

Veterinary Public Health activities at FAO Cysticercosis, Echinococcosis and Trichinellosis

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Abstract

In many developing and transition countries, parasitic zoonoses such as cysticercosis, echinococcosis and trichinellosis, cause serious human suffering and considerable losses in livestock and human productivity, thus posing a significant hindrance to economic development. Although, effective and reliable tools for the diagnosis, prevention and control of parasitic zoonoses are now available, their implementation has not always been successful in many countries. This is primarily due to the lack of awareness on the presence or impact of the causing parasites (*Taenia saginata*, *Taenia solium*, *Echinococcus* spp and *Trichinella* spp). In addition, the needed intersectoral cooperation, resource management and political commitment for their control are (also) absent. FAO's regular programme has established a global network of professionals directly involved in zoonotic and food borne diseases. The network provides a basic framework for the spread of information related to the diagnosis, prevention and control of major zoonotic diseases including cysticercosis, echinococcosis and trichinellosis.

Keywords: *Taenia solium*; *Echinococcus*; *Trichinella spiralis*; cysticercosis; neurocysticercosis; trichinellosis; parasitic zoonoses

Introduction

Taeniasis/Cysticercosis, Echinococcosis and Trichinellosis have been known in human and veterinary medicine for centuries. The three are zoonotic, diseases that remain a significant cause of human morbidity and mortality in many parts of the world. The diseases have veterinary public health implications [1]. While cysticercosis can be present in pigs and ruminants, it is mainly the biological cycle involving pigs that is most dangerous for humans. Hydatid disease affects ruminants, mainly sheep which leads to important economic losses. Trichinellosis affects domestic pigs and mainly wild carnivores. The economic impact of these diseases can be divided into three categories:

- a) cost due to the disease in humans;
- b) cost due to the disease in animals and thus causing production losses and/or condemnation at the slaughterhouse
- c) cost of the control programmes to mitigate or eliminate/eradicate the disease.

In many lesser developed and transition restructuring countries, parasitic zoonoses such as cysticercosis, echinococcosis, and trichinellosis cause serious human suffering and considerable losses in agricultural and human productivity, thus posing a significant hindrance to the overall development. Although, effective and reliable tools for the diagnosis, prevention and control of parasitic zoonoses are now available, these parasites remain an important problem in many countries. This is primarily due to the lack of awareness of their presence, knowledge on their impact and poor stakeholder cooperation. Usually, resource management and political commitment for their control are also absent.

The diseases and their controls

Cysticercosis:

Taenia solium causes two distinct clinical presentations:

- taeniasis, the presence of an adult tapeworm in the human small intestine;
- cysticercosis, the presence of larval stages in tissues of both pigs and humans.

In humans, cysticercosis can affect many anatomical areas like muscles, subcutaneous tissues, eyes, but it becomes prominent in the central nervous system (CNS), causing what is known as neurocysticercosis (NCC). NCC is the most common parasitic disease of the CNS and one of the most common causes of epilepsy. *T. solium* is a major public health problem in most areas of Latin America [2], Africa [3] and Asia [4]. Industrialized countries (mainly EU member states and the USA) may experience an increase in taeniasis and cysticercosis due to international travel and migration. Worldwide, as many as 50 million people are infected with *T. solium* and up to 50.000 deaths per year are due to cysticercosis [5].

Consumption of uninspected pig meat is undoubtedly a major source of human taeniasis. The transmission of *T. solium* to pigs, the essential partner in the pig-man-pig cycle, requires that pigs have access to human feces and that people consume improperly cooked pork.

The major risk factors related to transmission of eggs to pigs can be summarized as follows:

- extensive or free-range pig rearing;
- outdoor human defecation near or in pig rearing areas;
- use of pigs to scavenge and eat human feces (“sanitary policeman”);
- deliberate use of human feces as pig feed;
- connection of pig pens to human latrines (“pig sty privies”);
- use of sewage effluent, sludge or “night soil” to irrigate and/or fertilize pig pastures and food crops;
- involvement of humans carriers in pig rearing and care.

The prevention of free ranging and scavenging can be very effective in interrupting the transmission of *T. solium* to pigs.

Among humans, tapeworm carriers are potential sources of contagion to themselves and to those living in their close environment.

There are two commonly recognized ways in which person to person transmission can occur: 1) the ingestion of eggs in contaminated food and water; 2) the introduction of eggs from faeces into the mouth by contaminated hands.

To control taeniasis, the following control measures are recommended:

- improvement in sanitary infrastructures;
- prevention of porcine cysticercosis;
- implement meat inspection
- prevention of contaminated pork meat commercialization;
- render potentially infected pork meat non infectious;
- teaching hygienic habits and handwashing to general population;
- supplying health education, in particular to children to promote long term changes.

To control cysticercosis, the following control measures are recommended:

- establishment active surveillance for Taeniosis: tapeworm carriers should be detected and treated;
- avoidance of void food and water that might be contaminated with soil or fecal matter;
- strict hygiene measures and handwashing (when visiting endemic areas).

Taenia eggs detection in human feces provides diagnosis at genus level as well as copro-antigen detection. The latter is more sensitive and can even detect pre-patent infections. Anthelmintic treatments using praziquantel or niclosamide are indicated for all tapeworm carriers.

Many groups of researchers are engaged to expand the understanding of some aspects of *T. solium* infections, such as: the potential use of porcine cysticercosis vaccines [6], improved immunodiagnostic methods for both taeniosis and cysticercosis [7], a porcine therapy for the control of infected pigs, the relationship between human epilepsy and NCC, standardized diagnostic criteria and treatment of human NCC, experimental laboratory animal models for NCC and cysticercosis, mathematical models to study *T. solium* distribution and impact [8].

Echinococcosis:

In humans, the disease is initially without any symptoms until gradually the cyst increased in size, causing local pressure effects. In animals, the disease does not produce any clinical signs and is usually only discovered during meat inspection at the slaughterhouse, where the affected viscera (mainly liver and lung) are condemned.

It is well known that the main factor for the persistence of the disease is the feeding of infested parts (hydatid cysts) of sheep to dogs. Breaking the cycle is one of the main control measures. This however, largely requires awareness creation and public education.

The main constraints to control the disease could be further summarized as follows:

- high level of infection in endemic areas

- lack of resources
- difficulties in early diagnosis
- low public awareness
- existing habit of feeding sheep viscera to dogs
- absence of stray dogs control
- non-inspected or illegal slaughter

As a consequence the disease can cause

- high morbidity rates (sheep)
- high economic losses (sheep and condemned viscera)
- (high costs and suffering due to human cases)???

The main risk factors for humans, as determined through multivariate analysis were: Agricultural workers; livestock ownership; herding occupation; living in a rural area, being illiterate; having contact with dogs; nomadism; overgrazing conditions; age and gender (women) [9].

Anthelmintic treatments using praziquantel to prevent transmission by definitive hosts (dogs) are one of the most used strategies in control programmes [10]. However, although great efforts were undertaken in many countries and regions, the success in the eradication of hydatid disease it is not always a feasible task.

Vaccines that can prevent infection in the intermediate host provide an additional tool to assist with control of the disease. A vaccine based on a cloned recombinant antigen derived from *E. granulosus* eggs was developed and showed high level of protection in sheep. Recombinant DNA techniques provide the opportunity to produce antigens in suitable quantities for use as practical vaccines that as in experimental trials induced high level of protection (95-100%) against either experimental or naturally-acquired infections [11].

These preliminary encouraging results prompted vaccination trials in New Zealand, Australia and Argentina. The vaccine reduced considerably the number of viable cysts in sheep challenged with *E. granulosus* eggs. Although there are questions about its usefulness, this vaccine could be an additional measure to programmes based on dog control and could potentially decrease the length of time for control and management to achieve very low levels of transmission and eventual eradication. In addition, it has the potential to prevent hydatidosis in vaccinated humans?, but these trials are more difficult to conduct. Development of a canine *E. granulosus* vaccine is currently being undertaken and could potentially be of a great benefit in control programmes.

The development of coproantigen and serodiagnostic techniques in animals and humans have great potential for the diagnosis of hydatidosis in the laboratory and in the field in particular during surveillance and control programmes [12].

Trichinellosis:

Trichinellosis is a parasitic zoonosis, caused by the muscle dwelling *Trichinella* spp. parasitic nematodes [13]. The relatively simple basic transmission pattern of *Trichinella*, i.e. ingestion of infected meat, may seem easy to break for the control of the parasite. However, despite many efforts to control the disease it still remains an important food-borne parasitic zoonosis in many parts of the world with an estimated 11 million human cases globally [14, 15]. *Trichinella* prevalence in swine varies from country to country, and regionally within countries.

More than 10 000 cases of human trichinellosis were reported by the International Commission on Trichinellosis from 1995 to June 1997 and about 10 000 porcine infections were reported by the Office *International des Epizooties* in 1998. The disease is particularly worrisome in the Balkans, Russia, the Baltic republics, in some parts of China and Argentina [14].

The lowest prevalence rates in domestic swine are found in countries where enclosed (intensive) animal production systems and meat inspection programs have been in place for many years.

Main symptoms of a trichinellosis infection in humans are nausea, diarrhea, vomiting, fatigue, fever, and abdominal discomfort are the first symptoms of trichinellosis. Headaches, fevers, chills, cough, eye swelling, aching joints and muscle pains, itchy skin, diarrhea, or constipation follow the first symptoms. If the infection is heavy, patients may experience difficulty coordinating movements, and have heart and breathing problems. In severe cases, death can occur.

The major risk factors related to transmission of *Trichinella* include:

- exposure of pigs to rodents and wildlife;
- extensive or free-range pig rearing
- consumption of uninspected meat;
- failure of meat inspection procedures
- consumption of meat from backyard pigs;
- consumption of raw infected horse meat;
- consumption of uninspected pork meat sausage-like product
- consumption of meat from wild game (especially wild boars and, bears);
- inadequate cooking of the pig meat;
- lack of adequate diagnostic procedures;

During the last years a new feature related to globalisation appeared in epidemiology of trichinellosis. Global increase in animal and meat trade can transfer *Trichinella* to new areas where this parasite is absent or very rare. For example marketing of meat or meat products through modern chain supermarkets may turn localised event into a widely distributed outbreak [16; 17]. Another source of problems is migration of human and consequently their food habits, which became a risk factor for trichinellosis under some circumstances in new regions. Food for personal consumption prepared from meat obtained in regions where trichinellosis is endemic pose a risk when people travel to other countries.

Good production practices, including a high level of sanitation, rodent and cat control on farms, can prevent opportunities for exposure of pigs to these parasites.

Alternatively, meat inspection, proper commercial processing and adherence to guidelines for in-home preparation of meat are effective methods for reduction of risks for human exposure.

Main measure to prevent trichinellosis could be summarized as follows:

- cook meat products until the juices run clear or to an internal temperature of 60°C .
- freeze pork less than 15 cm thick for 20 days at -15°C to kill any worms.
- cook wild game meat thoroughly.
- cook all meat fed to pigs or other wild animals.
- do not allow hogs to eat uncooked carcasses of other animals, including rats.
- clean meat grinders thoroughly if you prepare your own ground meats.
- make people aware that curing (salting), drying, smoking, or microwaving meat does not consistently kill infective worms.

FAO's specific activities

Within the FAO Animal Production and Health Division the Veterinary Public Health Programme is constituted by members of the different Services (Animal Health, Animal Production and Livestock Policy). In addition, it links up with other units within the organisation on issues related to VPH. The VPH programme has developed its Website (<http://www.fao.org/ag/vph.html>) in which information on ongoing activities, references and full text publications and manuals can be readily accessed. In addition, a number of fact sheets on zoonotic and food-borne diseases are provided as well as a database containing the addresses and contacts of veterinary faculties world-wide.

FAO's regular programme has also established a global network of professionals directly involved in VPH, and is currently establishing four regional networks located in Asia, Africa, Eastern and Central Europe, and Latin America. The networks provide a basic framework to spread information related to the diagnosis, prevention and control of major zoonotic diseases including echinococcosis. In addition electronic conferences, discussion fora and newsletters contribute to information dissemination and to the general discussion on VPH related issues. A Directory with contacts of individuals and institutions involved in VPH issues and zoonotic diseases has also been elaborated.

FAO contributed to a number of initiatives including the establishment of a *Global Campaign for Combating Cysticercosis*. This initiative envisages the establishment of an International Cysticercosis Coordinating Center (ICCC) and regional working groups for cysticercosis in the different endemic regions of the world, modelled on the Cysticercosis Working Group in Eastern and Southern Africa. One of the aims is to promote awareness and stimulate mobilization of resources for research and control of cysticercosis. Much emphasis is to be placed on securing evidence based information (frequency, space-time distribution, associated morbidities, burden and impact) concerning cysticercosis. This information is urgently needed to serve as an advocacy tool aimed particularly at policymakers and potential investors in order for

the disease to be given higher priority at the national, regional and international levels

As communities play a crucial role in the prevention and control of zoonotic diseases in general, and cysticercosis, echinococcosis and trichinellosis in particular, an expert consultation on community-based Veterinary Public Health delivery systems was organised by FAO in October 2003. Regarding capacity building, FAO with the collaboration of OIE and WHO held in June 2005 an Expert and Technical Consultation on Regional Capacity building for surveillance and control of Zoonotic Diseases. The outcomes of these meetings can be obtained from FAO and/or accessed directly via its Internet site (<http://www.fao.org/ag/againfo/programmes/en/vph/info.html>).

The outcome of the last meeting will be distributed through the Global FAO-VPH electronic network. Furthermore the FAO's Technical Cooperation Projects (TCP) are an additional tool available to assist member countries in responding to urgent and unforeseen demands. Detailed information on TCP can be found on <http://www.fao.org/tc/tcd/tcdt/Default.htm>

Currently Technical Cooperation Projects are being implemented to control hydatid disease in Lithuania and trichinellosis in Argentina. FAO encourage member countries to request support on zoonotic diseases for the implementation of surveillance, training, extension, prevention and strategic control programmes against major zoonotic diseases.

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