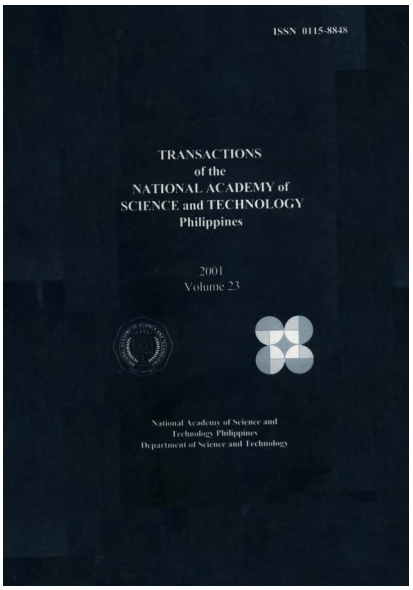
TRANSACTIONSNASTPHL
ISSN 0115-8848 (print)
ISSN 2815-2042 (online)
https://transactions.nast.ph
Vol. 23 Issue No. 2 (2001)
doi.org/10.57043/transnastphl.2001.5121

Transactions NAST PHL, is the official journal of the National Academy of Science and Technology Philippines. It has traditionally published papers presented during the Academy's Annual Scientific Meeting since 1979 to promote science-based policy discussions of and recommendations on timely and relevant national issues as part of its functions as a national science academy. Starting in 2021, this journal has been open to contributions from the global scientific community in all fields of science and technology.



Helminth Zoonoses in the Philippines: Public Health Problems Associated with Eating Habits and Practices

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Citation
Eduardo SL. 2001. Helminth zoonoses in the Philippines: Public health problems associated with eating habits and practices. Transactions NAST PHL 23(2): 105-119. doi.org/10.57043/transnastphl.2001.5121

Trans. Natl. Acad. Sci. & Tech., Philippines (2001) **23:** 105-119

HELMINTH ZOONOSES IN THE PHILIPPINES: PUBLIC HEALTH PROBLEMS ASSOCIATED WITH EATING HABITS AND PRACTICES

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ABSTRACT

A number of helminth zoonoses have been recorded in the Philippines and majority of these is transmitted through the food. These include echinostomosis, artyfechinostomosis, heterophydosis, carneophallosis, paragonimosis, opisthorchiosis, fasciolosis, taeniosis/cysticercosis, spirometrosis/sparganosis, gnathostomosis, intestinal capillariosis, angiostrongylosis and anisakiosis. The causative agents involved, animal hosts, human infections with these diseases and their distribution and transmission are discussed

Taenia saginata asiatica is recently recognized as the one of the two causes of human taeniosis in the Philippines. Previous reports locally of *Taenia saginata* were in fact of *Taenia saginata asiatica,* thus data for the former are now referable to the latter. The pig and its liver serve as the intermediate host and organ predilection site of the cysticercus (larval form), respectively for this species. Accordingly, meat inspection of slaughter pigs should now include the examination of the liver and not only of the muscles as currently practiced. The mudfish, *Channa striata* (dalag) is recently recorded to harbor the larva of *Gnathostoma doloresi.* Human infection with the nematode may occur through ingestion of improperly cooked infected fish.

While some of these zoonotic diseases are now rarely observed, still others continue to be public health problems. Many are endemic in certain areas of the Philippines because of the food habit of consuming raw or partly cooked fish, edible snails and crustaceans and meat in these areas.

More studies on the epidemiology and transmission, including the animal hosts involved locally, are still needed for some of these problems. Changing the eating habits and practices can prevent human infection with many of these diseases. Proper disposal of fecal materials from both man and animals can also help control or if not cut the life cycle of many of these infectious agents. These however require aggressive health education campaign in order to be successful.

INTRODUCTION

In the Philippines, parasitic diseases still rank high as health problems in both man and animals. Biomedical surveys conducted among human populations in the country point to parasitic diseases as important public health problems (Cross & Basaca-Sevilla, 1984). These are aggravated by problems of poverty, malnutrition and a declining economy. Some of these parasitic problems are caused by helminths, which are transmissible from animals to man or vice versa. Human infection with some of them is acquired through the food. Just as the Philippines is composed of many islands, the inhabitants are also varied with respect to customs, food habits and practices and many of these, as will be shown latter, favor the transmission of helminth infections.

Zoonoses, as defined by WHO (1979), are those diseases and infections which are naturally transmitted between vertebrate animals and man. The species of animal parasites causing infection and shared by both man and other vertebrate animals are therefore classed as zoonoses. This paper deals only with food-borne zoonoses caused by helminth parasites (trematodes, cestodes, nematodes and acanthocephala).

The nomenclature of helminth diseases given in this paper follows the Standardized Nomenclature of Parasitic Diseases (SNOPAD) as proposed by the World Association for the Advancement of Veterinary Parasitology (WAAVP) (prepared by Kassai *et al.*, 1988).

Scientific names of fish hosts follow the currently recognized names given in the checklist of the parasites of fishes of the Philippines by Arthur and Lumanlan-Mayo (1997).

TREMATODE ZOONOSES

Echinostomosis

Human echinostomosis in the Philippines is primarily caused by *Echinostoma ilocanum*. The adult fluke occurs in the small intestines, thus the disease condition is also called intestinal echinostomosis. It is widespread with prevalence of 3% but higher among Ilocanos in Northern Luzon where it reached to as high as 44% (Cross & Basaca-Sevilla, 1986)

Rattus spp. are important animal hosts. Dogs and cats were claimed as may equally be important. No data however as yet are available on the prevalence of natural infection especially on the last two hosts. A variety of laboratory animals especially rats, mice and hamsters are the most susceptible experimental hosts (Velasquez, and Eduardo, 1994).

This parasite requires fresh water snails as intermediate host to complete its life cycle. Locally, the freshwater planorbid snail, *Gyraulus phrasadi* serves as the first intermediate host and the second intermediate hosts include a variety of freshwater snails including *G. phrasadi* and *Pila conica*. Filipinos eat the latter

species, thus it is considered the primary source of infection. The Ilocanos of northern Luzon are known to consume partly cooked *Pila conica* (locally called "bisukol") hence human infection is highest in this region (Eduardo, 1991).

Artyfechinostomosis

Artyfechinostomum malayanum (syn.= *Cathaemasia cabrerai*) is the cause of this condition and it occurs in the intestines of the infected host. This species has already been reported for a long time in other Asian countries. Its occurrence in the Philippines has been recorded in man and the pig (Velasquez and Eduardo, 1994).

Human infections with this species have been reported from Isabela and Tarlac province (Monzon & Kitikoon, 1989). Pigs from Pangasinan and Bulacan were found naturally infected at slaughter. A total of 1,205 worms were recovered from one pig (Eduardo, 1989).

This helminth species also requires freshwater snails as intermediate hosts to complete its development. The snails, *Bullastra cumingiana, Radix quadrasi* and *Physastra hungerfordiana* are naturally infected in the Philippines and therefore serve as the second intermediate host. The source of human infection however is *Bullastra cumingiana* as this is edible to some Filipinos. All human cases in Isabela had a history of eating raw snail of this species that is locally known as *"birabid"*. It is prepared by shaking the snail with salt to remove mucus secretion. Then salt, ginger, onion, vinegar, pepper and other spices are added (Tangtrongchitr & Monzon, 1991). *B. cumingiana* collected from two distant places namely, San Pablo, Laguna in Southern Luzon and Echague, Isabela in Northern Luzon were found naturally infected with metacerariae which when fed to rats and hamster yielded adults of *A. malayanum* (Cabrera *et al.,* 1986, Monzon & Kitikoon, 1989).

Exact information on its epidemiology, transmission and its prevalence in pigs and man and other animals locally remains to be worked out.

Heterophyidosis

Members of the trematode family Heterophyidae are the causes of this condition. In the Philippines, several species of the family have been recorded from carnivores and birds. Many of these species are known to be transmissible to man (Velasquez and Eduardo, 1994). Only four species namely, *Haplorchis taichui, H. yokogawai, Procerovum calderoni* and *Stellanthchasmus falcatus* (=*S. pseudocirrata*) have actually been recorded in human infections locally and these were associated with lesions in the heart, brain and spinal cord. Unspecified heterophyid infections of man detected through fecal examination have also been reported (Cross & Basaca-Sevilla, 1984).

There are no data available yet on the prevalence of infection in animals. In human, less than one percent of 3,000 stool samples examined from various places in the country was found positive for heterophyid ova (Cross & Basaca-Sevilla, 1984).

Heterophyids require freshwater snails and fishes as first and second intermediate hosts, respectively to complete their cycle. A variety of food fishes, both freshwater and marine have been found infected with the metacercariae of heterophyid species (Velasquez and Eduardo, 1994) and those harboring the metacercariae of the four species mentioned above are given in Table 1. Infection therefore occurs through ingestion of raw or partly cooked fish containing metacercaria. The life cycle of only two species, *H. taichui* and *P. calderoni* are known in the Philippines. The snail hosts are *Melania juncea* and *Thiara riquetti,* respectively (Velasquez and Eduardo 1994).

Table 1. Philippine fishes found harboring metacercariae of heterophyid species.

Fish species: Scientific name (local name)	**Heterophyid species***	**Fish species: Scientific name (local name)**	**Heterophyid species***
Acentrogobius janthinopterus (biyang sapa)	PC	*Liza subviridis* (banak) (=*Mugil dussumieri* (talilong)	HT, HY, PC, SF
Ambassis buruensis (lañgaray)	HY, PC	*Mugil sp.* (banak)	HY, PC,SF
Anabas testudineus (martiniko)	PC, SF	*Oreochromis niloticus (tilapia)*	HT
Arius manillensis (Manila kanduli)	HY	*Pelates quadrilineatus* (agaak)	HY,PC, SF
Atherina balabacensis (guno)	PC	*Platycephalus indicus (sunog)*	PC
Butis amboinensis (biyang sunog)	PC	*Poecilia latipinna (bubuntis)*	PC
Channa striata (dalag)	HT,HY, PC	*Puntius binotatus* (pait)	HT
Chanos chanos (bangus)	PC	*Rhynchorhamphus georgii (buging)*	HY, PC
Clarias batrachus (hito)	HY	*Scatophagus argus (kitang)*	PC
Eleutheronema tetradactylum (mamali)	PC	*Siganus canaliculatus (barangan)*	HY,PC
Epinephelus corallicola (lapu-lapu)	HT, PC	*Siganus gutatus* (barangan)	HT, HY
Gerres filamentosus (malakapas)	PC	*Siganus javus* (barangan)	HY, PC
Gerres kappas (malakapas)	HY	*Spratellicypris palata* (manobud)	HT
Glossogobius giuris (biya)	PC	*Terapon jarbua* (bagaong)	HT, HY,SF

**Legend*
Haplorchis taichui – HT
Procerovum calderoni – PC
Haplorchis yokogawai – HY
Stellantchasmus falcatus – SF

Carneophallosis

Carneophallus brevicaeca is the etiologic agent of this disease condition. In the Philippines, it has been reported in man associated with lesions in the heart and spinal cord; in the bird (*Sterna albifrons sinensis*) and the fish (*Glossogobius giuris*). The shrimp, *Macrobrachium* sp. has been found to harbor metacercariae thus serving as intermediate host for the parasite (Velasquez, 1975; Velasquez and Eduardo, 1994). Infection occurs through ingestion of raw or partly cooked shrimps. Other invertebrate intermediate and animal definitive hosts still remain to be known.

Paragonimosis

Members of the genus *Paragonimus* are the causes of this condition. In the Philippines, Miyazaki (1981) concluded, after a taxonomic study on the lung flukes, that *Paragonimus westermani filipinus* is the only species and is responsible for this condition in the country.

Paragonimus infection is endemic in certain areas in the Philippines. Reported human cases were mostly from Sorsogon, Samar and Leyte. Prevalence in endemic areas may reach 4.6-12.5% (Cabrera & Fevidal, 1974). Wild rats (*Rattus norvegicus*) may play an important role in maintaining the cycle in nature and the prevalence in these animals may reach 9.4-11.1%. (Cabrera, 1977).

This species requires freshwater snails and crabs as first and second intermediate hosts, respectively to complete its cycle. Wild boars may serve as paratenic host. In the Philippines, the snail *Brotea asperata* and the mountain crab, *Sundathelphusa philippina* serve as intermediate hosts (Velasquez and Eduardo, 1994). Human infection results from consumption of infected crabs, raw or partly cooked.

In Sorsogon, Leyte and Samar, where paragonimosis is indemic, inhabitants are known to consume the crab host raw. A preparation of fresh crab juice known as *"kinagang"* is considered a local delicacy. Cabrera & Fevidal (1974) noted that infection is more frequent in males than in females but this difference was attributed to certain customs and habits rather than sex. Males in these areas were observed to eat crabs raw during drinking sessions with the local wine (*"basi"*) especially during festivities.

Opisthorchiosis

Opisthorchis (=Clonorchis) sinensis, the etiologic agent of this condition, has been reported in man in the Philippines during routine stool examination. In a survey of 30,000 Filipinos by Cross & Basaca-Sevilla (1984), ova similar to that of *Opisthorchis sinensis* were detected in 135 stool samples.

It is a known fact that this parasite requires snails and a variety of freshwater fishes serve as intermediate hosts but the species involved in the Philippines are

not yet known. Likewise, data on animal host infection especially carnivores are still needed.

Fasciolosis

Two species, *Fasciola gigantica* and *F hepatica* have been reported in animals in the Philippines but recent investigations based on previous and current collections have shown that the former is the predominant if not the only species now occurring in this country (Velasquez and Eduardo, 1994).

The prevalence of *Fasciola* infection in domestic ruminants is high. In endemic areas, it may reach to as high as 95%. Control program instituted on a nationwide scale in 1979-1981 reduced the infection rate in some areas. Lameta & Manuel (1981) found a prevalence of 3.6% in cattle and 38% in water buffaloes (carabaos). The snail intermediate hosts in this country are *Lymnaea philippinensis* and *L. auricularia rubiginosa,* which are likewise distributed throughout the islands. Animals become infected through the ingestion of metacercariae contained on grasses and other water plants or drinking contaminated water.

Only two cases of human infection with *Fasciola* have been recorded in the Philippines (Eduardo, 1991). The exact origin of the infection could not be traced but probably as a result of ingestion of partly cooked *Ipomea* ("kangkong") or accidental ingestion of water plants harboring metacercariae of the fluke. The high prevalence in animals in endemic areas put the local human population at risk to infection.

CESTODE ZOONOSES

Taeniosis/Cysticercosis

Taenia solium and *T. saginata asiatica* are the causes of human taeniosis in the Philippines. What was previously referred to in literature as *Taenia saginata* or *Taenia saginata*-like in Taiwan, Korea, China, Thailand, Indonesia and the Philippines is in fact *Taenia saginata asiatica* (Fan & Chung, 1998). The true *Taenia saginata* requires cattle and water bufalloes as intermediate host and its cysticerci are found in the muscles. *Taenia saginata asiatica* on the other hand requires pig as the intermediate host and its cysticerci occur in the liver. Infection of a pig with ova of *Taenia saginata asiatica* recovered from an infected woman in Leyte revealed the occurrence of cysticerci in the liver (Pejana & Eduardo, 2000). This suggests that examination of slaughter pigs at meat inspection should include the liver and not only the muscles as is currently practiced.

Various surveys showed *Taenia* prevalence of less than one percent (Arambulo *et al.,* 1976; Cross & Basaca-Sevilla, 1983; Carney *et al.,* 1987). Between the two species, *T. saginata asiatica* is more common. According to Arambulo *et al.* (1976), out of 1,000 cases of parasitologic condition examined annually at the Philippine General Hospital, an average case every two years of

one *T. solium* and six *T. saginata asiatica* were recorded. In *T. saginata asiatica* endemic foci in Leyte, Cabrera (1973) reported a prevalence of 10.26% for this species.

Human cases of cysticercosis have been reported in the Philippines and were diagnosed as either that of *T. solium* or highly suggestive of this species (Quimosing *et al.*, 1984; Eduardo, 1991).

In animals, cysticercosis is more common in swine than either in cattle or water buffalo and the prevalence in slaughter animals are:: swine 1.67%, cattle 0.02% and water buffalo 0.03%.

Human infection results from consumption of raw or improperly cooked infected pork and beef.

Spirometrosis and Sparganosis

Spirometra species and their spargana have been reported in animals in the Philippines. Sparganum is widespread in tadpoles and frogs and has been found in a bird, *Ixobrychus cinnamomeus,* a lizard, *Gecko gecko* and several species of snakes namely, *Lapemis hardwickii, Boiga dendrophila, Ahaetulla ahaetulla, A. caudolineata* and *Natrix chrysarga* (Velasquez and Eduardo, 1994).

Adult *D. latum* has been reported locally from a boy that died of anemia. Since *D. latum* is only found in temperate countries of the Northern Hemisphere, this identification is doubtful. It is possible that the species in question is *Diphyllobothrium erinaceieuropaei* (=*Spirometra erinacea, S. mansonoides*) (Velasquez and Eduardo, 1994). Stool survey showed diphyllobothrid ova in less than one percent of 30,000 persons examined in various places in the Philippines (Cross & Basaca-Sevilla, 1984).

Up to 1962, four human cases of sparganosis have been reported locally and since then no other case has been reported. As all cases gave no history of having eaten fresh meat of frogs, reptiles and birds nor used them as poultices, the mode of transmission was attributed to the drinking water with infected cyclops (Jueco, 1982).

NEMATODE ZOONOSES

Gnathostomosis

Members of the genus *Gnathostoma* cause this condition. The genus is represented in the Philippines by three species namely, *G. spinigerum, G. hispidum* and *G. doloresi. Gnathostoma doloresi* was first discovered and reported as a new species in the Philippines by Tubangui (1925) from the stomach of a pig in Los Baños, Laguna. It has been subsequently reported in the same host locally (Velasquez and Eduardo, 1994) and in several Asian countries and some Pacific Islands (Daengsvang, 1982). All three species have been recorded in man in other Asian countries but only *G. spinigerum* has been reported in man locally.

Gnathostoma spp. in order to complete their development requires aquatic copepods and fishes as intermediate hosts and a wide range of paratenic hosts may intervene as "extension host" in the cycle.

G. spinigerum has been reported locally in dogs, cats, flying lemur and palm civet. Copepods, *Cyclops (Encylops) serrulatus* and *C (Microcyclops) bicolor* and freshwater fishes namely, *Glossogobius giurus, Ophicephalus striatus* and *Therapon argenteus* serve as first and second intermediate hosts, respectively. The water snake, *Hurria rynchops* and the frog, *Rana limnocharis* may serve as the local paratenic hosts as they were found to harbor larvae of this parasite). Only three cases of human gnathostomosis have been reported locally and these were attributed to *G. spinigerum* (Velasquez and Eduardo, 1994).

Both *G. hispidum* and *G. doloresi* have been recorded in pigs in the Philippines (Velasquez and Eduardo, 1994). There is no case as yet reported of human infection with *G. hispidum* and *G. doloresi* in the Philippines. However, cases of human gnathostomosis have been reported in China, Japan and Thailand due to these two species. *Gnathostoma doloresi* is currently recognized as an important cause of clinical human gnathostomosis in Japan (Akahane *et al.*, 1982; Ogata *et al.*, 1988; Nawa *et al.*, 1989).

Cases of human gnathostomosis due to *G. hispidum* in Japan have been attributed to the consumption of raw loaches *(Misgurnus angillicaudatus)* usually imported from Mainland China, Taiwan and Korea. It is interesting to note here that the fish host (*Misgurnus anguillicaudatus*), which is the source of human infection with this species in Japan, now abounds in the rice terraces of Ifugao. The Ifugao call it "jojo" which probably is derived from the Japanese name "dojo" for the fish. How the fish found its way to the Cordillera is not exactly known. It is postulated that it was brought by Japanese soldiers during World War II as a protein supplement for their diet (Balatan, 1993). This is a case of the introduction of a new suitable intermediate host for a parasite already existing in a country. The introduction increases the range of suitable intermediate host available locally and hence insuring further dissemination and continued survival of the parasite concerned.

In Japan, wild boars, salamanders, frogs and snakes have been reported to harbor larvae of *G. doloresi* (Imai *et al.*, 1989; Miyazaki & Ishii, 1952; Hasegawa *et al.*, 1982). Human infections with *G. doloresi* in Japan have been attributed to the ingestion of raw meat of these hosts.

The author *et al.* (2001, in press) has found larvae of *G. doloresi* in some *Ophicephalus striatus* ("dalag") examined from Laguna Lake suggesting that this fish serves as the intermediate host locally. Human infection may result from consumption of improperly cooked infected fish,

Intestinal Capillariosis

Intestinal capillariosis of man is caused by *Capillaria philippinensis*. The species was first discovered and described as a new species by Chitwood *et al.* (1968)

based on specimens recovered from an Ilocano patient in the Philippines that died of the infection. Subsequently, the parasite has been recorded in Japan, Thailand, Taiwan, Korea, India, Iran and Egypt.

In the Philippines, intestinal capillariosis is endemic in coastal areas of Northern Luzon in the province of Ilocos Norte, Cagayan, Isabela, Ilocos Sur, La Union, Pangasinan and Zambales. Cases have also been reported in Southern Leyte), Bohol/Misamis Oriental and Agusan del Norte in Northeastern Mindanao. Since 1967, over 2,000 human cases have been documented (Cross & Basaca-Sevilla, 1984).

The cycle of *C. philippinensis* in nature has not been fully determined,. Experimental evidences however point to fresh and brackishwater fishes as the sources of infection (Cross & Bhaibulaya, 1983). Human infection may result from consumption of raw fish infected with larvae. *Hypseleotris bipartita* has been found to be a natural source of infection in Ilocos Sur (Cross & Basaca-Sevilla, 1991). Development of the parasite to the infected larva has been demonstrated experimentally in fishes (*Hypseleotris bipartita* or "bagsit"; *Chonophorus melanocephalus* or "bukto, biyang bato"; *Ambassis miops or* "bagsang"; *Eleotris melanosoma* or "birut"; *Sicyopterus sp.* or "ipon" and *Poecilia reticulata* or "guppy") found in endemic areas in Northern Luzon. With the exception of *Poecilia reticulata,* the rest are often eaten uncooked and gravid *Hypseleotris bipartita* is especially relished in the raw form (Cross & Basaca-Sevilla, 1991). Residents of endemic areas in Northeastern Mindanao were also noted to consume raw fish (Carney *et al.,* 1987).

Fish-eating birds are important reservoir host and responsible in disseminating infection along their migratory path. Experimental studies showed susceptibility of some birds to infection with the parasite. In the Philippines, a bird, *Ixobrychus sp.* (bittern) has been found to harbor a male specimen of the parasite. Other species of fish may be more commonly infected. Autoinfection is a part of the cycle in mammals as evidenced by embryonated ova produced by female worms. Human infection of *C. philippinensis* still occurs in the Philippines but at a very low rate (Cross & Basaca-Sevilla, 1991).

Angiostrongylosis

Angiostrongylus cantonensis is the only species of the genus reported in the Philippines. This species occurs as adults in the lungs of rats and several species of rats have been found naturally infected with the parasite with incidence ranging 3-10% (Cross, 1982). About 29% of field rats (*Rattus m. mindanensis*) examined from Mayorga, Leyte were found naturally infected with this lungworm (unpublished).

Land snails, *Achatina fulica, Hemiplecta sagittifera, Helicostyla macrostoma, Chlorea fibula* and *Cyclophorus sp.;* garden slugs, *Imerina plebeia* and *Laevicaulus alte* were found harboring larvae of the parasite (Cross, 1982). Velasquez (1972) found 100% of *Achatina fulica* and *Veronicella sp.,* and 50% of *Pila luzonica*

infected with the larvae of *A. cantonensis*. Prawn, fishes, crabs, cattle and chicken have also been shown to serve as paratenic hosts (Velasquez, 1981).

Angiostrongylosis in human affects the central nervous system where the migrating larvae cause a condition called tropical eosinophilic meningitis. Human infection results from ingestion of paratenic hosts and raw vegetables contaminated with larvae from infected mollusks. Ten human cases, all non-fatal, presumably due to larvae of *A. cantonensis* have been reported locally (Cross, 1982).

Anisakiosis

This condition is caused by the larval stages of anisakine nematodes persisting in the alimentary canal or penetrating the tissues of human after consuming raw or semi-raw fish. A variety of fish species acts as intermediate/transport hosts for the larva which mature to adult in warm blooded marine mammals.

Human cases of anisakiosis have been reported in the Americas, Europe and Japan resulting from ingestion of raw or semi-raw fish (WHO, 1979). While no human case has been reported as yet in the Philippines, a wide range of fish species have been found to harbor anisakine larvae (see Table 2) (Velasquez and Eduardo, 1994). The potential of human infection in the Philippines therefore is great especially now that many Japanese food preparations of raw and semi-raw fish (sashimi, etc.) are now gaining acceptance among Filipinos. It is also possible that there were human cases of anisakiosis in the Philippines but were unreported either because of the difficulty of its recognition or many local physicians are still unaware of this condition or both.

Table 2. Philippines fishes found harboring anisakine larva (from various authors)

Scientific name (Local Name)	**Scientific Name (Local name)**
Alectis sp. (pampanog puti)	*Oxyuricthys microlepis* (talimusak)
Acanthopagrus berda (bakoko)	*Pennahia aenea* (alakaak)
Amblygaster sirm (tonsoy)	*Pinjalo pinjalo* (sulid)
Apogon ellioti (dangat)	*Poecilia latipinna* (bubuntis)
Carangoides armatus (lawayan)	*Priacanthus tayenus* (bisugong tsina)
Caranx sp. (talakitok)	*Psettodes erumei* (dapa)
Caesio lunaris (dalagang bukid)	*Rastrelliger brachysoma* (alumahan)
Decapterus sp. (galonggong)	*Rastrelliger kanagurta* (alumahan)
Eleutheronema tetradactylum (mamali)	*Sardinella longiceps* (tamban)
Epinephelus sp. (lapu-lapu)	*Sardinella abella* (bagasbas)
Euthynnus affinis (katsarita)	*Saurida tumbil* (kalaso)
Gerres filamentosus (malakapas)	*Scatophagus argus* (kitang)
Lactarius lactarius (pagapa)	*Scomberomorus commerson* (tanguigue)
Leiognathus equulus (lawayakan)	*Selar crumenophthalmus* (matang-baka)
Leiognathus sp. (sapsap, tambong)	*Selaroides leptolepis* (salay-salay)
Lutjanus malabaricus (maya-maya)	*Sphyraena langsar* (tursilyo)

Table 2 (continued)

Scientific name (Local Name)	Scientific Name (Local name)
Lutjanus vitta (dayang-dayang)	*Stolephorus sp.* (dilis)
Megalaspis cordyla (oriles)	*Synaptura sorsogonensis* (dapa)
Mene maculata (hiwas)	*Siganus sp.* (samaral)
Muraenesox cinereus (pindanga)	*Terapon jarbua* (bagaong)
Nemipterus sp. (bisugo)	*Trichiurus lepturus* (espada)
Otolithes ruber (alakaak)	

EATING HABITS AND PRACTICES, TRANSMISSION AND PREVENTION

It is evident from the above of the role-played by food habits and practices in the epidemiology of these food-borne helminth zoonoses.

Food dishes prepared as raw or partly cooked are relished in some areas in the Philippines. "Kilawen", is a term given to any preparation of raw meat, fish, snail, shrimp or crab, etc. usually with salt, vinegar and sometimes spices. This kind of preparation is considered a delicacy by some especially the Ilocanos of Northern Luzon. Thus human cases of echinostomosis, artyfechinostomosis, and intestinal capillariosis have been mainly from this part of the country. In Isabela where human cases of artyfechinostomosis have been reported, the snail second intermediate host is eaten raw or partly fermented. It is prepared by shaking the snail with salt to remove mucus secretion, then salt, ginger, onion, vinegar, pepper and other species are added (Cabrera *et al.,* 1986; Tangtrangchitr & Monzon, 1991) and eaten or left overnight to ferment before being consumed. This in contrast to another place, San Pablo, Laguna in Southern Luzon, where the same snail has been found to have even higher percentage of infection than in Isabela, but no case of human infection has occurred as this particular snail is not eaten. It is detested due to its slimy texture (Monzon & Kitikoon, 1989) and even the local term, "susong linta" meaning leechy snail sounds unpleasant to the ear. "Kilawen" is also popular among folks in Leyte. Pig liver is cut into thin slices, soaked in vinegar with salt and condiments and eaten raw (Pejana and Eduardo, 2000). Pig meat, partly cooked and prepared as above, is also eaten half-cooked. Cysticercus (larva) of *Taenia solium* and *T. saginata asiatica* are found in the muscle and liver respectively of pigs, which serve as intermediate hosts. Human infection occurs through consumption of raw of partly cooked infected organs.

Pila conica ("kuhol", "bisukol") and *Sundathelpusa philippina* ("talangka"), the intermediate hosts of *E. ilocanum* and *P. westermani filipinus* respectively, are eaten practically all over the country. However, echinostomosis and paragonimosis are prevalent or endemic only in certain areas. It is among the Ilocanos in Northern Luzon where echinostomosis has the highest prevalence as the snail host

is eaten sometimes raw or partly cooked. Similarly, paragonimosis is endemic in Sorsogon, Leyte and Samar where inhabitants are known to consume the crab host raw. A preparation of fresh crab juice known as "kinagang" is considered a local delicacy. Males in these areas were observed to eat crabs raw during drinking sessions with the local wine ("basi") especially during festivities. The same is true for intestinal capillariosis in Northern Luzon. The fish host, *Hypseleotris bipartita* is especially desired when gravid (filled with eggs) and the entire fish is eaten raw. Another fish host, *Ambassis miops* in the raw form is bitten at the belly by some to suck out the juice (Cross & Basaca-Sevilla, 1991). Residents of endemic areas in Northeastern Mindanao likewise were also noted to consume fish raw (Carney *et al.*, 1987).

Some human infections with these diseases may have passed unnoticed or may have been misdiagnosed as some are difficult to detect or the physician may not be aware of them.

Simply giving up the habit of eating raw food of animal origin could prevent human infection with a number of these zoonoses. However, as the saying goes, old habits may not easily be given up. Cross & Bhaibulaya (1983) also pointed out that, it would be difficult in practice as some people in these areas, though properly informed about this transmission, still value their food habits and maintain that "cooking destroys the flavor they relish as well as the nutritive value of the food". Nevertheless, with a more aggressive health education campaign together with programs directed to the improvement of the living condition of the inhabitants in these areas, preventive measures against many of these zoonotic diseases could be achieved successfully (Eduardo, 1991).

HELMINTH PARASITES AS INDICATOR OF FECAL POLLUTION OF THE ENVIRONMENTAL

Pollution of the environment can have an important influence on the existence and survival of parasites (WHO, 1979). Many of the helminth agents causing zoonoses described in this paper are associated with fecal pollution of the environment, whether land or aquatic. These parasites require intermediate hosts to complete their cycle. In order to reach the intermediate host, a stage of the parasite has to leave the definitive or final host and that stage, in almost all cases, is the egg. The egg of the parasite is passed out with the feces of the definitive host to the environment and from there to the intermediate host.

The presence of the larval stages of the zoonotic agent in the environment and in the intermediate host therefore indicates fecal contamination from infected definitive hosts. The zoonotic helminth agents reach their respective intermediate host only after their eggs are passed out with the feces of the definitive host. Thus *E. ilocanum, A. malayanum, Fasciola* spp., *Heterophyid* spp., *C. brevicaeca, Capillaria philippinensis* reach their intermediate hosts through fecal contamination of the water environment. *Taenia* spp. reach their intermediate hosts through fecal

contamination of the pasture or direct access of the intermediate host (pig) to fecal matter of infected definitive host (man). Proper disposal of fecal material whether of man or animal therefore is everyone's concern.

The presence of reservoir hosts also maintains the infection in a particular area. It was observed by Monzon & Kitikoon (1989) that *Bullastra cummingiana* in Sampaloc Lake in San Pablo City had higher prevalence of infection with *A. malayanum* than the snails of the same species in Isabela. The cycle is probably maintained in the area by pigs and field rats as these are also known as definitive host of the parasite. It should be noted that piggeries abound around Sampaloc Lake and their excreta are allowed to pollute the lake. While there are no human cases of infection as yet, the presence of the parasite in the area still pose a threat to human health.

CONCLUDING STATEMENT

The Philippines has still a fast growing human population at 2% growth annually. The current population is 75.6 million (Asiaweek, May 2001). Food animal production has not kept pace with the demand of the increasing human population. Recent statistics reveal a slow growth for food animal production. A large proportion of the human population live in the rural areas and a much larger proportion of the food animal population is raised in backyards or small farmer holder system as compared to the number raised in large commercial farms. This ecological profile of human and animal population distribution makes a large proportion of both populations put at risk.

It is also evident that these diseases are prevalent in rural areas where the population depends on agriculture, fishery and forestry for livelihood. One-third of all goods and services produced by the economy is accounted to the agricultural/ rural sector, which also employs half of the country's workers and earns 36% of the country's export income (Department of Agriculture, 1989). "It can be said that unhealthy working population can only mean low or reduced productivity and unwholesome meat such as in cases of fasciolosis and cysticercosis can only lead to further reduction due to carcass condemnation of what is already an insufficient meat supply. In a country where poverty is widespread in rural areas like the Philippines, these diseases can only worsen what is already a bad situation "(Eduardo, 1991).

ACKNOWLEDGEMENT

This paper is a revised, modified and updated version of a lecture delivered by the author as a recipient of a SEARCA professorial chair grant at UPLB. I am grateful to SEARCA and the university for the grant.

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