



Trichinella infection in Serbia in the first decade of the twenty-first century



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ABSTRACT

In Serbia, infection with *Trichinella* spp. has been recognized as a human health and animal husbandry problem for almost a century. The rate of swine infection gradually decreased from 0.14% to 0.02% between 2001 and 2010. For the past 5 years, *Trichinella* infections among swine were detected at levels higher than 0.05% in 3 districts of Serbia while prevalence persisted at lower levels for the rest of the country. During this 10-year period, there were 2257 cases of human trichinellosis, including 3 deaths; however, a significant decrease in the number of cases was reported during the last 5 years (fewer than 200 cases per year). The fact that prevalence data presented here are similar to prevalence data from 1990 indicates that this period of 10 years was needed to overcome the re-emergence of *Trichinella* infection in swine and humans that occurred during the last decade of the previous century.

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1. Introduction

A few decades ago, when Serbia was a part of the former Yugoslavia, a combination of improvements in pig production practices (especially on big state farms), the efficacy of veterinary services, and the implementation of mandatory meat inspection resulted in reduced prevalence of *Trichinella* infection in swine. This prevalence, prior to 1980, was less than 0.009% (Cuperlovic, 1991; Cuperlovic et al., 2005). A moderate increase in the infection rates for swine and humans was observed during the period 1980–1990 (an increase from 0.009 to 0.02% prevalence in swine, and an increase from 100

to 200 cases of human trichinellosis/year) (Djordjevic, 1991; Cuperlovic, 1991). The re-emergence of this infection coincided with period (1990–1999) when political and social changes, and civil wars took place in the country (Djordjevic et al., 2003). Prior to 1990, the presence of infection among swine was confined to three endemic regions in Serbia (Cuperlovic et al., 2001). During the period of political and economical upheaval, areas with high infection rates expanded to include approximately one third of the Republic, with lower infection rates throughout most of the remainder of the country (Djordjevic et al., 2003; Cuperlovic et al., 2005). The increased prevalence of infection in swine (up to 0.17% by 1999) was accompanied by a significantly higher number of cases of human trichinellosis (more than 500 on average per year). The complex events that influenced the re-emergency of trichinellosis were explained by Cuperlovic et al. (2005). They emphasized that the veterinary control system responsible for enforcing animal husbandry and marketing regulations has failed to fulfill its mission at that time. To overcome this

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Table 1
Trichinella infection in swine in Serbia for the period 2001–2010.

	Year 2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
No of inspected pigs ($\times 1000$)	2023	2438	2838	1419	1508	2545	2643	2100	2064	2038
No of infected pigs	2875	2663	2498	1419	1358	1143	1223	1091	581	461
Percent of infected pigs	0.14	0.11	0.09	0.10	0.09	0.05	0.05	0.05	0.03	0.02

situation, animal health measures were introduced by the Serbian Veterinary Directorate and applied by the veterinary service. Some measures were implemented in the whole country such as (1) introduction of a systematic pig identification and registration system in 2006; (2) mandatory testing for *Trichinella* infection for all pigs slaughtered in abattoirs or on holdings for personal consumption; (3) surveillance of wild boar; and, (4) mandatory rodent control on pig farms twice per year. Additional measures were intensified or modified in zones of greatest prevalence (e.g., intensified supervision over the implementation of prescribed control measures in regions with higher prevalence of trichinellosis) (Plavsic et al., 2009). The aim of this study was to present data obtained from monitoring *Trichinella* spp. infections in Serbia during the first decade of this century and after the introduction of control measures.

2. Materials and methods

The Republic of Serbia, with approximately 7.5 million of inhabitants, is divided into 30 districts (25 in Central Serbia and Vojvodina and 5 in Kosovo). Epidemiological data on *Trichinella* spp. infection in animals and human trichinellosis in Serbia, collected in the first decade of the 21st century, and available for 25 districts excluding Kosovo, were analyzed. Information was obtained from annual reports issued upon request from the National Reference Laboratory for Trichinellosis (NRLT), by local/regional veterinary inspectorates (who provided total no. of slaughtered i.e., inspected, as well as infected pigs per district), and by the Institute of Public Health of Serbia "Milan Jovanovic Batut".

3. Results

3.1. *Trichinella* infection in swine

In Serbia, the average number of pigs slaughtered for human consumption over the past 20 years has been approximately two million per year. Data summarizing the number of inspected and infected swine in the last 10 years (2001–2010) are presented in Table 1. By implementation of mandatory meat inspection (artificial digestion and trichinelloscopy), the presence of *Trichinella* spp. muscle larvae was detected in 2875 carcasses in 2001 and trended downward during the 10-year period to a level of 461 in 2010. The percentage of infected pigs, during the period 2001–2005, was on average 0.11%, followed by more than a twofold reduction (an average of 0.05%) in the next 3 year period, from 2006 to 2008. The same trend was maintained during the last 2 years, 2009–2010, with an average

infection level of 0.025%. In fact, the prevalence of *Trichinella* infection in swine during 2010 reached a level of 0.02%, which is exactly the same as before the re-emergence of *Trichinella* infection in 1990 (Cuperlovic et al., 2005). Only *Trichinella spiralis* has been identified in a limited number of isolates in domestic pigs (Cuperlovic et al., 2005; Pozio et al., 2009). The distribution and prevalence of swine infection in Serbia for the period 2006–2010 are presented in Fig. 1A. In three of 25 districts, the prevalence was over 0.05% (ranging from 0.05 to 0.37%), in 19 districts the prevalence was less than 0.05% (ranging from 0.001 to 0.048%), while in three districts, *Trichinella* infection was not detected.

3.2. *Trichinella* infection in human

During the period from 2001 to 2010 there were 2257 cases of human trichinellosis, including 3 deaths in Serbia in 2005. The number of infected people, the incidence (per 10^5 inhabitants) and the number of outbreaks per year are shown in Table 2. The number of infected people varied over the years, with the maximum number reported in 2002 (577 cases, 7.7 incidence) and the minimum number reported in 2009 (50 cases, 0.68 incidence). A significant reduction of human infections was observed for the period of 2006–2010 (692 cases), when compared with the period 2001–2005 (1565 cases). The geographical distribution of *Trichinella* infections in humans during the period 2006–2010 is presented on Fig. 1B. In 8 districts of Serbia, outbreaks were reported during three, four or five year periods. The incidence of trichinellosis within those regions varied widely, from 0.16 to 16.08 (Table 3). In 11 regions, ranging from the northern to the southern ends of the country and including most of the central parts, outbreaks occurred rarely and in only one or two years during the period. The incidence of human trichinellosis for the above mentioned districts is presented in Table 4. In six districts, scattered throughout Serbia, human trichinellosis was not reported during the period.

Taken together, data for the entire 10 year period showed 144 outbreaks in total, including 87 for the first 5 years and 57 for the last 5 years. Epidemiological investigations performed from 2006 to 2010 revealed the presence of different sources of infection responsible for the 57 outbreaks of trichinellosis. The cause of the infection in 53 (93%) of outbreaks was the consumption of pork meat, specifically, raw or undercooked meat or meat products (homemade sausages and smoked meat). Other sources of infection included wild boar meat (3 outbreaks, 5%) and horse meat (1 outbreak, 2%). Most of the outbreaks were small family epidemics.

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