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Epidemiology of ascariasis, enterobiasis and giardiasis in a Romanian western county (Timis), 1993–2006

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ABSTRACT

The purpose of this study is to bring new and important data regarding the epidemiology of ascariasis, enterobiasis and giardiasis in the Romanian largest county during a 14-year period. We have performed a retrospective collection and analysis of the available information provided by the general practitioners to the Statistics Department database of the Timis County Public Health Authority. The mean annual incidence of the studied parasitic diseases during 1993–2006 was the following: 194 cases per 100,000 inhabitants (range: 90–304) for ascariasis, 777 cases per 100,000 inhabitants (range: 417–1241) for enterobiasis and 1076 cases per 100,000 inhabitants (range: 93–1770) for giardiasis. Noteworthy is that Romania reported 90.8% of the total cases of giardiasis at the European Union's level during 2006–2008. The general trend of the incidences throughout the studied period was constant for ascariasis ($R^2 = 0.192$, $p = 0.1$), showed no statistically significant variation ($R^2 = 0.025$, $p = 0.6$) for enterobiasis and was upward for giardiasis ($R^2 = 0.6$, $p = 0.001$). Intestinal parasitoses represent an important public health concern in Romania due to the extremely high incidence rates reported. Special attention should be paid to the young population (0–14 years), where the negative disease consequences on children's health and their educational process may be traced for a long-term. Therefore, efficient educational programs and campaigns should be timely implemented.

1. Introduction

The roundworm *Ascaris lumbricoides* is responsible for ascariasis, and it is estimated that approximately 1.2 billion of the global population are infected with this helminth (Dold and Holland, 2011). The disease is maintained by small children who defecate indiscriminately in the neighborhood of their home and collect on their hands the infective eggs while playing. *Enterobius vermicularis*, also known as the pinworm, produces enterobiasis. It is considered the oldest and the most widely spread worm infecting at least 200 million people worldwide, predominantly children (Plorde, 2004). *Giardia intestinalis* is a protozoan that causes giardiasis, one of the most commonly spread intestinal parasitoses, having a global burden of approximately 2.8 million new cases per year. *G. intestinalis* is particularly common in warm climates, and it is one of the most frequently found intestinal parasites in children living in developing countries (Eissa and Amer, 2012). This parasite protozoan is also common in industrialized countries, where it can be present in contaminated wells and water systems, especially stagnant water sources such as naturally occurring ponds, and storm water storage systems (Sinnis, 2009). In Romania, intestinal parasitic infections such as ascariasis, enterobiasis and giardiasis constitute the most commonly detected parasitoses (Neghina et al., 2011a).

The aim of this study was to bring new and important data regarding the epidemiology of ascariasis, enterobiasis and giardiasis in the Romanian largest county (Timis County, western Romania) during a 14-year period.

2. Materials and methods

We have retrospectively collected the available information regarding ascariasis, enterobiasis and giardiasis from the Statistics Department database of the Timis County Public Health Authority. The epidemiological data for the period 1993–2006 was provided by the general practitioners, and cases were classified according to the following age groups: 0–14 years, 15–64 years and ≥65 years.

Timis is Romania's largest county and according to its population (677,926 inhabitants) is situated on the 8th position at the national level. The predominant population is urban (58%). It is well known as the county with the smallest rate of unemployment. According to the available data, at the end of 1995, its rate of unemployment was 4% and in 2004–2.6% compared to other counties that registered a

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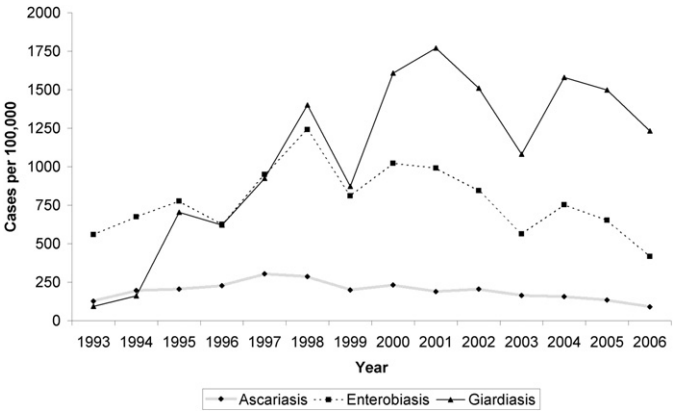

Fig. 1. The incidence of ascariasis, enterobiasis and giardiasis during the period 1993–2006.

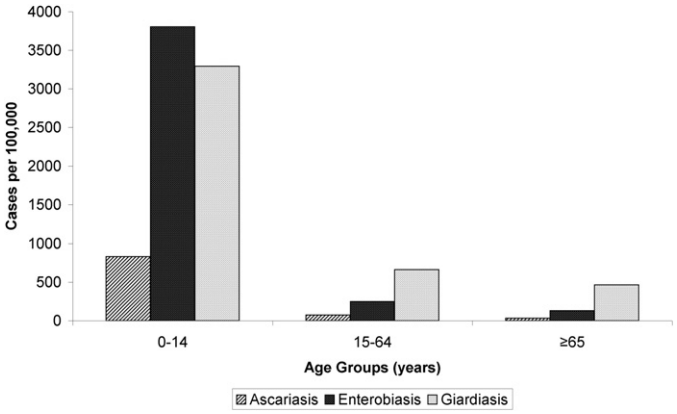

Fig. 2. The age group distribution of ascariasis, enterobiasis and giardiasis cases per 100,000 inhabitants.

rate of approximately 17% (1995) and approximately 11% (2004) (Badulescu, 2006).

Statistical analysis was performed using the software package SPSS version 17.0 for Windows (SPSS Inc., Chicago, IL). Descriptive statistics (mean, 95% Confidence Interval, CI) were calculated for each variable as appropriate. Mann–Whitney *U* statistics for quantitative data was used to compare two independent patient groups. Trends over time in the incidence of the ascariasis, enterobiasis and giardiasis were determined by linear regression analysis. A *p*-value of less than 0.05 was regarded as statistically significant.

3. Results

3.1. Ascariasis

The mean annual incidence of ascariasis in Timis County during the study period was 194 cases per 100,000 inhabitants (95% CI, 160–228), ranging between 90 cases per 100,000 inhabitants in 2006 and 304 cases per 100,000 inhabitants in 1997 (Fig. 1). There was a general constant trend of the incidence throughout the period of 1993–2006 ($R^2 = 0.192$, $p = 0.1$) (Fig. 1). The mean annual incidence was significantly higher in rural inhabitants as compared to urban inhabitants (262 vs. 162 cases per 100,000 inhabitants, $p = 0.003$). Detailed infection rates per year in urban and rural inhabitants are provided in Table 1 (Fig. 2).

The highest incidence was reported in patients aged 0–14 years (830 cases per 100,000 inhabitants). The detailed infection rates for each population group per year are summarized in Table 2.

3.2. Enterobiasis

The mean annual incidence of enterobiasis in Timis County during 1993–2006 was 777 cases per 100,000 inhabitants (95%CI, 650–904), ranging between 417 cases per 100,000 inhabitants in 2006 and 1241 cases per 100,000 inhabitants in 1998 (Fig. 1). The analysis for trend showed no statistically significant variation in the affected persons over the study period ($R^2 = 0.025$, $p = 0.6$) (Fig. 1). The mean annual incidence was comparable in both rural and urban inhabitants (815 vs. 803 cases per 100,000 inhabitants). The annual rates of infection in urban and rural inhabitants are provided in Table 1.

The highest incidence was reported in patients aged 0–14 years (3805 cases per 100,000 inhabitants). The annual infection rates for each population group are summarized in Table 2.

3.3. Giardiasis

The mean annual incidence of giardiasis in Timis County during 1993–2006 was 1076 cases per 100,000 inhabitants (95%CI, 767–1385), ranging between 93 cases per 100,000 inhabitants in 1993 and 1770 cases per 100,000 inhabitants in 2001 (Fig. 1). There

Table 1
The annual and mean incidence rate (cases per 100,000 inhabitants) of ascariasis, enterobiasis and giardiasis in Timis County, Romania in urban and rural inhabitances.

Variable	Ascariasis		Enterobiasis		Giardiasis	
	U	R	U	R	U	R
1993	110	165	674	438	106	81
1994	181	240	718	676	216	93
1995	199	236	845	751	966	375
1996	200	292	671	620	876	298
1997	249	416	1068	864	1309	432
1998	266	346	1446	1052	2021	597
1999	138	314	796	914	1212	445
2000	135	402	928	1265	2180	896
2001	164	246	894	1237	2226	1249
2002	185	244	806	987	1949	995
2003	145	208	545	647	1361	765
2004	109	244	777	790	1806	1390
2005	115	178	696	652	1717	1312
2006	65	136	381	512	1562	851
Mean (95% CI)	162 (129–194)	262 (214–310)	803 (659–947)	815 (669–960)	1393 (1006–1781)	699 (447–950)

CI: confidence interval; R: rural; U: urban.

Table 2
The annual and mean incidence rate (cases per 100,000 inhabitants) of ascariasis, enterobiasis and giardiasis in Timis County, Romania according to age groups.

Variable	Ascariasis			Enterobiasis			Giardiasis		
	0–14 y	15–64 y	≥65 y	0–14 y	15–64 y	≥65 y	0–14 y	15–64 y	≥65 y
1993	707	13	0	3285	17	0	310	48	56
1994	1008	54	25	3378	148	59	99	194	59
1995	901	74	24	3601	242	52	2131	470	133
1996	928	98	31	2826	199	117	1764	433	176
1997	1063	164	82	4544	253	115	3278	488	266
1998	1159	123	53	9495	429	181	4555	779	729
1999	807	84	51	3685	264	87	3034	469	286
2000	1120	62	13	4846	287	93	5204	915	743
2001	872	59	17	4307	358	166	5033	1179	777
2002	857	85	20	3596	320	155	4849	910	477
2003	779	42	31	2435	202	118	3111	723	418
2004	605	71	44	3066	299	244	4753	988	710
2005	505	62	56	2459	281	352	4391	897	1043
2006	307	52	16	1741	161	101	3601	779	641
Mean (95% CI)	830 (692–968)	75 (53–96)	33 (21–46)	3805 (2379–4870)	247 (189–305)	131 (81–182)	3294 (2320–4268)	662 (477–848)	465 (285–646)

CI: confidence interval; y: years.

was a general upward trend of the annual incidence throughout the study period, and this increase was not continuous, but statistically significant ($R^2 = 0.6$, $p = 0.001$) (Fig. 1). The mean annual incidence was higher in urban inhabitants as compared to rural inhabitants (1393 vs. 699 cases per 100,000 inhabitants, $p = 0.007$). The annual rates of infection in urban and rural inhabitants are provided in Table 1.

The highest incidence was reported in patients aged 0–14 years (3294 cases per 100,000 inhabitants). The annual rates of infection for each population group are summarized in Table 2.

4. Discussion

The parasitic diseases addressed in this study are considered to be some of the most important neglected infections of poverty and represent serious public health concerns in many European countries. Their prevalence varies among countries and studies, as follows: 1–69% for ascariasis, 2–40% for enterobiasis and 1–11% in case of giardiasis (Hotez and Gurwith, 2011). In Romania, the prevalence of ascariasis varied in different clinical studies and years as follows: 23.4% (1966), 51.7% (1968), 4–62% (1991) and 69.1% (2001) (Neghina et al., 2011b). The available data for enterobiasis are poor and less conclusive, with 3% reported cases in a study including children with disabilities (Panaitescu et al., 1995). The prevalence of giardiasis varied among different study groups; rates of 56.2% and 15–77% were reported in 1984 and in the new millennium, respectively (Neghina et al., 2011a).

Our study detected the highest incidence of ascariasis in children aged 0–14 years compared to older age groups (15–64 years and ≥65 years) that corresponded to the findings of other studies in which children aged 2–10 years were the most affected and the prevalence decreased beyond the age of 15 years (Adeoye et al., 2007; Mishra et al., 2008; Stojanovic et al., 2011). Rural inhabitants infected with *Ascaris* prevailed in this study, and a similar finding was noted in a study from Iran (Sayyari et al., 2005).

In the present study, the highest incidence of enterobiasis was also registered in children under 14 years old. Previous observations have shown that the age group of 5–14 years is predominantly affected by this disorder (Degerli et al., 2009). A Japanese study found this infection predominantly in children aged 5–8 years old (Fukushima et al., 2010). Our study revealed a relatively balanced distribution in rural and urban inhabitants, which was also reported in a recent Estonian study, where the rate of enterobiasis was 14% in large towns, 19% in small towns, and 26% in rural settlements (Remm and Remm, 2010) – and in the study performed in Iran (Sayyari et al., 2005).

Our results revealed that the highest incidence of giardiasis was registered in children aged 0–14 years. In the Iranian study, the highest incidence was found in children aged 2–14 years (Sayyari et al., 2005). In the United States, during 2003–2005 (Yoder and Beach, 2007) and during 2006–2008 (Yoder et al., 2010) the highest number of cases was reported in children from the age groups of 1–4 years and 5–9 years. Similarly, the most affected age group was 0–4 years in New Zealand (Snel et al., 2009a). In Germany, during 2001–2007, the highest incidence was detected in the age group of 1–5 years old (Sagebiel et al., 2009). The annual average incidence of giardiasis in Germany for the above mentioned period of time was 4.6 cases per 100,000 inhabitants (Sagebiel et al., 2009), that is approximately 200 times lower compared to the average incidence reported in our study. In New Zealand the average annual incidence of giardiasis was 44 cases per 100,000 inhabitants between 1997 and 2006, approximately 25 times lower than our results (Snel et al., 2009a,b). In this study, the incidence was higher in urban inhabitants, correspondingly to the results reported by Sayyari et al. (2005). In contrast with our results and those reported by others (Sayyari et al., 2005), the incidence was higher in the rural regions of New Zealand (Snel et al., 2009a,b). According to the European Centre for Disease Prevention and Control ECDC (2010) during the period of 2006–2008 the incidence of giardiasis in the European Union (EU) ranged between 59.6 and 66.52 cases per 100,000 inhabitants with the predominance of children aged 0–4 years. Noteworthy is that during these years Romania reported 483,392 cases of the total 532,643 affected persons in the EU (90.8%).

In Romania, intestinal parasitoses represent an important public health concern due to the extremely high incidence rates reported. Special attention should be paid to the infections that target the young population (0–14 years). The negative consequences on children's health and their educational process may be traced for a long-term following the onset of the disease. Ascariasis has a mortality rate that may vary between 8000 and 100,000 cases per year worldwide (Plorde, 2004) and may cause severe complications such as intestinal obstruction, appendicitis, peritonitis, biliary and pancreatic involvement (Muller and Wakelin, 2002) Although enterobiasis rarely leads to severe illness, the invasion of the female genital tract with subsequent vaginitis, endometritis or salpingitis may occur (Plorde, 2004). Giardiasis is an important cause of diarrheic syndrome and its major impact is on children with inadequate nutritional status in whom the association between malabsorption

and infection leads to stunted growth (Sinnis, 2009). While in low-income countries, the poor levels of sanitation lead to the increase of the disease, in the high-income states may be involved the relative resistance of *Giardia* to routine water treatment (Hill and Nash, 2011). In Romania a combination of these 2 factors is plausible. Therefore, efficient educational programs and campaigns should be timely implemented in schools with the aim of providing basic rules of hygiene, of which proper hand washing represents a key learning point.

Conflict of interests

None.

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