

THE EFFECT OF TRICHINOSIS ON WEIGHT GAIN AND FOOD INTAKE OF RATS FED LOW AND HIGH PROTEIN DIETS

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INTRODUCTION

Animals experimentally infected with *Trichinella spiralis* are apathetic, sluggish and diarrhoeic. They begin losing weight at 6 - 9 days and maximal loss have been reported about 11 - 14 days after infection (Larsh, 1963; Kozar and Kozar, 1963, 1965). During this period food intake was considerably reduced. Thereafter, weights as well as food intake increased. Platt and Heard (1965) reported that young animals infected with *Toxocara canis* and *Nippostrongylus muris*, and fed diets of low protein value suffered more severely in regard to growth rate and general clinical condition than did adequately nourished animals. The effects of trichinosis on weight gain and food intake were reported in mice, rats (Pollay *et al.*, 1954) and guinea pigs (Castro *et al.*, 1967) which were fed stock diets.

This communication was designed primarily to clarify the effect of trichinosis on the weight gain and food intake of rats fed low and high protein diets during early stages of the infection, and, secondarily, to follow the progress of the animals for an extended period (24 weeks) after infection.

MATERIALS AND METHODS

Sixty weanling male rats, London black-and-white hooded strain, were randomly divided into two groups, one of which was fed *ad lib.* on a low protein diet and the other on a high protein diet (Platt and Stewart, 1968), throughout the experiment. At the end of

the third week on the diets, 15 rats from each dietary group were infected with 25 *T. spiralis* larvae/gm body weight and the rest were kept as controls. The rats were subdivided into high protein control (HPC), high protein infected (HPI), low protein control (LPC), and low protein infected (LPI) groups. Their weight and food intake were recorded once a week before and twice a week after infection for a total of 7 weeks. Subsequently, the weight gain of 6 rats from each dietary group, 3 controls and 3 infected, were followed for 24 weeks. Food intake was calculated as gm eaten/100 gm body weight/day.

RESULTS

Before infection, rats fed on the low protein diet consumed more food per 100 gm body weight but gained less weight than rats fed on the high protein diet (Table 1 and Fig. 1). The daily food intake of the low protein group ranged from 9.0 to 10.9 gm/100 gm body weight during the first three weeks as compared with 7.2 to 8.8 gm/100 gm in the high protein group. These two groups of rats had almost the same original mean weights, approximately 50 gm, and at the end of the third week the mean weight of the low protein rats (90.4 ± 3.4 gm) was significantly lower than those of the high protein rats (141.6 ± 3.5 gm).

Over the 7-week study period, daily food intakes relative to body weight fell steadily as body weight increased. The food intake per 100 gm of the low protein rats (LP) was consistently higher than that of the high protein group (HP) of the same age.

Table 1

Mean daily food intake (gm/100 gm body weight) of rats fed low and high protein diets and infected with 25 *Trichinella spiralis* larvae per gm body weight; mean body weight at each stage is shown in parenthesis.

Diets	Weeks									
	1	2	3	4	4½	5	5½	6	6½	7
LP*	10.9 (62.2)	11.3 (80.2)	9.0 (90.4)	Control 5.6 (113.4)	8.6 (124.2)	7.4 (133.8)	6.7 (142.2)	6.8 (149.4)	6.6 (162.9)	4.8 (170.2)
				Infected 2.8 (92.2)	3.5 (85.6)	4.2 (82.3)	7.2 (82.6)	7.6 (88.6)	6.9 (90.8)	4.4 (97.3)
HP*	8.8 (89.8)	8.8 (124.0)	7.2 (141.6)	Control 5.5 (186.3)	6.5 (206.0)	6.3 (232.7)	5.6 (241.9)	5.0 (255.8)	5.6 (272.2)	5.6 (207.6)
				Infected 3.4 (148.5)	5.9 (133.2)	6.6 (139.2)	7.8 (152.2)	7.0 (165.6)	5.4 (173.9)	6.6 (180.1)

*See details in text.

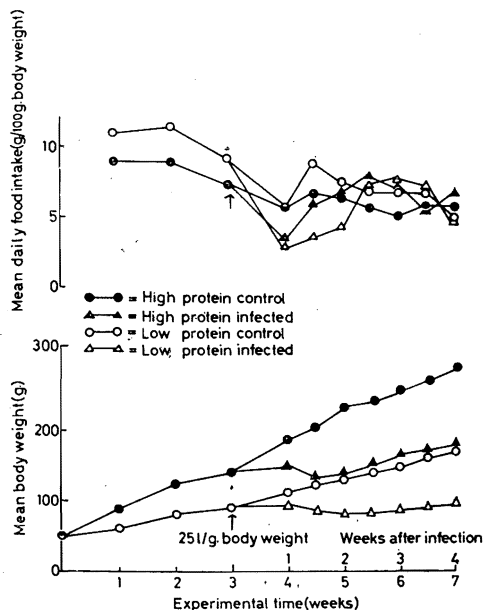


Fig. 1—Mean daily food intake (gm per 100 gm body weight) and body weight (g) of rats fed low (NDp Cal% 5) and high protein (NDp Cal% 10) diets before and after infection with 25 larvae/g body weight.

Infection induced a drastic reduction in food intake, in both the LP and HP animals. However, the HPI animals regained their appetite more rapidly. Changes in food intake for any given week in infected animals did not correlate with body weight changes

for that week. Minimal food intake was in the first week and minimal weight in the second week after infection, when food intake was increasing again, especially in the HPI group.

There was no evidence of “catch up” of growth even in the HPI group which was fed an adequate diet (Fig. 2). The weights of infected group (both fed on low and high protein diets) remained significantly lower than those of their controls, after 24 weeks of infection. Growth of the HPI rats was seriously retarded and ran along a course very close to that of the LPC group.

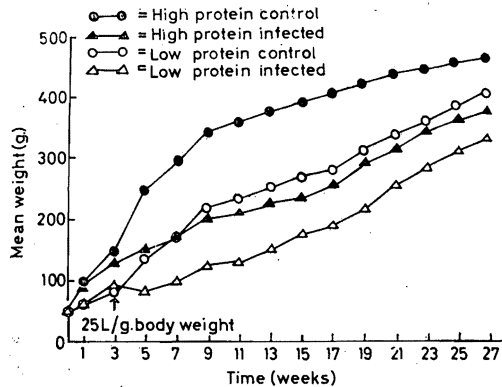


Fig. 2—The mean body weight (g) of rats fed on low and high protein diets for 24 weeks after infection.

DISCUSSION

Growth depends on a supply of calories, protein and other nutrients which are sufficient (1) to meet maintenance requirements and (2) to provide energy and material for the synthesis of new tissues. Rats grew on both the LP and HP diets, but the growth rate was lower in the LP group. The poor growth due to the limited amount of protein in the diet was enough for maintenance requirements but was not sufficient for full growth. This is illustrated by the results shown in Table 2 in which the efficiency of food conversion (gm weight gained/gm food eaten) was compared for the two diets during the first 3 weeks of the experiment (before infection). The LP rats gained 0.22 gm in body weight for every 1 gm of food eaten, whereas the HP rats gained 0.41 gm/gm food eaten. During the phase of rapid growth, the actual growth achieved was directly proportional to the protein value of the diet, LP and HP respectively.

Table 2

Mean daily weight gain and mean daily food intake for the first three weeks of experiment (the beginning of week 1 to the end of week 3) of rats, fed low and high protein diets.

Treatment	Initial mean body weight (gm)	Mean weight gain gm/rat/day	Mean food intake gm/rat/day	Ratio of Mean daily weight gain to mean daily intake (gm/gm)
LP	49.4	1.75	8.0	0.22
HP	51.2	3.98	9.6	0.41

When rats on these two diets were infected with *T. spiralis*, food intake and growth rates were impaired. Food intake was cut to a half or less of the control value (Table 1), and the effect in both cases could have been due mainly to shortage of calories, which were apparently barely sufficient to meet maintenance requirements. Growth did not resume as rapidly as food intake, suggesting

that there was a period (between weeks 4 and 5 in HPI, and weeks 4 and 6 in LPI) when food was being less efficiently utilized. Rogers (1942) and Dema *et al.*, (1959) showed in rats infected with *T. spiralis* and malaria, respectively, that the digestion of nitrogen was altered. Al Rabii (1963), Orraca-Tetteh (1964), and Platt and Heard (1965) have also demonstrated the reduction of food utilization in infected animals.

Table 3

Mean daily weight gain and mean daily food intake, from the end of week 5 to the end of week 7, of rats fed low and high protein diets and either noninfected, or infected with 25 *Trichinella spiralis* larvae/gm body weight.

Treatment	Mean weight at the end of week 5 (gm)	Mean weight gain gm/rat/day	Mean food intake gm/rat/day	Ratio of mean daily weight gain to mean daily food intake (gm/gm)
LPC	133.8	2.60	9.7	0.26
LPI	82.3	1.07	5.8	0.19
HPC	232.7	3.92	14.4	0.27
HPI	139.4	2.91	11.2	0.26

From the end of week 5 to the end of week 6 food was utilized with almost equal efficiency by the LPC, HPC and HPI groups, but with lower efficiency by the LPI group (Table 3). Therefore, the infection apparently had a much more lasting effect in rats fed the diet of suboptimal protein value than in adequately nourished animals. Infection increased the requirements for protein (impaired utilization); the high protein diet had enough protein to spare for this increase but the low protein diet was inadequate. Therefore, either a greater degree of protein-calorie malnutrition or a heavier infection could easily have had an increased severity in these low-protein animals.

With regard to the long term effects on growth (Fig. 2), the body weight of the HPI group resembled that of the LPC group. The

combination of infection plus protein-calorie malnutrition had effects which were much more severe and long-lasting. However, under the conditions of this experiment, recovery was being slowly achieved in both the LPI and HPI groups.

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