

THE PRESENT STATUS OF TRICHINELLOSIS IN THAILAND

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Abstract. The epidemiology of trichinellosis in northern Thailand may be unique. Since 1962, outbreaks of the disease have occurred almost every year. The Department of Communicable Disease Control, Ministry of Public Health reported 118 discrete outbreaks of the disease, involving 5,400 patients, 95 of whom have died.

Epidemiological investigations reveal that the outbreaks have occurred mostly in rural areas, associated with villagers celebrating local and traditional festivals such as the northern Thai New Year, wedding ceremonies, or other festive occasions. In almost all cases the source of infection has been traced to either hilltribe pigs, which are raised like wild animals, or to meat from wild boar. Infection is usually acquired through consumption of a local dish called "lahb," traditionally served during these festivities. This popular dish consists of raw finely chopped meat mixed with spices and chilies and is served nearly raw. Common clinical symptoms of trichinellosis in northern Thailand are fever and myalgia, presenting about two weeks after ingestion of raw meat containing encysted *Trichinella* larvae.

Based on its infectivity for rats and pigs and on alloenzyme typing, the species appears to be *Trichinella spiralis*. The transmission cycle of trichinellosis in northern Thailand is primarily of a sylvatic type. Hilltribe pigs, wild boars, black bear and jackal are common reservoirs. Man intrudes into the cycle by eating the raw or under-cooked meat of these animals.

INTRODUCTION

Trichinellosis is still one of Thailand's major health problems, especially in the north. Infection is acquired by the consumption of under-cooked meat of animals harboring the infective larvae of *Trichinella spiralis*. Northerners are very fond of eating raw meat in the form of "lahb" and "nahm," favorite dishes in northern Thailand. "Lahb," or raw spiced meat, is made of finely minced meat mixed with spices and dry chilies. The dish, usually served along with vegetables, is promptly eaten as soon as the ingredients have been added. "Nahm," similar to what Americans call "spam," is made from freshly ground pork, garlic, cooked rice, salt, sodium glutamate and potassium nitrate, thoroughly mixed and tightly wrapped in a plastic wrapper or banana leaf. It is commonly consumed after being left to ferment at room temperature for 2 to 5 days. From 18,765 samples of "Nahm" taken between 1962 to 1973 from various provinces of northern Thailand and analyzed for *T. spiralis* larvae, 23 samples were found to contain larvae, ranging from 0.5-20 larvae per gram of "Nahm" (Dissamarn, 1974).

The first outbreak of trichinellosis in Thailand was recorded in Mae Sariang district of Mae Hong Son Province (Menakanit *et al*, 1962; Boonthanom and Nawarat, 1963). The district is located about 800 kilometers northwest of Bangkok along the Thai-Myanmar border. The villagers had pooled their labor, or "long kag" in Thai, to help thatch the village school. After finishing their work they celebrated by illegally slaughtering a pig and using its meat to prepare a dish of "lahb" to be served during the party celebration. Two weeks later those villagers and their family members who had eaten the dish developed clinical symptoms and signs of trichinellosis. According to records, 56 villagers (36 males and 20 females) fell sick and 11 patients died. The epidemiology of the infection was investigated. It was found that the pig was a hilltribe pig. Hilltribe pigs are domestic pigs, allowed to free forage in the mountains. They may become feral and some of them have crossbred with wild boars. Since trichinellosis was first recognized in 1962, there have been outbreaks of the disease almost every year. Almost all outbreaks have occurred in the

northern provinces of Thailand, with few exceptions. Two outbreaks were reported from the eastern provinces of Rayong and Prachin Buri, one from Chumphon in the south and one from Kanchanaburi in the west. According to the Division of Epidemiology, Department of Communicable Diseases Control, Ministry of Public Health of Thailand, 118 outbreaks of the disease have been recorded since 1962, involving approximately 5,400 people; 95 patients have died from the infection (Chumkasian P, personal communication).

The meat sources of the outbreaks were traced to raw pig meat from hilltribes (56), wild boars (32), free-foraging domestic pig (1), black bears (2) (Doegé *et al*, 1969), jackal (1), wild squirrel (1) (Wiwatanaworapant, 1980), brown lizard (*Varanus nebulosus*) (1), and turtle (1). The source of remaining transmissions were either not investigated or were unknown (Satapanakul and Na Bangxang, 1964; Satapanakul *et al*, 1964; Manupichu and Sinthusane, 1970; Suriyanon and Klunklin, 1972; Khamboonruang and Nateewatana, 1975; Ratdilokpanich *et al*, 1979). Although trichinellosis outbreaks have been reported since 1962, the prevalence of trichinellosis in human cadavers has not been investigated.

TRANSMISSION

There are two generally accepted modes of transmission of trichinellosis, called the sylvatic and domestic cycles (WHO and the International Commission on Trichinellosis, 1988). In the sylvatic cycle the parasite maintains its life cycle in wild carnivores and scavengers by predation and by eating carrion. Man intrudes into the cycle by eating wild animal meat or game.

In the domestic cycle, domestic pigs play a major role in transmission of trichinellosis to man. Man acquires the infection by eating insufficiently cooked infected pork. However, the sources of infection in pig has been a subject of debate. There has long been agreement that pigs become infected by eating pork scraps from garbage. It has also been demonstrated that swine transmit the disease through cannibalism. The importance of rats in the cycle is also now well-established.

Trichinellosis is known as a zoonosis, a disease transmitted from animals to man. Prevalence studies of trichinellosis have been undertaken since the infection was first recognized in northern Thailand three decades ago.

Swine

Swine in northern Thailand are generally fed rice bran, vegetation, and garbage. Commercial grain-fed swine are common in the meat production industry. However, those raised domestically for slaughter have a more varied diet. From 1967 to 1973, 355,820 pig diaphragms, collected from various slaughter houses in the northern provinces of Thailand, were examined by the trichinoscopic method. It was found that 19 diaphragms (0.005%) harbored *Trichinella* larvae. By using the digestion method, larvae were recovered ranging from 2–800 per gram of the diaphragm (Dissamarn, 1974). These infected pigs were obtained from hilltribe villages. From 1973 to 1975, 7,598 pig diaphragms collected from Chiang Mai municipal slaughterhouse were examined by the digestion method. Only one diaphragm harbored muscle larvae, with 41.7 larvae per 1 gram of muscle (Khamboonruang *et al*, 1978). Unfortunately, it was not possible to trace the pig to its origin.

Rodents

One rat of 12 *Rattus rattus* collected from a hilltribe village in the Province of Phrae was found to be infected with *T. spiralis* larvae (Dissamarn and Chai-Anan, 1970). However, none of the 1,070 rodents trapped in the Chiang Mai municipal area was found to harbor the larvae (Khamboonruang *et al*, 1978).

Domestic dogs

Because of the outbreak of trichinellosis in Phetchabun Province in 1981, domestic dogs in the village were examined for the presence of *T. spiralis*. Eight of 15 dogs were found to be infected with larvae (Chalermchaikit *et al*, 1982). It was proposed that the dogs acquired the infection by eating discarded infected pig scraps. Some Thais do eat dog meat. Health workers in Thailand should be aware that Thais could acquire trichinellosis from eating dog meat. It

is interesting to note that at Sakon Nakhon Province, located in the northeastern part of Thailand, there is a dog meat market. From February to June 1982, 421 dog diaphragms were examined for *Trichinella* larvae by the digestion method. The result revealed that 7 dogs were infected. The number of larvae ranged from 5–9 per gram of dog meat (Srikitjakarn *et al*, 1981).

Wild animals

Trichinellosis in wild animals in northern Thailand is not well studied. Although prohibited by law, the hunting of wild animals is quite common. Obtaining samples to examine for *Trichinella* larvae is difficult. The prevalence rate of trichinellosis in feral hilltribe pigs surveyed in 15 villages of Chiang Mai, Chiang Rai, Phrae, and Nan provinces in 1963 and 1964, revealed that 8 out of 70 pigs were infected (Dissamarn and Chai-Anan, 1970). Because of the paucity of information on trichinellosis in wild animals, an extensive survey is urgently needed for a better understanding of the epidemiology of this infection in northern Thailand.

It is likely that the transmission of trichinellosis in the north of Thailand is a sylvatic cycle of transmission. Hilltribe pigs are an important source of meat for the transmission of the disease. In addition, the geography of the north is mountainous with deep jungle forests, important habitat for the kinds of carnivores which may maintain the sylvatic cycle of trichinellosis.

BIOLOGY OF TRICHINELLA IN THAILAND

Four species of *Trichinella* have been described (WHO and the International Commission on Trichinellosis, 1988). These are *T. spiralis*, *T. nativa*, *T. nelsoni* and *T. pseudospiralis*. There are few, if any, confirmed morphological differences between the isolates. Differences, though highly complex, are confined to host range, interbreeding capacity, freezing tolerance and distinct biochemical (alloenzyme, DNA) characters.

Trichinella spiralis

This isolate, with a cosmopolitan distribution,

is found in domestic pigs, wild animals, including rats, and is transmitted to man from pigs through the consumption of meat that has not been adequately cooked.

Trichinella nativa

Found mainly in Palearctic mammals, this parasite has low infectivity to pigs and rats and is relatively tolerant to freezing. The disease has a longer prepatent period. The course of the infection tends to be severe and chronic and does not respond well to corticosteroid therapy.

Trichinella nelsoni

This worm is predominantly found in carnivores and omnivores in Africa. It has low infectivity to pigs and rats.

Trichinella pseudospiralis

This isolate is found in birds and mammals. The absence of capsule formation in host muscle is a prominent characteristic. So far, there are no reported cases found in humans.

Trichinella muscle larvae isolated from patients in northern Thailand are routinely inoculated into rats and in a few instances into pigs; the parasite is easily propagated in these hosts. In 1986 there was an outbreak of trichinellosis reported at Mae Hong Son Province. Six *Trichinella* encysted larvae were obtained from a patient by muscle biopsy. When the larvae were inoculated into an experimental mouse, infection was easily established. The isolate has now been maintained in laboratory mice up to the 8th serial passage (Pozio and Khamboonruang, 1989). In a recent outbreak of trichinellosis in Chiang Rai Province in May 1989, a total of 28 *Trichinella* larvae specimens obtained by pooled muscle biopsy from 21 patients were inoculated into a mouse. At present 12 mice are inoculated and maintained in the laboratory (Morakote *et al*, unpublished).

In 1989 *Trichinella* muscle larvae from an isolate from Mae Hong Son Province was characterized biochemically. The larvae were enzymatically typed by starch gel electrophoresis. The results revealed that the isolate had an alloenzyme profile like *T. spiralis* (Pozio and Khamboonruang, 1989).

In summary, the epidemiology of trichinellosis in northern Thailand may be unusual. The disease was first reported in 1962. Since then, outbreaks have been reported almost every year; there have been 118 discrete outbreaks of the disease. Approximately 5,400 patients have been affected by this infection and 95 patients have died. Epidemiological investigations reveal that the outbreaks have mostly occurred in rural areas where villagers often celebrate traditional festivals such as northern Thai New Year, wedding ceremonies, etc. Typically, the source of infection is domestic hilltribe pigs raised like wild animals or from wild boar. Infection is usually acquired from consuming the ethnic dish called "Lahb" served during the festivities. Common clinical symptoms of trichinellosis in northern Thailand are fever and myalgia, presenting about two weeks after ingestion of raw meat containing encysted *Trichinella* larvae. From both its high infectivity to rat and pigs and from enzymatic typing, the species appears to be *Trichinella spiralis*. The transmission cycle of trichinellosis in northern Thailand is considered to be the sylvatic cycle. Hilltribe pigs, wild boars, black bear and jackal are common reservoirs. Man intrudes into the cycle by consumption of flesh of these animals.

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