OCCURRENCE OF SOME ZOONOTIC MICROORGANISMS IN FAECAL MATTER OF HOUSE RAT (RATTUS RATTUS) AND HOUSE MOUSE (MUS MUSCULUS) TRAPPED FROM VARIOUS STRUCTURES

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ABSTRACT

Commensal as well as wild rats and mice may present a potential risk to public health. They may harbour microorganisms that can be transmitted either through contact with infected rodent urine or faeces, or through ectoparasites. Prevalence of zoonotic microorganism in house rat (Rattus rattus) and house mouse (Mus musculus) in different types of structures such as grocery shops, sweet shops, rice godowns, wheat godowns and poultry feed stores was studied in Sargodha and Faisalabad districts of Pakistan. In R. rattus, E. coli showed the highest prevalence in faecal material from rice godowns (4.72%), while the lowest prevalence (3.46%) was in poultry feed stores (P<0.05). S. typhi had the highest prevalence (4.44%) in samples from grocery shops and lowest (3.56%) in those from sweet shops (P<0.05). Similarly, the highest prevalence of H. nana (3.89%) was recorded in faeces from grocery shops and lowest in those from poultry feed stores (P<0.05). In case of Mus musculus, rats from sweet shops showed the highest prevalence of E. coli (4.83%), while the lowest was in rats from wheat godowns (4.05%; P<0.05). S. typhi had the highest prevalence (4.56%) in grocery shops and lowest (3.28%) in sweet shops (P<0.05). For H. nana, the highest prevalence (3.61%) was noted in samples from rice godowns and lowest (3.00%) in sweet shops (P<0.05). Fecal samples of R. rattus and Mus musculus of all the structures of Sargodha district were significantly more infected with E. coli, S. typhi and H. nana compared with the samples collected from the structures of district Faisalabad (P<0.05). These results indicated that both house rat and house mouse may act as reservoir for E. coli, S. typhi and H. nana.

Key words: House rat, house mouse, E. coli, S. typhi, H. nana, faecal sample.

INTRODUCTION

Rats and mice play a significant role in public health, chiefly due to their role as carriers or reservoirs for microorganisms associated with infections and diseases that can be transmitted to humans. These diseases include plague, salmonellosis, leptospirosis, murine typhus, rickettsial pox, lymphocytic choriomeningitis, rat-bite fever, hanta virus haemorrhagic pulmonary syndrome, haemorrhagic fever, Venezuelan equine encephalitis (Alphavirus), powassan encephalitis (Flavivirus), an encephalitis, rabies, Rocky Mountain spotted fever and tularemia as well as parasitism such as trichinosis, coenomophilic meningitis, taeniasis, cryptosporidia (Singleton et al., 2003) and Trypanosoma lewisi (Linardi and Botelho, 2002). Transmission of these infections to humans occurs by indirect contact. Some are transmitted through contact with infected rodent urine or faeces, others through fleas and lice, and still others through mosquito bites (Ruiz, 2004). According to Battersby et al. (2002), rural wild brown rats on farm serve as vectors of zoonotic and many other diseases and may represent a serious risk to the health of human and domestic animals. Rats are found to be infected with a number of zoonotic parasites including cryptosporidium, pasturella, listeria, yersinia and Hantavirus, and represent a potential risk to the health of humans and domestic animals.

The brown rats (Rattus norvagicus) from Doha, Qatar have been reported to be infested by Hymenolopis diminuta (Abu-Madi et al., 2001). Salmonella in faecal pellets of wild brown rats (Rattus norvagicus) in the west Midlands is sufficient to present a potential risk to public health (Hilton et al., 2002). The present work was undertaken to isolate and make a preliminary investigation to zoonotic bacteria and helminths from house rat (R. rattus) and house mouse (Mus musculus) from different structures and poultry feed stores.

MATERIALS AND METHODS

Collection of the samples

Five structures i.e., grocery shops, sweet shops, rice godowns, wheat godowns and poultry feed stores from Faisalabad and Sargodha districts of Pakistan were sampled. Ten samples per collection, comprising
10 pellets of faecal matter of each of the house rat (R. rattus) and house mouse (Mus musculus) were taken from the structures. The sampling was done fortnightly for a period of eight months i.e. from March through October, 2005. Each faecal sample was placed in 8 to 10 ml phosphate-buffered-saline (PBS) in a plastic bottle and stored in a refrigerator till processed.

Isolation of microorganisms

Each sample was processed for the presence of bacteria and helminths following the methods described by Battersby et al. (2002). Briefly, two methods i.e. direct smear method and salt floatation technique were applied to find out the helminth eggs/larvae. For direct smear method, a drop of faecal sample thoroughly mixed with normal saline was placed on a slide and a cover slip was placed over the smear. Two slides of each sample were observed under the microscope at 40X.

Salt floatation solution was prepared by adding NaCl in distilled water up to saturation level. Faecal matter was thoroughly mixed in this solution. After straining, the solution was centrifuged for 5 minutes at 1500 rpm. After this, a few drops from centrifuged solution were placed on slides and examined under microscope and eggs and larvae were identified following Hayat and Akhtar (1999).

For bacterial isolation, media selective for S. typhi and E. coli were prepared as described by Cappucino and Sherman (1996). Salmonella shigella agar (SS Agar) was prepared for S. typhi and MacConkey’s agar was used for E. coli following Yaqoob (2007). Each sample was inoculated on the Petri’s plates of each media, incubated at 37°C overnight and suspected colonies were re-streaked to obtain pure culture (Cruickshank et al., 1975).

Identification and characterization of isolates

Plates were observed for characteristic shape, color and other features of colonies for Salmonella typhi and Escherichia coli (Athar et al., 2007). Slides were prepared from discrete colonies, stained by Gram’s staining method and observed under oil immersion lens of the microscope at 100X for examination of shape, arrangement and staining reaction of isolates. Methyl red test, indole test, nitrate reduction test, Voges-Prauskaur’s (VP) test, urease test and hydrogen sulphide (H2S) production test were biochemical tests adopted. In sugar fermentation reaction, xylose, glucose, lactose, sucrose, maltose, arabinose, raffinose, inositol and mannitol solutions were used.

Statistical analysis

Positive samples for E. coli, S. typhi and helminths were recorded from the faecal matters of R. rattus and M. musculus collected from poultry feed stores and other structures under study. Studentized t-test was applied for data analysis.

RESULTS

In the present study, maximum faecal samples from R. rattus were found infected with E. coli from rice godowns (4.72%), followed by grocery shops (4.22%; Table 1). The prevalence of house mouse infected with E. coli showed non-significant difference between grocery shops, sweet shops and rice godowns. Rice godowns showed higher prevalence than for sweet shops, wheat godowns and poultry feed stores, differences among the latter three structures were non significant (Table 1). Faecal pellets from the house rats of grocery shops infected with S. typhi (4.44%) were significantly higher (p<0.05) than sweet shops and wheat godowns, whereas the faecal samples collected from R. rattus of rice godowns and poultry feed stores showed non significant difference with all other structures under study. The prevalence of H. nana in grocery shops and rice godowns was significantly higher (p<0.01) than sweet shops and poultry feed stores, whereas the same in wheat godowns showed non significant difference with other structures (Table 1).

For Mus musculus, prevalence of E. coli was significantly higher in the faecal pellets collected from grocery shops, sweet shops and rice godowns than poultry feed stores and wheat godowns, the difference between the latter two structures was non significant. Faecal pellets collected from house mouse (Mus musculus) of grocery shops and rice godowns revealed non significant difference from each other in relation to the percent prevalence of S. typhi but both of these had significantly higher prevalence than from Mus musculus of sweet shops, wheat godowns and poultry feed stores (Table 1). Faecal pellets of Mus musculus collected from grocery shops and rice godowns were significantly higher in H. nana prevalence than sweet shops, whereas the samples from wheat godowns and poultry feed stores had non significantly different prevalence of H. nana compared to all other structures (Table 1).

DISCUSSION

The prevalence of E. coli, S. typhi and H. nana in the faecal matter of R. rattus and Mus musculus was studied in the present manuscript. E. coli are a type of faecal coliform bacteria found in sewerage, contaminated food and water. Rats and mice mostly live in house sewerage pathways or animal farms from where they can pick E. coli by eating contaminated feed, drinking water, wastes through poultry and cattle excreta and also from infected herbage. E. coli in the present study remained the most prevalent bacteria
isolated and identified from the faecal matter of *R. rattus* and *Mus musculus*, which is in agreement with Cizek *et al.* (1999), who reported that 5.3% of rodents stool samples were found positive for *E. coli* in Czech Republic.

*S. typhi* are a group of bacteria that can cause diarrheal illness (salmonellosis) in humans. They are usually transmitted to rats and mice through eating contaminated feed and wastes of infected human, animals, raw food of animal origin, contaminated water, milk and sewerage wastes (Hilton *et al.*, 2002).

In the present study, the prevalence of *S. typhi* from different structures ranged from 3.28 to 4.56%. A previous study revealed that 5.1% mice and 16.2% rats were positive for Salmonella spp (Henzler and Optiz, 1992). During another study in UK, 4.91% of the rats and mice were found to carry Salmonella infection (Healing, 1991). Hilton *et al.* (2002) studied the prevalence of Salmonella in Midlands UK by culturing faecal dropping (n=100) and rectal swabs (n=50) of Norway rats and reported that 8% of faecal samples and 10% of rectal swabs were positive for Salmonella, which are in close agreement to the results presented in the present study.

Among the helminth parasites, *H. nana* is one of the most common rat tapeworms. In the present study, faecal matter of *R. rattus* and *Mus musculus* infected with *H. nana* identified from different structures viz grocery shops, sweet shops, rice godowns and poultry feed stores ranged from 2.97 (poultry feed stores) to 3.89% (grocery shops). Abu-Madi *et al.* (2001) reported the prevalence of *H. diminuta* in 17.1% rats in Doha, Qatar. The parasites of wild rats on a farm in UK included 22% *H. diminuta* eggs and 11% *H. nana*. The difference among the prevalence of *H. nana* in different studies may be due to selection of different rat species.

In the present study, it was noted that the faecal matter of the structures viz. grocery shop, sweet shops, rice godowns and wheat godowns of Sargodha district were significantly more infested with *E. coli*, *S. typhi* and *H. nana* compared to the same structures present in Faisalabad district. This might be assumed that the hygienic condition of the surroundings or vicinity of the structures of Sargodha from where samples were collected were poor compared to the vicinity of the structures of Faisalabad district.

Based on the results of the present study it can be concluded that the *R. rattus* and *Mus musculus* may pose a potential risk in the zoonosis of colibacilosis, salmonellosis and infestation of *H. nana*.

### REFERENCES


### Table 1: Percent prevalence of *E. coli*, *S. typhi* and *H. nana* from the faecal samples of *R. rattus* and *Mus musculus* from different structures of Pakistan

<table>
<thead>
<tr>
<th>Structure</th>
<th><em>R. rattus</em></th>
<th><em>Mus musculus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>E. coli</em></td>
<td><em>S. typhi</em></td>
</tr>
<tr>
<td>Grocery shops</td>
<td>4.22ab</td>
<td>4.44a</td>
</tr>
<tr>
<td>Sweet shops</td>
<td>3.56b</td>
<td>3.56b</td>
</tr>
<tr>
<td>Rice godowns</td>
<td>4.72a</td>
<td>3.89ab</td>
</tr>
<tr>
<td>Wheat godowns</td>
<td>3.72b</td>
<td>3.61b</td>
</tr>
<tr>
<td>Poultry feed stores</td>
<td>3.46b</td>
<td>3.91ab</td>
</tr>
</tbody>
</table>

Values within a column with different letters are significantly different (p≤0.05) from each other.

### Table 2: Percent prevalence of *E. coli*, *S. typhi* and *H. nana* isolated from faecal matters of *R. rattus* and *Mus musculus* from two districts of Pakistan

<table>
<thead>
<tr>
<th>Locality</th>
<th><em>R. rattus</em></th>
<th><em>Mus musculus</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><em>E. coli</em></td>
<td><em>S. typhi</em></td>
</tr>
<tr>
<td>Faisalabad</td>
<td>3.14b</td>
<td>2.79b</td>
</tr>
<tr>
<td>Sargodha</td>
<td>4.97a</td>
<td>4.78a</td>
</tr>
</tbody>
</table>

Values within a column with different letters are significantly different (p≤0.05) from each other.