

## **B. SUMMARY RISK PROFILE ON *C. BOVIS* IN MEAT FROM DOMESTIC CATTLE**

### **1. Hazard-food commodity of concern**

Bovine cysticercosis is a parasitic disease of cattle caused by the larval stage (*Cysticercus bovis*) of the human tapeworm *Taenia saginata*. The indirect life cycle of this taeniid involves only humans as the primary host and bovines as the intermediate host. Infection of humans with the adult tapeworm, known as taeniosis, occurs via the consumption of beef which has been insufficiently cooked or frozen to kill the cysticerci. Although multiple infections in humans can occur, most cases of taeniosis involve a single tapeworm, which can persist for years. The adult tapeworm develops to reproductive maturity as early as 10-12 weeks after infection. The adult tapeworm regularly sheds its most posterior and mature segments, called gravid proglottids, which are discharged from infected humans spontaneously or with defecation. Upon release, these proglottids contain thousands of infective eggs that can remain in the proglottid or be expelled into the surrounding fecal matrix or environment. Eggs can remain infective for several months under cool and moist environmental conditions, and can be disseminated by water and other fomites. Upon ingestion of contaminated feed or water by a bovine intermediate host, a hexacanth embryo, or oncosphere, hatches from the egg and penetrates the intestinal mucosa within a few hours to enter the cardiovascular or lymphatic system. Once it reaches a suitable muscle or other tissue site it develops into a cysticercus and becomes infective for a human host after about 10-12 weeks. In cattle, cysticerci are found predominantly in cardiac and skeletal musculature, and occasionally in other sites including liver, lungs, kidneys and lymph nodes. Cysticerci remain infective for several months to a year or more (WHO/FAO/OIE, 2005; OIE, 2012).

*Taenia saginata* occurs worldwide, with the highest prevalence in developing regions where poor sanitation and poor animal husbandry practices, and habits of eating inadequately prepared beef, facilitate parasite transmission. In non-endemic areas, sporadic cases of human taeniosis and of epizootic outbreaks of bovine cysticercosis do occur in spite of better public health and veterinary infrastructure, including regulated inspection of cattle carcasses at slaughter.

### **2. Description of the public health concern**

*Taenia saginata* is most prevalent in sub-Saharan Africa, Latin America, Asia, and some Mediterranean countries. Tens of millions of persons are likely infected with *T. saginata* taeniosis worldwide, but reliable estimates are lacking due to the low pathogenicity and under-reporting of this infection. For many otherwise healthy humans infected with *T. saginata*, the symptoms are mild and unrecognized for many years until the parasite dies or is eliminated. The most common manifestation is mild non-specific gastrointestinal illness with symptoms such as pruritus ani, nausea, weight loss, abdominal pain, diarrhoea, and anorexia, although more serious complications such as appendicitis have been reported. Cattle with cysticercosis typically do not exhibit any clinical signs. Human taeniosis can be safely and effectively treated with a single oral dose of praziquantel or niclosamide (Craig, 2007)

Globalization poses an increased threat of incursions of cysticercosis and taeniosis via the international movement of people and animals, their products, and potentially contaminated produce or other fomites from endemic regions. Since humans as the definitive host are key to maintaining the parasite cycle, accurate prevalence data on *T. saginata* taeniosis are needed; this can be acquired by effective surveillance and mandatory reporting by public health agencies. Practical and effective control programs are also needed, including education regarding the parasite life cycle, mitigating measures such as proper hygiene to prevent access of cattle to human faeces, thorough cooking of meat, and taeniocidal treatment (Gajadhar et al, 2006).

### **3. Food production, processing, distribution and consumption**

Risk factors for bovine cysticercosis include any that increases the chance of exposure of cattle to infective eggs from human faeces/sewage, such as close proximity to public areas, flooding, use of fertilizer that may contain human sewage, use of potentially contaminated feed or water, and employing labour potentially infected with *T. saginata*. The control measures most commonly implemented are based on the organoleptic detection of cysticerci in bovine carcass “predilection” sites during post-slaughter inspection. These sites typically include the heart, masseters, tongue, oesophagus, diaphragm, and the superficial and cut surfaces of the carcass; the triceps brachii muscle of the forelimb may also be examined in some regions. The heart and masseters consistently rank amongst the most likely sites to detect infection (Scandrett et al., 2009). Degenerating cysticerci are more easily detected than viable cysticerci, which are translucent and difficult to differentiate from surrounding host tissue. Since both viable and degenerating cysticerci can co-exist in the same carcass, detection of degenerated cysts does not ensure that viable cysticerci are not present at other sites (Gajadhar et al., 2006). The sensitivity of post-slaughter organoleptic inspection is low, particularly for lightly-infected animals. Serological assays for bovine cysticercosis are not yet reliable for determining the status of individual animals, but may be of some value as screening tests in herds and for epidemiological investigations. There are no commercial vaccines yet available, and anthelmintic treatment of infected animals is not cost-effective. However, methods are available for the effective treatment of carcasses to render cysticerci non-infective.

All beef should be processed within government regulated establishments with competent meat inspection, with no clandestine supply of beef to the local community. Those establishments that use freezing rather than chilling for cold storage of carcass meat and viscera, especially heart and head meat, can reduce the likelihood of products being infective to consumers. Freezing meat and viscera at a minimum of -10 °C for no less than 10 days should render any cysticerci non-viable. Also, cooking to attain a core temperature of at least 60 °C is considered sufficient to kill cysticerci, which can also be inactivated with low dose irradiation of 0.5 kGy (WHO, 1995). Beef produced in endemic regions and distributed for local consumption is often not subjected to any cold or heat treatments and thus is more likely to be infective than products which are frozen for broader distribution.

Consumers are generally unaware of this parasite and the potential for beef to transmit taeniosis. Education of the public on the risks posed by consuming inadequately cooked or frozen beef will contribute to better overall control of this zoonosis.

### **4. International trade**

Due to the public health and aesthetic implications of cysticercosis, this parasite causes substantial economic loss through condemnation of infected meat and offal, and trade restrictions for endemic regions. The international trade of beef and beef products is the largest of the red meat trade sector. Close to 5 million tonnes of beef and veal were exported globally in 2011 (FAO, 2013). Much of the global trade in beef is destined for the fast food market, and such products are usually frozen, cooked or otherwise processed, which reduces the likelihood of consumers being infected with *T. saginata*. However, the international trade in chilled beef poses a higher risk, especially to those markets where raw or poorly cooked meat is consumed.

## **References**

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