RESEARCH NOTE

Consumption of untested pork contributed to over two-thousand clinical cases of human trichinellosis in Romania

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Abstract: Trichinellosis is an important zoonosis that is difficult to diagnose and that can lead to disability, death and economic losses for the meat processing industry. The outbreaks are related to the consumption of insufficiently cooked pork containing larvae of *Trichinella spiralis* (Owen, 1833). Here, we describe epidemiological features of the disease in a region where incidence rates are typically elevated (Braşov County, Romania). Our descriptive, retrospective epidemiological study spanned a period of 25 years (1983–2007) in a group of 3 345 consumers of infected meat, of whom 2 179 became infected. Both raw pork and processed pork products were consumed, typically during winter and spring holidays. Pigs bred and slaughtered by households were not always tested prior to consumption. The imposition of greater hygiene and testing has decreased the burden of disease in recent years, but the tradition of raising swine for familial consumption without prior testing continues to threaten health, even among groups, not typically suspected of facing elevated zoonotic risk such as children and residents of urban areas. Most outbreaks took place at family celebrations during which pork raised locally was consumed. Higher rates of clinical disease in women may reflect their greater participation in such events, but may alternatively reflect greater exposure to raw pork during meal preparation.

Keywords: *Trichinella*, outbreak, consumers, patients, epidemiology

Trichinellosis results when people consume pork or game that has been incompletely or incorrectly cooked, and has not been tested for the presence of this zoonotic parasite (Dupoy-Camet 2009, Gottstein et al. 2009). Household consumption of swine bred outdoors and in proximity to environmental sources of exposure elevates risk for zoonotic outbreaks of both trichinellosis and toxoplasmosis (Nemet et al. 2000, Blaga et al. 2007, Pastiu et al. 2013, Dubey et al. 2014).

Here, we report the results of an epidemiological surveillance covering a period of 25 years (1983–2007) in order to establish a strategy for limiting the spread of the disease in a highly endemic region of Romania. Braşov County is a mountainous district where animal husbandry is a principal occupation, even in more densely populated regions.

We provide a retrospective and descriptive epidemiological study on disease incidence in humans, based on records of all outbreaks of trichinellosis registered in Braşov County during 1983–2007. The outbreak includes all consumers/patients that have eaten meat from the same animal infected with *Trichinella spiralis* (Owen, 1833) regardless of their residence. Over all, we identified 2 179 clinical cases among 3 345 persons who have consumed meat infected with *T. spiralis*. All these infections were attributed to 246 outbreaks. We attempted to identify the source of each infection and the subsequent dissemination made to people.

Epidemiological investigations were conducted, after human trichinellosis was suspected, in patients from the Infectious Diseases Hospital and within family medicine offices. These investigations were used to elaborate the size of the outbreak, the form of the disease and the source of infection; epizootologic investigations (trichinoscopy of pork consumed in the outbreak, animal breeding conditions) complemented our study. The data sources were: the epidemiological and epizootological investigations, data collected from patients' charts of trichinellosis cases registered by the Infectious Diseases Hospital and from the offices of family physicians.

During the studied period the incidence of trichinellosis in Braşov County constantly exceeded the incidence in Romania, as a whole. A study limitation is the period of the data collection finished in 2007, because of a decrease in numbers of trichinellosis cases due to a successful implementation of the National program of human and veterinary medicine against trichinellosis in humans and animals.

In Braşov, there were a total of 246 outbreaks involving 3 345 consumers, of which 2 179 contracted trichinellosis. Between 1987 and 1997, the number of outbreaks reached alarming proportions (202), with 2 503 consumers and 1 660 patients. After Romania implemented the National Program of Surveillance and Control of Trichinellosis in humans and animals (in 2000), there were only 44 recognised outbreaks, with 378 consumers and 231 patients.

The source of infection could not be determined in 22% of the outbreaks; in 9%, the source could be attributed to a neighbouring county; in 69% the outbreak originated from swine raised in Braşov County. Incidence increased between 1987 and

Fig. 1. The number of outbreaks (axis y) of human trichinellosis during the studied period (1983–2007).

Fig. 2. Variation in the annual proportion of infected persons experiencing clinical symptoms.

1997 (Fig. 1), due to the deficiencies of trichinostomy tests in swine slaughtered in private households. This was correlated with overall poor sanitary conditions in swine breeding.

Out of 3345 consumers, 65% were confirmed with symptoms that required treatment, either in hospitals or in the offices of family physicians. The proportion of infected individuals experiencing clinical symptoms varied from less than 6% to more than 60% in a given year (Fig. 2). It is unknown whether disease risk varied as a consequence of the intensity of infection in the consumed pork.

Most outbreaks occurred during Easter or Christmas, when household-raised pigs are traditionally slaughtered. These holidays accounted for approximately 23% and 67% of the outbreaks, respectively. Only 10% of outbreaks, by contrast, occurred during the summer and autumn. Given the timing and circumstances of most outbreaks, persons who frequently engage in meetings, weddings, family reunions, christenings and religious holidays may be at greatest risk of getting the disease. Women accounted for more than a half (56%) of cases. This may reflect their greater likelihood of tasting raw pork during its preparation. Home cooked meals were consumed in the outbreaks.

A worrying percentage of cases (22%) occurred in children; two cases were observed in infants less than one year of age. They may be least aware of the danger of consuming meat from pigs untested by trichinostomy, becoming sick because of the neglect and ignorance of adults. There were 23 cases of trichinellosis in people over 75 years.

In principle, the pork consumed by people inhabiting urban areas should derive from slaughterhouses, where meat is tested prior to consumption. Rural residents would be suspected to face elevated risks, as they more typically consume meat derived from locally raised and slaughtered animals that have not been subjected to testing. However, we documented 177 outbreaks in urban areas and 69 outbreaks in rural areas, and the share of documented disease among urban residents was 83%.

If rural outbreaks were less likely to be recognised, or if pork consumption was greater in the cities, than the preponderance of recognised outbreaks among urban dwellers may artificially elevate the perceived risk there. In addition, the participation of urban dwellers in family celebrations in rural regions may expose them to uncontrolled pork raised by extended family members. Nonetheless, it remains important to recognise that trichinellosis in this region was not restricted to rural farmers and villagers.

During the study period, and especially during the 1990s, trichinellosis imposed considerable human costs. During a 25-year-period we documented more than two thousand clinical cases. More than a fifth of these cases were children. The re-imposition of slaughterhouse inspections has helped bring down the number of outbreaks and the number of clinical cases. However, the traditional practice of household swine husbandry and the consumption of such meat without inspection or proper preparation remains a significant source of human disease.

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Received 7 March 2014

Accepted 9 June 2014