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Cysticercosis is one of the most dangerous diseases caused by a parasite that passes from animals to human beings. It is most prevalent in the rural areas of developing countries, from where it can become a threat in urban areas too. Cysticercosis is closely related to economic standards, culture and aspects of hygiene. Latin America, non-Islamic parts of Africa and South East Asia and especially India face major problems with this disease. In this article the author describes cysticercosis that originates from pigs (*Cysticercosis cellulosae*) in Bolivia, South America. (from Urban Agriculture Magazine).

Knowledge and confusion

When talking with people in the village of Punata, near Cochabamba, one notices that 'triquina' is something that they are worried about. This parasite, that one can see as small nodules, or cysts, on the pig's tongue, is renowned for its ability to cause disease in humans. The exact symptoms of this disease are not generally known, whereas everyone knows that the price one can fetch for a pig with 'triquina' is considerably lower than the price of one without cysts. In the weekly Punata market there is a specific site where every pig on sale is reviewed by traditional 'triquina controllers', usually older women, who receive a small fee for each pig. With great skill, these women immobilise each pig and check its tongue.

There is less general knowledge about the ways to prevent the pig from getting the 'triquina', and even professional people are often confused, though many of them know that the name 'triquina' is not right. The parasite is actually called 'cysticercus'. Triquina is another, much smaller, zoonotic parasite in the meat of pigs and other animals (*Triquinella espiralis*). Some pig owners indicate that, in order to prevent cysticercosis, it is better to buy white pigs from the larger farms; others assume that one should give the pig special food before taking it to the market. Most people know, however, that once a pig has the cysts in its muscles, no medicine can get it out.

The municipality, responsible for the market, does not really know what to do about the problem, and leaves the control to the traditional structures, without enforcement. There is no compensation for the pigs found 'positive', so these animals are used for meat anyway. Most pigs in the region are slaughtered in backyards without formal meat inspection. Traditional pork dishes, however, usually include deep frying or long cooking of the meat, which considerably diminishes the danger of transmission of the parasite.

Real problem

One of the reasons for the confusion about cysticercosis is that the life cycle of this parasite is very complicated. Cysticercosis occurs in both pigs and cattle, and represents a problem for humans.

Studies indicate that the incidence of cysticercosis is quite alarming, especially of *Cysticercosis cellulosae*, which derives from pigs. It affects, to varying degrees, some 19 countries in Latin

America and is of real significance in 15 of them. In some regions, between 15 and 60 % of the pigs kept in traditional systems have antibodies against the parasite, indicating that they have been in contact with it during their lifetime. Other studies have indicated that around 30% of the pigs have cysticercus nodules on their tongues. In Bolivia between 1.4 and 2% of the people in rural areas have the *Taenia solium* parasite in their intestines; the WHO considers it a serious problem when the level of people infected with *Taenia solium* is above 1%.

Life cycle of cysticercosis

The parasite's primary host is the human being. In humans it is found as a white tapeworm, up to several metres in length, built up of small segments, called proglottides. The person generally is not aware of the tapeworm, other than small white spots (the proglottides that have been released) in the excrement. The proglottides are full of eggs, that can infect the animal. The tapeworm that can infect pigs is called *Taenia solium*; the one that can infect cattle is considerably longer - up to 12 metres - and is called *Taenia saginata*.

When human excrement is consumed by pigs, the cysts of the intermediate parasite, called *Cysticercus cellulosae*, are formed in the meat and other parts of the pig. These cysts are transparent/white, between 0.5 and 1 cm. in diameter. Only in the case of intensive infection the cysts are found in the tongue. The cysts generally do not result in any other visual abnormalities in the living animal. Again, when people eat meat containing the cysts, which is uncooked, or undercooked, and get infected, the *Taenia solium* tapeworm develops in their intestines. This general life cycle of the tapeworm is similar in bovines, but it is far more dangerous in pigs because a parallel cycle occurs.

Where human excrement containing the eggs of *Taenia solium* infects waste water, which is then used to grow vegetables and other products for human consumption, the situation becomes very dangerous. If a person drinks this water or consumes raw vegetables (e.g. lettuce) or fruits that are not peeled (e.g. strawberries), he or she can ingest the *Taenia solium* eggs. In this case the cycle that normally takes place in the pig, now starts in the human body. The cysts are formed in different parts of the body, in some cases in the eye or the brain. In this latter case the disease is called neurocysticercosis, and symptoms are severe, similar to those of a brain tumour or epilepsy. In Bolivia many cases diagnosed as epilepsy are, in fact, neurocysticercosis. There is no cure for this once the cysts have been formed, and the impact on the patient and the family is enormous.

Urban and rural setting

The problem of cyst infection from pig meat is closely related to the way the pigs are kept. It does not occur in intensive pig-keeping, where the animals are raised in an enclosed space. The problem arises when the pigs are raised in small-scale extensive systems, where contact between humans and animals is far more intense. Free roaming pigs, in combination with absence or non-use of latrines, are the major conditions under which humans become infected with the tapeworm. These conditions occur most frequently in the marginal rural and urban areas. The infected pigs live in, or can be transported from, the rural areas to the urban areas. People with a tapeworm in their body move back and forth from rural to urban areas and can infest the waste waters there. The possibility of consuming water, or products contaminated with infected human excrement, is far higher in urban than in rural areas. Hence, the control of these parasites

requires activities in both the urban and rural settings.

Control methods

The control of this parasite is extremely difficult. In the case of pigs it involves for example personal hygiene, waste waters, latrines, meat control, cooking traditions and the way the pigs are kept. Cysticercosis is related to a few of the most burning problems in the world today: poverty in the marginal rural regions, and migration from rural to urban areas. Simply suggesting that the pigs should be locked up does not provide the answer. Although the life cycle of the parasite can be successfully broken by eliminating the contact between human excrements and pigs, this is not that easily achieved. Extensive pig keeping has been part of rural people's survival strategy for ages, and will continue to remain so.

An interdisciplinary approach is necessary, which involves farmers, representatives from the medical field and the veterinarian/zootechnical field, as well as people from both rural and urban municipalities.

The control methods mentioned most frequently in literature are listed here.

In people: Emphasis is placed on education and general awareness about the zoonosis: the ways to prevent excrement from being deposited in places where pigs can gain access to it; to use latrines and general hygiene measures, especially related to washing hands; to cook or fry all pig meat before consumption; to use an anthelmintic treatment whenever white spots are noticed on excrement. Treatment with iodine, or another disinfectant, of raw vegetables and fruits that cannot be peeled, whenever there is doubt about the origin of the food.

For pig keepers: Education and general awareness on the role of pigs in maintaining the life cycle of the parasite; to keep pigs in a separate place; not to use pigs as cleaners of human dirt.

For municipalities: The traditional control methods in the markets are not enough, they should be complemented and enforced; introduce strict measures related to meat control, especially in backyard slaughtering. Control of the use of waste water.

The way ahead

The problem is considerable and the questions arise: who is responsible and who controls? An increased general awareness in both urban and rural settings about the problem may well be one of the keys to this issue, as well as measures from the municipalities. NGOs, school teachers and extension workers should all be well aware of the problem and methods of prevention. Radio programmes can involve women, one of the most important groups where awareness needs to be improved.

An interdisciplinary approach is needed, that includes the efforts of the medical and veterinary scientists, as well as municipalities and farmers' organisations. Government commitment to controlling this disease is also a major factor. As long as the legislative basis for enforcing the work of the veterinary inspectors is lacking, it is not possible to set up a reliable meat control system. Both the ministries of health and agriculture should be involved. The control of cysticercosis is truly a methodological challenge!

References



Yes