Study on Helminths Infections on Rats at Commercial and Residential Areas in Kota Kinabalu, Sabah

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ABSTRACT

A study of helminthes infection on rats was conducted at four different locations. Kota Kinabalu port and Anjung Selera representing commercial area, whereas Indah Permai and Kingfisher represents residential area. Based on number of captures from four different locations, total number of 145 rats were caught representing of eight species. The species are Rattus rattus, Rattus norvegicus, Rattus exulans, Rattus tiomanicus jalorensis, sundamy muelleri, Rattus argentiventer and Mus custaneous which is from family Muridae and also 'shrew' from family Soricidae which is Suncus murinus species. At Kota Kinabalu port, Rattus rattus have the highest cestodes infections with infection rates of 62.5%, whereas Rattus exulans got infected from cestodes with 8.3% infection rates. At Anjung Selera, it shows that Rattus tiomanicus jalorensis were highly infected with cestodes based on 66.7% of infection rates. The highest nematode infection are on Sundamy muelleri which is 58.3%. Study at Kingfisher area shows that Rattus rattus were the most cestode infected 60.6% compared to nematoda which shows only 42.9%. At Indah Permai residential area, Mus custaneous shows the highest nematode with 66.7%, which means that the infection rates for cestode are 33.3%.

Keywords: *Commercial and residential area, helminthes, rats*

Introduction

Anjung Selera is one of the well known food court in Kota Kinabalu. There are about 25 stalls. The operation starts around 4 pm and ends at 1 am.

Kota Kinabalu port situated in southwest Sabah that is around 3 kilometer from Kota Kinabalu.there are vast area in this port and have different department that is dock for ships to unload things, warehouses and contenna zones.

Indah Permai residential area situated between the main road of Menggatal and Tuaran. Indah Permai residential area is a typical residential area. Equipped by vary infrastructure and facilities, Indah Permai residential area also have lots of new business premises that operating during night time.

As for Kingfisher residential area, before this, it is a swamp area with its own uniqueness. Due to the fast development process, the area were identified as a strategic area for human daily activity, it were explored and developed. However, there are still some swamp area that not been explored.

Objective of this study is to identify the species of the infeted rats. Besides that, this study also to determine the infection rates and to identify the species the helminthes that infected.

Literature Review

Parasites are organisms that live temporarily or permanently in or on other organisms and use these organisms to get their physiological needs. Helminth which is an endoparasit to an organism is a worm-like animal that includes three classes which are trematode, cestode dan nematode. Only these three classes are usually become a parasites to vertebrate like humans, livestocks and also crops. It can live in various vertebrates' organs such as heart, lungs, liver, intestines, guts,

blood, skin, and muscle. Every helminth species are able to caused certain illness when infected humans (Wahab, 1993).

Rats are one of the primary illness vectors in our country. Eventhough it have a short lifespan, which is about a year, it reproduced in a very fast rate. With the ability to have pregnancy more than 5 to 10 times a year, rats had caused various infectious and illness such as Salmonellosise, Leptospirosise dan Taifus Murine.

The dirty habitate and various diet of rats, had made rats as a potential host of helminth.Comes from three main classes which are nematode, cestode, dan trematode, atest research indications shows that helminth from nematode species are the most helminth that infected rodents. *Angiostrongylus malaysiensis* is one of the helminth species example that usually infected comencal rats until at one time, this specific helminth was recorded to caused an illness which is Eosinophylic Meningoensefphalitis at two location in our country which are Sarawak and Kuala Lumpur (Ambu et al., 1996).

Methods and Materials

Through this study, there are two different parts of works to do. The first part is the fieldwork that includes trap setting and rats collecting. The second part is the lab work including the rat's species identification, rats' dissection, helminthes identification, helminthes collection and staining.

Field Work

Wire trap 28cm x 12.5cm x 18cm were randomly set at all study area.The bait that were used are dried salted fish, sweet potatoe and banana.The trap were left a night that is from 6.00 p.m until next 6.00 a.m (Durden et al., 2000).

Identification of Rats Species

The rats length that were taken includes the body length, tail length, hind foot length, and bare foot length. Other features like fur color for upper and lower part and also at the rat's tail also were taken for identification. Identification of rats species were done following the method from Payne et al. (1985).

Helminths Collection

After all organs were inspected, the collected helminthes were put in a beaker containing saline solution (0.89% NaCl) for 30 minutes. Other methods to get helminthes from the organs,are by using glasses. For example, put the organs on a glass,and press the organs with another glass. After the glasses were taken up, helminths were visible from the pressed organs.

Staining and Slide Mounting

The collected helminths were put in a beaker containing 10% alcohol glyserin. Using a forcep, helminth was taken out from the beaker and was put onto a glass slide. Slowly, another glass slide was put onto it. After that, both slides were clipped using paper clip. The glass slide was soaked in lactophenol. After 5 to 10 minutes, the helminthes were dehydrate or dried in a series of alcohol: 3 times changes in 70% alcohol, each time, and 15 minutes. 90% alcohol for 1 hour and 3 times changes in concentrated alcohol, each time 15 minutes. Lastly, the helminth that had dried was put on a slide. Depex medium were drop on the helminth and glass slip were put onto the slide to produce fixed slide.

Statistical Analysis

The differences for the infection rates of helminthes were done by statistical analysis. In this

study, the differences were considered significance when the value $p<0.05$. If the data not normally distributed, the non-parametric test which are the Mann-Whitney U Kruskal Wallis test were used (Zar, 1999).

Results and Discussion

Derived data were includes the distribution of host species that were caught from the study area that were divided to four different area. Two commercial areas and two residential areas. Hopefully, the data that represent here can give the real picture on the infection rates or the helminth infection to rats that live in a large scale around Kota Kinabalu.

Rats Distributions

Based on the caught from the four areas, 145 rats were caught. After the rats were identified, it shows that the rats that were caught were from the species live commencially and associated to human.

This study was divided to four areas which are Kota Kinabalu port and Anjung Selera represents commercial area, whereas Kingfisher and Indah Permai represents the residential area.

Table 1:Rats Species Distribution according to Area.

SPECIES	AREA				TOTAL HELMINTH
	KK PORT	ANJUNG SELERA	KINGFISHER	INDAH PERMAI	
Rattus rattus	24	9	21	9	63
Rattus norvegicus	10	11	0	16	37
Rattus exulans	12	0	0	0	12
Suncus murinus	8	5	0	2	15
Rattus tiomanicus jalorensis	0	2	2	0	4
Sundamy muelleri	0	3	7	0	10
Rattus argentiventer	0	0	3	0	3
Mus castaneous	0	0	0	1	1
Total	54	30	33	28	

According to Table 1, eight (8) rats species were caught from these four areas. The rats species are *Rattus rattus, Rattus norvegicus, Rattus exulans, Rattus tiomanicus jalorensis, sundamy muelleri, Rattus argentiventer* and *Mus custaneous* which are rats from family Muridae. Besides that, there's also shrew from family Soricidae that is the *Suncus murinus* species.

Helminth Distribution

All rats that been caught were dissected to identify the helminth in their body. Helminths from the nematode and cestode class were identified as the helminth that presents in the specimens that had been done.

Table 2: Distribution of Helminth Infection in Percentage for Every Rats Species by Area

RATS SPECIES	AREAS											
	KK PORT			ANJUNG SELERA			KINGFISHER			INDAH PERMAI		
	cestoda	trematoda	nematoda	cestoda	trematoda	nematoda	cestoda	trematoda	nematoda	cestoda	trema-toda	nematoda
Rattus rattus	62.5	0	25	53.7	0	46.3	60.6	0	42.9	63.8	0	36.2
Rattus norvegicus	60	0	60	56.6	0	43.4	0	0	0	66.2	0	33.8
Rattus exulans	8..3	0	0	0	0	0	0	0	0	0	0	0
Suncus murinus	0	0	12.5	62.5	0	37.5	0	0	0	50	0	50
Rattus tiomanicus jalorensis	0	0	0	66.7	0	33.3	12.6	0	28.6	0	0	0
Sundamy muelleri	0	0	0	41.7	0	58.3	14.2	0	14.3	0	0	0
Rattus argentiventer	0	0	0	0	0	0	12.6	0	14.3	0	0	0
Mus castaneous	0	0	0	0	0	0	0	0	0	33.3	0	66.7

Based from Table 2, it shows that at Kota Kinabalu port, helminth from cestode class were the highest that infected *Rattus rattus* with the 62.5% infection rates. For *Rattus norvegicus*, infections from both classes are same, which are 60%. For *suncus murinus*, 12.5% infection rates was nematode. Whereas *Rattus exulans* had 8.3% cestode infection rates.

From the study done, it shows that, at Kota Kinabalu port, helminth infection rates on *R. norvegicus* were the highest that is 80.0%, and the lowest infection rates are for *R. exulans* with only 8.3% infection rates. Eventhough the number of cestodes helminth were highest in *R. norvegicus*, but the infection rates were only 60.0%,which is lower than the cestodes infection rates in *R. rattus* that is 62.5%. This situation shows that, for an individual of *R. norvegicus*, the number of cestodes that collected were high but the number of infected *R. norvegicus* with this helminth were lower if compare to the infection to *R. rattus*.Helminths from genus *Toxocara* also were found infected the rats from port area. This helminthes have the second highest infection rates after *Taenia taeniaformis* which is 18.5%. *Toxocara* is a nematode that normally found in dogs and cats (Thomas, 1983).In this sudy, It shows that *Toxocara* infected *Rattus rattus* and *R. norvegicus*. In *Toxocara* life cycle, rats are the paratenic host which plays the role as the intermediate host for this helminth. Whereas, dogs and cats are the definitive host (Pakeer, 1991). There were dogs and cats straying at Kota Kinabalu port. So, rats aound the area helped to complete the helminthes cycle and play the role as the intermediate host.

At Anjung Selera, it's a different story. From the study, it shows that the Cestodes have the highest infection on *Rattus tiomanicus jalorensis* that is 66.7%. It means that the nematodes infection rates are only 33.3%. The highest nematodes infections are on *Sundamy muelleri* that is 58.3%. For *Suncus murinus*, the cestodes infection rates are 62.5% whereas the nematode infection rates are 37.5%. For *Rattus norvegicus*, the cestodes infection rates are 56.6%,and for nematodes, the infection rates are 43.4%. *Rattus rattus* had 53.7% cestodes infection rates and 46.3% nematodes infection rates.The reason for the presence of *Angiostrongylus malaysiensis* in *Rattus norvegicus* and *Rattus rattus* is because of the mollusc in their diet. The highest numbers were gain from the *R. norvegicus* species around the area. The Anjung Selera was the habitat for the mollusk.Because of these reason, rats in this area have higher potential to eat mollusc around and eat it (Lim et al., 1989). The numbers of *Hymenolepis diminuta* are also high on *R. norvegicus* dan *R. rattus*. Just like *A. malaysiensis*, *H. diminuta* were also found around this area.These rats live in a bush that became a habitate for beetles and mollusc (Lim et al., 1989).

Observation at Kingfisher residential area shows that *Rattus rattus* were most infected by cestodes at 60.6% infection rate compare to the nematodes group with only 42.9%. Whereas for *Rattus argentiventer* and *Sundamy muelleri* species, nematodes infection rates are same for both which is 14.3%,but the infection rate for cestodes in *R. argentiventer* were only 12.6% , whereas for *S. muelleri* were 14.2%. For *R. tiomanicus jalorensis*, the nematodes infection rates were 28.6%. Cestodes infection rates for this rat species were 12.6%. In this area, the infection rates of *Taenia taeniaformis* for whole rats that were caught were 56.7%.This quite high percentage shows that almost every rats species in this area were infected with *T. taeniaformis*. On the other hand, the numbers of this helminth species were lower compared to *Hymenolepis diminuta*. *T. taeniaformis* species had wide distribution and usually only this helminth larvae infected the rats liver (Flynn, 1973).Adult worms were usually found in small intestine in a cyst form in cats, dogs and other carnivorous animals. Infection rates of *Angiostrongylus malaysiensis* were high in *R. rattus*. Besides that, this helminthes infection rates were the third highest after *T. taeniaformis* and *H. diminuta*.This maybe due of the bush that become the habitate of the intermediate hosts, which are leeches and snails (Flynn, 1973). The larvae will grow to the third stage that infective in 20 days in the intermediate host. Rats will get infected when digesting the infected mollusc. This parasite will complete the life cycle until become adult in the rat's lung (Suriati, 1991).

At Indah Permai residential area, *Mus custaneous* shows the highest nematodes infections which are 66.7%, this means that the cestodes infection rates were only 33.3%. For *R. norvegicus*, cestodes infection rates were higher, which is 66.2%and the nematodes infection rates were 33.8%. So as *R. rattus*, the cestodes helmin infections were 63.8% with the nematodes infection rates were 36.2%. Lastly, for *S. murinus* species, the cestodes and nematodes infection rates were same, that is 50%.Helminth transmission that usually happen to rats were because it take mollusk as one of their food sources,specifically, mollusk were the intermediate host for *A. malaysiensis*

(Lim et al., 1989). The highest numbers of A. malaysiensis were drawn from *R. norvegicus* species which most of it were caught at Indah Permai. The study from Suriati (1991) shows, *A. malaysiensis* may be found in area with high density of the intermediate and definitive host, which aere mollusk and rats, respectively. Just like *A. malaysiensis*, *H. diminuta* also were most found in *Rattus norvegicus* and *Rattus rattus*. Because these rats live in the area that close with the beetles and mollusk habitate, so, the helminthes infection rates were similarly rates.

Conclusion

From these four studied area, we can conclude that the hishest cestodes infection rates were in *Rattus tiomanicus jalorensis* at Anjung Selera with 66.7%. Followed by cestodes infection in *Rattus norvegicus* (66.2%) and *Rattus rattus* (63.8%) at Indah Permai residential area. The cestodees infection in *R. rattus* at Kota Kinabalu and in *Suncus murinus* at kawasan Anjung Selera were same, which is 62.5%. At Kingfisher residential area, cestodes infections in *R. rattus* were 60.6%.

Highest nematodes infections were 66.7% which is in *Mus castaneous* atvIndah Permai residential area. Followed by nematodes infections in *Rattus norvegicus* at Kota Kinabalu port with 60%.The nematodes infections in *Sundamy muelleri* at Anjung Selera were 58.3%, whereas nematodes infections in *Suncus murinus* at Indah Permairesidential area were only 50%.

References

Ambu, S., Krishnasamy, M., & Ramachandran, P. (1996). Helminth infection of rodents in Orang Asli settlements in Selangor, Malaysia- possible health risks. *Tropical Biomedicine, 13,* 123-127.

Durden, H.U., Oliver, J.R., & Cilek. (2000). Rodent ectoparasites from two locations in Northwestern Florida. *Journal of Vector Ecology, 6,* 222-227.

Flynn, R.J. (1973). *Parasites of Laboratory Animals*. USA: The Iowa University Press.

Lim, B.L., Louis, R., & Saharudin, A. (1989). Study of the small mammals in Taman Negara with special reference to the rat lung-worm. *The Journal of Wildlife and Parks, 8,* 17-30.

Pakeer, O.S.A. (1991). *Protozoa perubatan bergambar*. Bangi: Penerbit Universiti Kebangsaan Malaysia.

Payne, J., Francis, C.M., & Philipps, K. (1985). *A field guide to the mammals of Borneo*. Kota Kinabalu, Sabah: The Sabah Society .

Suriati, S. (1991). *Gerakbalas keimunan melindung tikus daripada jangkitan Angiostrongylus malaysiensis*. Tesis Sarjanamuda. Kuala Lumpur: Universiti Malaya.

Thomas, M. (1983). *Parasitologi perubatan*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Wahab, A.R. (1993). *Cacing dan penyakit manusia*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Zar, J.H. (1999). *Biostatistical analysis (4th. ed.).* United States: Prentice Hall.

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