



UNIVERSITI PUTRA MALAYSIA

***ECTOPARASITES AND ENDOPARASITES OF LOCALLY PRODUCED
LABORATORY RATS***

TUAN AJMAL BINTI TUAN KAMALUDDIN

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**ECTOPARASITES AND ENDOPARASITES OF LOCALLY PRODUCED
LABORATORY RATS**

TUAN AJMAL BINTI TUAN KAMALUDDIN

A project paper submitted to the
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It is hereby certified that we have read this project paper entitled “Ectoparasites and Endoparasites of Locally Produced Laboratory Rats”, by Tuan Ajmal binti Tuan Kamaluddin and in our opinion it is satisfactory in terms of scope, quality, and presentation as partial fulfilment of the requirement for the course VPD 4999 – Project.

Assoc. Prof. Dr. Abdul Rahim Abdul Mutalib
DVM (Mymensingh), MS (UC Davis), PhD (Cambridge)
Lecturer,
Faculty of Veterinary Medicine
Universiti Putra Malaysia
(Supervisor)

Assoc. Prof. Dr. Shaik Mohamed Amin Babjee
BVS (Pakistan), MS (North Wales), PhD (Queensland)
Lecturer,
Faculty of Veterinary Medicine
Universiti Putra Malaysia
(Co-Supervisor)

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ABSTRAK

Abstrak daripada kertas projek yang dikemukakan kepada Fakulti Perubatan Veterinar untuk memenuhi sebahagian daripada keperluan kursus VPD 4999 – Projek.

EKTOPARASIT DAN ENDOPARASIT DALAM TIKUS MAKMAL

TEMPATAN

Oleh

Tuan Ajmal Binti Tuan Kamaluddin

2015

Penyelia: Prof. Madya Dr. Abdul Rahim Mutalib

Penyelia bersama: Prof. Madya Dr. Mohamed Shaik Amin Babjee

Tikus makmal, selain daripada mencit, marmut, arnab dan hamsters, seringkali digunakan di Malaysia dalam penyelidikan. Tikus makmal yang berkualiti dikategorikan sebagai haiwan bebas patogen tertentu (SPF) sementara tikus makmal yang kurang berkualiti dikategorikan sebagai haiwan konvensional. Haiwan konvensional biasanya dijangkiti organisma patogenik dan organisma berpotensi patogenik yang boleh membahayakan haiwan itu sendiri dan juga manusia. Lebih penting lagi, organisma patogenik tersebut boleh mengganggu penyelidikan di dalam pelbagai cara dan hasil penyelidikan yang diperoleh daripada haiwan tersebut mungkin tidak tepat. Oleh itu, objektif kajian ini adalah untuk melakukan pemeriksaan infestasi parasit di dalam tikus makmal tempatan. Lima ekor tikus makmal dari setiap tiga pembekal tempatan telah dipilih secara rawak dan digunakan

dalam kajian ini. Tikus-tikus tersebut telah dibunuh menggunakan gas karbon dioksida sebelum sampel-sampel diambil. Sampel yang diambil adalah air kencing, najis, dan bulu serta organ dalaman untuk mengenalpasti ektoparasit dan endoparasit daripada haiwan tersebut. Kajian ini menunjukkan bahawa kebanyakan tikus makmal dari tiga pembekal tersebut membawa ektoparasit dan endoparasit. Parasit yang dijumpai adalah *Ornithonyssus bacoti*, *Glycyphagus domesticus*, *Syphacia obvelata*, *Syphacia muris*, dan *Aspicularis tetraptera*. Yang menjadi perhatian ialah *Ornithonyssus bacoti* yang merupakan parasit burung juga telah dikesan dalam tikus makmal. Bagaimana parasit tersebut boleh dijumpai di dalam tikus menjadi persoalan yang menarik. Parasit tersebut bagaimanapun boleh juga manjangkiti manusia. Kebanyakan parasit yang dijumpai tidak membahayakan kesihatan tikus makmal tersebut tetapi sesetengahnya akan membahayakan kesihatan mereka apabila beban parasit sangat tinggi terutamanya apabila tikus berada dalam keadaan tertekan seperti semasa eksperimen dijalankan. Ini dapat disimpulkan bahawa tikus-tikus makmal daripada tiga pembekal tempatan tersebut tidak berkualiti tinggi dan apabila digunakan untuk eksperimen, ianya akan mengganggu keputusan kajian.

Kata kunci: Haiwan bebas patogen tertentu (SPF), Haiwan konvensional, Infestasi parasit

ABSTRACT

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

ECTOPARASITES AND ENDOPARASITES OF LOCALLY PRODUCED LABORATORY RATS

By

Tuan Ajmal Binti Tuan Kamaluddin

2015

Supervisor: Assoc. Prof. Dr. Abdul Rahim Mutalib

Co-supervisor: Assoc. Prof. Dr. Shaik Mohamed Amin Babjee

Laboratory rats, besides mice, guinea pigs and hamster, are commonly used in Malaysia in research studies. Good quality laboratory rats are categorized as specific-pathogenic-free (SPF) while others that are somewhat of lower quality are categorized as conventional animals. Conventional animals however, do carry pathogenic and potentially pathogenic organisms that can harm both the animals itself and also humans. More importantly the pathogenic organisms can interfere with research in many ways and results obtained from using such animals may not be valid. Therefore, objective of this study is to screen for parasitic infestation in laboratory rats that are produced locally. Five laboratory rats each from three different suppliers were selected randomly and used in this project. The rats were euthanized using CO₂ before samples were collected. Samples obtained were urine,

faeces and fur as well as internal organs to identify any possible ectoparasites and endoparasites in those animals. From this study, it showed that most of the laboratory rats from the three suppliers do carried both ectoparasites and endoparasites. The parasites found are *Ornithonyssus bacoti*, *Glycyphagus domesticus*, *Syphacia oblevata*, *Syphacia muris*, and *Aspiculuris tetraptera*. It is interesting to note that *Ornithonyssus bacoti*, which is a bird parasite, was also found in the rat. How the parasite managed to be present on the rat is an interesting question. This parasite however, can also infect humans. Many of the parasites found do not seem to affect the health of the rats but some are known to have affected the health of the animals when the parasitic load is heavy especially when the rats undergo stressful conditions such as during an experiment. It can be concluded that the laboratory rats produced by the three suppliers are not of very high quality and when used for experiment may affect the results of the study.

Keywords: Specific-pathogen-free (SPF) animals, Conventional animals, Parasitic infestation.

1.0 INTRODUCTION

Rats are rodents that belong to the family Muridae and the members of genus *Rattus*. There are about 64 species of rats found worldwide and the most important species to humans are the black rat, *Rattus rattus*, and the brown rat, *Rattus norvegicus* which originated in Asia. Rats, other than mice are the most frequently used animal species in experimental research and about 75-100 million of them are used annually worldwide for many purposes (Baumans, 2010a).

Brown rat is also known as Norway rat which is an omnivorous and opportunistic terrestrial rodent. It is one of the most abundant and widespread of all mammals, and it is also one of the world's most serious mammalian pests. This group of rat is mostly grey or brown in colour, have a weight more than 500 g for adult with a body length of 190-265 mm and a tail length of 160-2015 mm. This species can be confused with closely related black rat but it differs from its larger size, smaller eyes, shorter ears and proportionately shorter tail. Its albino form is used in laboratories for research and some have been bred as a pet (Burton, M. and Burton, R., 2002).

Laboratory rats have been used worldwide including Malaysia for research studies. Rats of very good quality for research purposes are those that are Specific Pathogen Free (SPF). However, rats of a lower quality known as conventional animals are also commonly used. These conventional rats are sometimes infected with pathogens or potential pathogens that can cause disease. Besides, pathogens that cause diseases in rats can infect human as well because of the exposure or direct contact between the rats and humans during laboratory works.

Ectoparasites are a diverse and highly adapted group of animals that infest the external body surfaces of vertebrates (Hanafi-Bojd *et al.*, 2007). They are organism that lives on or burrow under the skin surface of its host. The host is important for the parasites as it provide suitable environment and act as the source of food for them. They are also considered a main vector of zoonotic diseases and play an important role in the transmission of a wide variety of diseases. These organisms can cause serious and sometimes a life-threatening illness in humans and animals (Chul-Min *et al.*, 2006). In laboratory rats, most common ectoparasites found are mites, which are *Ornithonyssus bacoti*, *Laelaps nuttali*, *Laelaps echidninus*, *Laelaps sculpturatus* and *Listrophorvides sp.*), lice (*Polyplax spinulosa* and *Hoplopleura pacifica*) and tick (*Ixodes granulatus*) (Syazana *et al.*, 2013).

Endoparasites are parasites that live inside its host body and usually invade into the tissues of the host. They include worms which are helminths, and also single-celled protozoa. The largest group of helminth parasites of endothermal laboratory animals is nematode (Flynn, 1973). Important within this group are the pinworms or oxyurids which are intestinal nematodes belonging to the family Oxyuridae (Taffs, 1976). Oxyurid nematodes are widespread and common infections of both specific pathogen-free (SPF) and conventional laboratory rodents (Pritchett and Johnston, 2002).

The health of the laboratory rats undergoing experiment will influence the outcome of a study. When laboratory rats harbour pathogenic organisms, there is a high chance that they can become sick during experiment since they would definitely undergo stress from many manipulations and procedures being performed on them.

Data collected from sick rats, not due to the experiment itself, are usually flawed and cannot be used in the final analysis. In a worst case scenario, this animal may die and as such the life of the animal is wasted without any benefit. Presently, there are a few local companies that produce laboratory animal but their quality is not defined.

The objective of this study is:

1. To detect the occurrence of ectoparasites and endoparasites in laboratory rats produced locally.

The hypothesis of this study is:

1. Laboratory rats produced locally harbour ectoparasites and endoparasites.

2.0 LITERATURE REVIEW

2.1 Laboratory Rats

Rats are one of the rodents that are used worldwide for experiments and research studies. They are the second most used laboratory animals after mice. Most laboratory rats are from descendants of wild rats, *Rattus norvegicus*. This species of rats also known as Norway rat and they originated from temperate regions of Asia. They have various stocks and strains such as Wistar rats, Sprague-Dawley rats, Zucker rats and Hooded rats which are used for a multitude of research purposes. Although there are many strains of laboratory rats, its albino form are the most used. Based on Fox *et al.*, laboratory rats are categorized into a few categories based on the presence and absence of microbial flora. They are germfree or axenic animals, gnotobiotic animals or gnotobioti, specific-pathogen-free animals (SPF) and conventional animals.

Germfree or axenic animals are animals that are free from all foreign life forms such as bacteria, viruses, etc. While gnotobiotic animals are animals stock or strain derived by aseptic hysterectomy which are continuously maintained using aseptic technique and where the microbial status of the animal is fully defined. Gnotobioti is also known as germ free animal that have been inoculated with a specific number of known flora. Specific-pathogen-free (SPF) animals are animals that are free from specified pathogens but otherwise have undefined flora. SPF animals are typically bred, raised, and maintained in facilities that incorporate barriers to prevent contamination with specific pathogens. Conventional animals refer to animals housed in a system where no barriers are used to prevent

microbiological contamination of the colony which means they are reared with an unknown microflora and unknown disease status and these animals potentially carry common rat pathogens (Fox *et al.*, 2006).

2.2 Health Surveillance

As laboratory animals are used for experiments, they should be free from all microorganisms and in most experimental studies, researchers would like to use clean animals. Therefore health surveillance is regularly done in many laboratory animals facilities in various countries. Routine health monitoring of breeding colonies is essential to maintain high quality animals (Liang *et al.*, 2009). In health surveillance done in Korea from 2000-2003, they focused on increasing the quality of hygiene of laboratory animals and the standardization of microbiological monitoring in that country. This is because the health of animals mostly depends on its environment especially the hygiene of the surrounding area. To assure the microbiological quality of laboratory animals, the population and its environment need to be screened thoroughly on a routine basis (Seok *et al.*, 2005).

From the Animal Resource Center, University of Chicago, there are a few parasites that are excluded from clean laboratory rats. Endoparasites involve are *Aspicularis tetraptera*, *Syphacia sp.*, *Hymenolepis sp.*, *Giardia muris*, and *Encephalitozoon cuniculi*. While for ectoparasites, they are *Radfordia*, *Myobia*, *Ornithonyssus* and *Polyplax*. Meanwhile, SPF rats maintained at the Taiwan National Laboratory Animal Center are free from *Aspicularis tetraptera*, *Syphacia obvelata*, *Syphacia muris*, *Rodentolepsis nana* and *Rodentolepsis diminuta*. In Australia, health monitoring report was published in 2002 by Animal Research of

Monash University and the laboratory rats are free from ectoparasites, *Syphacia spp*, *Eimeria spp*, *Entamoeba muris*, *Giardia spp*, *Srpironucleus spp*, *Trichomonas spp*, and *Chilomastix spp*.

It is essential for laboratory animal breeders to implement and maintain a microbiological quality control program that includes strict biosecurity and comprehensive microbiological or health surveillance. Besides, the control or eradication of worm burdens in laboratory animals ensures the proper procedures in scientific research (Perec-Matysiak *et al.*, 2006). As for the choice of method for health monitoring, it is related to the type of infection and the manner in which the infection is spread in the environment. Therefore in some cases, direct contact and soiled bedding are the best sampling method to detect infection, whereas in other cases exhaust air is better for diagnosis (Liang *et al.*, 2009).

2.3 Ectoparasites

The arthropod ectoparasites of rodents are important vectors of pathogenic microorganisms and for parasitic zoonoses like babesiosis, plague and others. Ectoparasites recovered from rodents are classified into five main groups, Mesostigmata (mites), Prostigmata (chiggers), Acarina (ticks), Phthiraptera (louse) and Siphonaptera (fleas) (Parasmasvaran *et al.*, 2009). Ectoparasites carried by rats do not directly cause disease in humans or domestic animals, although as vectors they are responsible for serious diseases of humans in many countries, such as typhus and the plague via *Xenopsylla cheopis*, the rat flea. In studies done in UK, there a few ectoparasites found in wild brown rat. Although it is not a study of laboratory animals, the species of rat is the same which is *Rattus norvegicus*. The

high prevalence and intensity of fleas, mites, and lice detected could provide a reservoir for such infections but in UK, they represent little risk in the absence of primary pathogens. Ticks, on the other hand can be a vector for *Borrelia* and *Babesia* in the UK. However, these two tick-borne pathogens, were absent from the rats. With regard to species-specific parasites, fleas (*Nosopsyllus fasciatus*) are the intermediate host vector of the protozoan *Trypanosoma lewisi* and helminths *Hymenolepis nana* and *Hymenolepis diminuta*. Heavy infestations of lice (*Polyplax spinulosa*) in rats can cause irritation and anaemia, and are also the most likely vector for the rat rickettsia parasite *Haemobartonella muris* (Webster and Macdonald, 1995). A study also found *Notoedris muris* that spread to the rat's legs and genitalia in severe infections and can result in erosion of the pinna (Owen, 1992).

Among all ectoparasites found on rats, the most common is *Ornithonyssus bacoti* also known as tropical rat mite. *O. bacoti* is an external parasite occurring on rats (*Rattus norvegicus*, *Rattus rattus*), mice (*Mus musculus*), gerbils (*Meriones unguiculatus*) and various other small mammals whose developmental stages feed on the blood of their hosts (Beck and Folster-Holst, 2009). However rats are known to be the preferred hosts although infestation of 10 other species of small mammals has been reported (Baumstark, 2007). *Ornithonyssus bacoti* has been incriminated to cause pruritic dermatitis in man. This is because in case the principal animal host is not available, human beings may become the victim of mite infestation. The relatively low host specificity might be the reason why laboratory personnel was infested while handling the animals (Fox, 1982). The first case report of tropical rat

mite in humans is from Australia in 1913 (Cleland, 1913). Meanwhile, the first authentic case of dermatitis caused by *O. bacoti* in Malaysia was reported by Nadchatrain & Ramalingam (1974).

2.4 Endoparasites

Among helminth parasites infecting laboratory animals, the most common are pinworms belonging to the family Oxyuridae. Rodent pinworms may display some host-specificity and some can also cross species barriers (Perec-Matysiak *et al.*, 2006). In general, *Syphacia obvelata* and *Aspicularis tetraptera* are considered as mouse pinworms, *Syphacia muris* the rat pinworm, *Syphacia mesocricetus* the hamster pinworm and *Denstomella translucida* the gerbil pinworm (Baker, 1998). These pinworms are common high even in well-managed animal colonies (Pinto *et al.*, 1994). The prevalence of pinworms in an infected rodent population depends on many factors such as environmental load, gender, age, strain, and immune status. Animals can also be infected by two species of pinworms concurrently (Pritchett and Johnston, 2002).

While pinworm infections are usually subclinical, there are also some clinical signs in heavily infested rodents. The clinical signs include rough hair coat, rectal prolapse, intussusception, faecal impaction, and poor weight gain (Jacobson and Reed, 1974). Besides, very heavy parasite loads may lead to catarrhal enteritis, liver granulomas and perianal irritation (Baker, 1998). In Taiwan, the National Laboratory Animal Center reported that although pinworms are common in mouse and rat populations, the infestation is more prevalent in rat colonies than in mouse colonies. The likely reason is that laboratory rats typically are housed open, unfiltered cages,

whereas mice are more likely kept in individually ventilated cage system or filtered-top cages, thus limiting parasite spread between and worm numbers in individual mice (Liang *et al.*, 2009).

2.5 Impact on Research

A microbiological quality control for laboratory animals which composed of health surveillance and biosecurity are needed to prevent research complications and public health dangers that have been related with adventitious infections. It has been reported that laboratory animals with microorganism infections can interfere with research and experiments. In some papers it is showed that infected animals are not suitable for biomedical researches as well as for helminth biology experiments (Baird *et al.*, 1982; Ito, 1982). Infections may result in clinical disease and pathological changes, especially in perinatal and immunodeficiency animals (Seok *et al.*, 2005). From the study done by Habermann and Williams in 1958 and Griffiths' study in 1971 it was revealed that infected animals are not suitable for critical works as factors such as nutritional and blood values may not be normal, and it may influence experimental results. Microorganisms that can cause infections to the animals which will then disturb their health status are bacteria, parasites, fungi as well as viruses.

From the various microorganisms, it has been reported that parasitic nematodes may transmit, provoke, and enhance bacterial and viral diseases, suppress or enhance tumour growth (Taffs, 1976). Parasitic infections can affect investigations by increasing or diminishing host susceptibility to experimental stress and competing with the hosts for nutrients. From the endoparasites infections,

pinworm infection can retard growth in mice and rats (Perec-Matysiak *et al.*, 2006). Wagner *et al.* reported definite growth differences between pinworm-free and pinworm-infected rats. *Syphacia muris* experimentally infected animals grew slower than uninfected animals. It was reported that infection with *Syphacia muris* in laboratory rats caused impaired transport of water, sodium, and chloride in intestine (Perec-Matysiak *et al.*, 2006; Pritchett and Johnston, 2002).



3.0 MATERIALS AND METHODS

3.1 Animals

Rats were obtained from three different local breeding facilities and were screened for endoparasites and ectoparasites. Five Sprague Dawley rats each from Company A, B, and C were randomly selected regardless of sex. The rats were received by batch from each company and euthanized right away using CO₂ before sampling. Rats from Company A were all around 6 months old and the average weight is about 400 g, while rats from Company B were about 1 year old with average weight of 600 g and rats from Company C were 1 year old which weight between 400 to 700 g.

3.2 Sample Collections

3.2.1 Fur Combing

After general examinations on the rats were done, the fur was combed using a fine-tooth comb to collect external parasites such as fur mites, ticks, flea and lice. The fur was comb thoroughly so that as many parasites as possible can be collected. Samples were placed in the container filled with 75% ethanol before being fixed with Hoyer's solution for identification later under microscopical examination with 10x and 40x magnification.

3.2.2 Skin Scraping

The body of animals were examined for any skin lesions before skin scraping was performed using a sterile scalpel blade. The scrape was done at the lesions

observed on the animal. The lesion was scraped until it bled in order to get any buried mites. The scrape was placed on a clean glass slides with a drop of glycerol and then covered with a clean cover slip. The specimens were then examined under 10x and 40x magnification of light microscope.

3.2.3 Perianal Tape Impression

A clean cellophane tape about 5 cm in length was used for each animal for perianal tape impression. The tape was grasped with finger at the end part while the middle part of the tape was applied gently to the perianal region of the rat. This was applied a few times to ensure the possible parasites at the region can stick to the tape. Then the tape was placed on a clean glass slide for microscopic examination under 10x and 40x magnification.

3.2.4 Urine Smear

A fresh urine sample was collected from the prepuce of the rats which naturally urinated. The urine drop was then placed on the clean glass slide and covered with cover slip to be examined under the microscope. The urine sample from rats that did not urinate was collected using a sterile syringe and needle by cystocentesis. The samples then were examined under microscopic examination.

3.2.5 Direct Examination of Intestines

After euthanasia, the rats were dissected to collect internal parasites which are helminth and protozoa. The gastrointestinal tract from duodenum until descending colon were removed and placed into clean petri dish containing normal saline and examined under stereo microscope. Contents of the gastrointestinal tract

as well as the scrape of the intestine mucosal layer were placed on the glass slide for Giemsa stain to check for any possible protozoa. The slide was then examined under oil immersion of 100x magnification of light microscope. Adult helminths were detected by rinsing the intestinal tract of each rat into a 250 µm-aperture sieve. The adult helminths found were placed in the 75% ethanol for preservation. For identification, the helminths were placed on a glass slide with lactophenol to view under 10x and 40x microscopic examination. The intestinal contents were also taken for simple floatation technique to look for ova and possibly coccidian.

3.2.6 Faecal Floatation

Faecal floatation technique was performed to look for helminth ova and larval stages as well as to look for coccidia oocysts. Faecal samples were collected from the cage after being transported and also fresh from individual rat. The faeces weighing about 1 gram were mixed with 40 ml of sodium nitrate with specific gravity of 1.3. The mixture was then filtered by using a tea filter before being poured into a vial until a meniscus was formed at the top. A cover slip was placed on top of the vial and left for 20 minutes. After that, the cover slip was lifted up gently and transferred to a glass slide for examination under 10x magnification of light microscope.

3.2.7 Direct Examination of Internal Organs

Internal organs of the rats were also removed and taken for direct examination under stereo microscope. After being removed, the internal organs which were lungs, kidneys, liver, stomach, and urinary bladder were placed in the

container filled with 75% ethanol. The organs were examined to check for any presence of worms such as liver fluke and all the possible worms inside the organs.



4.0 RESULTS

4.1 Ectoparasites

In this study, the only ectoparasites found were mites. No lice, ticks, or fleas were found from the rats. Three different species of mites were identified from the rats. From Company A, all five rats were heavily infested with *Ornithonyssus bacoti*, from Company B, an unidentified mite was found from a single rat and from Company C, *Glycyphagus domesticus* was recovered from a single rat (Figure1).

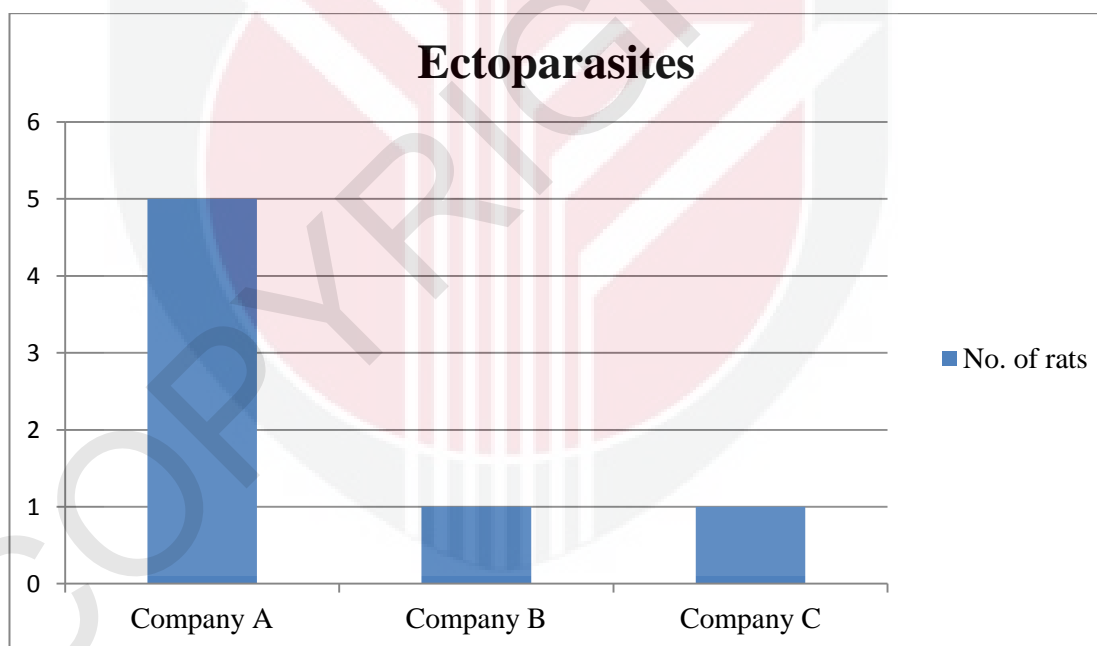


Figure 1: Number of rats infested with ectoparasites among three suppliers

From Fisher's Exact test (Table 1), it is found that there is a significant difference between the number of ectoparasites-infested rats and the suppliers ($p = 0.021$). It shows that rats from company A seem to be more infested with ectoparasites compared to company B and C which only one rat infested with ectoparasites.

Table 1: Mites found from the rats of the three suppliers

| Ectoparasites | Company A | Company B | Company C | Sig. p Value |
|----------------------|------------------|------------------|------------------|----------------------------------|
| Mites | 5/15 (33.3%) | 1/15 (6.7%) | 1/15 (6.7%) | 0.021 |

4.2 Endoparasites

Adult helminths that were recovered are mostly from oxyurid nematode commonly known as pinworms. The pinworms infested all rats in company B and C as adult pinworms were found in both the small intestine and caecum of the rats while rats from company A shown absence of adult pinworms in the intestinal tract but the helminth ova were present in the fresh faecal samples (Figure 2). The species of endoparasites found are *Syphacia muris*, *Syphacia obvelata*, and *Aspicularis tetraptera*.

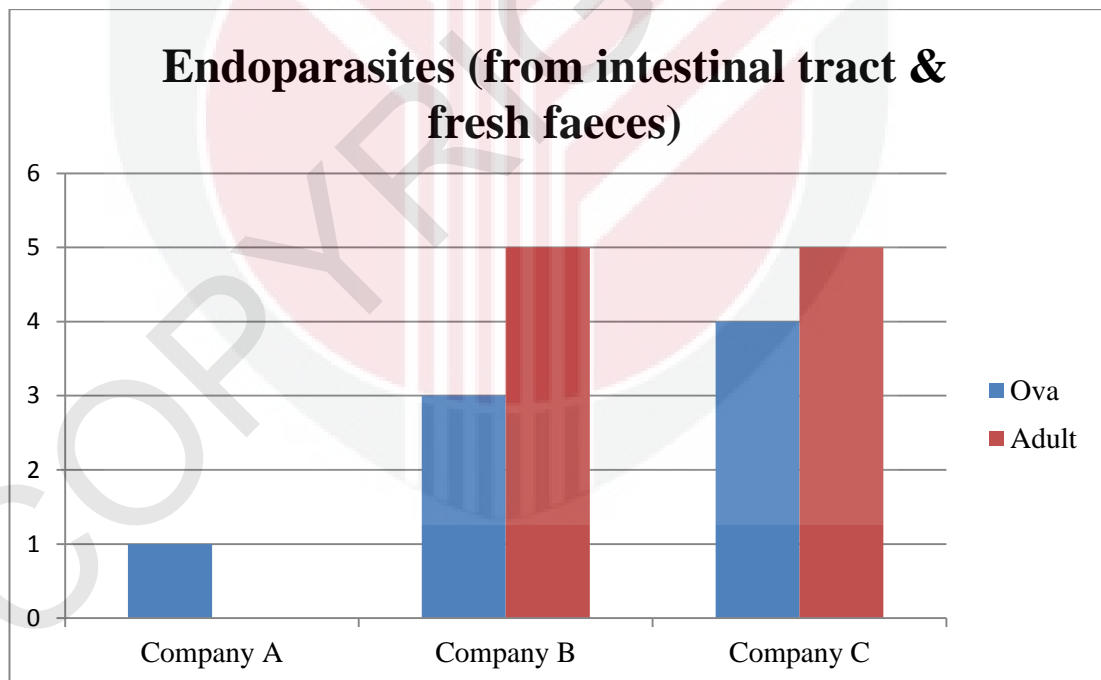


Figure 2: No. of rats infested with endoparasites among three suppliers

Fisher's Exact test (Table 2) revealed that there is no significant difference between the number of endoparasites (ova) infested rats and the suppliers ($p = 0.301$) while there is a significant difference between adult of endoparasites-infested rats with the suppliers ($p = 0.001$). It shows that there is at least one rat from each supplier infested with helminth ova but only rats from Company A are free from adult pinworms.

Table 2: Ova and adult pinworms found in rats from three suppliers

| Endoparasites | Company A | Company B | Company C | Sig. <i>p</i> Value |
|----------------------|------------------|------------------|------------------|----------------------------|
| Ova | 1/15 (6.7%) | 3/15 (20%) | 4/15 (26.7%) | 0.301 |
| Adult | 0/15 (0%) | 5/15 (33.3%) | 5/15 (33.3%) | 0.001 |

From perianal tape impression, *Syphacia sp.* ova were found in every rat from three suppliers (Figure 3).

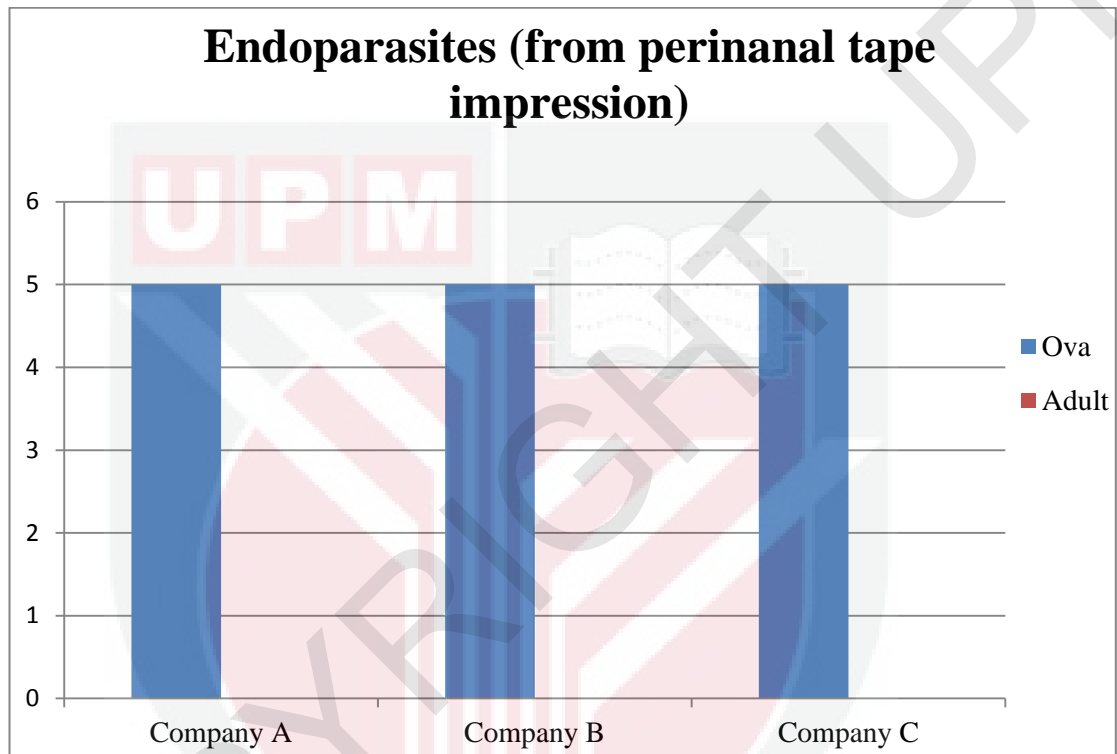


Figure 3: No. of rats with endoparasites ova recovered from three suppliers

No protozoa were found in all rats from the three companies either from the intestinal tract or from the faecal samples.

5.0 DISCUSSION

From the result obtained, it shows that all rats from Company A were heavily infested with mites while the other two companies had only one rat each that was infested with mite. The big difference can be seen between the number of rats infested with mites and also the number of mite found. The reason might be due to the environment and the hygiene factor of the supplier itself (Company A) that cause the rats to be heavily infested with the *Ornithonyssus bacoti* mites. Based on a case report by Baumstark *et al.*, 2007, most *Ornithonyssus bacoti* are found in and around the animals' sleeping area and nests, in the floor dust and in clothing. Between the three suppliers, it showed that rats from Company A are of a lower quality, based on the ectoparasite load compared to the other two suppliers.

Species found from rat of Company B could not be identified as there is no study shown a similar finding. However, the mite looks similar to a mite found on spiders. From identification, there is a resemblance between the organs parts of the mites when compare to the species of mites from spider. Hence, it can be said that this unidentified mite is similar to the spider mites but the exact name to this mite is not yet known. Meanwhile, species found from rat of Company C is *Glycaphagus domesticus*. This species of mite is a house mite which is mostly found on the furniture or storage room. It is known as a common and cosmopolitan stored product pest occurring in stores, houses, barns, straw- and haystacks, beehives, nests of birds and rodents (Brady, 1970; Chmielewski, 1971a; Cusack *et al.*, 1975; Kadzhaja, 1970). A previous study carried out in 2000 found this mite in some samples of beehive debris and post-harvest sweepings of buckwheat seeds collected from barns.

Among the species of ectoparasites found, the most important is *Ornithonyssus bacoti*. This species of mite is known as tropical rat mite which is an external parasite occurring on rats, mice, gerbils, hamsters and various other small mammals (Baumstark *et al.*, 2007) whose developmental stages feed on the blood of their hosts (Beck and Folster-Host, 2009). From previous study, it is known that when the animal host is not available, human can become the victim of the mite infestation. People infested by the tropical rat mite will develop pruritic insect bite-like cutaneous lesions.

The endoparasites found in this study, showed that all to be nematode worms or pinworms. Adult pinworms were found in all rats from Company B and C but no adults found were from Company A. The possible reason is there might be some technical error as the pinworms were very small in size therefore it is quite hard to see for the first time. There was a lack of technique used in finding the worms from intestinal tract of rats from Company A. The intestinal tract of the rats was not rinsed using a 250 µm-aperture sieve hence the pinworms are difficult to see without filtering the intestinal content. However, based on the findings of adult worms in rats from Company B and C using the correct technique, there is a possibility that the adult worms in the rats from Company A could have been recovered as well.

The species of endoparasites found from intestinal content is *Syphacia muris*, from faecal sample is *Aspiculuris tetraptera* and from perianal tape impression are the eggs of *Syphacia muris* and *Syphacia obvelata*. Hence, the findings are expected as previous study done by Taffs in 1976 revealed that mixed infections of rodents with *A. tetraptera* and *S. obvelata* are common. *Aspiculuris* is mainly found in the

colon while *Syphacia* is mostly found in the caecum. There have been reported that these species of pinworms are present in most conventional rat colonies (Hussey, 1957; Stahl, 1961a; Blair & Thompson, 1969). *S. obvelata* is the common *Syphacia* sp. of mice and *S. muris* is the common *Syphacia* sp. of rats, but cross-infection can occur (Hussey, 1957). The host becomes infected by ingesting eggs directly from perianal region of an infected animal, or indirectly from contaminated materials in the environment, such as food and water. Retrofection which is the migration of hatched larvae from anus to colon may possibly occur as reported by Prince, 1950 and Chan, 1952b.

A study conducted in 1976 by Taffs revealed that pinworms infections of laboratory rodents are considered to be non-pathogenic, and infections are generally regarded as being symptomless. However, it is agreed that infected animals are not suitable for critical work and the helminth infection may influence experimental results (Habermann & William, 1958; Griffiths, 1971).

CONCLUSION

This study showed that all rats produced by all suppliers have parasitic infestations. This means that conventional laboratory rats produced locally do carry ectoparasites and endoparasites. However, many of the parasites found do not seem to affect the health of the rats but some are known to have affected the health of the animals when the parasitic load is heavy especially when the rats undergo stressful conditions such as during an experiment. Moreover, it is known that there is a species of mite that can affect human as well. In conclusion, the laboratory rats produced by the three suppliers are not of very high quality and when used for experiment may affect the results of the study. It is important to create a suitable measure in order to control and reduce the parasitic infestation of these laboratory rats.

RECOMMENDATION

It is recommended that more detail and thorough examination of the rats should be carried out especially the intestine of each rat. This is because in this study no protozoa were found in all rats from all three suppliers. The technique used in detecting the protozoa might be improved in future study. Besides, this study also found that all three local animal facilities produced rats of low quality and therefore it is recommended that regular health monitoring should be carried out by local companies. The health surveillance is important in order to control and reduce the possible microorganism infecting laboratory animals especially the breeding colony as they will transfer it to their offspring. Lastly, researchers should also test their animals first before start an experiment. They should be aware of the health of the

animals they purchased are sick or healthy. This is important so that the condition of animal itself will not affect the result of the experiment because some results might not be valid if the animals are sick or unhealthy.



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APPENDICES

1. Ectoparasite (Mites)



Figure 4: *Ornithonyssus bacoti*



Figure 5: *Glycyphagus domesticus*



Figure 6: Unidentified mite

2. Endoparasites



Figure 7: *Aspiculuris tetraptera*



Figure 8: *Syphacia muris*

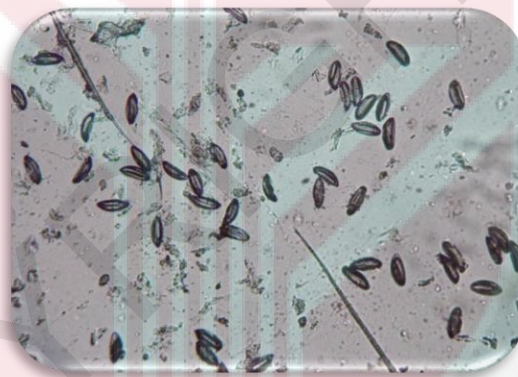


Figure 9: *Syphacia muris* ova



Figure 10: *Syphacia obvelata* ova