

Endoparasites of Rats Caught at Jeollabuk-do in Korea

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전라북도 지역 집쥐의 체내 기생충 감염 조사

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집쥐가 인체 기생충 전파에 어느 정도의 역할을 하는지 그 양상을 밝히고자 전라북도 남원, 익산지역에서 포획한 집쥐의 체내 기생충 감염상을 조사하였다. 섬진강 상류 남원지역에서 32마리, 만경강 중류 익산지역에서 53마리를 채집하여 총 85마리였고, 종별로는 곶쥐(*Rattus rattus*) 28마리, 시궁쥐(*Rattus norvegicus*) 57마리였다. 결과를 요약하면 다음과 같다.

1. 남원, 익산지역의 집쥐 85마리 중 71마리(83.5%)에서 체내 기생충이 검출되었다.
2. 폐장이 회수되었던 집쥐 74마리 중 35마리(47.3%)에서 폐장에 기생하는 조직 기생충인 폐포자충(*Pneumocystis carinii*)이 검출되었다.
3. 전체 85마리의 가로막에서 선모충(*Trichinella spiralis*)을 조사하였고, 폐심장 혈관계에서 광동주혈선충(*Angiostrongylus cantonensis*)을 조사하였으나 한 예도 검출하지 못하였다.
4. 간을 조사한 바 85마리 중 간모세선충(*Capillaria hepatica*) 22례(25.9%), *Taenia taeniaeformis*의 유충(*Cysticercus fasciolaris*) 9례(10.6%), 간흡충(*Clonorchis sinensis*) 1례(1.2%)가 검출되었다.
5. 장내용물을 조사 한 바 85 마리 중 50례(58.8%)에서 윤충 및 원충이 검출되었다. 윤충은 쥐조충(*Hymenolepis diminuta*), 극구흡충류(*Echinostoma* sp.), 쥐요충류(*Syphacia* sp.), 분신충류(*Strongyloides* sp.) 등이었고 원충은 대장아메바(*Entamoeba coli*) 등이었다.

이상의 결과에서 인수공통 질환을 일으킬 수 있는 폐포자충, 쥐조충, 간흡충 등이 집쥐에 감염되어 있어 철저한 집쥐 관리가 요망된다.

KEY WORDS: House rat, Parasite, Zoonosis

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Introduction

Rattus rattus and *Rattus norvegicus* have been regarded as harmful animal to mankind since old times. The rodents, which inhabit human dwellings, are easily capable of diseases transmission to man than any other animals, because of close association with human settlements. Thus, humans might be contracted by rat borne diseases in various ways, occasionally as a result of being bitten by rat or through handling the carcasses, but more commonly by consuming food contaminated by droppings or urine, or by coming into contact with infected blood-sucking arthropods. Another importance is that the rats might act a role as reservoir host of human parasites which could establish some zoonoses.

For the above reasons, many investigators have reported that various helminths and protozoa which infected the rats(Nagahana, 1934, 1935, 1937; Seo et al., 1964a, 1964b, 1968, 1981) and categorized some parasites as a part of zoonoses. Seo et al.(1964) found *Hymenolepis nana*, *Hymenolepis diminuta*, *Entamoeba histolytica* and *Balantidium* sp. from the rats which were collected mainly from Seoul and Chulwon-gun. So far as the literatures are available, parasite surveys of rodents were not performed in Southwestern part of Korea. The present study was aimed to figure out the general status of endoparasites of rats along two rivers of the Mangyung river and the Sunjin river which flow through Jeollabuk-do, and to find a relation between rat parasites and human parasites in terms of zoonosis.

Materials and methods

Rats

Two areas were selected for the collection of rats. Namwon-si near upper stream of the Sunjin river which was known endemic area for *Clonorchis sinensis* and *Metagonimus yokogawai* and Iksan-si near middle stream of the Mangyeong river which was known endemic area for *C. sinensis*. To catch the rats, a sticky paper(No-Run, Korea) was put on the floor or some places where the rats pass through.

The rats trapped on the hard-paper were collected and brought to the laboratory. A total of 85 rats were examined for helminths and protozoa during 1998 to 1999. Of 85 rats, 28 were identified as *R. rattus* and 57 were as *R. norvegicus*.

Rat parasites

A necropsy of the rats was subjected to detect tissue parasites such as *Pneumocystis carinii* from lung, *Angiostrongylus cantonensis* from heart and pulmonary vessels, *Trichinella spiralis* from diaphragm. The materials from liver and intestine were examined to find eggs, larvae or adults of helminths and protozoa.

Parasite collection and identification

For the tissue parasites, the lung tissues were grounded and digested with artificial gastric juice. The sediments were stained with Toluidine-blue O stain and Giemsa stain. The cyst with eight intra-cystic bodies was the criterion to determine *P. carinii*. Contents of blood vessels which connect to the lung and heart were put into petridish and

examined carefully to find *A. cantonensis*. Diaphragms of the rats were cut off, and examined microscopically to find *T. spiralis* by inserting the diaphragmatic tissue between two slide glasses. Liver was dissected along the common bile duct to find *Capillaria hepatica*, cestodes or trematodes.

For the intestinal parasites, all the intestinal contents that were transferred to petridishes, and the fecal matters from the colons were examined to find parasites in various developmental stages such as adult, larva, egg and protozoan trophozoite and cysts. For protozoan cyst the iodine staining solution was dropped and mixed with the sample before microscopical examination. When further detailed identification was needed, Heidenhein's iron hematoxylin stain or Giemsa stain was applied. Cestodes and trematodes were routinely fixed in hot alcohol-formalin acetic acid solution and stained in Semichon's acetocarmine, and permanent mounts were prepared.

Results

Of 85 house rats, 71(83.5%) were positive for parasites of which 47(55.3%) for helminths and 46 (54.1%) for protozoa(Table 1).

For the tissue parasites, *P. carinii* was found 35 (47.3%) of the 74 house rats(Table 2). No case with *T. spiralis* or *A. cantonensis* was found from the respective material examined. *C. hepatica* was found in 22 rats(25.9%) and the larval *Cysticercus fasciolaris* of *Taenia taeniiformis* was in 9(10.6%) and *C. sinensis* was 1(1.2%) only in *R. norvegicus* (Table 3). From Namwon area, endemic for *C. sinensis* and *M. yokogawai*, all the rats examined showed negative for *C. sinensis*, but one *R. norvegicus* rat caught at Iksan area near the Mangyung river that was endemic for *C. sinensis*, showed positive for *C. sinensis*.

Intestinal parasites including *C. sinensis* were positive in 50(58.8%) of 85 rats, regardless of singular

Table 1. Parasites found in house rats caught at Jeollabuk-do

Species of rat	No. of exam.	Parasites positive		Total
		Helminths	Protozoa	
<i>R. rattus</i>	28	11(39.3)	12(42.9)	19(67.9)
<i>R. norvegicus</i>	57	36(63.2)	34(59.6)	52(91.2)
Total	85	47(55.3)	46(54.1)	71(83.5)

Unit: No.(%)

Table 2. *P. carinii* in the lung of house rats caught at Jeollabuk-do

Species of rat	No. of exam.	Positive(%)	Collected place
<i>R. rattus</i> and <i>R. norvegicus</i>	74	35(47.3)	Namwon (Sumjin river) and Iksan (Mangyeong river)

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or mixed infection (Table 4). The parasites collected from intestine were as follows: *H. diminuta*, *Echinostoma* sp., *Syphacia* sp., *Strongyloides* sp., Rhabditoid larva, Coccidia (Eimeria), and *Entamoeba coli*.

Among the rat parasites found in this study, some parasites related to zoonoses in the aspect of human parasitic infection were 3 kinds in *R. rattus* and 5 kinds in *R. norvegicus* (Table 5).

Table 3. Parasites in the liver tissue and the bile ducts from house rats caught at Jeollabuk-do

Species of rat	No. of exam.	Parasites			Remarks
		<i>C. hepatica</i>	<i>T. taeniaeformis</i> *	<i>C. sinensis</i>	
<i>R. rattus</i>	28	7(25.0)	4(14.3)	0(0.0)	
<i>R. norvegicus</i>	57	15(26.3)	5(8.8)	1(1.8)	<i>C. sinensis</i> positive rat from Iksan (Mangyeong river)
Total	85	22(25.9)	9(10.6)	1(1.2)	

* : the larval *Cysticercus fasciolaris*.

Table 4. Parasites in the intestine from house rats caught at Jeollabuk-do

Rats	No. of exam.	No. of positive(%)	Parasites			
			Identified		Unidentified	
			Helminths	Protozoa	Helminths	Protozoa
<i>R. rattus</i>	28	9(32.1)	<i>H. diminuta</i> (1)*	<i>E. coli</i> (1)	<i>Echinostoma</i> sp. (1) <i>Syphacia</i> sp. (2) <i>Strongyloides</i> sp. (1)	Coccidia (5)
<i>R. norvegicus</i>	57	41(71.9)	<i>C. sinensis</i> (1) <i>H. diminuta</i> (4)	<i>E. coli</i> (3)	<i>Echinostoma</i> sp. (3) <i>Syphacia</i> sp. (2) <i>Strongyloides</i> sp. (12) Trematoda adult (1) Rhabditoid larva (3)	Coccidia (10)
Total	85	50(58.8)	6	4	25	15

* : Number of the parasite-positive rat.

Table 5. Parasites related to zoonoses in the house rats caught at Jeollabuk-do

Rat	No. of rat	No. of positive (%)	Species
<i>R. rattus</i>	28	13(46.4)	<i>Pneumocystis carinii</i> <i>Hymenolepis diminuta</i> <i>Echinostoma</i> sp.
<i>R. norvegicus</i>	57	48(84.2)	<i>Pneumocystis carinii</i> <i>Strongyloides</i> sp. <i>Hymenolepis diminuta</i> <i>Echinostoma</i> sp. <i>Clonorchis sinensis</i>

Discussion

About eleven species of rats have been described in Korea(Hwang, 1959). Among them *R. norvegicus*, *R. rattus alexandrinus* and *R. rattus rattus* are the known rats which inhabit near human dwellings (Park, 1929; Nagahana, 1937). And the three species have recognized as the most probable transmitter of human parasites together with other pathogenic agents(Ogura, 1936).

In the present survey, among the 85 house rats, the positive rate of parasites was 83.5%, of which 55.3% were for helminths and 54.1% were for protozoa. Seo et al.(1968) reported that 93.4% of helminths were positive in the rats caught in Seoul. Environmental improvement during past two decades may be the reason such a declining rate in helminth infection.

It is noteworthy that natural infection rate with *P. carinii* was 47.3% in the house rats in this study. In Japan, Yoshida et al.(1978) also reported 100% of incidence among 6 *R. norvegicus* caught in Kyoto during 1976-1977. Infections of *A. cantonensis* were reported in Taiwan and many parts of pacific islands (Faust et al., 1976), and *T. spiralis* from Thailand and Honkong(Harinasuta, 1983). The first human case of *T. spiralis* infection was reported in Korea (Sohn et al., 2000). However, all the cases in this study showed negative for the tissue parasites. In the liver, *C. hepatica*, the larva of *T. taeniaeformis*, and *C. sinensis* were found. The infection with *C. hepatica* has been reported in the rats(Seo et al., 1968). The prevalence in the late 1970s was 38.0% (Min, 1979), but it was 25.9% in this survey. *C. sinensis* from the liver of one *R. norvegicus* which

was caught at an endemic village near the Mangyeong river was indicative the fact that the rats play a role as the reservoir host(Seo et al., 1981). Among 32 rats caught at the upper stream of Sumjin river, no *M. yokogawai* was found though it was presumed that the rats in this area may play as the reservoir host.

From intestine, 32.1% of *R. rattus* and 71.9% of *R. norvegicus* were infected with helminths and/or protozoa. Three parasites were identified as *H. diminuta*, *C. sinensis* and *E. coli*, but other helminths and protozoa were not identified. *Echinostoma* sp. is the most probable zoonotic parasite(Seo et al., 1980, 1983). Several cases of human infection with *Echinostoma* sp. were reported in Korea. *E. hortense* in 1 case by Seo et al.(1983) 2 cases by Ryang et al.(1985), and *E. cinetochis* in 1 case by Seo et al. (1980), 2 cases by Ryang et al.(1986) had been reported.

Thus, the parasites found in the house rats such as *P. carinii*, *H. diminuta*, and *C. sinensis* related to zoonoses may infect to humans in this area, so massive control of the rats must be needed for the control of human parasitic infection.

Conclusion

A total of 85 house rats were caught in Jeollabuk-do. 32 rats at Namwon-si near upper stream of the Sumjin river and 53 at Iksan-si near middle stream of the Mangyeong river were classified 28 *R. rattus* and 57 *R. norvegicus*.

1. Of 85 house rats, 71(83.5%) were positive for parasites.
2. Natural infection of *P. carinii* were notified 35

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(47.3%) of 74 rats.

3. No *T. spiralis* and *A. cantonensis* were found in 85 rats.
4. *C. hepatica* in 22(25.9%), the larval *Cysticercus fasciolaris* of *T. taeniaeformis* in 9 (10.6%), and *C. sinensis* in 1 (1.2%) were found in 85 livers of the rats.
5. A fraction of 50 (58.8%) rats had helminths and/or protozoa in their intestines. *H. diminuta*, *Echinostoma* sp., *Syphacia* sp., *Strongyloides* sp., and *E. coli* were observed.

Because some parasites found in the house rats such as *P. carinii*, *H. diminuta*, and *C. sinensis* are related to zoonoses, the rats as a reservoir host must be controlled for the eradication of human parasitic infection.

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