Original Article

Prevalence of parasitic infections of mice and rats in research centers of Tabriz universities

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Summary

The development of many biological assays relies on the usage of various laboratory animals. Extensive utilization of these animals in biomedical researches necessitated high quality hygienic and breeding conditions in animal houses. Moreover, many zoonotic diseases including parasitic, bacterial and viral infections are transferred from the laboratory animals to humans. This study investigated the prevalence of parasitic infections of some laboratory animals that were conventionally maintained in animal houses of research centers in Tabriz universities. Blood, fecal and cutaneous samples were collected from 70 laboratory animals (35 mice and 35 rats).The fecal samples were stained with Trichrome, Modified Zeil-Nelson Staining and observed by direct method. All blood samples (100%) were negative. Fecal examinations revealed the cyst of *Giardia muris* (57%), eggs of *Ascaris* (spp.) (17%), *Oxyuris muris* (93%), *Syphacia muris* (4%), *Aspicularis tetraptera* (2%), and *Hymenolepis nana* (9%). In cutaneous examinations *Polyplax serrata* (21%) and lice nit (55%) were observed. The present study indicated that the examined laboratory animals were infected with different enteric and cutaneous parasites. Thus, we suggest that the staff and researchers working in this area need to be aware of the risk of these infections. Moreover, the monitoring of animal houses is indispensable.

Keywords: Parasitic infections, Laboratory animals, Research centers.

Introduction

Utilization of the laboratory animals in experimental biomedical researches and investigations have provided extended knowledge to better understanding the physiological, pathological, and immunological processes in human and animals (Clough, 1982). The results deriving from researches on these animals are affected by infectious diseases as well as housing conditions of these animals. Most of the zoonotic diseases may be transferred from the laboratory animals to humans. These include rat bite fever, tuberculosis, hemorrhagic fever, salmonellosis, lymphocytic choriomeningitis, leptospirosis, as well as various parasites such as *Hymenolepis nana, H. diminuta, Syphacia muris, S. obvelata, Aspicularia tetraptera, Physaloptera* spp., *Taenia* spp., *Giardia* spp., *Trichomonas* spp., *Eimeria* spp., *Encephalitozoon cuniculi, Polyplax* spp., lice, mites, etc.

Development of many biological assays depends on the usage of various laboratory animals. The most common laboratory animals used in research are rabbits, rats, mice, guinea pigs, and hamsters. It is indicated that the contaminated animals are not suitable for biomedical researches (Pam et al, 2013). Such a contaminations consist of parasitic, fungal, bacterial, and viral infections. Infectious diseases may affect research outcomes by altering pathophysiological, immunological, biochemical and hematological processes in hosts, increasing or decreasing host susceptibility to tissue damage, causing abnormal tissue growth, competing with the host for nutrients.

Among the nematodes infecting laboratory animals, the most common belong to the *Oxyuridae* Family. Rodent pinworms are mostly host-specific. Generally speaking, *Syphacia obvelata* and *Aspicularia tetraptera* are regarded as mouse pinworms, *Syphacia muris*, *Syphacia mesocricetus* and *Dentostomella translucida* regarded as rat, hamster and gerbil pinworms, respectively. *S.obvelata* has also been reported to infect humans (Kunstir et al., 1992; Pinto et al., 1994). The immunity to the infection is mostly homoral. Moreover, pinworms produce higher antibody production to non-parasitic antigenic stimuli (Kunstir et al., 1992; Pinto et al., 1994).

Giardia muris is a flagellated intestinal protozoan. Infections are occasionally detected in laboratory rodent colonies. Strains of *G. muris* infecting mice and rats may be host specific (Kunstir et al., 1992). The life cycle is direct. Environmentally resistant and infectious cysts are passed in the feces. Excystation occurs following ingestion. The minimum infectious dose for a mouse is approximately 10 cysts (Pinto et al., 1994). After the excystment, trophozoites divide longitudinally and colonize the mucosal surface of the proximal small intestine, adhering to columnar cells near the bases of intestinal villi moving within the mucus layer on the mucosa (National Research Council, 1991). Most infections are asymptomatic. When apparent, clinical signs are nonspecific and include weight loss, stunted growth, rough coat, and enlarged abdomen. In athymic or otherwise immunocompromised hosts, clinical signs may be more severe and may include diarrhea and death; and cyst shedding may be prolonged (Jungmann et al., 1996).

Spironucleus muris (formerly called *Hexamita muris*) is a second flagellated protozoan commonly infecting laboratory mice and rats. Host-specific strains of *S. muris* have been identified (Whitehouse et al., 1993). The minimum infective dose for a mouse is 1 cyst (Stachan et al., 1983). Infections with *S. muris* are asymptomatic in immunocompetent adult mice and rats. It has been reported by several investigators that young mice may develop diarrhea, dehydration, weight loss, rough coat, lethargy, abdominal distension, and hunched posture and may die (National Research Council, 1991; Whitehouse et al., 1993). In athymic (nu/nu) and lethally irradiated mice, *S. muris* causes severe chronic enteritis and weight loss. The crypts are hyperplastic and may be distended with trophozoites, microvilli and villi may be shortened, and enterocyte turnover is increased; inflammation is minimal (National Research Council, 1991; Whitehouse et al., 1993*)*.

Pinworms commonly infecting laboratory rodents included the rat

pinworm *Syphacia muris* and murine *Syphacia obvelata* and *Aspicularis tetraptera. S. obvelata* have also been reported to infect humans (National Research Council, 1991). The prevalence of infection remains high (National Research Council 1991; Jungmann et al., 1996), even in well-managed animal colonies. While infections are usually subclinical, rectal prolapse, intussusception, fecal impaction, poor weight gain and rough coat have been reported in heavily infected rodents, although generally without adequate exclusion of other pathogens (National Research Council, 1991). Athymic (nu/nu) mice are reportedly more susceptible to infection. There are few reports documenting the effects of pinworms on research. Pinworm infection resulted in significantly higher antibody production to sheep erythrocytes (Whitehouse et al., 1993), reduced the occurrence of adjuvant-induced arthritis and impaired intestinal electrolyte transport.

The aim of this study was to investigate the parasitic infections of laboratory animals maintained conventionally in animal houses of Tabriz Universities Research Centers.

Materials and Methods

This study was conducted on ecto- and endo-parasites of rats and mice in breeding and research conventional system animal houses of Universities of Tabriz. These centers include Medicine Faculty, Pharmacy Faculty, Drug Applied Research Center (DARC) of Tabriz University of Medical Sciences, Faculty of Veterinary Medicine, Khalatpoushan center at University of Tabriz, Azad University Tabriz Branch and finally Azad University Marand Branch. Seventy samples (35 rats and 35 mice) were selected randomly. Faecal samples were collected for parasitological examination (direct and staining). Two staining techniques were used: Trichrome staining for protozoa (Romia et al., 1990) and Modified Ziel-Nelsen staining for *Cryptosporidium* (Fayer et al., 2001). Blood samples were collected and stained with Giemsa staining (Shahbazi et al., 2011). Finally, cutaneous samples were collected in 70% Ethilic Alchohol. The results of the study were analyzed by excel software.

Results

All blood samples (100%) were negative for blood parasites. Fecal examinations revealed the cyst of *Giardia muris* (57%), *Ascaris* spp. eggs (17%), *Oxyuris muris* (93%), *Syphacia muris* (4%), *Aspicularis tetraptera* (2%), and *Hymenolepis nana* (9%). In cutaneous examinations, *Polyplax serrata* (21%) and lice nit (55%) were observed. Figures 1 and 2 show the percentages of various parasites of rats and mice isolated from the so-called centers. According to fig. 1, among 35 examined mice from all centers (DARC, Medicine Faculty, Pharmacy Faculty, Faculty of Veterinary Medicine (University of Tabriz), Khalatpoushan Center, Faculty of Veterinary Medicine (Azad University, Tabriz Branch), and Azad University Marand Branch) parasitic species consisted of *Giardia* (trophozoite and cyst) (88.5%), *Ascaris* egg (14.28%), *Oxyuris* egg (5.71%), *Hymenolepis nana* egg (22.85%), *Syphacia obvelata* egg (8.57%), *Aspicularia tetraptera* egg (5.71%), and lice nit (71.42%). The prevalence of various parasites isolated from rats is summarized in fig. 2.

Accordingly, the common parasites are: *Giardia* (trophozoite and cyst) 74.28%, *Ascaris* egg 28.57%, *Oxyuris* egg 2.85%, *Syphacia obvelata* 2.85%, *Polyplax serrata* 60%, and Nit 85.71%.

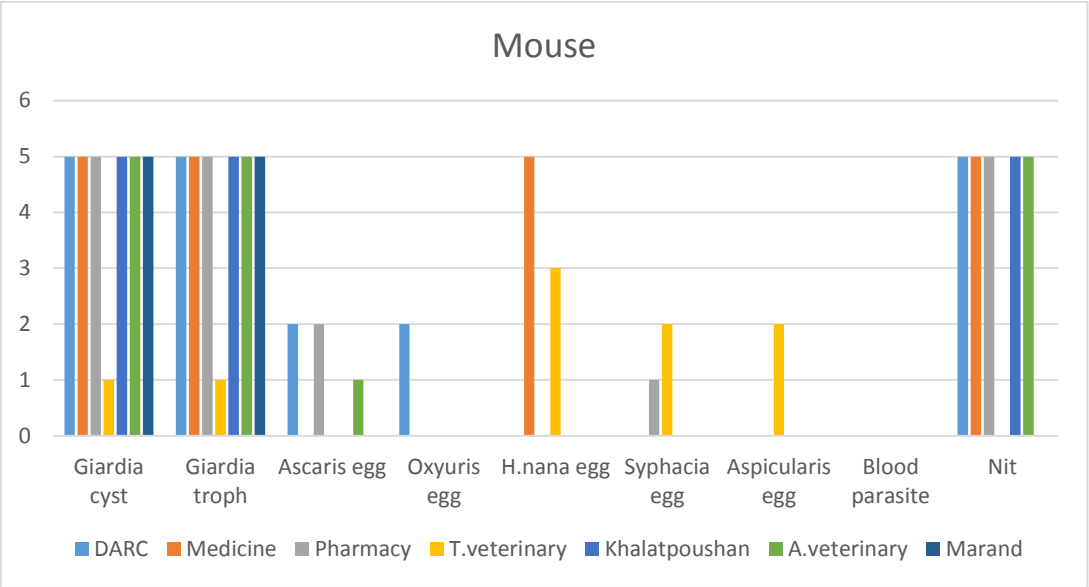

Fig. 1. Infection rate of the parasites isolated from mice: DARC (Drug & Applied Research Center of Tabriz University of Medical Sciences). Medicine Faculty, Pharmacology Faculty, Faculty of Veterinary Medicine University of Tabriz, Khalatpoushan Center, Faculty of Veterinary Medicine (Azad University Tabriz Branch) and Azad University Marand Branch.

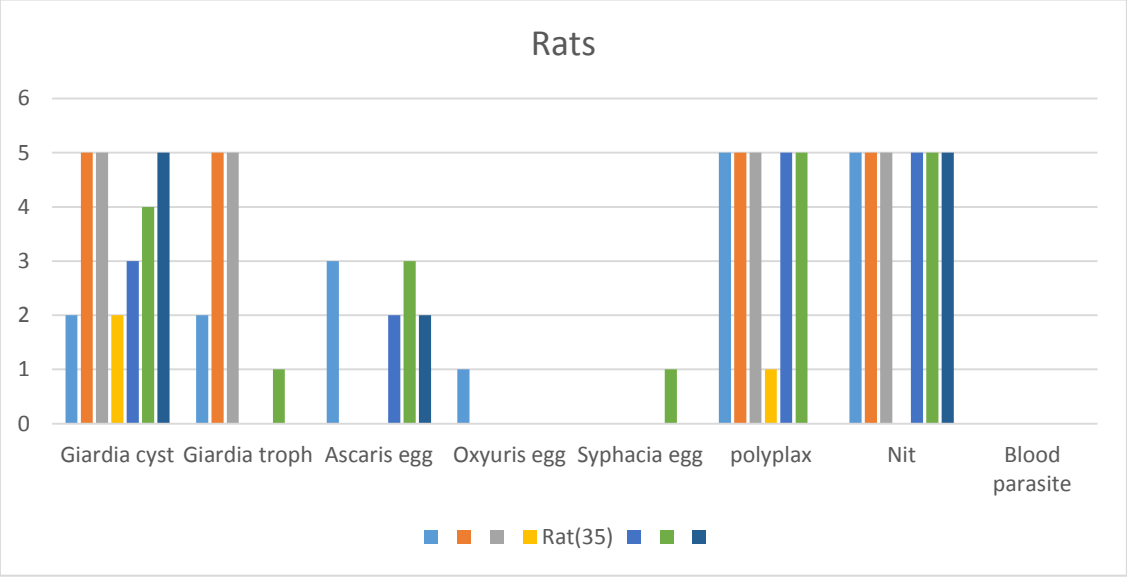

Fig. 2. Infection rate of the parasites isolated from rats: DARC (Drug & Applied Research Center of Tabriz University of Medical Sciences). Medicine Faculty, Pharmacology Faculty, Faculty of Veterinary Medicine (University of Tabriz), Khalatpoushan Center, Faculty of Veterinary Medicine (Azad University, Tabriz Branch) and Azad University Marand Branch.

The fig. 3 to 10, show the parasites isolated from mice and rats.

Fig 3. Lice nit

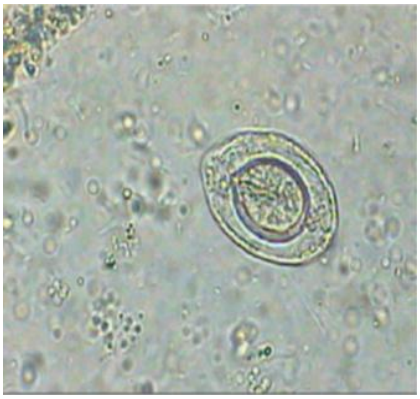

Fig 4. *Hymenolepis nana* egg

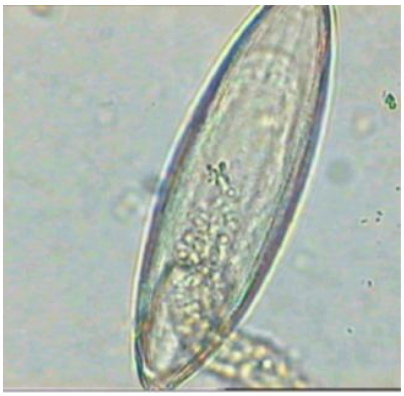

Fig 5. *Syphacia obvelata* egg

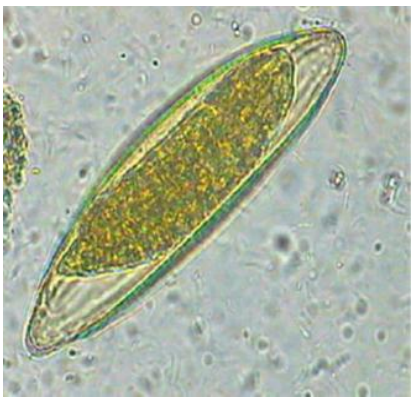

Fig 6. *Aspicularia* egg

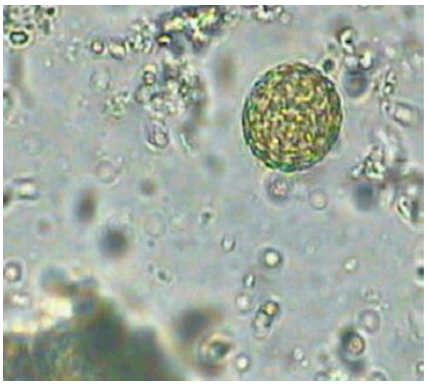

Fig 7. *Ascaris* spp. egg

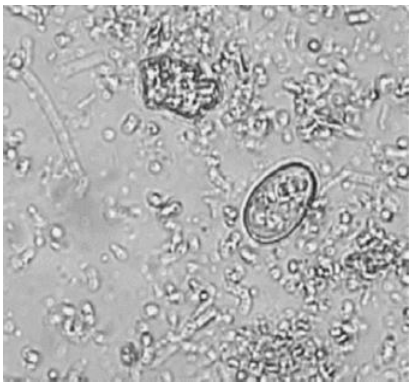

Fig 8. *Giardia* cyst

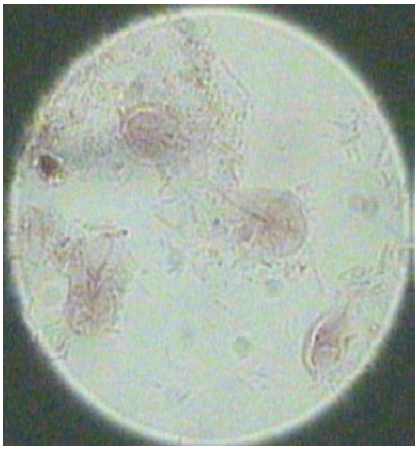

Fig 9. *Giardia* trophozoite

Fig 10. *Polyplax serrata*

Discussion

Using laboratory animals devoid of pathogens, particularly in faculties and research centers is prominent. Parasitic infections in these animals, even asymptomatic, may act as an important variable during research and also could be a potential source for infection of staff and researchers. In animal houses, these animals are generally infected with parasitic infections or become infected during research. Heretofore, limited studies were conducted in this area. Thus, this study embarked to investigate the parasitic infections of laboratory animals in research centers.

There are few studies on the presence of parasites (ecto- and endo-parasites) and their interference with research in laboratory animals conventionally maintained in animal houses, particularly in West Azarbaijan's Universities. Controlling the sanitary and moral conditions as well as the isolation of animal houses is highly recommended. The control or eradication of parasite burdens in laboratory animals ensures the proper procedures in scientific research.

Pakdel et al. (2013), conducting a survey in Kermanshah, revealed that the examined rodents were more infected with nematodes than other helminthes. As rodents are usually infected with a number of zoonotic parasites, the control of these animals has an important role in safeguarding public health. Their results are consistent with findings of the current study (Pakdel et al., 2013).

The findings of this study were not in line with report of Pam et al., (2013) in which parasitic infections of laboratory animals (rabbits, mice, and rats) with *Coccidia* and *Taenia* were evident.

In a study conducted by Gudissa et al., (2011), the prevalence of enteric parasites of rats and mice in a Ethiopian institute was investigated while their findings were similar with the results of the present study (Guidessa et al., 2011).

Hymenolepis nana, the common parasite of laboratory mice in animal houses and also found in this study, is zoonosis and has autoinfection characteristic. Accordingly, its direct life cycle makes it possible to continue the infection in animal houses. These infected animals, therefore, are not recommended for educational and research purposes. Moreover, this parasite may affect the results of intestinal,

hematological, immunological, and nutritional systems investigations.

Infections of pinworms (*Syphacia*, *Oxyuris*, and *Aspicularia*), which are zoonosis too, could be pathogenic for humans, although with little sanitary significance. But there are some reports that these helminthes diminish the adjuvants produced in Arthritis disease. Also, the infection may be conductive to the alteration of humoral response to non-parasitic antigenic factors meaning that the infection may affect the immune system. Pinworms elicit the proliferation of T and B lymphocytes in spleen and lymph nodes. Thus, the animals infected by pinworms are not suitable for growth and behavioral studies.

Conclusion

The results of this study indicated that extended investigations on science and technology of laboratory animals, including housing conditions, equipment, personal resources, and hygienic monitoring are required in animal houses for development of life quality of these animals as well as to diminish the transmission of infection to human and other laboratory animals. Moreover, quarantine programs for new animals or biological materials are imperative.

The present study revealed that the laboratory animals were infected with various intestinal and cutaneous parasites. Thus, it is suggestive that all staff and researchers working with these animals should be trained accordingly and be aware of the potential consequences of parasitic infections and their effects on researches. Additionally, periodical monitoring of animal houses is necessary and indispensable to make sure all animals, staff and researchers are not infected.

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