

Helminth parasites of laboratory mice and rats

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ABSTRACT. Rodents, as mice and rats are the most common laboratory animals used in research and testing. They are seldom investigated for autochthonous ecto- and endoparasites prior their utilization in the experiments. Helminth parasites can alter the interpretation of final results. Pinworms commonly infecting laboratory rodents include mainly the mice pinworms *Syphacia obvelata* and *Aspiculuris tetraptera*, and in rats *Syphacia muris*. The fact that many laboratory rodent colonies were found to be parasite contaminated suggests a need for eradication and improvment of the quality of laboratory rodents. This review reports the data on the presence of helminth parasites in laboratory rodents colonies, and suggests to pay special attention on controlling the sanitary conditions of animal houses.

Key words: helminths, laboratory rodents, pinworms.

Development of many biological assays still depends on the use of living laboratory animal models. Rodents, as mice and rats are the most common laboratory animals used in research and testing. Experimental results from research performed with living laboratory animals may be affected by environmental conditions provided to breeding and maintaining of theses animals and by infectious agents [1-3]. In some papers it is showed that infected animals are not suitable for biomedical researches as well as for helminth biology experiments [4, 5].

The parasite infections can affect investigations by inducing physiological and immunological alterations in the hosts, increasing or diminishing host susceptibility to experimental stress, inducing tissue damages, stimulating abnormal tissue growth, competing with the host for nutriens, decreasing the volume of host's blood and body fluids and by mechanical interference [6].

This review reports the data on the presence of helminth parasites, mainly with regard to pinworm species, and its interference with research in laboratory rodents colonies. It is suggested to pay special attention on controlling the sanitary conditions and barriers of animal houses.

Still little is known about the effects of environmental changes on the biological variation in experimental results [7] as well as laboratory rodents are seldom investigated for autochthonous ecto- and endoparasites prior their utilization in the experiments [8, 9]. The control or eradication of worm burdens in laboratory animals ensures the proper procedures in scientific research.

Among helminth parasites infecting laboratory animals the most common are pinworms belonging to the family Oxyuridae. Rodent pinworms display some host-specificity, although some can cross species barriers. In general *Syphacia obvelata* and *Aspiculuris tetraptera* are considered as mouse pinworms, *Syphacia muris* the rat pinworm, *Syphacia mesocricetus* the hamster pinworm and *Denstomella translucida* the gerbil pinworm [10, 11]. *S. obvelata* has also been reported to infect humans [12]. It is common high even in well-managed animal colonies [8]. While pinworm infections are usually subclinical, rectal prolapse, intussuspection, faecal impaction, rough hair coat and poor weight gain

have been reported in heavily infected rodents [10, 13]. Very heavy parasite loads may lead to catarrhal enteritis, liver granulomas and perianal irritation [10]. There are a few reports documenting how pinworms infection influenced experimental results. A significant reduction of activity of mice infected with *S. obvelata* was observed in behavioral studies [14]. Wagner et al. [15] reported definite growth differences between pinworm-free and pinworm-infected rats. *S. muris* experimentally infected animals grew slower than uninfected animals. It was reported that in laboratory rats infected with *S. muris*, despite of absence of apparent histopathological changes, intestinal transport of water and electrolytes is significantly decreased due to pinworm infection [16]. Additonally infection with *S. muris* retarded the growth of young mice and accelerated the development of their hepatic monooxygenase system [17].

Immunity to infection is mostly humoral as for many other helminthoses. In this regard, studies carried out by Sato et al. [18] reported that antibodies against *S. obvelata* somatic antigen were detected in experimental infection of pinworms in mice. Additionally pinworm infection altered higher antibody production to nonparasitic antigenic stimuli [18]. Moreover study of Beattie et al. [19] showed that infection with *S. obvelata* induces a proliferation of T- and B-lymphocytes in spleen and lymph nodes and occasional germinal center formation. In addition athymic mice infected with pinworms develop a lymphoproliferative disorder which eventually leads to lymphoma [4]. These studies indicate that infection with this parasite can modulate the immune system of the host and affect experimental final results [8, 18, 20].

Data on the prevalence and mean intensity of the helminth fauna recovered from outbred and inbred mice conventionally maintained in Brazilian animal houses were presented by Bazzano et al. [20]. As it was found out the frequency of *S. obvelata* in laboratory animals ranged from 9 to 74% (intensity 13–67 specimens/host) and *A. tetraptera* from 17 to 83% (intensity 6–17 specimens/host). Infections due to a single species were observed in 62% of the animals, compared to 16% related to associations. In the latests study carried out by us [21] the prevalence of infection was as high as 66% however the intensity ranged from 1 to 250 specimens. According to Taffs [22] the prevalence of *S. obvelata* infection in laboratory animals may be a function of age (the intensity diminishes with increasing age of the host), sex (higher prevalence in male hamsters than females), strain and the host status.

In Poland *S. obvelata* was noted several times in laboratory mice colonies, e.g. by Szymańska et al. [23] and Obruśnik and Stankiewicz [24] — in 52% of mice in open conventional colonies, and in 5.5–15% in closed colonies respectively. On the contrary, the reports on *A. tetraptera* infections are not so common. Klausa and Złotorzycka [25] demonstarted 20% prevalence of laboratory mice infected with this nematode. Our previous examinations of 176 laboratory mice (BALB/c strain) [26] demonstrated that the prevalence of *S. obvelata* in males was 70% (with the intensity of infection of 1–102) and in females was 52% (with the intensity of 1–34 individuals). In our other mice colony of BALB/c strain which was obtained from different laboratory, the invasion of *A. tetraptera* developed rapidly. Examinations of 40 mice showed the prevalence as high as 75% (with the intensity of 1–193 individuals).

A parasitological survey of laboratory mice of 18 different strains from three animal facilities in Wrocław, Poland was presented by Pacoń and Piekarska [27]. Coproscopic examinations of mice revealed the presence of pinworm eggs in every colony. The prevalence of *S. obvelata* ranged from 5.5% to 15% while *A. tetraptera* infection was higer ranging from 33% to 75%. Additionally the necropsy of three mice from one colony demonstrated the presence of *Taenia taeniaeformis* cysticerci — the tapeworm, which in adult stage parasitises cats.

A study carried out by Gilioli et al. [28] showed that parasite infections were present in most of the 18 Brazilian animal houses investigated. A high proportion of animals infected with four or more parasite species was observed in a single group of six animals, indicating that the colonies were heavily infected. As far as only helminth infections in rat colonies are concerned the prevalence of *Syphacia muris* was as high as 80%, *Trichosomoides crassicauda* 55.5% and *Hymenolepis nana* 40% respectively. Prevalence of helminths in mice colonies was as follows: *Syphacia obvelata* 86.6%, *Aspiculuris tertaptera* 60% and *H. nana* 53.3% respectively.

A parasitological monitoring of mice and rats facilities at the Central Institute of Experimental Animals of Japan was carried out in years 1996–1998. The inspection of mice facilities showed the detection of parasites in 125 of 444 facilities. The number of positive facilities with respect to helminths as *Syphacia obvelata* and

Aspiculuris tetraptera was in 14% and 7% respectively [29].

It is obvious that the scientists should no longer minimize the influence of parasites on experimental results. Because the measures taken to combat parasitic contamination in laboratory mice and rats have conspicuously lagged behind those taken against other pathogens e.g. bacteria, viruses and protozoa, parasites may currently be found even in animal facilities that appear to be well maintained without any problems. Ultimately pinworms often serve as possible indicators of biologically contaminated animal facilities and it is advised that pinworm existence and species name should be clearly indicated in the health monitoring reports [29]. The fact that many laboratory rodent colonies were found to be parasite contaminated [30], suggests a need for eradication and improvment of the quality of laboratory rodents. Works of Flynn [31] and Klement et al. [32] revealed that pinworm infection is difficult to control because anthelmintics like ivermectin eliminate adult worms but have no effect on ova, which can survive *ex vivo* for prolonged periods. Proposed much earlier by Wescott et al. [33] rigid sanitary procedures using for example filter hoods to prevent aerosol transmission and regular ova examinations which may control the parasitism did not find the practical application. Among many recommended methods for elimination of helminths one involve mixing anthelminthic with food or spraying the animals or bedding with anthelminthic as well as cleaning the colony using embryo transplant method [29]. But still prevention and control of parasitic infections in laboratory animals remains a challenge and it is another topic for review and discussion.

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