment requires a baseline understanding of disease detection rate in already vulnerable taxa. Although no studies on the GI parasites of elephants have been conducted in Malaysia, there have been studies in other Asian nations like Indonesia, Thailand, Sri Lanka, and India. In this work, endoparasite worms found in Asian elephants kept in captivity in Malaysia are fully identified. The majority of the Asian elephants whose samples were taken from the Zoo Taiping & Night Safari in Perak, the Zoo Negara in Selangor, the Kuala Gandah National Elephant Conservation Centre in Pahang, and the Kenyir Elephant Conservation Village in Terengganu were infected with GI parasites, some of which had very high intensities. For devising effective treatment or management regimens in captive host populations, estimation of GI parasite egg loads is also essential. In order to properly deworm captive elephants, and it is essential to perform a fecal egg count and fecal sedimentation.

6.2 Recommendations

For the recommendation, more samples can be taken from other locations including Zoo Melaka. Moreover, research can be done in wild Asian elephants in Malaysia and comparing the parasite load between the Asian elephants in wild against the Asian elephants in captivity. This could provide a clearer view on the free-roaming parasites and the parasite load in different management.

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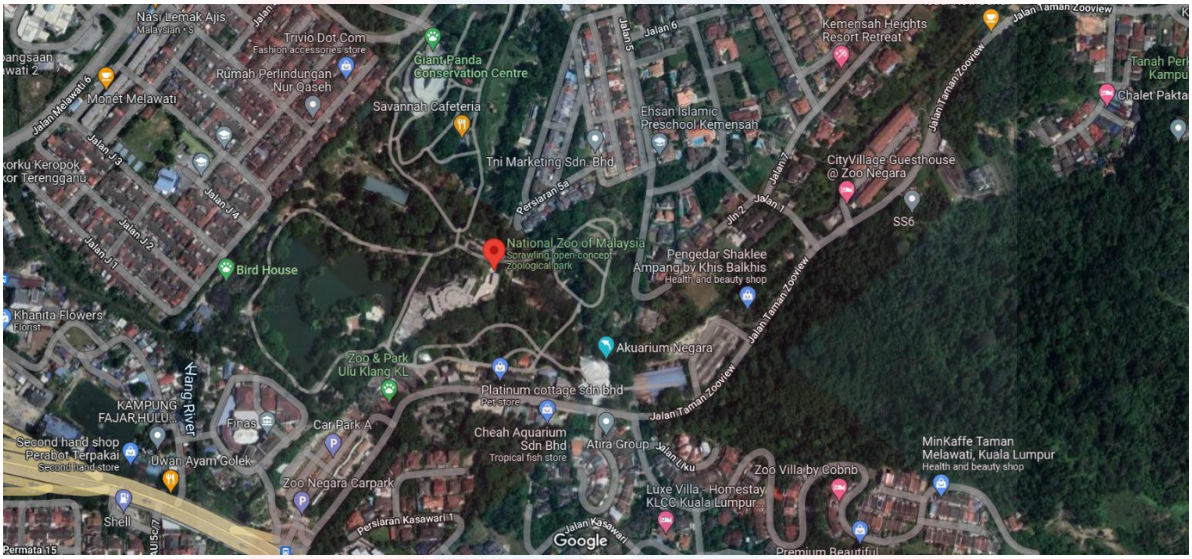
APPENDIX A

Appendix A.01: The satellite view and Entrance picture of Location A



Appendix A.01a: The satellite view of Location A

Appendix A.01b: The Entrance Picture of Location A

Appendix A.02: The satellite view and Entrance picture of Location **B**

Appendix A.02a: The satellite view of Location B

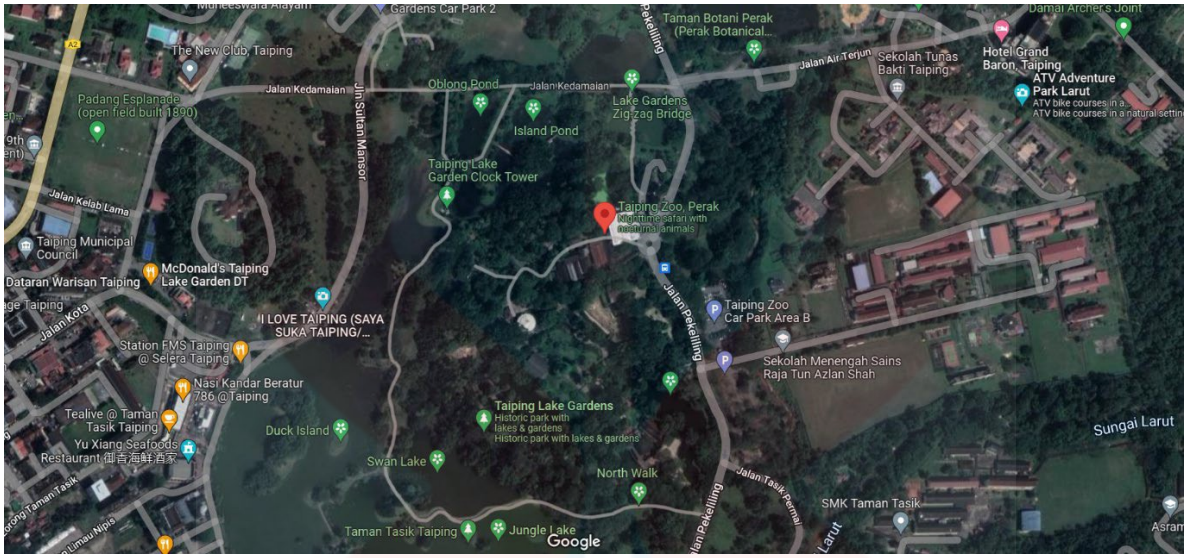
Appendix A.02b: The Entrance Picture of Location B

Appendix A.03: The satellite view and Entrance picture of Location C

Appendix A.03a: The satellite view of Location C

Appendix A.03a: The Entrance Picture of Location C

Appendix A.04: The satellite view and Entrance picture of Location D



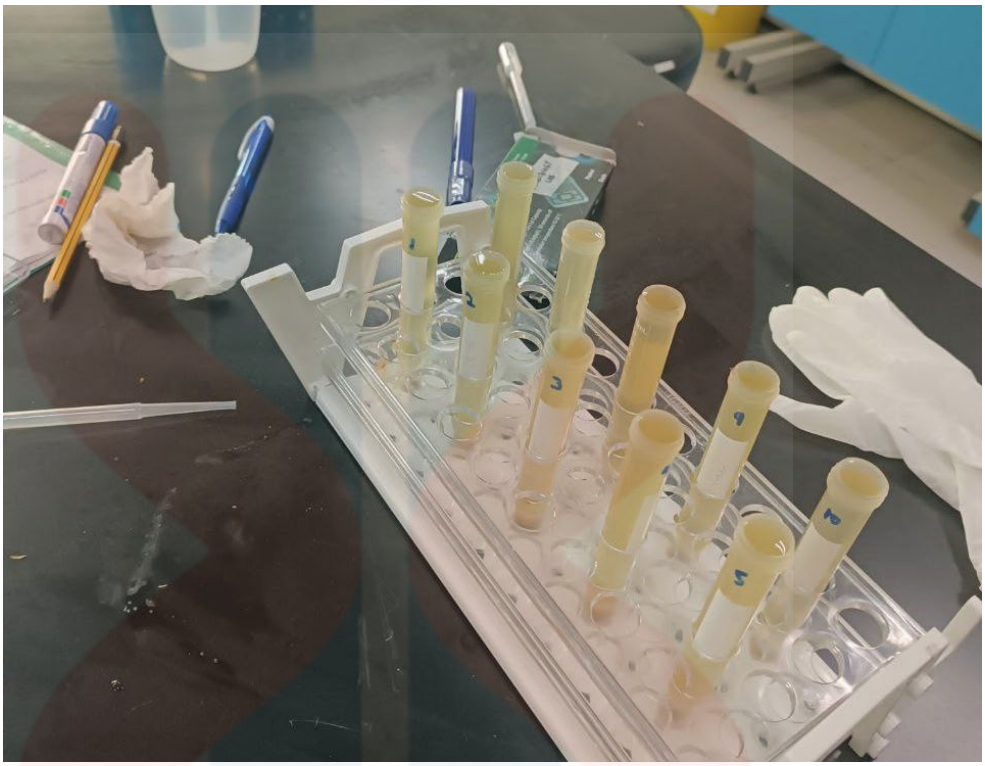
Appendix A.04a: The satellite view of Location D

Appendix A.04b: The Entrance Picture of Location D

Appendix A.05: Sample Collection

Appendix A.06: Fecal Storage

Appendix A.07: Lab Procedures



Location	Name	Age	Sex	Findings				Parasitic Load
				McMaster	Fecal Floatation	Fecal Sedimentation	Fecal Culture	
Zoo Negara	Sibol	45	F	1350 epg	*Strongyles* eggs + *Demodex* eggs	No Findings	*Oesophagostomum sp.*	4
	Siti	44	F	1500 epg	*Strongyles* eggs	No Findings	*Oesophagostomum sp.*	4

Appendix A.08: Individual findings From Location A

Location	Name	Age	Sex	Findings				Parasitic Load
				McMaster	Fecal Floatation	Fecal Sedimentation	Fecal Culture	
Kuala Gandah	Amoi	4	F	250 epg	*Strongyles* eggs + *Ancylostoma* eggs	No Findings	*Oesophagostomum* sp. + *Ancylostoma* sp.	3
	Timur	44	F	0	No Findings	No Findings	No Findings	1
	Siput	17	F	300 epg	*Strongyles* eggs + *Ancylostoma* eggs + *Strongyloides* eggs	No Findings	*Oesophagostomum sp. + Ancylostoma sp. + Strongyloides sp.*	2
	Rambai	38	F	0	No Findings	No Findings	No Findings	1
	Linang	15	F	200 epg	*Strongyles* eggs + *Ancylostoma* eggs + *Strongyloides* eggs	No Findings	*Oesophagostomum sp. + Strongyloides sp. + Ancylostoma sp.*	3
	Poi	3	M	0	No Findings	No Findings	No Findings	1
	Ani	9	F	250 epg	*Strongyles* eggs + *Ancylostoma* eggs	No Findings	*Oesophagostomum sp. + Ancylostoma sp.*	2
	Elly	5	F	0	*Strongyles eggs+ Strongyloides* eggs	No Findings	*Strongyloides sp. + Ancylostoma sp.*	2
	Lasah	23	M	250 epg	*Strongyles* eggs + *Strongyloides* eggs + *Ancylostoma* eggs	No Findings	*Oesophagostomum sp. + Strongyloides sp. + Ancylostoma sp.*	3
	Langsat	13	F	150 epg	*Strongyles eggs + Strongyloides* eggs	No Findings	*Oesophagostomum sp. + Strongyloides sp.*	2
	Pes	6	M	200 epg	*Strongyles* eggs + *Strongyloides* eggs + *Ancylostoma* eggs	No Findings	*Oesophagostomum sp. + Strongyloides sp. + Ancylostoma sp.*	2
	Abot	25	F	350 epg	*Strongyles* eggs + *Strongyloides* eggs + *Ancylostoma* eggs	No Findings	*Oesophagostomum sp. + Strongyloides sp. + Ancylostoma sp.*	3
	Siti	43	F	0	No Findings	No Findings	No Findings	1

Appendix A.09: Individual findings From Location B

Location	Name	Age	Sex	Findings				Parasitic Load
				McMaster	Fecal Floatation	Fecal Sedimentation	Fecal Culture	
KECV	Gawi	9	F	0	*Ancylostoma* eggs	*Fasiola sp.*	*Ancylostoma sp. + cyathostomin sp.*	4
	Ketiar	9	F	0	No Findings	*Fasiola sp.*	No Findings	3
	Akuang	15	M	0	*Ancylostoma* eggs	*Fasiola sp.*	*Ancylostoma sp*	4
	Ab	13	M	0	No Findings	*Fasiola sp.*	No Findings	3
	Tenang	24	M	0	*Ancylostoma* eggs	*Fasiola sp.*	*Ancylostoma sp. + cyathostomin sp.*	4
	Dusun	12	F	0	*Ancylostoma* eggs	*Fasiola sp.*	*cyathostomin sp.*	4
	Detok	16	M	0	No Findings	*Fasiola sp.*	No Findings	3
	Ayang	18	M	0	*Ancylostoma* eggs	*Fasiola sp.*	*Ancylostoma sp. + cyathostomin sp.*	4
	Leo	11	M	0	No Findings	*Fasiola sp.*	*cyathostomin sp.*	3
	Limau	17	F	0	*Ancylostoma* eggs	*Fasiola sp.*	*Ancylostoma sp. + cyathostomin sp.*	4

Appendix A.10: Individual findings From Location C

Location	Name	Age	Sex	Findings				Parasitic Load
				McMaster	Fecal Floatation	Fecal Sedimentation	Fecal Culture	
Zoo Taiping	Boyan	3	M	0	No Findings	*Fasiola sp.*	No Findings	2
	Jaya	31	F	0	No Findings	*Fasiola sp.*	No Findings	2
	Selama	17	F	0	No Findings	No Findings	No Findings	1
	Klian	14	F	0	No Findings	No Findings	No Findings	1
	Jalung	34	F	0	No Findings	No Findings	No Findings	1

Appendix A.11: Individual findings From Location D

Appendix A.12: SPSS Analysis (Fisher's Exact Test and Bar Graph)

```
CROSSTABS
  /TABLES=Location Lifespan Sex Area Dewormed BY Load
  /FORMAT=AVALUE TABLES
  /STATISTICS=CHISQ RISK
  /CELLS=COUNT ROW
  /COUNT ROUND CELL
  /BARCHART
  /METHOD=EXACT TIMER(5).
```

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Location * Load	30	100.0%	0	0.0%	30	100.0%
Lifespan * Load	30	100.0%	0	0.0%	30	100.0%
Sex * Load	30	100.0%	0	0.0%	30	100.0%
Area * Load	30	100.0%	0	0.0%	30	100.0%
Dewormed * Load	30	100.0%	0	0.0%	30	100.0%

Location * Load

Location * Parasite Load Crosstabulation

			Load				
			ABSENT	MILD	MODERATE	SEVERE	Total
Location	A	Count	0	0	0	2	2
		% within Location	0.0%	0.0%	0.0%	100.0%	100.0%
	B	Count	4	5	4	0	13
		% within Location	30.8%	38.5%	30.8%	0.0%	100.0%
	C	Count	0	0	4	6	10
		% within Location	0.0%	0.0%	40.0%	60.0%	100.0%
	D	Count	3	2	0	0	5
		% within Location	60.0%	40.0%	0.0%	0.0%	100.0%
Total		Count	7	7	8	8	30
		% within Location	23.3%	23.3%	26.7%	26.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	26.275[a]	9	.002	.001	
Likelihood Ratio	34.440	9	.000	.000	
Fisher's Exact Test	23.495			.000	
Linear-by-Linear Association	.646[b]	1	.422	.452	.243
N of Valid Cases	30				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.055
N of Valid Cases	

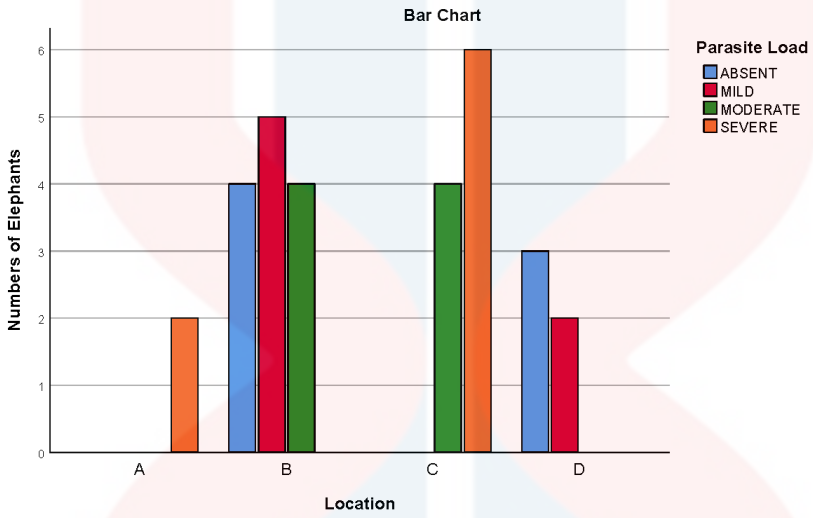
a. 16 cells (100.0%) have expected count less than 5. The minimum expected count is .47.

b. The standardized statistic is -.804.

Risk Estimate

	Value
Odds Ratio for Location (A / B)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.



Lifespan * Load

Age * Parasite Load Crosstabulation

			Load				
			ABSENT	MILD	MODERATE	SEVERE	Total
Age	≥ 14	Count	2	5	4	2	13
		% within Lifespan	15.4%	38.5%	30.8%	15.4%	100.0%
	15-24	Count	1	1	4	4	10
		% within Lifespan	10.0%	10.0%	40.0%	40.0%	100.0%
	≥ 25	Count	4	1	0	2	7
		% within Lifespan	57.1%	14.3%	0.0%	28.6%	100.0%
Total		Count	7	7	8	8	30
		% within Lifespan	23.3%	23.3%	26.7%	26.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	10.738[a]	6	.097	.097	
Likelihood Ratio	11.835	6	.066	.130	
Fisher's Exact Test	9.436			.121	
Linear-by-Linear Association	.279[b]	1	.597	.618	.337
N of Valid Cases	30				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.070
N of Valid Cases	

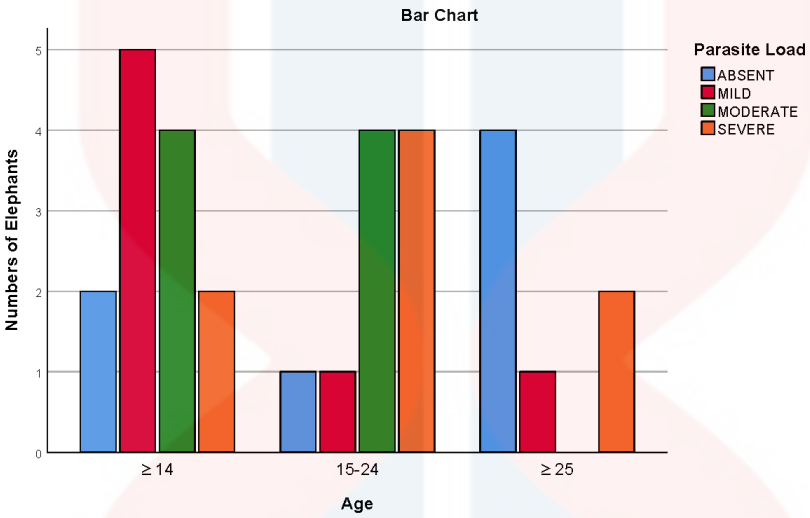
a. 12 cells (100.0%) have expected count less than 5. The minimum expected count is 1.63.

b. The standardized statistic is -.528.

Risk Estimate

	Value
Odds Ratio for Lifespan (≥ 14 / 15-24)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.



Sex * Load

Sex * Parasite Load Crosstabulation

			Load				
			ABSENT	MILD	MODERATE	SEVERE	Total
Sex	MALE	Count	1	2	4	3	10
		% within Sex	10.0%	20.0%	40.0%	30.0%	100.0%
	FEMALE	Count	6	5	4	5	20
		% within Sex	30.0%	25.0%	20.0%	25.0%	100.0%
Total		Count	7	7	8	8	30
		% within Sex	23.3%	23.3%	26.7%	26.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.277[a]	3	.517	.623	
Likelihood Ratio	2.398	3	.494	.622	
Fisher's Exact Test	2.257			.660	
Linear-by-Linear Association	1.293[b]	1	.255	.310	.169
N of Valid Cases	30				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.073
N of Valid Cases	

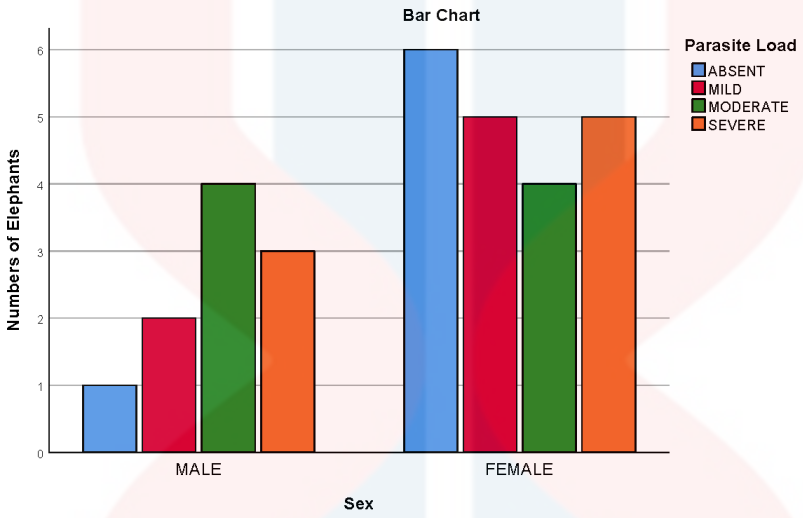
a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is 2.33.

b. The standardized statistic is -1.137.

Risk Estimate

	Value
Odds Ratio for Sex (MALE / FEMALE)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.



Area * Load

Area * Parasite Load Crosstabulation

			Load				
			ABSENT	MILD	MODERATE	SEVERE	Total
Area	RURAL	Count	4	5	8	6	23
		% within Area	17.4%	21.7%	34.8%	26.1%	100.0%
	URBAN	Count	3	2	0	2	7
		% within Area	42.9%	28.6%	0.0%	28.6%	100.0%
Total		Count	7	7	8	8	30
		% within Area	23.3%	23.3%	26.7%	26.7%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.046[a]	3	.257	.315	
Likelihood Ratio	5.663	3	.129	.273	
Fisher's Exact Test	4.188			.266	
Linear-by-Linear Association	1.273[b]	1	.259	.347	.177
N of Valid Cases	30				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.081
N of Valid Cases	

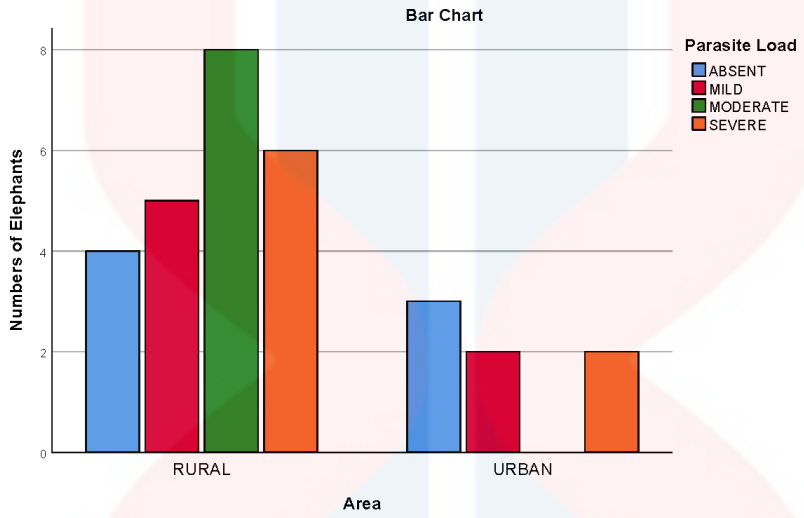
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.63.

b. The standardized statistic is -1.128.

Risk Estimate

	Value
Odds Ratio for Area (RURAL / URBAN)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.



Dewormed * Load

Deworming Status * Parasite Load Crosstabulation

			Load			
			ABSENT	MILD	MODERATE	SEVERE
Deworming Status	YES	Count	7	7	8	6
		% within Dewormed	25.0%	25.0%	28.6%	21.4%
	NO	Count	0	0	0	2
		% within Dewormed	0.0%	0.0%	0.0%	100.0%
Total		Count	7	7	8	8
		% within Dewormed	23.3%	23.3%	26.7%	26.7%

Deworming Status * Parasite Load Crosstabulation

			Total
Deworming Status	YES	Count	28
		% within Dewormed	100.0%
	NO	Count	2
		% within Dewormed	100.0%
Total		Count	30
		% within Dewormed	100.0%

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Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	5.893[a]	3	.117	.225	
Likelihood Ratio	5.698	3	.127	.225	
Fisher's Exact Test	3.654			.225	
Linear-by-Linear Association	3.417[b]	1	.065	.113	.064
N of Valid Cases	30				

Chi-Square Tests

	Point Probability
Pearson Chi-Square	
Likelihood Ratio	
Fisher's Exact Test	
Linear-by-Linear Association	.064
N of Valid Cases	

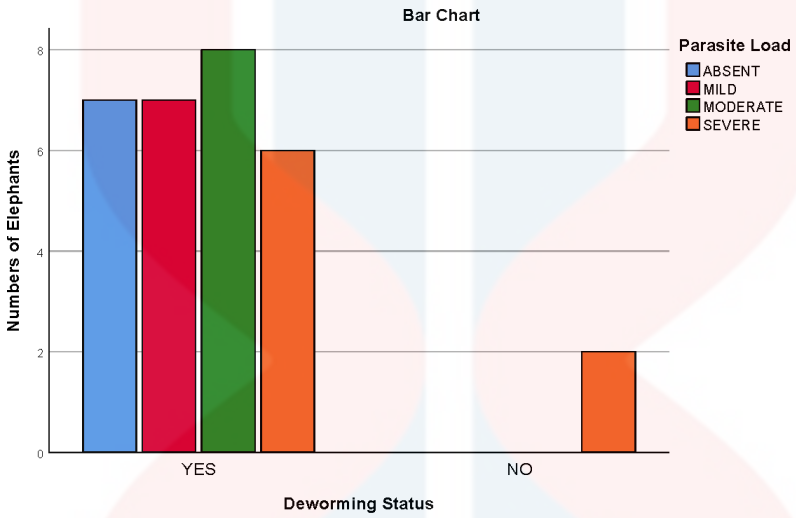
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is .47.

b. The standardized statistic is 1.848.

Risk Estimate

	Value
Odds Ratio for Dewormed (YES / NO)	[a]

a. Risk Estimate statistics cannot be computed. They are only computed for a 2*2 table without empty cells.



APPENDIX B

IBU PEJABAT
JABATAN PERLINDUNGAN HIDUPAN LIAR DAN
TAMAN NEGARA (PERHILITAN) SEMENANJUNG MALAYSIA
HEADQUARTERS
DEPARTMENT OF WILDLIFE AND NATIONAL PARKS (DWNP)
PENINSULAR MALAYSIA
KM.10, JALAN CHERAS
56100 KUALA LUMPUR
MALAYSIA

Tel. : 03-90866800
Faks : 03-90752873
E-mel : pakp@wildlife.gov.my
Laman Web : www.wildlife.gov.my

Ruj. Kami: JPHLTN.600-6/1/4 JLD2(34)
Tarikh: 29 September 2022

Dr. Mohammad Sabri Bin Abdul Rahman
Fakulti Perubatan Veterinar
Universiti Malaysia Kelantan
Pengkalan Chepa
16100 Kota Bharu
KELANTAN

YBrs Dr,

KEPUTUSAN PERMOHONAN MENJALANKAN PENYELIDIKAN

Dengan hormatnya saya diarah merujuk kepada keputusan Mesyuarat Jawatankuasa Penyelidikan Jabatan PERHILITAN Bil.10/2022 pada 12 September 2022 adalah berkaitan.

2. Sukacita dimaklumkan bahawa Jabatan **meluluskan** permohonan YBrs Dr. untuk menjalankan penyelidikan seperti butiran di bawah:

Nama Pemohon	:	**Subeinthiran A/L Rinagasamy (Pelajar DVM, UMK)**
Institusi Pemohon	:	**Universiti Malaysia Kelantan**
Tajuk	:	**Identification of Endoparasites in Captive Asian Elephants *(Elephas Maximus)* in Malaysia**
Tempoh kajian	:	**Ogos 2022 – Januari 2023**
Penyelia	:	**Dr. Mohammad Sabri Bin Abdul Rahman**

3. Sehubungan itu, YBrs Dr. dipohon untuk melakukan beberapa perkara seperti berikut :

a) Kebenaran masuk ke kawasan kajian hendaklah diperoleh daripada pengurusan kawasan berkenaan;
b) Rakan Saing dan *Co-author* penyelidikan ini ialah Dr. Hamidah binti Helman, Bahagian Konservasi Ex-Situ;
c) Sebarang sampel tidak boleh dibawa ke luar negara;
d) Berkongsi hasil penyelidikan seperti laporan, penerbitan kertas saintifik, tesis dan data melalui rakan saing Jabatan;
e) Menyumbang penulisan kepada"*Journal of Wildlife and Parks*" (JWP) Jabatan PERHILITAN;
f) Mengemukakan satu laporan hasil penyelidikan yang lengkap kepada Jabatan dalam tempoh dua (2) bulan selepas tamat penyelidikan;

g) Penyelidikan hendaklah diselesaikan dalam tempoh yang dinyatakan dalam permit; dan
h) Perkembangan kajian perlu dimaklumkan kepada Jabatan melalui rakan saing pada setiap bulan Jun dan Disember daripada tarikh kajian bermula

4. Sebarang pertanyaan mengenai perkara ini, YBrs Dr boleh berhubung dengan Sekretariat Jawatankuasa Penyelidikan Jabatan PERHILITAN di talian 03-90866800 untuk maklumat lanjut. Segala perhatian dan kerjasama tuan dalam perkara ini didahului dengan ucapan terima kasih.

Sekian.

"WAWASAN KEMAKMURAN BERSAMA 2030"
"BERKHIDMAT UNTUK NEGARA"

Saya yang menjalankan amanah,

(DR. PAZIL BIN ABDUL PATAH)
Pengarah
Bahagian Konservasi Ex-Situ
b.p Ketua Pengarah
Jabatan Perlindungan Hidupan Liar dan
Taman Negara (PERHILITAN)

s.k.
Ketua Pengarah
Timbalan Ketua Pengarah (Konservasi)
Pengarah PERHILITAN Kelantan

Dr. Hamidah binti Helman,
Pegawai Veterinar
Bahagian Konservasi Ex-Situ
hamidah.helman@wildlife.gov.my

LAMPIRAN A

SENARAI RAKAN SAING
PENYELIDIKAN IDENTIFICATION OF ENDOPARASITES IN CAPTIVE ASIAN ELEPHANTS *(ELEPHAS MAXIMUS)* IN MALAYSIA

BIL	NAMA	AGENSI
1.	Dr. Hamidah binti Helman	PERHILITAN
2.	Dr. Mohammad Sabri Bin Abdul Rahman (Penyelia)	UMK
3.	Dr Choong Siew Shean	UMK
4.	Dr Basripuzi Nurul Hayyan Binti Hassan Basri	UMK

LAMPIRAN B

BUTIRAN PENYELIDIKAN BERTAJUK IDENTIFICATION OF ENDOPARASITES IN CAPTIVE ASIAN ELEPHANTS *(ELEPHAS MAXIMUS)* IN MALAYSIA

BIL	BUTIRAN PERMOHONAN	LOKASI PERSAMPELAN
1.	**Objektif** a) Untuk mengkaji dan mengenalpasti genus dan/atau spesies endoparasit (cacing) yang terdapat dalam Gajah Asia. b) Untuk menganggarkan kelaziman genus dan/atau spesies endoparasit yang menyerang Gajah Asia.	• Zoo Taiping & Night Safari (Perak) • Zoo Negara (Selangor) • Kuala Gandah National Elephant Conservation Centre (Pahang) • Kenyir Elephant Conservation Village (Terengganu
2.	**Spesies Hidupan Liar** **Jadual Kedua :** Gajah Asia *(Elephas Maximus)*	
3.	**Metodologi** 1. Kajian akan menumpu kepada lima atau lebih Gajah Asia (jantan dan betina) yang sihat dan sesuai untuk kajian ini. 2. Sampel Najis (Voided) Gajah Asia dikutip sebagai sampel dan disimpan dalam "icebox". 3. Sampel-sampel yang dikutip dibawa ke Makmal Parasitologi Universiti Malaysia Kelantan. 4. "Simple Floatation Technique" dan "Fecal Sedimentation Technique" digunakan untuk mengenalpasti endoparasit yang terdapat dalam sampel najis. 5. Analisis dibuat mengikuti keputusan yang didapati daripada sampel-sampel najis dari keempat-empat lokasi tersebut.	
4.	**Jenis Penyelidikan** Persampelan	
5.	**Jenis Sampel** Najis	