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The Investigation of Intestinal Parasites and VRE Carriage in Children Studying in Schools with Different Socio-Economic Levels in İstanbul, Turkey

İstanbul'da Farklı Sosyo-Ekonomik Seviyeli Okullarda Okuyan Çocuklarda Bağırsak Parazitlerinin ve VRE Taşıyıcılığının Araştırılması

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ABSTRACT

Objective: Intestinal parasitic infections are among the most common infections worldwide, and approximately 3.5 million people are infected with a variety of intestinal parasites. Recently, Istanbul has received migration from rural areas and Syria. The aim of the present study was to investigate intestinal parasites, intestinal flora, and vancomycin-resistant *Enterococcus* (VRE) carriage in children studying in schools with different socio-economic levels (SELs).

Materials and Methods: The fecal samples were collected from 570 students (ages 9-12 years) studying in schools with different SELs. In Istanbul University-Cerrahpaşa School of Medicine, Department of Medical Microbiology Laboratory, the fecal samples were examined macroscopically and microscopically. Native-lugol and formalin-ethyl acetate concentration techniques were used for intestinal parasites. In addition, in fecal samples, the fecal flora of the children was analyzed by conventional methods and was examined with respect to VRE carriage.

Results: Intestinal parasites were found in 10.8% of the stool samples of students. *Blastocystis hominis* (5.2%) was the most common intestinal parasite. *Giardia intestinalis* (3.5%) was the second most prevalent parasite. A significant increase in the rates of the KES group (*Klebsiella* spp., *Enterobacter* spp., and *Serratia* spp.) and enterococci was observed in children studying in schools with high SELs. VRE carriage was determined to be 0.8%.

Conclusion: Despite the improved sanitation conditions in Istanbul, in our study, the rate of parasites was found to be high in socio-economic low level schools due to the recent migration from both Syria and the eastern regions of Turkey. In particular, it is necessary to make informed studies about sanitation in these schools.

Keywords: Intestinal parasites, fecal flora, VRE carriage, students, schools with different socio-economic level

ÖZ

Amaç: Bağırsak parazit infeksiyonları tüm dünyada en sık görülen infeksiyonlar arasındadır ve yaklaşık olarak 3,5 milyon insan bağırsak parazitlerinin bir çeşidi ile infektedir. Son zamanlarda İstanbul, kırsal alanlardan ve Suriye'den çok göç almaktadır. Bu çalışmada sosyo-ekonomik düzeyleri farklı okullarda okuyan çocuklarda bağırsak parazitleri ve bit araştırılması, aynı zamanda bu çocukların bağırsak floraları ve VRE taşıyıcılığı yönünden incelenmesi amaçlanmaktadır.

Gereç ve Yöntem: İstanbul' da sosyo-ekonomik düzeyleri farklı olan okullardaki yaşları 9-12 arasında değişen kız ve erkek olmak üzere toplam 570 öğrenciden barsak paraziti için dışkı örnekleri toplandı. Bu örnekler İstanbul Üniversitesi-Cerrahpaşa Tıp Fakültesi Tıbbi Mikrobiyoloji Anabilim Dalı laboratuvarında makroskobik ve mikroskobik olarak incelendi. Bağırsak parazitleri için nativ-lügol ve formalin etil asetat konsantrasyon tekniği kullanıldı. Ayrıca toplanan dışkı örneklerinde, çocukların dışkı floraları konvansiyonel yöntemlerle araştırıldı ve vancomycin-resistant *Enterococcus* (VRE) taşıyıcılığı yönünden incelendi. Gerektiğinde otomatize sistemlerlerle kontrol edildi.

Bulgular: 570 çocuğun dışkı örneğinde 33 (%6) parazit tespit edildi. Patojenik parazitlerin (*G. intestinalis, E. vermicularis, A. lumbricoides*) oranı %1 olarak bulundu. Bu 33 parazitin 27 (%82)'si *Blastocystis hominis* kisti, 3 (%9)'ü *Giardia intestinalis* kisti ve trofozoiti, 1'i *Ascaris lumbricoides* yumurtası, 1'i *Enterobius vermicularis* yumurtası ve 1'i de *Iodamoeba butschlii* idi. Örneklerin hiçbirinde patojen bağırsak bakterisi bulunmadı. Ancak 1 örnekte VRE taşıyıcılığı tespit edildi (%0,8).

Sonuç: Bu çalışmada İstanbul'daki okul çocuklarının iç ve dış parazit oranlarının önceki çalışmalara kıyasla önemli ölçüde azaldığını gözlemledik, ancak düşük sosyo-ekonomik düzeye sahip okullarda hala bu patojenlere rastlanmaktadır. Bu enfeksiyonların önüne geçebilmek için sanitasyon, kişisel hijyen, insanların farkındalığının artması ve sağlık eğitimi konuları üzerinde daha çok durulmalı ve bu konularda yapılan çalışmalar hızlandırılmalıdır.

Anahtar Kelimeler: Bağırsak parazitleri, fekal flora, VRE taşıyıcılığı, öğrenciler, farklı sosyo-ekonomik düzeyde okullar

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INTRODUCTION

Intestinal parasitic infections are among the most common infections worldwide, and approximately 3.5 million people are infected with a variety of intestinal parasites. The high prevalence of intestinal parasitic infections in developing countries is due to the lack of sanitation, the lack of access to safe water, and improper hygiene; therefore, they occur wherever there is poverty. People of all ages are affected by this cycle of prevalent parasitic infections; however, the case of children is the worst (1, 2).

Giardia intestinalis that causes giardiasis is the most common parasite affecting nearly 200 million people (3, 4). Approximately 3.5 billion people are affected, and 450 million are ill because of these infections (5). These infections can cause severe public health problems due to growth retardation in children and other physical and mental health illnesses (6).

The main aims of the present study were to detect the prevalence of intestinal parasites, intestinal flora, and vancomycin-resistant *Enterococcus* (VRE) carriage in children studying in school and its relation to socio-economic factors, environmental factors, behavioral habits, and complaints related to intestinal infections.

MATERIALS AND METHODS

Study Population

Data for the study were acquired from primary schools in almost the whole county of İstanbul, the largest city of Turkey.

The calculated study population size was 570 students. Multistage sampling was used in the selection of the study sample. The primary schools of Istanbul were separated into three regions according to socio-economic data.

Permission was granted by the Directorate of Education for the inclusion of schools in the study.

The fecal samples were collected from a total of 570 children examined in our study. The study included 316 (55%) girls and 254 (45%) boys. The age of the children ranged from 9 to 12 years. The age distribution rates had been determined to be 63% (aged 9 years), 20% (aged 11 years), 10% (aged 12 years), and 7% (aged 10 years).

According to the socio-economic levels (SELs) of schools where the stool samples were collected, the different categories were divided into three. Of the 570 children, there were 231 (40%) socio-economic low level (SELL), 169 (30%) socio-economic middle level, and 170 (30%) socio-economic high level.

This research study was approved by the Istanbul University-Cerrahpaşa School of Medicine Ethics Committee of Clinical Research and the authors declared that the research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013).

The Questionnaire and Family Information Form

The questionnaire contained several sections as follows: age, gender, residence, education and occupation of parents, housing conditions and water supply, and "behavior habits"; type of toilet commonly used, hand washing (no washing/washing with only water/washing with soap), washing the anal area by hands after defecation (yes/no), usage of toilet paper (always/sometimes/never); and "complaints" of abdominal pain, nausea/vomiting, lack of appetite, salivation during sleeping, headache, irritability in sleeping, perianal itching, teeth grinding, and history of parasitic infections.

Written informed consent was obtained from all of the parents of the children who participated in the study.

Intestinal Parasitic Examination

The stool specimens (0.5-1.5 g) were collected in labeled plastic vials without preservatives and transported to the laboratory within 4 h after collection.

In Istanbul University-Cerrahpaşa School of Medicine, Medical Microbiology Laboratory, the fecal samples were examined for the presence of parasites by direct wet mount, Lugol's iodine solution, and modified formalin-ethyl acetate sedimentation techniques. In addition, in fecal samples, the fecal flora of the children was analyzed using conventional methods and was examined with respect to VRE carriage.

RESULTS

Intestinal parasites were found in 62 (10.8%) stool samples of 570 subjects (316 girls and 254 boys) (Figure 1).

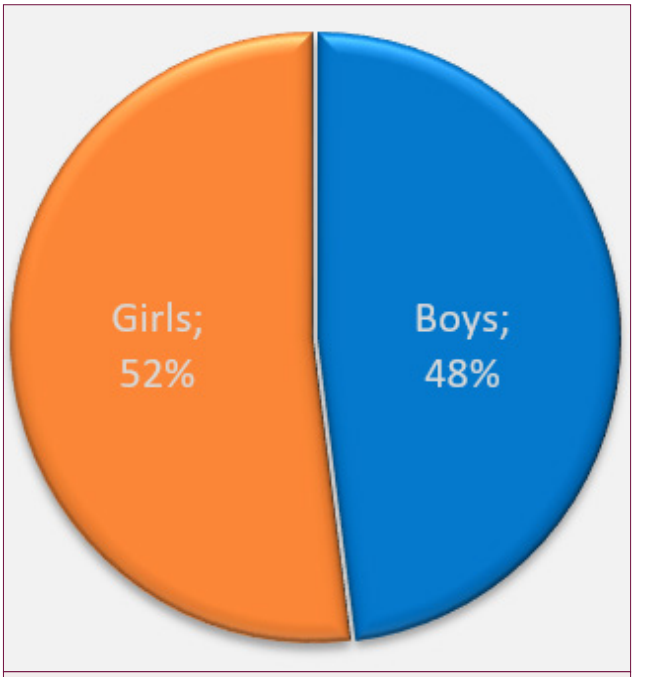

Figure 1. Comparison of sex distribution for intestinal parasite carriage

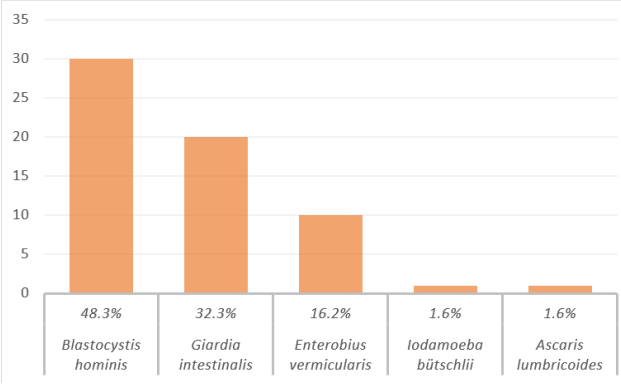

Figure 2. Species distribution of intestinal parasites detected among the schoolchildren in İstanbul

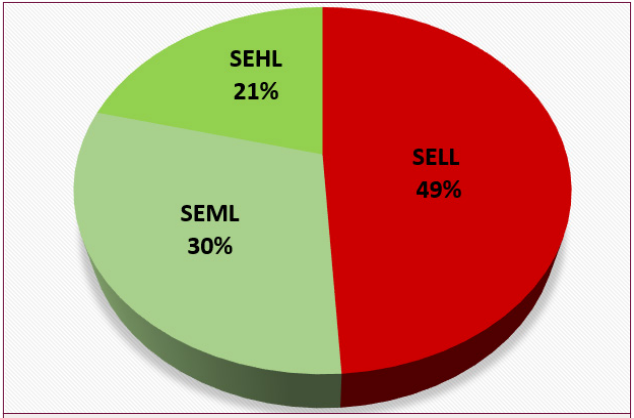

Figure 3. Association between socio-economic status and parasite detection among the schoolchildren in İstanbul

Blastocystis hominis (5.2%) was the most common intestinal parasite. *G. intestinalis* (3.5%) was the second most prevalent parasite. However, there was no significant difference in the prevalence of intestinal protozoa between boys and girls. Furthermore, in three stool samples, *Enterobius vermicularis*, *Iodamoeba bütschlii*, and *Ascaris lumbricoides* that may exist as commensal in the intestine were determined. The prevalence and distribution of intestinal parasites are shown in Figure 2.

There was no any statistically significant difference in the comparison of sex distribution in three different categories. The association between socio-economic status and parasite detection among the schoolchildren in İstanbul is shown in Figure 3.

From the 570 specimens investigated, only one specimen was positive for vancomycin-resistant *Enterococcus* (VRE).

DISCUSSION

The study revealed that >10% of the primary school students in different SELs of İstanbul were positive for parasitic intestinal infections. The demographic data indicated a significant difference between the incidence of parasites and the residing area, i.e., urban and rural areas.

In addition, the study revealed that a significant number of parents had a primary school level of education among the parents in these children. It was observed that there was a significant relationship between whose parents had a primary school level of education and the incidence of parasites.

Compared with the study performed between 2001 and 2005 by Ulukanligil (7), the rate of parasites that were detected in our study was rather low. The rate of intestinal parasites was 10.8% lower in our study than in Ulukanligil's study in 2005.

Okyay et al. (8) found that 31% (in Aydin, Turkey) and Hamamci et al. (9) found that 35% (in Kayseri, Turkey) of children are infected with one or more intestinal parasites. The study shows that rural residence, mother education less than primary school, sometimes or never usage of toilet paper, and washing the anal area by hands after defecation were significantly associated.

In another study, Ekinci et al. (10) found that the intestinal parasite rate is 11% in Muğla, one of the western cities of Turkey. This rate is similar to the results of our study. The parasite rates compared with the level of development vary in different cities in Turkey.

Socio-economic conditions and poor hygiene practices have been associated with parasitic infections in any household. Poor sanitation conditions constituted public health importance among schoolchildren especially SELL children. School health programs including deworming and sanitation activities through the health education and improvement of sanitation conditions in schools have the potential to better health and education for schoolchildren.

Köksal Çakirlar et al. (11) showed in their retrospective study between January 1999 and December 2009 that the parasite rate in Istanbul is similar to our study (4%). This may be because sanitation is better, and the infrastructure is improved, in which it does not mix with wastewater and drinking water.

However, previous studies in Istanbul have reported higher prevalence rates of intestinal parasites. These rates have shown that the prevalence of intestinal parasites is significantly lower today than earlier decades in Istanbul.

In our study, the second most frequent parasite was *G. intestinalis* (3.5%). In previous studies in Istanbul, the prevalence of *G. intestinalis* has been reported to be 1%-15% (12, 13).

Tang et al. (14) reported that the prevalence rate is higher in females than in males, although Arani et al. (15) suggested that susceptibility to parasitic infections is greater in males. However, in our study, there was no significant difference between boys and girls.

The present study revealed that intestinal parasite carriage was prevalent, thereby affecting the health of schoolchildren.

Although these findings are limited to only one city, it may represent the population of the area because of the full range of demographic diversity in the city. In conclusion, our results showed that the prevalence of intestinal parasites considerably decreased in Istanbul. This may be due to the general improvement in sanitary/hygienic conditions, such as the infrastructure of the city, sanitary installations of buildings where people live, and pure water that is of sufficient high quality. Hence, improving environmental hygiene, inadequate water sanitation, and health education for behavioral changes to personal hygiene would be crucial for the effective control of parasitic intestinal infections.

Despite the improved sanitation conditions in İstanbul, in our study, the rate of parasites was found to be higher in SELL schools due to the recent migration from both Syria and the eastern regions of Turkey. In particular, it is necessary to make informed studies about sanitation in these schools. A multidisciplinary approach is needed for a wide review.

Ethics Committee Approval: Ethics committee approval for this study was obtained from the Istanbul University-Cerrahpaşa School of Medicine Ethics Committee of Clinical Research.

Informed Consent: Written informed consent was obtained from all of the parents of the students who participated in this study.

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Author Contributions: Concept - F.K.Ç., S.Y.; Design - F.K.Ç., S.Y., O.A., S.Ö., S.A.Ç., Z.T., H.T., N.G.; Supervision - F.K.Ç., S.Ö., S.A.Ç., N.G.; Materials - S.Y., O.A., Z.T., H.T.; Data Collection and/or Processing - S.Y., O.A., S.Ö., S.A.Ç., Z.T., H.T.; Analysis and/or Interpretation - O.A., S.Ö., S.A.Ç., Z.T., H.T.; Literature Search - O.A.; Writing Manuscript - O.A., F.K.Ç., Z.T.; Critical Reviews - F.K.Ç., S.Y., O.A., S.Ö., S.A.Ç., Z.T., H.T., N.G.

Conflict of Interest: The authors declared that they have no conflict of interest.

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Hasta Onamı: Yazılı hasta onamı çalışmaya katılan tüm öğrencilerin ailelerinden alınmıştır.

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