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THE ROLE OF RATS AS RESERVOIR OF SOME INTERNAL PARASITES WITH POSSIBLE PUBLIC HEALTH IMPLICATIONS IN THE SUEZ CANAL AREA.

(With 4 Tables)

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دور الفئران كعائل خازن لبعض الطفيليات الداخلية وتأثيرها على الصحة العامة فى منطقة قناة السويس

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فى مسح شامل لطفيليات الفئران تم تجميع ٣١٠ فأر من نوعين هما (الفأر النرويجى) والفأر الاسكندرانى من مناطق مختلفة بمحافظتى الإسماعيلية وبورسعيد وتم فحصها لمعرفة مدى إصابتها بالطفيليات الداخلية. ووجد أن الإصابة الكلية بالطفيليات الداخلية كانت ٧٣,٥٪ وكان معدل الإصابة للأنواع المختلفة من هذه الطفيليات كالآتى: ٣٧,٧٪ طفيليات أولية (١٣,٢٪ تريبانوسوما لويس، ٨,١٪ إبيترسروزون ميورس، ٢,٩٪ بابيزيا ميكروتى، ١٧,٤٪ كريبتوسبوريديم)، ٥٣,٥٪ ديدان شريطية (٤٠,٦٪ هيمينوليبس دايمنيوتا، ٤,٨٪ هيمينوليبس نانا، ٩,٠٣٪ حويصلات الفشيولارس)، ٥٩,٤٪ ديدان اسطوانية (٣١,٣٪ بروتوسبريورا، ٤,٥٪ ستربتوفاريجس كنتازى و ٢,٥٪ سترنجولويديس راتى و ١١,٩٪ سايفيشيا ابفيلاتا، ١٩,٠٣٪ سايفيشيا ميورس، ١,٣٪ كابيلاريا هيباتيكا)، ٣,٢ ٪ أكانسوسفالا (مونيليفورمز مونيليفورمز) ٠,٣٪ ديدان مفلطحة (أبوفيلس دونيكس). وقد تمت مقارنة النتائج فى كلا المحافظتين وكذلك فى كل من النوعين. هذه النتائج تؤكد ان هذه الفئران تحمل بعض الطفيليات الداخلية والتى لها تأثير أكيد على الصحة العامة.

SUMMARY

A total of three hundred and ten rats of two common species; *Rattus r.* norvegicus and *Rattus r. alexandrinus*, were trapped from different localities of Ismailia and Port Said Governorates. The overall internal parasitic infestation rate was 73.5% (228 out of 310 rats). The infestation rates of different categories of the identified parasites were 37.7% of protozoa (13.2% of *Trypanosoma lewisi*, 8.1% of *Eperythrozoon muris*, 2.9% of *Babesia microti* and 17.4% of *Cryptosporidium* sp.); 53.5% of cestodes (40.6% of *Hymenolepis diminuta*, 4.8% of *Hymenolepis nana* and 9.03% of *Cysticercus fasciolaris*); 59.4 of nematodes (31.3% of *Protospirura* sp., 4.5% of *Streptopharagus kuntzi*; 2.5% of *Strongyloides ratti*, 11.9% of *Syphacia obevelata*, 19.03% of *Syphacia muris* and 1.3% of *Capillaria hepatica*); 3.2% of acanthocephala (*Moniliformis moniliformis*) and 0.3% of trematodes (*Apophallus donicus*). These findings confirm that rats in the investigated area have particular parasites which affect the public health.

Key words: *Rats- Reservoir- Internal parasites- Public Health.*

INTRODUCTION

Rats serve as a primary reservoir of many zoonotic disease organisms (Walter, 1982). The disease organisms may be spread by bites, hairs, feet, ectoparasites, urine, faeces, oral or nasal secretions. Since the pathogens are often in the blood stream and vital organs of the rats, an animal eating them may acquire the disease. Wild rats are often considered man's enemy because of the disease organisms they harbor, the people they bite, the food they destroy and the terror they create. The world wide distribution and public health importance of parasitic diseases infesting rodents have been attracted the attention of several investigators in Egypt (Monib, 1980, in Assiut; El-Azzazy, 1981, in Sharkia, El-Sokkary and Heikel, 1986; Samaha and Otify, 1991, in Behera and Alexandria; Fayek and El-Gwady, 1991, in Sinai and Abdel-Salam, et al., 1994, in Sohag). However the research on parasites of rats in Suez Canal area was very scanty and limited to certain parasitic species (Morsy et al., 1982 & 1986; and El-Gindy, et al. 1987). Therefore, this study was undertaken to determine the internal parasites of rats in Ismailia and Port Said Governorates, throwing a light on the role of rats as potential sources of some zoonotic parasites.

MATERIALS and METHODS

Three hundred and ten rats were trapped alive from Ismailia and port Said Governortates. These rats were identified according to Osborn and Helmy (1980) as 120 of *Rattus r. norvegicus* and 40 of *Rattus r. Alexandrinus* from Ismailia and 100 of *Rattus r. norvegicus* and 50 *Rattus r. Alexandrinus* from Port Said. Each rat was anaesthetized using a piece of cotton, soaked with a small amount of ether and chloroform mixture. Blood smears were prepared from the inner canthus of the eye using a special capillary tube. The smears were air-dried, fixed in absolute methanol, then stained with Giemsa stain, washed in running tap-water, air-dried and examined carefully (Levine, 1985). The anaesthetized rats were scarified, the chest and abdominal cavities were opend for detection of extraintestinal helminths. The liver was inspected for any parasitic cysts specially *Cysticercus fasciolaris*. The lung and liver were cut into small pieces and put them in separate petri-dishes containing a warm physiological saline for detection of fine worms. The alimentary tract was divided into three parts; stomach, small and large intestines. Each part was opened and scrapped in separate petri-dishes. The large worms were collected by naked eye and the microscopic ones were collected by the aid of dissecting microscope. Trematodes, cestodes and Acanthocephala were stretched, then fixed in 10% neutral buffer formalin, washed in running water, stained in Semichon's acetic carmin, decolorized in 1% acid alcohol, dehydrated in ascending grades of alcohol, cleared in clove oil, then xylene and mounted in Canada balsam, according to Gardner et al. (1988). Nematodes were fixed in hot-alcohol-glycerine, cleared, in lactophenol and mounted in glycerine-geline. Feces and intestinal scrapping were examined for protozoa both by direct smear method and concentration flotation technique (Levine, 1985). Iodine wet mount and modified Zel Nelsson technique (MA and Soave, 1983), was used as confirmatory test for identification of *Cryptosporidium* sp. oocysts. Specimens from liver, lung and brain were fixed in 10% neutral buffer formalin and processed for histopathologic examination. The detected parasites were identified according to El-Azzazy (1981) and Monib (1980). A x^2 test of independence was used in the analysis of the results.

RESULTS

The data summarized in Table (1) showed that the overall internal parasitic infestation rate among the examined rats was 73.5% (228 out of

310). The total prevalence of parasitic infestation rate among *Rattus r. norvegicus* (72.7%) was nearly similar to that obtained from *Rattus r. Alexandrinus* (75.5%). There was no significant difference between the internal parasitic infestation rate among the examined rats in Ismailia (70%) and Port Said (77.3%) Governorates (P > .05).

The infestation rates of different categories of parasites among the examined rats were 37.1% of protozoa; 53.5% of cestodes; 59.4% of nematodes; 3.2% of Acanthocephala and 0.3% of treamatode as shown in Table (2).

The distribution of infected rats according to polyparasitism was illustrated in Table (3). In decreasing order, the highest infestation rates were recorded with two parasites (36.4%); three parasites (29.4%), one parasite (22.4%) and four parasites (10.1%). The lowest infestation rates were with six parasites (0.4%) and five parasites (1.3%).

The prevalence of different species of parasites in rats in Ismailia and Port Said Governorates was summarized in Table (4). In protozoa; the prevalence rates of *Trypanosoma lewisi, Eperythrozoon muris, Babesia microti* and *Cryptosporidium muris* were 13.2%, 8.1%, 2.9% and 17.4% respectively. In Ismailia governorate, the infestation rates of *Trypanosoma lewisi* (16.6%), *Eperythrozoon muris* (10%) and *Babesia microti* (5%) among *Rattus r. norvegicus* were higher than those (7.5%, 2.5% and 0.0% respectively) reported among species of *Rattus r. alexandrinus*. However, *Cryptosporidium muris* infestation rates were similar in both species.

In Port Said governorate, the infestation rates of rats of species *Rattus r. norvegicus* with *Trypanosoma lewisi* (15%), *Eperythrozoon muris* (10%) and *Cryptosporidium muris* (20%) were higher than those reported among species of *Rattus r. alexandrinus*. However, the prevalence rates of *Babesia microti* were similar in both species (2%).

The total infestation rates of cestodes were *Hymenolepis diminuta* (40.6%), *Hymenolepis nana* (4.8%) and *Cysticercus fasciolaris* (9.03%). The infestation rates of cestodes in Ismailia Governorate were nearly similar to those obtained in Port Said Governorate.

The highest prevalence rates of nematodes were reported with *Protospirura* sp. (31.3%), *Syphacia muris* (19.03%) and *Syphacia obvelata* (11.9%). The lowest infestation rates were obtained with *Capillaria hepatica* (1.3%), *Strongyloides ratti* (2.5%) and *Streptopharagus kuntzi* (4.5%).

The total prevalence rate of acanthocephala (*Moniliformis moniliformis)* was 3.2%. *Apophallus donicus* was the only recorded trematode from one *Rattus r. norvegicus* in Port Said Governorate.

DISCUSSION

Rats play a great part in disseminating parasitic worms or acting as an intermediate host. It is of interest to find what parasites carry and whether any of these parasites are found in man and domestic animals. The present investigation revealed that the two common rats; *Rattus r. norvegicus* and *Rattus r. alexandrinus*, in Suez Canal area, were infested with 15 internal parasites. The parasitic infestation rates among these rats were nearly similar to those reported by El-Sokkary and Heikel (1986) in Behera Governorate (78%) and Abdel-Salam et al., (1994) in Sohag Governorate (68.8%). But it was higher than those reported by Saoud et al., (1986) in Lower Egypt (29%) and Samaha and Otify (1991) in Behera and Alexandria Governorates (42.3%). In general, the highest infestation rates were recorded in nematodes; cestodes and protozoa.

These results differ from those recorded by Rifaat et al (1971) who reported that the infestation rates of cestodes and nematodes were 22.2% and 17.6% respectively, while Abdel-Salam et al (1994) recorded that the highest infestation rate was in cestodes (28.13%) and the lowest was in protozoa (14.38%) .

From the mentioned above, the parasitic infestation rates in this study, vary in frequency percentages with those reported in the available literature. This may be attributed considerably to rat species, behaviour and environmental condition (Fahmy et al., 1983).

Regarding polyparasitism in rats; the highest infestation rates were recorded with two, three and four parasites, while the lowest infestation rates were recorded with six and five parasites. These findings confirm that the mixed parasitic infestations are common in animals (Tarczynski, 1981).

The infestation rates of *Trypanosoma lewisi*, *Eperythrozoon* sp. and *Babesia microti*, in this study, were nearly similar with those reported by Fayek and El-Gwady (1991), in Sinai Peninsula, who found that *Trypanosoma lewisi* was more prevalent (15%) than *Eperythrozoon* sp. (10%) and the lowest prevalence rate was with *Babesia microti* (2%). Johnson (1933) reported *Trypanosoma lewisi* in a Sikh child in Malaysia. Moreover, human infection with this parasite was also recorded by Shrivastava and Shrivastava (1974) in India. This suggests the possibility of transmission of *Trypanosoma lewisi* to man (Tikaram and Banerjee, 1984). *Babesia microti* was thought to be restricted to small mammals until the first human cases were diagnosed in residents of Nantucket Island, Massachusetts (Western et al., 1970). This zoonotic parasite has recently infected numerous

human residents worldwide (Dammin et al., 1981). The known reservoirs included several rodents (Spielman et al., 1981).

Cryptosporidium sp. infestation rate, was higher than those reported by Samaha and Otify (1991) in Behera and Alexandria Governorates (5.7%) and Abdel-Salam et al., (1994) in Sohag Governorate (6.25%). The possibility of cross infestation between rats and other animals or man is not to be disregarded. Since the mammalian species of *Cryptosporidium* may not be host specific (Tzipori et al., 1980; Desokey et al., 1989 and Abou-Eisha, 1994).

Hymenolepis diminuta is very common in rats in all parts of the world. The general infestation rate in the present investigation was nearly similar to that reported by Fahmy et al., (1969) in the Nile-Delta area (36.8%). However, they reported higher infestation rates with *Hymenolepis diminuta* in Upper Egypt (67%) and central zone of Egypt (53.1%). *Hymenolepis nana* infestation rate, in this study, was lower than those reported by Kaoud, et al (1983); Samaha and Otify (1990) and Abdel Salam, et al. (1994). However, it was higher than that reported by Fayek and El-Gwady (1991) in Sinai Peninsula (2%). Regarding the public health importance of both *Hymenolepis diminuta* and *Hymenolepis nana*, Riely (1920) and El-Masry et al (1985) detected both types in children and they considered, rodent feces as a main source of human infestation. *Cysticercus fasciolaris* infestation rate in rats was higher than that reported by Fayek and El-Gwady (1991). But it was lower than that recorded by Fahmy, et al. (1969) who found that 32.8% of Norway rats in Egypt infected with this metacestode.

In the present investigation, the highest prevalence rates of nematodes were reported with *Protospirura* sp. (31.3%) and the lowest with *Capillaria hepatica (1.3%), Strongyloides ratti (2.5%)* and *Streptopharagus kuntzi(4.5%)*. These results differ with data given by Saoud, et al. (1986) in lower Egypt who recorded the highest infestation rates with *Syphacia* spp. *Syphacia obvelata* was an oxyuride nematode of cosmopolition distribution among rats. *Syphacia obvelata* infestation rate in this study was nearly similar to that reported by Abdel-Salam, et al. (1994) in Sohag (15.63%). It was higher than those reported by Arafa (1968) and Fahmy, et al. (1983) who estimated an incidence percentages of 3.0% and 4.2% respectively. Our obtained data agree with those reported by Hussey (1957) and El-Sokkary and Heikel (1986) in that *Syphacia muris* was more prevalent than *Syphacia obvelata* in rats. Concerning the public health importance of syphacia species, Reily (1920) isolated it from children and he added that rats act as reservoir hosts for human infestation .

Rats have been involved with *Capillaria hepatica* for a long time. The first isolation from a rat was made in 1893 (Walter, 1982). In the present study, *Capillaria hepatica* infestation was lower than that reported by Farhang-Azad (1976), in Baltimore zoo and in Ethiopia (75%), who found that nearly all of the adult rats were infested, while 65% of the Juveniles had infestations. Ashi (1961) in Hawaii, observed *Capillaria hepatica* in the liver of a rat in conjunction with a report of a fatal infection in a child with *Capillaria hepatica.*

In the present study, the infestation rate with Acanthocephalan species, *Moniliformis moniliformis* was nearly similar to that reported by Fayek and El-Gwady (1991) in Sinai Peninsula (2%). Walter (1982) stated that the general rate of infesation in wild rats in Egypt was reported as 7% with a peak of 31.6% in Faiyum.

Only one heterophyid trematode (*Apophallus donicus*) was identified in *Rattus r. norvegicus* with prevalence of 1%. These results were in line with that of Price (1931) who detected this Parasite from rats. This may attributed to the presence of fresh and marine water fishes in both Ismailia and Port Said areas where the rats may feed on them.

In conclusion, from the mentioned above, rats in Suez Canal area, act as a reservoir of particular parasites which are transmissible to man. The presence of wild rats constitute a complex economic and public health problems. Therefore, rat proofing in human and animal buildings and the maintenance of sanitary measures together with the mechanical, chemical and biological distruction of rodents are essential.

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Table (1) : The total infestation rates of rats with internal parasites in Ismalia and Port Said.

Type of wild rats	Isamilia		Port Said		Total	
	No. of infested / No. of examined	%	No. of infested / No. of examined	%	No. of infested / No. of examined	%
Rattus r. norvegicus	80/120	66.7	80/100	80	160/220	72.7
Rattus r. alexandrinus	32/40	80	36/50	72	68/90	75.5
Total	112/160	70	116/150	77.3	228/310	73.5

$X^2 = 2.2$ ($P > .05$)

Table (2) : The total prevalence of different categories of parasites in Ismalia and Port Said..

Parasites	Isamilia		Port Said		Total	
	No. of infested / No. of examined	%	No. of infested / No. of examined	%	No. of infested / No. of examined	%
- Protozoa	62/160	38.8	53/150	35.3	115/310	37.1
- Cestodes	90/160	56.9	76/150	50.7	166/310	53.5
- Nematodes	106/160	66.3	78/150	52	184/310	59.4
- Acanthocephala	4/160	2.5	6/150	4	10/310	3.2
- Trematode	0/160	0.0	1/150	0.7	1/310	0.3

Table (3) : Distribution of the infested rats according to the mixed parasitic infections.

No. of parasites	Infected wild rats	
	No.	%
One parasite	51	22.4
Two parasites	83	36.4
Three parasites	67	29.4
Four parasites	23	10.1
Five parasites	3	1.3
Six parasites	1	0.4
Total	228	100

Table (4) : Prevalence of different species of parasites among the examined rats.

Parasite species	Ismailia						Port Said						Grand total	
	R. norv		R. r. alex.		Total		R. norv		R. r. alex.		Total			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
- Protozoa														
- Trypanosoma lewisi	20/120	16.6	3/40	7.5	23/160	14.4	15/100	15	3/50	6	18/150	12	41/310	13.2
- Eperythrozoon muris	12/120	10	1/40	2.5	13/160	8.1	10/100	10	2/50	4	12/150	8	25/310	8.1
- Babesia microti	6/120	5	0/40	0.0	6/160	3.8	2/100	2	1/50	2	3/150	2	9/310	2.9
- Cryptosporidium muris	24/120	20	8/40	20	32/160	20	20/100	20	6/50	12	26/150	17.3	58/310	17.4
- Cestodes														
- Hymenolepis diminuta	50/120	41.7	18/40	45	68/160	42.5	40/100	40	18/50	36	58/150	38.7	126/310	40.6
- Hymenolepis nana	7/120	5.8	2/40	5	9/160	5.6	4/100	4	5/50	4	6/150	4	15/310	4.8
- Cysticercus fasciolaris	15/120	12.5	1/40	25	16/160	10	10/100	10	2/50	4	12/150	8	28/310	9.03
- Nematodes														
- Protospirura sp.	44/120	36.7	11/40	27.5	55/160	34.4	32/100	32	10/50	20	42/150	28	97/310	31.3
- Streptopharagus kuntzi	6/120	5	3/40	7.5	9/160	5.6	2/100	2	3/50	6	5/150	3.3	14/310	4.5
- Strongyloides ratti	1/120	0.8	3/40	7.5	4/160	2.5	0/100	0.0	4/50	8	4/150	2.7	8/310	2.5
- Syphacia obvelata	20/120	16.7	6/40	15	26/160	16.3	5/100	5	6/50	12	11/150	7.3	37/310	11.9
- Syphacia muris	32/120	26.7	11/40	27.5	43/160	26.8	16/100	16	0/50	0.0	16/150	10.7	59/310	19.03
- Capillaria hepatica	3/120	2.5	0/40	0.0	3/160	1.9	0/100	0.0	1/50	2	1/150	0.7	4/310	1.3
- Acanthocephalla														
- Moniliformis moniliformis	3/120	2.5	1/40	2.5	4/160	2.5	6/100	6	0/50	0.0	6/150	4	10/310	3.2
- Trematode														
Apophallus donicus	0/120	0.0	0/40	0.0	0/160	0.0	1/100	1	0/50	0.0	1/150	0.7	1.310	0.3