



# The Reason Why Everyone is obsessing About Human Taeniasis

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## Abstract

Taeniasis caused by two species, the pork tapeworm, *Taenia solium* and the beef tapeworm, *Taenia saginata*, and 'Asian *Taenia*', *Taenia saginata asiatica*, are briefly overviewed. Among these tapeworms, *T. solium* is unique and has serious public health importance, since it causes cysticercosis, especially neurocysticercosis, the most potentially lethal helminthic disease in humans, when tapeworm carriers and others get egg ingestion. Cysticercosis is crucially different from taeniasis, since the former is transmitted from human (tapeworm carriers) to humans including the tapeworm carriers themselves. These tapeworm infections, especially *T. solium* and *T. saginata asiatica* are exclusively endemic in remote areas where local people defecate out-doors and pigs have free access to human feces. Pigs are contaminated with eggs of these tapeworms in human feces and harbor huge number of the larval stage, cysticerci of *T. solium*. In contrast, although pig is only confirmed domesticated animal harboring cysticerci of *T. saginata asiatica* in the liver, the cysticerci have never been fully developed. The endemic areas are remote or rural areas in developing countries in Asia where the owners of these domesticated animals sacrifice them in the backyard of their houses and serve uncooked or undercooked meat and viscera without meat inspections at all. The endemic areas for both *T. solium* and *T. saginata asiatica* are often crucially different from *T. saginata*. It is affected from the religion. In Muslim societies, *T. solium* taeniasis is not endemic. In non-Muslim societies, *T. solium* is more common than *T. saginata*. Even though taeniasis are endemic in remote areas, CC including NCC is becoming cosmopolitan distribution. Such crucial difference between taeniasis and CC in Asia is overviewed.

**Keywords:** Taeniasis; cysticercosis; Asia; *Taenia solium*; *Taenia saginata*; *Taenia saginata asiatica*

## Introduction

Taeniasis/cysticercosis caused by the pig tapeworm, *Taenia solium* is the most neglected helminthic disease among the neglected tropical diseases and caused by two different developmental stages. Taeniasis is an intestinal tapeworm infection, a food-borne (meat-borne) helminthic disease after eating uncooked pork contaminated with larval stage, cysticercus/cysticerci, whereas cysticercosis is transmitted from humans (tapeworm carriers) to humans including the carriers themselves and others who accidentally ingest eggs released from the carriers. The most serious problem is the carriers who got infection in remote areas travel all over the world and no one knows such accidents until cysticercosis, especially neurocysticercosis, becomes symptomatic. Therefore, cysticercosis is the most potentially lethal helminthic disease distributed worldwide through globalization [1-4].

The genus Taeniidae consists of approximately 50 species and the life cycle completes through predator-prey relationship [5-7]. Among them, only two species, *T. solium* and *T. saginata* including *T. saginata asiatica* [8] are human parasite [6,7]. *Taenia solium* exclusively causes human cysticercosis and the longevity of adult worms is estimated within 5 years [9-14]. In contrast, *T. saginata* including *T. saginata asiatica* survives at least approximately 50 years without cysticercosis [13,15]. In this mini review, I focus on *T. solium* except minimum information on others. *Taenia saginata asiatica* was published in peer reviewed international journal based on molecular studies [16]. However, it is well known as a third independent species *Taenia*

*asiatica* [17] published in the local journal in Korea, the first issue without Korean abstract. If Eom and Rim [17] submitted the paper to any international journal(s) to pass the reviewers' examinations, it was never accepted. All morphological observation is similar to Fan's reports [18,19]. Fan wanted to describe Asian *Taenia* as a new species as published in 1990 [19]. But John Cross, who was called as the great father for parasitologists in Asia over 50 years of his academic life, did not recommend Fan's publication based on morphology alone and pushed Fan add molecular evidence [16]. Eom and Rim [17] completely ignored molecular finding [16] and published in the local journal. So, from the beginning of the Korean work, the history has been crooked until now [20]. Objective analysis of the crooked history is under preparation.

## Taeniasis and Cysticercosis in Asia

As mentioned above, taeniasis are intestinal tapeworm infections caused by the two species.

*Taenia saginata* (beef) and its variant, *T. saginata asiatica* (pig viscera) and *T. solium* (pork). As humans get tapeworm infections with the variant and *T. solium* developed in pigs, the topics have been crooked without any supporting evidence but 100% fiction scenarios. So far as we know, both *T. saginata* [13] and *T. saginata asiatica* [15] survive approximately 50 years in the human intestine but no cysticercosis case has been confirmed. In contrast, *T. solium* survives less than 5 years [9-14] and cysticercosis occurs in the parenteral tissues including brain of the tapeworm carriers and others. Taeniasis are rather local but cysticercosis is all over the world, especially in capital cities in developed countries. It is caused by carriers who want to travel [21-24]. So, health education for prevention of taeniasis is

“Check sanitation system when you visit remote areas and eat well-cooked meat or viscera”. As you now know, we are basically safe in developed countries where meat-inspection is routinely carried out by authorized facilities. Treatment of tapeworm carriers is easy using several highly efficient drugs.

### Where is the Endemic Area or Country?

The answer is in almost all countries where remote mountainous area(s) are located. These all tapeworms are often confirmed from mountainous areas in the Tibetan plateau. One of such areas is Muli Tibetan Autonomous County, Liangshan Prefecture, Sichuan Province, China. There are many gorgeous hotels for tourists in Xichang, the capital city in Liangshan Prefecture [13]. The inhabitants of Muli include more than 10 China’s minorities, predominantly Tibetan and Yi. Muli county is located at the foot of Mount Gongga (altitude 7,556 m), the highest peak in Sichuan, and well known as Shangri-La. In villages in Muli, primary school children are infected with these *Taenia* tapeworms [13]. Similar situations are common in other mountainous countries including Nepal etc. Another unique country is Indonesia. Most provinces in Indonesia are Muslim societies (88%) [25]. Thus, beef tapeworm, *T. saginata* is common in rural and/or remote areas. But in Bali, one of the world-famous tropical resort islands, *T. solium* is common. Local people’s religion is Balinese Hinduism and people enjoy eating uncooked minced pork. Also, Samosir Island in the Lake Toba and neighbor counties in North Sumatra is known as endemic for *T. saginata asiatica* [15]. If some traveler(s) who are *T. solium* carriers visit this area, it is easy for us to expect outbreak of *T. solium* infections.

In Asia, taeniasis may be common in remote and/or rural areas. Cysticercosis is exclusively caused by ingestion of eggs of *T. solium*. Therefore, endemic areas are not only taeniasis endemic areas but also all over the world through globalization.

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