CURRENT STATUS OF FOOD-BORNE PARASITIC ZOONOSES IN INDIA

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Abstract. Food-borne parasitic zoonoses have a major impact on the health and economy in developing countries in the tropics and sub-tropics. Complex socio-economic and socio-cultural factors impact on the maintenance of parasitic zoonoses. In addition to human disease, some of these parasites are responsible for economic loss to livestock production.

Throughout India, problems of food-borne parasitic zoonoses differ because of varied food habits. Other factors, however, such as unhygienic living conditions, lack of education, poor personal hygiene, poverty and occupation, also contribute to the dissemination of parasitic infections. The present status of various food-borne parasitic zoonoses are briefly given here.

MEAT-BORNE PARASITIC ZOONOSES

Sarcocystis suihominis

Although the occurrence of microcysts of Sarcocystis in the musculature of pigs in India has been known, only recently were microcysts of S. suihominis identified and differentiated from species of S. miescheriana in striated muscles of different organs of pigs in India (Solanki et al., 1990). In both cases, the prevalence of S. suihominis had been found surprisingly higher (47.11%) than S. miescheriana (43.14%).

Pigs raised in rural areas are generally fed on garbage and human refuge, including night soil. The coprophagic nature of pigs exposes them to infective materials of all kinds. These animals are slaughtered in unhygienic places without official supervision. The offal are carelessly discarded. Half-roasted pork is considered a delicacy in some communities, particularly on the occasion of a ceremony. S. suihominis, more than S. hominis (which has a cattle-man cycle), causes severe digestive troubles in humans. The preponderance of this species in an undescribed breed of pigs (> 80 per cent of the total population of pigs in India) needs detailed investigation. The continuous propagation of S. suihominis in nature proves of human infection which has yet to be searched and confirmed especially in persons handling pigs and consuming pork.

Sarcocystis hominis

There is only one report on the occurrence of this species in muscles of cattle in Madhya Pradesh (Jain and Shah, 1987).

Toxoplasma gondii

Antibodies to T. gondii have been demonstrated in 9.7 to 33.7 percent cases of sheep, goats, pigs, cattle, buffaloes, camels, horses, cat and dogs (Chhabra et al., 1985). Dubey (1987) stated that isolation of T. gondii from pig and sheep is very low and clinical toxoplasmosis is not known in animals in India. A few cases of abortions were, however, seen in goats with titers of 1:64 or above (IHA titers) and a neonatal mortality was seen in goat born to dams with titers from 1:8 to 1:256 from Parbhani (Marathwada) (Singh and Msolla, 1986).

In humans, significant levels of toxoplasma antibodies have been shown through indirect hemagglutination, ELISA and dye tests (Gupta et al., 1985). Seropositivity has been demonstrated both in the vegetarian and non-vegetarian popula-
Parasitologically proved cases of human *Toxoplasma* infections have been documented (Parija, 1990).

In India, transmission of *T. gondii* to humans by ingestion of meat from pigs, cats and chicken, seems to be minimal because these meats are well-cooked before consumption. Transmission of *T. gondii* through oocysts shed by infected cats appears to be a more viable source of *Toxoplasma* infection for humans and animals in India (Dubey, 1987). However, systematic studies of toxoplasmosis in animals and man are needed to determine its status in India.

*Trichinella spiralis*

There were a few reports of the occurrence of *T. spiralis* in some mammalian hosts, namely, from a civet cat in Calcutta (West Bengal) (Schad and Chowdhury, 1967); a *Bandicota bengalensis* in Bombay (Niphadkar, 1973); and in 3 of 500 domestic pigs examined in Bombay (Niphadkar et al., 1979). Trichinosis has not been reported in humans in India.

**TAENIASIS/CYSTICERCOSIS**

Taeniasis is a zooanthroponosis in which man is an essential definitive host whereas cattle and pig act as intermediate host for *Taenia saginata* and *T. solium*, respectively. Transmission from man to animals occurs by handling calves and piglets, contamination of feed and water with *Taenia* eggs. Transmission may also occur through the coprophagic activity of pigs on human night soil. Transmission from animal to man depends on ethnological factors, ie, food processing and food preferences. In India, taeniasis is most common among castes in India that consume half-baked or smoked meat, and where the slaughter of animals is unsupervised.

*Taenia saginata/Cysticercus bovis*

In India, the occurrence of *T. saginata* in man, and its metacestode, *Cysticercus bovis*, in muscles of cattle is rare. Recently, there have been a few case reports of *C. bovis*: 8 bullocks and 9 buffaloes in western Uttar Pradesh (Gaur, 1976); one bullock in Andhra Pradesh (Sreemannarayana and Christopher, 1977), and a Gir cow in Madhya Pradesh (Kolte et al., 1981).

*Taenia saginata* and *T. solium* have been observed in Sikkim with higher infection rates in Tibetan, Lepchas, and Sikkimese Bhotiya communities, than in Nepalis and Indians (Mitra, 1970). Eight cases of human *T. saginata* infection also included a Hindu (Anantaraman, 1984). Lall (1985) reported *T. saginata* in 0.1 percent people in Andaman and Nicobar Islands. Ahmad et al. (1988) found *T. saginata* infection in 1.5 percent of the rural people in Kashmir. Information on the present status of *T. saginata* in India is very limited; research is needed, especially since there is no complete ban on the slaughter of cattle in some States of the country.

*Taenia solium/Cysticercus cellulosae*

The prevalence of the metacestode of *T. solium*, *C. cellulosae*, in muscles of pigs is very well established in different parts of India, with an overall prevalence ranging from 2.0 to 28.8 percent. Based on the work conducted since 1980, the prevalence has been detected as high as 15.5 percent in pigs in some northern parts of the country. The cysticerci are commonly found in muscles of the thigh, tongue, and neck, and sometimes in the liver, heart, lungs, lymph nodes, and brain (Deka and Gaur, 1990). The prevalence rate of *T. solium* in man varies from 0.75 to 1.00 percent in certain communities, particularly in rural areas where there is more contact with pig populations (Verma and Ahluwalia, 1981; Pathak et al., 1984).

Cysticercosis in humans is caused by the invasion of *T. solium* eggs, leading to a variety of neuro-ocular and cerebral conditions depending of their localization. Human infection occurs most probably through food or drinking water contaminated with human feces containing *T. solium* eggs. Unwashed raw vegetables, grown in soil irrigated by sewage water, may be the other source of infection.

Recent reports on human cysticercosis in India include the fatal case of a 51 year-old man from Delhi with symptoms of headache, dimness of vision, vomiting and convulsions (Vijayan et al., 1976); a free-floating cysticercus found in the anterior chamber of the eye of a 14 year-old boy and three other cases of ocular cysticercosis from Pondicherry (Kapoor et al., 1977; Kapoor, 1978); 20 cases of neurocysticercosis of encephalitic type reported from Bangalore (Karnataka) (Srinivas et al., 1980); a 14 year-old Hindu boy from Ambala.
having a painless cyst in the outer part of the upper eyelid (Singh and Kaur, 1982); a case of acute suppurative dacryoadenitis (a palpable lobe of the lachrymal gland) from Delhi (Sen, 1982); a strict vegetarian 8 year-old girl in Madurai with signs of raised intracranial pressure (Inpasekaran et al., 1983); and a 22 year-old woman from Aligarh (UP) with a nodule on her back (Khan et al., 1984). Recently, there was a report from Bangalore of a 15 percent prevalence rate on neurocysticercosis (Chandramukhi et al., 1988).

These reports clearly indicate a well established infection with T. solium in human and pig populations in India, and that the spread of infection between the two hosts is mainly due to a lack of inadequate sanitation for humans and a neglected type of management of pigs, especially in rural areas.

FISH-BORNE PARASITIC ZOOSONES

Gnathostoma spinigerum

There have been reports of G. spinigerum in a cat from Madras (Tamil Nadu) (Chellappa, 1978), in dogs from Kerala (Nayar et al., 1978), and recently in 1.65 percent of the dogs from Assam (Baruah and Gogoi, 1988; Gogoi and Baruah, 1988). Infective larvae of G. spinigerum were also found in viscera and muscles of 3.09 percent of fish (Ophiocephalus punctatus). A common water-flea (Mesocyclops leuckarti) was identified as the first intermediate host in which second stage larvae develop in two days (Gogoi and Baruah, 1988). There has not been a report of human gnathostomiasis from fish since a worm was reported from subcutaneous tissue of a man from West Bengal (Mukerjee and Bhaduri, 1945). Other fresh water fish, such ad Ophiocephalus striatus, O. argus, and Clarias batrachus, have also been found to harbor infective larvae of G. spinigerum (Rai, 1976).

Spirometra sp.

Saleques et al. (1990) reported Spirometra tapeworms in a cat fed offals of fish bought at a market in Pantnagar (UP), and he reviewed two earlier reports from Calcutta and Jabalpur (MP). A mongrel dog was also reported with a spirometrid tapeworm (Pal et al., 1981). A case of human sparganosis, possibly due to the ingestion of Cyclops containing procercoids, was reported from Jodhpur (Rajasthan) (Datta et al., 1982). There are no reports of transmission from carnivores to man of certain trematodes, such as Heterophyes, Echinococcus perfoliatus, Opisthorchis tenuicollis, and Pseudophistomum truncatum, which have infective metacercariae in edible fishes, even though these parasites are commonly found throughout India.

SNAIL- AND CRUSTACEAN-BORNE PARASITIC ZOOSONES

Angiostrongylus cantonensis

Angiostrongyliasis occurs in lungs of rats in India. Two human cases were reported from Bombay (Maharashtra) with symptoms of eosinophilic meningitis; it was confirmed that raw slugs (Laevicaulis alta) infected with A. cantonensis worms were ingested (Sharma et al., 1981). Slugs (harboring as many as 200 larvae per gram of tissue) and a snail, Macrochlamys indica, were identified as intermediate hosts.

Paragonimus westermani

Paragonimiasis was reported from Manipur in 39 people (11-30 years of age) with symptoms of recurrent hemoptysis. They had eaten raw crabs (Potaman dehani) infected with Paragonimus westermani (Singh et al., 1986). There are a few reports of P. westermani in tigers (Panthera tigris) in India, including the latest one from the National Kanha Park, Mandla (MP) (Parihar and Srivastava, 1988).

Dracunculus medinensis

Guinea worm infection in humans is widespread in India. At least seven states in the country have endemic foci; these are Rajasthan, Maharashtra, Madras, Andhra Pradesh, Karnataka, Gujurat, Orissa besides Nicobar Islands (Kumar, 1983). Nearly 0.5 percent of those who suffer from Guinea worm infections are permanently crippled. There are more infections in remote rural areas, where nearly 5 percent of some village populations are reported to suffer from this infection. In 90 percent of the cases, the worms emerge from the lower extremities.

Human infections increase in endemic areas during the summer months when there is an acute
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shortage of potable water. People draw water from step-wells and storage tanks which are often infested with Cyclops (Mesocyclops leuckarti). Infected persons in remote villages usually do not visit health centers for treatment; therefore, efforts of control the infection have failed in rural areas. Stray dogs are the principal reservoir hosts. Non-human primates, carnivores, cattle and horse are also reservoirs.

A Guinea worm control and eradication program was initiated in India in 1979, which included educating the people and providing potable clean water in endemic areas. There was a mass treatment program for infected humans, and biological control of Cyclops by introducing larvivorous fish, such as Gambusia affinis and Poecilia reticulata (Prakash and Srivastava, 1989), and using larvicidal drugs, such as Abate (Cynamid).

POTABLE WATER AND MILK-BORNE PARASITIC ZOOLOGICAL DISEASES

Cryptosporidium sp.

There have been no reports of Cryptosporidium infections in cattle or buffalo calves or any other farm animals in India. Human cases have been reported, however, with symptoms of diarrhea, particularly in bottle-fed children, from Vellore (13 percent) (Mathan et al, 1985), Calcutta (Das et al, 1987), Varanasi (Singh et al, 1988), Bombay (Saraswathi et al, 1988), Kashmir (Navash and Wattal, 1988) and from Chandigarh (Malla et al, 1987; Mahajan et al, 1988; Malla et al, 1989). There have been other reports from Bangalore and Madurai (Parija, 1990).

The widespread incidence of cryptosporidiosis in humans suggests that infections with Cryptosporidium in dairy animals and their calves needs investigation.

Toxocara vitulorum

Infection with T. vitulorum has been reported in buffalo calves (Warren, 1971). Larvae have been detected in colostrum and milk of buffaloes just after calving (Chauhan et al, 1974a; Gautam et al, 1976; Banerjee et al, 1983); and in organs and tissues of poultry (Chauhan et al, 1974b). In some communities colostrum and raw milk from buffaloes is given to children; however no cases of visceral larva migrans have been reported in India.

RAW VEGETABLES

Fasciolopsis buski

This fluke, commonly found in pigs in different parts of the country including Assam, Bihar, Uttar Pradesh, Madhya Pradesh and Tamil Nadu, has been reported in 60 percent of some undescribed pig populations.

In Assam, 33 percent of pigs were found infected with F. buski (Sarma and Gogoi, 1986). Metacercariae adhere to the shell of water chestnuts (Trapa natans) which propagate in seasonal ponds and storage tanks in rural areas. This water is frequently contaminated with feces from infected pigs. Although there have been no recent reports of human infections, transmission of F. buski occurs when people peel the water chestnuts with their teeth.

Gastrodiscoides hominis

The infection with this amphistome fluke in caecum of pigs in India is widespread; however there have been no reports of human infections.

Other food-borne parasitic infections, such as amebiasis, giardiasis, balantidiasis, hymenolepiasis, and ascariasis are quite common in humans all over the country. Modes of transmission vary, but the most common ones are ingestion of food and water contaminated with feces from infected humans or animals and the consumption of raw leafy green vegetables irrigated with sewage water (Bhatia et al, 1978).

CONCLUSION

Cysticercosis, taeniasis and dracunculosis are the most common and well established food-borne parasitic zoonoses adversely affecting human health in India. Toxoplasmosis, sarcocystosis and cryptosporidiosis are emerging as important food-transmitted parasitic zoonoses pathogenic to farm animals and humans. The role of pigs seems to be important in the maintenance and
propagation of most food-borne parasitic zoonoses in India.

Although sufficient cooking of meat, fish and vegetables is generally practiced throughout the country, unhygienic living conditions, poverty and lack of education are major factors in the transmission of food-borne parasitoses in India.

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