

Short Communication

Alimentary tract parasites of vervet monkeys (*Cercopithecus aethiops*): A potential reservoir for human transmission

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ABSTRACT

Monkeys are important experimental models for investigating human diseases. The aim of this study was to survey the alimentary tract parasites among imported vervet monkeys (*Cercopithecus aethiops*) to Iran. Fecal samples were collected from 40 vervets imported from Tanzania to Razi Vaccine and Serum Research Institute of Iran. Fecal samples were assessed by direct smear and Telman sedimentation methods. The results of microscopic examination demonstrated that all (100%) the animals were infected with different alimentary tract parasites. The protozoan parasites comprised of *Iodamoeba butschlii* (85%), *Entamoeba coli* (72.5%), *Entamoeba histolytica/dispar* (37.5%), *Chilomastix mesnili* (12.5%), *Balantidium coli* (10%), *Blastocystis hominis* (7.5%), and *Giardia intestinalis* (5%). Additionally, eggs of some helminths, including *Physaloptera caucasica* (27.5%), *Trichostrongylus* spp. (7.5%), *Trichuris trichiura* (7.5%), *Bertiella* spp. (2.5%), and *Strongyloides fulleborni* (2.5%), were detected. The presence of gastrointestinal parasites in vervets poses a risk for human or experimental results. Thus, the diagnosis and treatment of these parasites should be considered before any laboratory assay.

Keywords: Vervet monkeys, Alimentary tract, Parasites, Telman

Les parasites du tube digestif du singe Vervet : un réservoir potentiellement transmissible aux humains

Résumé: Les singes sont utilisés comme modèle animal dans l'étude de nombreuses maladies humaines. Le but de cette étude était de déterminer les parasites affectant le tube digestif des Vervets (*Cercopithecusaethiops*) importés en Iran. Des prélèvements de fèces ont été recueillis à partir de 40 Vervets importés de Tanzanie par l'Institut Razi de Recherche sur les Vaccins et Sérum d'Iran. Les échantillons fécaux ont été analysés par frottis direct et par la méthode de sédimentation de Telman. Les observations microscopiques démontrent que tous les échantillons (100% des singes testés) étaient infectés par différents parasites du tube digestif. Différents parasites protozoaires ont été détectés comme l'*Iodamoebabutschlii* (85%), l'*Entamoebacoli* (72,5%), l'*Entamoebahistolytica/dispar* (37,5%), le *Chilomastixmesnili* (12,5%), le *Balantidiumcoli* (10%), le *Blastocystishominis* (7,5%) et le *Giardiainestinalis* (5%). De plus, des œufs d'helminthes appartenant aux espèces *Physalopteraucasica* (27,5%), *Trichostrongylusspp.* (7,5%), *Trichuristrichiura* (7,5%), *Bertiellasp.* (2,5%) et *Strongyloidesfulleborni* (2,5%) ont été identifiés. La présence de parasites intestinaux chez les Vervets constitue un risque potentiel pour l'homme ainsi que pour la fiabilité des expérimentations. Par conséquent, le diagnostic et le traitement de ces parasites doivent être considérés avant chaque étude en laboratoire.

Mots clés: Singes Vervets, Tube digestif, Parasites, Telman

INTRODUCTION

Non-human primates, especially monkeys, are important animal models for simulation of human diseases (Herodin et al., 2005). Different species of monkeys including vervet monkeys (*Cercopithecus aethiops*) have been used as relevant models for immunological and vaccine studies (Herodin et al., 2005). Several species of monkeys (e.g., *Cercopithecus aethiops*) harbor a variety of gastrointestinal parasites (Petrášová et al., 2010). Many of endoparasite infections have minor clinical symptoms; therefore, the infection remains asymptomatic for a long time (McSorley and Maizels, 2012). However, the presence of gastrointestinal parasites in vervets poses a risk for laboratory-acquired infections due to accidental exposures; moreover, it can interfere with immune responses to vaccines or experimental studies. They may affect animal studies through several immunological alterations, which consequently interfere with immune responses to vaccines or experimental infections (Baker, 1998; McSorley and Maizels, 2012). On the other hand, several gastrointestinal parasites are zoonotic pathogens, and therefore, pose a potential reservoir of human transmission of infection s(Herwaldt, 2001; Singh, 2009). Numerous gastrointestinal protozoa and helminths were reported in different species of monkeys (Legesse and Erko, 2004; Carvalho Filho et al., 2006; Bezjian et al., 2008; Kooriyama et al., 2010; Lee et al., 2010; Petrášová et al., 2010; Berrilli et al., 2011; Howells et al., 2011; Petrasova et al., 2011; Kooriyama et al., 2012; Parmar et al., 2012; Parr et al., 2013). Some of these gastrointestinal protozoa and helminths are generally non-pathogenic (e.g., *Entamoeba coli*, *Iodamoeba buetschlii*, and *Chilomastix mesnili*) and several of them are zoonotic pathogens (e.g., *Entamoeba histolytica*, *Giardia lamblia*, and *Blastocystis hominis*). The aim of the present study was to evaluate the prevalence of gastrointestinal parasites among imported vervets to Iran.

MATERIALS AND METHODS

Animals. A total of 40 *Cercopithecus aethiops*, imported from Tanzania to Razi Vaccine and Serum Research Institute of Iran for polio vaccine evaluation, were included. All the animals were aged under five years old. The animals were housed in separate sanitary cages with free access to food and water.

Sample collection and fecal examination. Fecal samples were obtained from each monkey immediately after defecation and placed in plastic bags with a specific identification number. The direct smears were immediately prepared after stool collection for diagnosis of trophozoites of amoebae and flagellates. The Telman sedimentation method was conducted for identification of protozoal cysts, helminth ova, and larval stages (Munene et al., 1998).

RESULTS AND DISCUSSION

The prevalence of different gastrointestinal parasites is shown in Table 1. All the 40 vervets (100%) were infected with different gastrointestinal parasites.

Table 1. Prevalence of gastrointestinal parasites of imported vervet monkeys to Iran

Parasite species	Animals (n=40)
Protozoans	
<i>Iodamoeba butschlii</i>	34(85%)
<i>Entamoeba coli</i>	29(72.5%)
<i>Entamoeba histolytica/ dispar</i>	15(37.5%)
<i>Chilomastix mesnili</i>	5(12.5%)
<i>Balantidium coli</i>	4(10%)
<i>Blastocystis hominis</i>	3(7.5%)
<i>Giardia lamblia</i>	2(5%)
Helminths	
<i>Physaloptera caucasica</i>	11(27.5%)
<i>Trichostrongylus</i> spp.	3(7.5%)
<i>Trichuris trichiura</i>	3(7.5%)
<i>Bertiella</i> spp.	1(2.5%)
<i>Strongyloides fülleborni</i>	1(2.5%)

As noted in Table 1, seven species of protozoans and five species of helminths were found in the fecal samples. The most prevalent protozoan was *Iodamoeba butschlii* 34/40 (85%) followed by *Entamoeba coli* 29/40 (72.5%), *Entamoeba histolytica/dispar* 15/40 (37.5), *Chilomastix mesnili* 5/40 (12.5%), *Balantidium coli* 4/40 (10%), *Blastocystis hominis* 3/40 (7.5%), and

Giardia lamblia 2/40 (5%). Among the five species of helminths, *Physaloptera caucasica* 11/40 (27.5%) had the highest prevalence followed by *Trichostrongylus* spp. 3/40 (7.5%), *Trichuris trichiura* 3/40 (7.5%), *Bertiella* spp. 1/40 (2.5%), and *Strongyloides fulleborni* 1/40 (2.5%). Table 2 exhibits the prevalence of single and multiple gastrointestinal parasites among the animals. The results revealed that only five fecal samples had single infections and the remaining samples were co-infected with two to five parasite species. Among the seven reported species of protozoans, four species are potential pathogens (*Entamoeba histolytica/dispar*, *Balantidium coli*, *Blastocystis hominis*, and *Giardia lamblia*). These protozoan parasites can transmit from animals to humans via water, food, and oral-fecal route. *Blastocystis hominis*, *Giardia lamblia*, and *Entamoeba histolytica/dispar* are the most common causes of diarrhea among immunocompetent and immunocompromised individuals (Sohail and Fischer, 2005; DuPont, 2009; Thompson and Smith, 2011).

Table 2. Prevalence of single and multiple gastrointestinal parasites in vervet monkeys

One parasite	5(12.5%)
Two parasites	12(30%)
Three parasites	11(27.5%)
Four parasites	9(22.5%)
Five parasites	3(7.5%)

In addition, these protozoan parasites were reported in *Cercopithecus aethiops*, chimpanzees, baboons, and Sykes monkeys (Munene et al., 1998; Muriuki et al., 1998; Legesse and Erko, 2004; Petrášová et al., 2010; Howells et al., 2011; Kooriyama et al., 2012). All the five reported species of helminths (*Physaloptera caucasica*, *Trichostrongylus* spp., *Trichuris trichiura*, *Bertiella* spp., and *Strongyloides fulleborni*) were zoonotic pathogens (McCarthy and Moore, 2000; Sato et al., 2011; Furtado et al., 2012; Malik et al., 2013). Former reports revealed that the different species of monkeys are appropriate hosts for these helminths (Munene et al., 1998; Legesse and Erko, 2004; Bezjian

et al., 2008; Kooriyama et al., 2010; Lee et al., 2010; Petrášová et al., 2010; Howells et al., 2011; Parmar et al., 2012). In our study, *E. histolytica/dispar* was highly prevalent pathogenic protozoan parasite. We observed that 37.5% (15/40) of the vervets were infected with *E. histolytica/dispar*. *E. histolytica/dispar* was also found among 47.06% of baboons in Senegal (Howells et al., 2011), 23.6% of Sykes monkeys, and 26.1% baboons in Kenya (Munene et al., 1998), 13% of chimpanzees, 49% of red colobus, 52% of red-tailed monkeys, 89% of vervet monkeys, and 77% of yellow baboons in Tanzania (Kooriyama et al., 2012), 10% of Gray langurs in India (Parmar et al., 2012), and 16.9% of baboons and 24.4% of vervets in Ethiopia (Legesse and Erko, 2004). In the current study, the prevalence rates of *Balantidium coli*, *Blastocystis hominis*, and *Giardia lamblia* were 10% (4/40), 7.5% (3/40), and 5% (2/40), respectively. These protozoan parasites were reported from different species of monkeys from Senegal (Howells et al., 2011), Kenya (Munene et al., 1998), Korea (Lee et al., 2010), Tanzania (Kooriyama et al., 2012), and Ethiopia (Legesse and Erko, 2004). Five species of helminths were detected in our study (*Physaloptera caucasica*, *Trichostrongylus* spp., *Trichuris trichiura*, *Bertiella* spp., and *Strongyloides fulleborni*). *Physaloptera caucasica* was detected in 27.5% (11/40) of vervets in the present study and 13.28% of chimpanzees in a study performed in Senegal (Howells et al., 2011). We observed that the prevalence rates of *Trichostrongylus* spp., *Trichuris trichiura*, *Bertiella* spp., and *Strongyloides fulleborni* were 7.5% (3/40), 7.5% (3/40), 2.5% (1/40), and 2.5% (1/40), respectively. These zoonotic helminths are highly common among different species of monkeys in Senegal (Howells et al., 2011), Uganda (Bezjian et al., 2008), Kenya (Munene et al., 1998), Korea (Lee et al., 2010), Tanzania (Kooriyama et al., 2010), and Ethiopia (Legesse and Erko, 2004). In conclusion, our findings unmasked the high prevalence of zoonotic gastrointestinal protozoa and helminth infections among imported vervets to Iran. Consequently, for prevention of laboratory-acquired infections, diagnosis

and treatment of these parasites should be considered before any examinations.

Ethics

We hereby declare all ethical standards have been respected in preparation of the submitted article.

Conflict of Interest

The authors declare that they have no conflict of interest.

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