

SUSCEPTIBILITY OF RATS AND MICE TO INFECTION WITH CYNODIPLOSTOMUM AZIMI (TREMATODA : DIGENEA) AND THE EFFECT OF INFECTION ON THEIR WEIGHT GAIN.

Amal I. Khalil, Ahlam E. Abou Safey, Ahmed A. Massoud and Ehab M. Tossou

Zoology Department, Faculty of Science, Tanta University

ABSTRACT

An experimental study was carried out to observe the effect of species, sex and maturity on the susceptibility of rats and mice to Cynodiplostomum azimi infection. This was estimated through the study of the worm recovery rate, the distribution of worms within the intestine, the prepatent period and the number of intrauterine eggs found within the adult.

Mice were found to be more susceptible than rats, males more than females and immature animals more than mature ones.

The possible effect of hormonal balance, mucus and immune response on the susceptibility in different groups of animals was discussed.

Infected animals gained less weight than the control throughout the experiment, possibly due to malabsorption and reduced food intake.

INTRODUCTION

Cynodiplostomum azimi is an intestinal trematode of mammals and fish eating birds that is found in Egypt. El-Assal (1974) and Khali (1987) studied and reviewed its growth and development in naturally and experimentally infected hosts.

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Khalil (1987) and Tosson (1991) described the pathologic effect on both the intermediate and final hosts.

In 1991, Huffman *et al.*, declared that parasite establishment, survival and fecundity are affected by host-related factors such as strain, age and sex.

The present study is undertaken to study the susceptibility of experimental animals to *C. azimi* infection in relation to host species, sex and maturity and the effect of infection on the ability of the host to gain weight.

MATERIAL AND METHODS

Live encysted metacercariae of *Cynodiplostomum azimi* were collected mechanically from the skeletal muscles of the Nile fish *Clarias lazera* and kept in physiological saline.

A total of 240 albino rats and 240 albino mice were divided each into 4 groups according to sex (males and females) and maturity (mature and immature) as illustrated in Table (1). Each group contained 60 animals of the same species. Thirty of which were fed each with 20 encysted metacercariae and were used for infection studies, and thirty as control. From each group ten infected animals and 10 control were sacrificed after one week, 4 weeks and 8 weeks post infection.

The intestine was longitudinally divided into three parts, the fore part (the duodenum and jejunum), the mid part (proximal ileum) and the hind part (distal ileum and rectum). The lumen was opened in physiological saline. Worms from each part were collected separately in saline, counted and fixed in 70% ethyl alcohol.

The variables used to assess the susceptibility of animal hosts for experimental infection with *C. azimi* one week after infection were :

- The percentage of adult worms recovered from the intestine of the host (worm recovery rate).
- The distribution of adult worms within the intestine of the host.
- The time of first appearance of trematode eggs in the stool of the host (Prepatent period).
- The mean number of intrauterine eggs within the adult worm.

Changes in the mean weight gain of different groups of infected animals were compared with controls at different time intervals; one week 4 weeks, and 8 weeks after infection.

Student's "t" test was used to determine significant difference between different groups of animals.

RESULTS

In the present study, all groups of animals were susceptible to *C. azimi* infection. Data presented in tables (1 and 2) show that the worm recovery rate was significantly higher in infected mice than rats ($P < 0.05$). In both species, the majority of adult worms were recovered from the fore part of the intestine, few from the middle and none from the hind part. Eggs appeared earlier in the stools of infected mice than rats. No apparent difference was observed in the mean number of intrauterine eggs in trematodes recovered from rats and mice.

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Table (1) : Recovery rate and distribution of *C. azimi*, one week after experimental infection of rats and mice with 20 metacercariae.

Host	Mean Number of worms recovered	Recovery rate (%)	Recovery rate (%) from the intestine		
			Fore* part	Middle* part	Hind* part
Rats					
Immature ♂	19.1	95.5	100.0	0.0	0.0
Mature ♂	18.2	91.0	98.9	1.1	0.0
Immature ♀	18.9	94.5	100.0	0.0	0.0
Mature ♀	16.5	82.5	100.0	0.0	0.0
Mice					
Immature ♂	19.6	98.0	100.0	0.0	0.0
Mature ♂	19.5	97.5	98.0	2.0	0.0
Immature ♀	19.1	96.0	100.0	0.0	0.0
Mature ♀	18.9	94.5	100.0	0.0	0.0

* Duodenum and jejunum

** Proximal ileum

*** Distal ileum and rectum

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Table (2) : Time and percentage of earliest recovery of eggs in stool and number of intrauterine eggs of experimentally infected rats and mice one week after infection.

Host	Mean Number of worms recovered	Earliest recovery of eggs in stool		Mean number of intrauterine eggs
		Day	% of infected animals	
Rats				
Immature ♂	20	5th 4th	80% 20%	7
Mature ♂	20	5th 4th	80% 20%	6
Immature ♀	20	5th 4th	80% 20%	6
Mature ♀	20	5th 4th	80% 20%	5
Mice				
Immature ♂	20	4th	100%	6
Mature ♂	20	4th	100%	7
Immature ♀	20	4th	100%	7
Mature ♀	20	4th	100%	6

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Table (3) : Percentage gain in the body weight of control and experimentally infected rats and mice.

Host	1st week		1st week		1st week	
	Control	Infected	Control	Infected	Control	Infected
Rats						
Immature ♂	0.185	0.144	0.851	0.566	1.710	1.624
Mature ♂	0.155	0.141	0.534	0.513	1.350	0.361
Immature ♀	0.195	0.148	0.855	0.613	1.725	1.412
Mature ♀	0.175	0.143	0.598	0.540	1.410	0.498
Mice						
Immature ♂	0.510	0.128	1.115	0.448	1.850	1.704
Mature ♂	0.350	0.123	0.565	0.112	0.955	0.513
Immature ♀	0.350	0.145	1.080	0.312	1.785	1.712
Mature ♀	0.380	0.165	0.820	0.211	1.155	0.520

As regards the sex of the host, the recovery rate was significantly higher in males than in females ($P < 0.05$). In all female animals, adult worms were recovered from the fore part of the intestine. In males, the majority of the worms were recovered from the fore part, few from the middle and none from the hind part of the intestine. No apparent difference was observed between male and female animals in the preparent period or the number of intrauterine eggs.

As regards the maturity of the host, the recovery rate was significantly higher in immature hosts than in mature ones ($P < 0.05$). In all immature hosts, adult worms were only recovered from the fore part of the intestine, whereas in mature animals the majority of worms were recovered from the fore part, very few from the middle and none from the hind part. No apparent difference was observed in the prepatent period or the number of intrauterine eggs in both mature and immature animals.

The effect of *C. azimi* infection on the mean gain in the body weight of infected animals was studied at different time intervals. Data is represented in table (3) and figures (1 and 2). The mean gain in body weight of all groups of experimentally infected animals was significantly less than that of control groups ($P > 0.05$) at the different time intervals.

DISCUSSION

The susceptibility of laboratory animals to trematode infection has been estimated through the study of certain variables : the parasitic burden after infection as expressed by worm recovery rate; the distribution of adult worms in the intestine of infected individuals; and the ability to develop and mature within the host as

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Fig . (1) Percentage gain in body weight of control and experimentally infected rats .

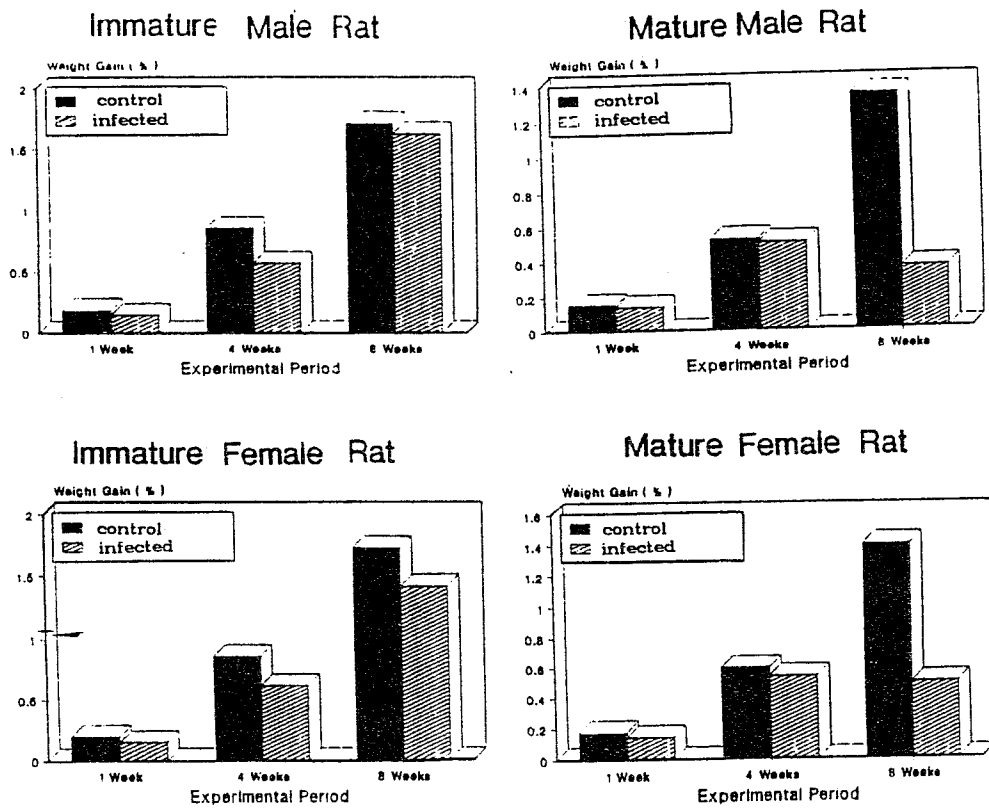
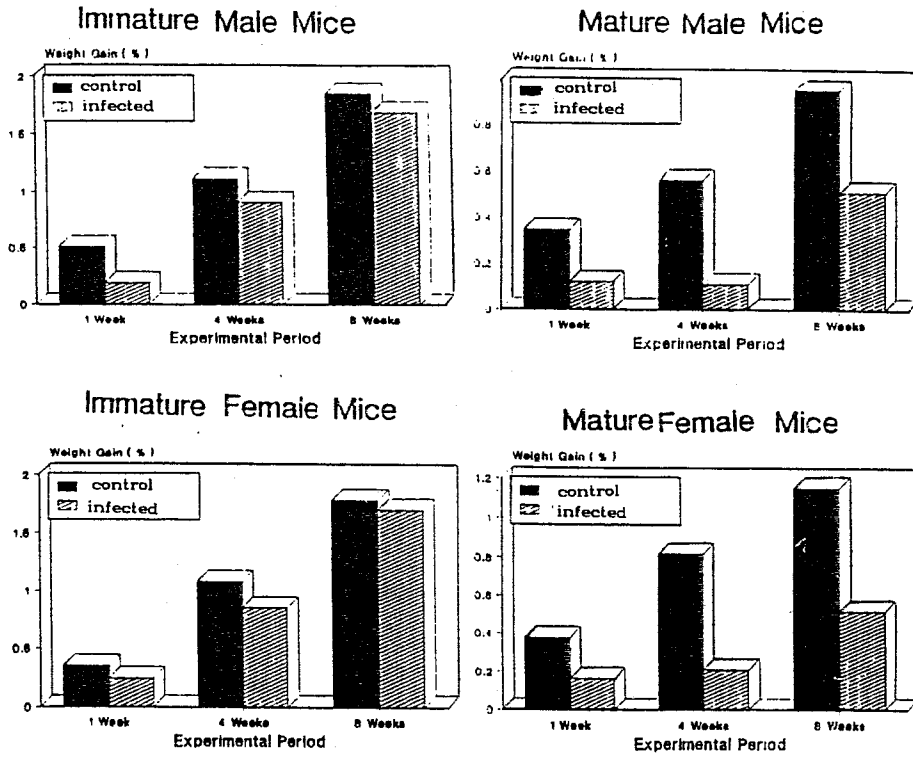


Fig. (2) Percentage gain in body weight of control and experimentally infected mice .



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measured by the prepatent period the number of intrauterine eggs (Hong *et al.*, 1983). The recovery rate, however, is the most commonly used parameter since it depends greatly on the host's susceptibility (Chai *et al.*, 1984).

The present results showed that mice were more susceptible to *C. azimi* infection than rats. Previous literatures showed that hosts differ in their susceptibility to parasites (Mansour *et al.*, 1981 and Lee *et al.*, 1988). Moreover, it was reported that different strains of mice have different degrees of susceptibility (Chai *et al.*, 1984). Dobson (1966) suggested that the innate and natural immunity of the host constitute a barrier to the successful establishment of helminth parasites. Chai *et al.* (1984) proposed that genetic factors may be responsible for various degrees of susceptibility in different strains of mice.

In both rats and mice, the worm recovery rate was higher in males than in females and in immature than in mature animals. This difference could be related to the hormonal level.

It has long been known that hormones produced by the host can be advantageous or disadvantageous for the parasite. Both stimulatory and inhibitory effects of hormones have been reported (Weinstein, 1939; Nicol and Bilbey, 1958; Chai *et al.*, 1984 and Spindler, 1988). Gray (1972) discussed the possible factors responsible for the age resistance. He suggested that the difference in the development of age resistance between sexes implicates some kind of hormone balance as a possible factor. Another feature discussed by Gray (1972) is the increase per unit area of Goblet cells in the intestinal mucosa associated with maturation of the host. He stated that the increase in the number of Goblet cells corresponds well with the development of age resistance. The third factor he discussed was the increase

of immune potential of the maturing host.

It can be thus assumed that in the present study, immature male mice were the most susceptible group of animals studied. This assumption was made primarily on the worm recovery rate which showed significant difference in different groups. The effect of the species, maturity and sex of the host on the establishment of *C. azimi* infection is apparent. The exact nature of the factors involved need further studies, however all three factors discussed before, hormonal balance, mucus and immune response may act independently or together.

As regards the higher weight gain of non infected animals compared to infected ones throughout the experiment. Similar results were reported by Fried and Wilson (1981); Lee *et al.* (1985); Huffman *et al.* (1986); Sun-Huh *et al.* (1988) and Kim and Fried (1989).

The marked decrease in weight gain of infected animals may be an outcome of malabsorption due to mucosal atrophy (Lee *et al.*, 1985 and Sun-Huh *et al.*, 1988). It may also be due to reduced food intake in infected animals as suggested by Chapman *et al.* (1982). Fluid loss, due to severe diarrhea may also be responsible for some weight loss as proposed by Franco *et al.* (1988).

In the present study, diarrhea was not evident, but mucosal changes were reported (Tosson, 1991). Therefore, the decrease in weight gain reported in the present study is likely due to decreased absorption of nutrients in addition to reduced food intake resulting from the parasitic infection.

It can be concluded that species, sex and maturity of the host have an effect on its susceptibility to *C. azimi* infection and that this infection decreases the

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weight gain of the host.

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قابلية كل من الرات والمائيس للعدوى بالسنوديلوستومم عظيمى
(تريماتود - ثنائىة العائل) وتأثير الاصابة على معدل زيادة وزنهم

آمال خليل حلام أبو شافعى أحمد مسعود أيهاب طوسون
قسم علم الحيوان - كلية العلوم - جامعة طنطا

أجريت الدراسة للتعرف على تأثير نوع وجنس ودرجة النضج على قابلية كل من الرات والمائيس للعدوى التجريبية بطفيل سينوديلوستومم عظيمى. وقد تم تقدير قابلية العدوى من خلال دراسة نسبة الديدان المسترجعة من أمعاء العائل المصاب وتوزيع الديدان فى الامعاء وفترة ما قبل ظهور البيض وعدد البويضات بداخل رحم الديدان الناضجة.

أوضحت الدراسة أن قابلية العدوى أكثر فى المائيس عنها فى الرات وفى الذكور عنها فى الاناث وفى الحيوانات الغير ناضجة عنها فى الناضجة.

وعلى ضوء نتائجنا تم مناقشة العوامل التى قد تؤثر على قابلية المجموعات المختلفة من الحيوانات للعدوى مثل التوازن الهرمونى والمخاط ورد الفعل المناعى.

كما أوضحت هذه الدراسة أيضا أن متوسط معدل زيادة وزن الحيوانات المصابه أقل من المعدل الطبيعى ويرجع هذا الى احتمال سوء ونقص الغذاء.